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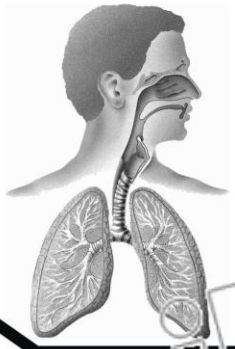

CH# 10 GASEOUS EXCHANGE

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10.1 GASEOUS EXCHANGE IN PLANTS

LONG QUESTION

Q.1 Describe gaseous exchange in plants. *(K.B)* **(LHR 2016)**

OR

How do the different parts of the plant body exchange gases with the environment?
(Understanding the Concept Q.1)

Ans:

GASEOUS EXCHANGE IN PLANTS

Definition:

"Exchange of gases among **plants** and their **environments**, is termed as gaseous exchange in plants".

Organs and Organ Systems:

Plants have **no organs** or **organ systems** for the **exchange of gases** with the environment. **Every cell** of the **plant** body **exchanges gases** with the environment by its **own**.

But following parts and structures are used for the gaseous exchange in plants.

Through Stomata:

The **leaves** and **young stems** have **stomata** in their epidermis. The **gaseous exchange** occurs through these stomata.

Through Air Spaces:

The inner cells of leaves (mesophyll cells) and **stems** also have **air spaces** among them, which help in the **exchange of gases**.

Through Cuticle:

In **young stems** and **leaves**, some gaseous exchange also occurs through the **cuticle** which is present **over** their **epidermis.**

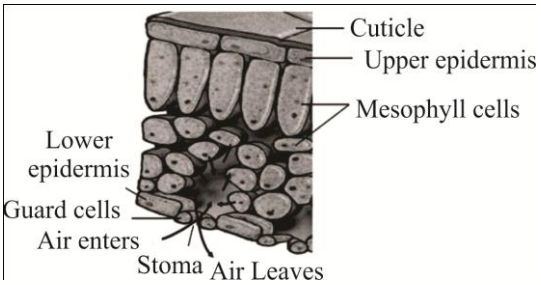

Figure: Gaseous Exchange in a Leaf

Situations in Plants Life:

Leaf cells face **two situations**.

- During day time
- During night time

During Day Time:

During the **day time,** when the **mesophyll cells** of leaves are carrying out **photosynthesis** and **respiration** side by side, the **oxygen produced** in photosynthesis is **utilized** in **cellular respiration**. Similarly, the **carbon dioxide produced** during **cellular respiration** is **utilized** in **photosynthesis**.

During Night Time:

During **night**, when there is **no photosynthesis** occurring, the **leaf cells** get **oxygen** from the **environment** and **release carbon dioxide** through **stomata**.

Through Lenticels:

In **woody stems** and **mature roots**, the entire **surface** is **covered** by **bark** which is **impervious** to **gases or water**. The lenticels **allow air** to **pass** through them.

Lenticels:

The **pores** in the **layer of bark** are called as **lenticels**.

Location of Lenticels:

The **lenticels** are **found** on stems and **slightly** more **raised** than the **general surface** of the **stem**.

Through Roots:

Gases diffuse in and out of the **general surface** of the **young roots**. The gases are **found** in the **soil surrounding** the **roots**.

Aquatic Plants:

The **aquatic plants** get the **oxygen dissolved in water** and **release carbon dioxide** in the **water**.

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SHORT QUESTIONS

Q.1 What are stomata? ***(K.B)*** **GRW 2015**

Ans:

STOMATA

Stomata are the small openings in the epidermis of leaves and young stems for gaseous exchange.

Q.2 Define cellular respiration. ***(K.B)***

Ans: **CELLULAR RESPIRATION** **(MTN 2015)**

Definition:

"Cellular respiration is the process in which the C–H bonds in food are broken by oxidation reductions reactions and energy is transformed into ATP."

Q.3 Define gaseous exchange. ***(K.B)***

Ans: **GASEOUS EXCHANGE**

Definition:

"Taking in oxygen and giving out of carbon dioxide is termed as gaseous exchange."

Q.4 Difference between breathing and cellular respiration. ***(K.B)*** **(GRW 2015, LHR 2015)**

Ans: **DIFFERENTIATTION**

The differences between breathing and cellular respiration are as follows:

Breathing	Cellular Respiration
• The process through which animals take air in their bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide is called breathing.	• The process in which the carbon-hydrogen bonds in the food are broken by oxidation reduction reactions and the energy is transformed into ATP is called cellular respiration.
• Breathing is only the mechanical or physical process for the exchange of gases.	• Respiration involves the mechanical and the bio chemical processes.
• No energy is produced.	• Energy is produced in the form of ATP.
• It occurs at organ system level and respiratory system is involved.	• It occurs at cell level.

Q.5 How gaseous exchange occurs in young stems and leaves? ***(U.B)*** **(GRW 2016, GRW 2015)**

Ans: Page no 02.

Q.6 What are lenticels? Describe their function. ***(K.B)*** **(GRW 2015, 17 LHR 2015, 17)**

Ans: Page no 02.

Q.7 How gaseous exchange takes place in young roots? ***(U.B)***

Ans: Page no 02.

Q.8 How gaseous exchange takes place in aquatic plants? ***(U.B)***

Ans: Page no 02.

Q.9 Define cuticle. ***(K.B)*** **(GRW 2016)**

Ans: Page no 02.

Q.10 How can you find out location of lenticels on stem of plants? ***(U.B)***

Ans: Page no 02.

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10.1 MULTIPLE CHOICE QUESTIONS

1. Which of the following do not contain C-H bonds? *(U.B)*
(A) Carbohydrates (B) Proteins
(C) Vitamins (D) Minerals

2. Which bonds in food are broken during oxidation-reduction reactions? *(A.B)*
(A) C–H (B) C–N
(C) C–O (D) C–S

3. Which process stops during night time? *(U.B)*
(A) Respiration (B) Breathing
(C) Gaseous exchange (D) Photosynthesis

4. Complete oxidation of food requires the presence of: *(K.B)*
(A) Oxygen (B) Nitrogen
(C) Hydrogen (D) CO_2

5. Respiration is a: *(K.B)*
(A) Physical process (B) Bio-chemical process
(C) Mechanical process (D) Geo-chemical process

6. In plants, the gaseous exchange occurs through: *(K.B)*
(A) Stomata (B) Cuticle
(C) Lenticels (D) All of these

7. The process that takes place during day time in plants to produce food: *(U.B)*
(A) Respiration (B) Breathing
(C) Gaseous exchange (D) Photosynthesis

8. In woody stem and mature roots, the entire surface is covered by: *(K.B)*
(A) Wood (B) Bark
(C) Cambium (D) Lenticels

9. Stomata are frequently present on: *(K.B)* **(LHR 2016)**
(A) Upper side of leaf (B) Lower side of leaf
(C) Both sides of leaf (D) Stem

10. The gas produced in mesophyll cells as by product during day time is called: *(K.B)* **(LHR 2016, GRW 2013)**
(A) Carbon dioxide (B) Oxygen
(C) Nitrogen (D) Ammonia

11. The oxygen produced in photosynthesis is utilized in : *(U.B)*
(A) Cellular respiration in plants (B) Cellular respiration in animals
(C) Cellular respiration in Fungi & bacteria (D) All of these

12. Slightly raised structure of stem is : *(K.B)*
(A) Stomata (B) Bark
(C) Lenticels (D) Cambium

13. Most of the gaseous exchange in a leaf occurs through: *(K.B)* **(SWL 2015)**
(A) Stomata (B) General surface
(C) Cuticle (D) Lenticels

14. In young stems and leaves, some gaseous exchange also occurs through _____ which is present over the epidermis: *(K.B)* **(LHR 2016)**
(A) Cortex (B) Endodermis
(C) Cuticle (D) Stomata

15. The aquatics plants get the _____dissolved in water and release _____ in the water: *(K.B)*
(A) Nitrogen, Carbon dioxide (B) Carbon monoxide, oxygen
(C) Oxygen, Carbon dioxide (D) Hydrogen, oxygen

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10.2 GASEOUS EXCHANGE IN HUMANS

LONG QUESTIONS

Q.1 Discuss air passageway in humans. ***(K.B)***

Ans: **HUMAN RESPIRATORY SYSTEM**

Definition:

"Taking in oxygen and **giving out of carbon dioxide** is termed as gaseous exchange."

Explanation:

In **humans** and other **higher animals**, the **exchange of gases** is carried out by the **respiratory system.**

The human respiratory system consists of two parts:

- The air passageway
- The lungs

The Air Passageway:

The **air passageway consists** of the **parts** through which the **outside air comes** in the **lungs** and **after the exchange of gases** it **goes out**. This passage of air consists of the following **parts**:

- External Nostrils
- Nasal cavity
- Internal Nostrils
- Pharynx
- Larynx
- Trachea
- Bronchi
- Bronchioles
- Alveolar Ducts
- Alveoli

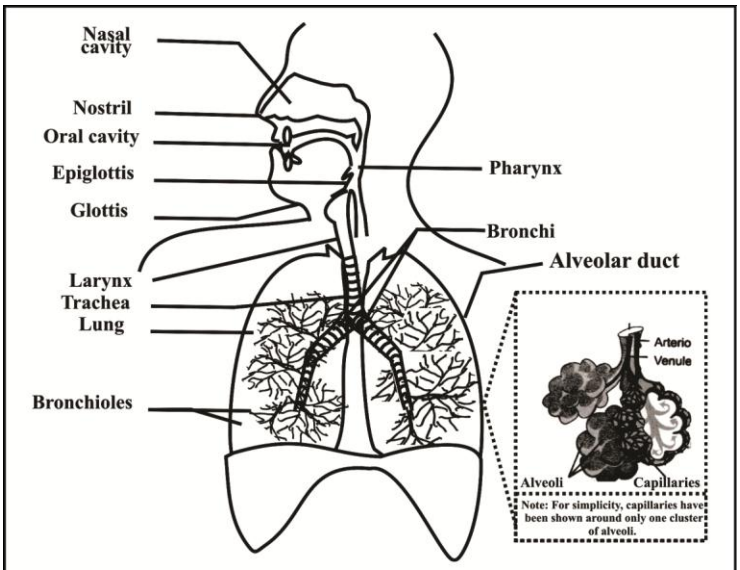

Figure: The Air Passageway and the Lungs

External Nostrils:

The **nasal cavity opens** to the **outside** through the **openings** called **external nostrils**.

Nasal Cavity:

The **nose encloses** the **nasal cavity.** The nasal cavity is divided into **two portions** by a wall. **Each** portion is **lined by fine hairs** and **mucous** which **filter the dust particles** from the air. The **mucous** also **moistens** and **warms** the **incoming air** and keeps its **temperature** nearly **equal to that of the body**.

Internal Nostrils:

The **nasal cavity opens** into **pharynx** by means of **two small openings** called **internal nostrils**.

Pharynx:

Pharynx is a **muscular passage** and is common to **both food and air**. It **extends** to the **opening of oesophagus** and the **larynx**.

Larynx:

The **air goes** from the **pharynx** into the **larynx**. The **larynx** is the **box** made of **cartilage**. It is present **between pharynx and trachea**. It is also called as **voice box**.

Glottis:

Glottis is a **narrow opening** at the **floor** of the **pharynx** which **leads** into **larynx**.

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Epiglottis:
The **glottis** is guarded by a **flap of tissue** called the **epiglottis**.
Vocal Cords:
Two pairs of **fibrous bands** called **vocal cords** are stretched across the **larynx**. The vocal cords **vibrate** when the **air passes** through them. This vibration **produces sounds**.
Trachea:
Larynx continues to the **trachea**, which is also called as **windpipe**. It is about **12 cm long tube** which lies **in front** of the **oesophagus**. There are **C-shaped cartilaginous rings** in the wall of trachea. The **cartilages keep** the **trachea** from **collapsing** even when there is **no air in it**.
Bronchi:
On **entering** the **chest cavity**, the **trachea divides** into **two smaller tubes** called **bronchi**. The singular of bronchi is bronchus. The bronchi also have **cartilaginous plates** in their **walls**. Each **bronchus** enters into the **lung** of its **side** and then **divides** into **smaller branches**.
Bronchioles:
The **bronchi** continue **dividing** in the lungs until they **make several fine tubes** called **bronchioles**.
Alveolar Ducts:
The **bronchioles** progressively **lose** the **cartilage** and they become **narrower**. The bronchioles end as **fine tubules** called the **alveolar ducts**.
Alveoli:
Each **alveolar duct opens** into a **cluster of pouches** called **alveoli**. The alveoli **form** the **respiratory surface** in human body. Each alveolus is a **sac like** structure **lined** by a **single layer** of **epithelial cells**. It is bound on the **outside** by a **network** of **capillaries**.
Working of Lungs:
The **pulmonary artery** from the **heart** containing **deoxygenated blood** enters the **lungs** and branches into **arterioles** and then into **capillaries** which surround the alveoli. These then **join** together to **form** the **venules** which form **pulmonary vein**. The pulmonary vein **carries** the **oxygenated blood** back to the **heart**.

Q.2 Describe structure of lungs. ***(K.B)***

Ans:

THE LUNGS

Definition:
"**Muscular**, **spongy** and **elastic organs** used for the **gaseous exchange** in **higher animals** are called **lungs**". All the **alveoli** on **one side** constitute a **lung**."
There is a **pair of lung** in the **thoracic cavity**.

STRUCTURE OF LUNGS

Ribs and Intercoastal Muscles:
The **chest wall** is made up of **12 pairs** of **ribs** and the **rib muscles** called the **intercoastal muscles**.
Diaphragm:
A **thick muscular** structure, called **diaphragm** is present **below** the **lungs**.
Size:
The **left lung** is **slightly smaller** and has **two lobes** and the **right lung** is **bigger** with **three lobes**.
Elasticity:
The lungs are **spongy** and **elastic organs**.
Presence of Blood Vessels:
The lungs also have **blood vessels** that are the **branches** of **pulmonary arteries** and **veins**.

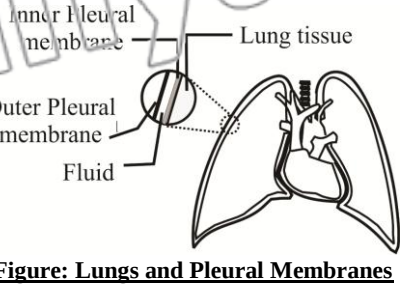

Figure: Lungs and Pleural Membranes

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Internal Features of Lungs:

Bronchi:

On entering the chest cavity, the trachea divides into two smaller tubes called bronchi. The singular of bronchi is bronchus. The bronchi also have cartilaginous plates in their walls. Each bronchus enters into the lung of its side and then divides into smaller branches.

Bronchioles:

The bronchi continue dividing in the lungs until they make several fine tubes called bronchioles.

Alveolar Ducts:

The bronchioles progressively lose the cartilage and they become narrower. The bronchioles end as fine tubules called the alveolar ducts.

Alveoli:

Each alveolar duct opens into a cluster of pouches called alveoli. The alveoli form the respiratory surface in human body. Each alveoli is a sac like structure lined by a single layer of epithelial cells. It is bound on the outside by a network of capillaries.

Protection of Lungs:

Each lung is enclosed by two membranes called the outer pleural membrane and the inner pleural membrane. The membranes enclose a fluid which provides lubrication for the free expanding and contracting of the lungs.

Working of Lungs:

The pulmonary artery from the heart containing deoxygenated blood enters the lungs and branches into arterioles and then into capillaries which surround the alveoli. These then join together to form the venules which form pulmonary vein. The pulmonary vein carries the oxygenated blood back to the heart

10.2 SHORT QUESTIONS

Q.1 Show air passageway of human. ***(K.B)***

Ans: **AIR PASSAGEWAY OF HUMAN**

External nostrils→Nasal cavity→Internal nostrils→Pharynx →Larynx→Trachea→Bronchi→ Bronchioles→Alveolar duct→Alveoli.

Q.2 Define nasal cavity ***(K.B)*** **(LHR 2016)**

Ans: Page no 05.

Q.3 What is pharynx? ***(K.B)***

Ans: Page no 05.

Q.4 What is glottis and epiglottis? ***(K.B)*** **(MTN 2015, LHR 2014, GRW 2016)**

Ans: Page no 05,06.

Q.5 Define voice box. ***(K.B)*** **(LHR 2014, GRW 2017)**

Ans: Page no 06.

Q.6 Define vocal cards. ***(K.B)*** **(LHR 2016)**

Ans: Page no 06.

Q.7 How sound is produced? ***(K.B)***

Ans: **PRODUCTION OF SOUND**

Two pairs of fibrous bands called vocal cords are stretched across the larynx. The vocal cords vibrate when the air passes through them this vibration produces sound.

Q.8 What is trachea? Where is it located? ***(K.B)*** **(MTN 2015, LHR 2013, GRW 2017)**

Ans: Page no 06.

Q.9 What are bronchi? ***(K.B)***

Ans: Page no 06.

Q.10 What are bronchioles? ***(K.B)***

Ans: Page no 07.

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Q.11 What are alveolar duct and alveoli? ***(K.B)***

Ans: Page no 07.

Q.12 What is pulmonary circulation? ***(K.B)***

Ans: Page no 06.

Q.13 Explain the production of speech. ***(U.B)*** **(SWL 2015)**

Ans:

PRODUCTION OF SPEECH

The vibration in vocal cords and the movements of lips, cheeks, tongue and jaws produce specific sound which results in speech. Speech is ability that only humans are gifted.

Q.14 Describe functions of glandular cells of trachea and bronchi. ***(A.B)***

Ans:

FUNCTIONS

The functions of glandular cell and bronchi are as follows:

The trachea and the bronchi are also lined with glandular cells. The glandular cells secrete mucus whish moistens the air and also traps any fine particle of dust or bacteria that have escaped the nasal charity.

Q.15 What are the roles of cilia in trachea and in bronchi? ***(A.B)***

Ans:

ROLES OF CILIA

The trachea and the bronchi are also lined with ciliated cells. The cilia beat with an upward motion so that the foreign particles along the mucous are sent to the oral cavity from where it may be either swallowed or coughed out.

Q.16 What is Larynx? Write its function ***(A.B)*** **LHR 2015**

Ans: Page no 06.

10.2 MULTIPLE CHOICE QUESTIONS

1. In how many portions, the nasal cavity is divided? (K.B)

(A) 1 (B) 2
(C) 3 (D) 4

2. Filtration of dust particles is controlled by : (U.B)

(A) Fine hairs in nasal cavity (B) Mucous
(C) Blood vessels (D) Both a & b

3. Which of the following moistens and warms the incoming air? (K.B)

(A) Fine hairs in nasal cavity (B) Mucous
(C) Blood vessels (D) Both a & b

4. Narrow opening at the floor of pharynx which leads to larynx: (K.B)

(A) Epiglottis (B) Glottis
(C) Nasal Cavity (D) Nostril

5. The glottis is guarded by a flap of tissue called: (K.B)

(A) Pharynx (B) Larynx
(C) Trachea (D) Epiglottis

6. How many pairs of fibrous bands are present in larynx? (K.B)

(A) 1 (B) 2
(C) 3 (D) 4

7. Pharynx is a muscular passage of: (K.B)

(A) 1 (B) 2
(C) 3 (D) 4

8. Larynx continues to the: (K.B)

(A) Bronchi (B) Bronchioles
(C) Trachea (D) Pharynx

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9. Vocal cords are stretched across: (K.B)
(A) Larynx (B) Pharynx
(C) Trachea (D) Esophagus

10. Which one is a sac like structure form the respiratory surface in human body? (K.B)
(A) Bronchus (B) Trachea
(C) Alveolus (D) Larynx

11. Trachea is also termed as: (K.B)
(A) Windpipe (B) Voice box
(C) Air duct (D) Breathing centre

12. Which vessel contains deoxygenated blood? (K.B)
(A) Pulmonary artery (B) Pulmonary vein
(C) Coronary artery (D) Hepatic artery

13. The anatomy of osophagus is _____ to trachea : (K.B)
(A) Dorsal (B) Ventral
(C) Anterior (D) Posterior

14. How many ribs are present in chest wall? (K.B)
(A) 6 (B) 12
(C) 18 (D) 24

15. Alveoli are lined by: (K.B)
(A) Endothelial cells (B) Epithelial cells
(C) Epidermal cells (D) Mesodermal cells

16. The purpose of ribcage is: (A.B) **(GRW 2017)**
(A) Protection of stomach (B) Protection of heart and lungs
(C) Protection of spinal card (D) Protection of pharynx

17. Which statement is correct? (U.B)
(A) Left lung is smaller than right lung (B) Right lung is smaller than left lung
(C) Both lungs are equal in size (D) All statements are correct

18. Lobes present in right lung? (K.B) **(GRW 2017)**
(A) 1 (B) 2
(C) 3 (D) 4

19. How many lobes are present in left lung? (K.B)
(A) 1 (B) 2
(C) 3 (D) 4

20. Venules unite to form: (K.B) **(DGK 2015)**
(A) Pulmonary vein (B) Pulmonary arteries
(C) Trachea (D) Alveoli

21. The part of the air passage way which comes after larynx: (K.B)
(A) Pharynx (B) Trachea
(C) Bronchi (D) None

22. Each alveolar duct opens into a cluster of pouches called: (K.B)
(A) Bronchioles (B) Bronchi
(C) Alveoli (D) Trachea

23. The bronchi continue dividing in the lungs until they make several fine tubes called: (K.B)
(A) Bronchi (B) Trachea
(C) Bronchioles (D) Alveoli

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24. The larynx is a box, made of cartilage, it is present between pharynx and trachea it is also called: (K.B)
(A) Trachea (B) Bronchi
(C) Voice box (D) Vocal cords

25. Each lung is enclosed by two membranes called: (K.B)
(A) Chest cavity (B) Pleural membranes
(C) Thoracic cavity (D) Lungs membrane

26. The length of the trachea is: (K.B)
(A) 13 cm (B) 14 cm
(C) 12 cm (D) 20 cm

27. In humans and higher animals, the exchange of gases is carried out by: (U.B)
(A) Skin (B) Respiratory surface
(C) Air passageway and lungs (D) Only lungs

28. Gaseous exchange occurs in human: (K.B) **(LHR 2017)**
(A) Alveoli (B) Bronchi
(C) Trachea (D) Pharynx

29. The capillaries surrounding the alveoli are joined to form _____, which carry oxygenated blood. *(K.B)*
(A) Arterioles (B) Arteries
(C) Veins (D) Venules

10.2.3 THE MECHANISM OF BREATHING

LONG QUESTION

Q.1 Explain mechanism of breathing. *(K.B)*

OR

Write down the steps of inhalation and exhalation. **(Understanding the Concept Q.2)**

Ans: **MECHANISM OF BREATHING**

Definition:

"The **physical movements** associated with the **gaseous exchange** are called **breathing**".

Explanation:

There are **two phases** of breathing.

- Inhalation or inspiration
- Exhalation or expiration

Inhalation/ Inspiration:

The following **changes** occur in the body during inhalation.

- During **inspiration**, the **rib muscles contract** and **ribs** are **raised**.
- The **dome** shaped **diaphragm contracts** and is **lowered**.
- These movements **increase** the **area** of the **thoracic cavity**, which **reduces** the **pressure** on lungs.
- The **lungs expand** and the **air pressure** within them also **decreases**.
- The **air from outside rushes into** the **lungs** to **equalize** the **pressure** on **both sides**.

Exhalation/Expiration:

After the **gaseous exchange** in the **lungs**, the **impure air** is **expelled out** in exhalation. The following **changes** occur in the body during exhalation.

- During **expiration**, the **rib muscles** relax bringing the **ribs back** to the **original position**.
- The **diaphragm** muscles also **relax** and it gets its **raised** dome shape.
- This **reduces the space** in the **chest cavity** and **increases** the **pressure** on lungs.
- The **lungs contract** and the **air is expelled** out of them.

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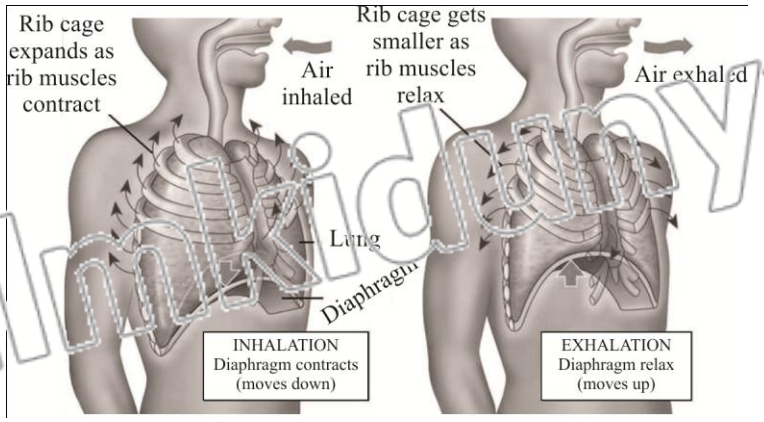

Figure: Steps of Inhalation **Figure: Steps of Exhalation**

Feature	Inspired Air	Expired Air
Amount of oxygen	21%	16%
Amount of carbon dioxide	0.04%	4%
Amount of nitrogen	79%	79%
Amount of water vapours	Variable	Saturated
Amount of dust particles	Variable	Almost none
Temperature	Variable	Almost equal to body temperature

Comparison between the Inspired and the Expired Air

Normal Breathing Rate of Human:

Humans breathe **16-20 times per minute** in **normal** circumstances (at rest condition).

Role of Respiratory Center:

The **rate** of **breathing** is **controlled** by the **respiratory center** in the **brain**. The respiratory centre is **sensitive** to the **concentration** of **carbon dioxide** in the **blood.** When we do exercise or some **hard job** our **muscle cells** carry out **cellular respiration** at **greater rate** it **results** in the **production** of **more carbon dioxide** which is **released** in the **blood**. This greater than normal concentration of carbon dioxide **stimulates** the **respiratory centre** of brain. The respiratory centre **sends messages** to the **rib muscles** and **diaphragm** to **increase** the rate of **breathing** so that the **excess carbon dioxide** present in blood can be **removed out** of body.

Increase in Breath Rate:

During exercise or other **hard physical** works the **breathing rate** may **increase** up to **30-40 times per minute.**

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10.2.3 SHORT QUESTIONS

Q.1 What is dead space? ***(U.B)*** **(LHR 2015)**

Ans: **DEAD SPACE**

The amount of air which is inhaled that doesn't take part in gaseous exchange is called dead space.

Q.2 Can we control breathing? ***(A.B)***

Ans: **CONTROL OF BREATHING**

We can control the rate of breathing but not for a long time. The breathing movements are involuntary to a large extent.

Q.3 Differentiate between inspiration and expiration ***(K.B)*** **(GRW 2016)**

Ans: **DIFFERENTIATION**

The differences between inspiration and expiration are as follows:

Inspiration	Expiration
• During inspiration, the rib muscles contract and ribs are raised.	• During expiration, the rib muscles relax bringing the ribs back to original position.
• The dome shaped diaphragm contracts and is lowered.	• The diaphragm muscles also relax and it gets its raised dome shape.
• These movements increase the area of the thoracic cavity and reduce pressure on lungs.	• This reduces the space in the chest cavity and increases the pressure on lungs.
• The lungs expand and the air pressure within them also decreases.	• The lungs contract and the air is expelled out of them.

Q.4 Give a comparison between inspired and expired air. ***(K.B)***

Ans: **COMPARISON**

The comparison between the inspired and expired air are as follows:

Feature	Inspired Air	Expired Air
Amount of oxygen	21%	16%
Amount of carbon dioxide	0.04%	4%
Amount of nitrogen	79%	79%
Amount of water vapours	Variable	Saturated
Amount of dust particles	Variable	Almost none
Temperature	Variable	Almost equal to body temperature

Q.5 What part of the blood transports oxygen to the body? ***(K.B)***

Ans: **TRANSPORT OF OXYGEN TO THE BODY**

Haemoglobin in red blood cells transport oxygen to the body.

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10.2.3 MULTIPLE CHOICE QUESTIONS

1. Rate of breathing depends upon concentration of which gas in the blood? (A.B) (LHR 2014)
(A) Oxygen (B) Carbon dioxide
(C) Nitrogen (D) Hydrogen

2. During inspiration, the rib muscles: (K.B)
(A) Contract (B) Relax
(C) Expand (D) Elongate

3. During inspiration, the lungs: (K.B)
(A) Expand (B) Become small
(C) Contract (D) Decrease in size

4. A thick muscular structure below the lungs: (K.B) (GRW 2017)
(A) Kidney (B) Liver
(C) Diaphragm (D) Ureter

5. In human, normal breathing rate per minute: (K.B) (DGK 2014)
(A) 10-20 times (B) 10-15 times
(C) 16-20 times (D) 15-18 times

6. The respiratory center is sensitive to the concentration of which gas in blood? (U.B)
(A) Carbon monoxide (B) Carbon dioxide
(C) Ammonia (D) Oxygen

7. Temperature of inhaled air is: (U.B)
(A) Equal to body temperature (B) Higher than body temperature
(C) Depends on atmosphere (D) All of thsese

8. The respiratory centre is present in: (K.B) (LHR 2017)
(A) Lungs (B) Brain
(C) Nose (D) Muscles

9. During exercise or other hard physical work, the breathing rate per minute may increase up to: (A.B)
(A) 20-30 times (B) 25-35 times
(C) 30-35 times (D) 30-40 times

10. Amount of nitrogen in expired air: (K.B)
(A) 70% (B) 72%
(C) 76% (D) 79%

11. Percentage of carbon dioxide in expired air during breathing is: (K.B) (LHR 2015)
(A) 16% (B) 4%
(C) 21% (D) 0.04%

12. Water vapors in expired air: (K.B)
(A) Variable (B) Saturated
(C) Almost none (D) 100%

13. Dust particles in expired air: (K.B)
(A) Variable (B) Saturated
(C) Almost none (D) 50%

14. Amount of oxygen in expired air is: (K.B) (BWP 2015)
(A) 4% (B) 14%
(C) 16% (D) 20%

15. Amount of carbon dioxide in inspired air is: (K.B)
(A) 16% (B) 13%
(C) 0.04% (D) 4%

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10.3 RESPIRATORY DISORDERS

LONG QUESTIONS

Q.1 What are the respiratory disorders? Write names of some respiratory disorders. (K.B)

Ans:

RESPIRATORY DISORDERS

There are number of respiratory disorders which affect people. The percentage of such disorders is particularly high in Pakistan. It is due to more concentration of air pollutants not only in the urban but also in the rural atmosphere. Some of the important respiratory disorders are given below:

- Bronchitis
- Emphysema
- Pneumonia
- Asthma
- Lung Cancer

Q.2 Explain bronchitis and its types. (A.B) **(Understanding the Concept Q.3)**

Ans:

BRONCHITIS

Etymology:

Bronchi/Bronchioles and Itis = Inflammation

Definition:

'The **inflammation** of the **bronchi** or **bronchioles** is called bronchitis'.

Normal Bronchus Inflamed Bronchus

Figure: Bronchi

Effects:

It results in excessive **secretions of mucus** into the **tubes**, leading to the **swelling** of **tubular walls** and **narrowing of tubes**.

Causes:

It is caused by:

- **Viruses**
- **Bacteria**
- **Exposure to chemical irritants** (e.g. tobacco smoke)

Types of Bronchitis:

There are **two major types** of bronchitis:

- Acute Bronchitis
- Chronic Bronchitis

Acute Bronchitis:

The **acute bronchitis** usually **lasts** about **two weeks** and patients **recover** with **no permanent damage** to the bronchi or bronchioles.

Chronic Bronchitis:

In **chronic bronchitis**, the **bronchi develop chronic inflammation**. It usually **lasts** for **three months** to **two years**. The majority of people **diagnosed** with chronic bronchitis are **45 years** of age or **older**.

Symptoms:

Symptoms of bronchitis include:

- **Cough**
- **Mild wheezing**
- **Fever**
- **Chills**
- **Shortness of breath** (especially when doing hard job).

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Q.3 What is emphysema? Explain its symptoms. (A.B) **(Understanding the Concept Q.3)**

Ans: **EMPHYSEMA** **(GRW 2015)**

Definition:

"Emphysema is the **destruction** of the **walls** of the **alveoli**".

Effects:

It results in **larger sacs** but with **less surface** area for **gaseous exchange**. As **lung tissue breaks** down, the lungs **do not come back** to their **original shape** after **exhalation**. So, **air** cannot be pushed out and is **trapped** in the **lungs**.

Causes:

- **Smoking**
- **Severe air pollution**
- **Other chemical irritants**

Symptoms:

The symptoms of emphysema include:

- **Shortness of breath**
- **Fatigue**
- **Recurrent respiratory infections**
- **Weight loss**

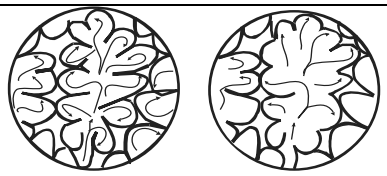

Figure: The Alveoli

Appearance of Symptoms:

By the time the **symptoms** of emphysema **appear**, the patient has usually **lost 50% to 70%** of his/her **lung tissue**.

Level of Oxygen in Blood:

The **level** of **oxygen in blood** may get so **low** that it **causes** serious **complications**.

Q.4 Write a note on pneumonia. (A.B) **(Understanding the Concept Q.3) (LHR 2015, 2016)**

OR

What is pneumonia? Describe its symptoms and causes **(LHR 2016)**

Ans: **PNEUMONIA**

Definition:

"Pneumonia is an **infection** of **lungs**".

Double Pneumonia:

If this **infection** affects **both lungs**, it is called **double pneumonia**.

Common Cause:

The most common cause of pneumonia is a **bacterium, Streptococcus pneumoniae.**

Other Causes:

- **Viral infections** (influenza virus)
- **Fungal infections**

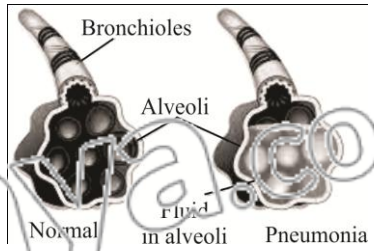

Figure: Pneumonia

Mode of Action:

When the **causative organisms** enter the **alveoli**, they **settle there** and **grow** in number. They **break** the **lung tissues** and the area becomes **filled** with **fluid and pus**.

Symptoms: **(GRW 2013)**

The symptoms of pneumonia include:

- **Cold**
- **High fever**
- **Shivering**
- **Cough**
- **Sputum production**
- **Shortness of breath**

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Skin Colour:
The patient's **skin colour** may **change** and become **dusky or purplish**. It is due to **poor oxygenation of blood.**

Vaccination:
Vaccines are available to **prevent pneumonia** caused by S. pneumoniae.

Treatment:
Antibiotics are used in the **treatment** of this type of **pneumonia**.

Fatal Disease:
Prior to the **discovery** of **antibiotics**, **one-third** of pneumonia patients **died** from the infection.

Q.5 Write a note on asthma. (A.B) **(GRW 2015)**

Ans:

ASTHMA

Introduction:
"Asthma is a form of **allergy**".

Causes:
- **Inflammation of the bronchi**
- **More mucous production**
- **Narrowing of the airways**

Sensitivity to Allergens:
In asthma patients, the **bronchi** and bronchioles become **sensitive** to different **allergens**. When **exposed** to any of such **allergens**, the sensitive **airways** show **immediate** and **excessive response of constriction**. In this condition, the patient feels **difficulty** in **breathing**.

Allergens:
The **agents** that **cause allergy** are called allergens.

Examples:
- **Dust**
- **Smoke**
- **Perfumes**
- **Pollens**

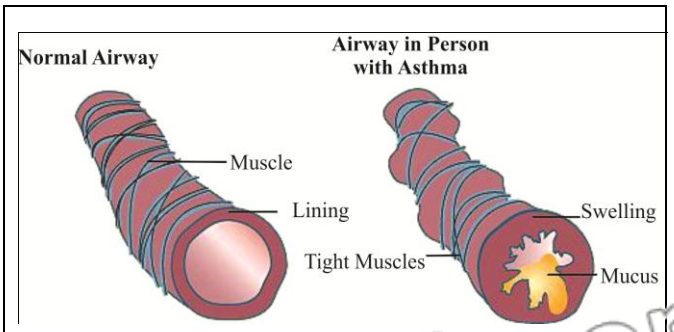

Figure: Asthma

Symptoms:
The **symptoms** of asthma **vary** from **person to person**. The major symptoms include:
- **Shortness of breath** (especially with exertion or at night)
- **Wheezing** (whistling sound when breathing out)
- **Cough**
- **Chest tightness**

Treatment:
The **chemicals** with **ability** to **dilate the bronchi** and bronchioles are used in the **treatment** of asthma. Such medicine is given in the form of **inhalers**.

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Q.6 Write a note on lung cancer. (A.B) **(LHR 2014, MTN 2015)**

Ans:

LUNG CANCER

Introduction:

"**Lung cancer** is a **disease** of **uncontrolled cell divisions** in the **tissues** of the **lung**. The cells continue to **divide without** any **control** and form **tumours**".

Incidence:

Lung cancer is the most **common** cause of **cancer - related deaths** and is responsible for more than **1.3 million deaths worldwide** annually.

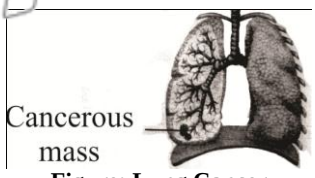

Figure: Lung Cancer

Malignant Tumours:

The cellular growth may also **invade adjacent tissues** beyond the lungs.

Symptoms:

The most common **symptoms** are:

- **Shortness of breath**
- **Coughing** (including coughing up blood)
- **Weight loss**

Major Cause:

Smoking is the **main cause** of lung cancer. This risk of lung cancer is significantly **lower in nonsmokers**. **Cigarette** smoke contains **over 50** known **carcinogens**.

Other Causes:

The main **causes** include:

- **Carcinogens**
- **Ionizing radiation**
- **Viral infection**

Passive Smoking:

"The **inhalation** of **smoke** from **another's smoking** is called **passive smoking**".

It is also a **cause** of **lung cancer**. The **smoke** from the **burning end** of a cigarette is more **dangerous** than the **smoke** from the **filter end**.

Prevention:

Eliminating tobacco smoking is a primary **goal** in the prevention of lung cancer.

Role of WHO:

The World Health Organization has **called** for **governments** to **stop tobacco advertising** to prevent young people from taking **up smoking**.

10.3 SHORT QUESTIONS

Q.1 What is bronchitis? (K.B) **(LHR 2016)**

OR

What are the major types of bronchitis?

Ans: Page no 14.

Q.2 Differentiate between acute bronchitis and chronic bronchitis.(K.B) **(LHR 2017)**

Ans:

DIFFERENTIATION

The difference between acute bronchitis and chronic bronchitis is as follows:

Acute Bronchitis	Chronic Bronchitis
• The "acute bronchitis" usually lasts about two weeks and patients recover with no permanent damage to the bronchi or bronchioles.	• In "chronic bronchitis" the bronchi developed chronic inflammation. It usually lasts for three months to two years.

Q.3 Write symptoms of bronchitis. (U.B) **(GRW 2017, DGK 2015, SWL 2015)**

Ans: Page no 14.

Q.4 What are the causes of bronchitis? (A.B) **(DGK 2015)**

Ans: Page no 18.

Q.5 Differentiate between asthma and emphysema. (K.B) **(GRW 2016)**

Ans:

DIFFERENTIATION

The differences between asthma and emphysema are as follows.

Asthma	Emphysema
Definition	
• "Asthma is a form of allergy".	• "Emphysema is the destruction of the walls of the alveoli".
Causes	
• Inflammation of the bronchi • More mucous production • Narrowing of the airways	• Smoking • Severe air pollution • Other chemical irritants

Q.6 Define emphysema. (K.B)

OR

What are symptoms of emphysema? (U.B) **(SWL 2014)**

Ans: Page no 14.

Q.7 What are the causes of pneumonia? (A.B)

Ans: Page no 15.

Q.8 How pneumonia develops? (A.B)

Ans: Page no 15.

Q.9 What are symptoms of pneumonia? (U.B)

Ans: Page no 16.

Q.10 What is the treatment of pneumonia? (A.B)

Ans: Page no 16.

Q.11 Define asthma. (K.B) **(LHR 2015)**

OR

Write symptoms of asthma. (U.B) **(LHR 2015, 2016, GRW 2016)**

Ans: Page no 16.

Q.12 How asthma develops? (A.B)

Ans: Page no 16.

Q.13 What is the treatment of asthma? (A.B)

Ans: Page no 16.

Q.14 What is meant by lungs cancer? (K.B)

OR

What are the symptoms of lungs cancer? (U.B) **(GRW 2016)**

Ans: Page no 17.

Q.15 What are the main causes of lung cancer? (A.B)

Ans: Page no 17.

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10.3 MULTIPLE CHOICE QUESTIONS

1. A disease which is not caused by Bacteria : (U.B)
(A) Pneumonia (B) Bronchitis
(C) Emphysema (D) Tuberculosis

2. The inflammation of bronchi or bronchioles is called: (K.B) **(LHR 2013)**
(A) Bronchitis (B) Emphysema
(C) Pneumonia (D) Asthma

3. Causes of bronchitis: (A.B)
(A) Viruses (B) Bacteria
(C) Chemical irritants (D) All of these

4. The destruction of the walls of alveoli: (K.B)
(A) Asthma (B) Pneumonia
(C) Emphysema (D) Bronchitis

5. By the time, the symptoms of emphysema appear what percentage of lung tissue damage has happened? (A.B)
(A) 40% - 60% (B) 50% - 70%
(C) 60% - 80% (D) 50% - 80%

6. In which of the following disease the alveoli are filled with pus? (K.B)
(A) Bronchitis (B) Asthma
(C) Pneumonia (D) Emphysema

7. In which disease, the patient's skin colour may become dusky or purplish? (K.B)
(A) Lung cancer (B) Pneumonia
(C) Emphysema (D) Bronchitis

8. The decrease in surface area of lungs is observed in : (U.B)
(A) Pneumonia (B) Emphysema
(C) Bronchitis (D) Asthma

9. Main causes of any cancer include: (A.B)
(A) Carcinogens (B) Ionizing radiations
(C) Viral infections (D) All of these

10. How many carcinogens are present in cigarette smoke? (K.B) **(MTN 2015)**
(A) Over 50 (B) At least 50
(C) Less than 50 (D) Both a and b

11. Which one was used as insecticide in the past? (A.B)
(A) Caffeine (B) Ephedrine
(C) Marijuana (D) Nicotine

12. Increase the tooth loss in smokers: (K.B)
(A) 1 - 2 times (B) 2 - 3 times
(C) 3 - 4 times (D) 4 - 5 times

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13. Increase the risk of tuberculosis in smokers: (K.B)

(A) 2 - 4 times (B) 3 - 5 times

(C) 4 - 6 times (D) 5 - 7 times

14. Increase the risk of pneumonia in smokers: (K.B)

(A) 2 times (B) 3 times

(C) 4 times (D) 5 times

15. Increase the risk of heart diseases in passive smokers: (K.B)

(A) 20 - 30% (B) 25% - 30%

(C) 25% - 40% (D) 30% - 40%

16. Increase the risk of lung cancer in passive smokers: (K.B)

(A) 10 - 20% (B) 15% - 25%

(C) 20% - 30% (D) 25% - 35%

17. Cancer of which organ can be caused by smoking: (U.B)

(A) Oral cavity (B) Larynx

(C) Lung (D) All of these

18. Which gas reduces the oxygen carrying capacity of haemoglobin? (U.B)

(A) Carbon dioxide (B) Carbon monoxide

(C) Nitrogen (D) Ammonia

19. Due to smoking, production of which blood cells increase? (K.B)

(A) Erythrocytes (B) Leucocytes

(C) Blood Platelets (D) None of these

20. The trachea and the bronchi are also lined with: (K.B)

(A) Ciliated cells (B) Mucous cells

(C) Glandular (D) Both A and C

21. Which one is the form of allergy in respiratory disorders? (K.B)

(A) Asthma (B) Bronchitis

(C) Pneumonia (D) Lung Caner

22. According to the WHO, the rates of smoking have declined in the developed world. In the developing world, however, it is rising by: (A.B)

(A) 3.4% (B) 3.5%

(C) 5.6% (D) None

23. Lung cancer is the most common cause of cancer-related death and is responsible for more than _____ million deaths worldwide annually. (K.B)

(A) 1.6 (B) 1.3

(C) 1.7 (D) 2

24. The majority of people diagnosed with chronic bronchitis are _____. (K.B)

(A) 40 Years or older (B) 50 Year or older

(C) 45 Years or older (D) Less than 50 Years

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10.3.2 BAD EFFECTS OF SMOKING

LONG QUESTION

Q.1 Describe bad effects of smoking. (A.B) **(BWP 2014)**

Ans:

BAD EFFECTS OF SMOKING

Smoking is **harmful** due to the **chemicals** in **cigarettes** and **smoke**.

Chemical Composition of Tobacco Smoke:

Tobacco smoke contains **over 4,000 different** chemicals, out of which **at least 50** are **carcinogens** and many are **poisonous**.

Miss Concept about Smoking:

Many people think that **lung cancer** is the only **smoking related disease** and it is the **number one cause** of **death** among **smokers**. But it is **not right**. **Cigarette smoke affects** the **body** from **head to toe. Smokers** have a **much higher** risk of developing a number of **life threatening diseases**.

Smoking may also lead to the cancer in:

- **Kidneys**
- **Oral cavity**
- **Larynx**
- **Breast**
- **Bladder**
- **Pancreas**

Effects on Respiratory System:

Many **chemicals** in **tobacco smoke damage** the air **passageway**, which leads to **emphysema** and other **respiratory disorders**.

Effects on Circulatory System:

Smoking also has **effects** on the **circulatory system**. The following are the **side effects** of **smoking** on circulatory system.

- The **carbon monoxide** present in **tobacco smoke lessens** the **oxygen-carrying capacity** of **haemoglobin**.
- Many other **chemicals** in **smoke** increase the **production of blood platelets**. When **platelets** are **more than the normal numbers**, they make the **blood viscous** and it can **lead to arteriosclerosis**.

Other Disorders Related to Lungs:

Smokers are at **greater risk** of developing **infections**, particularly in the **lungs**. For examples:

- **Smoking** increases the **risk of tuberculosis** by two **to four times**.
- **Pneumonia by four times**.

Effects on Teeth: **(BWL 2014)**

Smoking is also responsible for **weakening** and **staining** the teeth. Tooth loss is **2 to 3 times higher in smokers** than in **non-smokers**.

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10.3.2 SHORT QUESTIONS

Q.1 How nicotine is dangerous to human body? (A.B)

Ans:

NICOTINE

Nicotine is a powerful poison and was widely used as an insecticide in the past. When inhaled through tobacco smoking. It reaches our circulatory system and not only hardens the walls of the arteries but also damages the brain tissues.

Q.2 Describe social effects of smoking. (A.B)

Ans:

SOCIAL EFFECTS OF SMOKING

Smoking also affects the social life of a person. Smokers may face social un-acceptance because other people may not want to be exposed to other's smoke.

Q.3 What are effects of smoking on circulatory system? (A.B) **(LHR 2016, GRW 2016)**

Ans: Page no 21.

Q.4 Why does blood become thick due to smoking? (A.B)

Ans: Page no 21.

Q.5 Write two risks of passive smokers. (U.B)

Ans:

PASSIVE SMOKERS

Non-smokers who are exposed to second-hand smoke (passive smoke) at home or work increase their heart diseases risk by 20-30% and their lung cancer risk by 20-30%.

Q.6 Write the chemical composition of cigarette smoke. (K.B)

Ans: Page no 21.

Q.7 If a person stop smoking can contaminant particles will remove from lungs or not? (U.B)

Ans:

CONTAMINATED PARTICLES

If a person stop smoking, the chance to develop cancer decreases as damage to the lungs is repaired and contaminant particles are gradually removed.

10.3.2 MULTIPLE CHOICE QUESTIONS

1. Total chemicals in tobacco smoke are: (K.B)

(A) 1000 (B) 2000
(C) 3000 (D) 4000

2. Every year world no tobacco day is celebrated on: (K.B)

(A) 31 March (B) 31 May
(C) 21 March (D) 30 May

3. How many carcinogens are present in cigarette smoke? (K.B)

(A) 30 (B) 40
(C) 50 (D) 60

4. Many chemicals in smoke increase the production of which type of blood cells? (K.B)

(A) Platelets (B) Lymphocytes
(C) Red blood cells (D) Monocytes

5. Smoking increases the risk of tuberculosis by: (K.B)

(A) Two times (B) Four times
(C) Two to four times (D) Four to eight times

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

10.1 GASEOUS EXCHNAGE IN PLANTS

1	D	2	A	3	D	4	A	5	B	6	D
7	D	8	B	9	B	10	B	11	D	12	C
13	A	14	C	15	C						

10.2 GASEOUS EXCHANGE IN HUMANS

1	B	2	D	3	B	4	B	5	D	6	B
7	D	8	C	9	A	10	C	11	A	12	A
13	B	14	B	15	B	16	B	17	A	18	C
19	B	20	A	21	B	22	C	23	C	24	C
25	B	26	C	27	C	28	A	29	D		

10.2.3 THE MECHANISM OF BREATHING

1	B	2	A	3	A	4	C	5	C	6	B	7	C
8	B	9	D	10	D	11	B	12	B	13	C	14	C
15	C												

10.3 RESPIRATORY DISORDERS

1	C	2	A	3	D	4	C	5	B	6	C
7	B	8	B	9	D	10	A	11	D	12	B
13	A	14	C	15	B	16	C	17	D	18	B
19	C	20	D	21	A	22	A	23	B	24	C

10.3.2 BAD EFFECTS OF SMOKING

1	D	2	B	3	C	4	A	5	C

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. The process of gaseous exchange involves: (U.B)
(a) Breakdown of C-H bonds to yield energy.
(b) Physical movements that take air in and out of body.
(c) Getting oxygen from the air and removing carbon dioxide.
(d) Transport of oxygen by the blood to different parts of the body.

2. Most of the gaseous exchange in a leaf occurs through: (K.B)
(a) Stomata (b) General surface
(c) Cuticle (d) Lenticels

3. How many bronchi are there in the air passageway? (K.B)
(a) One (b) Two
(c) Many (d) None

4. Where does the gaseous exchange occur in humans? (K.B)
(a) Pharynx (b) Trachea
(c) Bronchi (d) Alveoli

5. Which structure actively helps in taking the air out of lungs? (K.B)
(a) Nasal cavity (b) Bronchus
(c) Bronchiole (d) Diaphragm

6. The primary chemical stimulus for breathing is the concentration of: (U.B)
(a) Carbon dioxide in blood (b) Oxygen in blood
(c) Carbon dioxide in muscles (d) Oxygen in muscles

7. Point out the FALSE statement about respiration: (U.B)
(a) Gases can easily pass through the walls of the alveoli
(b) Gas exchange in lungs is very efficient because lungs provide large surface area
(c) In emphysema the walls of alveoli break and there is more surface area
(d) Dust particles can damage the lung by irritating the inner alveoli surface.

8. A disease involving the breakdown of air sacs of the lungs is: (K.B)
(a) Pneumonia (b) Bronchitis
(c) Asthma (d) Emphysema

9. Which process does not occur in the nasal cavity? (U.B)
(a) Trapping of large dust particles (b) Humidification of the inhaled air
(c) Warming of the inhaled air (d) Exchange of gases

10. What type of blood vessels surrounds the alveoli? (K.B)
(a) Artery (b) Arteriole
(c) Capillary (d) Vein

ANSWER'S KEY

1	c	2	a	3	b	4	b	5	d
6	A	7	c	8	d	9	d	10	c

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SHORT QUESTIONS

1. Differentiate between breathing and cellular respiration. (K.B)

Ans: **DIFFERENTIATION**

The differences between breathing and cellular respiration are as follows:

Breathing	Cellular Respiration
• The process through which animals take air in their bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide is called breathing.	• The process in which the carbon-hydrogen bonds in the food are broken by oxidation reduction reactions and the energy is transformed into ATP is called cellular respiration.
• Breathing is only the mechanical or physical process for the exchange of gases.	• Respiration involves the mechanical and the biochemical processes.
• No energy is produced.	• Energy is produced in the form of ATP.
• It occurs at organ system level and respiratory system is involved	• It occurs at cell level.

2. Trace the path of air from the nasal cavity to the alveoli. (K.B)

Ans: **PATH OF AIR FROM THE NASAL CAVITY TO THE ALVEOLI**

External nostrils→ Nasal cavity → Internal nostrils →Pharynx → Larynx → Trachea →Bronchi → Bronchioles → Alveolar duct → Alveoli

3. How will you differentiate between a stoma and a lenticel? (K.B) **(GRW 2016)**

Ans: **DIFFERENTIATION**

The differences between stoma and lenticel are as follows:

Stoma	Lenticel
• Stomata are the small openings in the epidermis of leaves and young stems for gaseous exchange. • They are found in the epidermis of leaves and young stems.	• Small raised areas in the bark of stems and roots that enable gaseous exchange. • They are found in the layer of bark.

UNDERSTANDING THE CONCEPT

1. How do the different parts of the plant body exchange gases with the environment? (K.B)

Ans: See the LQ.1 of **(Topic 10.1)**

2. Write down the steps of inhalation and exhalation. (K.B)

Ans: See the LQ.1 of **(Topic 10.2.3)**

3. State the signs and symptoms, causes and treatments of bronchitis, emphysema and pneumonia. (A.B)

Ans: See the LQ 2, 3, 4 **(Topic 10.3)**

4. How does the tobacco smoke damage the respiratory system? (A.B)

Ans: **DAMAGE OF TOBACCO SMOKE TO RESPIRATORY SYSTEM**

Smoking is harmful due to the chemicals in cigarettes and smoke. Tobacco smoke contains over 4,000 different chemicals, out of which at least 50 are carcinogens and many are poisonous.

Misperception:

Many people think that lung cancer is the only smoking-related disease and it is the number one cause of death among smokers. But it is not right. Cigarette smoke affects the body from head to toe. Smokers have a much higher risk of developing a number of life threatening diseases.

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Damage to Respiratory System:

Many chemicals in tobacco smoke damage the air passageway, which lead to emphysema and other respiratory disorders.

Lung Infections:

Smokers are at greater risk of developing infections, particularly in the lungs. For example, smoking increases the risk of tuberculosis by two to four times, and of pneumonia by four times.

Passive Smokers:

Non-smokers who are exposed to second hand smoke (passive smoke) at home or work increase their heart disease risk by 25-30% and their lung cancer risk by 20-30%.

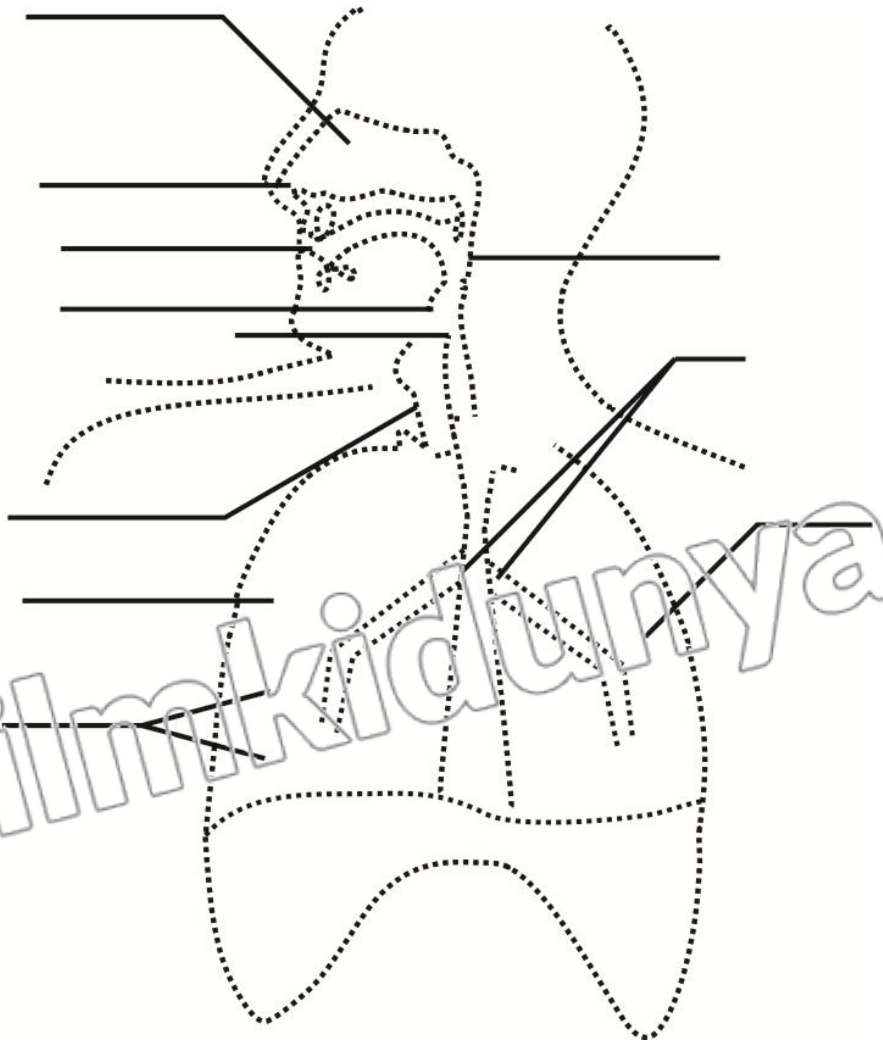
Effect of Smoking on Social Life:

Smoking affects the social life of a person. Smokers may face social unacceptance because other people may not want to be exposed to other's smoke.

ASSIGNMENT

PRACTICE DIAGRAM & LABEL

RESPIRATORY SYSTEM



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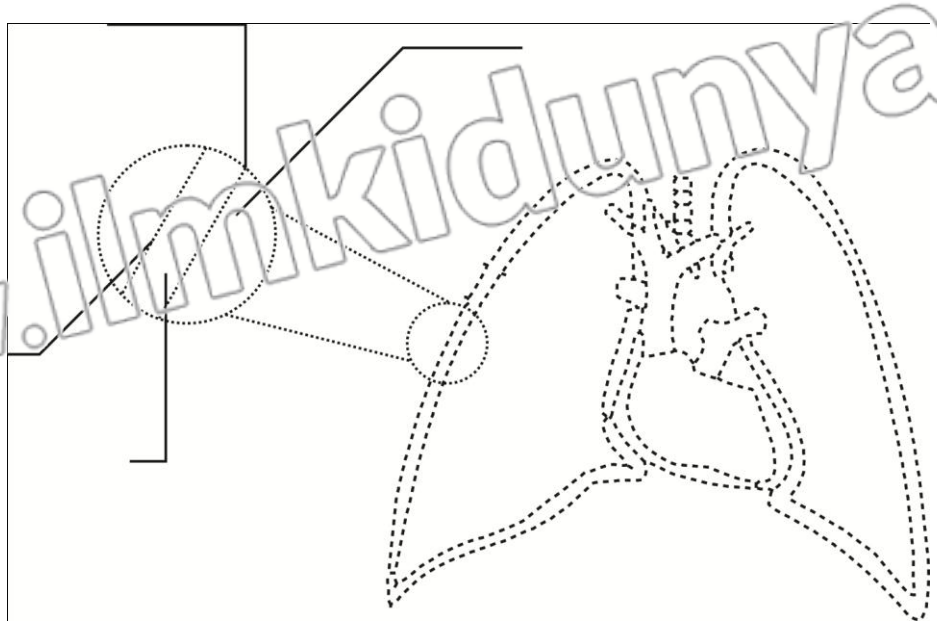
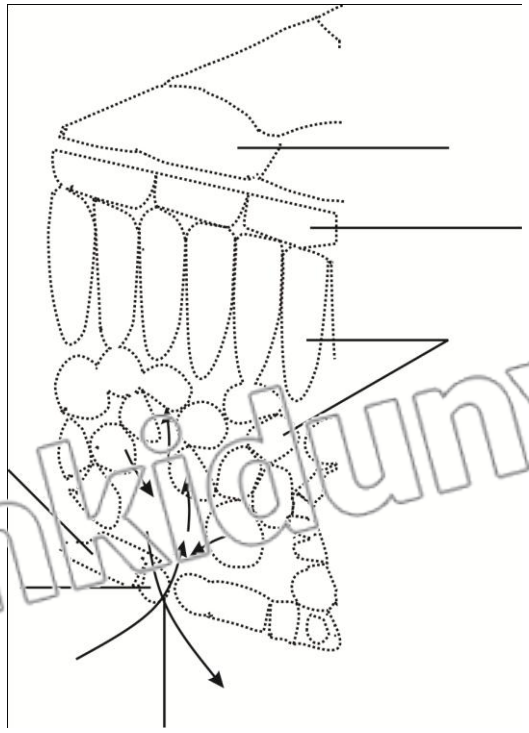
LUNGS



GASEOUS EXCHANGE IN A LEAF



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. (6×1=6)

1. In young stems and leaves, some gaseous exchange also occurs through _____ which is present over the epidermis. (K.B)

(A) Cortex **(B)** Endodermis
(C) Cuticle **(D)** Stomata

2. The aquatics plants get the ____ dissolved in water and release _____ in the water. (K.B)

(A) Nitrogen, carbon dioxide **(B)** Carbon monoxide, oxygen
(C) Oxygen, carbon dioxide **(D)** Hydrogen, oxygen

3. How many pairs of fibrous bands are present in larynx? (K.B)

(A) 1 **(B)** 2
(C) 3 **(D)** 4

4. Which one was used as insecticide in the past? (A.B)

(A) Caffeine **(B)** Ephedrine
(C) Marijuana **(D)** Nicotine

5. A disease involving the breakdown of air sacs of the lungs is: (K.B)

(A) Pneumonia **(B)** Bronchitis
(C) Asthma **(D)** Emphysema

6. Which process does not occur in the nasal cavity? (U.B)

(A) Trapping of large dust particles **(B)** Humidification of the inhaled air
(C) Warming of the inhaled air **(D)** Exchange of gases

Q.2 Give short answers to following questions. (5×2=10)

(i) How gaseous exchange occurs in young stems and leaves? **(U.B)**

(ii) Difference between breathing and respiration. **(K.B)**

(iii) What is the role of glandular cells of trachea ad bronchi? **(A.B)**

(iv) What is the prevention and treatment of pneumonia? **(A.B)**

(v) How nicotine is dangerous to human body? **(A.B)**

Q.3 Answer the following questions in detail. (5+4=9)

(a) Explain the mechanism of breathing. **(K.B)**

(b) Write a note on asthma. **(K.B)**

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.

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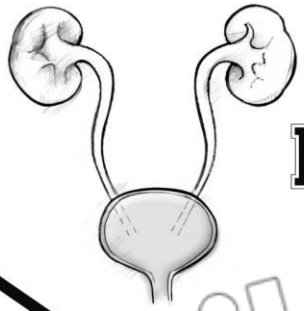

CH# 11 HOMEOSTASIS

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11.1 HOMOSTASIS IN PLANTS

LONG QUESTIONS

Q.1 Describe homeostasis in plants. (A.B) **(GRW 2014, LHR 2015, DGK 2015)**

OR

How do the plants excrete extra water and salts form their bodies. (A.B)

(Understanding the Concept Q.2)

Ans: **HOMEOSTASIS IN PLANTS**

Definition:

"The **maintenance** of the **internal conditions** of body at **equilibrium**, despite **changes** in the **external environment**".

Explanation:

Plants **respond** to **environmental changes** and keep their **internal conditions constant** (homeostasis). They apply **different mechanisms** for the homeostasis of water and other chemicals (oxygen, carbon dioxide, nitrogenous materials etc.).

Removal of Carbon Dioxide:

- In **daytime**, the **carbon dioxide produced** during **cellular respiration** is **utilized** in **photosynthesis** and hence it is **not** a **waste** product.
- At **night**, it is **surplus because** there is **no utilization** of carbon **dioxide**. It is **removed** from the tissue cells by **diffusion**.
- In leaves and young stems, carbon dioxide **escapes** out through **stomata**.
- In **young roots**, carbon dioxide **diffuses** through the **general root surface**, especially through **root hairs**.

Removal of Extra Oxygen:

- **Oxygen** is produced in **mesophyll cells** only during **daytime**, as a **by-product** of **photosynthesis.**
- After its **utilization** in **cellular respiration**, the **mesophyll cells remove** the **extra amount** of oxygen through stomata.

Removal of Extra Water:

- Plants **obtain water** from **soil** and it is also **produced** in the **body** during **cellular respiration**. Plants **store large amount** of water in their cells for **turgidity**.
- **Extra water** is **removed** from plant body by **transpiration**.

Transpiration:

- **"The loss of water** from **plant surface** in the form of **vapors** is called **transpiration**".

  At night, transpiration usually does **not occur** because most plants have their **stomata closed**.

Guttation:

- "The **appearance** of **drops of water** on the **tips or edges of leaves** is called **guttation**".

  If there is **high water** content in **soil**, water **enters** the **roots** and is **accumulated** in **xylem vessels**. Some plants such as **grasses force** this water through **special pores**, present at leaf tips or edges, and form drops.

  Guttation Versus Dew:

  Guttation is **not** to be confused with **dew**, which **condenses** from the **atmosphere** onto the **plant surface**.

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Removal of Metabolic Wastes:

Plants **deposit** many **metabolic wastes** in their **bodies** as **harmless insoluble materials**.

Examples of Metabolic Wastes:

- **Calcium oxalate** is deposited in the form of **crystals** in the leaves and stems of many **plants** e-g. **In tomato**.
- In **trees** which **shed** their **leaves** yearly, the **excretory products** are **removed** from body during **leaf fall**.
- Other **wastes materials** that are **removed** by some plants are
  - **Resins** (by coniferous trees)
  - **Gums** (by keekar)
  - **Latex** (by rubber plant)
  - **Mucilage** (by carnivorous plant and lady finger) etc.

Resin drops from a cut tree | Lattice being from a tree extracted | Mucilage drops on a carnivorous plant

Figure: Removal of some Wastes in Plants

Q.2 Describe osmotic adjustments in plants. (A.B)

Ans: **OSMOTIC ADJUSTMENTS IN PLANTS**

On the basis of the available **amounts of water and salts**, plants are divided into **three groups**:

- Hydrophytes
- Xerophytes
- Halophytes

Hydrophytes: **(GRW 2014, BWP 2014, DGK 2014)**

Etymology:

Hydro = Water and Phytes = Plants (aquatic plants)

Introduction:

Hydrophytes are the plants which **live completely or partially** submerged in **freshwater**. Such plants **do not** face the **problem of water** shortage.

Environmental Adaptations:

- They have **developed mechanisms** for the **removal of extra water** from their **cells**.
- Hydrophytes have **broad leaves** with a **large number of stomata** on their **upper surface**. This **characteristic** helps them to **remove the extra amount of water.**

Examples:

- **Water lily**
- **Lotus**

Xerophytes: **(LHR 2013, BWP 2014, GRW 2015)**

Etymology:

Xero = Dry and Phytes = Plants (desert plants)

Introduction:
Xerophytes live in **dry environments.**
Environmental Adaptations:
- They possess **thick, waxy cuticle** over their **epidermis**, to **reduce water loss** from internal tissues.
- They have **less number of stomata** to **reduce** the **rate of transpiration.**
- Such plants have **deep roots** to **absorb** maximum **water** from soil.
- Some xerophytes have **special parenchyma cells** in stems or roots in which they **store large quantities of water**. This makes their stems or roots **wet and juicy**, called **succulent organs**.

Example:
- Cacti (Singular: Cactus)

Halophytes: **(BWP 2015)**
Etymology:
Halo = Salt, Phytes = Plants (marine water plants)
Introduction:
Halophytes live in **sea waters** and are **adapted** to **salty environments**.
Environmental Adaptations:
- Salts **enter** in the **bodies** of such plants due to their **higher concentration** in **sea water**.
- **Water** tends to **move out** of their cells into the **hypertonic sea water**.
- When salts enter into cells, plants carry out **active transport** to move and **hold large amount of salt** in vacuoles. Salts are **not allowed** to move out through the semi-**permeable** membranes of **vacuoles**. So the **sap** of vacuoles **remains** even more **hypertonic** than sea water. In this way, **water does not move** out of **cells**.

Example:
- Many sea grasses

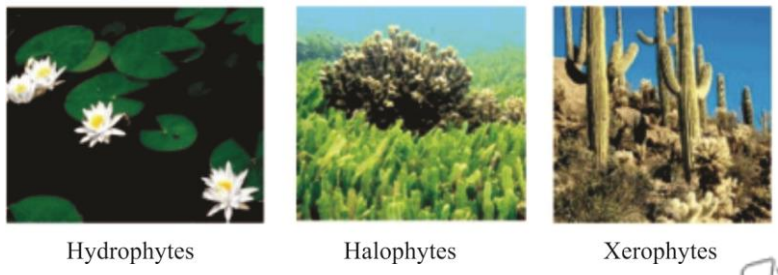

Figure: Three Groups of Plants

11.1 SHORT QUESTIONS

Q.1 Define homeostasis. Give an example. (K.B) **(GRW 2013,16, MTN 2013, 2014, 2015, BWP 2014)**
Ans: **HOMEOSTASIS**
Definition:
"Maintenance of the internal condition of body at equilibrium, despite changes in external environment."
Example:
The core temperature of human body remains at about 37°C despite fluctuation in the surrounding air temperature.

Q.2 Define osmoregulation. Give an example. (K.B) **(GRW 2014, 15, 16, 17 LHR 2015, 17)**
Ans: **OSMOREGULATION**
Definition:
"Maintenance of the amounts of water and salts in body fluids (i.e. blood & tissue fluids)."

Example:
The relative amounts of water and slats in body fluids and inside cells control the processes of diffusion and osmosis, which are essential for the functioning of cells.

Q.3 Define thermoregulation. (K.B) **(GRW 2014, 16, 17, BWP 2014, LHR 2015)**

Ans:

THERMOREGULATION

Definition:
"Thermoregulation is the maintenance of internal body temperature."

Optimum Temperature:
The enzymes of body work best at particular temperature (optimum temperature). Any change in body temperature may affect the functioning of enzymes.

Example:
The core temperature of human body remains at about 37°C despite fluctuation in the surrounding air temperature.

Q.4 Define an excretion. (K.B) **(LHR 2013, GRW 2015, SWL 2015)**

Ans:

EXCRETION

Definition:
"This is the process of homeostasis in which metabolic wastes are eliminated from body to maintain the internal conditions at equilibrium."

Q.5 What is metabolic waste? (K.B)

Ans:

METABOLIC WASTE

Definition:
Metabolic waste means any material that is produced during body metabolism and that may harm the body.

Example:
Resins by coniferous plants and latex by rubber plants.

Q.6 What are succulent organs? (K.B) **(GRW 2017)**

Ans: Page no 32.

Q.7 Define hydrophyte with an examples (K.B) **(LHR 2017, GRW 2016)**

Ans: Page no 31.

Q.8 What is meant by halophyte? (K.B) **(GRW 2016, BWP 2015)**

Ans: Page no 32.

Q.9 How plants remove extra CO_2 from their body? (A.B)

Ans: Page no 30.

Q.10 Differentiate between transpiration and guttation? (K.B) **(LHR 2014, SWL 2015)**

Ans:

DIFFERENTIATION

The difference between transpiration and guttation is as follows:

Transpiration	Guttation
• Transpiration is the loss of water from plant surface in the form of vapors.	• The appearance of drops of water on the tips or edges of leaves is called Guttation.

Q.11 How plants remove metabolic wastes? (A.B)

Ans: Page no 31.

Q.12 Write two characteristics of xerophytes? (K.B)

Ans: Page no 32.

Q.13 Define osmosis. (K.B) **(LHR 2016)**

Ans:

OSMOSIS

Definition:
"Osmosis is the movement of water from hypotonic solutions (less solute concentration) to hypertonic solutions (higher solute concentration), through semipermeable membrane."

Q.14 What is the secondary function of leaf fall? (U.B)

Ans:

SECONDARY FUNCTION OF LEAF FALL

The removal of excretory products is a secondary function of leaf fall. If the leaves are not Sshed, the calcium oxalate just remains as harmless crystals in the leaves.

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11.1 MULTIPLE CHOICE QUESTIONS

1. How many grams of glucose are present in one liter of Human blood? (A.B)
(A) 10g (B) 1g
(C) 0.1g (D) 100g

2. Any material that is produced during body metabolism and that may harm the body is called: (U.B)
(A) Guttation (B) Ion
(C) Metabolic waste (D) Oxygen

3. Thermoregulation is essential for : (K.B)
(A) Excretion (B) Enzyme activity
(C) Metabolism (D) both b & c

4. The loss of water from plant surface in the form of vapors is called: (K.B)
(A) Guttation (B) Transpiration
(C) Excretion (D) Thermoregulation

5. _____ is deposited in the form of crystals in the leaves and stems of tomato. (K.B)
(A) Calcium carbonate (B) Calcium silicate
(C) Calcium sulphate (D) Calcium oxalate

6. Plant homeostasis is concerned with concentrations of all of the following, except; (U.B)
(A) Water (B) Carbon dioxide
(C) Nitrogenous waste (D) Chlorophyll

7. The waste product of keekar (K.B)
(A) Resins (B) Gums
(C) Latex (D) Mucilage

8. The CO_2 is removed from cell by: (U.B)
(A) Diffusion (B) Facilitated Diffusion
(C) Filtration (D) Active transport

9. _____ is broad leafed hydrophytes. (U.B) **(LHR 2013, MTN 2015)**
(A) Hydrilla (B) Water lilly
(C) Vallisneria (D) Pistia

10. Example of xerophyte is: (K.B) **(LHR 2013)**
(A) Cactus (B) Pinus
(C) Cycas (D) Sea grasses

11. The waste product of carnivorous plants and lady finger is: (K.B)
(A) Resins (B) Gums
(C) Latex (D) Mucilage

12. Gums is the waste product of: (K.B)
(A) Coniferous trees (B) Keekar
(C) Rubber plant (D) Ladyfinger

13. Secretions which are secreted by conifers are called: (K.B) **(LHR 2014)**
(A) Resins (B) Gums
(C) Latex (D) Mucilage

14. Mucilage is the waste product of: (K.B)
(A) Coniferous trees (B) Keekar
(C) Rubber plant (D) Ladyfinger

15. Excretion is one of the process of _____. (K.B)
(A) Homeostasis (B) Transpiration
(C) Guttation (D) Mutation

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16. Oxygen is produced in _____ cells during day time, as a by-product of photosynthesis. (K.B)
(A) Cortex (B) Endodermis
(C) Mesophyll (D) Epidermis

17. In young roots, CO_2 diffuses through the general root surface, especially through_____. (K.B)
(A) Root hairs (B) Root
(C) Xylem (D) Stem

18. Plants store large amount of water in their cells for_____. (A.B)
(A) Flaccid (B) Turgidity
(C) Summer season (D) Winter session

19. The appearance of drops of water on the tips or edges of leaves is called_____. (K.B)
(A) Transpiration (B) Dew
(C) Guttation (D) Evaporation

20. The most common example of hydrophytes: (K.B) **(LHR 2017)**
(A) Sea grass (B) Cactus
(C) Water lily (D) Lady finger

21. Play role in maintaining body temperature: (K.B) **(LHR 2017)**
(A) Lungs (B) Kidney
(C) Skin (D) Ear

11.2 HOMEOSTASIS IN HUMANS

LONG QUESTIONS

Q.1 Describe homeostasis in human. (A.B)

OR

Name the organ which work for homeostasis in human, describe detail of work of any two organs in detailed. **(LHR 2017)**

Ans:

HOMEOSTASIS IN HUMAN

Organs for Homeostasis:

Like other **complex animals**, humans have **highly developed systems** for **homeostasis**. The following are the **main organs** which work for homeostasis.

- **Lungs**
- **Skin**
- **Kidneys**

Lungs:

Lungs **remove excess carbon dioxide** and keep it in **balance**.

- **Maintain** the concentration of **carbon dioxide** in **blood**.
- **Our cells** produce **carbon dioxide** when they perform **cellular respiration**.
- From cells, **carbon dioxide diffuses** into **tissue fluid** and from there into **blood**.
- **Blood** carries **carbon dioxide** to **lungs** from where it is **removed in air.**

ROLES OF SKIN IN HOMEOSTASIS

Definition:

"Outer most **protective layer** around the **body** of higher animals to perform **different vital tasks**".

Figure: Goosebumps

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Structure of Skin:

Our skin consists of **two layers**:

- Epidermis
- Dermis

Epidermis:

The **outer protective layer without blood vessels** is called epidermis.

Dermis:

This **inner layer of skin** consists of:

- **Blood vessels**
- **Sensory nerve endings**
- **Sweat glands**
- **Oil glands**
- **Hairs**
- **Fat cells**

Skin as a Thermoregulatory Organ:

Skin performs important **role** in the **regulation of body temperature**.

In Cold:

The **thin layer** of **fat cells** in the **dermis insulates** the body. **Contraction** of **small muscles** attached to hairs forms **'Goosebumps'**. It creates an **insulating blanket** of **warm air**.

In Hot:

Similarly, **skin** helps in providing **cooling effect** when **sweat** is produced **by sweat glands** and **excess body heat** escapes through **evaporation**.

Skin as an Osmoregulatory and Excretory Organ:

The following **metabolic wastes** are also **removed** in **sweat** through **skin**:

- **Excess water**
- **Salts**
- **Urea**
- **Uric acid**

11.2 SHORT QUESTIONS

Q.1 Which organs of human work for homeostasis? (A.B) **(LHR 2016)**

Ans: Page no 35.

Q.2 How lungs and skin work for homeostasis? (A.B)

Ans: Page no 35.

Q.3 Write the name of two layers of skin? (K.B)

Ans: Page no 36.

Q.4 What are the roles of skin in human body? (A.B) **(LHR 2014)**

Ans: Page no 35

Q.5 How lungs remove CO_2, during cellular respiration? (A.B)

Ans: Page no 35.

Q.6 Why the dogs hang their tongues out and pant? (U.B)

Ans:

PANTING IN DOGS

Dogs hang their tongues out and pant to remove extra metabolic heat from their bodies.

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W11.2 MULTIPLE CHOICE QUESTIONS

1. In humans, which organs help in the removal of carbon dioxide? (K.B)
(A) Kidneys (B) Adrenal glands
(C) Liver (D) Lungs

2. The skin perform its role as an organ of : (K.B)
(A) Osmoregulation (B) Excretion
(C) Thermoregulation (D) All of these

3. Which organ helps in providing cooling effect? (U.B)
(A) Kidneys (B) Skin
(C) Liver (D) Lungs

4. Excess body heat escapes through: (U.B)
(A) Transpiration (B) Excretion
(C) Cooling (D) Evaporation

5. Outer protective skin layer without blood vessels is: (K.B)
(A) Epidermis (B) Dermis
(C) Hypodermis (D) Endodermis

6. The outer protective layer of skin contains : (U.B)
(A) Blood vessels (B) Sweat and oil glands
(C) Fat cells (D) Dead cells

7. Which of the following process dogs do to get rid of extra body heat? (U.B)
(A) Transpiration (B) Panting
(C) Cooling (D) Evaporation

11.3 THE URINARY SYSTEM OF HUMANS

LONG QUESTIONS

Q.1 Describe human urinary system. (K.B)

Ans:

HUMAN URINARY SYSTEM

Definition:

"The **excretory system** of human is also called the **urinary system**".

The human urinary system **consists** of the following:

- A pair of kidneys
- A pair of ureters
- A urinary bladder
- A Urethra

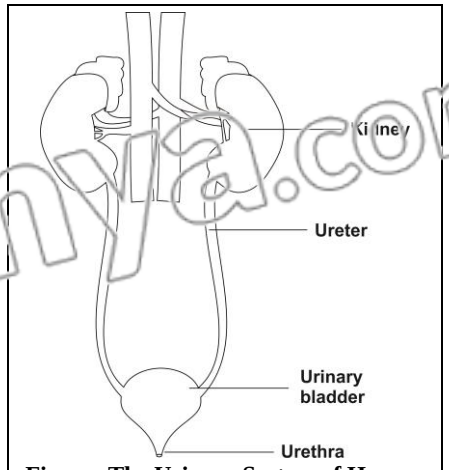

Figure: The Urinary System of Human

Pair of Kidney:

A **pair of kidneys** is present against the **back wall** of **abdominal cavity** just **below diaphragm**, one on **either side** of the **vertebral column**. The kidneys **filter blood** to produce **urine**.

Pair of Ureter:

The ureters **carry urine** from kidneys to the **urinary bladder**.

Urinary Bladder:

The urinary bladder **temporarily stores urine** until it is released from the body.

Urethra:

Urethra is the **tube** that carries **urine** from **urinary bladder** to the **outside** of the body.

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Q.2 Describe structure of human kidney. **(LHR 2014, BWP 2014, SWL 2015)**

Ans:

STRUCTURE OF HUMAN KIDNEY

Definition:

"Organ responsible for **filtering the blood** is called **kidney**".

Colour:

The kidneys are **dark-red in colour**.

Shape:

The **kidneys** are **bean shaped**.

Dimensions:

Each **kidney** is **10 cm long**, **5 cm wide** and **4 cm thick.**

Weight:

Each **kidney weighs** about **120 grams**.

Location:

The kidneys are placed against the **back wall** of **abdominal cavity** just **below diaphragm**, one on either side of **vertebral column**. The left kidney is a **little higher** than the **right**. The **concave side** of the kidney **faces vertebral column.**

Protection:

The kidneys are **protected** by the **last two ribs**.

Internal Structure of Kidney:

Each kidney consists of the following structures:

Hilus:

There is a **depression** near the center of the **concave area** of the kidney called **hilus**. This is the area of kidney through which **ureter leaves kidney** and the other **structures enter and leave kidney**:

- **Blood vessels**
- **Lymphatic vessels**
- **Nerves**

The **longitudinal section** of the kidney shows **two regions.**

- Renal cortex
- Renal medulla

Renal Cortex:

Renal cortex is the **outer part of kidney**. It is **dark red in colour.**

Renal Medulla:

Renal medulla is the **inner part** of the kidney. It is **pale red in colour.**

Renal Pyramids:

Renal medulla consists of **several cone shaped areas** called **renal pyramids.**

Renal Pelvis:

Renal pyramids project into a **funnel-shaped cavity** called **renal pelvis**, which is the **base of ureter.**

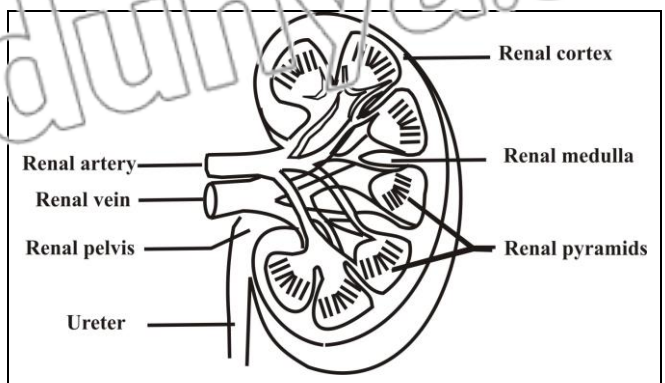

Figure: The Anatomy of a Kidney

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Q.3 What is the functional unit of the kidney? Describe its structure and draw label diagram.
(Understanding the Concept Q.3)

OR

What is nephron? Describe its structure and also draw labelled diagram (U.B) (LHR 2017)

Ans:

NEPHRON

Definition:

"The **structural** and **functional unit** of the **kidneys** is called **nephron**". There are over **one million nephrons** in each kidney.

STRUCTURE OF NEPHRON

There are **two parts** of a nephron

- Renal corpuscle
- Renal tubule

Renal Corpuscle:

The renal corpuscle is **not tubular**. It consists of **two parts**. i.e. Glomerulus and Bowman's capsule.

Glomerulus:

It is the **network of capillaries**. The **capillaries** of the **glomerulus arise** from the **afferent arteriole** and **join** to form the **efferent arteriole**.

Bowman's Capsule:

Bowman's capsule is a **cup-shaped structure** that encloses **glomerulus.**

Renal Tubule:

The renal tubule is the **part of nephron** which **starts after Bowman's capsule**. It consists of **three parts**:

- Proximal convoluted tubule
- Loop of henle
- Distal convoluted tubule

Proximal Convoluted Tubule:

The **first portion** of the renal tubule is called **proximal convoluted tubule**.

Loop of Henle:

Next portion of renal tubule is **U-shaped** and is called the **loop of henle**.

Distal Convoluted Tubule:

The **last portion** of the renal tubule is the **distal convoluted tubule**.

Collecting Duct:

The distal convoluted tubules of **many nephrons open** in a **single collecting duct**.

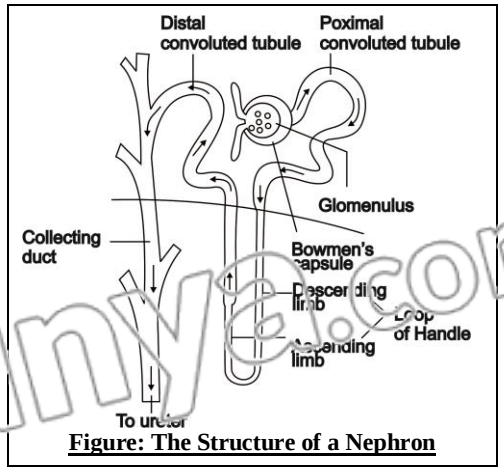

Figure: The Structure of a Nephron

Papillary Ducts:

Many collecting ducts **join together** to form **several hundred papillary ducts** which drain into **renal pelvis**.

Q.4 What steps are involved in formation of urine in kidney (A.B)
(Understanding the Concept Q.4) (LHR 2016)

Ans:

FORMATION OF URINE

There are **two major functions** of kidneys:

- As excretory organs
- As osmoregulartory organs

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Kidneys as Excretory Organs:

The main function of kidneys as excretory organs is urine formation, which takes place in the following **three steps**:

- Pressure filtration
- Selective reabsorption
- Tubular secretion

Pressure Filtration: **(GRW 2015)**

This is the **first step**. When **blood enters** the **kidney** via the **renal artery**, it goes to many **arterioles,** and then to the **glomerulus**. The **pressure** of blood is very **high** and so most of the **water, salts**, **glucose** and **urea** of blood is **forced** out of **glomerular capillaries**.

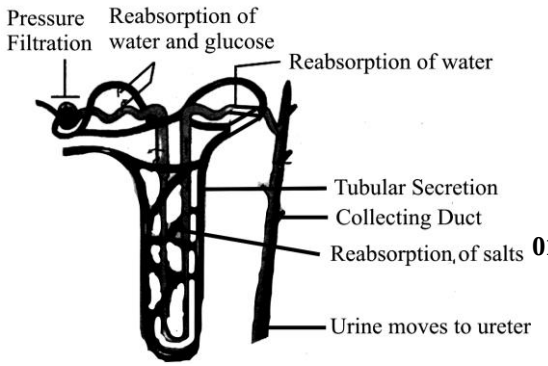

Figure: Functioning of Kidney (Nephron) **015)**

Glomerular Filtrate:

The **material** that passes into the **Bowman's capsule** from the glomerulus after **pressure filtration** is called **glomerular filtrate.**

Selective Reabsorption:

The **second step** is the **selective reabsorption**. In this step **about 99%** of the **glomerular filtrate** is **reabsorbed** into the **blood capillaries** surrounding **renal tubule**. The selective reabsorption occurs through:

- **Osmosis**
- **Diffusion**
- **Active transport**

Proximal Convoluted Tubule:

Some **water** and **most of the glucose** is **reabsorbed** form the **proximal convoluted tubule**. Here, **salts** are **reabsorbed** by **active transport** and then water follows by osmosis.

Loop of Henle:

The **descending limb of loop of Henle** allows the **reabsorption of water** while the **ascending limb of Loop** of Henle allows the **reabsorption of salts**.

Distal Convoluted Tubule:

The **distal convoluted tubule** again allows the **reabsorption of water** into the blood.

Tubular Secretion:

The **third step** is the **tubular secretion**. Different **ions, creatinine, urea etc**. are **secreted** from **blood** into the **filtrate** in renal tubule. This is done to maintain **blood at a normal pH** (7.35 to 7.45).

Urine:

After pressure filtration, selective reabsorption and tubular secretion, the **filtrate** present in **renal tubules** is known as **urine**. It moves into **collecting ducts** and then into **pelvis**.

At the **final stage urine** is only **1%** of the originally filtered volume. The typical **volume** of urine produced by average adult is around **1.4 liters per day.**

Water	95%
Urea	9.3 g/l
Chloride ions	1.87 g/l
Sodium ions	1.17 g/l
Potassium ions	0.750 g/l
Other ions and compounds	Variable amounts

Table: Normal Chemical Composition of Urine (Source: NASA Contractor Report)

Q.5 Along with excretion, kidneys also play role in osmoregulation. Comment on this statement. (A.B) **(MTN 2015) (Understanding the Concept Q.5)**

Ans: **OSMOREGULATORY**

Osmoregulation:

The **regulation** of the concentration of **water and salts in blood** and other **body fluids** is called **osmoregulation**.

Importance:

Kidneys play important **role** in osmoregulation by **regulating the water** contents of **blood**. It is an important process as **excessive loss of water** concentrates the body fluids whereas **excess** intake of water **dilutes** them.

Production of Hypotonic Urine:

When there is **excess water** in body fluids, kidneys form **dilutes** (hypotonic) urine. For this purpose, kidneys filter more water from glomerular capillaries into Bowman's capsule. Similarly, **less water** is **reabsorbed** and **abundant dilute urine** is produced. It brings **down** the volume of **body fluids** to normal.

Production of Hypertonic Urine:

When there is **shortage of water** in body fluids, kidneys filter **less water** from **glomerular capillaries** and the rate of **reabsorption of water** is **increased**. **Less filtration** and **more reabsorption** produce **small amount** of concentrated (hypertonic) **urine**. It **increases** the volume of **body fluids to normal**.

Hormonal Control:

This whole process of kidneys is under **hormone control**.

Q.6 Describe the process of selective reabsorption in the kidney. (U.B)
(Understanding the Concept Q.1)

Ans: **SELECTIVE REABSORPTION**

The second step in urine formation is the selective reabsorption. In this step about 99% of the glomerular filtrate is reabsorbed into the blood capillaries surrounding renal tubule. The selective reabsorption occurs through:

- Osmosis
- Diffusion
- Active transport

Proximal Convoluted Tubule:

Some water and most of the glucose is reabsorbed form the proximal convoluted tubule. Here, salts are reabsorbed by active transport and then water follows by osmosis.

Loop of Henle:

The descending limb of loop of Henle allows the reabsorption of water while the ascending limb of loop of henle allows the reabsorption of salts.

Distal Convoluted Tubule:

The distal convoluted tubule again allows the reabsorption of water into the blood.

Tubular Secretion:

The third step is the tubular secretion. Different ions, creatinine, urea etc. are secreted from blood into the filtrate in renal tubule. This is done to maintain blood at a normal pH (7.35 to 7.45).

Urine:

After pressure filtration, selective reabsorption and tubular secretion, the filtrate present in renal tubules is known as urine. It moves into collecting ducts and then into pelvis.

At the final stage urine is only 1% of the originally filtered volume. The typical volume of urine produced by ab average adult is around 1.4 liters per day.

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11.3 SHORT QUESTIONS

Q.1 Enlist the parts of human urinary system. (K.B) **(LHR 2015, 2016, GRW 2015, MTN 2015)**

Ans: Page no 37.

Q.2 How excretory system works in humans? (A.B) **(GRW 2014, MTN 2015)**

Ans: Page no 37.

Q.3 What is renal corpuscle? (K.B) **(DGK 2015)**

Ans: Page no 39.

Q.4 Name the parts of nephron. (K.B) **(LHR 2016)**

Ans: Page no 39.

Q.5 What is tubular secretion? (K.B) **(GRW 2013)**

Ans: Page no 40.

Q.6 How kidneys manage the excess water in body fluid? (U.B)

Ans: Page no 41.

Q.7 What is the function of loop of henle? (A.B)

Ans: Page no 40.

Q.8 Why blood cells and proteins are not filtered through the glomerular capillaries? (U.B)

Ans:

FILTRATION OF BLOOD

Blood cells and proteins are not filtered through the glomerular capillaries because they are relatively larger in size.

Q.9 Why filtration takes place in glomerulus part of nephron? (U.B)

Ans:

FILTRATION IN GLOMERULUS

Filtration takes place in glomerulus part of nephron due to:

- High blood pressure
- Presence of blood capillaries

Walls of glomerulus are porous

Q.10 How kidneys help to control blood pressure? (U.B)

Ans:

BLOOD PRESSURE CONTROL

Kidneys filter salts from blood to excrete salts out of body in the form of urine. It helps in controlling blood pressure.

11.3 MULTIPLE CHOICE QUESTIONS

1. Colour of human kidney: (K.B)

(A) Dark yellow (B) Dark red
(C) Dark Green (D) Purple

2. Tube between kidney and urinary bladder is. (K.B) **(SWL 2015)**

(A) Nephron (B) Urethra
(C) Renal tubule (D) Ureter

3. The tubes that carry urine from kidney are: (K.B) **(SWL 2015)**

(A) Urethra (B) Urinary bladder
(C) Ureters (D) Pelvis

4. Ribs which protect the kidney are: (K.B) **(MTN 2013)**

(A) First two (B) Last two
(C) Middle (D) Last four

5. Organ responsible for filtering the blood is: (K.B) **(LHR 2015, GRW 2017)**

(A) Intestine (B) Brain
(C) Stomach (D) Kidney

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6. Which one is correct? (U.B)
(A) The left kidney is little higher than the right
(B) The right kidney is little higher than the left
(C) Both are equally placed
(D) The left kidney is half smaller than the right

7. Approximate weight of a kidney is: (K.B) **(LHR 2014)**
(A) 10 grams (B) 15 grams
(C) 20 grams (D) 120 grams

8. Urine is temporarily stored in : (K.B)
(A) Urethra (B) Urinary bladder
(C) Ureters (D) Pelvis

9. Right kidney is lower than left due to: (K.B)
(A) Diaphragm (B) Stomach
(C) Liver (D) Vertebral column

10. Colour of renal medulla: (U.B)
(A) Dark red (B) Pale red
(C) Dark yellow (D) Dark green

11. The functional unit of kidney: (A.B) **(DGK 2014, BWP 2015)**
(A) Nephron (B) Neuron
(C) Renal pelvis (D) Renal cortex

12. In how many steps urine formation takes place? (K.B)
(A) 1 (B) 2
(C) 3 (D) 4

13. The percentage of urine at final stage to the originally filtered volume: (K.B)
(A) 1% (B) 2%
(C) 3% (D) 4%

14. In urine chemical composition, the percentage of water: (K.B) **(LHR 2016)**
(A) 80% (B) 85%
(C) 90% (D) 95%

15. In urine chemical composition, the amount of urea: (K.B)
(A) 8.9 g/l (B) 9.1 g/l
(C) 9.3 g/l (D) 9.5 g/l

16. In urine chemical composition, the amount of chloride iron: (K.B)
(A) 1.79 g/l (B) 1.83 g/l
(C) 1.85 g/l (D) 1.87 g/l

17. The vessels which take blood towards renal corpuscles : (K.B)
(A) Afferent arteriole (B) Efferent arteriole
(C) Afferent venule (D) Efferent venule

18. The left kidney is little _____ than the right. (K.B)
(A) Lower (B) Higher
(C) Beside (D) Diagonal

19. The concave side of kidney faces _____. (K.B)
(A) Vertebral column (B) Lungs
(C) Pituitary gland (D) Stomach

20 _____ is a cup shaped structure that encloses glomerulus. (K.B)
(A) Bowman's capsule (B) Nerve
(C) Nephron (D) Renal

21. Renal pyramids project into funnel shaped cavity called renal pelvis which is at the base of: (K.B)
(A) Urethra (B) Ureter
(C) Nephron (D) Bladder

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22. The renal corpuscle has _____ parts. (K.B)
(A) 4 (B) 5
(C) 3 (D) 2

23. There are over _____ million nephrons in each kidney. (K.B) **(DGK 2015)**
(A) 1 (B) 2
(C) 3 (D) 4

24. Last portion of convoluted tubule in called _____ convoluted tubule. (K.B)
(A) Proximal (B) Distal
(C) Glomerulus (D) Loop of Henle

25. Normal pH of human blood is: (K.B)
(A) 7.00 – 8.00 (B) 6.35 - 6.45
(C) 7.35 – 7.45 (D) 7.30 – 7.40

26. The most of glucose is reabsorbed from : (K.B)
(A) Distal convoluted tubules (B) Proximal convoluted tubules
(C) Ascending loop of Henle (D) Descending loop of Henle

27. Amount of K^+ ions in urine: (K.B)
(A) 0.450 g/l (B) 0.650 g/l
(C) 0.350 g/l (D) 0.750 g/l

28. The typical volume of urine produced by an adult in liter per day is: (K.B) **(GRW 2016)**
(A) 2.4 (B) 1.4
(C) 4.2 (D) 4.1

29. The longitudinal section of kidney shows outer part: (K.B) **(GRW 2017)**
(A) Renal cortex (B) Renal pyramid
(C) Renal medulla (D) Renal pelvis

11.4 DISORDERS OF KIDNEY

LONG QUESTIONS

Q.1 Explain some kidney disorders. (K.B)

Ans:

KINDNEY DISORDERS

There are many different **kidney disorders**. Some of them are:

- **Kidney Stones**
- **Kidney (Renal) Failure**

KIDNEY STONES

Explanation:

When urine becomes **concentrated crystals** of the following **salts** are formed:

- **Calcium oxalate**
- **Calcium phosphate**
- **Ammonium phosphate**
- **Uric acid**

Such **large crystals cannot pass** in urine and form **hard deposits** called **kidney stones**. Most **stones start in kidney**. Some may **travel to ureter** or **urinary bladder**.

Causes:

The **major causes** of kidney stones are:

- **Age**
- **Diet (containing more green vegetables, salts, vitamins C and D)**
- **Recurring urinary tract infections**
- **Less intake of water**
- **Alcohol consumption**

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Symptoms:

The **symptoms** of kidney stones include:

- **Severe pain in kidney** or in **lower abdomen**
- **Vomiting**
- **Frequent urination**
- **Foul-smelling urine**
- **Urine with blood and pus**

Treatment:

The **treatment** of kidney stones includes:

- **Excessive water intake**
- **Surgical treatment**
- **Lithotripsy**

Excessive Water Intake:

About 90% of all kidney **stones** can **pass** through the **urinary system** by **drinking plenty of water**.

Surgical Treatment:

In **surgical treatment**, the **affected area** is **opened** and **stone**(s) are **removed**.

Lithotripsy:

Lithotripsy is another **method** for the **removal of kidney stones**. In this method, **non-electrical shock waves** from **outside** are **bombarded** on the **stones** in the urinary system. Waves hit the **dense stones** and break them. Stones become **sand-like** and are **passed** through **urine**.

KIDNEY (RENAL) FAILURE

Definition:

"Kidney failure means a **complete or partial failure** of kidneys to **function**".

Causes:

Following are the **causes** of kidney failure:

- **Leading causes**
- **Other causes**

Leading Causes:

- **Diabetes mellitus**
- **Hypertension**

Other Causes:

- **Sudden interruption** in **blood supply** to kidneys
- **Drug overdoses**

Symptoms:

The **main symptoms** of kidney failure are:

- **High level of urea**
- Other **wastes in blood** which can result in the following **symptoms**
  - **Vomiting**
  - **Nausea**
  - **Weight loss**
  - **Frequent urination**
  - **Blood in urine**
- **Excess fluids** in body may also cause **swelling of legs**, feet and face
- **Shortness of breath**

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Treatment:

The **kidney failure** is treated with the following:

- **Dialysis**
- **Kidney Transplant**

Q.2 Explain different treatments of kidney failure. (A.B)

Ans:

TREATMENTS OF KIDNEY FAILURE

The kidney failure is **treated** with the following:

- Dialysis
- Kidney Transplant

DIALYSIS

Definition:

"The **cleaning of blood** by **artificial ways** is called dialysis".

Methods of Dialysis:

There are **two methods** of dialysis

- Peritoneal Dialysis
- Haemodialysis

Peritoneal Dialysis:

In this type of dialysis, the **dialysis** fluid is **pumped** for a **time** into the **peritoneal cavity** which is the space around **gut**. This cavity is **lined** by **peritoneum**. Peritoneum contains **blood vessels**.

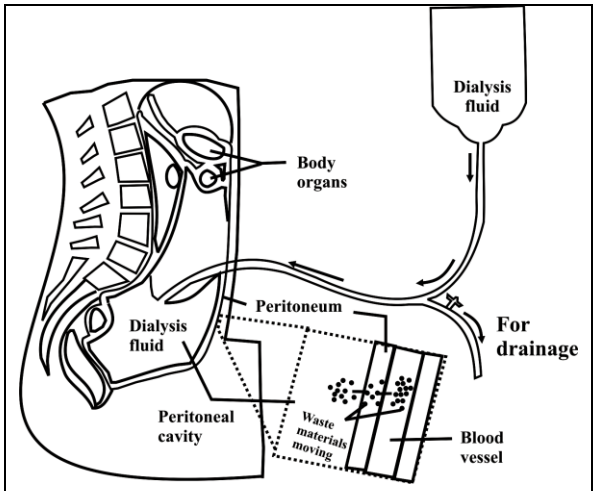

Figure: Peritoneal Dialysis

Extraction of Waste Materials:

When we place dialysis fluid in **peritoneal cavity, waste materials** from **peritoneal blood vessels** diffuse into the **dialysis fluid**, which is then **drained out**.

Duration:

This type of dialysis can be performed at **home**, but must be done **every day**.

Haemodialysis:

In haemodialysis, patient's **blood** is **pumped** through an **apparatus** called **dialyzer**. The **dialyzer** contains **long tubes**, the **walls** of which act as **semi-permeable membranes.**

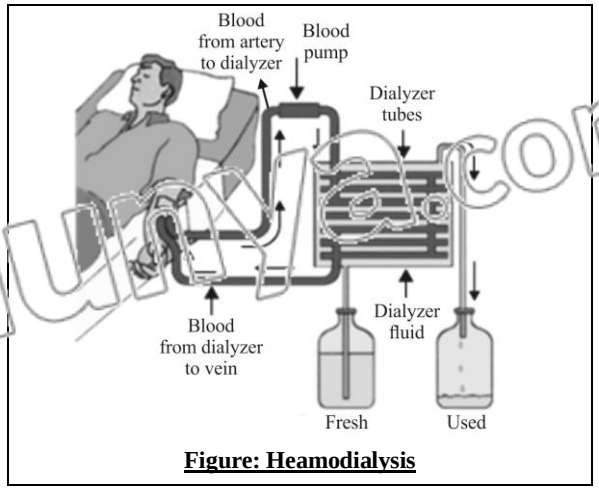

Figure: Heamodialysis

Extraction of Waste Materials:

Blood flows through the **tubes** while the **dialysis fluid** flows **around the tubes**. Extra **water and wastes** move from blood into the **dialysis fluid**. The **cleansed blood** is then **returned back** to body.

Duration:

The haemodialysis **treatments** are typically given in **dialysis centres three times per week**.

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KIDNEY TRANSPLANT

Definition:

"The **replacement** of patient's **damaged kidney** with a **donor's healthy kidney** is called kidney transplant."

End Stage Renal Failure:

Dialysis needs to be **repeated after every few days** and is unpleasant for patients and attendants. Another treatment for the **end-stage kidney** failure is **kidney transplantation**.

Kidney Donors:

Kidney may be **donated** by a **deceased donor** or **living donor**. The **donor may** or **may not be a relative** of the **patient**.

Tissue Matching:

Before transplant, the **tissue proteins** of **donor** and **patient** are **matched**.

Transplantation:

The **donor's kidney** is **transplanted** in **patient's body** and is connected to the **patient's blood** and **urinary system**.

Average Life Time of Transplanted Kidney:

The **average lifetime** for a **donated kidney** is **ten** to **fifteen years**.

Failure of Transplanted Kidney:

When a **transplant fails**, the **patient may** be given a **second kidney transplant**. In this situation, the **patient is treated** through **dialysis** for **some intermediary time**.

Problems After Kidney Transplant:

Problems after a **transplant** may include:

- **Transplant rejection**
- **Infections**
- **Imbalances in body salts which can lead to**
  - **Bone problems**
  - **Ulcers**

11.4 SHORT QUESTIONS

Q.1 What are kidney stones? (K.B) **(LHR 2014, 17, GRW 2016, 17)**

OR

What are the causes of kidney stones? (U.B)

Ans: Page no 44.

Q.2 What are symptoms of kidney stone? (U.B)

Ans: Page no 44.

Q.3 What are treatments of kidney stone? (A.B)

Ans: Page no 44.

Q.4 What is lithotripsy? (A.B) **(LHR 2016, 17)**

Ans: Page no 45

Q.5 Define kidney failure. What are the causes of kidney failure? (K.B)

Ans: Page no 45.

Q.6 What are symptoms of kidney failure? (U.B)

Ans: Page no 45.

Q.7 What are the treatments of a kidney failure? (A.B)

Ans: Page no 45.

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Q.8 Define dialysis. What are its types? (K.B) **(LHR 2013, 16)**
Ans: Page no 46.
Q.9 Define kidney transplant. (K.B) **(GRW 2014)**
OR
What is meant by kidney transplant? (K.B) **(GRW 2017)**
Ans: Page no 46.
Q.10 What are the problem after kidney transplant? (U.B)
Ans: Page no 46.
Q.11 What are the contributions of Abu Nasr-al-Farabi? (K.B)
Ans:

CONTRIBUTION OF ABU NASR-AL-FARABI

Abu Nasr-al-Farabi (872-951 AD) was a prominent scientist who wrote many books that contained information about kidney diseases.

Q.12 What are the contributions of Al. Zahrawi? (K.B)
Ans:

CONTRIBUTION OF AL. ZAHRAWI

The genius Abul-al-Qasim Al-Zahrawi (known as Albucasis: 936-1013 AD) is considered to be Islam's greatest surgeon who invented many surgical procedures including the surgical removal of stones form the urinary bladder. His encyclopedia, Al-Tasrif ("The Method") contained over 200 surgical medical instruments he personally designed.

11.4 MULTIPLE CHOICE QUESTIONS

1. What are the leading causes of kidney failure? (A.B)

(A) Diabetes mellitus and hypertension (B) Hypertension only
(C) Diabetes mellitus only (D) Drug overdoses

2. The haemodialysis treatment is given in dialysis centers _____ times per week. (A.B)

(A) 4 (B) 3
(C) 2 (D) 1

3. Diabetes and hypertension are leading causes of _____ failure. (K.B)

(A) Lung (B) Kidney
(C) Liver (D) Stomach

4. Major causes of kidney stones are: (A.B)

(A) Age (B) diet
(C) Less water intake (D) All of these

5. Date of death of Abu Nasr al-Farabi: (K.B)

(A) 950 AD (B) 951 AD
(C) 952 AD (D) 953 AD

6. Al-tasrif was written by: (K.B)

(A) Abu Nasir Al- Farabi (B) Abu Musa Ashari
(C) Abu Usman umer Aljahiz (D) Abu al Qasim Al-Zaharawi

7. The main symptom/symptoms of kidney failure is: (U.B) **(LHR 2013)**

(A) Weight loss (B) Frequent urination

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(C) Vomiting (D) All of these

8. How many surgical medical instruments were personally designed by Abu al-Qasim Al-Zahrawi: (K.B)

(A) Less than 200 (B) 200

(C) Over 200 (D) 150

9. A method for the removal of kidney stone is: (A.B) **(LHR 2013)**

(A) Peritoneal dialysis (B) Haemodialysis

(C) Kidney transplant (D) Lithotripsy

10. Swelling of legs, feet and face and shortness of breath are the symptoms (U.B)

(A) Diarrhoea (B) Constipation

(C) Kidney failure (D) Kidney stones

11. The replacement of the patient's damaged kidney with the donor's healthy kidney is called: (K.B)

(A) Heart transplant (B) Kidney transplant

(C) Liver transplant (D) Brain transplant

12. Average life time of donated kidney: (U.B)

(A) Five to ten years (B) Ten to fifteen years

(C) Twelve to twenty years (D) Two to five years

13. Problems after kidney transplant include: (U.B)

(A) Transplant rejection (B) Infections

(C) Imbalance in body salts (D) All of these

14. There are _____ methods of dialysis. (K.B)

(A) 2 (B) 3

(C) 4 (D) 5

15. Abu Nasr al Farabi was born in: (K.B)

(A) 800 AD (B) 870 AD

(C) 850 AD (D) 872 AD

16. Abu Al-Qasim Al-Zahrawi died in: (K.B)

(A) 1011 AD (B) 1013 AD

(C) 1015 AD (D) 1012 AD

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

11.1 HOMEOSTASIS IN PLANTS

1	B	**2**	C	**3**	D	**4**	B	**5**	D	**6**	D	**7**	B	**8**	A	**9**	B
10	A	**11**	D	**12**	B	**13**	A	**14**	D	**15**	A	**16**	C	**17**	A	18	B
19	C	**20**	C	**21**	C												

11.2 HOMEOSTASIS IN HUMANS

1	D	**2**	C	**3**	B	**4**	D	**5**	A
6	D	**7**	B						

11.3 URINARY SYSTEM OF HUMANS

1	B	**2**	D	**3**	C	**4**	B	**5**	D	**6**	A
7	D	**8**	B	**9**	C	**10**	B	**11**	A	**12**	C
13	A	**14**	D	**15**	C	**16**	D	**17**	A	**18**	B
19	A	**20**	A	**21**	B	**22**	D	**23**	A	**24**	B
25	C	**26**	B	**27**	D	**28**	B	**29**	A		

11.4 DISORDERS OF KIDNEY

1	A	**2**	B	**3**	B	**4**	D	**5**	B	**6**	A	**7**	D	**8**	C
9	D	**10**	C	**11**	B	**12**	B	**13**	D	**14**	A	15	D	16	B

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. The human urinary system consists of: (K.B)
(a) Rectum, lungs, kidneys, ureters (b) Kidneys, ureters, urinary bladder
(c) Skin, liver, lungs, kidneys (d) Kidneys, ureters, urinary bladder, urethra

2. Which organ is responsible for filtering the blood? (K.B)
(a) Intestine (b) Brain
(c) Stomach (d) Kidney

3. The tube between kidney and urinary bladder is the: (K.B)
(a) Ureter (b) Urethra
(c) Renal tubule (d) Nephron

4. 'Body balance' of water, salts, temperature and glucose is termed as: (K.B)
(a) Excretion (b) Tubular secretion
(c) Homeostasis (d) Re-absorption

5. Which is the correct order for the path taken by urine after it leaves the kidneys? (U.B)
(a) Urethra, bladder, ureters (b) Bladder, ureters, urethra
(c) Ureters, bladder, urethra (d) Bladder, urethra, ureters

6. What is the function of the ureter? (A.B)
(a) To store urine (b) To carry urine from the kidney to the bladder
(c) To carry urine out of the body (d) To remove waste from the blood

7. What waste products are excreted by kidneys? (U.B)
(a) Urea, water & salts (b) Salts, water and carbon dioxide
(c) Urea & water (d) Urea & salts

8. The two main functions of sweat are: (A.B)
(a) To keep the body cool and to remove excess proteins
(b) To keep the body warm and to filter the blood
(c) To filter the blood and to remove waste products
(d) To remove waste products and to cool the body

9. Which would NOT be present in the filtrate entering the Bowman's capsule of nephron? (K.B)
(a) Water (b) Calcium ions
(c) Blood cells (d) Urea

10. During peritoneal dialysis, the waste materials move from: (U.B)
(a) The abdomen to the dialysis fluid
(b) The dialysis fluid to the peritoneum blood vessels
(c) The peritoneum blood vessels to the dialysis fluid
(d) The dialysis fluid to the abdomen

ANSWER'S KEY

1	d	2	d	3	a	4	c	5	c
6	b	7	a	8	d	9	c	10	c

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SHORT QUESTIONS

1. What are the major organs involved in homeostasis in human body? State the roles of each of these organs. (K.B)

Ans:

ORGANS WORK FOR HOMEOSTASIS

Like other complex animals, humans have highly developed systems for homeostasis. The following are the main organs which work for homeostasis.

Lungs:

Lungs remove excess carbon dioxide and keep it in balance.

- Maintain the concentration of carbon dioxide in the blood.
- Our cells produce carbon dioxide when they perform cellular respiration.
- From cells, carbon dioxide diffuses into tissue fluid and from there into blood.
- Blood carries carbon dioxide to lungs from where it is removed in air.

Skin:

Skin performs role in the maintenance of body temperature and also removes excess water and salts.

Kidneys:

Kidneys filter excess water, salts, urea, uric acid etc. from the blood and from urine.

2. Identify and label the following: diagram (K.B)

Ans:

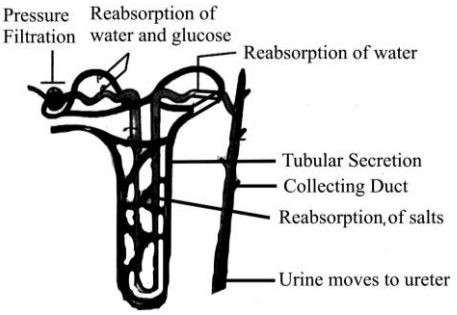

Figure: Functioning of Kidney (Nephron)

UNDERSTANDING THE CONCEPT

1. Describe the process of selective reabsorption in the kidneys. (K.B)

Ans: See the LQ.6 (Topic 11.3)

2. How do the plants excrete extra water and salts from their bodies? (A.B)

Ans: See the LQ. 1 (Topic 11.1)

3. What is the functional unit of the kidney? Describe its structure and draw labelled diagram (K.B)

Ans: See the LQ.3 (Topic 11.3)

4. What steps are involved in the formation of urine in the kidneys? (A.B)

Ans: See the LQ.4 (Topic 11.3)

5. "Along with excretion, kidneys also play role in osmoregulation." Comment on this statement. (U.B)

Ans: See the LQ.5 (Topic 11.3)

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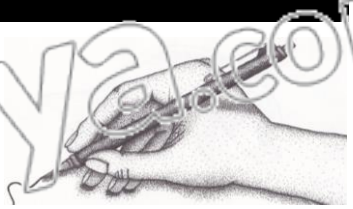
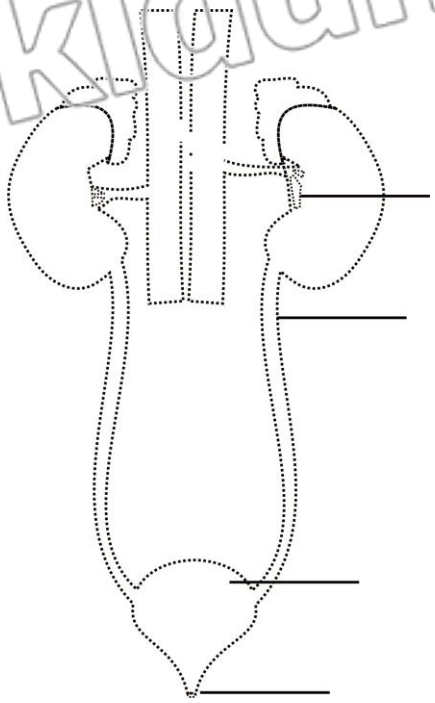
ASSIGNMENT

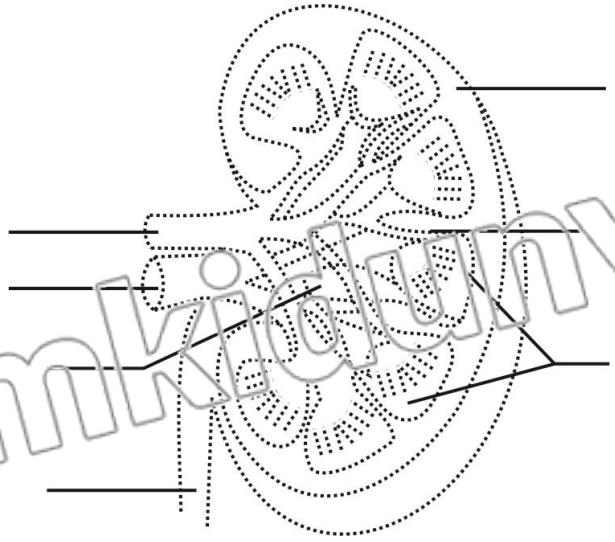
PRACTICE DIAGRAM & LABEL



URINARY SYSTEM OF HUMANS



ANATOMY OF A KIDNEY



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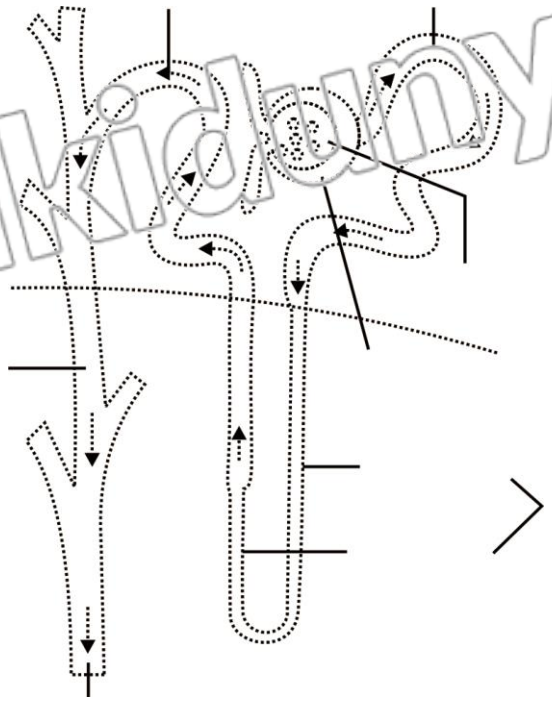
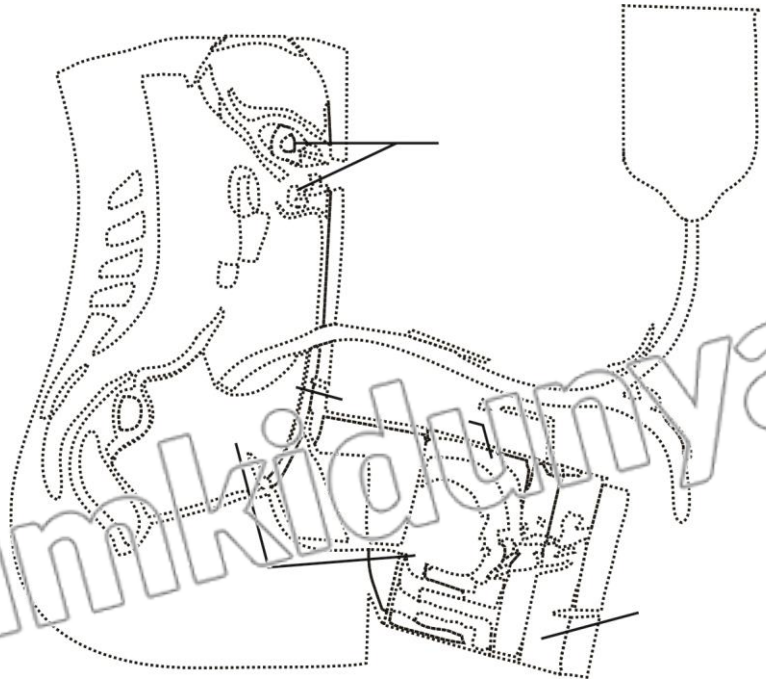
STRUCTURE OF A NEPHRON



PERITONEAL DIALYSIS



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CUT HERE

SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. The waste product of keekar: (K.B)

(A) Resins **(B)** Gums

(C) Latex **(D)** Mucilage

2. Excess body heat escapes through: (K.B)

(A) Transpiration **(B)** Excretion

(C) Cooling **(D)** Evaporation

3. Which one is correct? (U.B)

(A) The left kidney is little higher than the right

(B) The right kidney is little higher than the left

(C) Both are equally placed

(D) The left kidney is half smaller than the right

4. The renal corpuscle has _____ parts. (K.B)

(A) 4 **(B)** 5

(C) 3 **(D)** 2

5. A method for the removal of kidney stone is: (A.B) **(LHR 2013)**

(A) Peritoneal Dialysis **(B)** Haemodialysis

(C) Kidney transplant **(D)** Lithotripsy

6. The replacement of the patient's damaged kidney with the donor's healthy kidney is called: (K.B)

(A) Heart transplant **(B)** Kidney transplant

(C) Liver transplant **(D)** Brain transplant

Q.2 Give short answers to following questions. **(5×2=10)**

(i) Differentiate between transpiration and guttation. **(U.B)**

(ii) Write two characters of xerophytes? **(K.B)**

(iii) How lungs remove CO_2, during cellular respiration? **(K.B)**

(iv) Name the parts of nephron. **(K.B)**

(v) What are symptoms of kidney failure? **(U.B)**

Q.3 Answer the following questions in detail. **(5+4=9)**

(a) Describe Human urinary system. **(K.B)**

(b) Write few roles of skin in homeostasis. **(A.B)**

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of the students.

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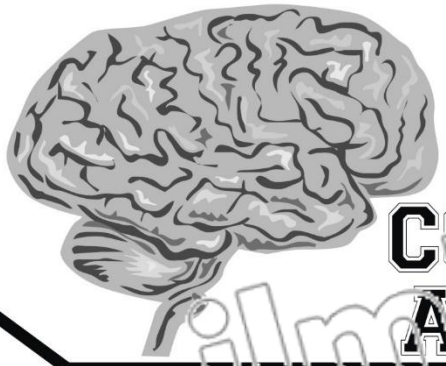

CH# 12

COORDINATION AND CONTROL

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12.1 COORDINATION AND TYPES OF COORDINATION

LONG QUESTIONS

Q.1 Describe the types of coordination and also discuss components of a coordinated action. ***(K.B)***

Ans:

COORDINATION

"**Synchronization** of various activities or **actions of body** or body organs **as a unit** is termed as **coordination**".

Example:

Working of muscles with different body systems together during body movements is the best example of coordination.

Types of Coordination:

There are **two types** of coordination in organisms**:**

(i) Nervous coordination brought about by **nervous system**

(ii) Chemical coordination brought about by **endocrine system**

Animals have **both** the nervous and chemical coordination system in their bodies while plants and **other organisms** have only **chemical coordination.**

COMPONENTS OF COORDINATED ACTION

A coordinated action has following **five components**:

Stimulus → Receptor → Coordinator → Effector → Response

Stimuli:

"Any **change** in **external and internal** environment of an organism which can **provoke a response** is called a stimulus".

Examples:

- **Touch**
- **Light**
- **Heat**
- **Cold**
- **Pressure**
- **Sound waves**
- **Presence of chemicals**
- **Microbial infections**

Type of Stimulus:

There are **two types** of stimulus

- **External Stimulus**
- **Internal Stimulus**

Receptors:

"The **organs, tissues or cells** which are specifically **built to detect** particular type of **stimuli** are called receptors".

Examples:

- **Sound waves** are detected by **ears**
- **Light** is detected by **eyes**
- **Chemicals in air** are detected by **nose**
- Touch, heat, cold and pressure are detected by skin
- Taste is detected by tongue

Coordinators:

"The **organs** that **receive information** from **receptors** and **send messages** to particular **organs** for proper action are called coordinators".

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Nervous Coordination:

In **nervous coordination**, **brain and spinal** cord are coordinators. They **receive information** and send messages through **neurons** in the form of **nerve impulses**.

Chemical Coordination:

In **chemical coordination**, various **endocrine glands** play the role of coordinators. The **receive information** in the form of **various chemicals** and **send messages** by **secreting** particular **hormones** in blood.

Effectors:

"The **parts** of body which **receive messages** from **coordinators** and produce **particular responses** are called effectors".

Nervous Coordination:

In **nervous coordination**, **neurons** carry messages from coordinators (brain and spinal cord) to muscles and glands, which act as effectors.

Chemical Coordination:

In **chemical coordination**, particular **hormones** carry messages from coordinators (endocrine glands) to particular target tissues, which act as effectors. For some hormones, **nephrons** act as effectors. Similarly, **bones and liver act** as **effectors** for many hormones.

Response:

"The **action performed** by the effectors on **receiving the message** from coordinators is called response".

Examples:

- Pulling our hand away from something very hot
- The movement of the flower of sunflower towards light

Nervous Coordination:

Nervous coordination produces **immediate** but **short-living responses**.

Chemical Coordination:

Chemical coordination produces **slow** but **long-living responses**.

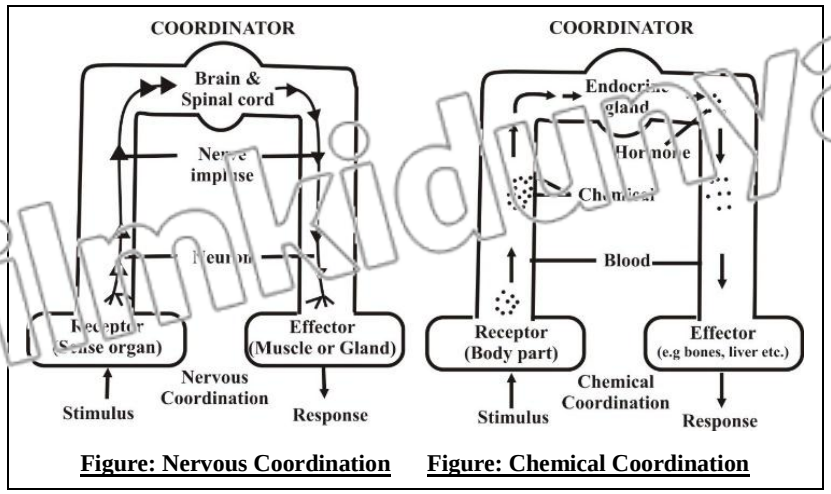

Figure: Nervous Coordination **Figure: Chemical Coordination**

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12.1 SHORT QUESTIONS

Q.1 Define coordination. ***(K.B)*** **(GRW 2017, DGK 2015)**

Ans: Page no 57.

Q.2 Define stimuli. ***(K.B)***

Ans: Page no 57.

Q.3 What are two types of coordination in living organisms? ***(K.B)*** **(LHR 2013, GRW 2015,17)**

Ans: Page no 57.

Q.4 How does coordination take place in unicellular organism? ***(K.B)*** **(GRW 2015)**

Ans:

COORDINATION IN UNICELLULAR ORGANISM

Chemical co-ordination takes place in unicellular organisms by chemical coordination. The response to stimuli is brought about through chemicals.

Q.5 What is spinal cord? Give its length. **GRW 2017**

Ans: Page no 66.

Q.6 Define Stimuli and Response. **LHR 2015**

Ans: Page no 57.

Q.7 What is the difference between co-ordination systems in animals and plants? ***(U.B)***

Ans:

CO-ORDINATION SYSTEMS

The major difference between coordination system of animals and plants is:

Animals have both the nervous and chemical coordination systems in their bodies while plants and other organisms have only chemical coordination.

Q.8 Write the five components of the coordinated action? ***(K.B)*** **(BWP 2014, DGK 2015)**

Ans: Page no 57.

Q.9 Define stimulus. Give examples. ***(K.B)*** **(GRW 2014, 2015, LHR 2015, MTN 2015)**

Ans: Page no 57.

Q.10 Define receptors. Give examples. ***(K.B)*** **(GRW 2015, LHR 2016)**

Ans: Page no 57.

Q.11 What are coordinators? Gives examples. ***(K.B)***

Ans: Page no 57.

Q.12 What are nervous coordinators? Write its function. ***(K.B)***

Ans: Page no 58.

Q.13 What are chemical coordinators? Write its function? ***(K.B)***

Ans: Page no 58.

Q.14 What are effectors? ***(K.B)*** **(GRW 2015, BWP 2015)**

Ans: Page no 58.

Q.15 What is response? Give examples? ***(K.B)*** **(LHR 2015, GRW 2015)**

Ans: Page no 58.

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12.1 MULTIPLE CHOICE QUESTIONS

1. Number of components of coordinated action is: ***(K.B)***

(A) 3 (B) 5

(C) 7 (D) 4

2. Which process enables the organisms to respond to happenings in the world around them? ***(U.B)***

(A) Respiration (B) Coordination

(C) Excretion (D) Reproduction

3. In unicellular living organisms the response to stimuli is brought about through ***(U.B)***

(A) Impulses (B) chemicals

(C) neurons (D) electric waves

4. The movement of sunflower towards light is an example of ***(U.B)***

(A) Stimuli (B) response

(C) coordinator (D) receptor

5. Which coordination systems do animals have? ***(K.B)***

(A) Nervous (B) Chemical

(C) Nervous and chemical (D) Mutual

6. Any change in internal or external environment of an organism: ***(K.B)***

(A) Response (B) Receptor

(C) Stimulus (D) Coordinator

7. Organs specifically built to receive particular type of stimuli: ***(K.B)***

(A) Receptors (B) Effectors

(C) Responses (D) Glands

8. In some parts of the body neurons many cell bodies combine to make a group: **(LHR 2014)** ***(K.B)***

(A) Nerves (B) Tissues

(C) Ganglion (D) Muscles

9. Brain and spinal cord are: ***(K.B)***

(A) Receptors (B) Coordinators

(C) Effectors (D) Responses

10. All can detect a stimuli corresponding to their organs, except: ***(U.B)***

(A) sound waves - Ear (B) Light - eyes

(C) chemicals - smooth muscles (D) heat/cold – Muscles

11. Extended processes that conduct the nerve impulse towards cell body are ***(K.B)***

(A) Axons (B) dendrites

(C) nerves (D) nodes of Ranvier

12. Classification of nerves is based upon the property of ***(K.B)***

(A) dendrites (B) Axons

(C) Ganglions (D) Neuroglial cells

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12.2 HUMAN NERVOUS SYSTEM

LONG QUESTIONS

Q.1 Describe human nervous system. ***(K.B)***

Ans:

HUMAN NERVOUS SYSTEM

Definition:

"A **system** of animals which is **used** for **nervous coordination** and **controls** various **activities** of the body is called nervous system".

There are **two major components** of nervous system which are as follow:

- Central nervous system
- Peripheral nervous system

Central Nervous System:

It comprises of:

- **Brain**
- **Spinal Cord**

Peripheral Nervous System:

It **consists of nerves** that **arise** from **central nervous** system and **spread** in different **parts of body**.

Peripheral nervous system **consists** of two parts

- **Sympathetic**
- **Parasympathetic**

All these **components** are made of **neurons** and **associated cells**.

Q.2 What is neuron? Describe its structure. ***(K.B)*** **(GRW 2013, LHR 2015)**

OR

Define neuron and describe the structure of a general neuron. (Understanding the Concept Q.3)

Ans:

STRUCTURE OF A NEURON

Definition:

"The **unit** of the **nervous system** is called neuron or nerve cell."

OR

"Neurons are the **specialized cells** that are able to **conduct nerve impulses** from receptors to coordinators and from coordinators to effectors".

STRUCTURE OF NEURON

Explanation:

The human nervous system **consists** of **billions of neurons plus supporting** (neuroglial) cells.

Functions:

Neurons are **specialized cells** that are **able** to **conduct nerve impulses** from receptors to coordinators and from coordinators to effectors.

In this way they **communicate** with **each other** and with other types of body cells.

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Parts of a Neuron:

A neuron **consists** of the following parts:

- Cell Body
- Dendrites
- Axon
- Schwann Cells
- Myelin Sheath
- Nodes of Ranvier

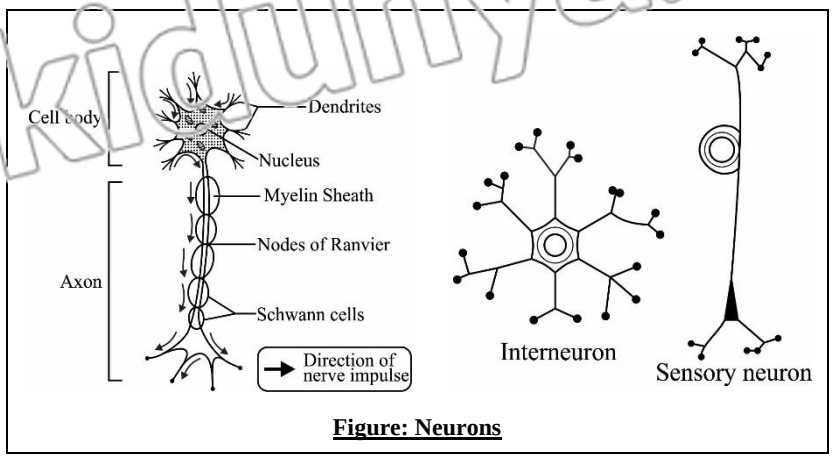

Figure: Neurons

Cell Body:

The **nucleus** and most of the **cytoplasm** of a neuron is **located** in its **cell body**.

Dendrites:

Different **processes extend out** from **cell body**, these are called **dendrites**. Dendrites **conduct impulses toward cell body**.

Axon:

An axon **arises** from the **cell body** and **conducts impulses away from** cell body.

Schwann Cells:

Schwann cells are **special neuroglial cells located** at **regular intervals** a **long axons**.

Myelin Sheath:

In some neurons, Schwann cells **secrete a fatty layer** called myelin sheath, over axons.

Saltatory Nerve Impulse:

Myelin sheath is an **insulator** so the **membrane coated** with this **sheath does not** conduct **nerve impulse**. In such a neuron, **impulses 'jump'** over the areas of myelin going from **node to node**. Such impulses are called **saltatory ('jumping') impulses**. This **increases** the **speed** of nerve impulse.

Nodes of Ranvier:

Between the areas of myelin on an axon, there are **non-myelinated points**, called the **nodes of Ranvier**.

Q.3 Write a note on neuron and nerve. ***(K.B)***

Ans:

NEURON

Definition:

"Neurons are **specialized cells** that are **able** to **conduct nerve impulses** from receptors to coordinators and from coordinators to effectors".

TYPES OF NEURONS

On the **basis of their function**, neurons are of **three types**:

(i) Sensory Neurons
(ii) Interneurons
(iii) Motor Neurons

Sensory Neurons:

- Conduct **sensory information** (nerve impulse) from receptors **towards the CNS**.
- Sensory neurons have **one dendrite** and **one axon**.

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Interneurons:

- From **brain and spinal cord**. They **receive information**, interpret them and **stimulate motor neurons**.
- They have **many dendrites and axons.**

Motor Neurons:

- Carry **information** from **interneurons to muscle or glands** (effectors).
- They have **many dendrites** but only **one axon**

Q.4 Describe division of human nervous system. ***(K.B)***

OR

Explain the location and function of these parts of brain; cerebrum, cerebellum, pituitary gland, thalamus, hypothalamus, medulla oblongata. ***(K.B)***

(Understanding the Concept Q.2)

Ans:

DIVISION OF THE NERVOUS SYSTEM

Human nervous system is divided into two parts:

- Central Nervous System
- Peripheral Nervous System

Central Nervous System:

The central nervous system consist of:

- Brain
- Spinal cord

BRAIN

In animals, all **life activities** are under the **control of brain**. The **structure of brain** is **suitable** to perform this function.

Location:

Brain is **situated** inside a **bony cranium** which is the **part of skull**.

Protection:

Inside cranium, brain is **covered** by **three layers** called **meninges**. Meninges **protect brain** and also **provide nutrients** and **oxygen to brain** tissue through their **capillaries**.

Ventricles:

The brain contains **fluid-filled ventricles** that are **continuous** with the **central canal** of spinal cord.

Cerebrospinal Fluid:

Fluid within **ventricles** and **central canal** is called **cerebrospinal fluid** (CSF).

Divisions of Brain:

There are **three major regions** in the brain of human and other vertebrates. These are:

- Forebrain
- Midbrain
- Hindbrain

Forebrain: **(LHR 2013, 17, BWP 2014)**

Forebrain is the **largest area** of brain. It is most **highly developed** in humans. Following are the important parts of this region.

- **Thalamus**
- **Hypothalamus**
- **Cerebrum**

Thalamus:

Thalamus lies just **below cerebrum**.

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Functions:

- **Thalamus** serves as a **relay center** between various parts of brain and spinal cord.
- It also **receives** and **modifies sensory impulses** (except from nose) **before** they travel to **cerebrum**.
- **Thalamus** is also involved in **pain perception** and **consciousness** (sleep and awakening).

Hypothalamus:

Hypothalamus lies **above midbrain** and **just below thalamus**.

Size:

In humans, it is **roughly** the **size of an almond.**

Functions:

- One of the most **important function** of hypothalamus is to link **nervous system** and **endocrine system**.
- It **controls** the **secretions** of **pituitary gland**.
- It also **controls feelings** such as rage, pain, pleasure and sorrow.

Cerebrum:

Cerebrum is the **largest part** of **forebrain**.

Functions:

It controls:

- **Skeletal muscles**
- **Thinking**
- **Intelligence**
- **Emotions**

Divisions of Cerebrum:

Cerebrum is divided into **two cerebral hemispheres**.

Olfactory Bulbs:

The **anterior parts** of cerebral hemispheres are called **olfactory bulbs** which **receive impulses** from **olfactory nerves** and create the **sensation of smell**.

Cerebral Cortex: **(SWL 2014)**

The **upper layer** of **cerebral hemispheres** i.e. **cerebral cortex** that **consists** of **grey matter**. The grey matter of nervous system consists of **cell bodies** and **non-myelinated axons.**

White Matter:

Beneath this **layer** is present the **white matter**. The **white matter** of nervous system consists of **myelinated axons**.

Lobes of Cerebral Cortex:

Cerebral cortex has a **large surface** area and is **folded** in order to **fit in skull**. It is **divided** into four lobes:

- **Frontal lobe**
- **Parietal lobe**
- **Occipital lobe**
- **Temporal lobe**

Frontal Lobe:

- **Controls motor functions**
- **Permits conscious control of skeletal muscles**
- **Coordinates movements involved in speech**

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Parietal Lobe:

- **Contains sensory areas** that receive **impulses from skin**

Occipital Lobe:

- **Receives** and **analyzes visual information**

Temporal Lobe:

- **Concerned with hearing and smell**

Midbrain:

Midbrain lies between **hindbrain and forebrain and connects** the two.

Functions:

- The midbrain **receives sensory information** and **sends** it to the appropriate part of **forebrain**.

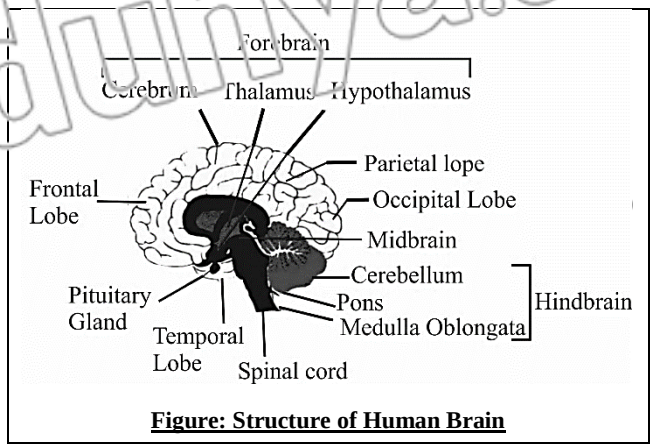

Figure: Structure of Human Brain

- Midbrain also **controls** some **auditory reflexes** and **posture**.

Hindbrain:

Hindbrain **consists** of three major parts:

(i) Medulla Oblongata

(ii) Cerebellum

(iii) Pons

Medulla Oblongata:

Medulla oblongata lies on the **top of spinal cord**. **Information** that **passes** between **spinal cord** and the **rest of brain** pass through medulla.

Functions:

It controls:

- **Breathing**
- **Heart rate**
- **Blood pressure**
- **Reflexes such as vomiting, coughing, sneezing**

Cerebellum:

Cerebellum lies **behind medulla oblongata**.

Function:

- It **coordinates muscle movements.**

Pons:

Pons is present on **top of medulla.**

Functions:

- It **assists medulla** in controlling **breathing**.
- It also **serves** as a **connection** between **cerebellum and spinal cord.**

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Q.5 Define spinal cord, describe its structure with diagram. ***(K.B)*** **(DGK 2014, SWL 2015)**

Ans:

SPINAL CORD

Definition:

"The **spinal cord** is in fact a **tubular bundle of nerves**. It **starts** from **brain stem** and **extends to lower back."**

Protection:

- Like brain, **spinal cord** is also **covered** by **meninges**
- The **vertebral column surrounds** and **protects spinal cord**

STRUCTURE

Outer Region:

The **outer region** of **spinal cord** is made of **white matter** (containing myelinated axons).

Central Region:

The **central region** is **butterfly shaped** that surrounds the **central canal**. It is made of **grey matter** (containing neuron cell bodies).

Spinal Nerves:

31 pairs of **spinal nerves** arise **along spinal cord**. These are **"mixed" nerves** because each contains **axons** of both **sensory and motor neurons**.

Roots of Spinal Nerve:

At the point where a **spinal nerve arises** from **spinal cord**, there are **two roots** of spinal nerve. Both roots **unite** and form **one mixed spinal nerve.**

Dorsal Root:

The **dorsal root** contains **sensory axons** and a **ganglion** where **cell bodies are located.**

Ventral Root:

The **ventral root** contains **axons** of **motor neurons**.

Functions:

Spinal cord performs two main functions:

(i) It serves as a **link** between **body parts and brain**. Spinal cord **transmits nerve impulses** from body parts to brain and from brain to body parts.

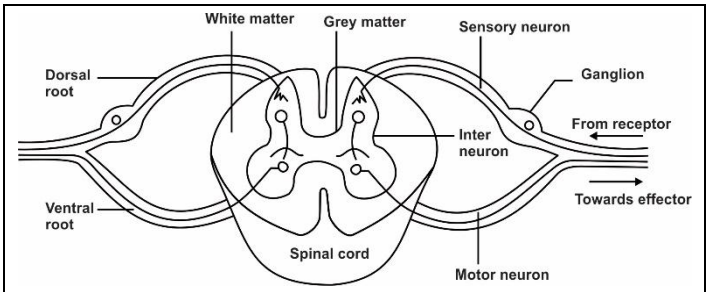

Figure: Spinal Cord and Spinal Nerves

(ii) Spinal cord also acts as a **coordinator**. **Responsible** for some **simple reflexes**.

Q.6 Write a note on peripheral nervous system. ***(K.B)***

Ans:

PERIPHERAL NERVOUS SYSTEM

Composition:

The peripheral nervous system (PNS) is **composed** of **nerves and ganglia. Ganglia** are the **clusters** of **neuron cell bodies outside** central nervous system.

Cranial Nerves:

The **nerves** that **arise or lead** to **brain** are called **cranial nerves**. Humans have **12 pairs** of **cranial nerves**. Some **cranial nerves** are **sensory**, **some are motor** and **some are mixed.**

Spinal Nerves:

The **nerves** that **arise** or lead to **spinal cord** are called spinal nerves. Humans have **31 pairs** of **spinal nerves**. All spinal nerves are **mixed nerves**.

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Pathways:

The cranial and spinal nerves make **two pathways**:

Sensory Pathway:

The **sensory pathway** (conducting impulses from receptors to central nervous system).

Motor Pathway:

The **motor pathway** (conducting impulses from central nervous system to effectors).

Motor pathway makes two systems:

- Somatic Nervous System
- Autonomic Nervous System

Somatic Nervous System:

Composition:

It **includes** all of the **motor neurons** that **conduct impulses** from **central nervous system** to **skeletal muscles**.

Function:

- It is **responsible** for the **conscious** and **voluntary actions**.

Autonomic Nervous System:

Composition:

It consists of **motor neurons** that send impulses to:

- **Cardiac muscles**
- **Smooth muscles**
- **Glands**

Function:

- It is **responsible** for the **activities**, which are **not under conscious control.**

Types of Autonomic Nervous System:

Autonomic nervous system comprises of:

- **Sympathetic Nervous System**
- **Parasympathetic Nervous System**

Sympathetic Nervous System:

Sympathetic nervous system **prepares body** to deal with **emergency situations**. This is often called the **"fight or flight"** response. During an emergency situation, this system takes **necessary actions**.

Examples:

- **Dilates pupils**
- **Accelerates heartbeat**
- **Increases breathing rate**
- **Inhibits digestion**

Parasympathetic Nervous System:

When **stress ends**, the **parasympathetic** nervous system takes **action** and **normalizes** all the functions.

- **Causes pupils to contract**
- **Promotes digestion**
- **Slows the rate of heartbeat and breathing rate**

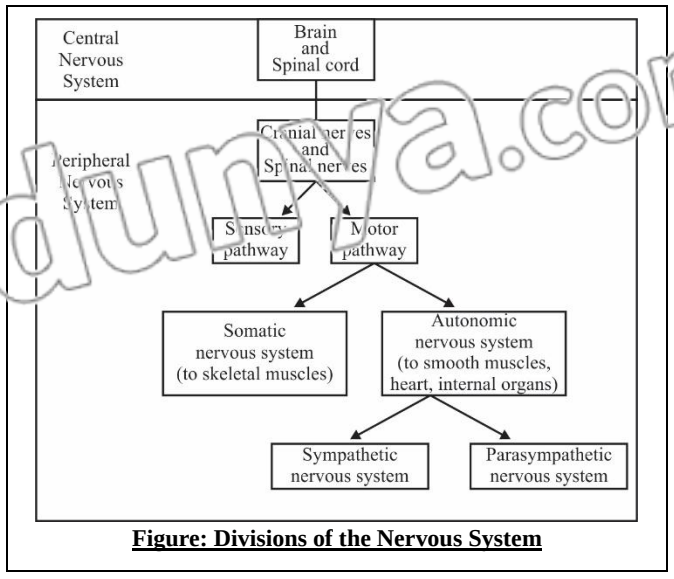

Figure: Divisions of the Nervous System

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Q.7 Define reflex action. Explain it with example. ***(K.B)*** **(DGK 2015)**

Ans: **REFLEX ACTION**

Definition:

"A **very quick involuntary response** produced by the **central nervous system** (CNS) is called **reflex action**".

Examples:

- **Withdrawal of hand** after touching a hot object
- **Knee jerk**
- **Pupil reflex**

Explanation:

When central nervous system **sends impulses** to **muscles and glands**, **two types** of actions (responses) result.

(i) The **higher centers** of brain **control** the **conscious action** or **voluntary actions**.

(ii) When **impulses** are **not passed** to the **higher centers** of brain, it results in responses which are not under conscious control. Such responses are called **involuntary actions**. Sometimes, the involuntary response produced by the CNS is **very quick**. Such a response is called reflex action.

Reflex Arc:

"The **pathway** followed by the **nerve impulses** for **producing** a **reflex action**, is called reflex arc".

Example:

The most common example of reflex action is the withdrawal of hand after touching a hot object. In this reflex action, spinal cord acts as coordinator. Heat stimulates temperature and pain receptors in skin. A nerve impulse is generated which is carried by sensory neurons to the interneurons of spinal cord. From interneurons, the impulse is passed to motor neurons, which carry it to the muscles of arm. As a result, the muscles contract to withdraw hand. During it, other interneurons transmit nerve impulses up to brain so that the person becomes aware of pain and what happened.

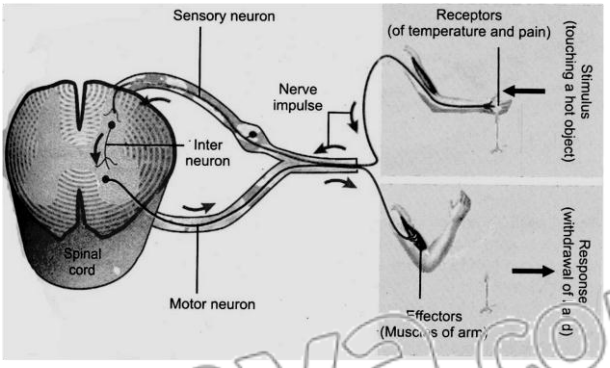

Figure: Reflex Arc in a Reflex Action

12.2 SHORT QUESTIONS

Q.1 What are two major components of nervous system? ***(K.B)***

Ans: Page no 61.

Q.2 Define nerve impulse. ***(K.B)*** **(LHR 2017)**

Ans: **NERVE IMPULSE**

Definition:

"A wave of electrochemical changes that travels along the length of neuron is called nerve impulse".

Q.3 Define reflex action and reflex arc.

Ans: Page no 68.

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Q.4 What are neurons? ***(K.B)***

OR

Write the types of neurons. ***(K.B)***

Ans: Page no 61.

Q.5 Write the name and functions of lobes of cerebrum. ***(K.B)*** **(LHR 2017)**

Ans: Page no 64, 65.

Q.6 What is nerve growth factor? How it repairs brain cells? ***(K.B)***

Ans:

NERVE GROWTH FACTOR

Unlike ordinary cells, matures neurons never divide but a protein called "nerve-growth-factor" promotes the regeneration of broken nerve cells. The degenerative brain cells could be repaired, by using embryonic stem cells.

Q.7 What is the difference between sensory and motor neurons? ***(K.B)*** **(GRW 2016, LAHR 2017)**

Ans:

DIFFERENTIATION

The difference between sensory and motor neurons is as follows:

Sensory	Motor neurons
• Sensory neurons conduct sensory information (nerve impulse) from receptors towards the CNS. Sensory neurons have one dendrite and one axon.	• Motor neurons carry information from interneurons to muscles or glands (effectors). They have many dendrites but only on axon.

Q.8 Define nerve and write its types. ***(K.B)***

Ans: Page no 62.

Q.9 What are saltatory nerve impulses? ***(K.B)*** **(LHR 2016)**

Ans: Page no 62.

Q.10 What is ganglion? ***(K.B)*** **(GRW 2016)**

Ans:

GANGLION

In certain parts of the body, the cell bodies of many neurons from a group enveloped by a membrane, this is called ganglion.

Q.11 What are meninges? Write its functions. ***(K.B)*** **(GRW 2014, LHR 2016)**

Ans:

MENINGES

Central nervous system is covered by three layers called meninges**.**

Functions:

The function of meninges are as follows:

- Protect brain and spinal

Provide nutrients and oxygen to brain tissues through their capillaries

Q.12 What are the functions of thalamus? ***(A.B)***

Ans: Page no 64.

Q.13 What is hippocampus? Write its function. ***(K.B)***

Ans:

HIPPOCAMPUS

Hippocampus is a structure that is deep in the cerebrum.

Function:

The function of hippocampus is formation of new memories. People with a damaged hippocampus cannot remember things that occurred after the damage but can remember things that had occurred before damage.

Q.14 What are the functions of hypothalamus? ***(A.B)*** **(GRW 2013)**

Ans: Page no 64.

Q.15 What are the functions of frontal lobe? ***(A.B)*** **(SWL 2014)**

Ans: Page no 65.

Q.16 What is spinal cord? What is its length? ***(K.B)***

Ans: Page no 66.

Q.17 Write down the function of mid brain. ***(A.B)***

Ans: Page no 65.

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12.2 MULTIPLE CHOICE QUESTIONS

1. The central nervous system comprises of: (K.B) (SWL 2015)
(A) Brain (B) Spinal cord
(C) Brain and spinal cord (D) liver

2. The neurons that conduct impulses from central nervous system to effectors: (K.B)
(A) Associative (B) Inter
(C) Motor (D) Sensory

3. Supporting cells of neurons are (K.B)
(A) Neuroglial cells (B) nerves
(C) ganglions (D) axons

4. The largest portion of the forebrain is: (K.B)
(A) Thalamus (B) Hypothalamus
(C) Cerebrum (D) Cerebellum

5. Which part of neuron conducts nerve impulses away from cell body? (A.B) (BWL 2015)
(A) Axon (B) Myelin sheath
(C) Node of Ranvier (D) Dendrite

6. In certain parts of the body, the cell bodies of many neurons form a group enveloped by a membrane: (U.B)
(A) Brain (B) Nerve
(C) Spinal cord (D) Ganglion

7. Is not a part of hindbrain: (K.B) (BWL 2014)
(A) Cerebellum (B) Medulla oblongata
(C) Pons (D) Cerebrum

8. Part of brain that coordinates muscle movements: (U.B) (LHR 2015)
(A) Cerebellum (B) Pons
(C) Medulla Oblongata (D) Hypothalamus

9. The three layers covering the brain: (K.B)
(A) Choroid (B) Meninges
(C) Sclera (D) Retina

10. The largest part of the brain: (K.B)
(A) Forebrain (B) Midbrain
(C) Hindbrain (D) All of these

11. CSF is filled in (K.B)
(A) meninges (B) ventricles
(C) cranium (D) skull

12. An almond size structure in fore brain is (K.B)
(A) Crebrum (B) cerebium
(C) hypothalamus (D) thalamus

13. The part of forebrain that lies just below cerebrum: (K.B)
(A) Thalamus (B) Hypothalamus
(C) Medulla (D) Pons

14. Lobe concerned with senses of hearing and smell: (K.B) (LHR 2013)
(A) Frontal (B) Parietal
(C) Occipital (D) Temporal

15. The lobes that receive and analyze visual information: (K.B)
(A) Frontal (B) Parietal
(C) Occipital (D) Temporal

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16. The largest part of the forebrain that controls skeletal muscles, thinking, intelligence and emotions: (K.B) **(LHR 2013)**

(A) Thalamus (B) Hypothalamus
(C) Cerebrum (D) Cerebellum

17. The part of brain present on the top of medulla: (K.B)

(A) Cerebrum (B) Pons
(C) Cerebellum (D) Thalamus

18. The degenerated brain cell could be repaired by (A.B)

(A) embryonic stem cells (B) ganglions
(C) neurons (D) nerves

19. Spinal cord is the continuation of: (K.B)

(A) Medulla oblongata (B) Thalamus
(C) Hypothalamus (D) Hippocampus

20. The ventral root contains the axons of which neurons? (U.B)

(A) Inter (B) associative
(C) Sensory (D) Motor

21. Spinal cord acts as a: (U.B)

(A) Receptor (B) Effector
(C) Coordinator (D) Stimulus

22. The peripheral nervous system consists of pairs of spinal nerves: (K.B)

(A) 30 (B) 12
(C) 31 (D) 14

23. The pathway followed by the nerve impulses for producing a reflex action: (K.B)

(A) Reflex arc (B) Coordinator
(C) Voluntary action (D) Saltatory

12.3 RECEPTORS IN HUMANS

LONG QUESTIONS

Q.1 Describe the structure of human eye. (K.B) **(GRW 2014)** **(Understanding the Concept Q.4)**

Ans:

HUMAN EYE

"Eyes are the **sensory organs** that are associated with the **sense of vision**".

Orbit:

Human eyes are **located** in **small portions** of **skull** known as the **orbits or eye sockets**.

Eyelids:

Eyelids wipe eyes and **prevent dehydration**. They **spread tears** on eyes which contains **substances** for **fighting bacterial infections.**

Eyelashes:

Eyelashes prevent fine particles from **entering** eye.

STRUCTURE OF EYE

The structure of eye can be divided into three main layers:

- Outer Layer
- Middle Layer
- Inner Layer

Outer Layer: **(GRW 2015)**

The **outer layer** of eyeball consists of

- **Sclera**
- **Cornea**

Sclera:

Sclera gives eye most of its **white colour**. It consists of **dense connective tissue** and **protects** the **inner components** of eye and **maintains its shape**.

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Cornea:

In the **front**, sclera forms the **transparent cornea**. Cornea **admits light** to the **interior of eye** and **bends light** rays so that they can be brought to a **focus**.

Middle Layer:

Choroid:

The **middle layer** is called **choroid**.

The choroid contains **blood vessels** and gives the inner eye a **dark colour**. The dark colour **prevents disruptive reflections** within eye.

Iris:

Behind cornea, **choroid bends** to form a **muscular ring**, called **iris**.

Pupil:

There is **round hole**, called **pupil**, in the **centre of iris**. After striking the cornea, **light passes** through the **pupil**. The **size** of pupil is **adjusted** by the **muscles** of iris. Pupil **constricts** in bright light when the **circular muscles** of iris contract. Similarly, **pupil dilates** in **dim light** when the **radial muscles** of iris **contract**.

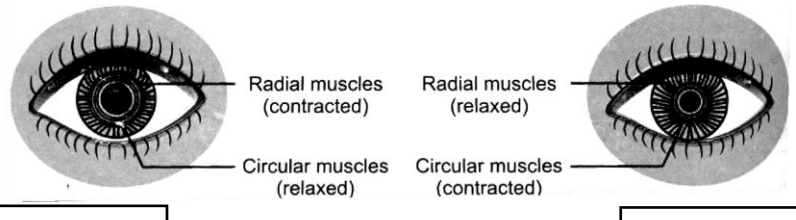

Figure: Contraction and Dilation of Pupil

Lens:

Behind iris, there is a **convex lens**, which **focuses** light on **retina**.

Ciliary Muscles:

Lens is **attached** to **ciliary muscles** of eye via a **ring** of **suspensory ligament**. To clearly see an object **far away**, **ciliary muscles** are **relaxed** and lens becomes **less convex**. When **ciliary muscles contract**, **lens** becomes more **convex** and **round**.

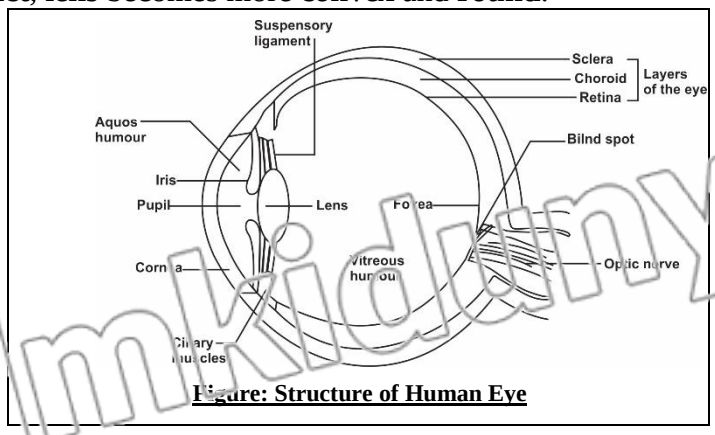

Figure: Structure of Human Eye

Inner Layer:

Retina:

The **inner layer** is **sensory** and is called as **retina**. It contains the **photosensitive cells** called **rods and cones** and **associated neurons**.

Rods:

Rods are **sensitive** to **dim light**.

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Cones:
The **cones** are **sensitive** to **bright light** and so distinguish **different colors**.
Fovea:
Fovea is a **dip in retina**, directly **opposite** to **lens** and is **densely packed** with **cone cells**. It is largely responsible for **colour vision** and **sharpness**.
Optic Disc:
Optic disc is a **point on retina** where the **optic nerve** enters retina.
Blind Spot:
There are **no rods and cones** at **optic disc point**, that is why it is referred to as the **blind spot**.
Chambers of Eye:
The iris **divides** the **cavity** of eye into **two chambers**.
Anterior Chamber:
The **anterior chamber** is in front of iris i.e. between cornea and iris. The anterior chamber contains a **clear fluid** known as **aqueous humor**.
Posterior Chamber:
The **posterior chamber** is **between iris and retina**. The posterior chamber **contains** a **jelly-like fluid** known as **vitreous humor**. It helps maintain the **shape of eye** and suspends the **delicate lens**.

Q.2 Describe different types of eye disorders. (K.B) **(BWP 2014, SWL 2014, GRW 2016)**

OR

What are short sight and long sight problems and how there can be treated? (A.B)
(Understanding the Concept Q.6)

Ans:

DISORDERS OF THE EYE

The **working** of eye is **affected** by the **changes in the shape** of **eyeball.**
Two disorders of eyes are:

- Myopia
- Hypermetropia

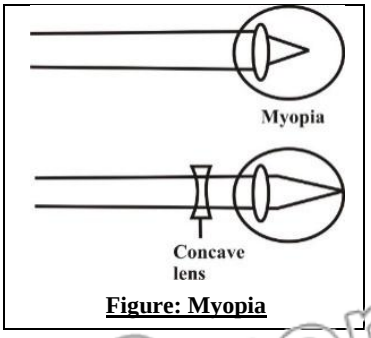

Figure: Myopia

MYOPIA

The image of a **distant object** is formed in **front of retina**. It is also known as **short sight**.

Cause:

The **elongation** of **eyeball** results in myopia.

Effect:

Such persons are **not able** to **see distant objects** clearly.

Treatment:

This problem can be **rectified** by using **concave lens**.

HYPERMETROPIA: (LONG SIGHTEDNESS)

The **image** is formed **behind retina**. It is also known as **long sight**.

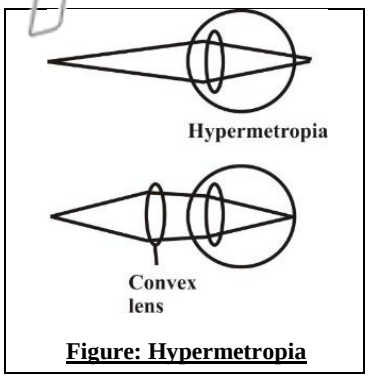

Figure: Hypermetropia

Cause and Effect:

It happens when **eyeball shortness**. Such persons are **not able** to **see near objects** clearly.

Treatment:

Convex lens is used to **rectify** this problem.

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Q.3 Describe structure of human ear and functions of ear. (K.B)

OR

How would you describe the structure of the external, middle and inner ear of man? (K.B) **(Understanding the concept Q.5)**

Ans:

STRUCTURE OF HUMAN EAR

Introduction:

Hearing is an **important** as **vision**. Our ear **helps** us in **hearing** and also to **maintain** the balance of **equilibrium** of our body.

Ear has the following **three main parts**:

- External ear
- Middle ear
- Internal ear

EXTERNAL EAR

External ear consists of **pinna**, **auditory canal** and **ear drum** (tympanum).

Pinna:

Pinna is the **broad external part**, made of **cartilage** and **covered with skin**. It **helps** to direct **sound waves** into **auditory canal**.

Auditory Canal:

There are **special glands** in the **walls** of auditory canal, which **produce wax**. The wax and the hairs in auditory canal **protect** ear from **small insects**, **germs and dust**. In additions to this, they help to **maintain** the **temperature** and **dampness** of auditory canal.

Ear Drum:

Auditory canal **ends in ear drum**. This **thin membrane separates external ear from middle ear.**

MIDDLE EAR

Middle ear is a **chamber** after external ear.

Ossicles:

Three small bones, called middle ear ossicles, are present in a **chain** in middle ear. These **movable bones** include **malleus, incus** and **stapes**. **Malleus is attached** with **ear drum**, then comes **incus** and finally **stapes** that is **connected** with a **membrane** called oval **window**.

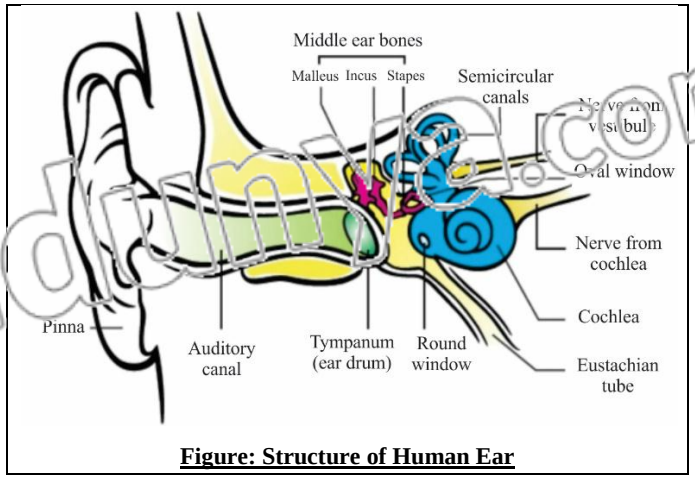

Figure: Structure of Human Ear

Oval Window:

Oval **window separates** middle ear from **inner ear**.

Eustachian Tube:

Middle ear also **communicates** with the **nasal cavity** through **Eustachian tube**. This tube **regulates** the **air pressure** on both sides of eardrum.

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INNER EAR

Inner ear consists of **three parts** i.e. **vestibule, semicircular canals** and **cochlea.**

Vestibule:

Vestibule is **present** in the **center of inner ear**.

Semicircular Canals:

Three canals called semicircular canals are **posterior** to the **vestibule**.

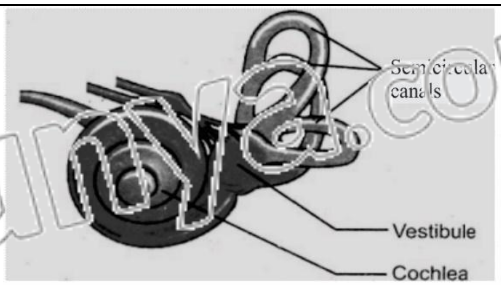

Figure: Structure of the Inner Ear

Cochlea.

The **cochlea** is made of **three ducts** and **wraps** itself into a **coiled tube**. Sound **receptor cells** are present within the **middle duct** of cochlea.

FUNCTIONS OF EAR

There are **two functions** of human ear.

- Hearing
- Balancing of Body

Hearing:

The **pinna** of the external ear focuses and **directs sound waves** into **auditory canal**. The sound waves **strike ear drum** and **produce vibrations** in it. From ear drum, the **vibrations** strike middle ear and **produce** further vibrations in **malleus**, **incus** and then **stapes**. From **stapes**, the vibrations strike the **oval window** and then reach the **fluid-filled middle duct** of cochlea. The fluid of cochlea is moved and **receptor cells** are **stimulated**. The receptor cells generate a **nerve impulse**, which travels to **brain** and is **interpreted as sound**.

Maintenance the Balance of Body:

Semicircular canals and **vestibule** help to **maintain** the **balance** of body. **Semicircular canals** contain **sensory nerves** which can **detect** any **movement of head**. **Vestibule can detect any changes** in the **posture** of body. The **neurons** coming from these two receptors reach **cerebellum** through the **auditory nerve**.

Q.4 Relate the contribution of Ibn-Al-Haitham and Ali–Ibn–Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases. (Understanding the Concept: Q.8)

Ans:

CONTRIBUTION OF IBN-AL-HAITHAM

Ibn-al-Haitham (965 – 1039 AD) an Arab scientists made scientific contributions to the principles of eye and vision. He is regarded as the father of optics (study of behavior of light). His book of optics' correctly explained and prove the modern theory of vision the discussed the topics of medicine and eye surgery in his book. He made several improvements to eye surgery and accurately described the processes of sight, the structures of eye, image formation in eye and visual system. Ibn al haitham also described the principals of pinhole camera.

CONTRIBUTION OF ALI–IBN–ISA

Ali Ibn Isa (950-1012 AD) was a famous Arab Scientist. He wrote three books on ophthalmology (study of the diseases and surgery of eyes). He describe 30 eyes diseases and prescribed 143 drugs to treat these diseases.

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12.3 SHORT QUESTIONS

Q.1 Define receptors. Give examples. (K.B)

Ans:

RECEPTORS

Definition:

"The organs or parts which are specifically built to detect particular type of stimuli are called sense organs and receptors".

Main receptors in humans are:

- Eyes
- Ears
- Nose
- Taste Buds

Receptors of Touch, Heat and Cold

Q.2 What is the role of suspensory ligament and ciliary muscle? (K.B)

Ans: Page no 72.

Q.3 What are rods and cones? (K.B) **(SWL 2014)**

Ans: Page no 72, 73.

Q.4 What is blind spot? (K.B)

Ans: Page no 73.

Q.5 Define night blindness. (K.B)

Ans:

NIGHT BLINDNESS

Rods contain a pigment called rhodopsin. When light falls on rhodopsin, it breaks for generating a nerve impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision. This problem is called the night blindness..

Q.6 What is color blindness? (K.B)

Ans:

COLOR BLINDNESS

Cones also contain a pigment, known as iodopsin. There are three main types of cones and each type has a specific iodopsin. Each type of cones recognizes one of three primary colors i.e. blue, green and red. If any type of cone not working well, it becomes difficult to recognize that color. Such person is also not able to distinguish different colors. This disease is called colour blindness and it is a genetic problem.

Q.7 Why owl is not able to see during day times? (U.B) **(LHR 2017)**

Ans:

OWL CAN'T SEE IN DAY TIMES

Owl is not able to see during day time. The reason for this is the deficiency of cones which receive and sense the bright light. But the presence of more rods gives it greater power of vision during night. All animals that search for prey during night have this characteristic.

Q.8 What is meant by soundless world? (U.B)

Ans:

SOUNDLESS WORLD

Deafness is a state in which hearing is not possible. The defect of ear drum, cochlea, middle ear ossicles, or auditory nerve may cause deafness. Infection in Eustachian tube may spread to middle ear too. Ear drum may damaged by an infection in auditory canal. Excessive noise, strong blows on cheek, pointed objects entering auditory canal and attack from insects may also affect hearing.

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Q.9 How thunderstorm is formed? (A.B)

Ans: **THUNDERSTORM**

A thunderstorm is characterized by the presence of lightning and a thunder. The lightning is caused by an electrical charge due to the movement of water droplets or electrical charge due to the movement of water droplets or crystals carried by the wind. The sudden increase in pressure and temperature from lightning produces rapid expansion of the air. This expansion of air produces a sound of thunder. The flash of lightning is followed after some seconds by a roar of thunder. This time difference is due to the fact that sound travels than light.

Q.10 Write down the pathway light in human eye? (K.B)

Ans: **PATHWAY LIGHT IN HUMAN EYE**

Light from objects enters eye and is refracted, when it passes through cornea, aqueous humor, lens and vitreous humor. Lens also focuses light on retina. As a result, the image falls on retina. Rods and cones generate nerve impulses in the optic nerve. These impulses are carried to the brain, which makes the sensation of vision.

Q.11 What is the role of special glands in the wall of auditory canal? (K.B)

Ans: Page no 74.

Q.12 How ears maintain the balance of body? (K.B) **(LHR 2016)**

Ans: Page no 75.

Q.13 Have you ever seen the eyes of cat and dog shining in night? Comment on this. (K.B)

Ans: **SHINING OF EYES**

The eyes of cat and dog shines in night due to presence of tapetum behind the eye which is a layer capable of reflecting light.

Q.14 Why color vision is essential for pilots? (U.B)

Ans: **COLOR VISION**

Color vision is essential for pilots, so that he/she can recognize aircraft position lights, light-gun signals, airport beacon, approach-slope especially at night. A pilot must have the ability to perceive these colours necessary for the safe performance of his/her duties.

12.3 MULTIPLE CHOICE QUESTIONS

1. Shape of eye is maintained by (U.B)

(A) Sclera (B) cornea
(C) choroid (D) retina

2. Cornea causes (U.B)

(A) duplication (B) reflection
(C) absorption (D) refraction

3. In how many layers the structure of the eye can be divided? (K.B)

(A) 1 (B) 2
(C) 3 (D) 4

4. The human eye contains rods about: (K.B) **(LHR 2013)**

(A) 12.5 millions (B) 7 millions
(C) 12 millions (D) 20 millions

5. The middle layer of the eye is called: (K.B) **(LHR 2015, GRW 2016, 17, DGK 2015)**

(A) Sclera (B) Choroid
(C) Cornea (D) Retina

6. Which are sensitive to dim light? (U.B)

(A) Cones (B) Lens
(C) Humours (D) Rods

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7. The point where there are no rods and cones: (K.B)
(A) Fovea (B) Optic nerve
(C) Retina (D) Blind spot

8. The pigment present in the cones: (K.B)
(A) Rhodopsin (B) Iodopsin
(C) Carotenoid (D) Xanthophyll

9. Which vitamin synthesizes rhodopsin? (K.B)
(A) A (B) B
(C) C (D) D

10. Deficiency of which vitamin causes night blindness? (A.B)
(A) K (B) D
(C) E (D) A

11. The eyes of cats and dogs shine at night because of the presence of: (U.B)
(A) Retina (B) Rods
(C) Cones (D) Tapetum

12. Date of birth of Ali Ibn Isa: (K.B)
(A) 940 (B) 950
(C) 960 (D) 970

13. Date of death of Ibn-al-Haytham: (K.B)
(A) 1045 (B) 1049
(C) 1048 (D) 1039

14. How many eye diseases were described by Ali Ibn Isa? (K.B) **(LHR 2013)**
(A) 100 (B) 110
(C) 120 (D) 130

15. The thin membrane separating external ear from middle ear: (K.B)
(A) Oval window (B) Tympanum
(C) Round window (D) Cochlea

16. Posterior lobe of pituitary gland secrets. The hormone: (K.B) **(SWL 2015)**
(A) Somatrophin (B) Thyroxin
(C) Oxytocin (D) Thyroid

17. In auditory canal wall, special glands produce: (K.B) **(LHR 2014)**
(A) Wax (B) Blood
(C) Auditory fluid (D) Nerve impulse

18. Which one is present in the center of the inner ear? (K.B)
(A) Malleus (B) Incus
(C) Stapes (D) Vestibule

19. The cochlea is present in: (K.B) **(LHR 2015)**
(A) External ear (B) Middle ear
(C) Internal ear (D) None of these

20. Which is not the part of external ear? (K.B)
(A) Ossicles (B) Pinna
(C) Auditory canal (D) Ear drum

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12.4 ENDOCRINE SYSTEM

LONG QUESTIONS

Q.1 Write a note on pituitary gland. (K.B) **(Understanding the Concept Q 9) (LHR 2016, MTN 2015)**

Ans:

PITUITARY GLAND

Shape:

- It is a **pea-shaped gland**.

Location:

- It is **attached** to the **hypothalamus** of brain.

Master Gland:

Many **hormones** (trophic hormones) of pituitary gland **influence** the **secretions of** other endocrine glands.

Direct Action:

Some hormones of this gland **act directly** on **various tissues** of body.

Lobes of Pituitary Gland:

There are **two lobes** of pituitary gland:

- Anterior lobe
- Posterior lobe

Anterior Lobe:

It produces **many hormones**.

Somatotrophin:

One of its **important hormones** is **somatotrophin**. It is also known as **growth hormone**. It **promotes** the **growth of body**.

Dwarfism:

If the production of this **hormone** is **diminished** during **growing age**, the rate of **growth decreases**. This condition is called dwarfism.

Gigantism:

If this **hormone** is **excessively** produced during **growing age**, it leads to **gigantism**. The person becomes **very tall** and **overweight**.

Acromegaly:

If somatotrophin is **excessively produced after growing age**, **internal organs** and body **extremities** alone **grow large**. This condition is known as acromegaly. Such persons will have large hands, feet and jawbones.

Thyroid Stimulating Hormone (TSH):

Another important **hormone** secreted by the **anterior lobe** of pituitary gland is **thyroid stimulating hormone** (TSH). It **stimulates thyroid gland** to **secrete** its hormones.

Other Hormones:

The **remaining hormones** of anterior lobe **influence reproductive** organs and also control **adrenal glands**.

Posterior Lobe:

The **posterior lobe** of pituitary gland **stores** and **secretes two hormones**.

- **Vasopressin** (Antidiuretic Hormone)
- **Oxytocin**

Production:

These **hormones** are produced by **hypothalamus** (a part of brain).

Vasopressin:

Vasopressin **increases** the **rate of reabsorption** of **water from nephrons**.

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Lesser Water Potential:

When we have **low amount** of **water** in body fluids, **pituitary gland secretes** vasopressin and so **more reabsorption** of water occurs from **nephrons into blood**. In this way, body retains water and **less amount of urine** is produced.

Greater Water Potential:

On the other hand, when body fluids have **more than normal water**, there is a **decline** in the **secretion** of this hormone. If pituitary gland **does not secrete** this hormone in the required amount; **less water** is **reabsorbed** from nephrons and there is **excessive loss of water** through **urine**. This condition is known as **diabetes insipidus**.

Oxytocin: **(MTN 2015)**

The hormone, **oxytocin stimulates** the **contraction of uterus** walls in mothers for **child birth**. Moreover, this hormone is necessary for the **ejection of milk from breast.**

Q.2 Write a note on thyroid gland. (K.B) **(Understanding the Concept Q.9) (LHR 2016, MTN 2015)**

Ans:

THYROID GLAND

Largest Gland:

This is the **largest endocrine gland** in human body.

Location:

It is present in **neck region**, below **larynx**.

Hormones:

It produces **two hormones**.

- **Thyroxin**
- **Calcitonin**

Thyroxin:

Thyroxin **increases** the **breakdown of food** (oxidation) and **release of energy** in body. It is also responsible for the **growth of body**.

Goiter:

Iodine is required for the **production** of **thyroxin**. If a person **lacks iodine** in diet, thyroid gland **cannot** make its **hormone**. In this condition, thyroid **gland enlarges**. This disorder is called **goiter**.

Hypothyroidism:

Hypothyroidism is caused by the **under-production** of **thyroxin**. It is characterized by **low energy** production in body and **slowing down of heart-beat.**

Hyperthyroidism:

Hyperthyroidism is caused by **over-production of thyroxin**. Its symptoms are:

- **Increase in energy production**
- **Increased heart-beat**
- **Frequent sweating**
- **Shivering of hands**

Calcitonin:

The thyroid gland produces another hormone called **calcitonin**. It **decreases the** level of **calcium ions in blood** and promotes the **absorption of calcium** from **blood into bones**.

Q.3 Write a note on parathyroid gland and adrenal gland. (K.B) **(Understanding the Concept Q.9)**

Ans:

PARATHYROID GLANDS

Number:

These are **four glands**.

Location:

These are situated on the **posterior side** of **thyroid gland**.

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Parathormone:

They produce a hormone known as **parathormone**. It **increases** the **level of calcium ions** in blood.

Production of Parathormone:

- When there is **increased production** of parathormone, more than **normal calcium salts** are **absorbed** from the **bones** and **added to blood**. Consequently the **bones** become **brittle**.
- If there is **deficiency** in the production of **parathormone**, blood **calcium level falls**. It leads to **tetany**, which affects the **functioning of muscles**.

ADRENAL GLANDS

Number:

These are **two in number**.

Location:

These are situated **above kidneys.**

Structure:

Each adrenal gland consists of **two parts**:

- The outer part is cortex
- The inner part is medulla

Adrenal Cortex:

The **adrenal cortex secretes many hormones called corticosteroids** which **maintain** the **balance** of **salts and water** in blood.

Adrenal Medulla:

Adrenal medulla secretes a **hormone** called **epinephrine or adrenaline** in response to **stress**. It prepares our body to overcome **emergency situations**. Therefore, adrenaline is also termed as **'emergency hormone'**.

Q.4 Write a note on pancreas. (K.B) **(Understanding the Concept Q.9) (LHR 2016, GRW 2017)**

Ans:

PANCREAS

This organ has **two functions**:

Exocrine Role:

The **major part** of pancreas is a **ducted (exocrine) gland**. This portion **secretes digestive enzymes**, through a duct, into the **small intestine**.

Endocrine Role:

Some portions of **pancreas** serve as **ductless (endocrine) gland**. This portion **contains groups** of endocrine cells referred to as **islets of langerhans**. These islets secrete **two hormones**:

- **Insulin**
- **Glucagon**

Insulin:

Insulin **influences** the **liver** to take **excess glucose** from **blood** and so the blood glucose concentration **falls**.

Glucagon:

Glucagon **influences** the **liver** to **release glucose in blood** and so the blood glucose concentration **rises**.

Diabetes Mellitus:

If a person's pancreas does not make **normal quantity of insulin**, the blood glucose concentration **rises** and we say that the person has **diabetes mellitus**.

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Symptoms:

Persons with diabetes have:

- **Loss of body weight**
- **Weakening of muscles**
- **Tiredness**

Control:

The disease can be **controlled** by **insulin administration**. Formerly, insulin extracted from animals was used for this purpose. But now human insulin produced from **bacteria** through genetic engineering is available.

Normal Blood Glucose Concentration:

The blood glucose concentration is maintained at the rate of 80 to 120 mg per 100 ml of blood.

Q.5 Write a note on gonads. (K.B) **(Understanding the Concept Q.9)**

Ans:

GONADS

The **male and female reproductive organs** are called as **gonads**. The **male reproductive organs** are called **testes** and **female reproductive** organs are called **ovaries**. In addition to producing **gametes**, gonads also **secrete hormones**, called **sex hormones**.

Testes:

The singular of testes is testis. **Testes secrete hormones** e.g. **testosterone**, which is **responsible** for the **development** of **male secondary sex characters** such as:

- **Growth of hair on face**
- **Coarseness of voice**

Ovaries:

Ovaries secrete the following hormones:

- **Estrogen**
- **Progesterone**

Function:

These both hormones are responsible for the **development** of **female secondary characters** such as the **development of breast** etc.

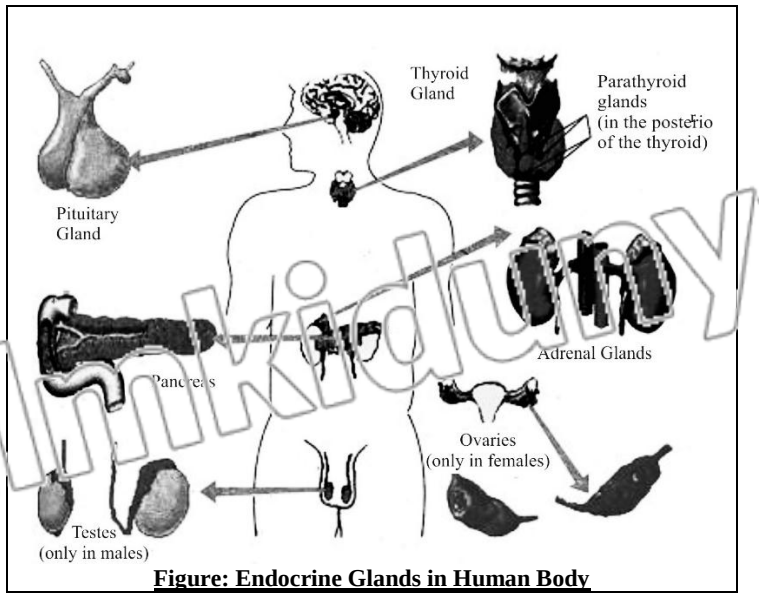

Figure: Endocrine Glands in Human Body

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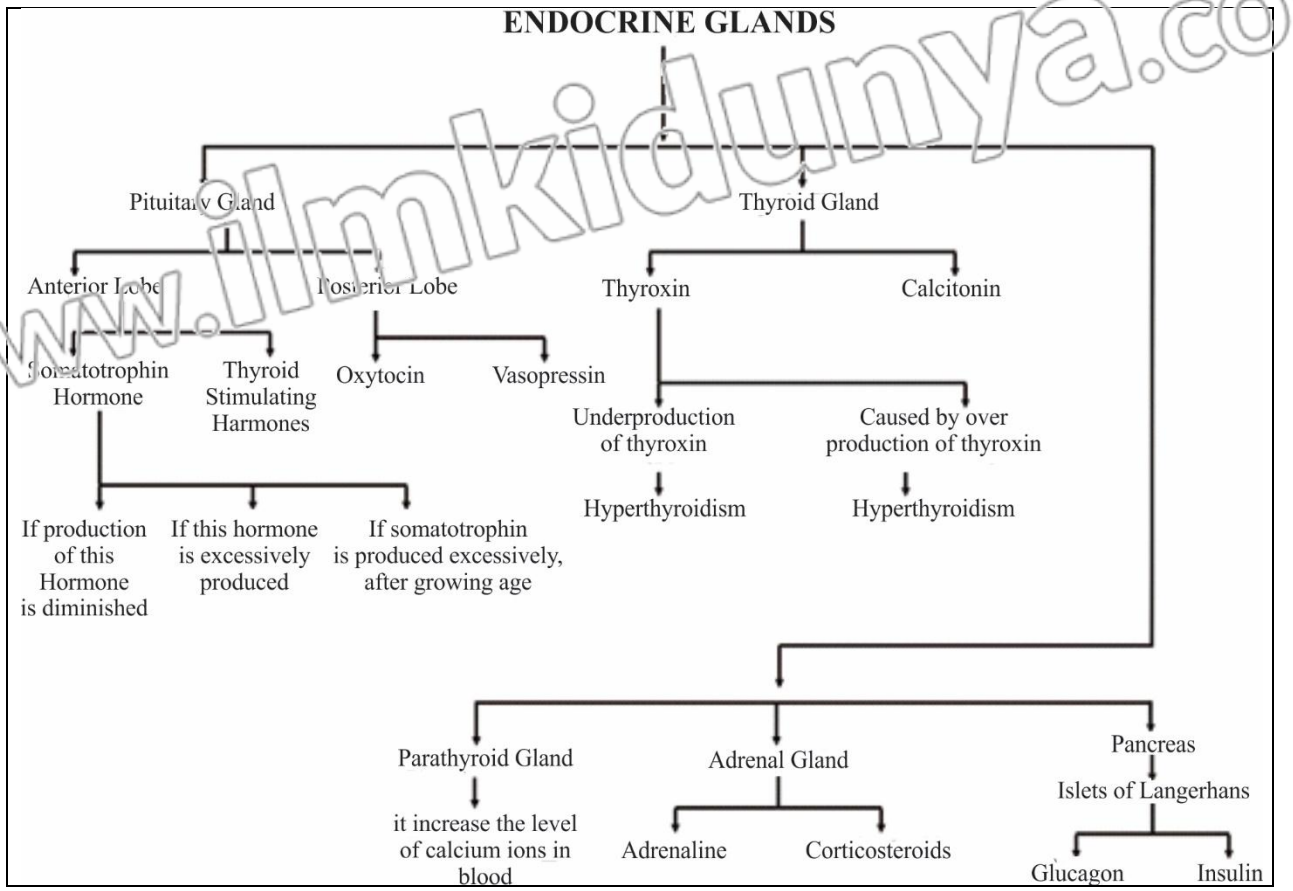
FLOW CHART OF ENDOCRINE GLANDS



Q.6 Describe feedback mechanisms with examples. (U.B) **(GRW 2015)**

OR

Describe negative feedback with reference to insulin and glucagon. (A.B)

(Understanding the Concept Q.10)

OR

Describe negative and positive feedback with reference to insulin and glucagon. (A.B)

Ans:

FEEDBACK MECHANISMS

Definition:

"The **regulation** of a **process** by the **output** of the **same process** is called feedback mechanism"

Explanation:

Endocrine glands **do not** secrete their **hormones** at a **constant rate**. The rate **varies** with the needs of the body. Like many other functions in body, the **secretion of hormones** is also **regulated** by **feedback mechanisms**.

TYPES OF FEEDBACK MECHANISMS

Feedback mechanisms are of **two types**:

- Negative Feedback
- Positive Feedback

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NEGATIVE FEEDBACK

Definition:

"The feedback in which the **output of a process decreases or inhibits** the process is called **negative feedback**".

Need of Negative Feedback:

This mechanism works to **return** a **condition** towards **its normal value**.

Control of (BGC):

The **blood glucose concentration** (output) **controls** the process i.e. the secretion of insulin and glucagon.

Rise in (BGC):

When the blood glucose concentration **rises**, pancreas **secretes insulin**. It **decreases** the blood glucose concentration. **Decline** in the blood glucose concentration to a **normal set-point inhibits** the secretion of **insulin**.

Fall in (BGC):

When blood glucose concentration **drops below normal**, pancreas **secretes glucagon**. It **raises** the blood glucose concentration. In this case, rise in the blood glucose concentration to a **normal set-point inhibits** the secretion of **glucagon**.

POSITIVE FEEDBACK

Definition:

"The feedback in which the **changes resulting from a process increases the rate** of process is called positive feedback".

Suckling Action of Infants:

Suckling action of an **infant stimulates** the production of a **hormone in mother**. This hormone works for the **production of milk**. More suckling leads to **more hormone**, which is turn leads to more milk production.

12.4 SHORT QUESTIONS

Q.1 Define hormones. Give examples. (K.B)

Ans: **HORMONE**

Definition:

A specific chemical messenger molecule synthesized and secreted by endocrine gland is called a hormone.

Example:

- Somatotrophin
- Thyroxin

Q.2 What is the difference between endocrine and exocrine glands? (K.B) **(LHR 2016)**

Ans: **DIFFERENTIATION**

The differences between endocrine and exocrine glands are as follows:

Endocrine Glands	Exocrine Glands
Definition	
• These glands are ductless and releases their secretions (called hormones) directly into blood stream.	• These glands have ducts for releasing their secretions into the target organs.
Examples	
• Pituitary Gland • Thyroid Gland	• Digestive Glands • Skin Glands

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Q.3 What are the roles of hormones in animals and unicellular organism? (A.B)

Ans:

ROLES OF HORMONES

The roles of hormones in animals and unicellular organisms are:

- The step wise process of metamorphosis in many animals is controlled by hormones.
- Life activities such cell division in invertebrates are also regulated by hormones.
- Hormones also control activities like migration in birds.
- Hormones have been identified even in unicellular organism.

Q.4 Why during summer, urine output is low? (U.B)

Ans:

URINE OUPUT IN SUMMER

During summer, urine output is low, Due to increased sweating; the water level of blood is lowered. As a result, pituitary gland releases more anti diuretic hormones (ADH) into blood.

Q.5 Write symptoms of tetany. (U.B)

Ans:

SYMPTOMS OF TETANY

The symptoms of Tetany are as follows:

- Sharp Flexion of the wrist and ankle joints it is due to decreased blood calcium level.
- Muscles twitching
- Cramps and convulsions

Q.6 Name two hormones which are secreted by posterior lobe of pituitary gland. (K.B)

Ans: Page no 79.

Q.7 What is B.G.C test? (A.B)

Ans:

B.G.C TEST

The amount of glucose in the blood is measured by this test. It is used to diagnose diabetes. Blood glucose may be measured on a fasting basis (collected after an 8 to 10 hour fast). Randomly (any times) and after a meal.

Blood Glucose After 8-10 Hours Fast	
BGC	**Diagnosis**
From 70 to 99 mg/100ml	Normal
From 100 to 125 mg/100 ml	Pre-diabetic
126 mg/100 ml and above	Diabetic

Blood Glucose 2 Hours after a 75 gram Glucose Drink	
BGC	**Diagnosis**
Less than 140 mg/100 ml	Normal
From 140 to 200 mg/100ml	Pre-diabetic
Over 200 mg//100ml	Diabetic

Q.8 Differentiate between dwarfism and gigantism. (K.B) **(LHR 2014)**

Ans:

DIFFERENTIATION

The difference between dwarfism and gigantism is as follows:

Dwarfism	Gigantism
• If the production of somatotrophin is diminished during growing age, the rate of growth decreases. The condition is called dwarfism.	• If the somatotrophin is excessively produced during growing age it lead to gigantism (very tall and overweight).

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Q.9 Define acromegaly. (K.B)

Ans: Page no 79.

Q.10 Define diabetes insipidus. (K.B)

Ans:

DIABETES INSIPIDUS

Definition:

"If pituitary gland does not secrete the hormone vasopressin in the required amount, less water is reabsorbed from nephrons and there is excessive loss of water through urine." This condition is known as diabetes insipidus.

Q.11 What is role of calcitonin and parathormone? (A.B)

Ans: Page no 80.

Q.12 What do you mean by emergency hormone? (U.B)

Ans: Page no 81.

Q.13 Differentiate between hypothyroidism and hyperthyroidism. (K.B)
(GRW 2017)

Ans:

DIFFERENTIATION

The differences between hypothyroidism and hyperthyroidism are as follows:

Hypothyroidism	Hyperthyroidism
• Hypothyroidism is caused by the under-production of thyroxin.	• Hyperthyroidism is caused by over-production of thyroxin.
• It is characterized by low energy production in body and slowing down of heart-beat.	• It is characterized by high energy production and increased heart-beat.

Q.14 What is role of glucagon and insulin hormones? (A.B) **(GRW 2016)**

Ans: Page no 81.

Q.15 Define diabetes mellitus. (K.B)

Ans: Page no 81.

Q.16 What are gonads? (K.B)

Ans: Page no 81.

Q.17 What is role of testosterone and estrogen in human reproductive system? (A.B)

Ans: Page no 82.

Q.18 Define feedback mechanism and what are its type? (K.B) **(BWP 2014)**

Ans: Page no 82.

Q.19 Name some activities of the body which are required to be regulated by hormones. (U.B)

Ans:

ACTIVITIES

Following are some of the activities of the body which are required to be regulated.

- Growth
- Reproduction
- Maintains of glucose concentration in blood
- Reabsorption of water in kidneys

Q.20 What changes occur in human body during emergency situation? (U.B)

Ans:

EMERGENCY SITUATION

When a person experiences fear, anger or anxiety, the rate and intensity of heartbeat increases, blood pressure increases, blood flow to the limbs increases, blood flow to the alimentary canal and skin is reduced. Such changes prepare the body to face any emergency situation.

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12.4 MULTIPLE CHOICE QUESTIONS

1. Pea shaped gland attached to hypothalamus: (K.B)
(A) Thyroid (B) Parathyroid
(C) Adrenal (D) Pituitary

2. If the production of somatotrophin is increased during growth, this leads to: (U.B)
(A) Dwarfism (B) Acromegaly
(C) Gigantism (D) Diabetes

3. Which harmone is secreted in case of emergency situation: (K.B) **(LHR 2014)**
(A) Oxytocin (B) Throxin
(C) Adrenaline (D) Calcitonin

4. When the human body has low amount of water then pituitary gland secrets: (K.B) **(LHR 2015)**
(A) Vassopressin (B) Insulin
(C) TSH (D) Oxytocin

5. The hormone that stimulates the contraction of uterus walls in mothers for child birth: (K.B)
(A) Somatotrophin (B) TSH
(C) Vasopressin (D) Oxytocin

6. Thyroxin is produced by which gland? (K.B)
(A) Parathyroid (B) Thyroid
(C) Pituitary (D) Adrenal

7. Which mineral is required for the production of thyroxin? (A.B)
(A) Chlorine (B) Fluorine
(C) Bromine (D) Iodine

8. Which is caused by the under production of thyroxin? (K.B)
(A) Hypothyroidism (B) Hyperthyroidism
(C) Acromegaly (D) Dwarfism

9. The hormone that decreases the level of calcium ions in blood and promotes the absorption of calcium from blood into bones: (A.B)
(A) Parathormone (B) Epinephrine
(C) Calcitonin (D) Thyroxin

10. Parathyroid gland secretes hormone is called: (K.B) **(SWL 2014)**
(A) Calcitonin is (B) Thyroxin
(C) Parathormone (D) Epinephrine

11. Hormones secreted by adrenal cortex: (K.B)
(A) Epinephrine (B) Adrenaline
(C) Corticosteroids (D) Oxytocin

12. Blood glucose level after 8-10 hours fast for normal: (K.B)
(A) From 70 to 99 mg/100ml (B) From 100 to 125mg/100ml
(C) 126 mg/100ml and above (D) From 10 to 20mg/100ml

13. Blood glucose level after 8-10 hours fast for diabetic: (K.B)
(A) From 70 to 99 mg/100ml (B) From 100 to 125mg/100ml
(C) 126 mg/100ml and above (D) From 10 to 20mg/100ml

14. Ovaries secretes_____, which are responsible for the development of female secondary characters such as the development of breast etc. (A.B)
(A) Progesterone (B) Testosterone
(C) Thyroxin (D) None

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15. The blood glucose concentration is maintained at the rate of_____ to _____ mg per 100 ml of blood. (A.B)
(A) 70, 100 mg (B) 80, 120 mg
(C) 90, 100 mg (D) None

16. If a person's pancreases does not make normal quantity of insulin, the blood glucose concentration rises and we say that the person has: (U.B)
(A) Diabetes insipidus (B) Diabetes mellitus
(C) Pre-diabetes (D) None

17. _____ influences the liver to release glucose in blood and so the blood glucose concentration rises. (K.B)
(A) Insulin (B) Oxytocin
(C) Thyroxin (D) Glucagon

18. _____ influences the liver to take excess glucose from blood and so blood glucose concentration falls. (K.B)
(A) Glucagon (B) Insulin
(C) Parathormone (D) None

19. _____ is caused by over production of thyroxin, its symptoms are increase in energy production, increased heartbeat. (K.B)
(A) Hypothyroidism (B) Hyperthyroidism
(C) Gingentism (D) None

20. This is the largest endocrine glands in human body. It is present in neck region, below larynx and produces a hormone_____. (K.B)
(A) Sometotrophin (B) Oxytocin
(C) Thyroxin (D) Parathhurmone

12.5 DISORDER OF NERVOUS SYSTEM

LONG QUESTIONS

Q.1 Describe disorders of nervous system. (K.B) **(DGK 2014)**

Ans:

NERVOUS DISORDERS

The **disorders** of the **nervous system** are called as nervous disorders.

Types:

There are **two main types** of nervous disorders:

- Vascular disorder
- Functional disorder

Vascular Disorder:

The disorders which are due to any **disturbance in the blood supply** of **nervous system are** called vascular disorders.

Example

Paralysis

Functional Disorder:

The disorders which are due to any **disturbance in nerve impulse generation** and **transmission** are called functional disorders.

Example:

- **Epilepsy**

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Q.2 Enlist the symptoms and treatments of paralysis and epilepsy. (A.B) **(Understanding the Concept Q.12)**

OR

Write a note on paralysis and epilepsy. (K.B)

Ans:

PARALYSIS

Definition:

"The **complete loss** of **function** by one or more **muscle groups** is called **paralysis**".

Causes:

It is most often caused by **damage** to the **central nervous system** (brain or spinal cord). The damage may be due to.

- **Stroke** (rupture in a blood vessel of brain or spinal cord)
- **Blood clotting in these blood vessels**
- **Poison produced by polio viruses**

Effected Areas:

Patient may have **weak paralysis** throughout his/her body or have **paralysis in one side** of the body. There may also be paralysis in the **lower extremities** or in **all four limbs**.

EPILEPSY

Definition:

"The nervous disorder in which there is **abnormal** and **excessive discharge** of **nerve impulses** in brain is called **epilepsy**".

Seizure:

It causes **unprovoked seizures** in patient. A **seizure** of epilepsy is a **temporary abnormal state** of brain **marked by convulsions**.

Causes:

- In **younger people**, epilepsy may be due to genetic or **developmental causes**.
- In people over age **40 years**, **brain tumours** are more likely to cause epilepsy.
- **Head trauma** and **central nervous system infections** may cause epilepsy at any age.

Cure:

There is **no known cure** of epilepsy but medicines can **control seizures**. Patients of epilepsy have to take medicines **daily** for the treatment as well as prevention of seizures. These are termed "anticonvulsant" or "**antiepileptic**" drugs.

Precaution during Attack:

During a seizure attack, objects should never be placed in a patient's mouth as it can result in serious injury. It is possible that the patient will bite his/her own tongue.

12.5 SHORT QUESTIONS

Q.1 What are two types of disorder of nervous system? (K.B)

Ans: Page no 88.

Q.2 What are vascular and functional disorders of nervous system? (K.B)

Ans: Page no 88.

Q.3 Define paralysis. (K.B) **(LHR 2015)**

OR

What are causes of paralysis? (U.B) **(LHR 2015)**

Ans: Page no 88.

Q.4 What do you mean by epilepsy? (K.B)

OR

What are the causes of epilepsy? (U.B)

Ans: Page no 88.

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12.5 MULTIPLE CHOICE QUESTIONS

1. Patients of epilepsy have to take medicine, daily for the treatment as well as prevention of seizures, these medicines are: (K.B)

(A) Antiviral (B) Antiepileptic

(C) Anti-pyretic (D) Antibiotics

2. _____ is a nervous disorder in which there is abnormal and excessive discharge of nerve impulses in brain. It causes unprovoked Seizure in patient. (K.B)

(A) Paralysis (B) Dementia

(C) Epilepsy (D) Anemia

3. _____ is the complete loss of function by one or more muscle groups. It is often caused by damage to the central nervous system. (K.B)

(A) Epilepsy (B) Phobia

(C) Paralysis (D) Dementia

4. _____ are due to any disturbances in the blood supply to nervous system. (K.B)

(A) Functional disorder (B) Vascular disorder

(C) Cardiac disorder (D) nervous disorder

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

12.1 COORDINATION AND TYPES OF COORDINATION

1	B	2	B	3	B	4	A	5	C	6	C	7	A
8	C	9	B	10	D	11	B	12	B				

12.2 HUMAN NERVOUS SYSTEM

1	C	2	C	3	A	4	C	5	A	6	B
7	D	8	A	9	B	10	A	11	B	12	C
13	B	14	D	15	C	16	C	17	C	18	A
19	A	20	C	21	C	22	C	23	A		

12.3 RECEPTORS IN HUMAN

1	A	2	C	3	C	4	A	5	B	6	D
7	D	8	B	9	A	10	D	11	D	12	B
13	D	14	B	15	B	16	C	17	A	18	D
19	C	20	A								

12.4 EDOCRINE SYSTEM

1	A	2	C	3	C	4	A	5	B	6	D
7	D	8	B	9	A	10	B	11	D	12	B
13	D	14	B	15	B	16	C	17	A	18	D
19	B	20	C								

12.5 DISORDER OF NERVOUS SYSTEM

1	B	2	C	3	C	4	B

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Processes that carry nerve impulses away from the cell body are called: (K.B)
(a) Axons (b) Dendrites
(c) Synapses (d) Myelin sheath

2. The portion of the nervous system that is involuntary in action: (K.B)
(a) Somatic nervous system (b) Motor nervous system
(c) Autonomic nervous system (d) Sensory nervous system

3. Which neurons are present inside the central nervous system? (K.B)
(a) Sensory neurons only (b) Motor neurons only
(c) Sensory and motor neurons both (d) Interneurons only

4. The part of the brain responsible for muscle movement, interpretation of the senses and the memory is the: (K.B)
(a) Pons (b) Medulla oblongata
(c) Cerebrum (d) Cerebellum

5. Apart from hearing, what other major body function is performed by the ear? (A.B)
(a) Hormone secretion (b) Body balance
(c) Reduction in nerve pressure (d) All of these

6. The myelin sheath is formed by, which wrap around the axons of some neurons. (K.B)
(a) Nodes of Ranvier (b) Axons
(c) Dendrites (d) Schwann cells

7. This is not a part of the hindbrain: (K.B)
(a) Pons (b) Medulla oblongata
(c) Cerebrum (d) Cerebellum

8. If you look at an intact human brain, what you see the most is a large, highly convoluted outer surface. This is the: (K.B)
(a) Cerebrum (b) Cerebellum
(c) Pons (d) Medulla oblongata

9. Insulin and glucagon are produced in the: (K.B)
(a) Hypothalamus (b) Anterior pituitary
(c) Liver (d) Pancreas

10. All of these are hormones except: (U.B)
(a) Insulin (b) Thyroxin
(c) Glucagon (d) Pepsinogen

ANSWERS KEY

1	a	2	c	3	d	4	c	5	b
6	b	7	c	8	a	9	d	10	d

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SHORT QUESTIONS

1. Identify the two types of coordination in living organisms. (K.B)

Ans:

TWO TYPES OF COORDINATION

There are two types of coordination in living organisms:

- Nervous Coordination brought about by nervous system
- Chemical Coordination brought about by endocrine system

2. Differentiate between the modes of nervous and chemical co-ordinations. (K.B)

Ans:

DIFFERENTIATION

The difference between nervous and chemical co-ordinations are as follows:

Nervous Coordination	Chemical Coordination
• In nervous coordination, brain and spinal cord are coordinators. They receive information and send messages through neurons in the form of nerve impulses.	• In chemical coordination, various endocrine glands play the role of coordinators. The receive information in the form of various chemicals and send messages by secreting particular hormones in blood.

3. What are the main components of coordination? (K.B)

Ans:

MAIN COMPONENTS OF COORDINATION

The following are the components of a coordination:

- Stimulus
- Receptor
- Coordinator
- Effectors
- Response

4. Define reflex action and reflex arc. (K.B)

Ans:

REFLEX ACTION

Definition:

"A very quick involuntary response produced by the central nervous system is called reflex action".

Examples:

- Withdrawal of hand after touching a hot object
- Knee jerk

REFLEX ARC

Definition:

"The pathway followed by the nerve impulses for producing a reflex action, is called reflex arc".

5. Trace the path of a nerve impulse in case of a reflex action. (K.B)

Ans:

PATH OF A NERVE IMPULSE IN REFLEX ACTION

Stimulus (Heat) → Receptor (Nerve Impulse) → (Sensory Organ) → Coordinator (Sensory Neuron) → (Inter neuron of Spinal Cord) → Effector (Motor Neuron) → (Muscles)

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6. Describe the pupil reflex in dim and bright light. (K.B)

Ans:

PUPIL REFLEX

Pupil:

There is round hole, called pupil, in the centre of iris. After striking the cornea, light passes through the pupil. The size of pupil is adjusted by the muscles of iris.

In Bright Light:

Pupil constricts in bright light when the circular muscles of iris contract.

In Dim Light:

Similarly, pupil dilates in dim light when the radial muscles of iris contract.

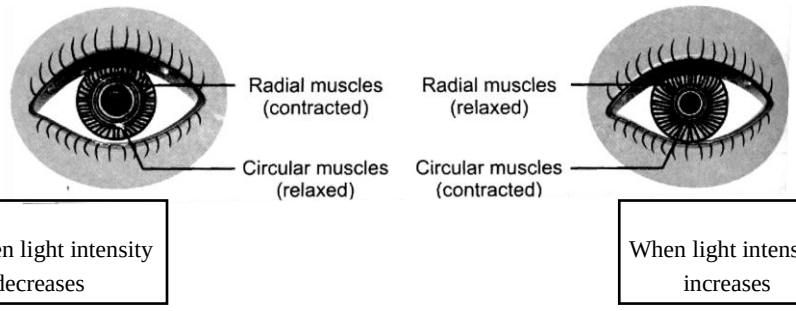

Figure: Contraction and Dilation of Pupil

7. How would you associate the role of vitamin A with vision and effects of its deficiency on retina? (U.B)

Ans:

ROLE OF VITAMIN A IN VISION

Rods contain a pigment called rhodopsin. When light falls on rhodopsin. It breaks for generating a nerves impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision. The problem is called the night blindness.

8. Define the terms; hormone and endocrine system. (K.B)

Ans:

HORMONE AND ENDOCRINE SYSTEM

Hormone:

A hormone is a specific messenger molecule synthesized and secreted by an endocrine gland.

Example:

- Somatotrophin
- Vasopressin

Endocrine system:

All the endocrine glands (ductless) collectively make a system which is known as endocrine system.

Example:

- Pituitary Gland
- Thyroid Gland

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UNDERSTANDING THE CONCEPT

1. Explain what can happen if there is no coordination in the activities of organisms. (U.B)

Ans:

LACK OF COORDINATION IN ACTIVITIES

If there is no coordination in the activities of organisms cannot perform their activities well.

Example:

When we are writing something, our hands and fingers work in collaboration with our muscles, eyes, thoughts etc. and then very intricate movements result.

Advantage:

Coordination also enables the organism to respond to happenings in the world around it.

2. Explain the location and function of these parts of brain; cerebrum, cerebellum, pituitary gland, thalamus, hypothalamus, medulla oblongata. (A.B)

Ans: See LQ.4 (Topic 12.2)

3. Define neuron and describe the structure of a general neuron. (K.B)

Ans: See LQ.2 (Topic 12.2)

4. Describe the structure of human eye. (K.B)

Ans: See LQ.1 (Topic 12.3)

5. How would you describe the structure of the external, middle and inner ear of man? (K.B)

Ans: See LQ.3 (Topic 12.3)

6. What are short sight and long sight problems and how these can be treated? (A.B)

Ans: See LQ.2 (Topic 12.3)

7. Explain the role of ear in the maintenance of balance. (K.B)

Ans:

MAINTENANCE THE BALANCE OF BODY

Semicircular canals and vestibule help to maintain the balance of body. Semicircular canals contain sensory nerves which can detect any movement of head. Vestibule can detect any change in the posture of body. The neurons coming from these two receptors reach cerebellum through the auditory nerve.

8. Relate the contribution of Ibn-al-Haitham and AI-Ibn-Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases. (K.B)

Ans: See LQ.4 (Topic 12.3)

9. Outline the major glands of the endocrine system (pituitary, thyroid, pancreas, adrenal, gonads), with name of their hormones and their functions. (K.B)

Ans: See LQ.1,2,3,4,5 (Topic 12.4)

10. Describe negative feedback with reference to insulin and glucagon. (U.B)

Ans: See LQ.6 (Topic 12.4)

11. Explain how adrenaline may be involved in exercise and emergency conditions. (U.B)

Ans:

EMERGENCY CONDITION

Adrenal medulla secretes a hormone called epinephrine or adrenaline in response to stress. It prepares our body to overcome emergency situations. Therefore, adrenaline is also termed as 'emergency hormone'.

12. Enlist the important symptoms and treatments of paralysis and epilepsy. (K.B)

Ans: See LQ.2 (Topic 12.5)

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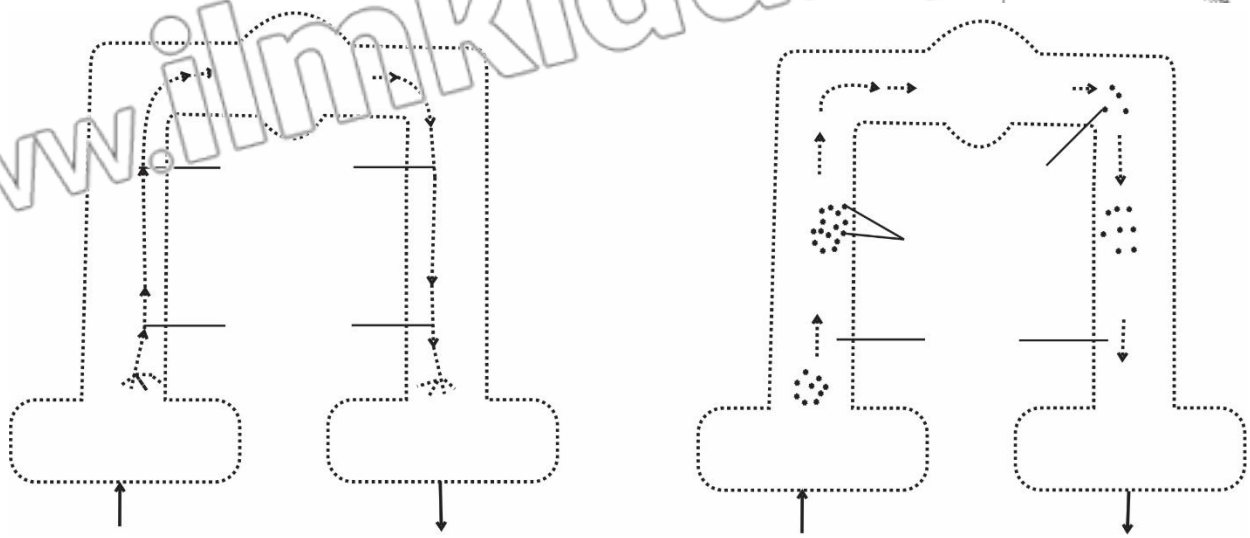
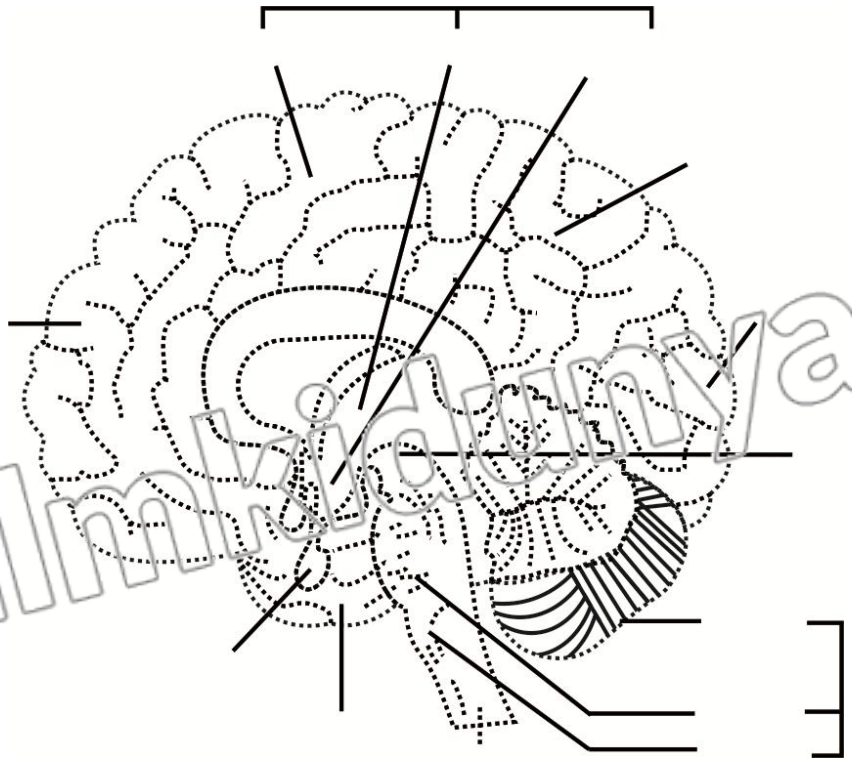
ASSIGNMENT

PRACTICE DIAGRAM & LABEL

NERVOUS AND CHEMICAL COORDINATION



STRUCTURE OF BRAIN



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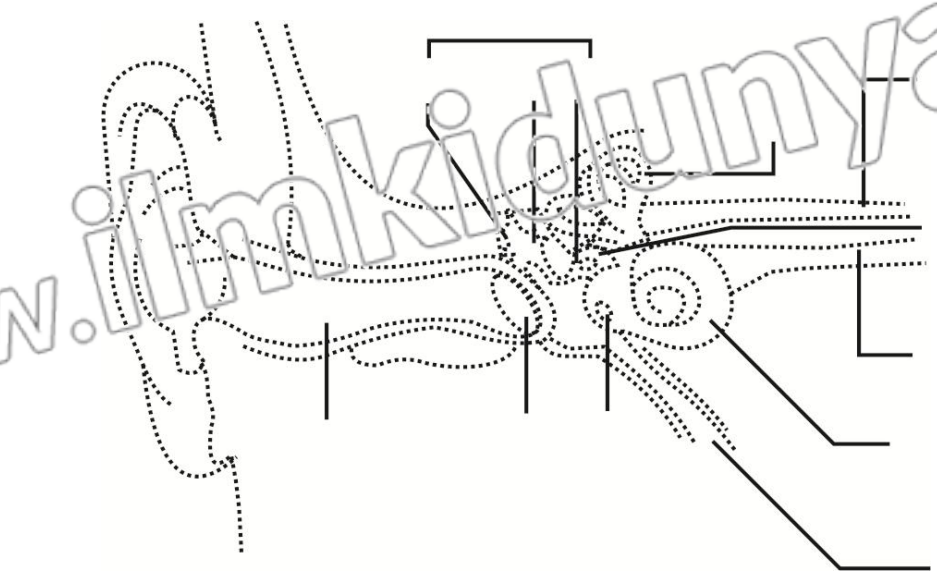
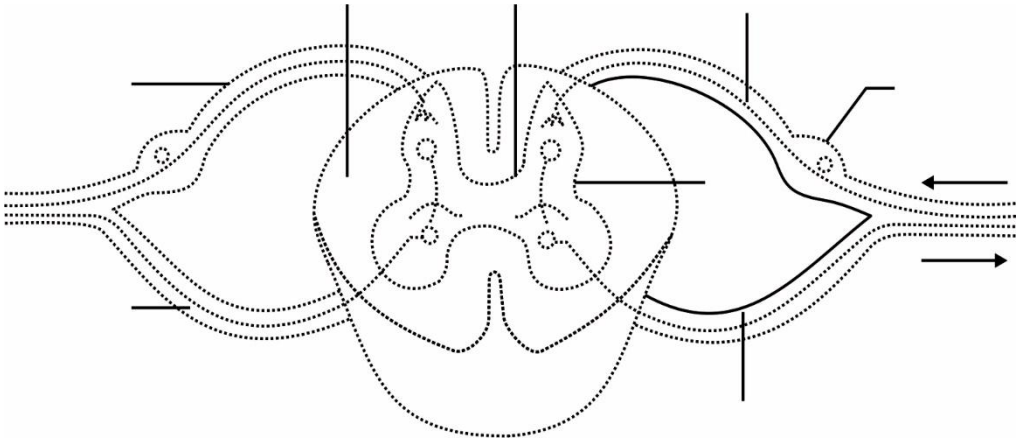
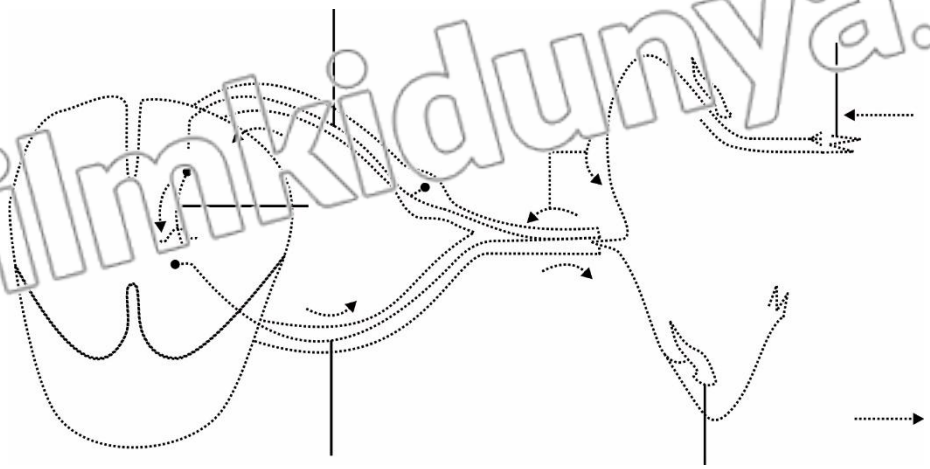
STRUCTURE OF EAR



STRUCTURE OF SPINAL CORD



REFLEX ARC AND REFLEX ACTION



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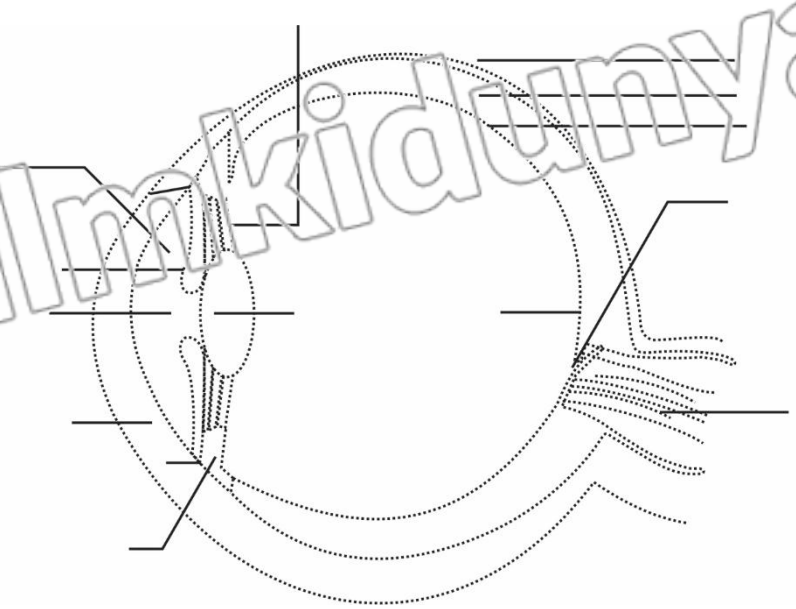
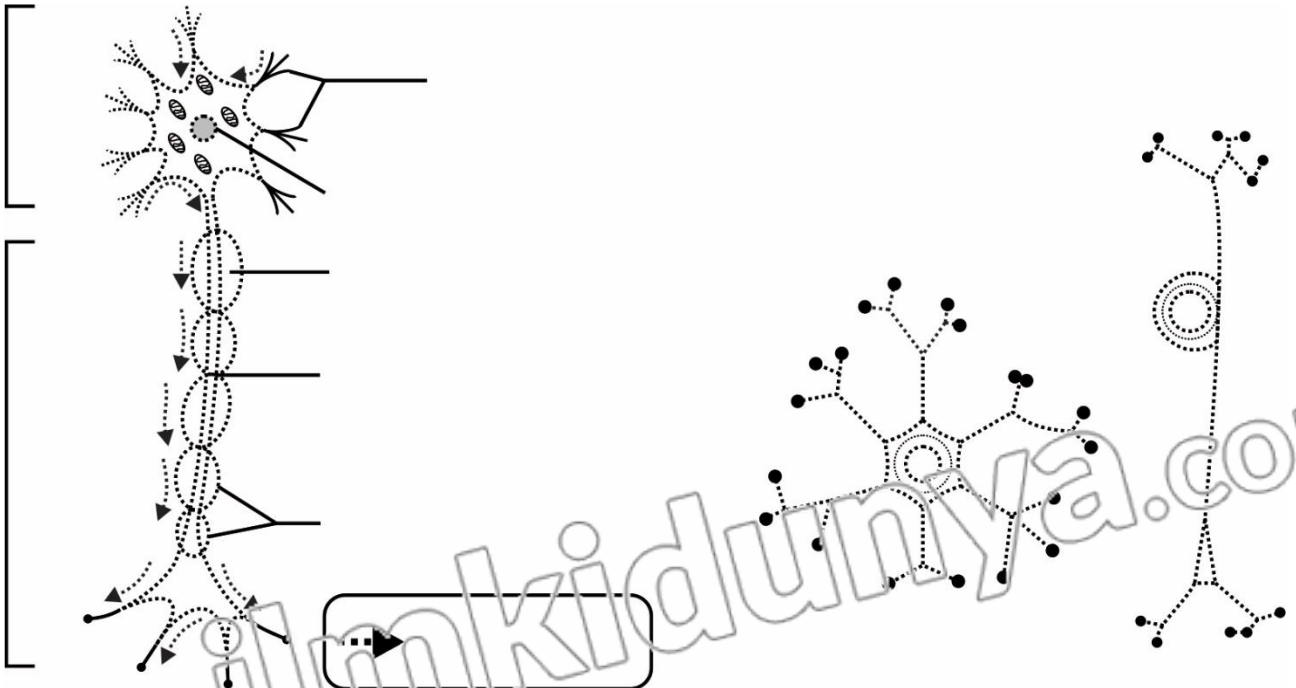
STRUCTURE OF HUMAN EYE



NEURONS



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. Number of steps of co-ordination action is:

(A) 3 **(B)** 5

(C) 7 **(D)** 4

2. Which part of neuron conducts nerve impulses away from cell body? **(BWL 2015)**

(A) Axon **(B)** Myelin sheath

(C) Node of Ranvier **(D)** Dendrite

3. The human eye contains rods about:

(A) 12.5 million **(B)** 0.7 million

(C) 1.2 million **(D)** 2 million

4. When the human body has low amount of water then pituitary gland secrets:

(A) Vassopressin **(B)** Insulin

(C) TSH **(D)** Oxytocin

5. _____ are due to any disturbances in the blood supply to nervous system

(A) Functional disorder **(B)** Vascular disorder

(C) Cardiac disorder **(D)** nervous disorder

6. All of these are hormones except:

(A) Insulin **(B)** Thyroxin

(C) Glucagon **(D)** Pepsinogen

Q.2 Give short answers to following questions. **(5×2=10)**

(i) What are two types of co-ordination in living organisms?

(ii) Write the five components of the co-ordinate action?

(iii) What is nerve growth factor? How they regenerate brain cells?

(iv) What is the role of special glands in the wall of auditory canal?

(v) What is role of testosterone and estrogen in human reproductive system?

Q.3 Answer the following questions in detail. **(5+4=9)**

(a) Write a note on pituitary gland.

(b) Describe the structure of eye.

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.

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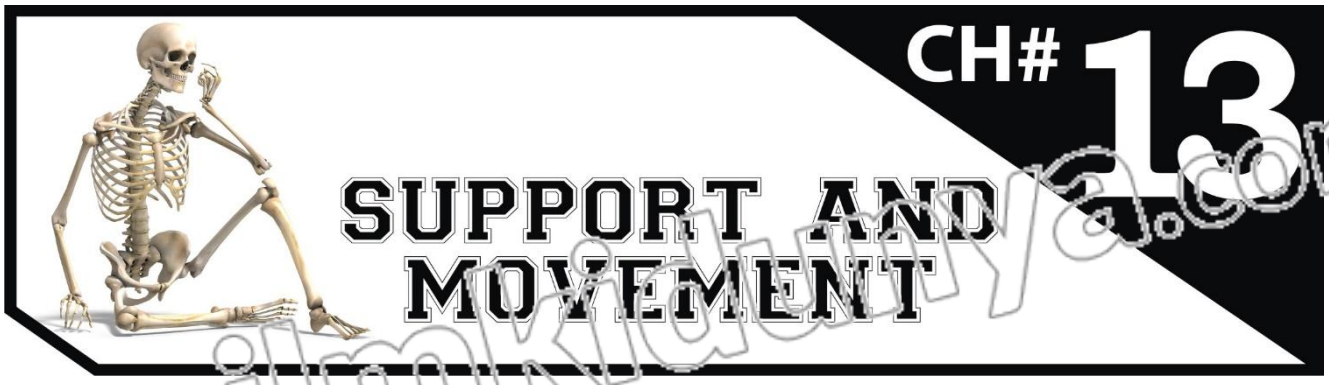

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13.1 HUMAN SKELETON

LONG QUESTIONS

Q.1 Write a note on skeletal system. ***(K.B)*** **(LHR 2017)**

Ans:

SKELETAL SYSTEM

Definition:

"**Skeletal system** or **skeleton** is defined as the **framework** of **hard**, **articulated structures** that **provide physical support**, **attachment for skeletal muscles**, and **protection** for the **bodies of animals**".

Explanation:

Like other **vertebrates**, the **human skeleton** is on **the inside of body** and is called **Endoskeleton**. In the living body, the **skeleton** is very **much alive**. **Bones and cartilages** are made of **living cells** and also have **nerves** and **blood vessels** in them. They grow and have the **ability to repair themselves**.

Role:

The role of skeleton system are as follows:

- The big functions of skeleton system **are protection, support** and **movement**.
- In **our body, skeleton** works very closely with the **muscular system to help us move**.
- **Skeleton** provide **protection** to many **internal organs** e.g. **skull protects brain**, **vertebral column protects spinal cord** and **ribs protect** most of our other internal organs.
- **Vertebral column** also **provide** the main **support** to our **body mass**.

Q.2 Write a note on cartilage. **(LHR 2014, SWL 2015)**

Ans:

CARTILAGE

Definition:

"**Cartilage** is a **dense, clear, blue-white firm connective tissue. Cartilage is less strong than bone".**

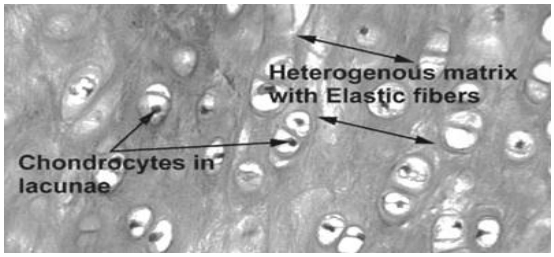


Figure: Chondrocytes in Cartilage Matrix

Explanation:

Chondrocytes:

The **cells of cartilage** are called **chondrocytes**.

Lacuna:

Each **chondrocyte lies** in a **fluid space** called **lacuna** present in the **matrix of cartilage**.

Collagen Fibers:

The **matrix of cartilage** contains **collagen fibers**.

Blood Vessels:

Blood vessels do not enter into the **cartilage**.

Types:

There are **three types** of cartilage:

- **Hyaline Cartilage**
- **Elastic Cartilage**
- **Fibrous Cartilage**

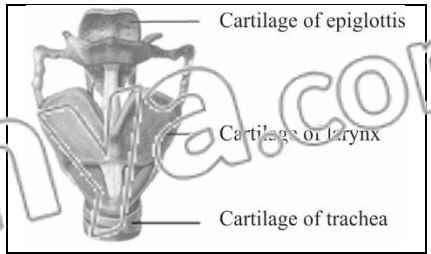
Hyaline Cartilage:

The **hyaline cartilage** is **strong** yet **flexible**.

Location:

It is found in:

- **Nose**
- **Larynx**
- **Trachea**
- **Bronchial Tubes**
- **Covering the ends of the long bones**



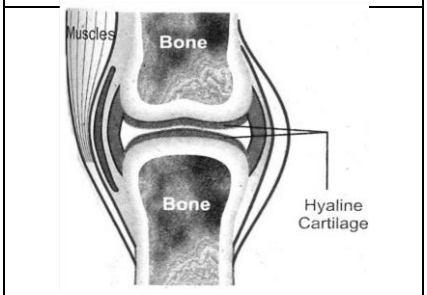


Figure: Hyaline Cartilage

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Elastic Cartilage:

Elastic cartilage is similar in **structure** to the **hyaline cartilage**. It is also **quite strong** but has **elasticity** due to the **network of elastic fibers** in addition to **collagen fibers**.

Location:

It is found in:

- **Epiglottis**
- **Pinna**

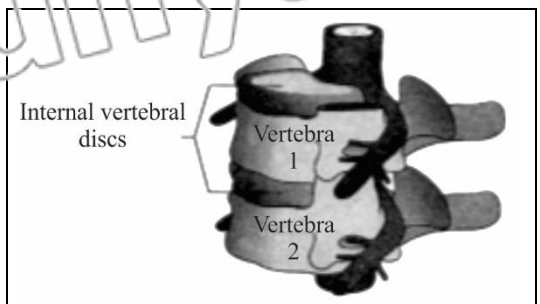

Figure: Fibrous Cartilage

Fibrous Cartilage:

Fibrous cartilage is very **tough** and **less flexible** due to the **large number of thick collagen fibers** present in **knitted** form.

Location:

It is **found in**:

- **Intervertebral discs**

Q.3 Explain structure of bone. ***(K.B)***

Ans: **BONE** **(DGK 2014)**

Definition:

"Bone is the **hardest type connective tissue** in the body **of animals".**

Functions:

The functions of bone are as follows:

- Bones help in **body movements**
- **Support body**
- **Protect** the various parts of body
- Produce **red** and **white blood cells**
- **Store minerals**

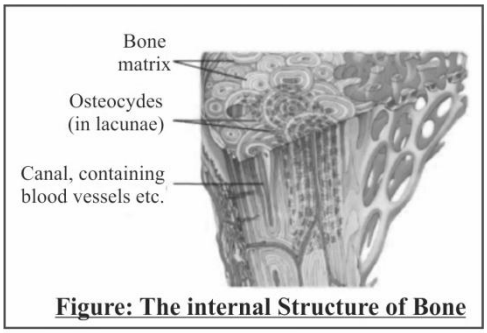

Figure: The internal Structure of Bone

STRUCTURE OF BONE

Compact Bone:

The **hard outer layer** of the bone is called **compact bone**.

Spongy Bone:

The **interior of the bone** is **soft** and **porous** and is called **spongy bone**. Spongy bone contains **blood vessels** and **bone marrow**.

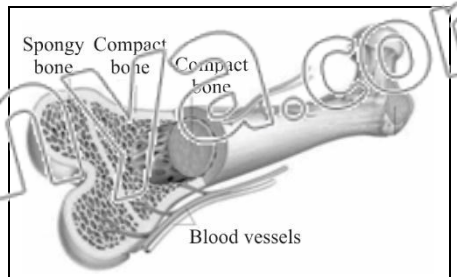

Figure: Compact and Spongy Bone

Composition of Bone Matrix:

The **matrix** of the bones contains:

- **Collagen**
- **Minerals (calcium and phosphate)**

Osteocytes:

Bone contains **different types of cells**. The mature **bone cells** are called **osteocytes**.

Soft Bone in Babies:

The **babies** are born with about **300 soft bones**. Some of these bones **later fuse together**, so that the adult skeleton has **206 hard bones**.

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Q.4 Count the bones of human skeleton. ***(K.B)***

OR

What are the main components of the axial skeleton and the appendicular skeleton of human? ***(K.B)*** **(Understanding the Concept Q.1)**

Ans:

COMPONENTS OF HUMAN SKELETON

The **206 bones** in the adult human skeleton are organized into a **longitudinal axis** i.e. **axial skeleton**, to which **appendicular skeleton** is attached.

AXIAL SKELETON

Number of Bones:

Axial skeleton consists of the **80 bones** in the **head** and **trunk** of the body.

Parts:

It is composed of **five parts**:

Skull:

Skull contains **22 bones out** of which:

- **8 are cranial bones** (enclosing the brain)
- **14 are facial bones**

Middle Ear Ossicles:

There are **6 middle ear ossicles** (3 in each ear).

Hyoid Bone:

There is a **hyoid bone** in the **neck**.

Vertebral Column:

Vertebral column contains 26 bones (vertebrae).

Chest:

The **chest** is made up of:

- A **chest bone** is called **sternum**
- **24 (12 pairs) ribs**

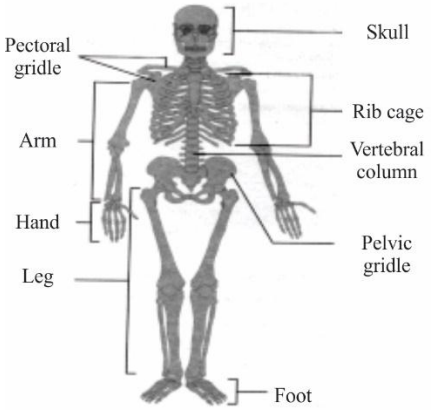

Figure: Human Skeleton

APPENDICULAR SKELETON

Number of Bones:

Appendicular skeleton is composed of **126 bones**.

Pectoral Girdle:

Pectoral (shoulder) girdle is made up of **4 bones.**

Arms:

Both **arms** have **6 bones**.

Hands:

Both **hands** have **54 bones**.

Pelvic Girdle:

Pelvic girdle (hips) has **2 bones**.

Legs:

Both legs have **6 bones**.

Feet:

Both feet have **54 bones**.

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13.1 SHORT QUESTIONS

Q.1 Why organisms need support? *(U.B)*

Ans:

NEED OF SUPPORT

The organisms with greater sizes need support to keep their body mass as one unit. This is particularly true for the organisms that live on land.

Q.2 What is movement? *(K.B)*

Ans:

MOVEMENT

The act of changing place or position by entire body or by its parts of organisms is called movement

Types:

There are two types of movement.

- Movement of body parts
- Locomotion

Q.3 Define locomotion. *(K.B)*

Ans:

LOCOMOTION

Definition:

"The movement of an animal as a whole from one place to another is called Locomotion".

Q.4 Define cartilage and give example also. *(K.B)* **(GRW 2016)**

Ans: Page no 100.

Q.5 Define skeleton? *(K.B)*

Ans: Page no 100.

Q.6 Write two functions of bones. *(A.B)*
LHR 2015

Ans: Page no 101.

Q.7 What are the advantages of skeleton? *(A.B)*

Ans:

ADVANTAGES OF SKELETON

The advantages of skeleton are as follows:

- Physical support
- Attachment for skeletal muscles
- Protection for the bodies of animals
- Movement

Q.8 Write down the number of bones in pectoral girdle and pelvic girdle. *(KS.B)* **GRW 2017**

Ans: Page no 102.

Q.9 What is difference between endoskeleton and exoskeleton? *(K.B)* **(GRW 2017, MTN 2015, DGK 2015)**

Ans:

DIFFERENTIATION

The differences between endoskeleton and exoskeleton are as follows:

Endoskeleton	Exoskeleton
Definition	
• The skeleton which is inside the body of an organism is called endoskeleton	• The skeleton which is on the outside of the body of an organism is called exoskeleton
Example	
• Skeleton of Human	• Skeleton of Arthropods

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Q.10 Write the name of largest and smallest bone of human skeleton. ***(K.B)***

Ans:

BONE

Largest Bone:

The largest bone of human skeleton is femur (Thigh bone).

Smallest Bone:

The smallest bone of human skeleton is stirrup (located in ear).

Q.11 What is the role of skeletal system? ***(K.B)***

Ans: Page no 100.

Q.12 What are chondrocytes and osteocytes? ***(K.B)***

Ans:

CHONDROCYTES AND OSTEOCYTES

Chondrocytes:

"Cartilage contain a single type of cell these are called chondrocytes."

Osteocytes:

"Bones contain different types of cell. The mature bone cells are called osteocytes."

Q.13 What are difference between bones and cartilage? ***(K.B)***

(LHR 2014, 2015, GRW 2014, BWP 2015)

Ans:

DIFFERENTIATION

The difference between bones and cartilage is as follows:

Cartilage	Bones
• Cartilage is a dense clear blue white firm connective tissue (but less strong then bones).	• Bones is the hardest connective tissue in body. Bones not only move support and protect various part of body, but also produce red and white blood cells and store minerals.

Q.14 What is Rheumatoid Arthritis? Write its symptoms. **LHR 2015**

Ans: Page no 114.

Q.15 Define bone and give example. ***(K.B)*** **(LHR 2016, GRW 2016)**

Ans: Page no 114.

Q.16 What is compact bone and spongy bone? ***(K.B)*** **(GRW 2013, 2014, MTN 2015)**

OR

Differentiate between compact bone and spongy bone. ***(K.B)*** **(LHR 2017)**

Ans: Page no 115.

Q.17 What are tendon and ligaments? ***(K.B)*** **(LHR 2015, BWP 2014, 2015)**

Ans: Page no 115.

Q.18 What is elastic cartilage? ***(K.B)*** **(GRW 2015)**

Ans: Page no 115.

Q.19 What is the contribution of Andreas Vesalius? ***(K.B)***

Ans:

CONTRIBUTION OF ANDREAS VESALIUS

Period Year:

1514AD-1564 AD

Place of Birth:

He was born in Brussels, Belgium

Contribution:

He was honored for developing modern anatomical studies. He made many discoveries in anatomy based on studies made by dissection of human dead bodies.

Book Contents:

His book contained the most accurate depictions of the whole skeleton and muscles of the human body.

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Q.20 Discuss the evolution of ear bones and jaws in mammals? *(K.B)* **(Do you know Pg. # 61)**

Ans: **EVOLUTION OF EAR BONES AND JAWS IN MAMMALS**

The upper jaw is fixed with the skull and is compressed of two bones. The lower jaw is mobile and articulates with the skull. In lower vertebrates, the lower jaw is made up of more than one bone while in mammals, it is made of single bone. During evolution, mammals modified the lower Jaw bones and incorporated four of them into the middle (in the form of malleus and incus in both ears). This adaptation proved beneficial for mammals. Lower jaw with single bone in stronger and the malleus and incus also improve hearing.

13.1 MULTIPLE CHOICE QUESTIONS

1. Which of the following inhabitants need more support than others? *(U.B)*
(A) Fresh water (B) Land
(C) Marine water (D) Both a & c

2. Locomotion and movement is the particular character of *(U.B)*
(A) Animals (B) Plants
(C) Fungi (D) All prokaryotes

3. Change in place of entire body of an organism is termed as *(U.B)*
(A) Support (B) Locomotion
(C) movement (D) Metastasis

4. The skeleton present inside the body is called: *(K.B)*
(A) Exoskeleton (B) Endoskeleton
(C) Cartilage (D) Ligament

5. The functions of skeletal system: *(A.B)*
(A) Protection (B) Support
(C) Movement (D) All of these

6. Which of the following is incorrect regarding to skeleton? *(U.B)*
(A) Living structure (B) Articulated structure
(C) Hard framework (D) Immobile structures

7. The purpose of rib cage is to _____. *(A.B)* **(LHR 2013, GRW 2017)**
(A) Protect the stomach (B) Protect the spinal cord
(C) Protect the heart and lungs (D) Provide an object to which the lungs can attach

8. Fluid filled space in the matrix of cartilage: *(K.B)*
(A) Chondrocyte (B) Lacuna
(C) Fibre (D) Hyaline

9. Cells of cartilage: *(K.B)*
(A) Chondrocytes (B) Osteocytes
(C) Fiber (D) Collagen

10. The hard outer layer of bone is called: *(K.B)* **(BWP 2015, GRW 2017)**
(A) Compact bone (B) Spongy bone
(C) Ligament (D) Tendon

11. Skeleton of arthropods: *(K.B)* **(DGK 2014)**
(A) Hydrostatic (B) Exoskeleton
(C) Endoskeleton (D) Axial Skeleton

12. The matrix of cartilage contains: *(K.B)*
(A) Glycogen (B) Murein
(C) Peptidoglycan (D) Collagen

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13. Date of death of Andreas Vesalius: ***(K.B)***
(A) 1560 AD (B) 1562 AD
(C) 1564 AD (D) 1566 AD

14. Spinal cord is protected by ***(K.B)***
(A) Skull (B) Vertebral column
(C) Ribs (D) Femur

15. The main support to the body parts is given by ***(U.B)***
(A) Pectoral girdle (B) Vertebral column
(C) Ribs (D) Pelvic girdle

16. Most of the internal organs are protected by ***(U.B)***
(A) Skull (B) Pelvic girdle
(C) Ribs (D) Vertebral column

17. Place of birth of Andreas Vesalius: ***(K.B)***
(A) Belgium (B) America
(C) England (D) France

18. The appendicular skeleton is made up of bones. ***(K.B)*** **(LHR 2013)**
(A) 126 (B) 56
(C) 8 (D) 6

19. Number of parts of axial skeleton: ***(K.B)***
(A) 3 (B) 5
(C) 7 (D) 9

20. Total number of bones in skull: ***(K.B)*** **(BWP 2014, LHR 2015, GRW 2016)**
(A) 20 (B) 22
(C) 24 (D) 26

21. Number of ossicles in each ear: ***(K.B)***
(A) 3 (B) 6
(C) 9 (D) 12

22. Total number of vertebrae in human skeleton: ***(K.B)***
(A) 31 (B) 26
(C) 35 (D) 37

23. Total number of ribs in human skeleton: ***(K.B)***
(A) 12 (B) 24
(C) 36 (D) 48

24. Total number of bones in appendicular skeleton: ***(K.B)*** **(MTN 2015, GRW 2016)**
(A) 120 (B) 80
(C) 116 (D) 126

25. Number of bones in pectoral girdle: ***(K.B)***
(A) 2 (B) 4
(C) 6 (D) 8

26. Total number of bones in both arms: ***(K.B)***
(A) 3 (B) 4
(C) 5 (D) 6

27. Total number of bones in one hand: ***(K.B)***
(A) 14 (B) 27
(C) 42 (D) 56

28. Number of bones in pelvic girdle: ***(K.B)***
(A) 1 (B) 2
(C) 3 (D) 4

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29. Number of bones in both legs: ***(K.B)***

(A) 4 (B) 8

(C) 12 (D) 16

30. Cartilage and bones are the types of _____ tissues in animals. ***(K.B)*** **(GRW 2013)**

(A) Ground (B) Supporting

(C) Connective (D) Columns1

31. Cartilage found in intervertebral disc is: ***(K.B)***

(A) Hyaline (B) Fibrous

(C) Matrix (D) Elastic

32. Which bone is the longest bone in human body? ***(K.B)***

(A) Skull (B) Vertebrae

(C) Thigh (D) Arm

33. A fluid space present in the matrix of cartilage containing chondrocytes ***(K.B)***

(A) Ligament (B) Lignin

(C) Lacuna (D) Lymph

34. He made many discoveries in anatomy, based on studies made by dissection of human dead bodies: ***(K.B)***

(A) Lamarck (B) Andreas Vesalius

(C) Andrea Caesalpino (D) Aristotle

35. Cartilage of epiglottis is an example of: ***(U.B)*** **(DGK 2015)**

(A) Elastic cartilage (B) Hyaline cartilage

(C) Fibrous cartilage (D) Ligament

36. Cartilage of larynx is an example of: ***(U.B)***

(A) Fibrous cartilage (B) Hyaline cartilage

(C) Elastic cartilage (D) Ligament1

37. Cartilage of trachea is an example of: ***(U.B)***

(A) Hyaline cartilage (B) Fibrous cartilage

(C) Elastic cartilage (D) Tendon

38. The skeleton found outside the body is called: ***(K.B)*** **(LHR 2016)**

(A) Endoskeleton (B) Exoskeleton

(C) Hydro skeleton (D) Fibro skeleton

39. Some bones prepare: ***(K.B)*** **(LHR 2016)**

(A) Mucous (B) Blood cells

(C) Oxygen (D) Hormones

40. Number of bones in both feet are: ***(K.B)*** **(LHR 2017)**

(A) 54 (B) 13

(C) 21 (D) 12

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13.2 TYPES OF JOINTS

LONG QUESTIONS

Q.1 What is a joint? Explain different types of joints. *(K.B)*
(LHR 2015, 16, 17 BWP 2014, GRW 2014,17 DGK 2014, MTN 2015)
OR
Describe the types of joint and give example. *(K.B)* **(Understanding the Concept Q.2)**

Ans:

JOINTS

Definition:
"The **location at** which **two** or **more bones make contact** is called as **joint**."

Examples:
Knee joint and **elbow joint**.

Explanation:

Functions:
The **functions** of joints are as follows:
- Allow **movement**
- Provide **mechanical support**

Basis of Classification:
The joints can be classified on the basis of the **degree of movement** they **allow**.

TYPES OF JOINTS

Following are the **three main types** of joints:
- **Immovable (fixed) Joints**
- **Slightly Movable Joints**
- **Movable Joints**

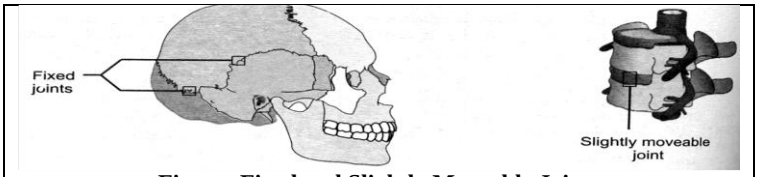


Figure: Fixed and Slightly Moveable Joints

Immovable (fixed) Joints:
Such joints **allow no movement.**

Example:
- Joints between the **skull bones**.

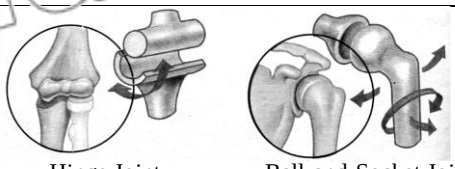
Slightly Movable Joints:
Such joints allow **slight movements**.

Examples:
- Joints between the **vertebrae**.

Movable Joints:
They allow a **variety of movements**. There are many types of **movable joints** in the body. The main types are as follow:
- **Hinge joints**
- **Ball-and-socket joints**

Hinge Joints:
These joints move **back and forth** like the **hinge on the door** and allow movements in one **plane only**.

Examples:
- **Knee joint**
- **Elbow joint**


Hinge Joint Ball-and-Socket Joint
Figure: Two Types of Moveable Joints

Ball-and-Socket Joints:
These joints allow movements in **all directions**.

Examples:
- **Hip joint**
- **Shoulder joint**

Q.2 What are ligaments and tendons? What function do they perform? *(K.B)* **(Understanding the Concept Q.3)**

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Ans: **TENDONS AND LIGAMENT**

Tendons:

Tendons are **bands of connective tissues** (made of collagen).

Functions:

The **functions of tendons** area as follows:

- Tendons are **tough bands**.
- They **attach muscles** to **bones**.
- When a **muscle contracts** tendon **exerts pulling force** on the **attached bone**, which moves as **result**.

Ligament:

Ligaments are bands of **connective tissues**.

Functions:

The functions of ligament are as follows:

- Ligaments are **strong** but **flexible bands**.
- They join one **bone** to another **at joints**.
- They **prevent dislocation** of **bones at joints**.

13.2 SHORT QUESTIONS

Q.1 What do you know about the movement of neck joint? ***(U.B)***

Ans: **MOVEMENT OF NECK JOINT**

The neck joint between vertebral column and head allows movement side to side.

Q.2 Differentiate between tendon and ligament. ***(K.B)*** **(GRW 2017)**

OR

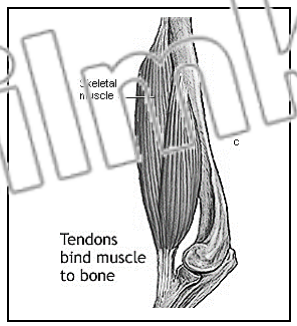
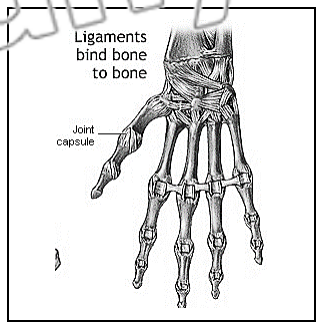
What is tendon? What is their function? ***(K.B)*** **(GRW 2016)**

OR

Define ligaments. ***(K.B)*** **(LHR 2017)**

Ans: **DIFFERENTIATION**

The differences between tendon and ligament are as follows:

Tendon	Ligament
• They attach muscles to bones. • When a muscle contracts tendon exerts pulling force on the attached bone, which moves as result. 	• They join one bone to another at joints. • They prevent dislocation of bones at joints. 

Q.3 What are the main types of movable joints? ***(K.B)***

Ans: Page no 108.

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Q.4 What do you know about hinge joint? *(U.B)*
Ans: Page no 108.
Q.5 How ligament prevent dislocation at joints? *(U.B)*
Ans: Page no
Q.6 What are ball and socket joints? Give examples. *(K.B)* **(GRW 2016)**
Ans: Page no 108.

13.2 MULTIPLE CHOICE QUESTIONS

1. An example of immovable joint: *(K.B)*
(A) Skull (B) Vertebrae
(C) Elbow (D) Shoulder

2. The location where two or more bones make contact is called *(K.B)*
(A) Socket (B) Hinge
(C) Joint (D) Cartilage

3. Which of the following joint is not an example of fixed joint? *(K.B)*
(A) Joints between skull bones (B) Joints between Vertebrae
(C) Joints between ribs & sternum (D) Joints between cranial bones

4. The joints which allow movement is all directions is *(K.B)*
(A) Hinge joint (B) Ball & socket joint
(C) Cranial joints (D) Vertebral joints

5. An example of slightly moveable joint: *(K.B)*
(A) Hip (B) Knee
(C) Vertebrae (D) Skull

6. An example of hinge joint: *(K.B)* **(SWL 2015)**
(A) Skull (B) Hip
(C) Shoulder (D) Elbow

7. Neck joint between vertebral column and head is *(K.B)*
(A) Hinge joint (B) Ball & socket joint
(C) Slightly moveable joint (D) Pivot joint

8. An example of ball-and-socket joint: (*K.B)* **(LHR 2014)**
(A) Vertebrae (B) Shoulder
(C) Elbow (D) Knee

9. Which prevent dislocation of joints? *(A.B)*
(A) Cartilage (B) Tendons
(C) Ligaments (D) Bones

10. _____ are tough bands and attach muscles to bones. *(U.B)*
(A) Ligament (B) Tendon
(C) Origin (D) Insertion

11. _____ are strong but flexible bands and join one bone to another at joints: *(U.B)*
(A) Tendon (B) Ligament
(C) Flexor (D) Extensor

13.3 MUSCLES AND MOVEMENT

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LONG QUESTIONS

Q.1 Explain the role of muscles in movements. ***(A.B)*** **(GRW 2014, BWP 2015)**

OR

Explain antagonism in muscle action selecting biceps and triceps as example. ***(A.B)*** **(Understanding the Concept Q.4)**

Ans: **ROLE OF MUSCLES IN MOVEMENTS**

Movements in Bones:

The **movements in bones** are brought about by the **contractions of skeletal muscles**, which are **attached** with them **by tendons**.

- **One end** of a skeletal muscle is always attached with **some immovable bone**. This end of muscle is **called the origin.**
- The other end of the muscle is attached with a **movable bone** and is called the **insertion**.

Contraction of Muscle:

When a muscle is **stimulated** by a nerve **impulse**, it contracts to become **shorter** and **thicker**. Due to its **contraction**, it pulls the **movable bone** (at insertion).

Antagonism: (Opposite Movement of Skeletal Muscles)

Skeletal muscles are usually in **pairs of antagonists**. In the **antagonist pair,** both muscles do **opposite jobs**. When one **muscle contracts** the **other relaxes** and this phenomenon is known as antagonism.

Flexion:

When a **muscle contracts** and **bends** the **joint**, this movement is called **flexion** and the muscle for this movement is known as **flexor**.

Extension:

When a muscle **contracts** and **straightens the joint**, this movement is called **extension** and the **muscle for** this movement is called **extensor**.

Example of Antagonism:

Biceps:

It is a **flexor muscle** on **the front of the upper arm bone**.

Triceps:

It is an **extensor muscle** on the **back of arm**.

Origin and Insertion:

Both these muscles have their **origin at pectoral girdle** and **insertion** at one of the two bones of **forearm**.

Contraction of Biceps:

When **biceps contracts**, the **forearm** (insertion end) is **pulled upward**. It is the **flexion** of elbow joint. During this flexion, **triceps** muscle **relaxes**.

Contraction of Triceps:

When **triceps** muscle **contracts**, **forearm** is **pulled down.** It is the **extension** at elbow joint. During this, biceps muscle **relaxes**.

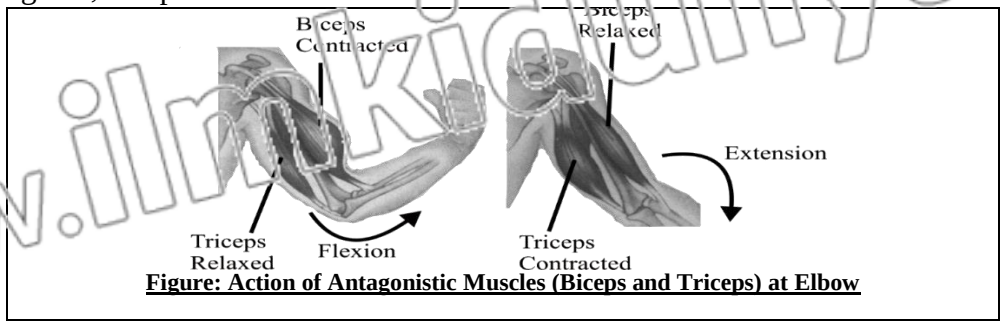

Figure: Action of Antagonistic Muscles (Biceps and Triceps) at Elbow

Antagonistic Pair of Muscles:

In this way, **biceps** and **triceps** make up an **antagonistic pair** of muscles. **Similar pairs**, working **antagonistically across** other joints, provide for almost all the **movements of skeleton**.

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13.3 SHORT QUESTIONS

Q.1 What is origin and insertion? (K.B) **(LHR 2014, GRW 2014)**

OR

Differentiation between origin and insertion of skeleton muscles. (K.B) **(GRW 2016, 17)**

Ans: Page no 111.

Q.2 Define antagonism. (K.B) **(LHR 2016)**

Ans: Page no 111.

Q.3 What are flexor and extensor? (K.B) **(DGK 2015)**

OR

Differentiate between flexor and extensor. (K.B) **(LHR 2016)**

Ans:

FLEXOR

When a muscle contracts and bends the joints, it is known as flexor muscle and the movement is called flexion.

EXTENSOR

When a muscle contracts and straightens the joint, it is known as extensor muscle and the movement is called extension.

Q.4 What are biceps and triceps muscles? (K.B) **(LHR 2015, 16)**

Ans: Page no 111.

Q.5 Why aquatic animals need less support? (U.B)

Ans:

SUPPORT OF AQUATIC ANIMALS

Aquatic animals need less support because buoyancy force of water gives them support well.

Q.6 Which point of attachment is pulled when a muscle contracts? (U.B)

Ans:

CONTRACTION OF MUSCLE

Insertion is pulled when a muscle contracts to produce movement in the bones.

Q.7 Can muscle pushed? (U.B)

Ans:

MUSCLE

Muscles can only pull or contract. It cannot push.

Q.8 Write some activities that require combine action of several muscles. (A.B)

Ans:

COMBINE ACTION OF MUSCLES

Most activities in our body require combined action of several of muscles. Like:

- Walking
- Running
- Playing
- Speaking

13.3 MULTIPLE CHOICE QUESTIONS

1. The end of skeletal muscle attached with immovable bone is called: (K.B) **(LHR 2017)**

(A) Insertion (B) Origin
(C) Extension (D) Flexion

2. The end of muscle attached with movable bone: (K.B) **(LHR 2013)**

(A) Extension (B) Flexion
(C) Insertion (D) Origin

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3. When a muscle contracts, it becomes: (K.B)

(A) Longer and thinner (B) Longer and thicker
(C) Shorter and thinner (D) Shorter and thicker

4. When a muscle relaxes, it becomes: (K.B)

(A) Longer and thinner (B) Longer and thicker
(C) Shorter and thinner (D) Shorter and thicker

5. When a muscle contracts and bends the joint, it is called as: (K.B)

(A) Flexor (B) Extensor
(C) Flexion (D) Extension

6. When a muscle contracts and straightens the joint, it is called as: (K.B)

(A) Flexor (B) Extensor
(C) Flexion (D) Extension

7. Bending of arm at elbow joint: (K.B)

(A) Flexor (B) Flexion
(C) Extension (D) Extensor

13.4 DISORDERS OF SKELETAL SYSTEM

LONG QUESTIONS

Q.1 Write a note on osteoporosis. (A.B) **(DGK 2015)**

Ans: **OSTEOPOROSIS**

Definition:

"Osteoporosis is the bone disease in adults, especially in old people. It is more common in old women".

Effects:

In osteoporosis, there is a decrease in the density of bones due to the loss of calcium and phosphorus.

Causes:

It may be due to:

- Malnutrition
  - Lack of proteins
  - Lack of vitamin C
- Lack of physical activities
- Deficiency of estrogen hormone

Effect of Old Age:

In old age, there is decreased secretion of growth hormones and it also leads to decreased deposition of minerals in bone matrix.

Q.2 Write a note on arthritis and its types. (A.B) **(LHR 2016, GRW 2017)**

Ans: **ARTHRITIS**

Definition

"Arthritis means "inflammation in joints". It is very common in old age and in women.

Symptoms:

It is characterized by:

- Pain
- Stiffness in joints

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Affected Joints:

The most affected joints are the weight bearing joints.

Examples:

- Hip joint
- Ankle joint

Treatment:

The treatment of arthritis includes

- Pain killers
- Anti-inflammatory medicines.

Types:

There are many types of arthritis. Some are as follow:

- Osteo-arthritis
- Rheumatoid Arthritis
- Gout

1. **Osteo-Arthritis:**
   - It is due to degeneration in the cartilage present at joints or due to decreased lubricant production at joints.
   - In this arthritis, fusion of bones at joints may occur and joints may become totally immovable.
2. **Rheumatoid Arthritis:** **(DGK 2014)**

It involves the inflammation of the membranes at joints.

Symptoms:

Its symptoms include:

- Fatigue
- Low grade fever
- Pain in joints
- Stiffness in joints

3. **Gout:**
   - It is characterized by the accumulation of uric acid crystals in movable joints. It generally attacks the toe joints.

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13.4 SHORT QUESTIONS

Q.1 Define osteoporosis. (K.B) **(GRW 2013, LHR 2015)**

Ans: Page no 113.

Q.2 What are causes of osteoporosis? (K.B) **(LHR 2013)**

Ans: Page no 113.

Q.3 What is osteoarthritis? (K.B) **(LHR 2016, GRW 2013, 14, 17, BWP 2015)**

Ans: Page no 114.

Q.4 Write function of esterogen. (A.B)

Ans:

FUNCTION OF ESTEROGEN

The function of esterogen is as follow:

Estrogen is deposit minerals in bones. When the reproductive cycle stops in females, not enough esterogen is secreted.

Q.5 What is rheumatoid arthritis? (K.B) **(LHR 2015, 17)**

Ans: Page no 114.

Q.6 Differentiate between osteo-arthritis and rheumatoid arthritis. (K.B) **(GRW 2016)**

Ans:

DIFFERENTIATION

The difference between Osteo-arthritis and rheumatoid arthritis is as follows:

Osteo-Arthritis	Rheumatoid Arthritis
• It is due to degeneration in the cartilage present at joints or due to decreased lubricant production at joints.	• It involves the inflammation of the membranes at joints.

Q.7 Define arthritis its treatment and symptoms. (A.B) **(LHR 2016)**

Ans: Page no 113, 114.

Q.8 What is gout? (K.B) **(LHR 2015, GRW 2016)**

Ans: Page no 114.

13.4 MULTIPLE CHOICE QUESTIONS

1. The inflammation of the joints is called: (K.B)

(A) Osteoporosis (B) Asthma
(C) Arthritis (D) Emphysema

2. Disease of bones in which there is a decrease in the density of the bones due to loss of calcium and phosphorus is: (U.B) **(LHR 2013)**

(A) Osteoporosis (B) Osteoarthritis
(C) Rheumatoid arthritis (D) Gout

3. Osteoporosis may be due to: (K.B)

(A) Lack of proteins and vitamin C (B) Lack of physical activities
(C) Deficiency of estrogen hormone (D) All of these

4. It involves the inflammation of the membranes at joints: (K.B)

(A) Osteoporosis (B) Gout
(C) Rheumatoid arthritis (D) Osteo-arthritis

5. It is one of the function of ____ to deposit minerals in bones when the reproductive cycle stops in females: (U.B)

(A) Progesterone (B) Estrogen
(C) Oxytocin (D) Thyroxin

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

13.1 HUMAN SLELETON

1	B	**2**	A	**3**	B	**4**	B	**5**	D	**6**	D
7	C	**8**	B	**9**	A	**10**	A	**11**	B	**12**	D
13	C	**14**	B	**15**	A	**16**	C	**17**	A	**18**	A
19	B	**20**	B	**21**	A	**22**	B	**23**	B	**24**	D
25	B	**26**	D	**27**	D	**28**	B	**29**	C	**30**	C
31	B	**32**	C	**33**	C	34	B	35	A	36	B
37	A	**38**	B	**39**	B	40	A				

13.2 TYPES OF JOINTS

1	A	**2**	C	**3**	D	**4**	B	**5**	C	**6**	D	**7**	C
8	B	**9**	C	**10**	B	**11**	B						

13.3 MUSCLES AND MOVEMENT

1	B	**2**	C	**3**	D	**4**	A	**5**	A	**6**	B	**7**	B

13.4 DISORDERS OF SKELETAL SYSTEM

1	C	**2**	A	**3**	B	**4**	C	**5**	B

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Find the ball-and-socket joint. (U.B)
(a) Joint in the finger bones (b) Joint of neck and skull bones
(c) Joint at elbow (d) Joint at pelvic girdle and leg bones

2. All these are the parts of axial skeleton of humans except: (K.B)
(a) Ribs (b) Sternum
(c) Shoulder girdle (d) Vertebral column

3. The disorders in which there is an accumulation of uric acid in joints: (K.B)
(a) Gout (b) Rheumatoid arthritis
(c) Osteoporosis (d) Osteo-arthritis

4. What is correct about tendons? (U.B)
(a) Tendons are flexible and they join muscles with bones
(b) Tendons are non-elastic and they join bones with bones
(c) Tendons are non-elastic and they join muscles with bones
(d) Tendons are flexible and they join muscles with muscles

5. How many bones make our skull? (K.B)
(a) 14 (b) 22
(c) 24 (d) 26

6. What are the main components of a bone? (K.B)
(a) Marrow, spongy bone, wax (b) Marrow, compact bone, wax
(c) Compact bone and marrow (d) Compact bone, spongy bone, marrow

7. What do some bones produce? (K.B)
(a) Mucous (b) Hormones
(c) Oxygen (d) Blood cells

8. How would you define skeletal system? (U.B)
(a) All the bones in body
(b) All the muscles and tendons
(c) All the body's organs, both soft and hard tissues
(d) All the bones in body and the tissues that connect them

9. Find the incorrect statement. (U.B)
(a) Bone is where 'most blood cells are made
(b) Bone serves as a storehouse for various minerals
(c) Bone is a dry and non-living supporting structure
(d) Bone protects and supports the body and its organs

10. The purpose of rib cage is to: (A.B)
(a) Protect the stomach (b) Protect the spinal cord
(c) Protect the heart and lungs (d) Provide an object to which the lungs can attach

ANSWER'S KEY

1	**d**	**2**	**a**	**3**	**a**	**4**	**c**	**5**	**b**
6	**d**	**7**	**d**	**8**	**d**	**9**	**c**	**10**	**c**

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SHORT QUESTIONS

1. Differentiate between cartilage and bone (K.B)

Ans: **DIFFERENTIATION**

The differences between cartilage and bone are as follows.

Cartilage	Bone
• Cartilage is a dense, clear, blue-white firm connective tissue.	• Bone is the hardest connective tissue in the body.
• Cartilage is less strong than bone.	• Bone is stronger than cartilage.
• The cells of cartilage are called chondrocytes.	• Bone contains different types of cells. The mature bone cells are called osteocytes.
• Hyaline Cartilage • Elastic Cartilage • Fibrous Cartilage	• Compact Bone • Spongy Bone

2. What is the role of skeleton in support and movement? (A.B)

Ans: **ROLE OF SKELETAL SYSTEM**

The role of the skeletal system are:

Protection:

Skeleton provides the protection to many internal organs, for example:

- Skull protects brain
- Vertebral column protects spinal cord.
- Ribs protect most of the internal organs.

Support:

Vertebral column provides the main support to the body mass.

Movement:

In our body skeleton works very closely with the muscular system to help or move.

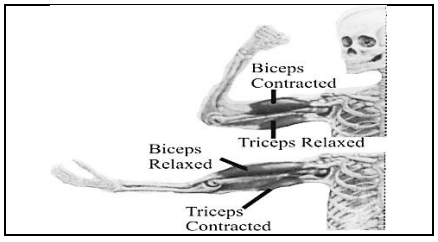
3. How would you differentiate between osteoporosis and arthritis? (K.B)

Ans: **DIFFERENTIATION**

The differences between osteoporosis and arthritis are as follows:

Osteoporosis	Arthritis
Definition	
• "Osteoporosis is the bone disease in adults, especially in old people. It is more common in old women".	• Arthritis means "inflammation in joints". It is very common in old age and in women.
Effects/Symptoms	
• In osteoporosis, there is a decrease in the density of bones due to the loss of calcium and phosphorus.	• It is characterized by pain and stiffness in joints (particularly in the weight bearing joints e.g. hip joint, ankle joint etc.).

4. Label the biceps and triceps in the following diagrams and also mention their contracted or relaxed states. (U.B)



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UNDERSTANDING THE CONCEPT

Q.1 What are the main components of the axial skeleton and the appendicular skeleton of human? (K.B)

Ans: See L.Q 4 (Topic 13.1)

Q.2 Describe the types of joints and give examples (K.B)

Ans: See L.Q 1 (Topic 13.2)

Q.3 What are ligaments and tendons? What function do they perform? (A.B)

Ans: See L.Q 2 (Topic 13.2)

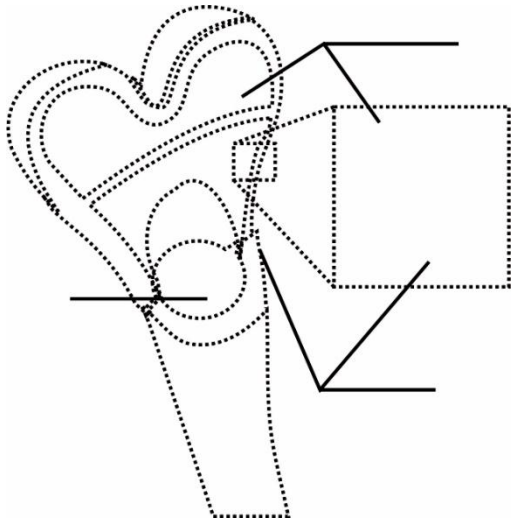
Q.4 Explain antagonism in muscle action selecting biceps and triceps as example. (A.B)

Ans: See L.Q 1 (Topic 13.3)

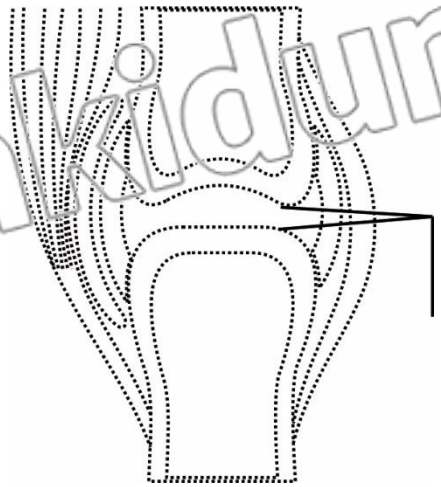
ASSIGNMENT

PRACTICE DIAGRAM & LABEL

COMPACT AND SPONGY BONE



HYALINE CARTILAGE



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. The movement of an animal as a whole from one place to another:

(A) Coordination **(B)** Reproduction

(C) Locomotion **(D)** Respiration

2. Skeleton of arthropods:

(A) Hydrostatic **(B)** Exoskeleton

(C) Endoskeleton **(D)** Axial

3. Which prevent dislocation of joints?

(A) Cartilage **(B)** Tendons

(C) Ligaments **(D)** Bones

4. _____ are tough bands and attach muscles to bones.

(A) Ligament **(B)** Tendon

(C) Origin **(D)** Insertion

5. The end of muscle attached with movable bone:

(A) Extension **(B)** Flexion

(C) Insertion **(D)** Origin

6. It involves the inflammation of the membranes at joints:

(A) Osteoporosis **(B)** Gout

(C) Rheumatoid arthritis **(D)** Osteo-arthritis

Q.2 Give short answers to following questions. **(5×2=10)**

(i) What is difference between endoskeleton and exoskeleton?

(ii) What are difference between bones & cartilage?

(iii) What do you know about the movement of neck joint?

(iv) What are flexor and extensor?

(v) Define arthritis its treatment and symptoms.

Q.3 Answer the following questions in detail. **(5+4=9)**

a. Define Joint. Describe its types.

b. Describe different types of cartilage.

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of the students.

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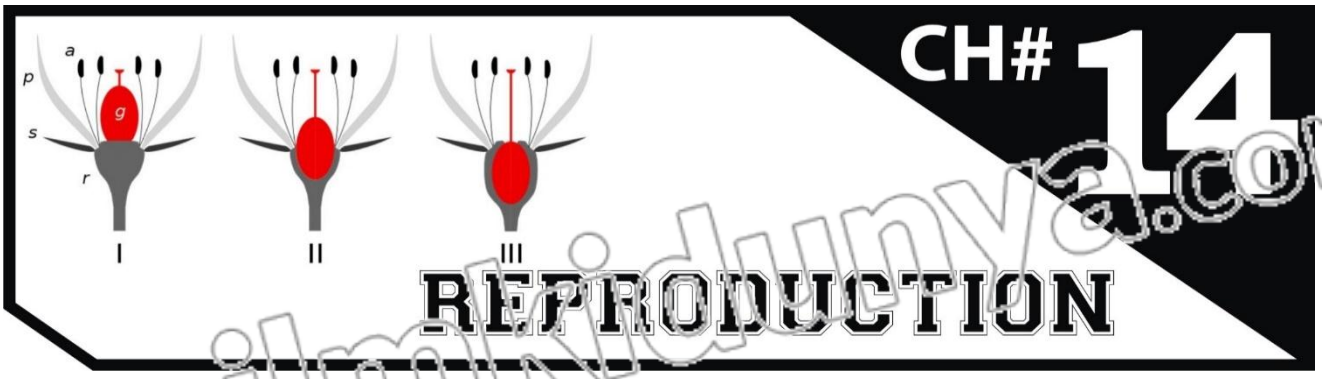

CH# 14

REPRODUCTION

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14.1 REPRODUCTION

14.2 METHODS OF ASEXUAL REPRODUCTION

LONG QUESTIONS

Q.1 Define asexual reproduction, and write different method of asexual reproduction. ***(K.B)***

OR

What are the different ways by which prokaryotes, protozoans and fungi reproduce asexually? ***(K.B)*** **(Understanding the Concept Q.1, Q.5)**

Ans:

ASEXUAL REPRODUCTION

Definition:

"Asexual Reproduction means simple **cell division** that produces an **exact duplicate** of an organism".

METHODS

Asexual reproduction **does not involve** the **fusion of gametes**. There are **many types** of asexual reproduction, all producing individuals that are **genetically identical** to each other and to the **parent**. Few **methods of asexual reproduction** are following

- **Binary fission**
- **Fragmentation**
- **Budding**
- **Spore formation**
- **Parthenogenesis**
- **Vegetative propagation**

Q.2 Write a note on binary fission. ***(K.B)*** **(LHR 2016)**

Ans:

BINARY FISSION

Definition:

"Binary fission means "**division into two**". The **simplest** and most **common** method of asexual reproduction in which an organism **divides into two** by simple cell division is called **binary fission**".

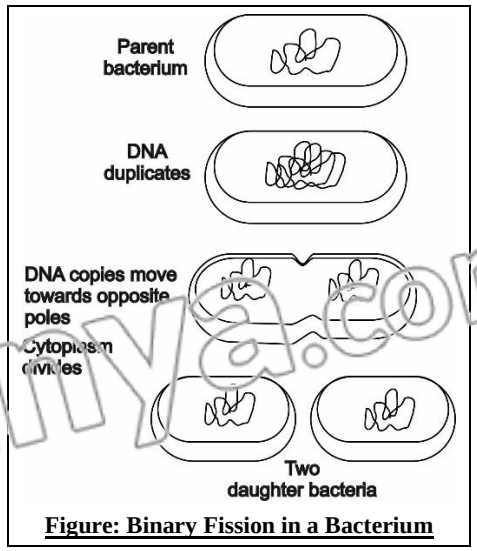

Figure: Binary Fission in a Bacterium

Examples:

- It occurs in **prokaryotes** (Bacteria)
- Many **unicellular eukaryotes** (Protozoa)
- Some **invertebrates** (Planarian)

Prokaryotes (Bacteria):

During **binary fission** in **bacteria**, the **DNA** is **duplicated** and so two **copies of DNA** are formed. The two copies move towards the **opposite poles of cell**. The **cell membrane invaginates** in centre and divides the **cytoplasm into two**. **New cell wall** is deposited between **two cross membranes**. It results in the formation of **two daughter bacteria**, which grow **in size** and **divide again**.

Unicellular Eukaryotes (Amoeba):

During **binary fission** in **unicellular eukaryotes**, the **nucleus** of **parent** organism divides into **two by mitosis**. It is followed by **the division of cytoplasm**. So **two daughter cells** of almost **equal size** are formed. **Daughter cells grow in size** and then **divide again**.

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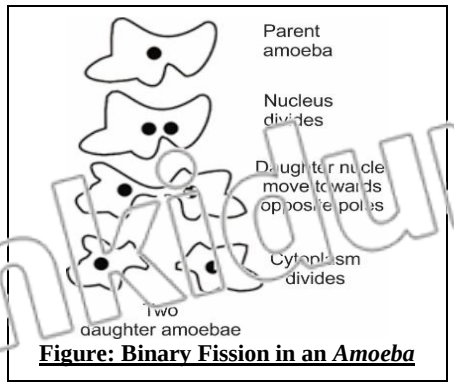

Figure: Binary Fission in an *Amoeba*

Invertebrates (Planrian):
Some **invertebrates** also reproduce **asexually** through **binary fission**. During this **reproduction**, body is cut into **two halves** (fission) and the **missing body** parts are **regenerated** in both halves. This type of asexual reproduction is common in:

- **Planarian**
- **Many Echinoderms**

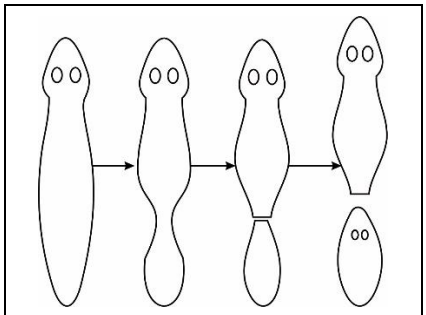
Figure: Binary Fission in a Planarian

Q.3 Write a note on multiple fission. *(K.B)*

Ans: **MULTIPLE FISSION**

Definition:
"The kind of asexual reproduction in which **one unicellular** organism **divides** into **many daughter cells** is called multiple fission".

Example:

- Amoeba

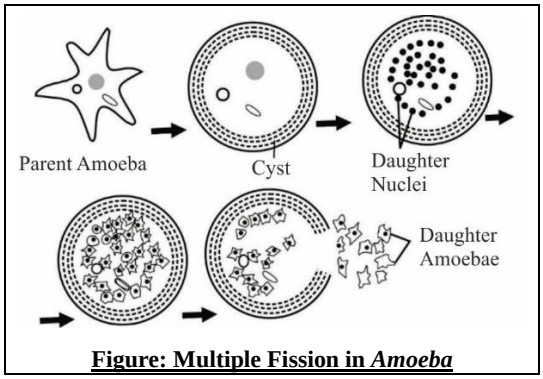

Figure: Multiple Fission in *Amoeba*

Mechanism:
Formation of Cyst and Division of Nucleus:
Some **unicellular organisms** form **hard walls** called **cysts** around them, under **unfavorable conditions**. When **favorable conditions** return, the nucleus of **parent divides** into many **daughter** nuclei by **repeated divisions**.

Division of Cytoplasm:
This is followed by the **division of cytoplasm** into **several parts**. Each **new part of cytoplasm encloses one nucleus.**

Daughter Cells:
So, a **number of daughter** cells are formed from a **single parent** at the **same time**. This kind of fission in known as multiple fission.

Q.4 Write a note on fragmentation. *(K.B)* **(DGK 2015)**

Ans: **FRAGMENTATION**

Definition:
"A kind of **asexual reproduction** in which the **detached parts** of the **organism** develop into **new organism** is called **fragmentation**".

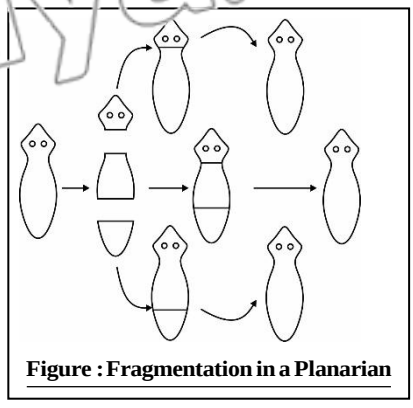
Figure : Fragmentation in a Planarian

Examples:
Worms:
As **certain worms** grow to **full size**, they spontaneously **break up** into **8 or 9 pieces**. Each **piece (fragment)** develops into a **mature worm**, and the **process is repeated**.

Planarian:
If a **planarian breaks** into **many pieces** instead **of two**, it will also be called as fragmentation.

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Q.5 Write a note on budding. (K.B) **(LHR 2014, GRW 2014, DGK 2015)**

Ans:

BUDDING

Definition:

"A type of **asexual reproduction** in which an **outgrowth on the body of an organism** develops into a **new complete organism** is called budding".

Bud:

The **developed outgrowth on the body** of an organism is called **bud**.

Explanation:

In this type of **asexual reproduction**, **a bud** develops as a **small outgrowth** on **parent's body**. The bud **may separate** from **parent body**. In **some cases**, the buds **never separate** and as a result, **colonies of individuals** are formed.

Examples:

- **Yeasts**
- **Sponges**
- **Hydra**
- **Corals**

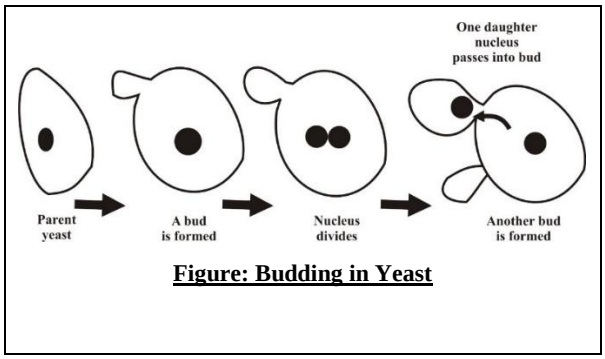

Figure: Budding in Yeast

Budding in Yeast:

Yeast is a **unicellular fungus**. A **small bud** is formed on **one side of cell.** The **nucleus of cell divides** and **one** of the **daughter nuclei** is **passed into the bud**. **Parent cell** may form **more than one** bud at **a time**. Each **bud enlarges** and **develops** the **characteristics of parent** organism.

Budding in Hydra:

A **small bud** is formed **on the side** of body of **hydra**, **by mitosis**. This bud **enlarges** by the **formation of more cells**. It then **detaches** from the **parent body** and **grows** into **new organism**. Animals such as sponges, **Hydra** and **corals** also reproduce by means of **budding**.

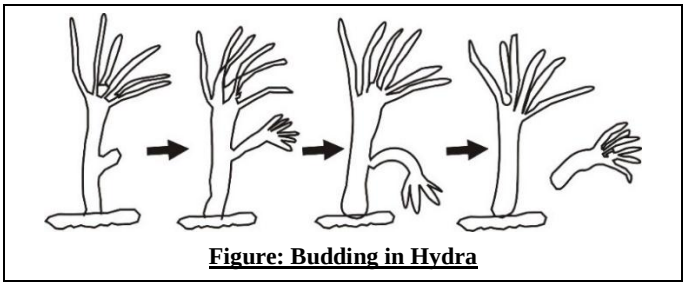

Figure: Budding in Hydra

Budding in Corals:

In corals, the **buds do not detach** from the **parent body**. **Corals** form **big colonies**, because the **buds grow** into new **organisms** by **remaining attached** to the **parent body**.

Q.6 Write a note on spore formation. (K.B) **(GRW 2013, 2014)**

Ans:

SPORE FORMATION

Definition:

"An **asexual reproductive** structure that **gives rise** to **new plant** body **directly** is called as **spore**".

Example:

- It is **generally** seen in **most fungi** e.g. **Rhizopus**.

Spore Formation in Rhizopus:

When **Rhizopus** reaches reproductive age, its body cells form thick walled spore sacs called sporangia (sing. Sporangium). Inside each sporangium, a cell divides many times and forms many daughter cells called spores. Each spore is covered with a thick wall called cyst and it can survive unfavorable conditions. When sporangia are mature, they burst and release spores. Under favorable conditions, the spores germinate and develop into new Rhizopus.

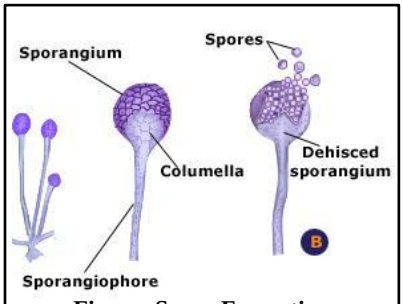

Figure: Spore Formation

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Endospore Formation in Bacteria:

Under unfavorable conditions, some species of bacteria reproduce by forming spores. The bacterial spores are also thick walled. They are formed inside bacterial cells, so are called endospores. For example, the bacteria of the following species form endospores:

- Clostridium
- Bacillus

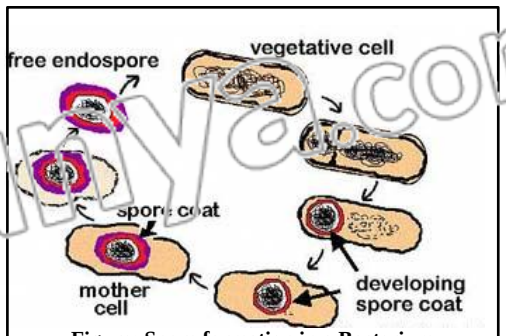

Figure: Spore formation in a Bacterium

Q.7 Write a note on parthenogenesis. (K.B)

Ans:

PARTHENOGENESIS

Definition:

"A type of asexual reproduction in which an **unfertilized egg develops** into a **new individual** is called parthenogenesis".

Examples:

The **phenomenon** of parthenogenesis is **observed** in some **fishes, frogs and insects**.

Parthenogenesis in Honey Bees:

Queen honeybee lays **eggs** in the **cells** of **honeycomb**. **Many** eggs remain **unfertilized** and **develop** into **haploid males** called (drones) by **parthenogenesis**. At the same time, **some eggs** are **fertilized** by **male bees** and these **develop** into **diploid females** and **new queen** and **worker bees** are **formed**.

Q.8 Write a note on natural vegetative propagation. (A.B) **(LHR 2016, MTN 2015)**

OR

Explain the different parts of the plants that help in natural vegetative propagation. (A.B) **(Understanding the Concept Q.2)**

Ans:

VEGETATIVE PROPAGATION

Definition:

"The process in which vegetative parts of **plants** i.e. roots, stems or leaves **give rise** to new **plants**, is called vegetative propagation". It is also called **vegetative reproduction**.

NATURAL VEGETATIVE PROPAGATION

Definition:

"If the process of vegetative propagation occurs **naturally** then it is called **natural vegetative propagation**".

Types of Natural Vegetative Propagation:

Vegetative propagation occurs naturally in several ways:

1. **Bulbs**
2. **Corms**
3. **Rhizomes**
4. **Stem Tubers**
5. **Suckers**
6. **Leaves**

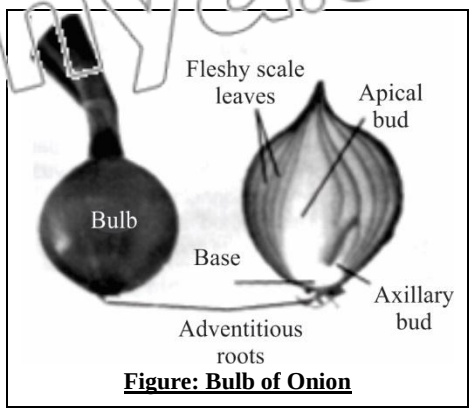

Figure: Bulb of Onion

Bulbs:

Bulbs are **short underground stems** surrounded by **thick, fleshy leaves** that contain **stored food**. **Adventitious roots emerge** under the **base of bulb** while **shoots emerge** from the **top of the base**.

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Examples:

- **Tulips**
- **Onions**
- **Lilies**

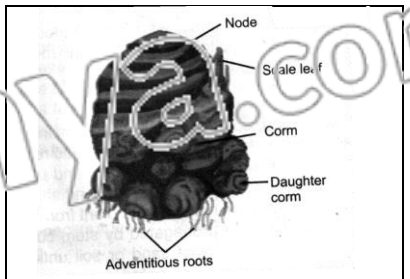

Figure: Corm of Colocacia

Corms:

Corms are **short** and **swollen underground stems** containing **stored food**. Buds are present at **the top** of corm. From a bud, **shoot grows** and forms a **new plant**.

Examples:

- **Dasheen**
- **Garlic**

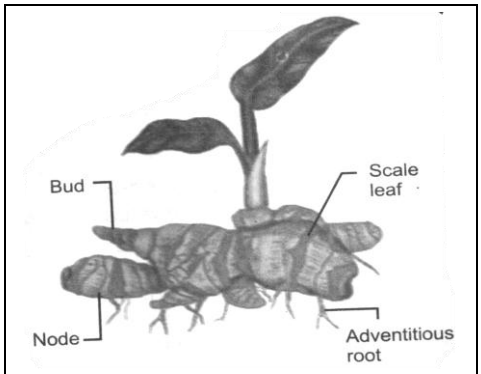

Figure: Rhizome of Ginger

Rhizomes:

Rhizomes are **horizontal underground stems** with **scale** leaves. There are **enlarged portions** called **nodes** on rhizome. **Buds** are **produced** at **nodes**. The buds present on the **upper surface** of rhizome give **rise to shoot**. The **lower surface** of rhizome **produces adventitious roots**.

Examples:

- **Ginger**
- **Ferns**
- **Water lilies**

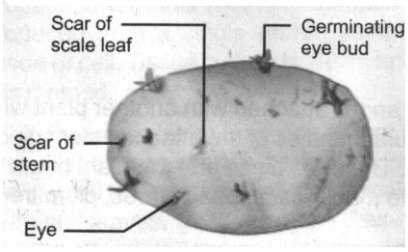

Figure: Stem Tuber of Potato

Stem Tubers:

Stem Tubers are the **enlarged portions** of an **underground stem** (rhizome). There are **aggregations** of **tiny buds** in the form of **"eyes"** along the **surface** of tuber. Each bud **develops** into **shoot** that grows **upward** and also **produces roots**.

Examples:

- **Potatoes**
- **Yams**

Suckers:

Suckers are **lateral stems close** to **ground level**. A sucker grows **underground** form some **distance** and then **turns up**, producing the **new plant**.

Examples:

- **Mint**
- **Chrysanthemum**

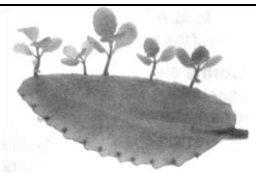
Figure: Bryophyllum Leaf with Buds

Leaves:

Vegetative propagation by leaves is **not common** and is seen in plants such as:

- **Bryophyllum (Pather chut)**

This plant has **fleshy leaves** and **adventitious buds** are present at the **margins** of leaves. When **leaf falls** on ground, the **buds grow** into new plants.

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Q.9 Write different methods of artificial vegetative propagation. (A.B) **(LHR 2017, DGK 2015)**

Ans:

ARTIFICIAL VEGETATIVE PROPAGATION

Definition:

"If the **process** of vegetative propagation occurs **artificially** by gardeners and farmers then it is called **artificial vegetative propagation**".

Types:

The following **two** are the most common **methods** of artificial vegetative propagation:

- **Cuttings**
- **Grafting**

Cuttings:

In this method, **cuttings** may be **taken** mainly from the **stems or roots** of **parent plant**. These cuttings must have a **meristematic region** from which **growth** can occur. The cuttings will form **roots and shoots** when they are placed in a **suitable soil** and under **favorable conditions** like:

- **Sufficient nutrients**
- **Water**
- **Sunlight**

Roots and shoots grow and **develop** into a **plant identical** to the **parent plant** from which the cuttings were taken.

Stem Cuttings:

The following plants are artificially propagated through stem cuttings:

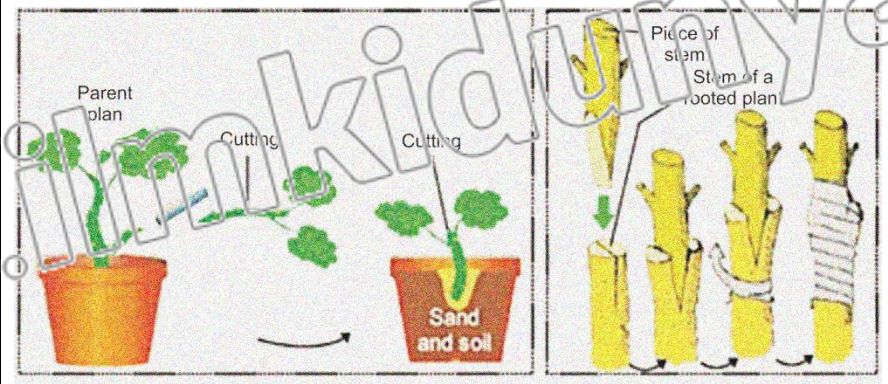
- **Roses**
- **Ivy**
- **Grapevines**

Root Cuttings:

Sweet potato is an **enlarged root**. Farmers place it in **moist sand** or **soil** until it produces **several plantlets**. Then the plantlets are **removed and planted**.

Advantages:

- This process is used to **produce many plants** from a **single plant**.
- All new plants are **exactly** the **same**.
- **This artificial vegetative propagation has been very beneficial on sugar cane plantation.**



Cutting Grafting

Figure: Artificial Vegetative propagation

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Grafting:

In grafting, a **piece** of **stem** is cut from the plant and is **attached** with **another plant** with established **root system**. After a while, the **vascular bundles** of the **attached** stem piece and the host plant are connected to each other. The stem piece and the plant **begin** to **grow** together.

Examples:

This method is used to propagate:

- **Many roses**
- **Peach trees**
- **Plum trees**
- Various **seedless fruits** including grapes

Q.10 Describe the advantages and disadvantages of vegetative propagation of plants. (A.B) **(LHR 2014, 16, GRW 2014, 17)**

Ans:

VEGETATIVE PROPAGATION

Definition:

"The process in which **vegetative parts** of plants i.e. roots, stems or leaves give **rise** to new **plants**, is called vegetative propagation". It is also called vegetative reproduction.

ADVANTAGES

The **advantages** of vegetative propagation are as follows:

Genetically Identical Offspring:

The offspring produced through vegetative propagation are **genetically identical**. Therefore **beneficial characteristics** can be preserved.

Pollination:

In vegetative propagation, there is **no need** of any **mechanism** of pollination. It helps to **increase number** of **plants** at a rapid rate.

Unfavorable Conditions:

The **organs** of vegetative propagation **enable** many plants to **pass over unfavourable conditions**.

Seedless Plants:

Plants bearing **seedless fruits** can be **grown only** by vegetative propagation.

DISADVANTAGES

The **disadvantages** of vegetative propagation are as follows:

Genetic Variations:

The plants **do not** have **genetic variations**.

Diseases Attack:

Species specific **diseases** can **attack** and this can result in the **destruction** of an **entire crop**.

Q.11 Write a note on tissue culture and cloning. (A.B) **(GRW 2015)**

Ans:

TISSUE CULTURE AND CLONING

Cloning:

"The process in which **identical offspring** are **produced** from a **single parent** using its vegetative **tissue** or cell is called cloning".

This method of propagation is also called **micro-propagation** since it uses only a small part of plant.

Latest Method:

Cloning is the **latest method** of vegetative propagation.

Technique:

Tissue culture is the **technique** applied in this **method.**

Mechanism:

Tissues are **taken from** any part of plant and are **put** in a **suitable nutrient medium**.

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Formation of Calluses:

The tissue cells start **mitosis** and produce **masses of cells called calluses** that are **transferred** to other **medium** that contains different **hormones** for the **formation** of roots, stem and leaves **Formation of New Plant:**

Calluses make these **structures** and grow into **new small plants**. The small plants are then planted in pots and then in fields

14.1, 14.2 SHORT QUESTIONS

Q.1 Define the term reproduction. Why it is necessary? (U.B) **(DGK 2015)**

Ans:

REPRODUCTION

Definition:

"Reproduction is defined as production of individuals of the same species. i.e the next generation of species."

Need of Reproduction:

It is one of the fundamental characteristics of living things. It is not an essential life process. Reproduction is necessary because of the following reasons.

- For the survival of species
- For the continuation of species

Q.2 What is the significance of reproduction? (K.B)

- Reproduction is one of the fundamental characteristics of living things, it is not an essential life process.
- It is essential for the continuation of species.
- It ensures that the genetic material of one generation is transmitted to the next.
- This ensures that the advantageous characteristics are transmitted to the next generation.

Q.3 Why each generation produces more offsprings for the next generation? (U.B)

Ans: Many individuals die due to various reasons like diseases, competition, genetic factors etc. before reaching the reproductive age. So each generation produces more offsprings for the next generation and only the fittest and the best survive can reach the reproductive age.

Q.4 How reproduction is important for the continuation of species? (U.B)

(LHR 2013, BWP 2015)

Ans:

IMPORTANCE OF REPRODUCTION

Reproduction is essential for continuation of species. It ensures that the genetic material of one generation is transmitted to the next. Each generation produces more offspring for the next generation. Characteristics are transmitted to the next generation. Only the best and fittest survive.

Q.5 What is difference between asexual and sexual reproduction? (K.B) **(GRW 2013, DGK 2015)**

Ans:

DIFFERENTIATION

The differences between asexual and sexual reproduction are as follows:

Asexual Reproduction	Sexual Reproduction
Definition	
• Simple cell division that produces an exact duplicate of an organism.	• Involves the joining (fusion) of male and female sex cells gametes.
Example	
• Binary fission in Bacteria	• Reproduction in Humans

Q.6 Define the term binary fission. Give examples. (K.B) **(DGK 2015)**

Ans: Page no 122.

Q.7 How budding occur in corals? (U.B) **(LHR 2017)**

Ans: **BUDDING IN CORALS**

In corals, the buds do not detach from the parent body. Corals form big colonies, because the buds grow into new organisms by remaining attached to the parent body

Q.8 How plants reproduced by suckers? Give examples. (U.B) **(LHR 2017)**

Ans: Page no 126

Q.9 What is meant by cutting? Give one example. (K.B) **(GRW 2016)**

Ans: Page no 127.

Q.10 How binary fission take place in planarian? (K.B)

Ans: Page no 123.

Q.11 What is multiple fission? (K.B) **(GRW 2014, LHR 2016)**

Ans: Page no 123.

Q.12 Define fragmentation. (K.B) **(GRW 2015)**

Ans: Page no 123.

Q.13 What is spore formation? (K.B) **(LHR 2014)**

Ans: Page no 124.

Q.14 What are endospores? (K.B)

Ans: Page no 125.

Q.15 Define the term parthenogenesis. (K.B) **(BWP 2015)**

Ans: Page no 125.

Q.16 Define the term vegetative propagation. (K.B) **(GRW 2017)**

Ans: Page no 125.

Q.17 How vegetative propagation occur by leaves? (K.B) **(GRW 2017)**

Ans: Page no 125.

Q.18 What are the disadvantages of vegetative propagation? (A.B) **(LHR 2017)**

Ans: Page no 127.

Q.19 Define the term coloning and tissue culture. (K.B) **(LHR 2015)**

Ans: Page no 128.

Q.20 What are the steps of tissue culture technique? (A.B) **(DGK 2015)**

Ans: **TISSUE CULTURE TECHNIQUE**

The steps involved in tissue culture technique are as follows:

- Tissues are taken from any part of plant and put in a suitable nutrient medium.
- The tissue cells start mitosis and produce masses of cells called calluses are transferred to other medium that contain different hormones for the formation of root, stem and leaves. Calluses make these structures and grow into new small plants.
- The small plants are then planted in pots and then in field.

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14.1, 14.2 MULTIPLE CHOICE QUESTIONS

1. All of the following characters are essential for the life of an individual, except; (U.B)
(A) Respiration (B) Metabolism
(C) Homeostasis (D) Reproduction

2. All of the following characteristics can be performed by non-living things, except; (U.B)
(A) Movement (B) Co-ordination
(C) Reproduction (D) Breakdown of C-H bond

3. Which of the following is an attribute relates to asexual reproduction? (U.B)
(A) Involves fusion of gametes (B) Produce genetically identical off springs
(C) Meiosis occurs (D) Bi-parental generation

4. All of the following events are similar in mitosis and binary fission, except; (U.B)
(A) Replication of DNA (B) Division of cytoplasm
(C) Formation of spindle fibers (D) Produces Genetically identical individuals

5. The simple and common method of asexual reproduction is: (U.B) **(LHR 2016)**
(A) Budding (B) Regeneration
(C) Multiple fission (D) Binary fission

6. Reproduction is essential for the survival of: (U.B)
(A) Species (B) Individual
(C) Organism (D) human

7. Which of the following is a prokaryote passing through Binary fission? (U.B)
(A) Amoeba (B) Planaria
(C) Bacteria (D) All of these

8. Simple cell division that produces an exact duplicate of an organism is: (K.B)
(A) Asexual reproduction (B) Sexual reproduction
(C) Photosynthesis (D) Respiration

9. Mark the exact sequence of the underground stem of vegetative propagation in onion, ginger, Potato and garlic: (U.B)
(A) Bulb, stem tuber, rhizome, corm (B) Bulb, rhizome, stem tuber, corm
(C) Stem tuber, bulb, rhizome, corm (D) None of these

10. Method of asexual reproduction found in Amoeba is: (K.B) **(LHR 2013)**
(A) Binary fission (B) Fragmentation
(C) Budding (D) Spore formation

11. Multiple fission occurs in: (K.B)
(A) Planarian (B) Yeast
(C) Amoeba (D) Hydra

12. Binary fission means division into: (K.B)
(A) Two (B) Three
(C) Four (D) Five

13. The type of division in which Amoeba nucleus divides to form many nuclei: (K.B)
(A) Binary fission (B) Multiple fission
(C) Fragmentation (D) Budding

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14. Breaking of an organism's body into many pieces: (K.B)

(A) Binary fission (B) Multiple fission

(C) Fragmentation (D) Budding

15. An outgrowth on the body of an organism: (K.B)

(A) Fragment (B) Bud

(C) Fission (D) Spore

16. Asexual reproduction in yeast take place by: (K.B) **(LHR 2017)**

(A) Binary fission (B) Multiple fission

(C) Fragmentation (D) Budding

17. Which animal reproduces by budding? (K.B)

(A) Planaria (B) Bacteria

(C) Hydra (D) Buffalo

18. The animals in which the bud does not detaches from the parent body: (K.B)

(A) Hydra (B) Goat

(C) Planaria (D) Coral

19. All o the following are animals reproduce by Budding, except; (K.B)

(A) Yeast (B) Hydra

(C) Sponges (D) Corals

20. Spore formation takes place in: (K.B) **(DGK 2014, LHR 2015)**

(A) Yeast (B) Rhizopus

(C) Onion (D) Potato

21. Spores are produced in: (K.B)

(A) Sporangiophore (B) Stolon

(C) Rhizoids (D) Sporangia

22. Spores are enclosed in thick walled structure called: (K.B)

(A) Bulb (B) Corm

(C) Cyst (D) Hyphae

23. Which of the following structure can survive under unfavorable conditions? (K.B)

(A) Cyst (B) Exospore

(C) Endospore (D) All of these

24. Form of asexual reproduction in which unfertilized egg develops into new offspring: (K.B)

(A) Multiple fission (B) Budding

(C) Parthenogenesis (D) Cloning

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25. Tulips reproduce by the formation of: (K.B) **(SWL 2014)**

(A) Rhizomes (B) Corms

(C) Bulbs (D) Suckers

26. Dasheen and garlic reproduce by the formation of: (K.B)

(A) Rhizomes (B) Corms

(C) Bulbs (D) Suckers

27. Which plant is not found in the form of underground bulb? (U.B) **(GRW 2013)**

(A) Garlic (B) Tulip

(C) Onion (D) Lily

28. Vegetative propagation through suckers: (K.B)

(A) Ginger (B) Chrysanthemum

(C) Mint (D) Mint, Ginger

29. An example of rhizome is: (K.B) **(LHR 2013)**

(A) Onion (B) Garlic

(C) Ginger (D) Potato

30. Ginger reproduces by the formation of: (K.B)

(A) Rhizomes (B) Corms

(C) Bulbs (D) Suckers

31. Potatoes and yams reproduce by the formation of: (K.B) **(BWP 2014)**

(A) Rhizomes (B) Corms

(C) Bulbs (D) Stem tubers

32. Mint and Chrysanthemum reproduce by the formation of: (K.B)

(A) Rhizomes (B) Corms

(C) Bulbs (D) Suckers

33. Vegetative propagation by leaf in: (K.B)

(A) Chrysanthemum (B) Bryophyllum

(C) Lilies (D) Tulips

34. Pathar chat is the name of: (K.B)

(A) Chrysanthemum (B) Bryophyllum

(C) Rhizopus (D) Clostridium

35. A latest method of vegetative propagation in which identical offspring are produced from a single parent using its vegetative tissue (K.B)

(A) Tissue culture (B) Cloning

(C) Callus culture (D) All of these

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14.3 SEXUAL REPRODUCTION IN PLANTS

LONG QUESTIONS

Q.1 Describe sexual reproduction in plants (K.B)

Ans: **SEXUAL REPRODUCTION IN PLANTS**

Definition:

"Sexual reproduction involves the **production of gametes** (sperms and egg cells) and their **fusion** i.e. fertilization".

Explanation:

The gametes are produced in **special structures** in plant body. The **major plant groups** are mosses, ferns and seed plants. The seed plants include **gymnosperms** and **angiosperms** (flowering plants).

Methods:

Plant groups use **different methods** for bringing the sperm and egg cell together.

- In mosses and ferns sperms are **motile** and can **swim to egg cells**. Therefore, these plants **require water** (in the form of few or rain) for sexual reproduction.
- On the other hand, gymnosperms and angiosperms have **special methods** for carrying their **sperms to egg cells**. They **do not** need **water** for reproduction.

Q.2 Explain the phenomenon of alternation of generations in plants. (K.B)

(GRW 2013, 14, MTN 2015)

Ans: **ALTERNATION OF GENERATIONS**

Definition:

"The phenomenon in which **two different generations alternate** with each other during **life cycle** is known as alternation of generations".

In the life cycle of plants, two different generations alternate with each other.

Sporophyte Generation:

One generation is **diploid** and produces **spores**. It is called **sporophyte generation**. In most plants, sporophyte generation is **dominant**. It means that it is **big in size** and is **independent**.

Gametophyte Generation:

The other generation is **haploid** and produces **gametes**. It is called **gametophyte generation**. It is **small in size** and **depends** upon sporophyte. It produces gametes by mitosis.

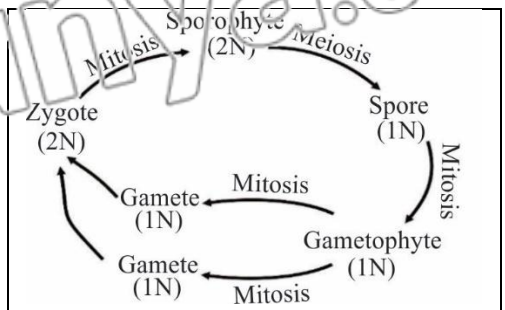

Figure: An overview of Alternation of Generations in Plants

Formation of Gametophyte:

Sporophyte produces **haploid spores** by **meiosis**. The spores **develop** into **gametophyte**.

Formation of Sporophyte:

The male and female **gametes fuse** and form **diploid zygote**. The **zygote** undergoes repeated **mitosis** and **develops** into a new **diploid sporophyte**.

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Q.3 Describe structure of flower. (K.B)

Ans:

STRUCTURE OF FLOWER

Definition:

"The flower is actually a **condensed shoot** with the **nodes** present very **close** to each other".

In **angiosperms**, parent plant is **diploid sporophyte** generation. **Flower** is the **reproductive** structure in this generation. The flower **components** are arranged in the form of **whorls**. The **outer two whorls** in a flower are the **non-reproductive** whorls while the **inner two whorls** are the **reproductive** whorls.

Whorl:

"All the **structures** present at **one node** are collectively called the **whorl**".

The following **four whorls** are present in the flower:

- Calyx
- Corolla
- Androecium
- Gynoecium

Calyx:

- **Calyx** is the **outermost whorl**.
- It usually **green** in colour.
- Its **individual units** (leaflets) are called **sepals**.

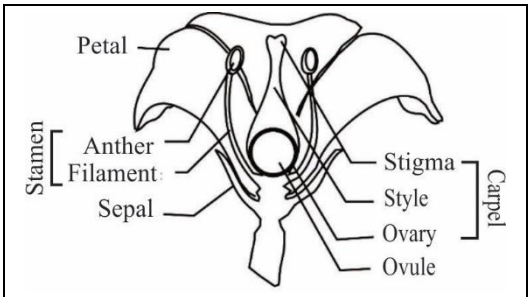

Figure: Structure of a Flower

Function:

Sepals **protect** the **inner whorls** at **bud stage**.

Corolla:

- **Corolla** is the **next inner whorl.**
- It is **brightly coloured**.
- Its **individual units** (leaflets) are called **petals**.

Function:

They **serve** to **attract bees**, birds etc. which are the **agents of pollination**.

Androecium:

Androecium is the **third whorl** and the **male reproductive part** of flower.

- Its **units** are called **stamens**.
- Each stamen has a **thread-like filament** at the **free end** of which **anther** is attached.
- Anther has **pollen-sacs** in which **haploid microspores** (pollen grains) are **produced** through **meiosis**. Each **microspore germinates** into the **male gametophyte generation**.

Gynoecium:

Fourth whorl i.e. **gynoecium** is the **female reproductive part** of flower.

Carpels:

Its **units** are called **carpels or pistils**.

Structure of Carpel:

Each carpel is made up of:

- **Basal ovary**
- **Middle style**
- **Upper stigma**

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Ovules:

Inside ovary, there are one to **many ovules**. Inside each **ovule**, one **haploid macrospore** is **produced** through **meiosis**. **Macrospore germinates** into the **female gametophyte generation**.

Q.4 Describe life cycle of a flowering plants. (K.B)

Ans:

LIFE CYCLE OF A FLOWERING PLANT

Definition:

"The flower is actually a **condensed shoot** with the **nodes** present very **close** to each other".

Explanation:

In **angiosperms**, parent plant is **diploid sporophyte generation**. **Flower** is the **reproductive** structure in this generation. The flower **components** are arranged in the form of **whorls**. The **outer two whorls** in a flower are the **non-reproductive** whorls while the **inner two whorls** are the **reproductive whorls**.

Whorls:

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The following **four whorls are** present in the flower:

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- **Gynoecium**

Calyx:

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- It is **brightly coloured**
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Function:

They **serve** to **attract bees, birds** etc. which are the **agents of pollination.**

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Androecium is the **third whorl and the male reproductive part** of flower.

- Its **units** are called **stamens.**
- Each stamen has a **thread-like filament** at the **free end** of which **anther** is attached.
- Anther has **pollen-sacs** in which **haploid microspores** (pollen grains) are **produced** through **meiosis.** Each **microspore germinates** into the **male gametophyte generation.**

Formation of Male Gametophyte:

The **nucleus** of **microspore** undergoes **mitosis** and **produces two nuclei:**

- **Tube nucleus**
- **Generative nucleus**

The **generative nucleus** again undergoes **mitosis** and **produces two sperms.** So, a germinated microspore has a **tube nucleus** and **two sperms.** All these **structures** are the **male gametophyte generation** of plant.

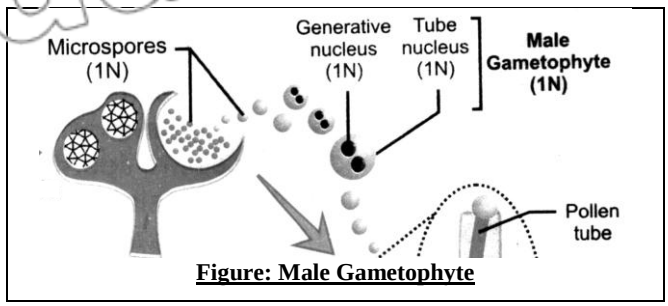

Figure: Male Gametophyte

Gynoecium:
Fourth whorl i.e. **gynoecium** is the **female reproductive** part of flower.
Carpels:
Its **units** are called **carpels or pistils.**
Structure of Carpel:
Each carpel is made up of:

- **Basal ovary**
- **Middle style**
- **Upper stigma**

Ovules:
Inside ovary, there are one to **many ovules.** Inside each ovule, **one haploid macrospore** is **produced** through **meiosis. Macrospore germinates** into the **female gametophyte generation.**

Formation of Female Gametophyte:

The **macrospore** undergoes **mitosis** and **produces** an **egg cell** and some **associated structures e.g. fusion nucleus.** Egg cell and associated structures are the **female gametophyte generation** of plant.

Pollination:

When **pollen grains mature,** they are **transferred** to stigma. It is called **pollination.**

On reaching the stigma, the **tube nucleus** of **pollen grain** constructs a **pollen tube.** The pollen tube **contains** a **tube nucleus** and **two sperms.** The tube **grows** through **style and ovary** and enters ovule. Here, it bursts and releases the sperms. Both sperms enter the female gametophyte.

Double Fertilization:

"The process of fertilization **involves two fusions,** it is called double fertilization."

Formation of Zygote:

One sperm fuses with egg and forms a diploid (2N) zygote.

Formation of Endosperm Nucleus:

The other sperm fuses with diploid fusion nucleus and forms a triploid (3N) nucleus called endosperm nucleus.

Developmental Process:

Zygote develops into embryo and **endosperm nucleus develops into endosperm tissue** (food of the growing embryo). Ovule then becomes seed and ovary changes into fruit.

Dispersal of Seeds.

When seeds mature, they are dispersed. If seeds get suitable conditions, their embryos develop into new plants i. e. the diploid sporophytes of the next generation.

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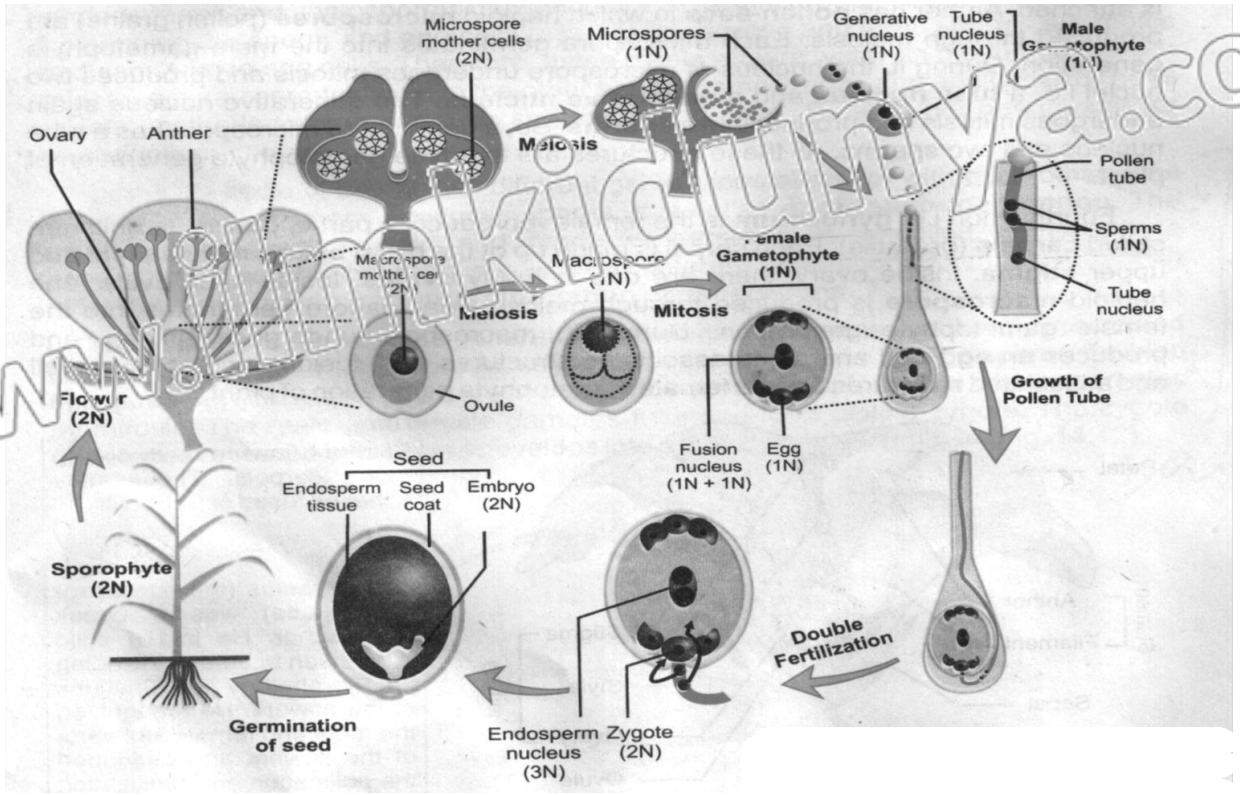

Figure: Life Cycle of a Flowering Plant

Q.5 Define pollination. Explain its types. (K.B)

Ans:

POLLINATION

Definition:

"The **transfer of pollen grains** from anther of the stamen (male part of the flower) **to stigma** of carpel (female part of the flower) is called pollination".

Types:

The following two types of pollination are recognized:

- Self pollination
- Cross pollination

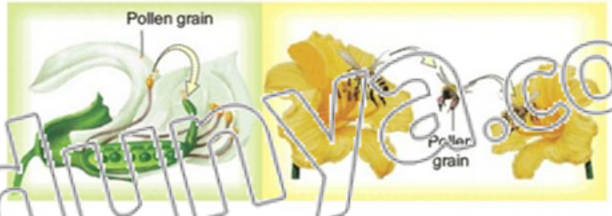

Figure: Self-pollination (left) and cross pollination (right)

Self-Pollination:

The transfer of pollen grains from the anther of stamen to the stigma of the carpel of the **same flower** or **other flower of the same plant** is called self pollination.

Cross Pollination:

The transfer of pollen grains from anther of stamen to the stigma of the carpel of one plant to the flower **on other plant of the same species** is called cross pollination.

Sources of Cross Pollination:

Cross pollination is brought about by various agencies like:

- Wind
- Water
- Bees
- Birds
- Bats
- Other animals including man

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Q.6 Discuss the adaptations in insect and wind pollinated flowers. (A.B) **(MTN 2015)**

Ans:

ADAPTATIONS

The insect pollinated and wind pollinated flowers have structural adaptations that facilitate the transfer of pollen grains between two plants. Some of these adaptions are described here:

Feature	Insect Pollinated Flowers	Wind Pollinated Flowers
Size	Generally large	Generally small
Colour	Petals brightly coloured	Petals green or dull in colour
Nectar	Produce nectar	Do not produce nectar
Floral Arrangement	Flowers face upwards	Flowers hang down for easy shaking
Stamens and Stigmas	Enclosed inside ring of petals	Hang out of ring of petals
Pollen Grains	Small number produced /heavy and sticky	Large number produced / light with smooth surface
Stigma	Pinhead shaped with no branches	Feathery branches for catching pollen
Examples	• Buttercup • Rose • Wallflower • Sunflower • Orchid	• Grasses • Hazel • Willow • Corn

Q.7 Describe the development and structure of seed. (U.B) **(LHR 2017, GRW 2016)**

Ans:

DEVELOPMENT OF SEED

Definition:

"The fertilized ovule is called seed".

Explanation:

After fertilization in the female gametophyte, zygote divides repeatedly by mitosis and develops into an embryo. At this stage (in gymnosperms and angiosperms), **ovule changes into seed.** The formation of seed completes the process of sexual reproduction in seed plants. The form of the stored nutrients in seeds varies depending on the kind of plant.

STRUCTURE OF SEED

Angiosperm seeds consist of three distinct parts:

1. The embryo formed from zygote
2. The endosperm tissue formed from endospermic nucleus
3. The seed coat which develops from the wall of ovule called integument

Seed Coat:

The other name of seed coat is testa. **Seed coat develops from the integument,** originally surrounding the ovule.

Thickness:

It may be a paper-thin layer, for example:

- Peanut

It may be thick and hard, for example

- Coconut

Function:

Seed coat protects embryo from mechanical injury and from drying out.

Hilum:

There is a scar on seed coat, called hilum. It is where the seed is attached to ovary wall (fruit).

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Micropyle:
At one end of hilum, there is micropyle. This is the same **opening through which the pollen tube entered** the ovule.

Function:
Seed uses it for the absorption of water.

Embryo:
Embryo is actually an immature plant. It consists of:

- A Radicle
- A Plumule
- One or two cotyledons (Seed leaves)

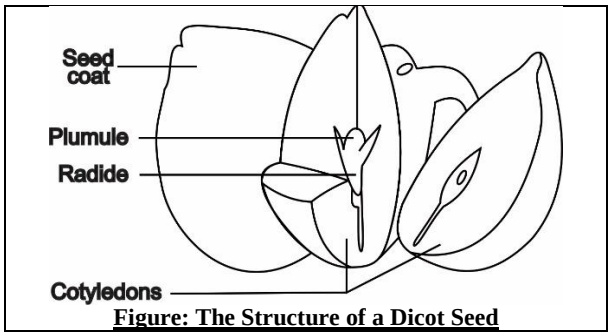

Figure: The Structure of a Dicot Seed

Radicle:
The radicle of embryo develops into new root.

Plumule:
The plumule develops into new shoot.

Epicotyl:
The embryonic stem above the point of attachment of cotyledons is called epicotyl.

Hypocotyl:
The embryonic stem **below the point of attachment** of cotyledons is called hypocotyl.

Endosperm:
Within seed, there is a store of nutrients for the seedling that will grow from embryo. In angiosperms, the **stored food is derived from the endosperm tissue.** This tissue is rich in oil or starch and protein. In many seeds, the food of the endosperm is absorbed and stored by cotyledons.

Q.8 Define germination. Explain its types. Write conditions necessary for seed germination. (U.B)
(GRW 2015, LHR 2016)

OR

Explain, how the epigeal and hypogeal germinations are different? (U.B)
(Understanding the Concept Q.3)

OR

What conditions are necessary for the germination of seeds? (U.B)
(Understanding the Concept Q.4)

OR

Describe the types of seed germination. (K.B)

Ans:

GERMINATION OF SEED

Definition:
"The process by which a seed embryo develops into a seedling is called seed germination".

Explanation:

Location:
For the germination of seed, they must arrive at the suitable location and be there at a time favourable for germination and growth.

Absorption of Water:
During germination, embryo soaks up water which causes it to swell, splitting the seed coat.

Formation of Root:
Root is the first structure that emerges from the radicle present in seed. It grows rapidly and absorbs water and nutrients from soil.

Formation of Shoot:
In the next phase, plumule develops into tiny shoot which elongates and comes out of soil.

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TYPES OF GERMINATION

On the basis of the elongation of hypocotyl and epicotyl, there are two types of germination:

- Epigeal Germination
- Hypogeal Germination

Epigeal Germination:

In epigeal germination, the **hypocotyl elongates** and forms a hook, pulling the cotyledons above ground. The examples of seeds that germinate this way are:

- Beans
- Cotton
- Papaya

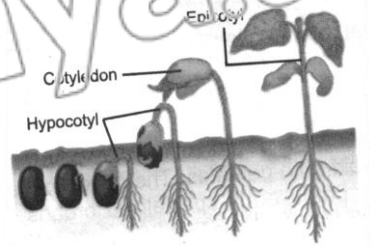

Figure: Epigeal Germination

Hypogeal Germination:

In hypogeal germination, the **epicotyl elongates** and forms the hook. In this type of germination, the cotyledons stay underground. The examples of seeds that germinate this way are:

- Pea
- Maize
- Coconut

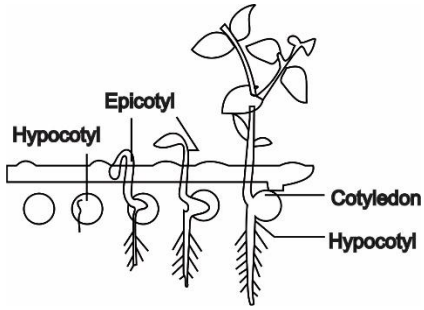

Figure: Hypogeal Germination

CONDITIONS FOR SEED GERMINATION

Seed germination depends on both internal and external conditions.

Internal Conditions:

The internal conditions include:

- A live embryo
- Sufficient food storage

External Conditions:

The most important external conditions include:

- Water
- Oxygen
- Favorable temperature

Water (Moisture):

Seeds of most plants have low water content, and germination cannot occur until seed coat or other tissues have **imbibed (taken in) water**. The absorbed water is used in the digestion of the stored food and it also helps in elongation of hypocotyl and epicotyl.

Oxygen:

Oxygen is essential for the respiration in the cells of embryo.

Temperature:

Seeds differ greatly in their temperature requirements for germination. The **optimum temperature** for the germination of the seeds of most plants ranges from **25-30^{o}C.**

Light:

Germination of seeds of many plants is also favoured by light. In other plants, germination is retarded by light.

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14.3 SHORT QUESTIONS

Q.1 What are the major groups of plants and what are seed plants? (K.B) **(LHR 2015)**

Ans:

SEXUAL REPRODUCTION IN PLANTS

Definition:

"Sexual reproduction involves the production of gametes (sperms and egg cells) and their fusion i.e. fertilization".

Explanation:

The gametes are produced in special structures in plant body. The major plant groups are mosses, ferns and seed plants. The seed plants include gymnosperms and angiosperms (flowering plants).

Methods:

Plant groups use different methods for bringing the sperm and egg cell together.

- In mosses and ferns sperms are motile and can swim to egg cells. Therefore, these plants require water (in the form of few or rain) for sexual reproduction.
- On the other hand, gymnosperms and angiosperms have special methods for carrying their sperms to egg cells. They do not need water for reproduction.

Q.2 How many types of seed plants (spermatophytes) are present? (K.B)

Ans: There are two types of seed plants based upon the nature of their seed production i.e.

- Gymnosperms (Cones bearing)
- Angiosperms (flowering plants).

Q.3 How plant groups use different method for bringing the sperm and eggs together? (U.B)

Ans:

FERTILIZATION IN PLANTS

- In mosses and ferns, sperms are motile and can swim to egg cells. Therefore, these plants required water (in the form of dew as rain) for sexual reproduction.
- On the other hand, the gymnosperms and angiosperms have special method for carrying their sperm to egg cells. They do not need water for reproduction wind and insects are the source.

Q.4 Enlist the different methods of fertilization in plants. (K.B)

Ans: Plant groups use different methods for bringing the sperm and egg cells together.

Fertilization due to water:

In mosses and ferns sperms are motile and can swim to egg cells. Therefore, these plants require water (in the form of dew or rain) for sexual reproduction.

Fertilization due to air:

Gymnosperms and angiosperms have special methods for carrying their sperms to egg cells. They do not need water for reproduction.

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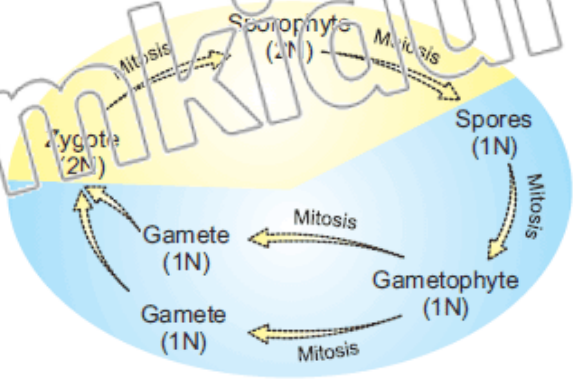
Q.5 What is meant by Alternation of generation in plants. (K.B)

Ans: The phenomenon in which a diploid sporophyte generation alternates with haploid gametophyte generation during life cycle in plants is known as alternation of generations.



Q.6 What are whorls? (K.B)

Ans: Page no 135.

Q.7 Define the term calyx and corolla? (K.B) **(LHR 2015)**

Ans: Page no 135.

Q.8 What is the contribution of Theophrasthus? (K.B)

Ans:

CONTRIBUTION OF THEOPHRASTHUS

Theophrastus (the successor of Aristotle) was a Greek philosopher. He laid a solid foundation of botany including the morphology and functions of the flowers. He recognized the male and female sex parts of the flowers and described the pollination and fertilization in flower.

Q.9 Define the term double fertilization. (K.B) **(GRW 2016, 17)**

Ans: Page no 137.

Q.10 Define pollination. Write its types? (K.B) **(SWL 2015)**

Ans: Page no 138.

Q.11 Define self-pollination. (K.B)

OR

Differentiate between self-pollination and cross pollination (K.B) **(LHR 2016)**

Ans:

DIFFERENTIATION

The difference between self pollination and cross pollination is as follows:

Self-Pollination	Cross Pollination
• It is the transfer of pollen grains from anther to the stigma of the same flower or other of flower of the same plant.	• It is the transfer of pollen grains from the flower on one plant to the flower on other plant of the same species. Cross pollination is brought about by various agencies like wind water, bees, birds, bats and other animals including man.

Q.12 Define the term parthenocarpy. (K.B)

Ans:

PARTHENOCARPY

Definition:

"In some plants, ovaries develop into fruit without the fertilization inside the ovary. This process is known as parthenocarpy and it results in seedless fruits".

- Bananas
- Seedless varieties of grapes

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Q.13 What are the parts of angiospermic seed? (K.B)
Ans: Page no 139.
Q.14 What is a seed coat or testa? (K.B)
Ans: Page no 139.
Q.15 Write the functions of radical and plumule. (A.B)
Ans: Page no 140.
Q.16 Define the term epicotyl and hypocotyls. (K.B)
Ans: Page no 140.
Q.17 Define seed dormancy. (U.B)

OR

What is the dormancy? (U.B) **(LHR 2016, GRW 2017)**

Ans:

ANGIOSPERMIC SEED

Angiosperm seeds consist of three distinct parts:

a. The embryo formed from zygote.
b. The endosperm tissue formed from endosperm nucleus.
c. The seed coat which develops from the wall of ovule (integument).

Q.18 What is epigeal germination? Give examples. (K.B) **(LHR 2017, GRW 2016, 17, MTN 2015)**
Ans: Page no 141.
Q.19 What is hypogeal germination? Give examples. (K.B) **(MTN 2015, GRW 2016, LHR 2017)**
Ans: Page no 141.
Q.20 What is the future of ovule and ovary after fertilization in flower? (K.B)
Ans: Page no 141.
Q.21 Write importance of seed evolution in plants life. (A.B)
Ans: Page no 141.

14.3 MULTIPLE CHOICE QUESTIONS

1. Fertilization of gametes in water, a characteristic relates to (U.B)
(A) Spermatophytes (B) Gymnosperms
(C) Angiosperms (D) Mosses & ferns

2. Which of the following generation is dominant in seed producing plants? (U.B)
(A) Diploid gametophyte (B) Haploid sporophyte
(C) Diploid sporophyte (D) Haploid gametophyte

3. Gametes in angiosperms are produced by (K.B)
(A) Mitosis (B) Meiosis
(C) Fragmentation (D) Budding

4. Major plant groups involve (K.B)
(A) Ferns (B) Mosses
(C) Seed plants (spermatophytes) (D) All of these

5. Number of major plant groups. (K.B)
(A) 1 (B) 2
(C) 3 (D) 4

6. Sporophyte generation in plant life cycle: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

7. Gametophyte generation in plant life cycle: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

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8. Male and female gametes fuse to form: (K.B)
(A) Ovum (B) Zygote
(C) Embryo (D) Faetus

9. The male reproductive part of flower is: (K.B) **(MTN 2015)**
(A) Stigma (B) Stamen
(C) Ovary (D) Carpel

10. How many floral whorls are present in a complete flower? (K.B)
(A) 2 (B) 4
(C) 6 (D) 8

11. The outermost whorl flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

12. The leaflets of calyx are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

13. The second whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

14. The leaflets of corolla are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

15. The third whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

16. Fourth whorl of flower is: (K.B) **(LHR 2015)**
(A) Calyx (B) Corolla
(C) Androecium (D) Gynoecium

17. The units of androecium are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

18. The innermost whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

19. The units of gynoecium are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

20. Is diploid (2N): (U.B) **(BWP 2014)**
(A) Zygote (B) Sperm
(C) Egg cell (D) Endospore

21. Stamen consists of: (K.B)
(A) Anther (B) Filament
(C) Anther, Filament (D) Stigma

22. Carpel consists of: (K.B)
(A) Stigma (B) Style
(C) Ovary (D) Stigma, style, ovary

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23. The egg cell is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

24. The sperm is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

25. Pollen grains are produced in anther of flower by_____. (K.B) **(LHR 2014)**
(A) Meiosis (B) Mitosis
(C) Binary fission (D) Multiple fission

26. The endosperm is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

27. Which structure is present inside the ovary of the carpel? (K.B)
(A) Anther (B) Style
(C) Stigma (D) Ovule

28. The ovule develops into: (K.B)
(A) Seed (B) Fruit
(C) Flower (D) Sporophyte

29. The wall of ovary develops into: (K.B)
(A) Seed coat (B) Fruit
(C) Flower (D) Stem

30. Pollination means transfer of pollen grain from anther to_____. (K.B) **(GRW 2013)**
(A) Style (B) Stigma
(C) Filament (D) Ovary

31. The fusion nucleus is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

32. The flowers producing nectar are pollinated by: (K.B)
(A) Wind (B) Water
(C) Insects (D) None of these

33. How many distinct parts are present in an angiosperm seed? (K.B)
(A) 7 (B) 5
(C) 3 (D) 11

34. Point of attachment of seed with the ovary wall: (K.B)
(A) Seed coat (B) Epicotyl
(C) Hypcotyl (D) Hilum

35. Microspore of plant is also termed as: (K.B)
(A) Pollen grain (B) Pollen tube
(C) Germs nucleus (D) Mega spore

36. Which of the following is an example of epigeal germination. (K.B)
(A) Beans (B) Cotton
(C) Papaya (D) All of these

37. A type of germination, the epicotyl elongates and forms the hook, called (K.B)
(A) Epigeal germinatio (B) Hypogeal germination
(C) Both A&B (D) Dormancy

38. A period in seed of no growth is called (K.B)
(A) Dormancy (B) Dominancy
(C) Germination (D) Fertilization

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39. Seed absorbs water through: (K.B) **(LHR 2017)**
(A) Testa (B) Hilum
(C) Micropyle (D) Cornea

40. The root is formed the part of the embryo: (K.B) **(GRW 2017)**
(A) Hilum (B) Radical
(C) Plumnle (D) Epicotyl

41. There is a scar on seed coat under the seed is attached to ovary wall is called: (K.B) **(GRW 2016)**
(A) Radical (B) Hilum
(C) Plumule (D) Apcotyl

42. Is not a part of carpel: (K.B) **(LHR 2016)**
(A) Ovary (B) Anther
(C) Sigma (D) Style

43. Calyx is the outermost whorl of the flower bears the colour: (U.B) **(LHR 2016)**
(A) Red (B) Green
(C) Blue (D) White

44. Ovary is ripened into: (K.B) **(LHR 2016)**
(A) Seed (B) flower
(C) Fruit (D) Sweetness

45. In some plants, ovaries develop into fruits without the fertilization inside their ovules. (K.B)
(A) Lemon (B) Oranges
(C) Bananas (D) Peach

46. The embryonic stem above the point of attachment of cotyledon's is called: (K.B)
(A) Hypocotyls (B) Epicotyls
(C) Endosperm (D) Radical

47. The plant in which vegetative propagation occurs by leaves is: (K.B)
(A) Garlic (B) Ginger
(C) Potato (D) Bryophyllum

14.4 SEXUAL REPRODUCTION IN ANIMALS

LONG QUESTIONS

Q.1 Write a note on gametogenesis in animals. (K.B) **(GRW 2013, 2015)**

OR

Describe the processes of spermatogenesis and oogenesis. (K.B)
(Understanding the Concept Q.7)

Ans:

GAMETOGENESIS

Definition:

"The formation of gametes is called gametogenesis".

In this process, diploid (2N) **gamete-mother cells** undergo meiosis and form haploid (1N) gametes.

Gonads:

"The **male gametes** (sperms) and **female gametes** (egg cells or ova) are produced in specialized organs called **gonads**".

- Male gonads are called testes. The singular of testes is testis.
- Female gonads are called ovaries.

Spermatogenesis:

"The process of **production of sperms in testes** is called spermatogenesis".

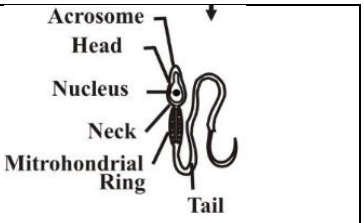

Figure: Structure of sperm

Spermatogonia:

Some cells present in the walls of the **seminiferous tubules** of testes divide repeatedly by mitosis to form large number of diploid **spermatogonia.**

Primary Spermatocyte:

Some spermatogonia produce **primary spermatocytes**

Secondary Spermatocyte:

Each primary spermatocyte undergoes meiosis-I and produces two haploid daughter cells called secondary spermatocytes.

Spermatids:

These cells undergo meiosis-II. In this way four haploid spermatids are produced from each primary spermatocyte. The **spermatids are non-motile** and many changes occur in them to **convert them into motile** cells.

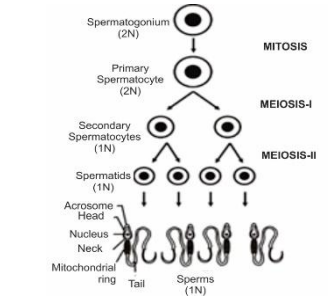

Figure: Spermatogenesis

Sperms:

Nuclei of spermatids shrink and the following structures are formed:

- A corner called acrosome
- A tail
- A mitochondrial ring

After these changes, the spermatids are called sperms.

Oogenesis:

"The process of production of egg cells in ovaries is called oogenesis".

Explanation:

Some cells of ovary prepare structures called **follicles**, in which many diploid **oogonia** are present. Some oogonia produce diploid **primary oocytes**.

Meiosis-I:

One of the primary oocytes completes meiosis-l and produces two haploid cells. The smaller cell is called first **polar body** and the larger one is called secondary oocyte.

Meiosis-II:

The secondary oocyte completes meiosis-II and produces two haploid cells i.e. a second polar body and an egg cell.

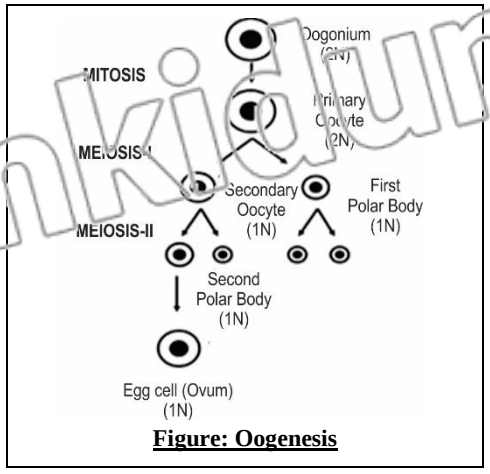

Figure: Oogenesis

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Q.2 Define fertilization. Explain its mechanism. (K.B) **(SWL 2015)**

OR

What do you know about external and internal fertilization (U.B) **(GRW 2017)**

Ans:

FERTILIZATION

Definition:

"The **fusion of male gamete** (sperm) and **female gamete** (egg or ovum) to form diploid zygote is called fertilization".

After the formation of gametes, fertilization occurs.

Mechanism of Fertilization:

There are two mechanisms by which fertilization can take place:

- External Fertilization
- Internal Fertilization

External Fertilization:

In external fertilization, egg cells are **fertilized outside of body**. External fertilization occurs mostly in aquatic environment.

Release of Gametes:

It requires both the male and the female animals to **release their gametes into their surroundings at almost the same time.** For external fertilization, the animals have to release great number of gametes.

Disadvantage:

In external fertilization, there **is risk of loss of gametes** due to environmental hazards such as predators.

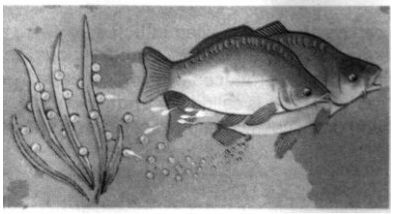

Figure: External Fertilization in Fish

Examples:

External fertilization occurs in many invertebrates and the first two groups of vertebrates:

- Fishes
- Amphibians

Internal Fertilization: **(DGK 2015)**

In internal fertilization, egg cells are **fertilized within the reproductive tract of female.** Such animals provide protection to the developing embryo.

Examples:

It occurs in:

- Reptiles
- Birds
- Mammals

In Reptiles and Birds:

After fertilization, reptiles and birds make protective shells around their egg cells and then lay them. The shell is resistant to water loss and damage.

In Mammals:

In mammals (with the exception of egg-laying mammals) the development of **fertilized egg** into new baby takes place **within mother body.** In this case, there is extra protection to the embryo and mother also supplies everything that embryo needs.

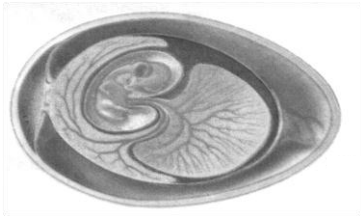

Figure: Reptiles and Bird's Egg provides Protection and Food to Embryo

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Q.3 Describe male reproductive system of rabbit. (K.B)

OR

Describe female reproductive system of rabbit. (K.B)(LHR 2015, GRW 2014, 2015, 3 WP 2015)

OR

Write a note on the male and female reproductive systems of rabbit (K.B)

(Understanding the Concept Q.6)

Ans:

MALE REPRODUCTIVE SYSTEM OF RABBIT

Introduction:

Rabbits are small mammals found in several parts of the world. They are used in research as experimental animals

Parts:

The male reproductive system of rabbit consists of:

- A pair of testes that produce sperms
- The associated ducts that transport sperms to external genitalia and glands that add secretions to sperms

Rabbits reingest their own pallet-like faeces to digest their food further and extract sufficient nutrients.

Scrotum:

Testes are located in a bag of skin called the scrotum that hangs below the body.

Seminiferous Tubules:

Each testis consists of a **mass of coiled tubes** called the **seminiferous tubules.** In these tubules, the **sperms are formed.**

Epididimis:

When **sperm are mature**, they **accumulate** in the **collecting ducts** of testes and then **pass to epididimis.**

Vas Deferens:

From epididimis, sperms move to a **sperm** duct called vas **deferens.**

Sperm Duct:

Both **sperm ducts** join urethra just below urinary bladder.

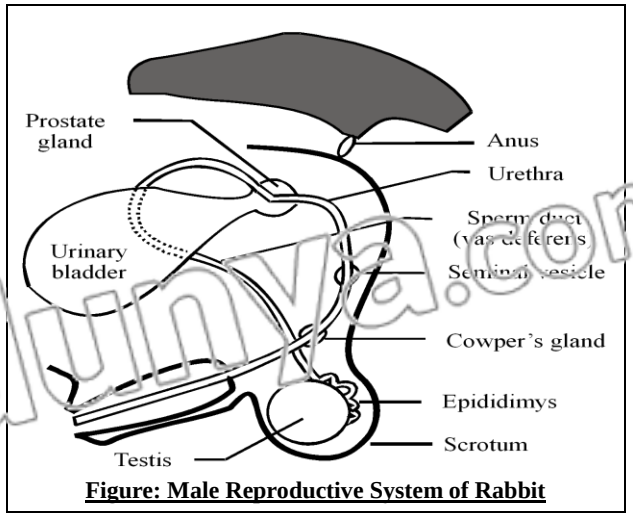

Figure: Male Reproductive System of Rabbit

Urethra:

The urethra **transports** both **sperm and urine.**

Semen:

Semen is the **material containing sperms** in a fluid. It consists of **10% sperms** and **90% fluid.**

Associated Glands:

As the sperms pass down the ducts from testes to urethra, the **associated glands** add various **secretions**

Seminal Vesicles:

Seminal vesicles produce **secretions** that provide **nutrients for sperms.**

Prostate Gland:

Prostate gland **produces** a secretion that **neutralizes the acidity of the fluid.**

Cowper's Glands:

Cowper's glands **produce** secretions that **lubricate the ducts.**

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FEMALE REPRODUCTIVE SYSTEM OF RABBIT

Introduction:

Rabbits are **small mammals** found in several parts of the world. They are used in research as experimental animals.

Parts:

The female reproductive system of rabbit consists of **ovaries** and **associated ducts.**

Ovaries:

Ovaries are **small oval organs** situated in **abdominal cavity** just **ventral to kidneys.** Like most animals, female rabbits have a **pair of ovaries.** The **outer region** of **ovary** produces **egg cells.**

Follicles:

A **cluster of specialized** cells called **follicle** surrounds and **nourishes** each egg cell. From ovaries, egg cells are released in **fallopian tubes.**

Fallopian Tube:

The **opening** of fallopian tube lies close to ovary. **Fertilization** occurs in **fallopian tubes.**

Uterus:

The **fertilized egg** (zygote) is carried to uterus. The uterus of rabbit is divided into two **separate parts or horns**.

Birth Canal:

The uterus horns join and open into vagina or **birth canal.**

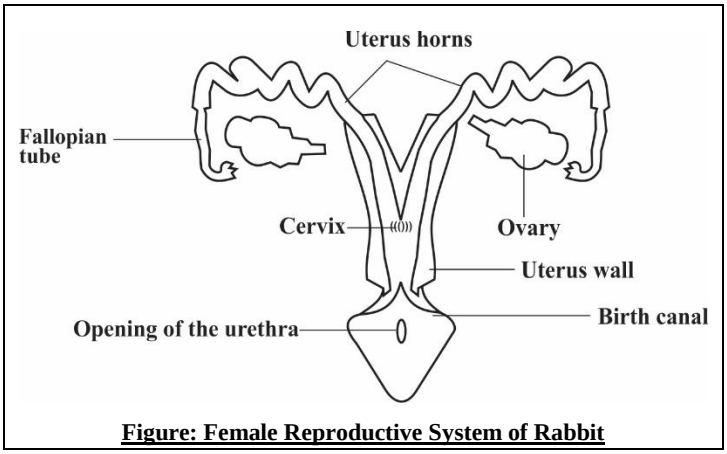

Figure: Female Reproductive System of Rabbit

Cervix:

Cervix is the **portion** of uterus, which **separates** it from **birth canal**, where **sperms of male are deposited.**

Q.4 Describe fertilization and development in rabbit. (K.B)

Ans:

FERTILIZATION AND DEVELOPMENT IN RABBIT

Definition:

"The **fusion of male gamete** (sperm) and **female gamete** (egg or ovum) to **form diploid zygote** is called fertilization".

After the **formation of gametes**, fertilization occurs.

Mechanism:

Rabbits can **breed throughout** the year but **male rabbits** are commonly **sterile** during the summer months. Male rabbit deposits its **sperms** in the vagina (birth canal) of female.

Sperms swim through **cervix** and uterus to **fallopian tubes** where they **fertilize** the **egg cells**, released from **ovary**.

Embryo Formation:

After fertilization, **zygote** is carried to **uterus**. By this time, the zygote has **started dividing** and is now called **embryo**.

Placenta:

The embryo is **implanted** in **uterus walls**. A connection, called **placenta**, is established between embryo and **uterus wall**.

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Gestation Period:

Embryo develops into **new offspring** (rabbit kit) in **30-32 days**, after which it is born.

Q.5 Discuss growth in human population and its consequences. (U.B)

OR

Why do we consider that overpopulation is a global problem? (U.B)

(Understanding the Concept Q.8)

Ans:

GROWTH IN HUMAN POPULATION

Population Growth:

Pakistan's population in the year 2014-2015 was 189,000,000. By the end of this **decade**, our population is **expected** to **exceed 200 million**. Pakistan's population had a **relatively high** growth rate in past.

Overpopulation:

When population **growth exceeds** the carrying capacity of an area or **environment**, it results in **overpopulation**.

CONSEQUENCES OF OVERPOPULATION

Many **problems are associated** with human overpopulation are as follows:

Shortage of Resources:

The overpopulated areas **face severe shortage** of **fresh water** and **natural resources**.

Loss of Ecosystems:

Overpopulation results in **deforestation** and **loss of ecosystems**.

Pollution:

It leads to **more pollution** and **global warming**.

Mortality Rate:

There is high infant and **child mortality rate** in **overpopulated** areas due to poverty.

Increased Demands:

Overpopulation raises demands for more:

- **Housing units**
- **Hospitals**
- **Jobs**
- **Educational institutions**
- **Food crops**

Logo of Organization Working for Awareness of Overpopulation

Control of Overpopulation:

The overpopulation should be **checked** otherwise we will have to **face huge problems** because of **our limited resources.**

Education:

People should be educated about the problems of overpopulation.

Role of Ministry of Population Welfare:

Pakistan's Ministry of Population Welfare has taken a number of steps to make people **aware** of the **hazards of overpopulation** and to **stabilize** the **population** to match our resource:

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Q.6 Write a note on AIDS. (K.B) **(BWP 2015, LHR 2016)**

Ans:

AIDS

Sexually Transmitted Diseases (STDs):

"The diseases that are **transmitted** through **sexual act** are called **sexually transmitted diseases**".

- The most serious and challenging health problem faced by the world today is AIDS.
- It is also a sexually transmitted disease.

According to the United nations Programme on AIDS i.e. UNAIDS estimates, some 70,000 to 80,000 persons, or 0.1 percent of the adult population in Pakistan, are infected with HIV.

Causative Agent:

It is caused by **Human Immuno Deficiency Virus** (HIV)

Mode of Action:

The virus destroys **white blood** cells, which results in loss of **resistance** against **infections**.

Fatal Disease:

It is a **fatal disease**.

Spread of Disease:

It spreads through **transfer of body fluids** such as **blood and semen**.

Causes:

The main causes are:

- **Unprotected sexual activities**
- **Use of infected needles**
- **Transfusion of infected blood**

Q.7 Describe the role of national AIDS control programme (NACP) and NGOs. (A.B)

Ans:

ROLE OF (NACP)

Introduction:

Pakistan's Federal Ministry of Health established **NACP** in **1987**.

Objective:

The **main objective** of this program is to **help the public** for the **prevention of HIV** transmission, **safe blood transfusions** and **reduction of STDs**.

Risk Factors:

The **frequency of HIV** infection in Pakistan is **still low**. But, the country is at risk of epidemic due to various **risk factors**:

- **Exposure to infected blood or blood products**
- **Homo-sexuality**
- **Injecting drug users**

Campaign:

For improved prevention by the general public, the **NACP** started services through **TV** and **radio channels** and **print media** in **2005**. The objectives of this activity were to:

- **Change public attitude** for safe sexual activities
- Create **demand** for **information on HIV and AIDS**
- Improve attitudes and behavior among healthcare workers

ROLE OF NON-GOVERNMENT ORGANIZATIONS

According to the latest data by the **World Bank**, at **least 54 NGOs** are working in Pakistan for **HIV/AIDS** public **awareness** and for the care and support of persons living with **HIV/AIDS.**

- These **NGOs** also work on **AIDS education** and **prevention for sex workers** and other **high-risk groups**.
- NGOs serve as members of the provincial consortium on HIV/AIDS, which has been set up in all the provinces of Pakistan.

Limitation of NGOs:

Although NGOs are very busy in HIV/AIDS prevention activities, it is believed that they are reaching less than 5 percent of the **vulnerable population**.

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14.4 SHORT QUESTIONS

Q.1 Define the term gametogenesis. (K.B)
Ans: Page no 147.
Q.2 What are gonads? (K.B)
Ans: Page no 147.
Q.3 Define the term spermatogenesis and oogenesis. (K.B)
OR
Differentiation between spermatogenesis and oogenesis. (K.B) **(LHR 2017, GRW 2016,17)**
Ans: Page no 148.
Q.4 What is semen? (K.B)
Ans: Page no 150.
Q.5 What are three associated glands in male reproductive system of rabbit? (K.B)
Ans: Page no 150.
Q.6 Define the terms embryo and placenta. (K.B)
Ans: Page no 151.
Q.7 Define the term STD. (K.B)
Ans: Page no 153.
Q.8 What is AIDS? (K.B) **(LHR 2013)**
Ans: Page no 153.
Q.9 What is UNFPA? (K.B)
Ans:

UNFPA

UNEPA (United Nations Population Fund) began operation in 1969. It is largest international organization funding for population and health programmes. The UNEPA works in over 140 countries, for awareness about the consequences of over population.

Q.10 Write the number of drug addicts in Pakistan currently. (K.B)
Ans:

NUMBER OF DRUG ADDICTS IN PAKISTAN

The number of drug addicts in Pakistan is currently estimated to be about 500,000, of whom 60,000 inject drugs.

14.4 MULTIPLE CHOICE QUESTIONS

1. Formation of gametes is called: (K.B) **(BWP 2014)**
(A) Spermatogenesis (B) Oogenesis
(C) Gametogenesis (D) Sporogenesis

2. Sperm consists of: (K.B)
(A) Mitochondrial ring (B) Acrosome
(C) Tail (D) Mitochondrial ring, Acrosome and a Tail

3. The spermatids develop into: (K.B)
(A) Primary spermatocytes (B) Secondary spermatocytes
(C) Spermatogonia (D) Sperms

4. Oogonia are produced in: (K.B)
(A) Testes (B) Follicles
(C) Polar bodies (D) Tube nucleus

5. The process after gamete formation: (U.B)
(A) Fertilization (B) Development
(C) Growth (D) Birth

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6. Testes are present in a bag of skin called: (K.B)

(A) Semen (B) Prostate

(C) Vesicle (D) Scrotum

7. Which produce the secretion that neutralizes the acidity of the semen? (K.B)

(A) Cowper's gland (B) Seminal vesicle

(C) Prostate gland (D) Epididimys

8. The sperm duct is called: (K.B)

(A) Vas deferens (B) Seminal vesicle

(C) Prostate gland (D) Epididimys

9. In which of the following animals groups, external fertilization takes place: (K.B) **(LHR 2014)**

(A) Reptiles (B) Amphibians

(C) Birds (D) Mammals

10. Normally external fertilization occurs in: (U.B) **(LHR 2015)**

(A) In the body (B) Air

(C) Water (D) Air, Water, In the body.

11. Internal fertilization occurs in: (U.B)

(A) Uterus (B) Fallopian tube

(C) Vagina (D) Cervix

12. After fertilization the zygote is carried to: (K.B)

(A) Uterus (B) Fallopian tube

(C) Vagina (D) Cervix

13. Gestation period of rabbits: (K.B)

(A) 20-30 days (B) 25-30 days

(C) 20-35 days (D) 30-32 days

14. The UNFPA works in how many countries? (A.B)

(A) 110 (B) 120

(C) 130 (D) 140

15. The number of drug addicts in Pakistan is currently estimated to be about 500,000 of whom _____ in inject drugs. (A.B)

(A) 50,000 (B) 30,000

(C) 60,000 (D) 45,000

16. In animals process reproduction without fertilization is called: (K.B) **(GRW 2016)**

(A) Parthennocarpy (B) Parthenogenesis

(C) Tissue culture (D) Fission

17. The material combining sperms in a fluid is called: (K.B) **(GRW 2017)**

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(A) Vas deferns (B) Uterus
(C) Cervix (D) Semens

18. According to united nations program on AIDS, UNAIDS estimates _____ % of the adult population in Pakistan are infected with HIV: (A.B)
(A) 0.3 % (B) 0.1 %
(C) 0.2 % (D) 0.4 %

19. Pakistan population, by the end of this decade is expected to exceed: (U.B)
(A) 170 million (B) 175 million
(C) 176 million (D) 200 million

20. Each testis consists of a mass of coiled tubes called: (K.B)
(A) Epidermis (B) Collecting duet
(C) Seminiferous tubules (D) Urethra

21. In external fertilization, there is risk of loss of gametes due to environmental hazards such as: (K.B)
(A) Prey (B) Predator
(C) Consumers (D) Epiphytes

22. Sperms and fluid collectively called: (K.B) **(LHR 2014)**
(A) Hormones (B) Follicle
(C) Semen (D) Scrotum

23. Some cells present in the walls of the seminiferous tubules of testes divide repeatedly by mitosis to form large number of diploid: (K.B)
(A) Primary spermatocytes (B) Secondary spermatocytes
(C) Spermatogonia (D) Sperms

24. The male and females gametes (sperm, egg cells) are produced in specialized organs called: (K.B)
(A) Oogoniea (B) Spermatogonia
(C) Gonads (D) Polar body

25. Semen in rabbit contains _____ sperms: (K.B) **(LHR 2015)**
(A) 5% (B) 10%
(C) 90% (D) 50%

26. _____ is essential for the respiration in the cells of embryo. (K.B)
(A) Nitrogen (B) Carbon
(C) Oxygen (D) Sulphur

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

14.1 REPRODUCTION

14.2 METHODS OF ASEXUAL REPRODUCTION

1	D	**2**	C	**3**	B	**4**	C	**5**	D	**6**	A
7	C	**8**	A	**9**	B	**10**	A	**11**	C	**12**	A
13	B	**14**	C	**15**	B	**16**	D	**17**	C	**18**	D
19	C	**20**	B	**21**	D	**22**	C	**23**	A	**24**	C
25	C	**26**	B	**27**	A	28	B	29	C	30	A
31	D	**32**	D	**33**	B	34	B	35	B		

14.3 SEXUAL REPRODUCTION IN PLANTS

1	D	**2**	C	**3**	B	**4**	D	**5**	B	**6**	B
7	A	**8**	B	**9**	B	**10**	B	**11**	A	**12**	B
13	D	**14**	A	**15**	B	**16**	B	**17**	C	**18**	C
19	D	**20**	A	**21**	C	**22**	D	**23**	A	**24**	A
25	A	**26**	C	**27**	D	**28**	A	**29**	B	**30**	B
31	B	**32**	C	**33**	C	**34**	D	**35**	A	**36**	D
37	B	**38**	B	**39**	C	**40**	B	41	B	42	B
43	B	**44**	C	**45**	C	**46**	B	47	D		

14.4 SEXUAL REPRODUCTION IN ANIMALS

1	C	**2**	D	**3**	D	**4**	B	**5**	A	**6**	D	**7**	C
8	A	**9**	B	**10**	C	**11**	B	**12**	B	**13**	D	**14**	D
15	C	**16**	B	**17**	D	**18**	B	**19**	D	**20**	C	**21**	B
22	C	**23**	C	**24**	C	**25**	B	**26**	C				

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Growing an entire new plant from part of the original plant is called: (K.B)
(a) Budding (b) Regeneration
(c) Fragmentation (d) Vegetative propagation

2. Rhizopus reproduces asexually by: (K.B)
(a) Binary fission (b) Budding
(c) Spore formation (d) Endospore formation

3. A corm develops into new garlic plant. This is the process of: (U.B) **(GRW 2016)**
(a) Vegetative propagation (b) Regeneration
(c) Meiosis (d) Gametogenesis

4. Which is not an advantage of grafting? (K.B)
(a) The graft is identical to the parent plant
(b) Grafting allows the propagation of seedless fruits
(c) The graft combines the characteristics of two plants
(d) Grafting may allow for the faster production of desirable fruits

5. Pollination is the transfer of pollens from: (K.B)
(a) Anther to stigma (b) Stigma to anther
(c) Sepal to petal (d) Petal to sepal

6. Double fertilization in plants means: (K.B)
(a) Fusion of two sperms with two egg cells
(b) Fusion of one sperm with egg cell and other sperm with fusion nucleus
(c) Fusion of two sperms with a single egg cell
(d) Fusion of tube nucleus with fusion nucleus and sperm with egg cell

7. After fertilization in plants, the fruit develops from: (K.B)
(a) Ovule wall (b) Ovary wall
(c) Petals (d) Anther

8. Which part of the female reproductive system receives egg cells from the ovary? (K.B)
(a) Fallopian tube (b) Uterus
(c) Vagina (d) Cervix

9. Inside testes, the sperms are produced in: (K.B)
(a) Vas deferens (d) Sperm duct
(c) Seminiferous tubules (d) Collecting ducts

10. Which of these cells has haploid number of chromosomes? (K.B)
(a) Spermatogonium (b) Primary spermatocyte
(c) Secondary spermatocyte (d) AII of these

ANSWER KEY

1	d	2	c	3	a	4	a	5	a
6	b	7	b	8	a	9	c	10	c

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SHORT QUESTIONS

1. How are the natural and artificial vegetative propagations different from the methods of asexual reproduction in plants? (U.B)

Ans: **NATURAL AND ARTIFICIAL VEGETATIVE PROPAGATIONS**

When vegetative parts of plants i.e. roots, stems or leaves give rise to new plants the process is called vegetative reproduction or vegetative propagation. It occurs naturally, and can also be brought about artificially.

2. Why do gardeners use the methods of cutting and grafting? (K.B)

Ans: **METHODS OF CUTTING AND GRAFTING**

Gardeners use the methods of cutting of grafting because of the following reasons:

- To produced many plants from single plant.
- To get desirable traits.
- To get more fruits and flowers.

3. "Parthenogenesis is a type of asexual reproduction". Give comments on this statement. (K.B)

Ans: **PARTHENOGENESIS**

Parthenogenesis is a type of asexual reproduction because an unfertilized egg develops into new offspring. Some fishes, frogs and insects reproduce by means of parthenogenesis.

4. Outline the life cycle of a flowering plant. (K.B)

Ans: **LIFE CYCLE OF A FLOWERING PLANT**

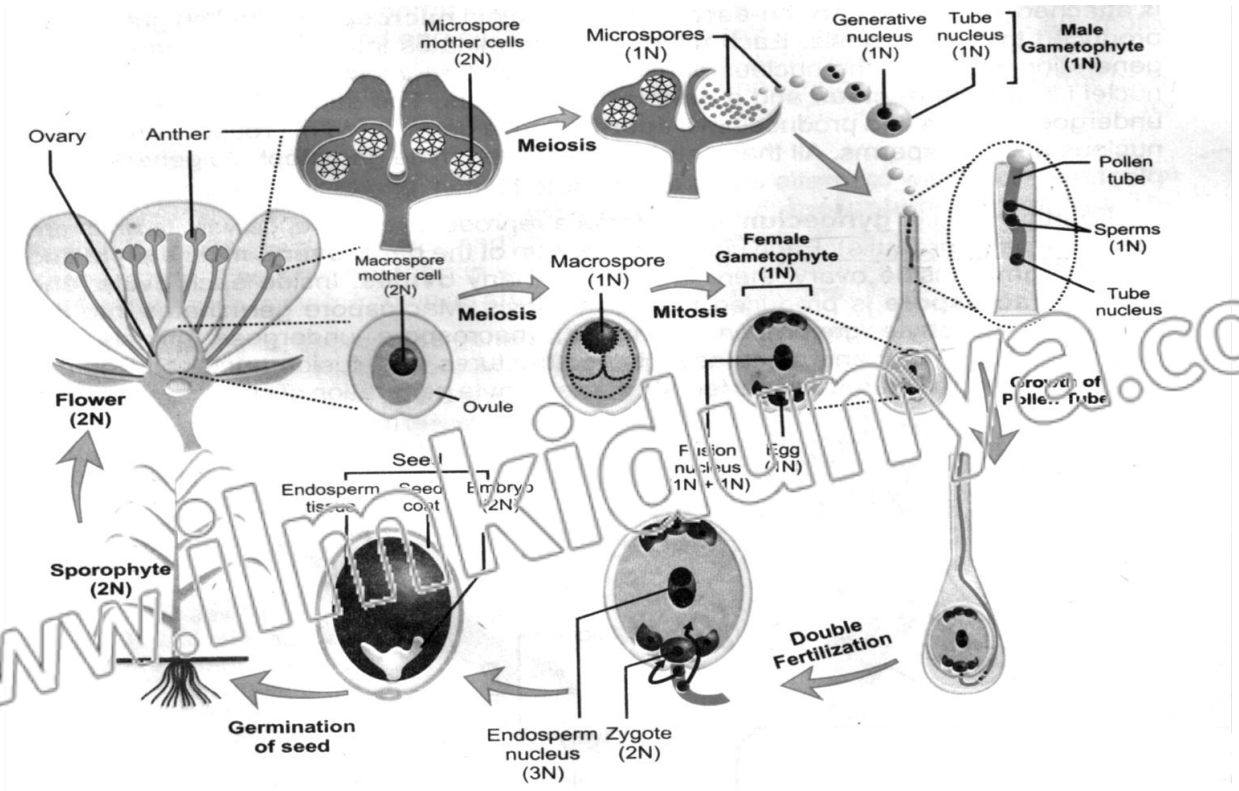

Fig: Life Cycle of A Flowering Plant

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5. What structural adaptations will you find in a wind-pollinated flower? (K.B)

Ans:

ADAPTATIONS

The insect pollinated and wind pollinated flowers have structural adaptations that facilitate the transfer of pollen grains between two plants. Some of these adaptions are described here:

Structural Feature	Wind Pollinated Flowers
Size	Generally small
Colour	Petals green or dull in colour
Nectar	Do not produce nectar
Floral Arrangement	Flowers hang down for easy shaking
Stamens and Stigmas	Hang out of ring of petals
Pollen Grains	Large number produced / light with smooth surface
Stigma	Feathery branches for catching pollen
Examples	• Grasses • Hazel • Willow • Corn

6. Give an introduction of Pakistan's National AIDS Control Program. (K.B)

Ans:

PAKISTAN'S NATIONAL AIDS CONTROL PROGRAM

Introduction:

Pakistan's Federal Ministry of Health established NACP in 1987.

Objective:

The main objective of this program is to help the public for the prevention of HIV transmission, safe blood transfusions and reduction of STDs.

UNDERSTANDING THE CONCEPT

1. What are the different ways by which prokaryotes, protozoans and fungi reproduce asexually? (K.B)

Ans: See LQ. 1 (Topic 14.1,14.2)

2. Explain the different parts of the plant that help in natural vegetative propagation. (U.B)

Ans: See LQ.8 (Topic 14.1)

3. Explain, how the epigeal and hypogeal germinations are different? (K.B)

Ans: See LQ.8 (Topic 14.3)

4. What conditions are necessary for the germination of seeds? (K.B)

Ans: See LQ.8 (Topic 14.3)

5. Outline the methods of asexual reproduction in animals. (K.B)

Ans: See LQ. (Topic 14.1, 14.2)

6. Write a note on the male and female reproductive systems of rabbit. (K.B)

Ans: See LQ.3, LQ.4 (Topic 14.4)

7. Describe the processes of spermatogenesis and oogenesis. (K.B)

Ans: See LQ.1 (topic 14.4)

8. Why do we consider that overpopulation is a global problem? (U.B)

Ans: See LQ.6 (topic 14.4)

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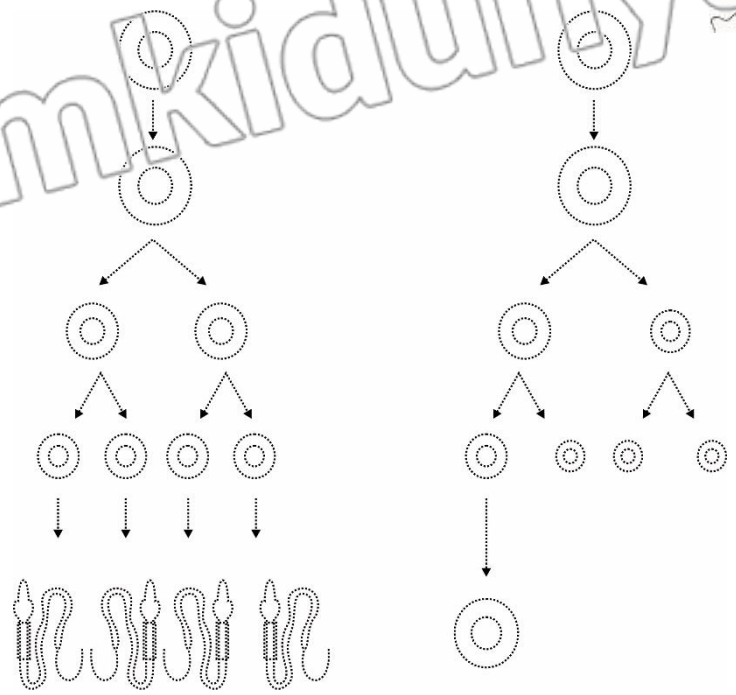
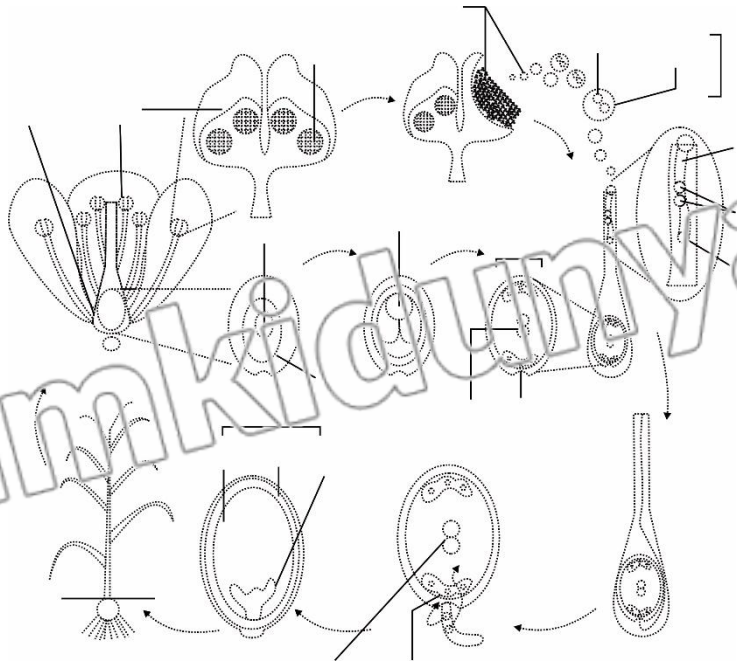
ASSIGNMENT

PRACTICE DIAGRAM & LABEL

SPERMATOGENESIS **OOGENESIS**



LIFE CYCLE OF A FLOWERING PLANT



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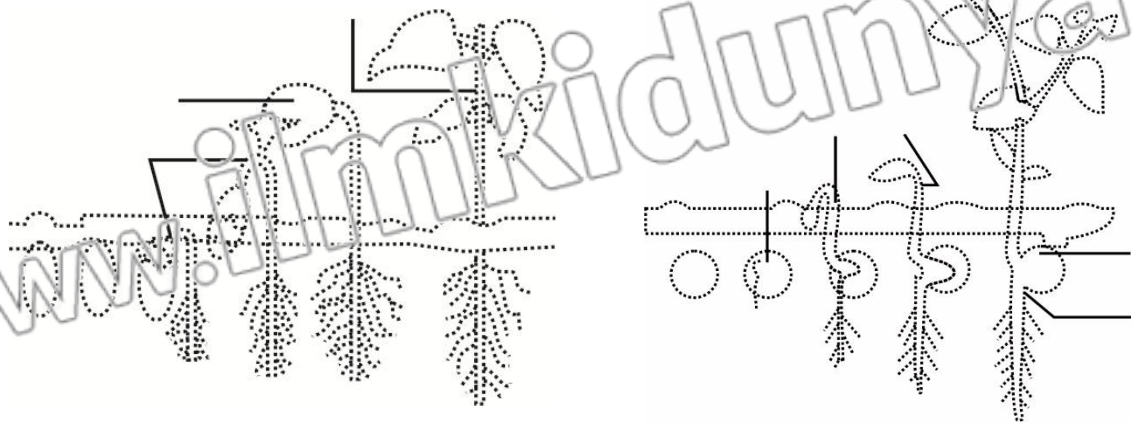
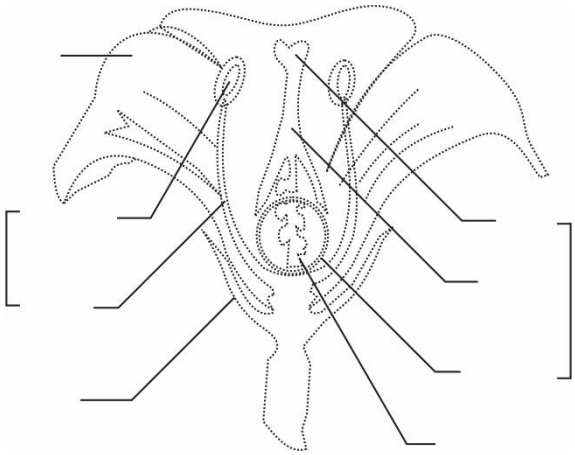
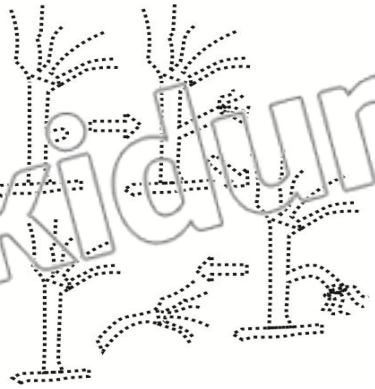
TYPES OF SEED GERMINATION



STRUCTURE OF FLOWER



BUDDING IN HYDRA



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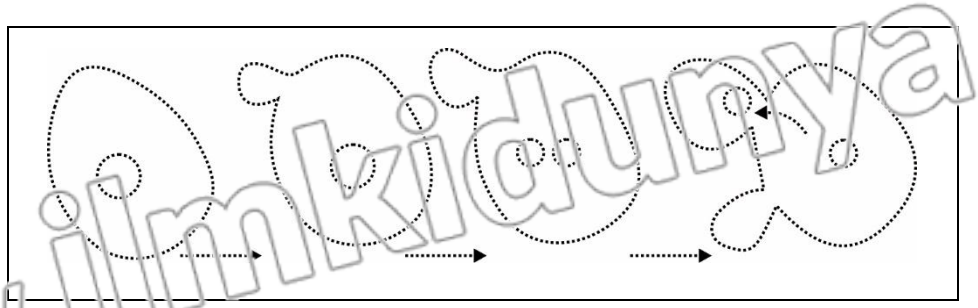
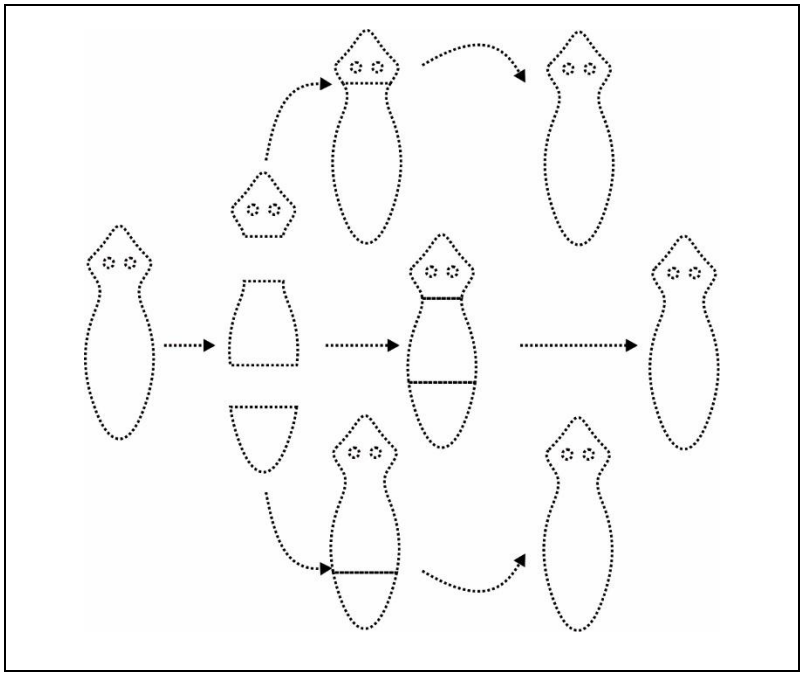
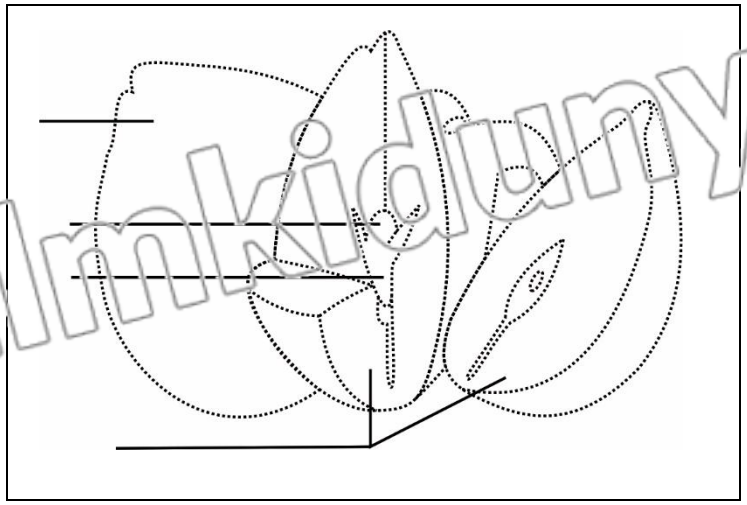
BUDDING IN YEAST



FRAGMENTATION IN A PLANARIAN



The Structure of a Dicot Seed



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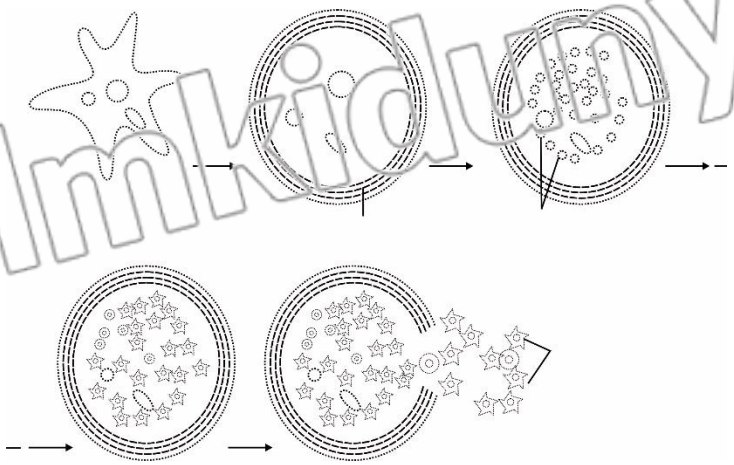
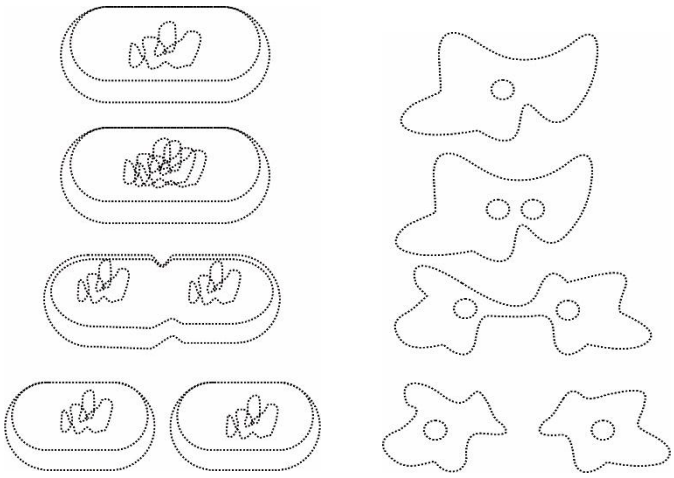
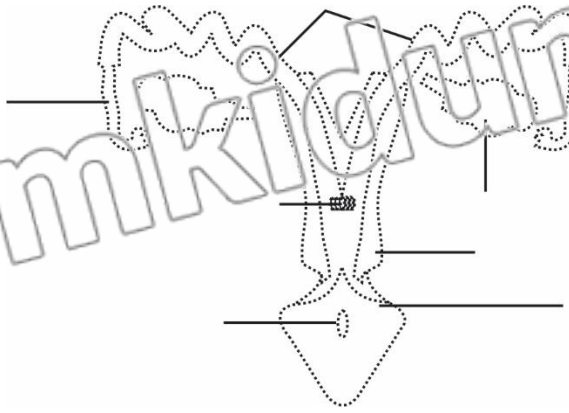
MULTIPLE FISSION



BINARY FISSION IN A BACTERIUM AND AMOEBA



FEMALE REPRODUCTIVE SYSTEM OF RABBIT



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. Method of asexual reproduction found in Amoeba is: (K.B)

(A) Binary fission **(B)** Fragmentation

(C) Budding **(D)** Spore formation

2. How many floral whorls are present in a complete flower? (K.B)

(A) 2 **(B)** 4

(C) 6 **(D)** 8

3. Oogonia are produced in: (K.B)

(A) Testes **(B)** Follicles

(C) Polar bodies **(D)** Tube nucleus

4. The process after gamete formation: (K.B)

(A) Fertilization **(B)** Development

(C) Growth **(D)** Birth

5. Carpel consists of: (K.B)

(A) Stigma **(B)** Style

(C) Ovary **(D)** Stigma, Style, Ovary

6. The egg cell is: (K.B)

(A) Haploid **(B)** Diploid

(C) Triploid **(D)** Tetraploid

Q.2 Give short answers to following questions. **(5×2=10)**

(i) Define the term binary fission give examples. **(K.B)**

(ii) How vegetative propagation occur by leaves? **(K.B)**

(iii) Define the term double fertilization. **(K.B)**

(iv) What are three associated glands in male reproductive system of rabbit? **(K.B)**

(v) Define AIDS. **(K.B)**

Q.3 Answer the following questions in detail. **(5+4=9)**

(a) Explain life cycle of flowering plant. **(K.B)**

(b) Describe oogenesis. **(K.B)**

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of the students.

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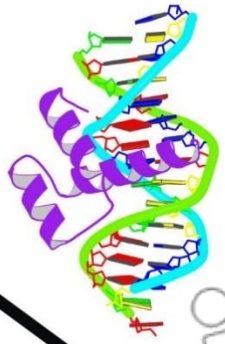

CH# 15 INHERITANCE

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15.1 INTRODUCTION TO GENETICS

15.2 CHROMOSOMES AND GENES

LONG QUESTIONS

Q.1 Describe structure of DNA. ***(K.P)*** **(Understanding the Concept Q.1)**

OR

Describe the structure of chromatin.

Ans:

STRUCTURE OF DNA

Introduction:

In **1953**, **James Watson** and **Francis Crick** proposed the structure for DNA that is why it is called, **Watson - Crick Model of DNA**.

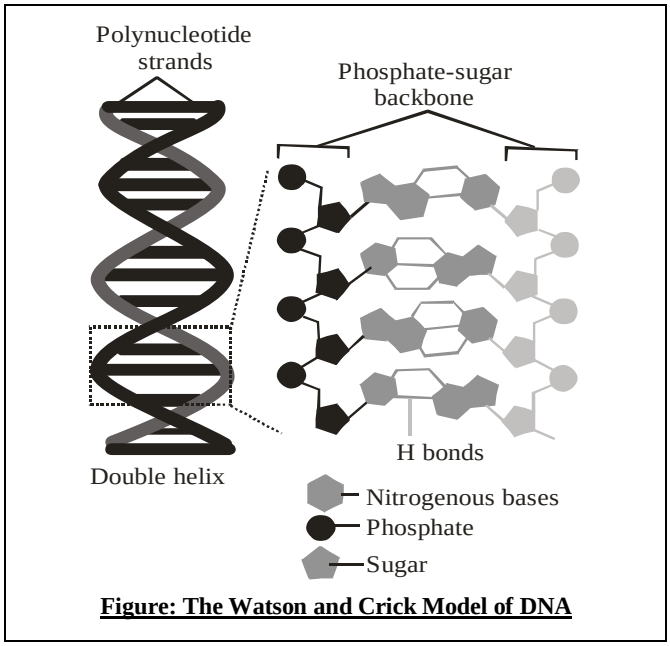

Figure: The Watson and Crick Model of DNA

Double Helix Structure:

According to the Watson - Crick Model, a **DNA molecule** consists of two **polynucleotide strands**. These strands are coiled around each other in the form of a **double helix**.

Backbone:

There is a **phosphate-sugar** backbone on the outside of **double helix**.

Nitrogenous Bases:

The **nitrogenous bases** are on the inside of the **double helix**. In double **helix**, the nitrogenous bases of opposite **nucleotides** form pairs through **hydrogen bonds**.

Specific Nucleotides Pairing:

The **pairing** of nucleotides is **highly specific**. The nitrogenous base **adenine** of one nucleotide forms pair with the **thymine** of opposing nucleotide, while **cytosine** forms pair with **guanine**.

Hydrogen Bonds:

There are two hydrogen bonds between adenine and thymine while there are three hydrogen bonds between cytosine and guanine.

Q.2 Describe DNA replication. ***(K.P)*** **(GRW 2016, DGK 2015)**

Ans:

DNA REPLICATION

Introduction:

Before a cell divides, its DNA is replicated (duplicated). It is done to **make the copies** of the chromatids of chromosomes.

MECHANISM OF REPLICATION

Uncoiling of DNA:

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During replication, the DNA double helix is **unwound** and the **two strands are separated**, much like the two sides of a zipper.

Templates:
Each strand acts as a template to produce another strand.

Pairing of Nucleotides:
The DNA template nitrogenous bases make pairs with the nitrogenous bases of new nucleotides. In this way, both **template strands make new polynucleotide strands** in front of them.

New DNA Molecule:
Each template and its new strand together then form a new DNA double helix, identical to the original.

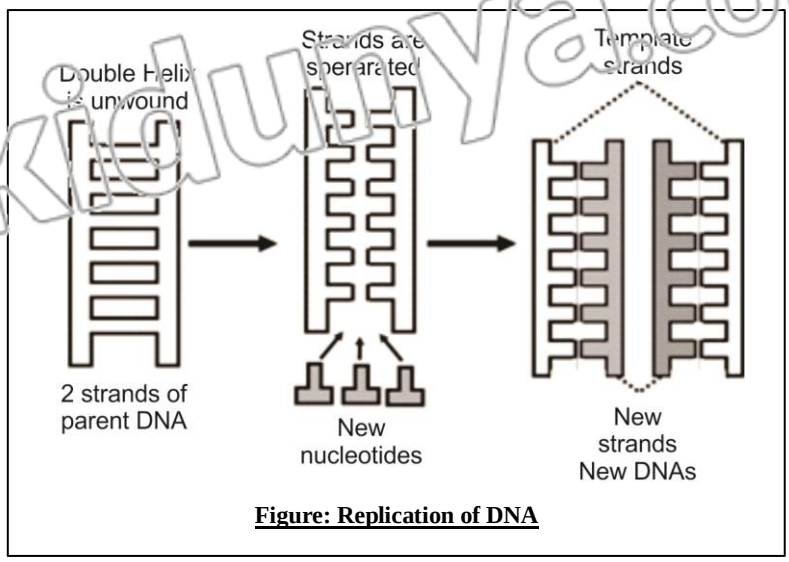

Figure: Replication of DNA

Q.3 Explain how does DNA of chromosome work? *(U.B)* **(LHR 2014)**

Ans:

WORKING OF DNA CHROMOSEMS

Genetic Material:
DNA is the genetic material. It contains the instructions to direct all the functions of cells. It performs its role by **giving instructions** for the **synthesis of specific proteins**.
Some proteins perform structural roles while the others act as enzymes to control all biochemical reactions of cells.

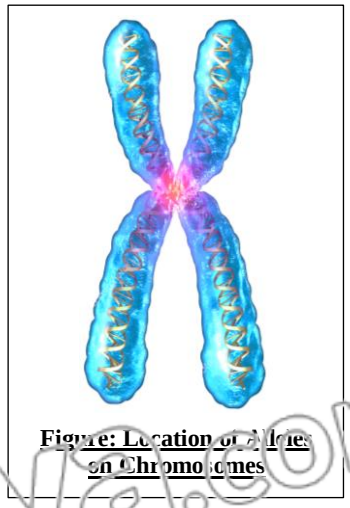
Figure: Location of Genes on Chromosomes

DNA Control:
In this way, **whatever a cell does is actually controlled by its DNA**. In other words, DNA makes the characteristic or trait of cell or organism.

Expression of Trait:
The **traits are made by specific proteins**. Specific proteins have specific **number and sequence of their amino acids**. DNA controls this sequence of amino acids by the sequence of its nucleotides. During protein synthesis, the sequence of DNA nucleotides decides that what will be the sequence of amino acids

Transcription:
The specific sequence of **DNA nucleotides is copied in the form of messenger RNA** (mRNA) nucleotides. This process is called transcription.

Translation:
The mRNA carries the **sequence of its nucleotides** to ribosome. The ribosome reads this sequence and **joins specific amino acids**, according to it, to form protein. This step is known as translation.
The part of DNA (sequence of nucleotides) that contains the instructions for the synthesis of a particular protein is known as a gene, each chromosome contains thousands of genes.

Gene-Trait Relationship:
The part of DNA (sequence of nucleotides) that contains the instructions for the synthesis of particular protein is known as gene. DNA of each chromosome contains thousands of genes.

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Like chromosomes, genes also occur in pairs, one on each homologous chromosome. The **locations or positions** of genes on chromosomes are known **as loci** (*Singular*. locus).
Each gene determines a particular trait in an organism. Each individual carries at least one pair of genes for each trait.

Representation:

For convenience, pairs of genes are **represented by a letter or symbol.**
Both members of a gene pair may be the same in some individuals (a condition which we may represent as AA or aa or BB) and different in others (Aa or Bb).

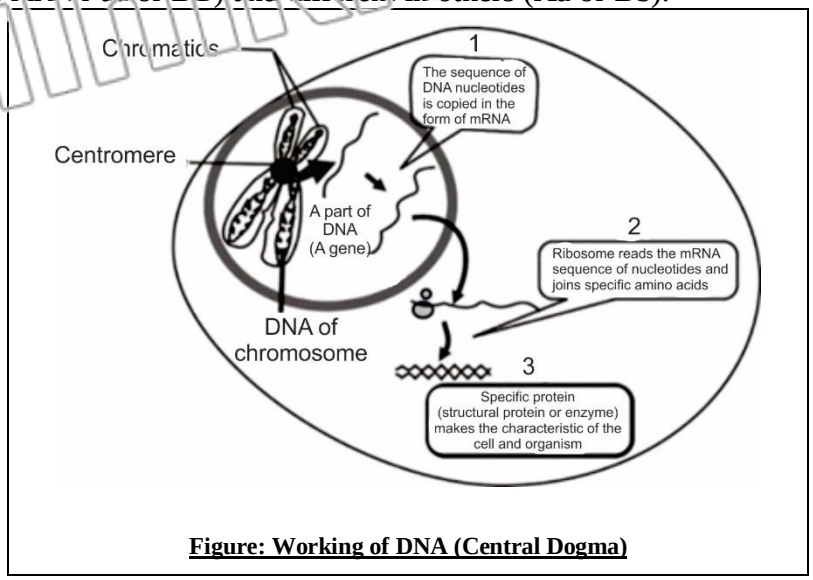

Figure: Working of DNA (Central Dogma)

15.1 SHORT QUESTIONS

Q.1 Define genetics. ***(K.B)*** **(GRW 2016)**

Ans:

GENETICS

Definition:

"Genetics is the branch of biology in which we study inheritance".

Q.2 Define inheritance. ***(K.B)*** **(LHR 2017)**

Ans:

INHERITANCE

Definition:

Inheritance means the transmission of characteristics from parents to offspring

Q.3 What are traits? Give some examples of traits in human. ***(K.B)*** **(GRW 2016)**

Ans:

TRAITS

Definition:

"Inheritable characteristics are called traits".

Example:

In human, some inheritable characteristics are given below.

- Height
- Colour of eyes
- Intelligence

Q.4 What is chromatin? ***(K.B)***

Ans:

CHROMATIN

Chromosome is made of chromatin material (simply as chromatin). Chromatin is a complex material, made of DNA and proteins (mainly histone proteins).

Q.5 Define genes? ***(K.B)***

Ans:

GENES

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Definition:

Parents pass characteristics to their young through gene transmission. Equal numbers of chromosomes from each parent are combined during fertilization. The chromosomes carry the units of inheritance called the genes.

Q.6 What are homologous chromosomes? How many homologous chromosomes are present in human body cells? *(U.B)* **(LHR 2014)**

Ans:

HOMOLOGOUS CHROMOSOMES

Pairs of chromosomes in a diploid cell are known as homologous chromosomes.

Example of Human:

In human body cells, there are 23 pairs of homologous chromosomes for a total of 46 chromosomes.

Q.7 Define nucleosomes *(K.B)* **(BWP2015, LHR 2016, 17)**

Ans:

NUCLEOSOMES

Definition:

DNA wraps around histone proteins and forms round structures called nucleosomes. DNA is also present between nucleosomes. In this way the nucleosomes and the DNA between them look "beads on a string".

The fibres consisting of nucleosomes condense into compact forms and get the structure of chromosomes.

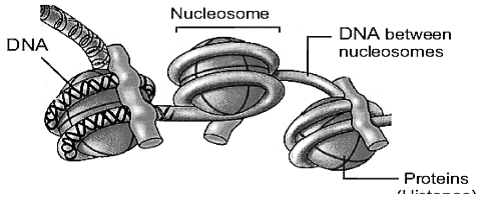

Figure: Chemical Composition of Chromosome

Q.8 Define transcription and translation. *(K.B)* **LHR 2016**

Ans: Page no 168.

Q.9 Name nitrogenous bases found in DNA molecule. *(K.B)* **LHR 2017**

Ans: Page no 168.

Q.10 Describe two major processes of organic evolution. *(K.B)* **LHR 2017**

Ans: Page no 186.

Q.11 Differentiate between transcription and translation. *(K.B)* **(LHR 2016)**

OR

What is meant by transcription? *(A.B)* **(GRW 2016)**

OR

What is meant by translation? *(A.B)* **(GRW 2016)**

Ans:

DIFFERENTIATION

The difference between transcription and translation is as follows:

Transcription	Translation
• The specific sequence of DNA nucleotides is copied in the form of messenger RNA (mRNA) nucleotides. This process is called transcription. **DNA→mRNA**	• The mRNA carries the sequence of its nucleotides to ribosome. The ribosome read this sequence and joins specific amino acids, accordingly to it, to form protein. This step is known as translation. **mRNA→Protein**

Q.12 Define central dogma? (U.B)

Ans: Page no

Q.13 Differentiate between gene and alleles. (K.B) **(LHR 2014, 16 MTN 2015, SWL 2015, DGK 2015)**

Ans:

DIFFERENTIATION

The differences between gene and alleles are as follows:

Gene	Alleles
Definition	
• The part of DNA (sequence of nucleotides) that contains the instructions for the synthesis of a particular protein is known as a gene.	• The alternate forms of a gene are called alleles.
Example	
• Gene for Height	• "A" and "a" are the two

• Gene for Intelligence	alternate forms of a gene and B and b are the alternate forms of another gene.

Q.14 Differentiate between genotype and phenotype? (K.B) **(LHR 2015)**

OR

What do you know about genotype? (U.B) **(GRW 2016)**

Ans:

DIFFERENTIATION

The differences between genotype and phenotype are as follows:

Genotype	Phenotype
• The specific combination of gene in an individual is known as genotype. It is of two types. • Homozygous Genotype • Heterozygous Genotype	• The expression of the genotype in the form of trait (in our example, being albino or having normal pigmentation) is known as the phenotype.

Q.15 What are homozygous and heterozygous genotype? (K.B)

Ans:

DIFFERENTIATION

The difference between homozygous and heterozygous genotype is as follows:

Homozygous genotype	Heterozygous genotype
• The genotype in which the gene pair contains two identical alleles (AA) is called homozygous genotype.	• The genotype in which the gene pair contains two different alleles (Aa) is called the Heterozygous genotype.

Q.16 What are dominant and recessive alleles? (U.B) **(SWL 2015)**

Ans:

DIFFERENTIATION

The differences between dominant and recessive alleles are as follows:

Dominant allele	Recessive allele
Definition	
• When in the heterozygous condition one allele masks or prevents the expression of the other, it is called the dominant allele.	• The allele which is not expressed is called recessive allele.
Example	
• "R" allele is dominant over "r" allele for the shape of seed.	• "r" allele is recessive for the shape of seed.
Representation	
• The dominant alleles are represented by capital letters.	• Recessive alleles are represented by lower case.

Q.17 Can dominant allele effect the nature of recessive allele? (U.B)

Ans:

EXPRESSION

A dominant allele only suppresses the expression of recessive allele. It does not affect its nature.

Q.18 What is albinism? Write its genotype? (A.B)

Ans:

ALBINISM

Condition in which normal body pigments are absent.

Genotype:

It is also controlled by one pair of genes. "aa" is a genotype of albinisim because it's a recessive trait in hum

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15.1 MULTIPLE CHOICE QUESTIONS

1. The idea of transmission of characteristic to off spring was 1st explained by: (K.B)
(A) Greger Mandel (B) James Watson
(C) Fransis crick (D) Jan Bepist De Lamark

2. The branch of Biology that deals with inheritance. (K.B) (DGK 2014, LHR 2015, SWL 2015)
(A) Physiology (B) Ecology
(C) Pharmacology (D) Genetics

3. Which of the following is an example of inheritable traits (U.B)
(A) Height (B) Colour of eye
(C) Intelligence (D) All

4. The chromosomes carry the units of inheritance called_____. (K.B)
(A) Genes (B) Traits
(C) Alleles (D) Genetics

5. Genes contains the specific instructions for the synthesis of: (K.B)
(A) Carbohydrates (B) Vitamins
(C) Lipids (D) Proteins

6. Which of the following statements regarding genes is false? (U.B) (LHR 2013)
(A) Genes are located an chromosomes
(B) Genes consist of a long sequence of DNA
(C) A gene contains information for the production of a protein
(D) Each cell contains a single copy of every gene

7. In humans, pairs of homologous chromosomes are: (K.B) (DGK 2015)
(A) 21 (B) 22
(C) 23 (D) 24

8. DNA wraps around histone proteins and forms round structures, called: (U.B) (BWP 2014)
(A) Chromatin (B) Chromosome
(C) Nucleolus (D) Nucleosomes

9. Watson and Crick proposed the DNA model in: (K.B) (MTN 2015)
(A) 1951 (B) 1953
(C) 1955 (D) 1957

10. According to Watson and crick model of DNA the backbone of DNA is formed of (U.B)
(A) Sugar-N-Bases (B) Phosphate-Sugar
(C) N-Base-Phosphate (D) N-Base-Sugar –Phosphate

11. In DNA molecule, adenine always pairs with: (K.B)
(A) Guanine (B) Cytosine
(C) Thymine (D) Uracil

12. How many hydrogen bonds are present between cytosine and guanine? (K.B)
(A) One (B) Two
(C) Three (D) Four

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13. The inside of helix is formed of (K.B)

(A) N-Base (B) Phosphates

(C) Ribose (D) Deoxyribose

14. The locations or positions of genes on chromosomes: (K.B)

(A) Loci (B) Traits

(C) Inheritance (D) Nucleotides

15. How many types of nucleotides are present in DNA? (K.B)

(A) 1 (B) 2

(C) 3 (D) 4

16. Ribosome reads the sequence of mRNA nucleotides and joins specific amino acids to form proteins. This step is known as: (U.B) **(LHR 2013**

(A) Combination (B) Replication

(C) Transcription (D) Translation

17. Which of the following statement is incorrect regarding to the process of DNA replication (U.B)

(A) Replication results into formation of two identical helixas of DNA from single Bond

(B) Both strands of Double helix in replication act as template

(C) Replication occurs during mitosis

(D) Replication means the creation of copies of the chromatids of chromosomes

18. A specific combination of genes in an individual is called: (K.B) **(GRW 2013)**

(A) Genotype (B) Phenotype

(C) Dominance (D) Recessive

19. Three possible combinations of pair (A and a) of genes (genotypes): (K.B)

(A) AA, Aa, aa (B) AA, AA, aa

(C) AA, BB, aa (D) AA, Bb, aa

20. Cytosine always make pair with: (K.B) **(LHR 2016, DGK 2014)**

(A) Guanine (B) Hydrogen

(C) Adenine (D) Thymine

21. Genotype in which gene pair contains two identical alleles is called: (U.B) **(LHR 2015, GRW 2016)**

(A) Homozygous (B) Heterozygous

(C) Hemizygous (D) Homologous

22. If organisms have genotype of AAbb, how many types of gametes can it produce? (U.B) **(LHR 2014)**

(A) 3 (B) 2

(C) 1 (D) 4

23. The specific combination of gene in an individual is known as: (K.B)

(A) Genotype (B) Phenotype

(C) Gene (D) Allele

24. The specific sequence of DNA nucleotide is copied in the form of messengers RNA nucleotide, this process is called: (U.B)

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(A) Translation (B) Transcription
(C) Transmission (D) None

25. In DNA molecule, guanine always pairs with: (K.B)
(A) Adenine (B) Cytosine
(C) Thymine (D) Uracil

26. A DNA molecule consists of _____ polynucleotide strands. (K.B)
(A) Two (B) Four
(C) Three (D) One

27. Alternate form of gene is called: (U.B) **(LHR 2016, 17)**
(A) DNA (B) Gamete
(C) Chromosomes (D) Allele

28. Transmission of characters (triats) from parent to offspring is called: (K.B)
(A) Inheritance (B) Mutation
(C) Regeneration (D) Reproduction

29. These are the unit of inheritance: (K.B) **(GRW 2017)**
(A) Genes (B) Alleles
(C) Phenotype (D) Genotype

30. Align the given events w.r.t the synthesis of protein

DNA→protein (nucleus)
DNA→mRNA (nucleus)
mRNA→protein (cytoplasm) (U.B)

(A) 1&3 (B) 2&7
(C) 2&3 (D) 3&2

15.3 MENDEL'S LAWS OF INHERITANCE

LONG QUESTIONS

Q.1 Why did Mendel select pea plant? (A.B)

Ans:

SELECTION OF PEA PLANT

Introduction:

Gregor Mendel was a **monk** (priest) in Austria. He developed the **fundamental principles** of **genetics**.

Mendel **proposed** that there are "**special factors**" in organisms, which **control** the **expression** of **traits** and their transmission to next generations. These factors were **eventually** termed **genes**.

Pea Plant:

Mendel **selected pea plant** (Pisum sativum) to **carry out** a **large** number of **experiments**. He argued that an organism for genetic experiments should have the **following features**:

Different Traits:

There should be a **number** of **different traits** that can be studied.

Contrasting Traits:

The organism should have **contrasting traits**. Each trait studied in pea plant had two distinct forms.

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Example:

The trait of height there should be only two very different phenotypes i.e. tallness and dwarfness.

DIFFERENT TRAITS AND THEIR PHENOTYPES STUDIED BY MENDEL

Traits	Phenotypes
Seed Shape	Round and Wrinkled
Seed Colour	Yellow and Green
Flower Colour	Purple and White
Pod Shape	Flat and Constricted
Pod Colour	Green and Yellow
Flower position	Axial and Terminal
Stem Length	Long and Short

Self-Fertilizing Plant:

The organism (if it is a plant) should be **self-fertilizing** but **cross fertilization** should also be possible.

Life Span:

The organism should have a **short** but **fast life cycle.**

Cross Fertilization:

Normally, the **flowers** of pea plant allow **self-pollination**. **Cross pollination** can also be done by **transferring** the **pollen grains** from the flower on one plant to the flower on another plant.

Mendel's Success:

Mendel's **succeeded** in his work not only because he selected the **right organisms** for his experiments but also because he **analyzed** the results by using the **principles of statistics** (ratios).

Q.2 State and explain Mendel's Law of Segregation. (Understanding the Concept Q.3) (K.B) (LHR 2016)

Ans:

MENDEL'S LAW OF SEGREGATION

Statement:

"In each **organism**, the **genes** are present in **pairs**. During **gamete formation**, **the genes (alleles) of each pair segregate from each other** and each **gamete** receives **one gene** from the pair. When the **gametes** of male and female parents **unite**, the resulting **offspring** again gets the **genes in pairs**".

Introduction:

Gregor Mendel was a **monk** (priest) in **Austria**. He **developed** the **fundamental principles** of genetics.

Selection of Plant:

Mendel **selected pea plant** (Pisum sativum) to carry out a large number of experiments.

Selection of Phenotype:

Mendel studied the **inheritance** of **seed shape** first.

Monohybrid Cross:

He crossed two plants having **one contrasting trait** i.e. seed shape. A **cross**, in which only **one** trait is studied at a time, is called as a **monohybrid cross**.

Cross Fertilization of True Breeding:

Mendel crossed a true-breeding **round-seeded** plant with a **true-breeding wrinkled seeded** plant.

P1 and F1 Generation:

The **parental generation** is denoted as P1 generation. The **offspring** of **P1 generation** are **F1 generation** (first filial).

Result:

All **resulting seeds** of the next generation were **round**.

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Conclusion:

Mendel declared the trait "**round Seeds**" as **dominant**, while "**wrinkled seeds**" as **recessive**.

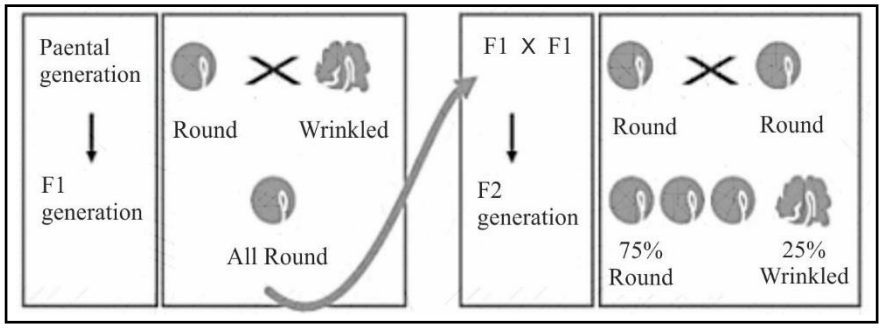
Self-Fertilization of F1:

The following year, Mendel planted these seeds and allowed the **new plants** to **self-fertilize**. The cross in **F1 generation produces F2 generation** (second filial).

Results:

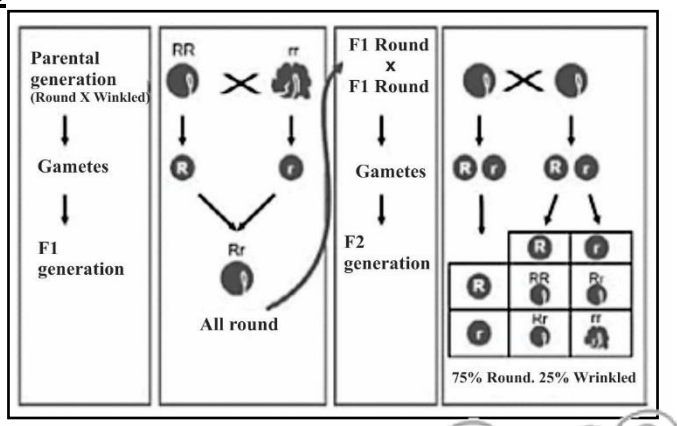
As a result, he got obtained.

Total seeds = 7324
Round seeds = 5474
Wrinkled seeds = 1850
Ratio= Round : Wrinkled
3 : 1



Experiments on Tall and Short Plants:

Similarly, when "**true-breeding**" tall **plants** were crossed with "**true-breeding**" **short plants**, all offspring of **F1** were **tall plants** i.e. tallness was a **dominant trait**. When members of F1 generation were **self-fertilized**, Mendel got the ratio of tall to short plants in F2 as 3:1.



Conclusion:

Mendel concluded that the traits under study were **controlled** by **discrete** (separable) **factors** or genes.

Q.3 State and explain Mendel's Law of Independent Assortment. (K.B) **(DGK 2014)**

OR

Explain how Mendel proved the law of independent assortment. (U.B)

(Understanding the Concept Q.3)

Ans: **MENDEL'S LAW OF INDEPENDENT ASSORTMENT**

Statement:

"The **alleles** of a **gene pair segregate** (get separated and distributed to gametes) **independently** from the **alleles** of **other gene pairs**".

Introduction:

Gregor Mendel was a **monk** (priest) in **Austria**. He **developed** the **fundamental principles** of genetics.

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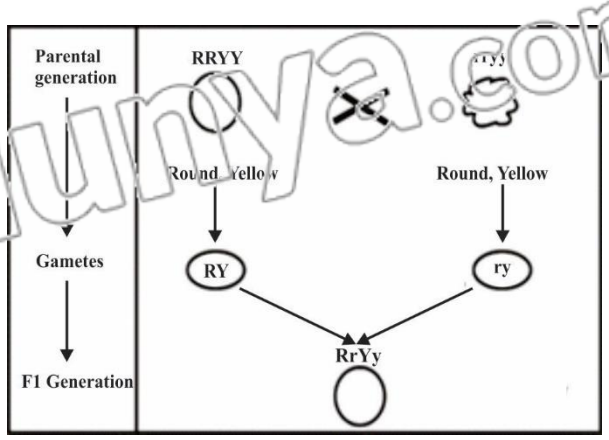
Selection of Plant:

Mendel **selected** pea **plant** (Pisum sativum) to carry out a large number of experiments.



Dihybrid Cross:

Mendel **studied two contrasting traits** at a time. Such crosses are called dihybrid crosses.

Selection of Phenotypes:

He performed experiments on **two seed traits**:

Seed Shape:

The trait of **round seeds**, (controlled by allele R), was **parental dominant** over **wrinkled** controlled by allele r) **seeds**.

Seed Colour:

Yellow seed colour (controlled by Y) was **dominant** over **green controlled** by y.

Cross Fertilization of True Breeding:

Mendel **crossed** a **true- breeding** plant-that had **round yellow seeds** (RRYY) with a **true breeding** plant having **wrinkled green** seeds (rryy).

Results:

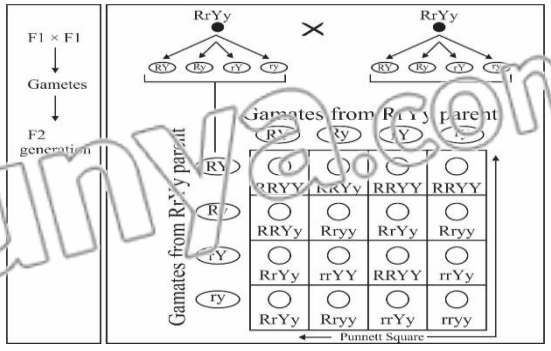
All seeds in **F1 generation** were **round yellow**.

Self-Fertilization of F1:

When **F1** seeds **grew** into plants, they were **self-fertilized**.

Results:

This **cross** produced seeds with **four phenotypes**.



Round yellow seeds = 315.

Round green seeds = 108

Wrinkled yellow seeds = 101

Wrinkled green seeds = 32

Phenotypic Ratio:

The ratio of these **phenotypes** was **9:3:3:1.**

Conclusion:

Mendel **concluded** that the **two traits** i.e. seed shape and seed colour, are **not tied** with **each other**. The segregation of 'R' and 'r' alleles happens independently of the segregation of 'Y' and 'y' alleles. From this, Mendel concluded that different traits are inherited independently of one another.

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15.3 SHORT QUESTIONS

Q.1 Differentiate between monohybrid and dihybrid cross? (K.B)
(LHR 2014, SWL 2015, DGK 2015)

Ans: **DIFFERENTIATION**

The differences between monohybrid and dihybrid cross are as follows:

Monohybrid Cross	Dihybrid Cross
Definition	
A cross, in which only one trait is studied at a time, is called as a monohybrid cross.	A cross, in which two traits are studied at a time, is called as a dihybrid cross.
Example	
In law of segregation, Mendel chose only shapes of seed to check his results. (Round seeded and wrinkled seeded plants)	In law of independent assortment, Mendel chose shapes and colour of seeds to check his results. (Round+Yellow seed and wrinkled+Green seed plants)

Q.2 Define transcription. (K.B) **GRW 2017**

Ans: Page no 168.

Q.3 What are the total contrasting traits observed by Mendel in his experiment? (K.B)
(DGK 2014)

Ans: **CONTRASTING TRAITS**

There are seven contrasting trait observed by Mendel in his experiment are as follows:

- Seed Shape ⇒ Round, Wrinkled
- Seed Color ⇒ Yellow, green
- Flower Color ⇒ Purple, white
- Pod Shape ⇒ Flat, Constricted
- Pod Colour ⇒ Green, Yellow
- Flower Position ⇒ Axial, Terminal
- Stem Length ⇒ Long, Short

Q.4 State Mendel's law of segregation. (K.B) **(LHR 2015, 17, GRW 2016, 17)**

Ans: Page no 157.

Q.5 Differentiate between Punnett square and checker board? (K.B) **(DGK 2015, LHR 2016)**

Ans: **DIFFERENTIATION**

The difference between Punnett square and checker board is as follows:

Punnett Square	Checker Board
• The Punnett square is a diagram that is used to predict an outcome of a particular cross or breeding experiment. If is named after R.C Punnett (an English mathematician). The gametes of both parents having all possible genetics setups are determined.	• A checker board is used to cross all the possible gametes of one parent with all the gametes of other parent. In this way a biologist can find all the possible genotypes of offspring.

Q.6 State Mendel's law of independent assortment. (K.B)

Ans: Page no 176.

Q.7 Differentiate between self and cross fertilization. (K.B)

Ans: Page no 175.

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15.3 MULTIPLE CHOICE QUESTIONS

1. How many plants were used by Mendel in his experiments? (K.B)
(A) 26,000 (B) 28,000
(C) 30,000 (D) 32,000

2. The term true breeder means. (K.B)
(A) Heterozygous (B) Genotype
(C) Phenotype (D) Homozygous

3. Mendel obtained how many round seeds in monohybrid cross? (A.B)
(A) 4784 (B) 5474
(C) 7454 (D) 4555

4. Which of the following genes will be termed as homozygous recessive: (K.B) **(LHR 2014)**
(A) RRYY (B) RrYy
(C) RrYY (D) rryy

5. Phenotypic ratio of monohybrid cross: (K.B)
(A) 3:1 (B) 2:1
(C) 9:3:3:1 (D) 1:2:1

6. Genotypic ratio of monohybrid cross: (K.B)
(A) 3:1 (B) 2:1
(C) 9:3:3:1 (D) 1:2:1

7. Phenotypic ratio of dihybrid cross: (K.B)
(A) 3:1 (B) 2:1
(C) 9:3:3:1 (D) 1:2:1

8. Number of round yellow seeds obtained in dihybrid cross: (K.B)
(A) 32 (B) 108
(C) 101 (D) 315

9. Number of round green seeds obtained in dihybrid cross: (K.B)
(A) 32 (B) 108
(C) 101 (D) 315

10. Number of wrinkled yellow seeds obtained in dihybrid cross: (K.B)
(A) 32 (B) 108
(C) 101 (D) 315

11. Number of wrinkled green seeds obtained in dihybrid cross: (K.B)
(A) 32 (B) 108
(C) 101 (D) 315

12. A couple can produced more than _____ genetically different children. (A.B)
(A) 60 trillion (B) 40 trillion
(C) 70 trillion (D) 100 trillion

13. A cross in which one character is studied at a time is called: (K.B) **(GRW 2016)**
(A) Monohybrid cross (B) Dihybrid cross
(C) Text cross (D) Back cross

14. When both the alleles of a gene pair in an organism are same the organism would be for that gene (U.B) **(GRW 2016)**
(A) homozygote (B) heterozygote
(C) homozygous (D) heterozygous

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15. If a homozygous tall (TT) is crossed with a homozygous short (tt), the F1 plants would be (U.B)

(A) all tall (B) 50% tall and 50% short
(C) all short (D) 75% tall and 25% short

16. If a tall heterozygote (Tt) is crossed with a short homozygote (tt), the F1 offspring would comprise of (U.B)

(A) all tall (B) 50% tall and 50% short
(C) all short (D) 75% tall and 25% short

17. A possible method used to predict an outcome of a particular cross or breeding experiment is (K.B)

(A) Punnett square (B) monohybrid cross
(C) dihybrid cross (D) test cross

18. The trait that appears in F1 after a cross is made between two true breeding plants is called (K.B)

(A) dominant (B) recessive
(C) Monohybrid (D) dihybrid

19. Mendel formulated Law of Independent Assortment with the help of (K.B)

(A) monohybrid cross (B) dihybrid cross
(C) test cross (D) all of these

15.4 CO-DOMINANCE AND INCOMPLETE DOMINANCE

LONG QUESTIONS

Q.1 Write a note on co-dominance. (K.B)

OR

What do you mean by co-dominance? Give an example. (Understanding the Concept Q.6)

Ans:

DOMINANCE

Definition:

"**Dominance** is a **physiological effect** of an **allele over its partner allele** on the **same gene locus**".

Example:

Round seed shape is dominant over wrinkled seed shape in cross fertilization.

Explanation:

After the **discovery** of **Mendel's work**, scientists began **experiments** on the genetics of various organisms. These experiments **proved** that all the traits in organisms **do not follow Mendel's laws**. For example, it was found that there are many traits which are **controlled by more than one pair of genes**. Similarly for many traits there are more than **two alleles** in a **gene pair**.

Types of Dominance:

There are **two types** of dominance relationships.

- Co-Dominance
- In-Complete Dominance

Co-Dominance:

"The situation where **two different alleles** of a gene pair **express themselves completely**, **instead** of showing a **dominant-recessive relationship** is called co-dominance".

Phenotype of Heterozygous:

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As a result, the **heterozygous organism** shows a **phenotype** that is **different** from both **homozygous parents**.

Example:

Expression of human **blood group AB**:

The **ABO blood group** system is **controlled** by the **gene** I. This gene has three alleles:

- I^A
- I^B
- i

Blood Group A:

The **allele I^A** produces **antigen A** in blood and the **phenotype** is **blood group** A.

Blood Group B:

The **allele I^B** produces **antigen B** in blood and the **phenotype** is blood group B.

Blood Group O:

The **allele i does not produce any antigen** and the **phenotype** is **blood group O.**

Blood Group AB:

The **alleles I^A and I^B** are **dominant over i**. When there is a **heterozygous genotype** of I^A I^B, each of the **two alleles** produces the **respective antigen** and **neither** of them **dominates** over the other.

Genotype	Antigen Produced	Phenotype	Relationship Between Alleles
I^A I^A or I^A i	Antigen A	Blood Group A	Allele I^A is dominant over i
I^B I^B or I^B i	Antigen B	Blood Group B	Allele I^B is dominant over i
Ii	No Antigen	Blood Group O	Allele i is recessive
I^A I^B	Antigen A & Antigen B	Blood Group AB	Alleles I^A and I^B are co-dominant

Q.2 Write a note on incomplete dominance. (K.B)

OR

Explain the phenomena of incomplete dominance with the help of example.

(Understanding the Concept Q.5)

Ans: **INCOMPLETE DOMINANCE**

Definition:

"The situation where, in **heterozygous genotypes**, both the **alleles express as a blend** (mixture) and **neither** allele is **dominant** over the other, is called incomplete dominance".

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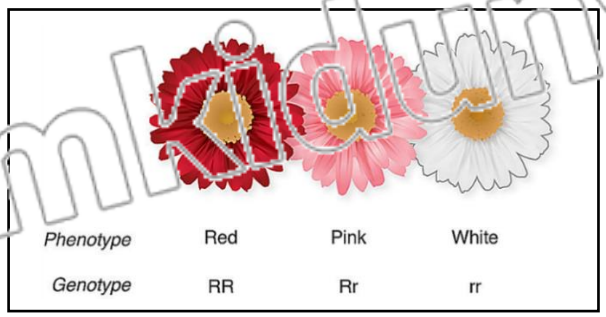
Intermediate Phenotype:

As a **result** of this **blending**, an **intermediate phenotype** is **expressed**.



Example:

In **Four 0 Clock plants**, there are three flower colours:

- **Red**
- **Pink**
- **White**

There is **no specific gene** responsible for **producing pink flowers.**

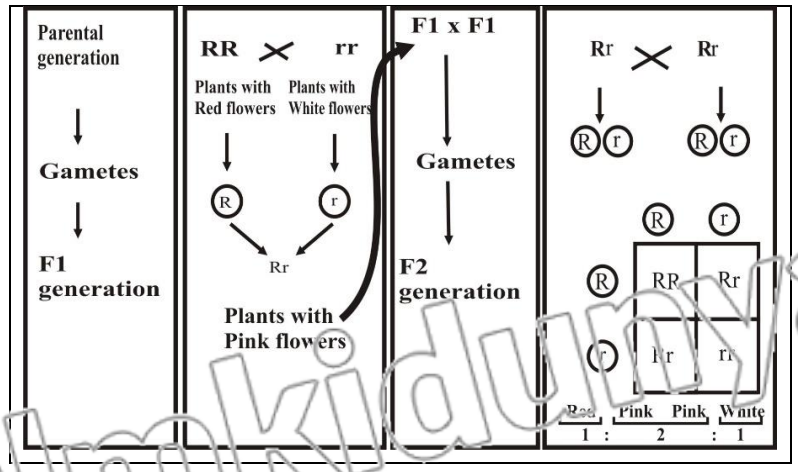
Explanation:

In four O clock plant, the trait of flower colour is **controlled** by two alleles 'R and r'.

- The **true breeding red flower** plants have RR alleles.
- The **true breeding white flower** plants have rr alleles.

Cross Fertilization of True Breeding:

A **homozygous red flowered** plant (RR) is **crossed** with **homozygous white flowered** plant (rr).



Result:

The **heterozygous** (Rr) plants of **F1 generation** produce **pink flowers**.

Conclusion:

Pink is a **blend** of red and white colours. This result clearly indicates that **neither** of the red **flower** allele (R) and **white flower** allele (r) is **dominant**.

Self-Fertilization of F1:

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When **two heterozygous** plants with pink flowers (Rr) are **crossed**, **F2 generation** shows **phenotypes** of red, pink and white flowers in the **ratio 1:2:1.**

15.4 SHORT QUESTIONS

Q.1 How co-dominance is difference form incomplete dominance? (K.B) (GRW 2017)

OR

What is co-dominance? Give an example (LHR 2014, GRW 2017, MTN 2015)

OR

Define in-complete dominance. (MTN 2015, DGK 2015)

Ans:

DIFFERENTIATION

The differences between co-dominance and incomplete dominance are as follows:

Co-Dominance	In-Complete Dominance
Definition	
• Co-dominance is the situation where two different alleles of a gene pair express themselves completely, instead of showing a dominant-recessive relationship. • The heterozygous organisms show a phenotype that is different from both homozygous parents.	• In-complete dominance is the situation where in heterozygous genotypes, both the alleles express as a blend (mixture) and neither allele is dominant over the other. • This blending an intermediate phenotype is expressed.
Example	

• Human blood group AB	• In Four 0 Clock plants, there are three flower colours:
	  • Red
	  • White
	  • Pink (In-complete Dominance)
	There is no specific gene responsible for producing pink flowers

Q.2 Write the genetic bases of blood group "O" (U.B)

Ans: Page no 181.

Q.3 Blood AB is a example of co-dominaie explain (U.B)

Ans: Page no 181.

Q.4 Blood groups A&B are example of complete dominance explain. (U.B)

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Ans: Page no 181.

15.4 MULTIPLE CHOICE QUESTIONS

1. The situation where two different alleles of a gene pair express themselves completely is called: (K.B)

(A) Co-dominance (B) Over dominance
(C) Incomplete dominance (D) Dominance

2. Which genotype represents blood group A? (K.B)

(A) I^AI^b (B) I^Ai
(C) I^AI^A, I^Ai (D) I^bi

3. Genotype of blood group B: (K.B)

(A) I^AI^A (B) I^Ai
(C) I^BI^B (D) AB

4. Person with genotype-ii has blood group: (K.B) **(LHR 20**

(A) AB (B) B
(C) O (D) A

5. What will be the colour of flowers produced as a result of cross between red and white flowered 4 o'clock plants: (K.B) **(SWL 2015)**

(A) Pink (B) Red
(C) White (D) Purple

6. Example of co-dominance is: (K.B) **(LHR 2017)**

(A) Blood group B (B) Blood group A
(C) Blood group AB (D) Blood group O

7. Phenotype ratio in incomplete dominance is: (K.B) **(LHR 2017)**

(A) 1 : 3 : 3 (B) 3 : 1
(C) 1 : 3 (D) 1 : 2 : 1

8. The pink coloured flowers in Four O' clock is an example of

(A) co-dominance (B) complete dominance
(C) in-complete dominance (D) Law of Independent Assortment

9. The situation in which heterozygous genotypes both the alleles express as a blend and neither allele is dominant over the other is called

(A) in-complete dominance (B) co-dominance
(C) non-disjunction (D) miss-match crosses

10. What is the dominance relationship between blood group alleles I^A and I^B?

(A) co-dominance (B) in complete dominance
(C) complete dominance (D) non-disjunction

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15.5 VARIATIONS AND EVOLUTION

LONG QUESTIONS

Q.1 Define variations. Discuss sources of variations. (A,B)

Ans:

VARIATIONS

Definition:

"The **differences among the individuals** of the **same species** are called variations".

Examples:

- Variations in human heights
- Variations in skin colour of rats

Explanation

Sexual reproduction produces variations in the next generation. **No two individuals** resulting from **separate fertilizations** are genetically **identical.**

SOURCES OF VARIATIONS

The **main sources** of variations in sexually reproducing populations are as follow:

Genetic Recombination:

The **genetic recombination** produced through **crossing over** occurring during **meiosis** results in **gametes** with **variations**.

Mutations:

Mutations which are the **sudden changes in the structure of DNA** are important source of **variations**. Mutations also **happen** during **gametes** formation through **meiosis**.

Random Fertilization of Gametes:

During **fertilization, one** of the **millions of sperms** combines with a **single egg**. The **chance** involved in this **combination** also act as the source of **variations**. .

Gene Flow:

The **movement of genes** from one **population to another** is called as **gene flow**. It is also an important **source** of **variations**.

Different Combinations of Chromosomes:

Variations are also caused by **different combinations** of **chromosomes** in gametes and then in **zygote**.

In the case of humans, the possible number of chromosomal combinations at fertilization is 70,368,744,177,664. In other words, **a couple** can produce **more** than **70 trillion** genetically **different children**.

> Variations are also caused by different combinations of chromosomes in gametes and then in zygote. In the case of humans, the possible number of chromosomal combinations at fertilization is 70,368,744,177,664. In other words, a couple can produce more than 70 trillion genetically different children.

Q.2 Differentiate between discontinuous and continuous variations. (K.B) **(BWP 2015)**

Ans:

DIFFERENTIATION

The differences between discontinuous and continuous variations are as follows:

Discontinuous Variations	Continuous Variations
Phenotypes	
• The **individuals** of a population **either** have **distinct phenotypes**, which can be **easily distinguished** from each other.	• In continuous variations, the **phenotypes** show a **complete range** of **measurements** from one **extreme** to the other.
Genes	
• Discontinuous variations are **controlled** by the **alleles** of a **single gene pair**.	• Continuous variations are **controlled** by **many genes**.
Environmental Effect	
• The environment has **little effect** on this type of variations.	• Continuous variations are **often affected** by environmental factors.
Example	
• Blood Groups. In human population, an individual has one of the four distinct phenotypes of blood groups (A, B, AB or O) and cannot have in between.	• **Height**: In every human population, the individuals have a range of heights (from very small to tall). No population can show only two or three distinct heights.
Other Examples	
• **Tongue rolling** • **Person with six fingers** of hand or foot	• **Weight** • **Feet size** • **Intelligence**

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Q.3 Prove that variations lead evolution.

OR

How would you prove that variations lead to evolution? (A.B) (Understanding the Concept Q.4)

Ans:

VARIATIONS LEAD TO EVOLUATION

Evolution:

"**Organic evolution** (biological evolution) is the **change** in the **characteristics** of a population or **species** of organisms **over the course** of **generations**".

Evolutionary Changes:

The **evolutionary changes** are always **inheritable**. The **changes** in an individual are **not** considered as evolution, because **evolution refers** to **populations** and **not** to **individuals**.

Process of Organic Evolution:

Organic evolution includes two major processes.

- **Alterations** in **genetic characteristics** (traits) of a type of organism over time
- **Creation** of **new types** of **organisms** from a single type

Theories:

The study of **evolution** determines the **ancestry** and **relationships** among **different kinds** of **organisms**. Following are the **two theories** related to the **creation** of **living organisms**.

- **Theory of Special Creation**
- **Theory of Evolution**

Theory of Special Creation:

"The **anti-evolution ideas** support that **all living things** had been created **in their current form only a few thousand years ago**. It is known as the **Theory of Special Creation**".

Theory of Evolution:

But the scientific work in **eighteenth century** led to the idea that "**living things might change as well**".

Charles Darwin (1809-1882) proposed the **mechanism** of **organic evolution** in **1838**. It was called as "The **theory of natural selection**". Darwin proposed this theory after his 5-year voyage on the HMS (His Majesty's Ship) Beagle. He also published a book "On the Origin of **Species by means** of **natural selection**" in **1859**.

Limitations of Darwin's Theory of Evolution:

Darwin's theory of evolution was **not widely accepted** because of **lack of sufficient evidence**.

Modern Evolutionary Theory:

Modern evolutionary **theory** began in the late **1920s** and early **1930s.** Some scientist proved that the theory of **natural selection** and **Mendelian genetics** are the **same ideas** just as **Darwin** had **proposed**.

Mechanism of Evolution:

Almost every **population** contains **several variations** for the characteristics of its members. In other words, there are **morphological** and **physiological variations** in all populations.

Different populations face different environments and they have to adapt to different conditions.

Natural Selection:

"Natural selection is the **process** which the **better genetic** variations become more common in the **successive generations** of a population".

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Survival for the Fittest:

The **central concept** of natural selection is the **evolutionary fitness** of an **organism**. Fitness **means** an **organism's ability** to **survive** and **reproduce**. **Organisms** produce more offspring than can survive and these **offspring** vary in fitness. These **conditions** produce struggle for survival among the organisms of population. The **organisms** with favorable variations are able to reproduce and pass these variations to their next **generations**. On the other hand, the rate of the transmission of **unfavorable** to next **generations** is **low**.

Selection of Variations:

The **favorable variations** are "selected for" their **transmission** to next generations, while the unfavorable variations are "**selected against**" their **transmission** to next generations.

First Example:

Natural Selection in Rats:

A mouse population with variations in skin colour.

- Light coloured
- Medium coloured
- Dark coloured

Favourable and Unfavourable Variations:

Cat preys upon light and medium coloured mouse. In first generation, light coloured mouse is preyed upon by cat. Only medium and dark coloured mouse can make their next generations. In next generation, population again contains light, medium and dark coloured mouse. Cat preys upon the light and medium coloured mouse. Now only the dark coloured mouse make new generation. If this happens in many generations, the dark coloured (favourable variation) mouse in the population.

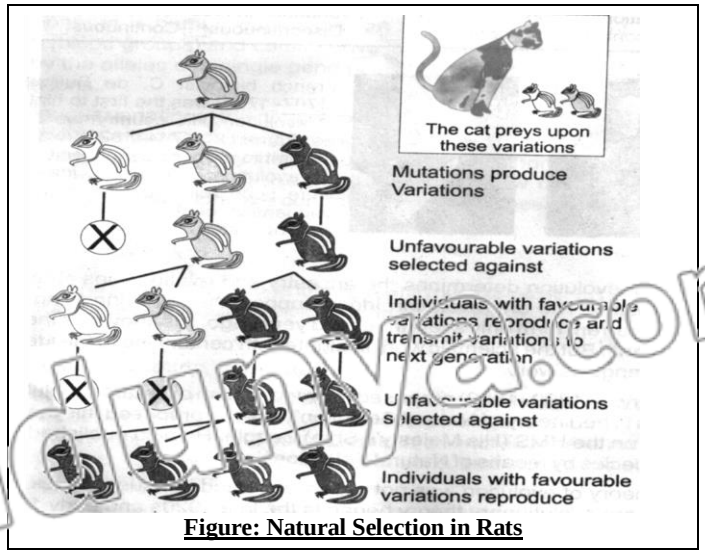

Figure: Natural Selection in Rats

Results of Natural Selection:

As a result of natural selection, the allele that gives more fitness of characteristics (favourable variations) than other alleles becomes more common within population. So, the individuals

with favourable variations become a major part of population while the individuals with harmful or unfavourable variations become rarer.

Second Example:

Natural Selection In Moths:

In England, the moths had two variations:

- Dark coloured moths
- White coloured moths

Favourable and Unfavourable Variations:

The moths used to rest on the light coloured tree trunks on which white lichens had grown. In the 19th century when industries were established in England, the lichens on tree trunks died due to polluted air and the naked tree trunks turned dark. Now the white moth variation became harmful because a white moth resting on a dark tree trunk was easily visible to the predatory birds. The natural selection selected dark moths to reproduce. In this way dark coloured moth became more common and at last the white moths disappeared from population. In this case, the dark colour variation in moth may be considered an adaptation to environment.

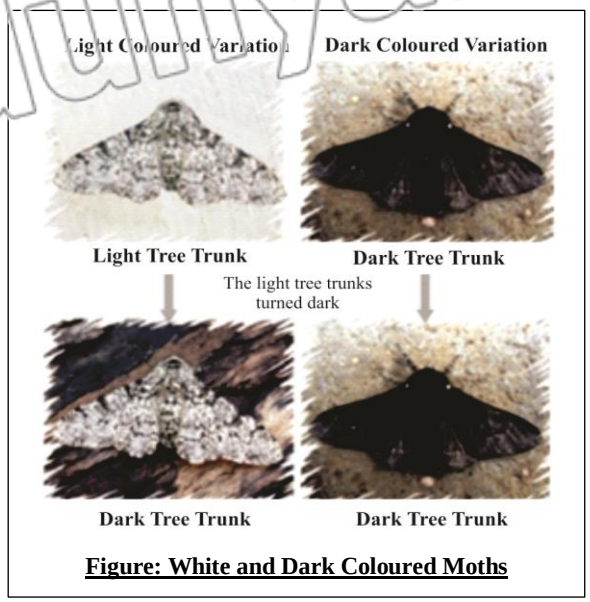

Figure: White and Dark Coloured Moths

15.5 SHORT QUESTIONS

Q.1 What is Theory of Special Creation? (K.B) **(LHR 2017)**

Ans: Page no 186.

Q.2 State Darwin's theory of evolution. (K.B)

Ans: Page no 186.

Q.3 Write limitation of Darwin's theory of evolution. (K.B)

Ans: Page no 186.

Q.4 When the work of modern evolutionary theory was started? (K.B)

Ans: Page no 186.

Q.5 Define organic evolution? (K.B)

Ans: **ORGANIC EVOLUTION**

Definition:

"Organic evolution (biological evolution) is the change in the characteristics of a population or species of organisms over the course of generations".

Q.6 What are the two major processes of organic evolution? (A.B) **(LHR 2017, MTN 2015)**

Ans: **MAJOR PROCESSES OF ORGANIC EVOLUTION**

Organic evolution includes two major processes.

- Alteration in genetic characteristics (traits) of a type of organism over time

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- Creation of new types of organism from a single type.

Q.7 Define gene flow. (K.B) **(LHR 2016)**

Ans:

GENE FLOW

Definition:

"Gene flow is the movement of gene from one population to another".

Q.8 What are the findings of C.de Buffoon and J. de Lamarck in evolution? (K.B)

Ans:

C. DE BUFFOON AND J.DE LAMARCK

French biologist C. de Buffon (1707–1788) was the first to hint at evolution. His countryman, J.de Lamarck (1744–1829) was the first to propose a mechanism of evolution. Lamarck's ideas were soon rejected due to the vagueness of the mechanisms he proposed.

Q.9 Define natural selection. (A.B)

Ans: Page no 186.

Q.10 Differentiate between contenous and Discontenous variation.

Ans: Page no 185.

Q.11 Explain Anti-Evolutiony idea or theory. **(MTN 2015)**

Ans: Page no 186.

15.5 MULTIPLE CHOICE QUESTIONS

1. Year of death of Charles Darwin: (K.B)

(A) 1880 (B) 1882
(C) 1884 (D) 1886

2. Year of death of C. de Buffon: (K.B)

(A) 1780 (B) 1784
(C) 1788 (D) 1790

3. In humans, possible number of chromosomal combinations at fertilization is: (K.B)

(A) 70,368,744,177,664 (B) 75,364,644,177,664
(C) 71,368,744,177,664 (D) 73,368,744,177,664

4. Which one is an example of discontinuous variation? (K.B)

(A) Height (B) Weight
(C) Intelligence (D) Blood group

5. Which one is not an example of continuous variation? (K.B)

(A) Height (B) Weight
(C) Intelligence (D) Blood group

6. Darwin published his book in: (K.B)

(A) 1853 (B) 1855
(C) 1857 (D) 1859

7. Modern evolutionary theory began in late: (K.B)

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(A) 1920 (B) Early 1930
(C) 1940 (D) 1920, early 1930

8. Charles Darwin proposed the mechanism of organic evolution in: (K.B)
(A) 1937 (B) 1838
(C) 1824 (D) 1939

9. The anti-evolution ideas support the theory of: (K.B)
(A) Special creation (B) Organic evolution
(C) Natural selection (D) Evolution

10. Variation in human skin color is: (K.B)
(A) Discontinuous (B) Continues
(C) Variable (D) None

11. Discontinuous variations are controlled by: (K.B)
(A) Single gene pair (B) Multiple gene
(C) Many gene (D) No any gene

12. Continuous variation are controlled by: (K.B)
(A) Single gene pair (B) Many gene pair
(C) No gene (D) Two genes

15.5.2 ARTIFICIAL SELECTION

LONG QUESTION

Q.1 Describe artificial selection. (K.B) **(LHR 2016)**

Ans:

ARTIFICIAL SELECTION

Definition:

"The **intentional breeding** between **individuals** for **certain traits** or **combination** of traits is called **artificial** selection or **selective breeding**".

The **term** "artificial selection" was **expressed** by the **Persian** scientist **Abu Rayhan Biruni** in the **11th century**. **Charles Darwin** also **used** this term in his work on natural selection.

Darwin's Observations:

Darwin noted that many **domesticated animals and plants** had **special properties** that were **developed** by:

- **Intentional breeding** among individuals with **desirable characteristics**
- **Discouraging** the breeding of individuals with **less desirable characteristics**

In **artificial selection**, **humans favor specific** variations for selection while in **natural selection** the environment selects or **rejects** variations.

Advantages of Selective Breading:

Selective breeding has revolutionized **agricultural** and livestock production throughout the world. Animals or plants having **desirable characteristics** are selected for **breeding**. In this way, many **new generations** with **desirable characteristics** are produced.

Breeds:

The bred **animals** are as **breeds** in **artificial selection** are called breeds.

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Cultivars:

The **bred plants** in **artificial selection** are known as **varieties or cultivars**.

Examples:

Numerous breeds of the following animals have been produced by artificial selection:

- **Sheep for wool**
- **Goat for meat**
- **Cow for milk**
- **Hen for eggs**

Plant Varieties:

Similarly many **plant varieties** (cultivars) have been **produced** for **better quantity** and **quality** of:

- **Cereals**
- **Fruits**
- **Vegetables**

Plants Varieties of Wild Mustard:

- **Kohlrabi**
- **Kale**
- **Cabbage**
- **Broccoli**
- **Cauliflower**

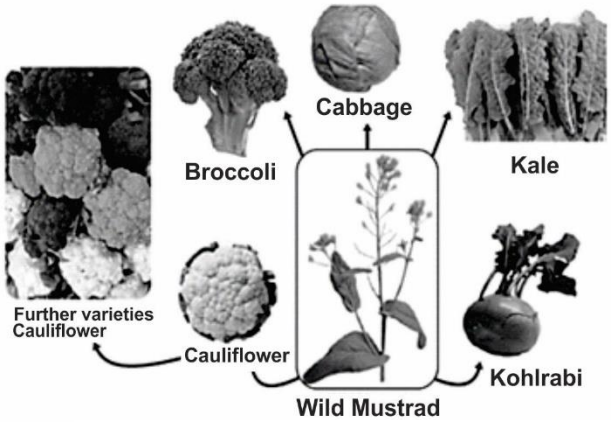

Figure: Plant Varieties Produced through Artificial Selection in Wild Mustard

15.5.2 SHORT QUESTIONS

Q.1 Define artificial selection. Give an example. (K.B) **(MTN 2015, GRW 2017)**

Ans: Page no 190.

Q.2 What are breed and cultivars? Give examples. (K.B)

OR

Differentiate between breed and cultivars. **(LHR 2016)**

Ans: Page no 190.

Q.3 Name three different plant varieties produced through artificial selection of wild mustard? (A.B)

Ans: Page no 191.

15.5.2 MULTIPLE CHOICE QUESTIONS

1. The term artificial selection was expressed by: (K.B)

(A) Abu Rayhan Biruni (B) Ali Ibn-e-Isa

(C) Jabir Bin Hayan (D) Musa Bin Nasir

2. Abu Rayhan Biruni introduced term artificial selection in: (K.B)

(A) 10^{th} century (B) 11^{th} century

(C) 12^{th} century (D) 13^{th} century

3. The bred animals are known as: (K.B)

(A) Cultivars (B) Varieties

(C) Breed (D) Recominant organism

4. The bred plants are known as: (K.B)

(A) Breed (B) Cultivars

(C) Recombinant organism (D) Sheeps

5. Plant varieties produced through artificial selection in wild mustard are: (K.B)

(A) Broccoli (B) Cauliflower

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(C) Broccoli, Cauliflower (D) Milk

ANSWER KEY

MULTIPLE CHOICE QUESTIONS

15.1 INTRODUCTION TO GENETICS

15.2 CHROMOSOMES AND GENES

1	A	**2**	A	**3**	D	**4**	A	**5**	D	**6**	D
7	C	**8**	D	**9**	B	**10**	B	**11**	C	**12**	C
13	A	**14**	A	**15**	D	**16**	D	**17**	A	**18**	A
19	A	**20**	A	**21**	A	**22**	C	**23**	A	**24**	B
25	B	**26**	A	**27**	D	**28**	A	**29**	A	**30**	C

15.3 MEDEL'S LAWS OF INHERITANCE

1	B	**2**	D	**3**	B	**4**	D	**5**	A	**6**	A
7	C	**8**	D	**9**	B	**10**	C	**11**	A	**12**	C
13	A	14	A	15	A	16	B	17	D	18	C
19	B										

15.4 CO-DOMINANCE AND INCOMPLETE DOMINANCE

1	A	**2**	C	**3**	C	**4**	C	**5**	A	**6**	C	**7**	D
8	C	**9**	A	10	A								

15.5 VARIATIONS AND EVOLUTION

1	B	**2**	C	**3**	A	**4**	D	**5**	D	**6**	D
7	D	**8**	B	**9**	A	**10**	B	**11**	A	**12**	B

15.5.2 ARTIFICIAL SELECTION

1	A	**2**	B	**3**	C	**4**	B	**5**	C

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. An organism's expressed physical trait, such as seed colour or pod shape, is called its;
(K.B) **(GRW 2017)**
(a) Genotype (b) Phenotype
(c) Karyotype (d) Physical type

2. An organism has two different alleles for a single trait. Its genotype is said to be: (U.B)
(a) Homozygous (b) Heterozygous
(c) Hemizygous (d) Homologous

3. In the cross-pollination between a true-breeding yellow pod plant and true-breeding green pod plant, where green pod colour is dominant, the resulting offspring (F1 generation) will be: (U.B)
(a) ¼ green, ¾ yellow (b) All yellow
(c) ¼ yellow, ¾ green (d) all green

4. How many genetically different kinds of gametes an individual with genotype AAbb can produce? (U.B)
(a) 1 (b) 2
(c) 4 (d) 8

5. Which of the following statements regarding genes is FALSE? (K.B)
(a) Genes are located on chromosomes
(b) Genes consist of a long sequence of DNA
(c) A gene contains information for the production of a protein
(d) Each cell contains a single copy of every gene

6. Mendel's primary contribution to our understanding of inheritance was: (U.B)
(a) The idea that genes are found on chromosomes
(b) Explanation of the patterns of inheritance
(c) The discovery of alleles
(d) Determining that informations contained in DNA are for protein synthesis

7. A purple-flowered pea plant has the genotype PP, which of the following statements about this plant is FALSE? (K.B)
(a) Its phenotype will be white flowers
(b) It has a homozygous dominant genotype
(c) When bred to a white-flowered plant, all offspring will be purple flowered
(d) All the gametes produced will have the same flower colour allele

8. Charles Darwin proposed that organism produce many more offspring than can possible survive on the limited amount of resources available to them. According to Darwin, the offspring that are most likely to survive are those that:
(a) Are born first and grow fastest (b) Are largest and most aggressive
(c) Have no natural predators (d) Are best adapted to the environment

ANSWER KEY

1	b	2	b	3	d	4	a	5	d	6	b	7	a	8	d

SHORT QUESTIONS

1. Define genotype and phenotype. (K.B)

Ans:

GENOTYPE AND PHENOTYPE

Genotype:

The specific combination of gene in an individual is known as genotype. It is of two types.

- Homozygous Genotype
- Heterozygous Genotype

Phenotype:

The expression of the genotype in the form of trait (in our example, being albino or having normal pigmentation) is known as the phenotype.

2. What do you mean by dominant and recessive alleles? (K.B)

Ans:

DOMINANT AND RECESSIVE ALLELES

Dominant Alleles:

When in the heterozygous condition one allele masks or prevents the expression of the other, it is called the dominant allele.

Example:

- "R" allele is dominant over "r" allele for the shape of seed.

Recessive Alleles:

The allele which is not expressed is called recessive allele.

Example:

"r" allele is recessive for the shape of seed.

3. What are the homozygous and heterozygous genotypes? (K.B)

Ans:

HOMOZYGOUS AND HETEROZYGOUS GENOTYPES

Homozygous Genotype:

The genotype in which the gene pair contains two identical alleles (AA) is called homozygous genotype.

Heterozygous Genotype:

The genotype in which the gene pair contains two different alleles (Aa) is called the Heterozygous genotype.

4. Differentiate between natural and artificial selection. (K.B)

Ans:

DIFFERENTIATION

The differences between natural selection and artificial selection are as follows:

Natural Selection	Artificial Selection
• Natural selection is the process by which the better genetic variations become more common in successive generations of a population.	• Artificial selection or selective breeding means intentional breeding between individuals for certain traits, or combination of traits.
• Natural selection is necessary for evolutionary process.	• Artificial selection is intentional breeding among individuals with desirable characteristics.

UNDERSTANDING THE CONCEPT

Q.1 Describe the structure of chromatin. (K.B)

Ans. See LQ.1 (Topic 15.1, 15.2)

Q.2 Describe Mendel's law of segregation. (K.B)

Ans: See LQ.2 (Topic 15.3)

Q.3 Explain how Model proved the law of independent assortment. (U.B)

Ans: See LQ.3 (Topic 15.3)

Q.4 How would you prove that variations lead to evolution? (U.B)

Ans: See LQ.3 (Topic 15.5)

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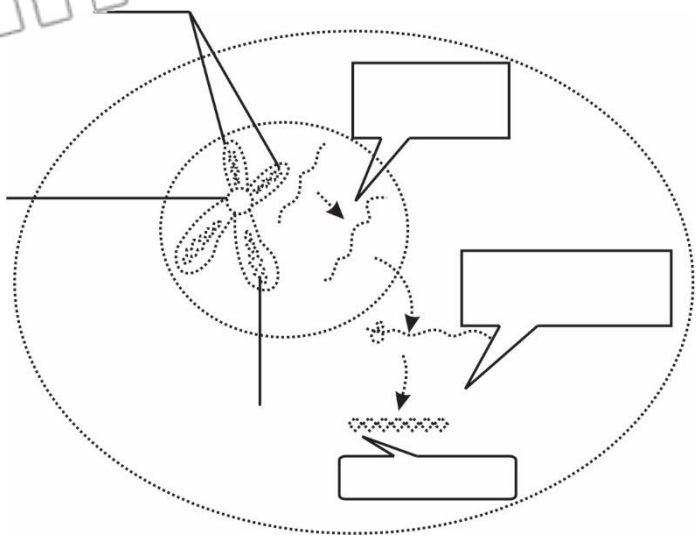
Q.5 Explain the phenomenon of incomplete dominance with the help of example. (K.B)
Ans: See the Q.2 of (Topic 15.4)
Q.6 What do you mean by co-dominance? Give an example. (K.B)
Ans See the Q.1 of (Topic 15.4)

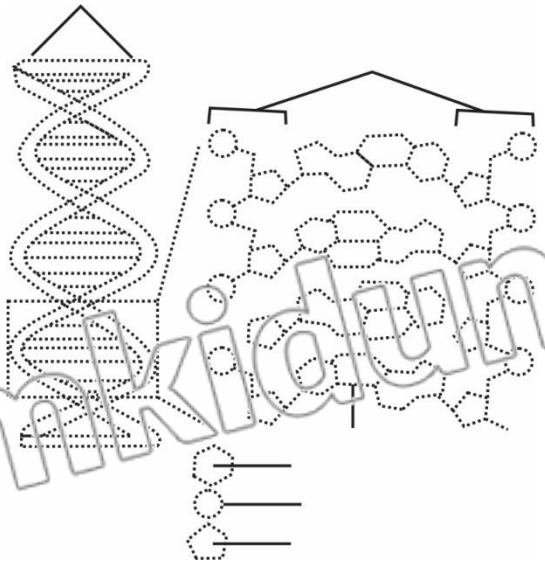
KIPS ASSIGNMENT

PRACTICE DIAGRAM & LABEL

WORKING OF DNA



THE WATSON AND CRICK MODEL OF DNA



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. How many types of nucleotides are present in DNA? (K.B)

(A) 1 **(B)** 2

(C) 3 **(D)** 4

2. The term true breed means: (K.B)

(A) Heterozygous **(B)** Genotype

(C) Phenotype **(D)** Homozygous

3. Genotype of blood group B: (U.B)

(A) I^AI^A **(B)** I^Ai

(C) I^BI^B **(D)** AB

4. The specific combination of gene in an individual is known as: (K.B)

(A) Phenotype **(B)** Genotype

(C) Gene **(D)** Allele

5. The anti-evolution ideas support the theory of: (K.B)

(A) Special creation **(B)** Organic evolution

(C) Natural selection **(D)** Evolution

6. An organism's expressed physical trait, such as seed colour or pod shape, is called its: (K.B)

(A) Genotype **(B)** Phenotype

(C) Karyotype **(D)** Physical type

Q.2 Give short answers to following questions. **(5×2=10)**

(i) What is P1 generation and F1 and F2 generation? **(K.B)**

(ii) What is albinism and its genotype? **(A.B)**

(iii) Give some example of traits in human. **(K.B)**

(iv) Define in-complete dominance. **(K.B)**

(v) What is the theory of special creation? **(K.B)**

Q.3 Answer the following questions in detail. **(5+4=9)**

(a) Describe Watson and Crick model of DNA. **(K.B)**

(b) Why did Mendel select pea plant**? (A.B)**

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of the students.

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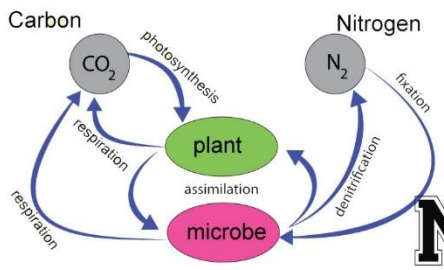

CH# 16

MAN AND HIS ENVIRONMENT

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16.1 LEVELS OF ECOLOGICAL ORGANIZATION

LONG QUESTIONS

Q.1 Write a note on components of an ecosystem. (K.B) **(LHR 2014)**

Ans:

COMPONENTS OF AN ECOSYSTEM

Definition:

"The **self sufficient** unit of an **environment** that is formed as a result of **interactions** between its **biotic community** and the **abiotic components** is known as an ecosystem."

Examples:

- Pond
- Lake
- Forest

Parts:

An ecosystem comprises of **two basic** parts:

- Abiotic components
- Biotic components

Abiotic Components:

"The **non-living** factors present in ecosystem are called **abiotic components**".

Examples:

The important non-living factors are:

- **Light**
- **Air**
- **Water**
- **Soil**
- **Basic elements**
- **Compounds**

Biotic Components:

"All the **living parts** (organisms) of the ecosystem are called as **biotic components**".

Classification:

Biotic components are further **classified** as:

- **Producers**
- **Consumers**
- **Decomposers**

Producers:

The producers are the **autotrophs** present in an ecosystem. These organisms are able to **synthesize complex organic compounds** (food) from **inorganic raw materials**. Producers form the basis of any **ecosystem**.

The **minerals**, which are **released** by **decomposers**, are used as **nutrients** by the produces.

Examples:

Producers include:

- **Plants**
- **Algae**
- **Photosynthetic bacteria**

Terrestrial Ecosystem:

In **terrestrial ecosystems**, **plants** are the **main producers**.

Aquatic Ecosystem:

In **aquatic ecosystems**, the **main producers** are the **floating photosynthetic** organisms (mainly algae) called **phytoplankton** and **shallow** water **rooted plants**.

Consumers:

The **consumers** are **heterotrophs**. They cannot **synthesize** their **food** and so **depend** upon **producers** for food.

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Examples:
Consumers include:
- All animals
- Fungi
- Protozoans
- Many of the bacteria

Major Consumers of Ecosystems:
The **animals** are the **major consumers** of ecosystems. They are further classified as:
- Herbivores
- Carnivores

Herbivores (Primary Consumers):
The animals that feed on plants are called **herbivores**. The herbivores are the **primary consumers**. They feed **directly** on **plants** or products of plants.

Examples:
- Cattle
- Deer
- Rabbit
- Grasshopper

Carnivores:
The animals that **feed** on other **animals** are called **carnivores**.

Types:
The types of carnivores are as follows:
- **Primary carnivores**
- **Secondary carnivores**
- **Tertiary carnivores**

Primary Carnivores:
Primary carnivores **(secondary consumers) feed** on **herbivores**.

Examples:
- Fox
- Frog
- Predatory birds
- Fish
- Snakes

Secondary Carnivores:
Secondary carnivores **(tertiary consumers)** feed on **primary carnivores.**

Examples:
- Wolf
- Owl

Tertiary Carnivores:
Tertiary carnivores feed on **secondary carnivores**. Tertiary carnivores are not **eaten** by any other animals. They are also called **top carnivores**.

Examples:
- Lion
- Tiger

Decomposers:
Decomposers or reducers **break down** the **complex organic** compounds of **dead matter** (of plants and animals) into **simple compounds**. They **secrete digestive enzymes** into dead and **decaying** plant and animal remains to **digest** the organic material. After digestion, decomposers absorb the products for their **own use**. The **remaining** substances are added to **environment**.

Examples:
- Bacteria

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- Fungi

16.1 SHORT QUESTIONS

Q.1 Differentiate between ecosystem and ecology. (K.B)

Ans:

DIFFERENTIATION

The difference between ecosystem and ecology is as follow:

Ecology	Ecosystem
• The study of the interrelationship between organisms and their environment is called ecology.	• The self-sufficient unit of an environment that is formed as a result of interaction between its biotic community and the abiotic components are known as an ecosystem.

Q.2 Differentiate between population and community? (K.B) **(MTN-15, SWL-14, BWP-15, DGK-14, LHR-16)**

Ans:

DIFFERENTIATION

The differences between population and community are as follows:

Population	Community
Definition	
• A group of the organisms of the same species inhabiting a specific geographical area at a particular time is called a population.	• All the population that live in a habitat and interact in various ways with one another are collectively called a community
Example	
• The human population in 2010 is 173.5 million.	• Forest community

Q.3 Define biosphere. Write its range. (K.B) **(LHR 2015)**

Ans:

BIOSPHERE

Definition:

"All ecosystems of the world together form the biosphere. It includes all the ecosystems of the planet earth."

The biosphere makes a thin layer surrounding the planet earth.

Range:

Biosphere range from the floor of oceans to the tops of the highest mountain. It is about "20" kilometer thick.

Q.4 Define ecosystem. Give example of natural and artificial ecosystem? (K.B) **(GRW 2014)**

Ans: Page no 198.

Q.5 What are abiotic components of ecosystem? (K.B) **(MTN 2015, LHR 2016, GRW 2015)**

Ans: Page no 198.

Q.6 What are biotic components of ecosystem? (K.B) **(DGK 2015, LHR 2016, MTN 2015, GRW 2015)**

Ans: Page no 198.

Q.7 What are producers? Give example? (K.B) **(LHR 2014)**

Ans: Page no 198.

Q.8 Write the names of producers in terrestrial and aquatic ecosystems. (K.B) **(DGK 2014)**

Ans: Page no 198

Q.9 What is consumer? Give example. (K.B) **(DGK 2014, SWL 2015)**

Ans: Page no 198, 199.

Q.10 What are reducers? Give example. (K.B) **(BWP 2014, SWL 2015)**

Ans:

REDUCERS

Decomposers or reducers break down the complex organic compound of dead matter (of plants and animals) into simple compounds.

Example:

Many types of bacteria and fungi are the principal decomposers of biosphere.

Q.11 What are omnivores? (K.B)

Ans: Page no 206.

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16.1 MULTIPLE CHOICE QUESTIONS

1. A group of organisms which can interbreed freely in nature and produce fertile off springs: (K.B)

(A) Community (B) Population
(C) Biosphere (D) Species

2. All populations collectively are called_____. (K.B) **(GRW 2013)**

(A) Species (B) Biome
(C) Community (D) Ecosystem

3. An example of artificial ecosystem: (K.B)

(A) River (B) Ocean
(C) Rain forest (D) Aquarium

4. Thickness of biosphere: (K.B)

(A) 10 Km (B) 15 Km
(C) 20 Km (D) 25 Km

5. Interrelationship between organisms and environment is called: (K.B) **(LHR 2015)**

(A) Mycology (B) Ecology
(C) Physiology (D) Morphology

6. Which one is not a biotic component: (K.B)

(A) Producer (B) Consumer
(C) Decomposer (D) Air

7. The consumers that feed on plants: (K.B)

(A) Omnivores (B) Carnivores
(C) Herbivores (D) Insectivores

8. The first trophic level is made up of: (U.B)

(A) Consumers (B) Producers
(C) Herbivores (D) Carnivores

9. Man is: (K.B)

(A) Omnivore (B) Carnivore
(C) Insectivore (D) Herbivore

10. Human is a _____ consumer. (U.B)

(A) Primary (B) Secondary
(C) Tertiary (D) Quaternary

11. All the ecosystem of the world together from the _____. (K.B) **(LHR 2016)**

(A) Population (B) Bisphere
(C) Cummunity (D) Habitat

12. Study of the relationship between organism and their environment is called: (K.B) **(LHR 2016, GRW 2017)**

(A) Histology (B) Ecology
(C) Genetics (D) Anatomy

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16.2 FLOW OF MATERIALS AND ENERGY IN ECOSYSTEMS

LONG QUESTIONS

Q.1 Describe flow of energy in an ecosystem. (K B)

Ans:

FLOW OF ENERGY

In an ecosystem, **energy** as well as **materials** travel from one **trophic level** to the next. **Trophic** (food) level is the level at which an **organism feeds** in food chain. The first trophic level is made of producers; the **second** of primary consumers and so on.

Flow of Energy:

The flow of energy in different trophic levels of ecosystem is unidirectional.

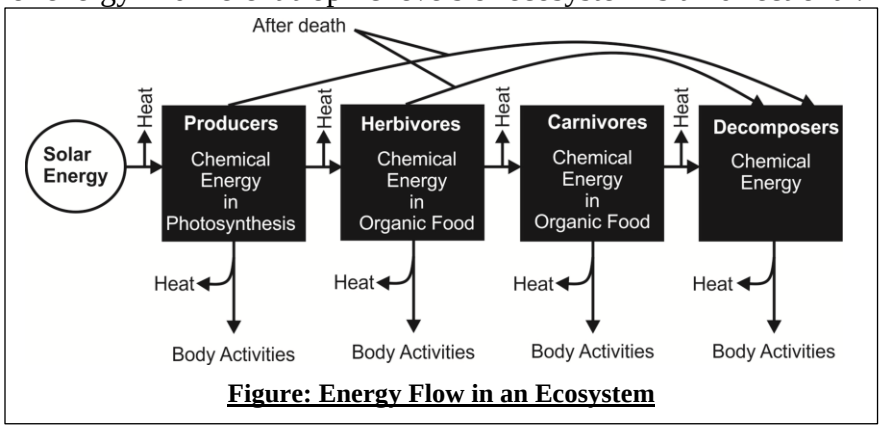

Figure: Energy Flow in an Ecosystem

Source of Energy:

The sun is the **primary source** of energy for all ecosystems.

Energy in Producers:

Producers get **solar energy** and transform it into **chemical energy** by the process of **photosynthesis**. They store this energy in their tissues and also transform it into **mechanical** and heat energy during their **metabolic activities**.

Energy in Herbivores:

The energy in producers' **tissues** flows to herbivores when producers are eaten. Herbivores transform it into mechanical and heat energy during their metabolic activities and store the rest in their tissues.

Energy in Carnivores:

Carnivores eat herbivores and **get energy**. They also use it for their **body activities** and store the rest in their tissues.

Energy in Decomposers:

After the death of producers and consumers, the **energy stored** in their tissues is used by **decomposers**.

Law of Thermodynamics:

The storage and **expenditure** of energy in an **ecosystem** is in **accordance** with the basic law of **thermodynamics**.

Statement:

"Energy can neither be created nor destroyed but can be transformed from one form into another".

Energy within Ecosystem:

In an ecosystem there is:

- Constant flow or **transfer of energy** from the Sun through producers to **consumers** and decomposer.

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- A **significant decrease** in useful energy during **transfer** of energy at each **trophic level**.

Q.2 Describe flow of material in an ecosystem. (K.B)

Ans:

FLOW OF MATERIALS

The **material flow** from one tropic level to the next by means of food chains and food webs.

Food Chain:

"A food chain is a series of **organisms** within an **ecosystem**, in which each **organism** feeds on the one before it and is fed by the one after it".

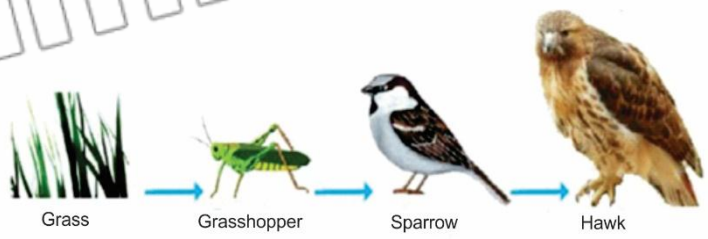

Figure: A Simple Food Chain

- The base of food chain is always formed by a plant (producer).
- It is eaten by a **primary consumer**, which is **preyed upon** by a **secondary consumer**.
- The **secondary consumer** may be eaten by a **tertiary consumer**.

Representation:

A food chain, can therefore, be represented as:

Producer – Primary Consumer – Secondary Consumer – Tertiary

Nutritive Interaction:

A food chain involves a **nutritive interaction** among the **biotic components** of an ecosystem. Usually there are 4 or 5 trophic levels. Shorter food chain provides greater available energy and vice versa.

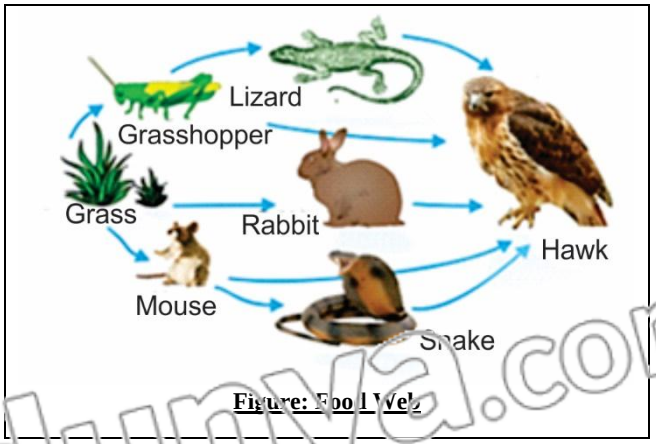

Figure: Food Web

Food Web:

"A network of food chains which are **interconnected** at various trophic levels".

Explanation:

In nature, food chain is **very complex**, as an organism may be the **food source** of many other organisms. Thus, instead of a simple linear food chain, there is a web-like structure formed by these **interlinked** food chains. Such **interconnected** food chains collectively make food web

Q.3 Write a note on ecological pyramids. **(GRW 2017)**

OR

Explain what do you mean by the pyramids of number and biomass. (A.B) **(Understanding the Concept Q.1)**

Ans:

ECOLOGICAL PYRAMIDS

Definition:

"A representation of the number of individuals or amount of **biomass** or **energy** present in various **trophic** levels of a **food chain**."

Explanation:

In **1927**, **Charles Elton** (an English ecologist) developed the concept of **ecological pyramids**.

Observation of Charles Elton:

He noted that the animals present at the **beginning** of food chain are **abundant** in number while the animals **present** at the end of food chain are **fewer** in number.

Types:

Ecological pyramids are of **three types**.

- Pyramid of Numbers
- Pyramid of Biomass
- Pyramid of Energy

The two are given below:

Pyramid of Numbers:

"The **graphic representation** of the number of individuals per unit area at **various trophic** levels are called pyramid of numbers."

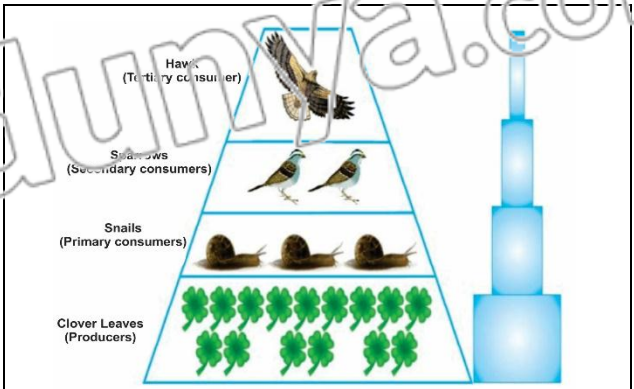

Figure: Pyramid of Numbers in an Ecosystem

Explanation:

Usually, producers are present in large number, primary consumers are in lesser number, and **secondary consumers** are fewer, and so on. So, the producers are of smallest size but maximum in number, while the **tertiary consumers** are larger in size but lesser in number.

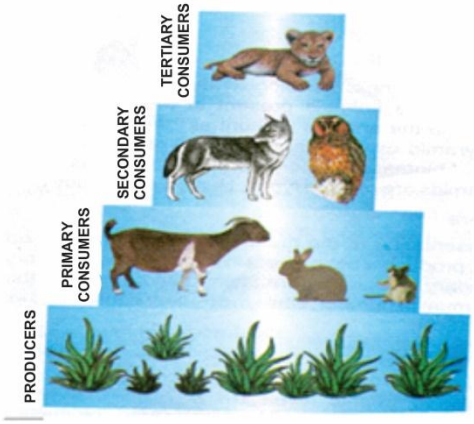

Figure: Pyramid of Biomass in an Ecosystem

Pyramid of Biomass:

"The graphic **representation** of **biomass** present per unit area at different trophic levels is called **pyramid of biomass**".

Biomass:

"The total amount of **living or organic matter** in an **ecosystem** at any time is called biomass".

Explanation:

In a **terrestrial ecosystem**, the maximum biomass occurs in producers, and there is progressive decrease in biomass from lower to higher trophic levels.

16.2 SHORT QUESTIONS

Q.1 Define trophic level. What are first and second trophic levels? (K.B) **(LHR 2015, SWL 2015)**

Ans:

TROPHIC LEVEL

Definition:

Trophic (food) level is the level at which an organism feeds in food chain.

First Trophic Level:

- The first trophic level is made of producers.

Second Trophic Level:

The second trophic level is made of primary consumers.

Q.2 State law of thermodynamics. (A.B)

Ans:

LAW OF THERMODYNAMICS

Statement:

Energy can neither be created nor destroyed but can be transformed form one from into another. Energy in an ecosystem is in accordance with the basic law of thermodynamics.

Q.3 How law of thermodynamics is used in energy expenditure in an ecosystem? (A.B)

Ans:

LAW OF THERMODYNAMICS IN ECOSYSTEMS

In an ecosystem there is:

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- Constant flow or transfer of energy from the Sun through producers to consumers and decomposers.
- A significant decrease in useful energy during transfer of energy at each trophic level.

Q.4 Define food chain. Give example. (K.B)
(LHR 2016, 17, GRW 2016, MTN 2015, BWP 2014,15, SWL 2014, 15)

Ans: Page no 203.

Q.5 Define Food Web. Give example. (K.B) **(MTN 2015, SWL2014, 15, GRW 2014, DGK 2014)**

Ans: Page no 202.

Q.6 How food chain can be represented? (K.B)

Ans: Page no 203.

Q.7 Define ecological pyramid. (A.B) **(LHR 2015)**

Ans: Page no 203.

Q.8 Define pyramid of number. (A.B) **(LHR 2013)**

Ans: Page no 204.

Q.9 Define pyramid of biomass. (A.B)

Ans: Page no 204.

16.2 MULTIPLE CHOICE QUESTIONS

1. Which one is the primary source of energy? (K.B)

(A) Moon (B) Mars
(C) Sun (D) Mercury

2. A network of food chains which are interconnected at various trophic levels: (K.B)

(A) Community (B) Population
(C) Species (D) Food web

3. Who developed the concept of ecological pyramids? (K.B) **(LHR 2013)**

(A) Charles Darwin (B) Charles Elton
(C) Charles Brown (D) Charles Asker

16.2.4 BIOGEOCHEMICAL CYCLES

LONG QUESTIONS

Q.1 Write a note on carbon cycle. (K.B) **(Understanding the Concept Q.2) (LHR 2015, 17, GRW 2016)**

Ans:

CARBON CYCLE

Definition:

"The **biogeochemical cycle** in which carbon flows between the **organisms** and the **environment**".

Carbon cycle is a **perfect cycle** in the sense that carbon is **returned** to **atmosphere** as soon as it is **removed**.

Explanation:

Carbon atom is the **principal building** block of many kinds of **biomolecules**. Carbon is found as **graphite** and **diamond** in nature. It also **occurs** as carbon **dioxide** in atmosphere.

Sources of Carbon:

Major source of carbon for the living world is **carbon dioxide** present in **atmosphere and water**. Carbonates of **Earth's crust** also give rise to carbon dioxide.

Fossil fuels also contain **carbon** like:

- **Peat**

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- **Coal**
- **Natural gas**
- **Petroleum**

Photosynthesis:

The **major process** that brings carbon from **atmosphere** or water into living world is **photosynthesis**. Producers take in carbon dioxide from atmosphere and convert it into organic **compounds**. In this way, **carbon** becomes a **part** of the **body** of producers.

Carbon in Animals:

This carbon **enters** food chains and is passed to:

- **Herbivores**
- **Carnivores**
- **Omnivores**
- **Decomposers**

Respiration:

Carbon dioxide is **released** back to environment by **respiration** of producers and consumers.

Decomposition:

It is also released by the **decomposition** of **organic wastes** and **dead bodies** by **decomposers**.

Combustion:

Burning of wood and **fossil fuels** also adds **large amount** of **carbon dioxide** in atmosphere.

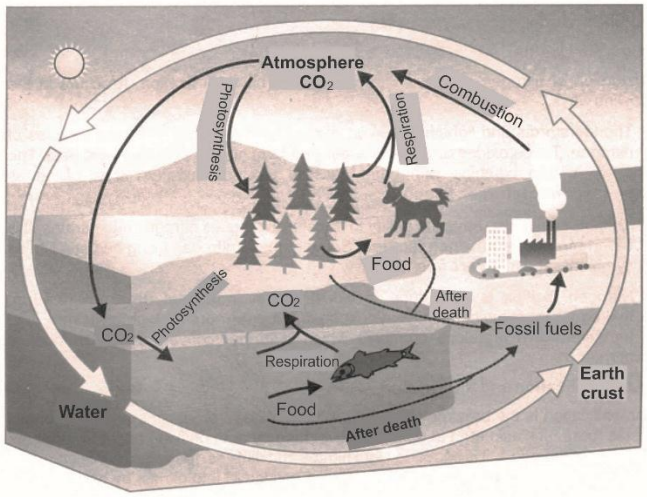

Figure: Carbon Cycle

Disturbance of Carbon Cycle:

The **balance** of carbon cycle has been **upset** by **human activities** such as:

- **Deforestation**
- **Excessive burning of fossil fuels**

Consequences:

As a result, the amount of **carbon dioxide** in atmosphere is **increasing**, causing:

- **Greenhouse effect**
- **Global warming**

Q.2 Write a note on nitrogen cycle. (K.E) **(LHR 2015)**

OR

What are the different stages of nitrogen cycle? (K.B) **(Understanding the Concept Q.3)**

Ans:

NITROGEN CYCLE

Definition:

"It is the flow of **nitrogen** between the **organisms and environment**".

Occurrence:

Nitrogen is an important component of many biomolecules, like:

- **Proteins**
- **Nucleic acids** (DNA and RNA)

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- Atmosphere is the **reservoir of free gaseous nitrogen**

Living organisms **cannot** pickup this gaseous **nitrogen directly** from atmosphere **except** for **nitrogen fixing bacteria**. It has to be **converted** into **nitrates** to be utilized by plants.

STAGES OF NITROGEN CYCLE

Nitrogen cycling involves several stages.

- Formation of nitrates
- Assimilation
- Denitrification

Formation of Nitrates:

It is done by the following ways:

Nitrogen Fixation:

The conversion of **nitrogen** gas into **nitrates** is called **nitrogen fixation**. It occurs in the following ways.

Atmospheric Nitrogen Fixation:

Thunderstorms and lightning convert atmospheric gaseous nitrogen to **oxides of nitrogen**. These oxides **dissolve** in water and form nitrous acid and **nitric acid**. The acids in **turn combine** with other salts to produce **'nitrates'**. It is called as atmospheric nitrogen fixation.

Biological Nitrogen Fixation:

Some bacteria also have the **ability** to transform gaseous nitrogen into nitrates. It is called biological nitrogen fixation. Some of these **nitrogen fixing bacteria** live as **symbionts** and many are **free-living**.

Industrial Nitrogen Fixation:

Nitrogen fixation is also **done** in industries. In industrial nitrogen fixation, **hydrogen** is **combined** with atmospheric nitrogen under **high pressure** and **temperature**. It produces ammonia which is further **converted** into **ammonium nitrate**.

Ammonification and Nitrification:

Ammonification:

"The **breakdown** of the **proteins** of dead organisms and **nitrogenous wastes** (urea, uric acid etc.) to ammonia is called ammonification".

It is done by **ammonifying bacteria**.

Nitrification:

"The process of **conversion** of ammonia into nitrites and **nitrates** is called **nitrification**."

It is done by **nitrifying bacteria**".

Formation of Nitrites:

First, ammonia is converted into nitrites by bacteria like:

- **Nitrosomonas**

Formation of Nitrates:

The nitrites are then **converted** into **nitrates** by other bacteria like:

- **Nitrobacter**

Assimilation:

"The **utilization** of **nitrates** by organisms is called assimilation".

Explanation:

The **nitrates** formed by the processes of **nitrification**, are absorbed by plants and are **utilized** for making proteins etc. Animals take **nitrogenous** compounds from plants.

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Denitrification:

"The **biological** process in which **nitrates** and **nitrites** are reduced to **nitrogen** gas by **denitrifying bacteria** is called **denitrification**".

Explanation:

By this process, nitrogen is returned to **atmosphere**.

Excessive denitrification **reduces soil fertility** and is stimulated by:

- **Water logging**
- **Lack of aeration**
- **Accumulation of organic matter in the soil.**

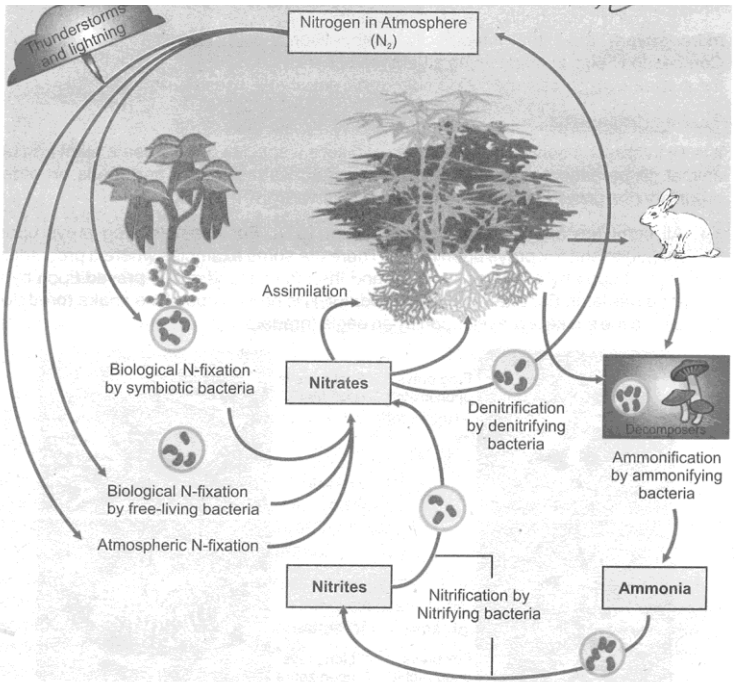

Figure: Nitrogen Cycle

16.2.4 SHORT QUESTIONS

Q.1 Write a note on biogeochemical cycles. (K.B)

OR

Define biogeochemical cycles. (K.B) **(LHR 2013,14, GRW 2014)**

Ans: Page no 205.

Q.2 Write a note on nitrogen fixation. (K.B) **(LHR 2016)**

OR

What is meant by nitrogen fixation? (K.B) **(LHR 2017)**

OR

Define atmospheric nitrogen fixation. (K.B)

OR

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What is industrial nitrogen fixation? (K.B) **(LHR 2014)**

Ans: Page no 207.

Q.3 Differentiate between nitrification and denitrification. **(GRW 2016)**

Ans: **DIFFERENTIATION**

The difference between nitrification and denitrification is as follows:

Nitrification	Denitrification
• The process of conversion of ammonia into nitrites and nitrates is called nitrification. It is done by nitrifying bacteria".	• The biological process in which nitrates and nitrites are reduced to nitrogen gas by denitrifying bacteria is called denitrification.

Q.4 Write ways to convert nitrogen gas into nitrates? (K.B)

Ans: Page no 207.

Q.5 How balance of carbon cycle has been upset by human activities? (K.B)

Ans: **BALANCE OF CARBON CYCLE**

The balance of carbon cycle has been upset by human activities such as deforestation and excursive burning of fossil fuels. As a result, the amount of carbon dioxide in atmosphere is increasing, causing the greenhouse effect and global warming.

Q.6 What is the effect of excessive denitrification? (A.B) **(GRW 2017)**

Ans: **EFFECT OF EXCESSIVE DENITRIFICATION**

Excessive denitrification reduces soil fertility and it is stimulated by:

- Water logging
- Lack of aeration
- Accumulation of organic matter in the soil

16.2.4 MULTIPLE CHOICE QUESTIONS

1. Excessive denitrification _____ soil fertility. (K.B) **(LHR 2014)**

(A) Increase (B) Reduces

(C) Bad (D) Finished

2. Which one cycle is a perfect cycle in nature? (U.B)

(A) Carbon (B) Oxygen

(C) Nitrogen (D) Water

3. The greenhouse effect and global warming are due to the increase in the concentration of: (U.B)

(A) Sulphur (B) Carbon dioxide

(C) Water vapors (D) Oxygen

4. Ammonia is converted into nitrites by: (K.B)

(A) Streptococcus (B) Penicillium

(C) Nitrobacter (D) Nitrosomonas

5. The biological process in which nitrates and nitrites are reduced to nitrogen gas: (K.B)

(A) Ammonification (B) Nitrification

(C) Denitrification (D) Assimilation

6. Naturally found in graphite and diamond: (K.B) **(LHR 2016)**

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(A) Nitrogen (B) Carbon
(C) Oxygen (D) Hydrogen

7. The total amount of living matter in an ecosystem at any time is called. (K.B) (LHR 2017)
(A) Food web (B) Food chain
(C) Energy (D) Biomass

16.3 INTERACTIONS IN ECOSYSTEMS

LONG QUESTIONS

Q.1 What do you mean by competition? Give an example.
(K.B) (Understanding the Concept Q.4) (GRW 2016)

Ans:

COMPETITION

In **ecosystems**, the natural resources e.g. nutrients, space etc. are usually in short supply. So there is a **competition** among the **organisms of ecosystem** for the utilization of resources. The competition may be **intraspecific** or **interspecific**.

Severity of Competition:

Intraspecific competition is always **stronger** and more **severe** than interspecific competition.

Need of Competition:

Competition helps in **maintaining** a balance between **available resources** and number of individuals of a species.

Competition in Plants:

Plants also show **competition** for:

- **Space**
- **Light**
- **Water**
- **Minerals**

Q.2 Define predation. Explain with examples. (K.B) (Understanding the Concept Q.4)

Ans:

PREDATION

Definition:

"It is an **interaction** between **two animals** of **different species** or between a **plant** and an **animal**".

OR

"The relationship between **predator** and **prey** is called **predation**".

Explanation:

- The organism **attacks**, kills and feeds on other organisms is called predator.
- The organism that is being **hunted upon** is called **prey**.

Examples:

All **carnivore** animals are **predators**. Some examples of predation are given below:

- Frog preys upon mosquito
- Fox preys upon rabbit

There are some examples where a predator is preyed upon by a second predator and then the second one is preyed upon by a third predator.

For example, frog (predator 1) is preyed upon by a snake (predator 2) and the snake is preyed upon by an eagle (predator 3).

Figure: Examples of Predators and their Preys

Carnivorous Plants:

Certain plants are carnivorous and live as **predators**. Such plants live in the areas where **minerals** and other **nutrients** are lacking. They feed on **insects** to fulfill their **nitrogen requirements**. These plants have **mechanism to attract insects**. For example, they secrete sweet nectar that attracts the **insects searching** for food. Their leaves are also modified to capture the prey.

Examples:

- **Pitcher plant**
- **Sundew**
- **Venus flytrap**

Advantages:

- **Predation** keeps the **prey population** under check, so as to **maintain** an **ecological balance**.
- **Humans benefit** from this interaction in the biological control of **weeds and pests**.
- In order to **control pests** in an area, their predators are released there.

Q.3 What is parasitism? Explain its two types with examples (K.B)

(Understanding the Concept Q.4) (LHR 2016)

PARASITISM

Definition:

"A type of symbiosis between members of **different species**, in which **smaller partner** (parasite) derives food and shelter from the body of **larger partner** (host) and, in turn, harms it is called parasitism".

TYPES OF PARASITISM

There are **two types** of parasitism

- Temporary Parasitism
- Permanent Parasitism

Temporary Parasitism:

In **temporary parasitism**, the parasite **spends** most of its **life cycle** as **independent free-living** organisms. Only a part of its life cycle is **spent** as a **parasite**. Some common temporary parasites of humans are:

- **Leech**
- **Bed bug**
- **Mosquito**

Permanent Parasitism:

In **permanent parasitism**, the parasites **spend** their **whole life** cycle as parasites. Some examples of permanent parasites are:

- **Disease causing bacteria**
- **All viruses**

Figure: Leech (An Example of Ectoparasite)

Types of Parasites:

Parasites may also be **classified** as:

- Ectoparasites
- Endoparasites

Ectoparasites:

"The parasites that **live outside** i.e. on the surface of host's body and get food from there are called Ectoparasites".

Examples:

- **Mosquitoes**
- **Leeches**
- **Lice**

Endoparasites:

The parasites that **live inside the body** of host and get food and shelter are called Endoparasites.

Examples:

- **Bacteria**
- **Viruses**
- **Tapeworm**
- **Ascaris**
- **Entamoeba**
- **Plasmodium**

Figure: Endoparasites

Parasitic Plants:

Some plants are **parasites** on other plants. Parasitic plants **grow** special **types of roots** called (haustoria) into **host body** and **suck** the **required nutrients** from the **vascular tissues** of host.

Figure: A Parasitic Plants and its Host Tree Trunk

Example:

Cuscuta plant which is also called **dodder**:

Survival of Host and Parasite:

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Host can **survive** without **parasite**, but **parasite cannot** survive without host.

Q.4 Write a note on mutualism. (K.B) **(Understanding the Concept Q.4)**

Ans:

MUTUALISM

Definition:

"The type of **symbiotic interaction** in which **both partners** of different species get benefit and **neither is harmed** is called mutualism."

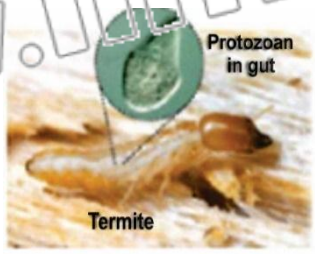

Figure: Termite, with Protozoan in its Gut

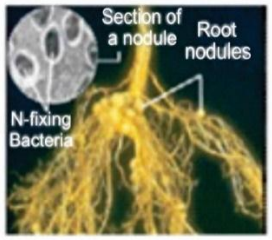

Figure: Bacteria in Root Nodules

Examples:

- Termites and Protozoan
- Bacteria and Plants

Termites and Protozoan:

Termites eat wood but are **not able** to **digest** it. A **protozoan** lives in its **intestine**. It secretes **'cellulase' enzyme** to **digest** the **cellulose of wood**. In return, the **termite provides food** and shelter to the **protozoan**.

Bacteria and Plants:

The nitrogen fixer **bacteria Rhizobium** live in the **root nodules** of **leguminous plants** like pea, gram etc. The bacteria **obtain** food and shelter from plants while in return they **fix gaseous nitrogen** into **nitrates** for the plant which is **required** for their **growth**.

Q.5 Explain commensalism with example. (K.B) **(Understanding the Concept Q.4)**

Ans:

COMMENSALISM

Definition:

"It is a type of **symbiosis** in which **one partner** is **benefited** while the other is **neither benefited nor harmed**".

Figure: An Epiphyte Orchid Plant Growing on a Tree Trunk

Examples:

- Epiphytes
- Sucker Fish

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Epiphytes:

Epiphytes are **small plants** found growing on other **larger plants** for space only. They **absorb water** and minerals from **atmosphere** and prepare their own food. The larger plants are **neither benefited** nor harmed in any way.

Figure: A sucker fish attached with shark

Sucker Fish:

Sucker fish attaches to the surface of **sharks** by its sucker. In this way, the shark **provides** easy **transport** to the sucker fish to **new feeding grounds**.

16.3 SHORT QUESTIONS

Q.1 Describe different interactions in ecosystems. (K.B)

Ans:

INTERACTIONS IN ECOSYSTEMS

In all ecosystems, there are many kinds of interactions among living organism i-e. Intraspecific interaction and interspecific interaction.

Some important interaction among living organisms in ecosystems are given below:

- Competition
- Predation
- Symbiosis
  - Parasitism
  - Mutualism
  - Commensalism

Q.2 Differentiate between intraspecific and interspecific interaction? (K.B) **(LHR 2015, 17, GRW 2017)**

Ans:

DIFFERENTIATION

The differences between intraspecific interaction and interspecific interaction are as follows:

Intraspecific interaction	Interspecific interaction
Definition	
• The interactions between the members of the same species are called intraspecific interactions.	• The interactions between the members of different species are called interspecific interactions.
Example	
• Competition	• Predation • Symbiosis

Q.3 Define predation. Give example. (K.B) **(LHR 2015,16, 17, GRW 2016, MTN 2015, BWP 2014)**

Ans: Page no 210.

Q.4 Define symbiosis. Write its different types. (K.B) **(LRH 2014, GRW 2017)**

Ans:

SYMBIOSIS

Definition:

"A relationship between members of different species, in which they live together for longer or shorter periods of time, is called symbiosis".

TYPES OF SYMBIOSIS

Symbiosis is of three types:

- Parasitism
- Mutualism
- Commensalism

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Q.5 How carnivores plants are predator? Give examples? (U.B) **(LHR 2013)**

Ans:

CARNIVORES PLANTS

Certain plants are carnivorous and live as predators. Such plants live in the areas where minerals and other nutrients are lacking. They feed on insects to fulfill their nitrogen requirements. These plants have mechanism to attract insects. For example, they secrete sweet nectar that attracts the insects searching for food. Their leaves are also modified to capture the prey.

Examples:

- Pitcher plant
- Sundew
- Venus flytrap

Q.6 What are temporary parasitism and permanent parasitism? (U.B)

Ans: Page no 211, 212.

Q.7 What are ectoparasites and endoparasites? (K.B) **(DGK 2014, LHR 2013, GRW 2015)**

Ans: Page no 232.

Q.8 Define mutualism. Give example. (K.B) **(GRW 2016)**

Ans: Page no 212, 213.

Q.9 How Rhizobium bacteria and leguminous plants are mutualistic in interactions? (U.B)

Ans: Page no 213.

Q.10 Define commensalism give one example. (K.B)

Ans: Page no 213.

Q.11 What is the relationship of honeyguide bird and badgers? (U.B)

Ans:

RELATIONSHIP OF HONEYGUIDE BIRD AND BADGERS

The honeyguide bird feeds on wax and the larvae present in honeycombs. It flies around looking for honeycombs, but it is not strong enough to open the comb. Badgers are large mammals that feed on honey. When a honeyguide bird goes to find honeycombs, the badger follows it. When the bird finds a honeycomb, it calls the badger. Sometimes the bird has to stop and wait for the slow-moving badger. After reaching there, the badger opens the honeycomb and both of them eat their foods together. This relationship is the best example of mutualism.

16.3 MULTIPLE CHOICE QUESTIONS

1. Types of symbiosis: (K.B)

(A) 1 (B) 2
(C) 3 (D) 4

2. Plants show competition for: (K.B)

(A) Space (B) Light
(C) Water (D) All of these

3. Which one is an ectoparasite? (K.B)

(A) Leech (B) Liver fluke
(C) Tape worm (D) Ascaris

4. Example of ectoparasite is: (K.B) **(LHR 2015)**

(A) Ascaris (B) Entamoeba
(C) Lice (D) Plasmodium

5. Parasitic plants have special roots called: (K.B)

(A) Rhizoids (B) Adventitious
(C) Tap (D) Haustoria

6. An example of carnivore plants is: (K.B) **(LHR 2014)**

(A) Rose plant (B) Mosses

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(C) Pitcher plant (D) Ferns

7. Small plants found growing on the other larger plants: (K.B)

(A) Lichens (B) Parasites

(C) Epiphytes (D) Barnacles

8. Large mammals that feed on honey: (K.B)

(A) Lions (B) Badgers

(C) Deer (D) Zebras

9. An example of endoparasites: (K.B) **(LHR 2017, GRW 2017)**

(A) Mosquitoe (B) Leeches

(C) Ascaris (D) Lice

16.4 ECOSYSTEM BALANCE AND HUMAN IMPACT

LONG QUESTIONS

Q.1 Write a note on global warming. (K.B) **(LHR 2017)**

OR

What is global warming? Describe its causes. (K.B) **(GRW 2017)**

Ans: **GLOBAL WARMING**

Definition:

"The **increase** in the **temperature** of the earth due to the **accumulation** of **greenhouse gases** is called **global warming**".

Causes:

The addition of greenhouse gases in atmosphere **increases** the temperature of the **Earth**. These greenhouses gases are:

- **Carbon dioxide**
- **Methane**
- **Ozone**

Reflecting Back of Solar Radiations:

These **gases remain** in the **lowest part** of Earth's **atmosphere** and do **not allow** solar **radiations** to **reflect back** into space. As a result, heat remains within the **Earth's atmosphere** and **increases** its temperature.

Effects:

Due to **global warming**:

- **Polar ice-caps** and **glaciers** are **melting faster** than the time taken for **new ice layers** to form.
- **Sea water** is also expanding causing sea levels to rise.
- Due to **melting glaciers**, rivers overflow and cause **floods**.

Q.2 Describe greenhouse effect. (K.B)

Ans: **GREEN HOUSE EFFECT**

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Definition:

"The term **'Greenhouse Effect'** refers to the phenomenon in which certain gases called **greenhouse gases trap** heat in the **atmosphere**".

Escape of Heat:

These **gases act** like the glass in a **greenhouse**, which **does not allow** the inner heat to escape. When **sunlight reaches** the surface of the Earth, much of its energy is transformed into **heat energy**. The **Earth surface** reflects this heat energy towards space as **infrared radiation**. The greenhouse gases trap **infrared radiation** and **send** it **back** to **Earth**.

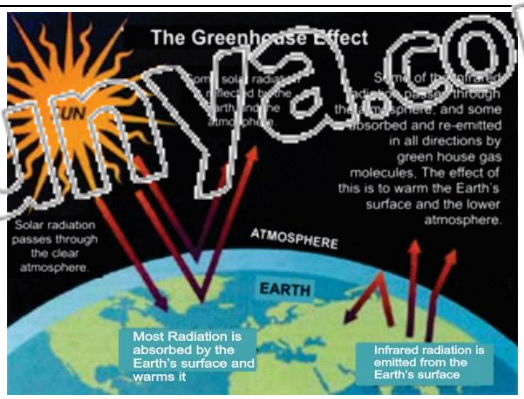

Figure: Greenhouse Effect

Green House Gases:

Some important greenhouse gases are:

- **Carbon dioxide**
- **Methane**
- **Nitrous oxide**

Increase Concentration of Greenhouse Gases:

Since **1800**, there is remarkable **increase** in the **amount** of the following **gases** in atmosphere:

- **Carbon dioxide 30 %**
- **Methane Doubled**
- **Nitrous oxide 8%**

Q.3 Describe adverse effects acid rain. (K.B)

Ans: **ACID RAIN**

Definition:

"The rain consisting of **sulphuric** acid and **nitric acid** with pH range of **3 to 6**".

Formation of Acids:

When **rain falls** through **polluted air**, it comes across **chemicals** such as **oxides of sulphur** and **nitrogen**. These chemicals **interact** with **water vapors** in the presence of **sunlight** to form **sulphuric acid** and **nitric acid**. These acids remain as **vapors** at **high temperatures**.

$$\text{Oxides of Sulphur} + \text{Water} \rightarrow \text{Sulphuric acid}$$

$$\text{Oxides of Nitrogen} + \text{Water} \rightarrow \text{Nitric acid}$$

pH Level:

As **temperature** falls, the **acids** begin to **condense** into **liquid** form and mix with **rain or snow**, on the way down to the Earth. This makes **rain acidic** with **pH** range of **3** to **6**.

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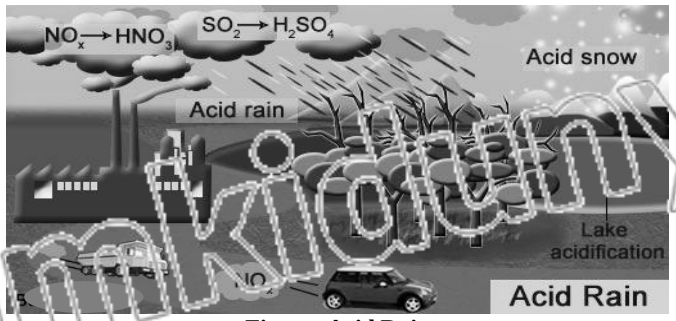

Figure: Acid Rain

ADVERSE EFFECTS OF ACID RAIN

Some of the significant ill **effects** of acid rain are:

Destruction of Nutrients:

Acid rain **destroys** the necessary **nutrients** present in the **waters** of rivers and lakes. Acid rain washes **nutrients** out of **soil**.

Lowering pH Level:

It also lowers the **pH** of **water**. Most of the **aquatic animals** cannot survive at this pH.

Damage to Trees:

It **damages** the bark and leaves of trees and **harms root hairs**. Leaf pigments like **chlorophyll** are also **destroyed**.

Corrosion:

Metallic surfaces exposed to acid rain are easily **corroded**.

Loss of Strength:

The following products **lose** their **material strength** or **disintegrate** easily due to acid rains:

- **Fabrics**
- **Paper**
- **Leather**

Damage to Building Materials:

Building materials are **weakened** with acid rains because of the **formation** of **soluble compounds** such as:

- **Limestone**
- **Marble**
- **Dolomite**
- **Mortar**
- **Slate**

Damage to Historical Monuments:

Acid rain is **dangerous** for **historical monuments**. The building of famous **Taj Mahal** has been **corroded** at **many places**, due to acid rains.

Q.4 Write a note on deforestation. (K.B)

Ans:

DEFORESTATION

Definition:

"The **clearing** of **forests** by **natural causes** or **humans** is called **deforestation**".

Causes:

Large areas of forests have been **cleaned** for:

- **Agriculture**
- **Factories**
- **Roads**

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- **Rail tracks**
- **Mining**
- Humans cut trees for **getting wood** (lumber), which is then used for making structures and for heat production.
- Humans **prey upon** forest **animals** which are the **predators** of many **insect pests**. In this way, insect pests destroy forests by eating the shoots and spreading diseases.

Effects:

The effects of deforestation include:

- **Floods**
- **Droughts**
- **Landslides**
- **Soil erosions**
- **Global warming**
- **Loss of habitat** of many species

Q.5 Write a note on overpopulation. (K.B)

Ans: **OVERPOPULATION**

Population:

"A **group** of the **organisms** of the **same species inhabiting** a specific geographical area **(habitat)** at a **particular** time is called a population".

World Population:

- When the **industrial revolution** started some 250 years ago, the world population was **600 million**.
- Now the **world population** is almost ten times at **6 billion**.
- The population will grow to **8 billion** by **2025**.

Reasons:

The following things have **contributed** in population growth:

- **Better health facilities**
- **Lowered mortality rates**

Year	Population	Year	Population
1981	85,096,00	1999	134,790,00
1984	92,284,301	2002	144,902,409
1987	99,953,282	2005	155,772,000
1990	107,975,060	2008	166,111,487
1993	116,444,165	2009	169,708,303
1996	125,409,851	2010	173,510,000

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		2015	189,000,000

Figure: Pakistan Population Growth Rates

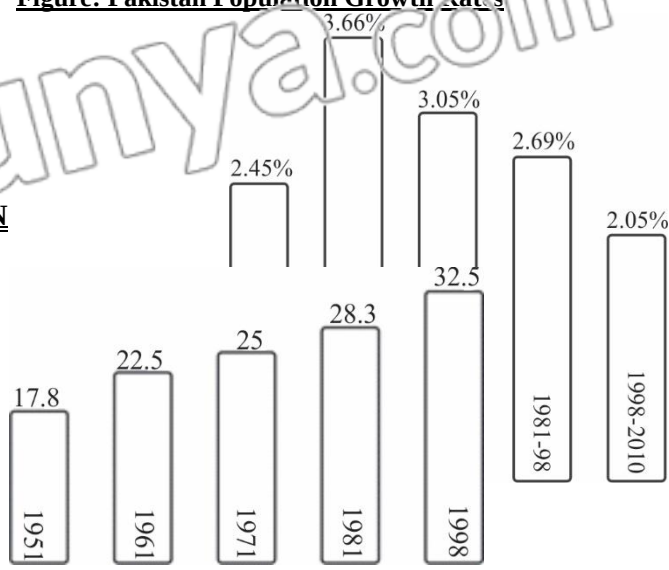

Figure: Urban Population (%age)

Q.6 Write a note on urbanization. (A.B)

Ans: **URBANIZATION**

Definition:

"The **growing** of **cities** is called **urbanization**".

Reasons:

People move from **rural areas** to cities in search of:

- **Better jobs**
- **Education opportunities**
- **Higher standards of living**

Problems for Government:

If there is **rapid urban growth**, the governments find it difficult to provide even the basic **facilities** like:

- **Health**
- **Education**
- **Shelter**
- **Water**
- **Electricity**

Urban Poverty:

Most of the migrants in cities **do not** find **good jobs** and become the **part** of **urban poor**.

Overcrowding:

There is **overcrowding** in schools, hospitals etc. The **slum areas increase** in number and people living there are at **greater risk of diseases**.

Global Problem:

Urbanization is a **global problem** and cannot be stopped but it can be **managed**.

Urbanization in Pakistan:

The **current level** of **urbanization in Pakistan** is about 32% which is not high by **global standards**.

Planned Urbanization:

A planned urbanization can solve many problems.

- The cities should have **thick green belts** in their surroundings to **control pollution**.
- The **open spaces** in cities should be reserved through **zoning** and **land plans**.
- The urban spread-out should also be controlled.
- Utilization of **public transport** instead of **individual transports** also proves effective way to manage **urbanization**.

16.4 SHORT QUESTIONS

Q.1 What are the different impacts of human on ecosystem? (A.B)

Ans: **ECOSYSTEM BALANCE AND HUMAN IMPACT**

The interactions among organisms and between organisms and the abiotic components of their environment produce steady and balanced ecosystems. Biogeochemical cycles also maintain the balance in ecosystems by recycling natural resources so that they do not deplete. Humans try to modify environment (e.g. cutting of trees) to fulfil their needs. This has upset the delicate balance in ecosystem and nature as well.

Some of the human impacts on the balance of ecosystems and nature are:

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- Global warming
- Acidic rain
- Deforestation
- Overpopulation
- Urbanization

Q.2 What are causes of deforestation? (A.B)
Ans: Page no 218

Q.3 What are causes of urbanization? (A.B)
Ans: Page no 219

Q.4 How planned urbanization can solve many problems? (U.B)
Ans:

PLANNED URBANIZATION

A planned urbanization can solve many problems. The cities should have thick green belts in their surroundings to control pollution. The open space in cities should be reserved through zoning and land plans. The urban spread-out should also be controlled. Utilization of public transport instead of individual transports also proves effective way to manage urbanization.

Q.5 How much the population of Pakistan in year 1993, 2010? (K.B)
Ans: Page no 219.

Q.6 What do you mean by IPCC? (K.B)
Ans:

IPCC

In 1990, the United Nations established intergovernmental Panel on Climate Change (IPCC). It provides scientific advice to the world leaders on issues like the build-up of greenhouse gases and its prevention. According to IPCC, Earth's surface temperature has increased ≈ 0.2°C per decade in the past 30 years.

Q.7 What do you know about Maldives Survival? (K.B)

OR

What is the threat for Maldives due to Oceans? (K.B) **(GRW 2016)**

Ans:

MALDIVES SURVIVAL

Scientists fear that the sea level is rising up to 0.9cm a year. Rise in sea level has worst effects on coastal countries. Most of the islands of the Maldives are less than 1 metre above sea level. It is estimated that within 100 years, the Maldives might become uninhabitable and the citizens would be forced to evacuate.

Q.8 What are the effect of global warming? (A.B) **(LHR 2016)**
Ans: Page no 216.

Q.9 What is greenhouse effect? (K.B) **(GRW 2017)**
Ans: Page no 216.

16.4 MULTIPLE CHOICE QUESTIONS

1. Average sea level rising in a year: (K.B)
(A) 0.6 cm (B) 0.7 cm
(C) 0.8 cm (D) 0.9 cm

2. Since 1800, the amount of carbon dioxide in atmosphere has increase up to: (K.B)
(A) 20% (B) 25%
(C) 30% (D) 35%

3. Clearing of forests by natural causes or humans is: (K.B)
(A) Deforestation (B) Afforestation
(C) Forestation (D) Acidic Rain

4. IPCC was established in: (K.B)
(A) 1990 (B) 1992
(C) 1996 (D) 1998

5. Increase in Earth's temperature for the last 30 years. (K.B)
(A) 0.1^oC (B) 0.2^oC
(C) 0.3^oC (D) 0.4^oC

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6. Height of the most of the islands of the Maldives is less than above sea level: (K.B)
(A) 4 meters (B) 3 meters
(C) 2 meters (D) 1 meters

7. Acid rain contains: (K.B)
(A) Sulphuric acid (B) Nitric acid
(C) Sulphuric acid, Nitric acid (D) Hydrogen

8. pH of acidic rain ranges from: (K.B)
(A) 1 to 4 (B) 2 to 6
(C) 2 to 5 (D) 3 to 6

9. Effects of deforestation include: (A.B)
(A) Floods (B) Droughts
(C) Soil erosions (D) All of these

10. Population of Pakistan in 1981: (K.B)
(A) 107,975,060 (B) 99,953,232
(C) 92,284,301 (D) 85,096,000

11. Population of Pakistan in 1984: (K.B)
(A) 107,975,060 (B) 99,953,232
(C) 92,284,301 (D) 85,096,000

12. Population of Pakistan in 1996: (K.B)
(A) 116,444,165 (B) 125,409,851
(C) 134,790,000 (D) 144,902,409

13. Population of Pakistan in 1999: (K.B)
(A) 116,444,165 (B) 125,409,851
(C) 134,790,000 (D) 144,902,409

14. Population of Pakistan in 2009: (K.B)
(A) 173,510,000 (B) 169,708,303
(C) 166,111,487 (D) 155,772,000

15. Population of Pakistan in 2010: (K.B)
(A) 173,510,000 (B) 169,708,303
(C) 166,111,487 (D) 155,772,000

16.5 POLLUTION ITS CONSEQUENCES AND CONTROL

LONG QUESTIONS

Q.1 Describe different types of pollution. (K.B)

Ans:

POLLUTION

Definition:

"Any **undesirable change** in the **physical**, chemical or **biological characteristics** of air, water and land that may **harmfully affect** living organisms and **natural resources** is called **pollution**".

Explanation:

For better life, **human society** is becoming more and more **dependent** on technologies and **industries**. Technology and industry are making the life **easier** and **convenient** for humans but are also **contributing towards** the pollution of **environment**.

Pollutants:

The **substances** that actually **cause pollution** are called the **pollutants**. They may be the **industrial effluents**, **domestic waste**, medical wastes etc. Pollutants are of two types i.e. **biodegradable** and **non-biodegradable**.

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Types of Pollution:

- Air pollution
- Water pollution
- Land pollution
- Noise pollution

Q.2 Write a note on air pollution. (K.B) **(Understanding the Concept Q.6)**

Ans: **AIR POLLUTION**

Definition:

"The **change of composition** of air by the addition of **harmful substances** is called air pollution".

Major Issue:

Air pollution is one of the **major** environmental **issues** of today.

Harmful Substances:

The **harmful substances** causing air pollution may be:

- **Industrial gases**
- **Automobile gases**
- **Particulate matter**

Sources:

All sources of **air pollution** are related to **human activities**.

Combustion:

Burning of coal produces a lot of **smoke** and **dust** whereas **burning** of **petroleum** produces **sulphur dioxide**.

Air Pollutants:

In addition to these, **air pollutants** include:

- **Carbon monoxide**
- **Carbon dioxide**
- **Nitrogen oxides**
- **Hydrocarbons**
- **Particulate matter**
- **Traces of metals**

Industrial Air Pollution:

Different **industries** produce air pollution in the following way:

Fertilizer Industries:

Fertilizer industries release:

- **Oxides of sulphur**
- **Oxide of nitrogen**
- **Hydrocarbons**
- **Particulate matter**
- **Fluorine**

Thermal Industries:

Thermal industries are **coal based** and their pollutants are:

- **Fly ash**
- **Soot**
- **Sulphur dioxide**

Textile Industries:

Textile industries release:

- **Cotton dust**

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- **Nitrogen oxides**
- **Chlorine**
- **Smoke**
- **Sulphur dioxide**

Steel Industries:

Steel industries release:

- **Carbon monoxide**
- **Carbon dioxide**
- **Sulphur dioxide**
- **Phenol**
- **Fluorine**
- **Cyanide**
- **Particulate matter**

EFFECTS OF AIR POLLUTION

The effects of air pollution are as follows:

- Global Warming
- Smog Formation
- Acid Rain
- Ozone Depletion

Global Warming:

Global warming is one of the **consequences** of air pollution.

Smog Formation:

Smoke + Fog = Smog

When pollutants like **hydrocarbons** and **nitrogen oxides combine** in the presence of sunlight, smog is formed. This is a mixture of gases. It forms a **yellowish-brown haze** especially during **winter**.

Effects of Smog:

The **bad effects** of smog are:

- It **hampers visibility** during winter.
- It causes many **respiratory disorders**.
- It causes **allergies** as it contains polluting gases.

Acid Rains:

The air pollutants like **sulphur dioxide** and **nitrogen oxides** react with water in the atmosphere producing **acid rains**.

Ozone Depletion:

The upper layer **(stratosphere)** of the atmosphere has **ozone (O_3)** which **absorbs ultraviolet** (UV) rays present in the **sun's radiation**. However, the air pollutants like **chlorofluorocarbons** (CFCs) **destroy** the **ozone** molecules and so break the **ozone layer**. **Ozone holes** are created which permit UV rays to reach the **Earth's surface**. The UV rays increase the temperature and also cause skin **cancers**.

CONTROL OF AIR POLLUTION

For effective **control** of air pollution, it is important to create **public awareness** about the ill-effects of air pollution. Air pollution can be controlled by the following ways:

Afforestation:

The **establishment** of new forests by **planting** on **non-forest** areas is called afforestation. Forests are effective means to **control air pollution** because plants can **filter** and **absorb air pollutants**.

Modification of Industrial Effluents:

The **air pollutants** coming from **industries** should be passed through **filters** and other

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devices, so that the **particulate matter** is **removed** before the **waste gases** are **released out**.
The smoke producing units should have long chimneys to take the polluting gases far above and then disperse over a larger area.
Industries should also invest for solar cookers or for producing bio gas.

Environment Friendly Fuels:

Lead-free fuels should be used in automobiles. Similarly, sulphur-free fuel should be used in coal-based industry to reduce pollution by sulphur dioxide.

Q.3 Write a note on water pollution. (K.3) **(Understanding the Concept Q.6)**

Ans:

WATER POLLUTION

Definition:

"The change in the composition of water by the addition of harmful substances is called water pollution".

Sources of Water Pollution:

Following are the sources of water pollution:

Sewage:

Sewage is one of the major pollutants of water. It contains organic matter and the excreta of human and other animals. Organic matter encourages the growth of micro-organisms which spread diseases.

Industrial Wastes:

The wastes of industries (acids, alkalis, dyes and other chemicals) are disposed in nearby water bodies. These wastes change the pH of water and are harmful or even fatal to aquatic organisms.

Hot Water:

Certain industries release a lot of hot water from their cooling plants. It results in heating up of water bodies and kills aquatic life.

Fertilizers and Pesticides:

Fertilizers and pesticides enter into water bodies with the rain water flow and the ground water by seepage. These chemicals remain in water for a long time and can enter food chains. They cause a number of diseases in animals.

Oil Leakage:

Oil tankers and offshore petroleum refineries cause oil leakage into water. Oil floats on the water surface and prevents atmospheric oxygen from mixing in water. So, aquatic animals begin to die due to oxygen shortage.

Heavy Metals:

Some heavy metals e.g. lead, mercury, arsenic and cadmium also make the water polluted. Such metals can be present in the water, released from industrial and urban areas.

EFFECTS OF WATER POLLUTION

Water pollution severely affects the health of people.
The following are major effects of water pollution

Eutrophication:

The enrichment of water with inorganic nutrients like nitrates and phosphates is called eutrophication.

Algal Blooms:

The sewage and fertilizers contain large amount of inorganic material **(nutrients)**. When sewage and fertilizers reach water bodies, the nutrients present in them promote algal blooms (excessive growth) there. Rich algal growth leads to increase in the number of the decomposers. Decomposers use the oxygen present in water and it results in the depletion of oxygen. Algal bloom also reduces the light reaching the lower layers in water.

Food Chain Contamination:

The non-biodegradable **water pollutants** may stay in water for long times. From water, they

enter into small organisms, which are fed upon by fish. The fish in turn are fed upon by land animals including human.

Epidemics:

Organic pollutants in water facilitate the growth of germs. Such polluted water causes **epidemics** like cholera, **gastroenteritis** etc.

Effect of Heavy Metals:

If water with such heavy metals is given to plants, the metals enter the vegetables that grow on these plants. Such contaminated vegetables are harmful for human health. Following are the adverse effects of heavy metals:

- Reduce growth and development
- Cause cancer
- Damage to nervous system

Effect of Mercury and Lead:

Mercury and lead can cause:

- Joint diseases such as **rheumatoid arthritis**
- Diseases of kidneys
- Diseases of circulatory system and nervous system

CONTROL OF WATER POLLUTION

Public Awareness:

Public should be made aware of the dangers of water pollution.

Sewage Treatment:

Before releasing the sewage into water bodies, it must be purified through sewage treatment techniques.

Industrial Waste Treatment:

Industrial wastes should also be treated before they are released into water bodies.

Q.4 Write a note on land pollution. (K.B)

Ans:

LAND POLLUTION

Definition:

The change in the composition of soil by the addition of harmful substances is called land pollution.

Importance of Land:

Land (soil) is an important resource as it is the basis for the growth of producers. In the recent times, soil has been subjected to pollution.

Sources of Land Pollution:

Following are the main sources of land pollution:

Pesticides:

The pesticides used in agriculture have chemicals that stay in soil for long times.

Acid Rains:

The acid rains change the pH of soil making it unsuitable for cultivation.

Garbage:

The household and other city garbage lies scattered in soil in the absence of a **proper disposal system.**

Polythene Materials:

Materials like polythene block the passage of water into soil and so decrease the **water-holding capacity of soil**.

Industrial Wastes:

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Many industries produce harmful chemicals which are disposed of without being treated.

Nuclear Wastes:

Improper disposal of nuclear wastes also causes radioactive substances to remain in soil for a long time.

Improper Sewerage System:

Open latrines in villages and some parts of cities are also the source of land pollution.

CONTROL OF LAND POLLUTION

Disposal of Wastes:

There should be suitable and safe disposal of wastes including nuclear wastes.

Recycling:

Non-biodegradable materials like plastic, glass, metals etc. should be recovered and recycled.

Less use of Inorganic Pesticides:

Inorganic pesticides should be replaced by organic pesticides.

16.5 SHORT QUESTIONS

Q.1 Define noise pollution? (K.B)

Ans: **NOISE POLLUTION**

Definition:

"Unwanted, unpleasant and annoying sounds are termed as noise. Noise is also considered as a form of pollution".

Effects:

Immediate effects of noise pollution are annoyance and aggression and the long term effects are hearing loos, depression, hypertension etc.

Q.2 In which country harmful effects of UV rays visible? (K.B)

Ans: **EFFECTS OF UV RAYS**

The harmful effects of the UV rays are visible in the countries such as Australia and New Zealand where the rate of skin cancer is higher than the other regions of the world.

Q.3 Explain Kasur Tannery pollution control project. (A.B)

Ans: **TANNERY POLLUTION CONTROL PROJECT**

There are more than 200 tanneries (industry where raw skin is treated to make leather) operating in Kasur city. The industry discharges 9000 cubic meters of waste water daily into the nearby water bodies. This water contains heavy metals and becomes a part of the underground water.

In 2003, a survey showed that two-thirds of residents and 72 percent of tannery workers suffered cancer, infections of the kidney, or loss of eyesight. These showed that the drinking water was contaminated with lead, mercury and chromium.

The Pakistan government and the United Nations Development Programmed (UNDP) launched the Kasure Tannery Pollution Control Project. The project has established and effluent treatment plant, chromium plant and a solid waste disposal site.

Q.4 What are pollutants? Give example. (K.B)

Ans: **POLLUTANTS**

Definition:

"The substances that actually cause pollution are called the pollutants".

Example:

May be industrial effluents, domestic waste and medical waste are of it's example.

Q.5 What are the types of pollutants? (K.B)

Ans: **POLLUTANTS**

The types of pollutants are as follows:

- Biodegradable
- Non-Biodegradable

Q.6 Define pollution. (K.B)

Ans: Page no 225.

Q.7 Define air pollution. (K.B)

Ans: Page no 222.

Q.8 Write the two sources of air pollution. (A.B)

Ans: Page no 222.

Q.9 How air pollution relates to human activities? Comments. (U.B)

Ans: **AIR POLLUTION AND HUMAN ACTIVITIES**

Air pollution are related to human activities.

- Burning of coal produces a lot of smoke and dust
- Burning of petroleum produces SO_2 It will harm the environment.

Q.10 What are air pollutants of fertilizer industry? (U.B) **(LHR 2013)**

Ans: Page no 223.

Q.11 Define smog. (K.B)

Ans: Page no 223.

Q.12 What are the effects of smog? (A.B)

Ans: Page no 223.

Q.13 Define acid rain. (K.B) **(GRW 2015, BWP 2014)**

Ans: Page no 217.

Q.14 Differential between deforestation and afforestation. (K.B)

Ans: **DIFFERENTIATION**

The difference between deforestation and afforestation is as follows:

Deforestation	Afforestation
Deforestation means clearing of forests by natural causes or humans.	Afforestation means the establishment of new forest by planting on non-forest areas.

Q.15 Define the term eutrophication. (K.B)

Ans: Page no 225.

Q.16 What are causes of land pollution? (A.B)

Ans: Page no 226.

Q.17 What are control measures of land pollutions? (A.B)

Ans: Page no 226.

Q.18 Write side effect of tanneries in Kasur city (A.B)

Ans: **SIDE EFFECT OF TANNERIES**

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In 2003, a survey showed that two-thirds of resident and 72 percent of tannery workers suffered cancer, infections of the kidney, or loss of eyesight. Tests showed that the drinking water was contaminated with lead, mercury and chromium.

Q.19 Write names of some heavy metals. (K.B)

Ans: **HEAVY METALS**

Some heavy metals are given below

- Mercury
- Arsenic
- Cadmium
- Lead

16.5 MULTIPLE CHOICE QUESTIONS

1. Non-biodegradable materials like_____, _____, _____ should be recovered recycled. (K.B)
(A) Plastics, Glass, metals (B) Plastics, metals, pesticides
(C) Plastics, metal, Fertilizes (D) None

2. Improper disposal of nuclear wastes also causes radioactive substances to remain in soil for a _____. (K.B)
(A) Shorter time (B) Longer time
(C) Not a shorter time (D) None

3. Kasur Tannery industry discharges _____ cubic meter of waste water daily into nearby water bodies. (K.B)
(A) 7000 cubic meter (B) 8000 c.m
(C) 9000 c.m (D) 10000 c.m

4. In 2003, a surrey showed that two-thirds of residents and _____ percent of tannery worked suffered cancer, infection of Kidney etc. (K.B)
(A) 70% (B) 72%
(C) 73% (D) 75%

5. Mercury and lead can cause, diseases: (A.B)
(A) Rheumatoid arthritis (B) Disease of kidney
(C) Circulatory system (D) Rheumatoid arthritis, Disease of kidney

6. Steel industries release: (K.B)
(A) CO (B) CO_2
(C) SO_2 (D) CO, CO_2, SO_2

7. Textile industries release: (K.B)
(A) Cotton dust (B) Chlorine
(C) Cotton dust, Chlorine (D) Cyanide

8. Thermal industries release: (K.B)
(A) Coal (B) Fly ash
(C) Soot (D) SO_2, Soot

9. Fertilizer industries release: (K.B)
(A) Hydrocarbons (B) Fluorine
(C) Hydrocarbons, Fluorine (D) Chlorine

10. According to estimates the increase in average global temperature in the next 100 years: (U.B)
(A) 1^oC to 3^oC (B) 3^oC to 7^oC
(C) 3^oC to 8^oC (D) 4^oC to 9^oC

11. Ozone is: (K.B)
(A) O_2 (B) O_3
(C) O_4 (D) O_5

12. In which country the rate of skin cancer is higher: (K.B)

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(A) Japan (B) China
(C) India (D) Australia

13. Number of tanneries in Kasur: (K.B)

(A) 200 (B) More than 200
(C) Less than 200 (D) None of these

16.6 CONSERVATION OF NATURE

LONG QUESTIONS

Q.1 What is 3R principle? (A.B)

Ans:

3R PRINCIPLE

To ensure sustainable use of resources in our environment, we should act upon the principle of the 3R' i.e.

- Reduce
- Reuse
- Recycle

The R1: Reduce:

- We should use the natural resources less and should not waste them.
- We should use this principle at different places, in our daily lives.
- We should not waste water, electricity, fuel etc.
- We should turn off the tap when not in use.
- We should bathe with a bucket instead of shower.
- The lights and fans should be off, when we are not in room.
- We should take public transport (like buses) or walk short distances instead of using motor fuel.
- We should not waste food and should give unused food to poor people.

The R2: Reuse:

We should use things again and again. We should not throw away materials such as glass containers, plastic bags, paper, cloth etc. These should be reused at domestic levels rather than being thrown. It also reduces solid waste pollution.

The R3: Recycle:

Materials such as paper, plastic, glass etc. can be recycled. This decreases the volume of refuse and helps in the conservation of natural resources. A recycling of one ton of paper can save 17 trees.

Addition of R4: Reforest:

We can add the R4 i.e. Reforest. Trees should be planted during the rains. Trees make our environment more cool, shady and green.

Q.2 Describe the plans for the conservation of nature. (A.B)

Ans:

PLANS FOR THE CONSERVATION OF NATURE

The following are the projects and plans of our government for the conservation of resources.

National Conservation Strategy:

In 1992, Pakistan developed the National Conservation Strategy. The main objectives of the strategy are conservation of natural resources and improved efficiency in the use of resources. It also covers the policies for promoting· efficiency and conservation of energy resources.

National Drinking Water and Sanitation Policy:

The Federal Ministry of Environment has launched the National Drinking Water and

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Sanitation Policy. It focuses on the provision of clean drinking water to entire population and the conservation of water resources. Water purification plants are being installed all over the country.

Mass Awareness for Water Conservation and Management:

In 2006, the UNDP launched the project "Mass Awareness for Water Conservation and Management". The objective of the project was to launch a comprehensive awareness campaign for the conservation and management of water resources in Pakistan.

Role of SCOPE:

The organization SCOPE (Society for Conservation and Protection of Environment) works with government for mass awareness and research for the conservation of natural resources in Pakistan.

Role of World-Wide Fund for Nature:

The WWF (old name is World Wildlife Fund but now it is called World Wide Fund for Nature) is working on many projects related to the conservation of nature.

The following are some important programmes of WWF-Pakistan in collaboration with the government of Pakistan:

- Improving sub-watershed management and environmental awareness around Ayubia National Park
- Plantation of the trees of Jatropha and Mangroves at District Thatta, Sindh
- District-wise forest cover assessment of Pakistan
- Saving Wetlands Sky High Programme (for the conservation and management high altitude wetlands)
- Indus Basin Water Security Project (to protect the water-flow needed for the maintenance of river ecosystem and for the benefit of nearby areas)
- Regional Climate Risk Reduction in Himalayas

Q.3 Write a note on dengue fever. (K.B)

Ans:

DENGUE FEVER

Causative Organism:

Dengue fever is a viral infection transmitted through a mosquito Aedes aegypti.

Major Health Problem:

It has become a major health problem in tropical and sub-tropical countries, including Pakistan.

Viral Attack and Immunity:

There are four types of dengue virus. Recovery from infection by one provides lifelong immunity against that virus but provides no protection against infection by the other three viruses.

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Incidence:
According to the World Health Organization, there are 50 million dengue infections worldwide every year. Now, there are 2.5 billion people at risk from dengue.

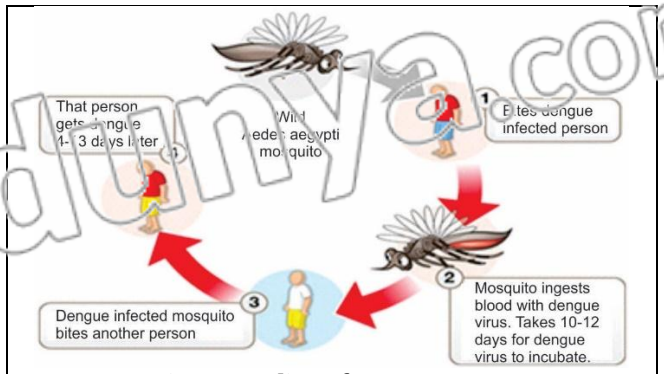

Fig: Spreading of Dengue Fever

Spread of Disease:
The female Aedes mosquito gets the virus when it bites an infected person. When an infected mosquito bites another person, viruses enter his/her blood and attack white blood cells. Inside WBCs, viruses reproduce and destroy them.

Life Cycle of Aedes Mosquito:
Adult Aedes → Eggs of Aedes → Larva of Aedes → Pupa of Aedes

Symptoms:
In severe cases, the virus affects liver and bone marrow. As a result, there is a decrease in the production of blood platelets and patient suffers from bleeding.
Other symptoms of dengue include:

- High fever
- Severe headache
- Pain behind the eyes
- Muscle and joint pains
- Rash

Complications:
Sometimes, dengue fever converts into:

Dengue Haemorrhagic Fever (DHF):
DHF results in:

- Bleeding
- Low levels of blood platelets
- Blood plasma leakage

Dengue Shock Syndrome (DSS):
In DSS the blood pressure falls dangerously low.

Vaccination:
There is no vaccine for dengue fever.

Treatment:
There is no treatment of dengue fever.

Control:
At present, the only method of controlling dengue virus transmission is to check the spread of Aedes mosquitoes.

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Breeding of Aedes aegypti:

Aedes aegypti breeds primarily in the:

- Containers used for water storage
- Discarded plastic containers
- Used automobile tyres
- Items that collect rain water

Control over Mosquitoes.

The mosquitoes can be controlled through:

- Proper solid waste disposal
- Improved water storage practices

Use of Predators:

Small fish and crustaceans have also been used for killing the larvae of the mosquito.

Use of Insecticides:

Insecticide sprays have not proved efficient in killing the mosquitoes, because spray does not penetrate all habitats of adult mosquitoes.

16.6 SHORT QUESTIONS

Q.1 How can we conserve nature? (U.B)

Ans: **CONSERVATION OF NATURE**

Meaning:

Conservation of nature means the conservation of natural resources.

Need of Conservation:

Everything that we use or consume e.g. food, petrol etc. is obtained from natural resources. The renewable natural resources e.g. air air reproduced easily but the' non-renewable resources (e.g. minerals and fossil fuels) are not replenished once they get depleted. We have to conserve the non-renewable resources because their reserves are limited' and humans are heavily dependent on them for daily needs. The renewable resources too have to be judiciously used.

Q.2 What do you mean by principle of 3-R? (A.B)

Ans: Page no 229.

Q.3 What is SCOPE? (K.B)

Ans: **SCOPE**

The organization SCOPE (Society for Conservation and Protection of Environment) works with government for mass awareness and research for the conservation of natural resources in Pakistan.

Q.4 Write symptoms of dengue fever. (K.B)

Ans: Page no 231.

Q.5 Write life cycle of Aedes mosquito. (U.B)

Ans: **LIFE CYCLE OF AEDES MOSQUITO**

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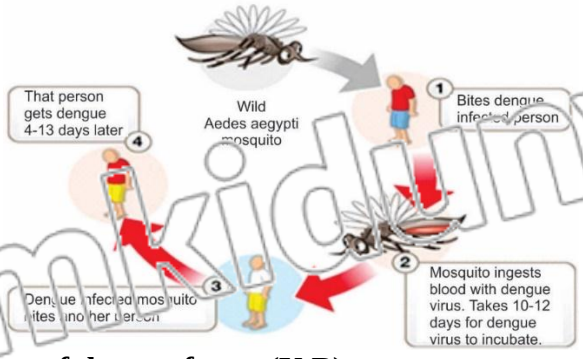

Q.6 Describe severe forms of dengue fever. (K.B)
Ans: Page no 231.
Q.7 What will happen if we deplete nature resource? (U.B)
Ans: **DEPLETEINTION NATURAL RESOURCE**
Clean water, air, fuels, agricultural land and forests appeared to be plentiful earlier, but now these are becoming scarce. If we continue depleting them like this, we will be creating untold misery for ourselves and for our future generations.

16.6 MULTIPLE CHOICE QUESTIONS

1. Pakistan developed the national conservation strategy for conservation of natural resources in: (K.B)
(A) 1991 (B) 1992
(C) 1993 (D) 1994

2. The UNDP launched the project mass awareness for water conservation and management in: (K.B)
(A) 2003 (B) 2004
(C) 2005 (D) 2006

3. The organization works with government for mass awareness and research for the conservation of natural rescues' is called: (K.B)
(A) UNDP (B) UNCP
(C) Scope (D) WWFP

4. It means the establishment of new forests by planning on non forest areas called_____. (K.B)
(A) Deforestation (B) Afforestation
(C) Concretion (D) Assimilation

5. The recycling of one tone of paper can save how many trees? (K.B)
(A) 13 (B) 15
(C) 17 (D) 19

6. Number of Dengue infections worldwide every year: (K.B)
(A) 20 million (B) 30 million
(C) 40 million (D) 50 million

7. How many people are at risk from dengue? (K.B)

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(A) 1.5 billion (B) 2.0 billion
(C) 2.5 billion (D) 3.0 billion

8. R-2 means: (K.B) **(LHR 2017)**

(A) Reduce (B) Recycle
(C) Renewable (D) Reuse

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

16.1 LEVELS OF ECOLOGICAL ORGANIZATION

1	D	**2**	C	**3**	D	**4**	C	**5**	B	**6**	D
7	B	**8**	B	**9**	A	**10**	B	**11**	B	12	B

16.2 FLOW OF MATERIALS AND ENERGY IN ECOSTSTEMS

1	C	**2**	D	**3**	B

16.2.4 BIOGEOCHEMICAL CYCLES

1	B	**2**	A	**3**	B	**4**	D	**5**	C	**6**	B	**7**	D

16.3 INTERACTIONS IN ECOSYSTEMS

1	C	**2**	D	**3**	A	**4**	C	**5**	D	**6**	C
7	B	**8**	B	**9**	C						

16.4 ECOSYSTEM BALANCE AND HUMAN IMPACT

1	D	**2**	C	**3**	A	**4**	A	**5**	B	**6**	D
7	C	**8**	D	**9**	D	**10**	D	**11**	C	**12**	B
13	C	**14**	B	**15**	A						

16.5 POLLUTION ITS CONSEQUENCES AND CONTROL

1	A	**2**	B	**3**	C	**4**	B	**5**	A	**6**	D
7	A	**8**	D	**9**	C	**10**	C	**11**	B	**12**	D
13	A										

16.6 CONSERVATION OF NATURE

1	B	**2**	D	**3**	C	**4**	B	**5**	C	**6**	D
7	C	**8**	D								

REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Which of the following is the abiotic component of the ecosystem? (K.B)

(a) Producers (b) Herbivores

(c) Carnivores (d) Oxygen

2. When we eat onions, our trophic level is; (U.B)

(a) Primary consumer (b) Secondary consumer

(c) Decomposer (d) Producer

3. Identify the correctly matched pair: (U.B)

(a) Rainfall - biotic factors in ecosystem (b) Global warming - formation of fossil fuels

(c) Renewable natural resource - air (d) Corn - secondary consumer

4. **In the food chain tree → caterpillar → robin → hawk → coyote, which is the secondary consumer? (K.B)**

(a) Caterpillar (b) Robin

(c) Hawk (d) Coyote

5. In ecosystems, the flow of _____ is one way, while _____ is/are constantly recycled. (U.B)

(a) Minerals, energy (b) Energy, minerals

(c) Oxygen, energy (d) Glucose, water

6. In the food chain "grass → rabbit → fox → bear → mushroom", how many types of decomposers are present? (K.B)

(a) 1 (b) 2

(c) 3 (d) 4

7. Organisms in the ecosystem that are responsible for the recycling of plant and animal wastes are: (K.B)

(a) Producers (d) Consumers

(c) Decomposers (d) Competitors

8. Which form of Nitrogen is taken by the producers of the ecosystem? (K.B)

(a) Nitrogen gas (b) Ammonia

(c) Nitrites (d) Nitrates

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ANSWER KEY

1	d	2	a	3	c	4	b	5	b	6	a
7	c	8	d								

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SHORT QUESTIONS

1. What are the different levels of ecological organization? (K.B)

Ans: **LEVELS OF ECOLOGICAL ORGANIZATION**

In ecology the levels of organization range from organism to biosphere. The followings are the levels of ecological organization

- Species
- Population
- Community
- Ecosystem
- Biosphere

2. Define ecosystem and its components. (K.B)

Ans: **ECOSYSTEM**

Definition:

"The self-sufficient unit of an environment that is formed as a result of interactions between its biotic community and the abiotic components is known as an ecosystem."

An ecosystem comprises of two basic parts:

- Abiotic components
- Biotic components

3. How the flow of energy is different from that of materials? (K.B)

Ans: **DIFFERENTIATION**

The differences between flow of energy and flow of materials are as follows:

Flow of Energy	Flow of Materials
• The flow of energy in different trophic levels of ecosystem is unidirectional.	• The materials flow from one trophic level to the next by means of food chains and food webs.
• The sun is the primary source of energy for all ecosystem.	• Different organisms depend on different organisms for the material in an ecosystem.
• Flow of energy follows basic law of thermodynamics.	• Flow of materials don't follow any law in an ecosystem.
• There is constant flow of energy in an ecosystem.	• Materials can be more or less in an ecosystem.

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4. Define food chain and food web. (K.B)

Ans: **FOOD CHAIN AND FOOD WEB**

Food Chain:

"A food chain is series of organisms within an ecosystem in which each organism feeds on the one before it and is fed by the one after it".

Examples:

Grass → Grasshopper → Sparrow → Hawk

- The base of food chain is always formed by a plant (producer).
- It is eaten by a primary consumer, which is preyed upon by a secondary consumer.
- The secondary consumer may be eaten by a tertiary consumer.

Food Web:

"A network of food chains which are interconnected at various trophic levels".

5. What do you mean by the concept of 3Rs with reference to the conservation of natural resources? (K.B)

Ans: **CONCEPT OF 3RS**

To ensure sustainable use of resources in our environment, we should act upon the principle of the 3R' i.e.

- Reduce
- Reuse
- Recycle

UNDERSTANDING THE CONCEPT

1. Explain what do you mean by the pyramids of number and biomass? (A.B)

Ans: See LQ.3 (Topic 16.2)

2. Write a note on Carbon cycle. (K.B)

Ans: See LQ.2 (Topic 16.2.4)

3. What are the different stages of Nitrogen cycle? (K.B)

Ans: See LQ.3 (Topic 16.2.4)

4. Write notes on competition, predation and symbiosis. (K.B)

Ans: See LQ.1, 2,3,4,5 (Topic 16.3)

5. Explain how human activities have contributed to the loss of balance in nature. (A.B)

Ans: See (Topic 16.4)

6. Write note on the causes and effects of the air and water pollutions. (A.B)

Ans: See LQ.2, 3 (Topic 16.5)

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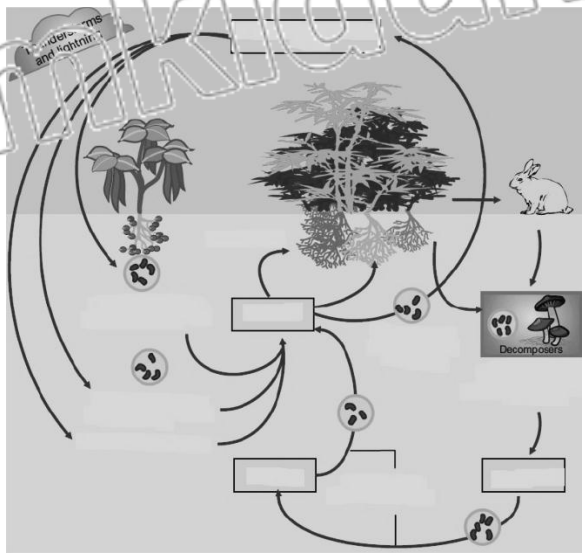
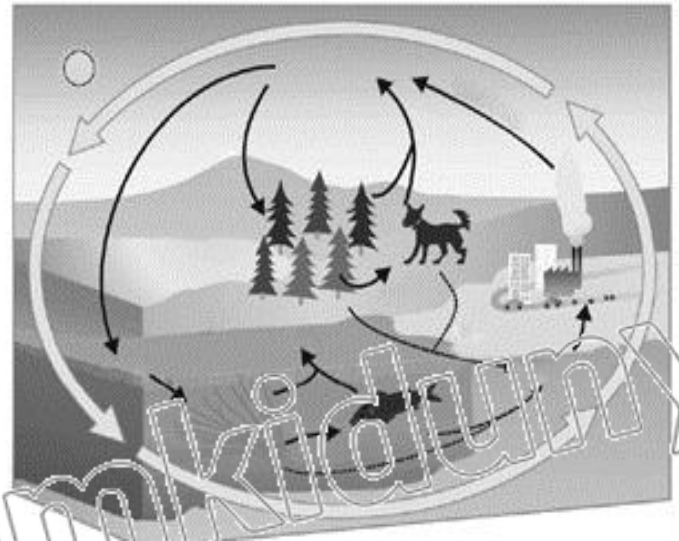
ASSIGNMENT

PRACTICE DIAGRAM & LABEL

NITROGEN CYCLE



CARBON CYCLE



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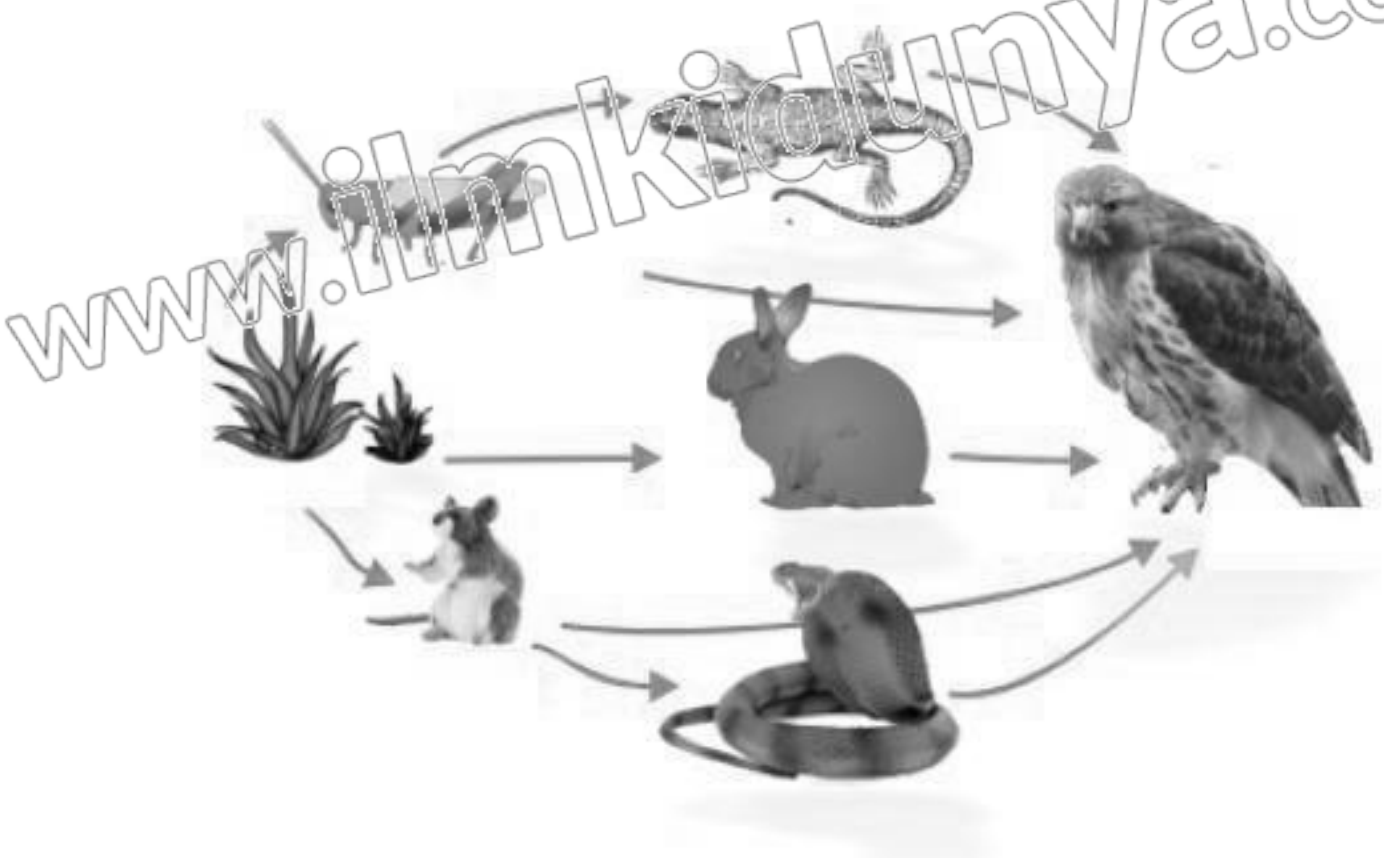
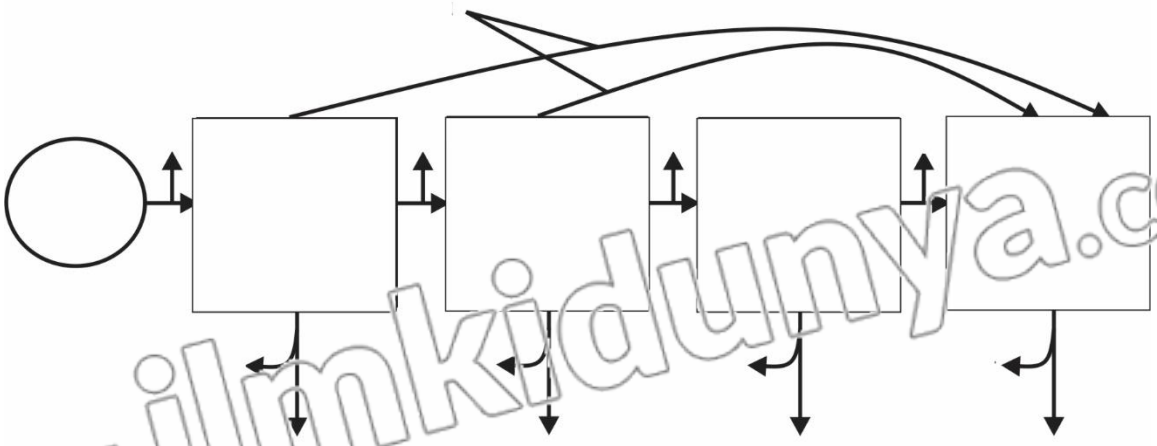
FOOD WEB



ENERGY FLOW IN AN ECOSYSTEM



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. An example of artificial ecosystem:

(A) River **(B)** Ocean

(C) Rain forest **(D)** Aquarium

2. Who developed the concept of ecological pyramids?

(A) Charles Darwin **(B)** Charles Elton

(C) Charles Brown **(D)** Charles Asker

3. Which one is an ectoparasite?

(A) Leech **(B)** Liver fluke

(C) Tape worm **(D)** Ascaris

4. Acid rain contains:

(A) Sulphuric acid **(B)** Nitric acid

(C) Sulphuric acid, Nitric acid **(D)** Hydrogen

5. Thermal industries release:

(A) Coal **(B)** Flyash

(C) Soot **(D)** Coal, Flyash, Soot

6. Which of the following is the abiotic component of the ecosystem?

(A) Producers **(B)** Herbivores

(C) Carnivores **(D)** Oxygen

Q.2 Give Short Answers to following questions. **(5×2=10)**

(i) How planned urbanization can solved many problems?

(ii) Define Mutualism. Give example?

(iii) How balance of carbon cycle has been upset by human activities?

(iv) What are examples of terrestrial and aquatic ecosystem?

(v) What are causes of land pollution?

Q.3 Answer the following questions in detail. **(5+4=9)**

(a) Write a note on nitrogen cycle.

(b) Describe flow of energy in an ecosystem.

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of the students.

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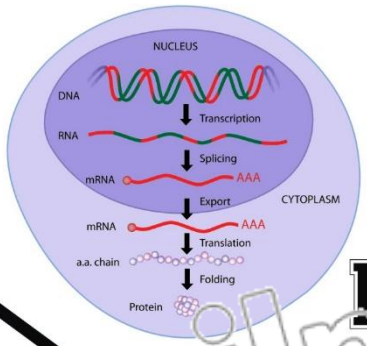

CH# 17

BIOTECHNOLOGY

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17.1 IMPORTANCE OF BIOTECHNOLOGY

LONG QUESTIONS

Q.1 What is meant by biotechnology? Explain the scope and importance of biotechnology. (A.B) **(LHR 2014, GRW 2016, 17, MTN 2015)**

OR

Define biotechnology and describe its importance. **(Understanding the Concept Q.1)**

Ans:

BIOTECHNOLOGY

Definition

"The use of **living organisms** in processes for the **manufacture** of useful products or for **services** for **mankind** is called biotechnology".

Fermentation and other such processes, which are **based** on the **natural capabilities** of organism, are commonly considered as **old biotechnology**

Scope and Importance:

In recent years, biotechnology is **growing** as a **separate science**. It has attracted the attention of many intellectuals from diverse fields like:

- **Agriculture**
- **Medicine**
- **Microbiology**
- **Organic chemistry**

The **scope** for biotechnology is so **wide** that it is difficult to recognize the limits. The following are some areas of the application of biotechnology:

- **Biotechnology in the field of medicine**
- **Biotechnology in the field of food and agriculture**
- **Biotechnology and environment**

Biotechnology in the Field of Medicine:

In the field of **medicine**, **biotechnologists** have **synthesized**:

- **Insulin**
- **Interferon (antiviral proteins)**
- **Vaccines**
- **Antibodies**
- **Human Growth Hormone**

Enzymes:

Various **enzymes** are being **synthesized** for **medicinal** as well as **industrial** use.

Gene Therapy:

Gene therapy (treatment through genes) has become **important** in recent years.

Forensic Medicine:

Biotechnology also proved much beneficial in forensic medicine.

Identification of Criminals:

The **study of DNA** helps in the **identification of criminals**.

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Biotechnology in the Field of Food and Agriculture:

Food Industry:

The following products are being produced by using **microorganisms**.

- **Fermented foods** (e.g. pickles, yogurt)
- **Malted foods** (e.g. powdered milk: a mixture of barley, wheat flour and whole milk)
- **Various vitamins**
- **Dairy products**

Beverage Industry:

- **Wine and beer** are produced in **beverage industry**.

Agriculture:

- **Biotechnology** has also **revolutionized** research activities in the area of **agriculture**.

Transgenic Organisms:

"The **organisms** with **modified genetic set-up** are called **transgenic organisms**".

Transgenic Plants:

Transgenic plants are being developed in which **desirable characteristics** are present. For example:

- **More yields**
- **Resistance against diseases**
- **Resistant against insects**
- **Resistant against herbicides**

Transgenic Animals:

- **Transgenic goats**, **chickens**, **cows** give more food and milk.
- Many animals like **mice**, **goats**, cows etc. have been made **transgenic** to get **medicines** through their **milk**, **blood** or **urine**.

Biotechnology and Environment:

Biotechnology is also being used for dealing with **environmental issues** like:

- **Pollution control**
- **Development of renewable sources for energy**
- **Restoration of degraded lands**
- **Biodiversity conservation**

Treatment of Sewage Water:

Bacterial enzymes are used to treat **sewage water to purify**.

Use of Microbes:

Microbes are being developed to be used as:

- **Biopesticides**
- **Biofertilizers**
- **Biosensors**

Other Purposes:

Transgenic microorganisms are also used for:

- **Recovery of metals**
- **Cleaning of spilled oils**

Fears of Biotechnology:

Fears are also being **expressed** about the **advantages** in **biotechnology** in terms of release of **harmful organisms** developed through **recombinant DNA technology**.

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17.1 SHORT QUESTIONS

Q.1 Define biotechnology. (K.B) **(GRW 2014)**

OR

What is meant by biotechnology? **(GRW 2017)**

Ans: Page no 242.

Q.2 Define genetic engineering? (K.B) **(DGK 2015, GRW 2013, 2015, 16, LHR 2017)**

OR

What is genetic engineering?

Ans: **GENETIC ENGINEERING**

Definition:

"Genetic engineering is defined as, the artificial synthesis, modification, removal, addition and repair of the genetic material (DNA) is considered as modern biotechnology."

Example:

Production of transgenic living organisms is through genetic engineering.

Q.3 What do you know about continuous fermentation process? (K.B) **GRW 2015**

Ans: Page no 249.

Q.4 When Human Genome Project was launched? (A.B)

Ans: **HUMAN GENOME PROJECT**

In 1990, the Human Genome Project was launched to map all the genes in human cell. The complete map of human genome was published in 2002.

Q.5 What are transgenic organisms? (K.B)

OR

What are the desired characteristics of transgenic plants? **(LHR 2017)**

Ans: Page no 243.

Q.6 When sheep (Dolly) was produced by genetic engineering? (K.B)

Ans: **PRODUCTION OF SHEEP (DOLLY)**

In Scotland, in 1997, an embryologist Ian Wilmut produced a sheep (Dolly) from the body cell of an adult sheep.

Q.7 What is old biotechnology? (U.B)

Ans: **OLD BIOTECHNOLOGY**

Fermentation and other such process, which are based on the natural capabilities of organisms, are commonly considered as old biotechnology.

Q.8 When genetic engineering was started? (K.B)

Ans: **GENETIC ENGINEERING**

The work on genetic engineering started in 1944 when it was prove that DNA carries the genetic information. Scientists isolated the enzymes of DNA synthesis and then prepared DNA outside cells. In 1970s, they were able to cut and paste the DNA of organisms. In 1978, scientists prepared human insulin by inserting the insulin gene in bacteria.

Q.9 Write uses of microorganism in early 4000 BC. (A.B)

Ans. **USES OF MICROORGANISM**

Human uses of microorganism in early 4000 BC for making:

- Wine
- Vinegar
- Cheese
- Yogurt

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Q.10 What is the other name of genetic engineering? (K.B)

Ans: **OTHER NAME OF GENETIC ENGINEERING**

The other name of genetic engineering is recombinant biotechnology and it is considered as modern biotechnology.

Q.11 How biotechnology has help us in improving the environment? (U.B) **(LHR 2017)**

Ans: **BIOTECHNOLOGY AND ENVIRONMENT**

Biotechnology is also being used for dealing with environmental issues like:

- Pollution control
- Development of renewable sources for energy
- Restoration of degraded lands
- Biodiversity conservation

Q.12 What is novel protein or mini food? (K.B) **GRW 2017**

Ans: Page no 258.

Q.13 What is malted food. (K.B) **GRW 2017**

Ans: Page no 243.

Q.14 Write any two applications of Fermentation. (U.B) **LHR 2015**

Ans: Page no 246.

17.1 MULTIPLE CHOICE QUESTIONS

1. Human have been making use of biotechnology since the discovery of (K.B)

(A) Farming (B) Fire extinction (C) Human production (D) Fermentation

2. All of the following are major techniques in biotechnology, except; (K.B)

(A) Cross pollination (B) Cross breeding (C) Fermentation (D) Pasteurization

3. When scientists prepared human insulin? (K.B)

(A) 1975 (B) 1976 (C) 1977 (D) 1978

4. All are old biotechnological products, produced by using microorganisms as early as 4000 BC, except; (K.B)

(A) Wine (B) Vinegar
(C) Cheese (D) Vaccines

5. Human growth hormone was synthesized from? (K.B)

(A) Fungi (B) Plants
(C) Bacteria (D) Animals

6. Ian Wilmut was: (K.B)

(A) Pathologist (B) Palaeontologist
(C) Embryologist (D) Physician

7. Insulin is effective against: (A.B)

(A) Blood pressure (B) Heart diseases
(C) Nervous disorders (D) Diabetes mellitus

8. The use of living organisms in process for the manufacture of useful products: (K.B)

(A) Parasitology (B) Biotechnology
(C) Pharmacology (D) Drug abuse

9. When the work on genetic engineering was started? (K.B) **(LHR 2015)**

(A) 1941 (B) 1942
(C) 1943 (D) 1944

10. Human insulin was prepared from bacteria in (K.B)

(A) 1990 (B) 1978
(C) 1970 (D) 1984

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11. The complete map of human genome was published in: (K.B)

(LHR 2016, GRW 2013, SWL 2014, MTN 2013)

(A) 2000 (B) 2002
(C) 2004 (D) 2006

12. What was the name of sheep produced by Ian Wilmut from the body cell of an adult sheep? (K.B)

(A) Dolly (B) Nancy
(C) Ethal (D) Dhani

13. Sheep Dolly was produced in: (K.B)

(A) 1993 (B) 1995
(C) 1997 (D) 1999

14. Organisms with modified genetic setup. (K.B)

(A) Transgenic organisms (B) Simple organisms
(C) Hormone producing animals (D) Breeding animals

17.2 FERMENTATION

LONG QUESTIONS

Q.1 Define fermentation. What is carbohydrate fermentation? Explain its types. (K.B)

(LHR 2013, GRW 2013, 2014)

Ans:

FERMENTATION

Definition:

"The **process** in which there is **incomplete oxidation-reduction** of **glucose** to release **less energy** in the form of **ATP** is called fermentation".

Explanation:

In **1857**, **Pasteur** convinced the **scientific community** that all **fermentations** are the results of **microbial activity**. He showed that **fermentation** is always **accompanied** by the development of **microorganisms**.

There are many kinds of fermentation and each kind is a **characteristic** of **microbial** group. Fermentations are classified in terms of the products formed.

One type of fermentation is **carbohydrate** fermentation.

CARBOHYDRATE FERMENTATION

The **initial steps** of carbohydrate fermentation are **identical** to those of **respiration**. The process begins with **glycolysis**, in which the **glucose, molecule** is broken into two **molecules** of **pyruvic acid**. Different **microorganisms** proceed the further reactions in different ways. It results in the formation of various products from **pyruvic acid**.

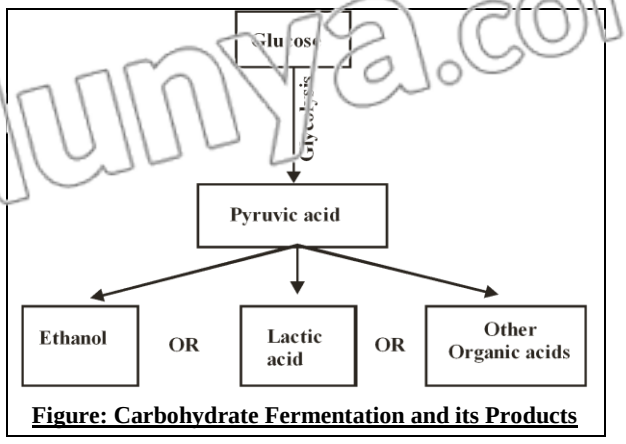

Figure: Carbohydrate Fermentation and its Products

Types.

The **two basic types** of **carbohydrate fermentation** are as follow:

- **Alcoholic Fermentation (by yeast)**
- **Lactic Acid Fermentation (by bacteria)**

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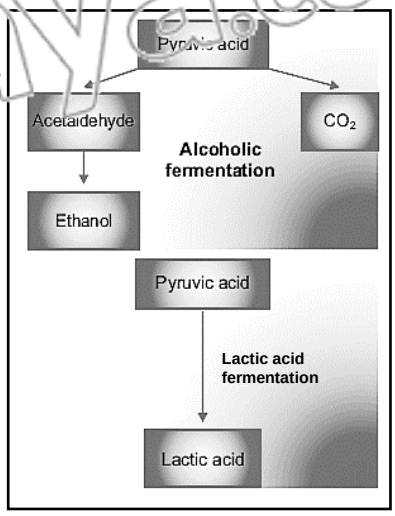
Alcoholic Fermentation (By Yeast):

This fermentation is **carried out** by many types of yeast such as **Saccharomyces cerevisiae**.

Mechanism:

In this process, **carbon dioxide** is **removed** from **pyruvic acid**. The product i.e. **acetaldehyde** is then reduced to **ethanol**. The **carbon dioxide** produced during this fermentation **causes** the **rise of the bread**.



Usage:

This process is **quite important** and is used to produce:

- **Bread**
- **Beer**
- **Wine**
- **Distilled spirits**

Lactic Acid Fermentation (By Bacteria):

It is **carried** out by many **bacterial species** like:

- **Streptococcus species**
- **Many Lactobacillus species**

Mechanism:

In this process, **pyruvic acid** is reduced to **lactic acid**.

Usage:

It is quite important in dairy industry where it is used for:

- **Souring milk**
- **Production of various types of cheese**

Q.2 Describe fermentation in biotechnology. (K.B)

OR

Write a note on applications of fermentation (A.B) **(LHR 2016)**

Ans:

FERMENTATION IN BIOTECHNLOGY

Definition:

"In biotechnology the term "fermentation" means the **production** of any product by the **mass culture** of **micro-organisms**".

APPLICATIONS OF FERMENTATION

In fermentation, **maximum growth** of an organism is **obtained** for the production of **desired products** of **commercial value**. Traditionally, only food and beverage products were produced by using fermentation. Now many other products e.g. **industrial chemicals** are also being produced.

This can be categorized into **two groups**:

a. Fermented Foods

b. Industrial Products

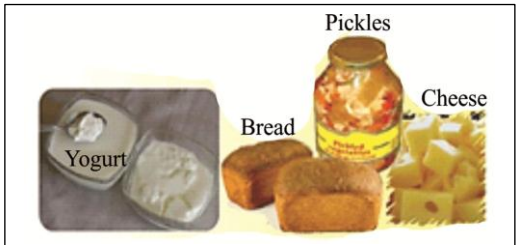


Figure: Fermented Foods

Fermented Foods:

Fermentation often makes the food more **nutritious**, more **digestible** and **tastier**. It also tends to preserve the food, lowering the need for **refrigeration**. The following groups are included in the **fermented foods**.

Cereal Products:

Bread is the **commonest** type of fermented **cereal product**. Wheat dough is **fermented** by **S.cerevisiae** along with some **lactic acid bacteria**.

Dairy Products:

Cheese and yogurt are important **fermentation products**.

Cheese Formation:

Cheese is formed when a **milk protein** is **coagulated**. This happens when the **acid produced** by lactic **acid bacteria** reacts with **milk protein**.

Yogurt Formation:

Yogurt is made from milk by different **lactic acid bacteria**.

Fruit and Vegetable Products:

Fermentation is usually used, along with salt and acid, to preserve:

- **Pickle**
- **Fruits**
- **Vegetables**

Beverage Products:

Beer is produced from **cereal grains** which have been **malted**, dried and ground into find powder. Fermentation of the powder is done by **yeast**. This process breaks the **glucose present** in powder into **pyruvic acid** and then into **ethanol**. Grapes can be directly fermented by yeasts to wine.

Industrial Products:

The following are the important industrial products produced through the process of fermentation.

Products	Microorganisms Used	Some Uses
Formic Acid	Aspergillus	• **Textile dyeing** • **Leather treatment** **(GRW 2013)** • **Electroplating** **(DGK 2015)** • Rubber manufacture
Ethanol	Saccharomyces	• **Used as solvent** • **Production of vinegar** • **Production of beverages**
Glycerol	Saccharomyces	• **Used as solvent** • **Production of plastics** • **Production of cosmetics** **(BWP 2015)** • **Production of soaps** • **Used in printing** **(GRW 2014)** • **Used as sweetener**
Acrylic Acid	Bacillus	• **Used in the production of plastics**

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Q.3 What is a fermenter? Describe types of fermentation. What are the advantages of using fermenters? (A.B) **(LHR 2016,17 GRW 2014, DGK 2015, BWP 2015)**

OR

What is fermenter? What are two types of fermentation carried out in fermenters? (A.B) **(Understanding the Concept Q.2)**

Ans:

FERMENTER

Definition:

"**Fermenter** is a device that **provides optimum environment** to **microorganisms** to grow into a **biomass**, so that they can **interact with a substrate**, **forming the product**".

Fermenter constitute the heat of any industrial fermentation process.

TYPES OF FERMENTATION

Fermentation is **carried out** in fermenters, in the following **two ways**.

- **Batch Fermentation**
- **Continuous Fermentation**

Batch Fermentation:

In this process, the tank of fermenter is filled with the **raw materials** to be **fermented**. The **temperature** and **pH for microbial fermentation** is properly adjusted, and **nutritive supplements** are added. All the material is **steam sterilized**, the pure culture of microorganisms is added to fermenter from a **separate vessel**. Fermentation proceeds and after the proper time the contents of fermenter are taken out. Fermenter is **cleaned** and the process is repeated. Thus, fermentation is a **discontinuous** process **divided** into **batches**.

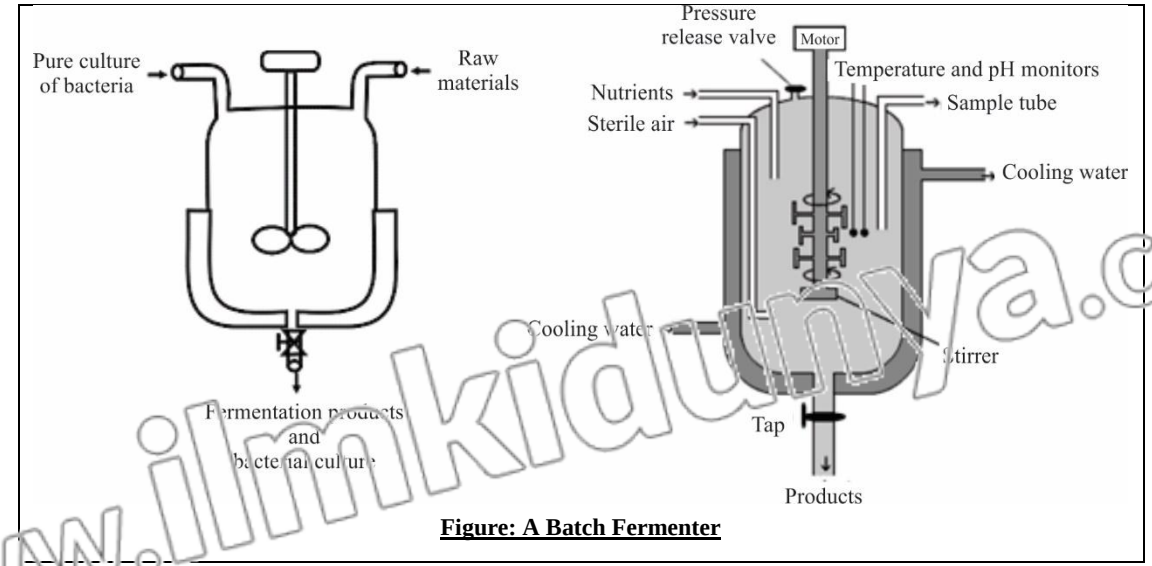

Figure: A Batch Fermenter

Continuous Fermentation:

In this process, the **substrate** is **added** to fermenter **continuously** at a **fixed rate**. This maintains the **microorganisms** in **growth phase**. **Fermentation products** are taken out **continuously**.

The design and arrangements for **continuous fermentation** are more complex.

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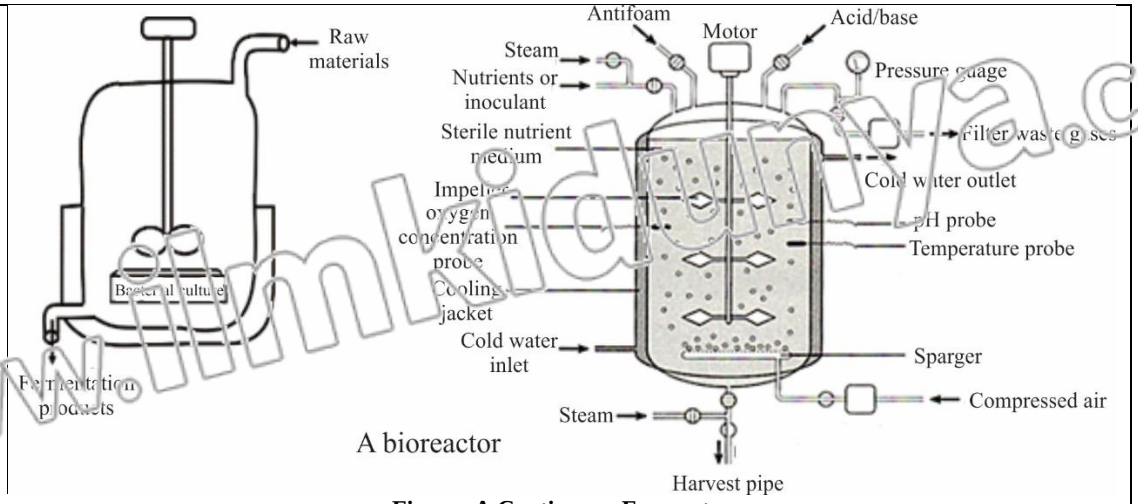

Figure: A Continuous Fermenter

Advantages:

The **advantages** of using fermenters are as follows:

Controlled Environment:

For each biotechnological process, the environment provided to the organisms must be monitored and controlled. Such a **controlled environment** is **provided** by **fermenters**.

Controlling Different Factors:

A fermenter **optimizes** the **growth** of the organisms by **controlling** many factors like:

- **Nutrients**
- **Oxygen**
- **Growth inhibitors**
- **pH**
- **Temperature**

Capacity:

A fermenter may hold **several thousand liters** of the **growth medium**. So, fermenters allow the production of materials in **bulk quantities**. Massive amounts of the following products are **being produced** in fermenters:

Figure: Fermenters Used in Food and Pharmaceutical Industry

- **Medicines**
- **Insulin**
- **Human growth hormone**
- **Proteins**

Inexpensive Products:

This production proves much inexpensive.

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17.2 SHORT QUESTIONS

Q.1 How biotechnology has helped us in improving the environment? (A.B) LHR 2017

Ans: Page no

Q.2 What is continuous fermentation? (U.B) LHR 2016

Ans: Page no 249.

Q.3 Name organisms which are involved in alcoholic fermentation and lactic acid fermentation. (K.B) (GRW 2016)

Ans: Page no 247

Q.4 Draw a flow chart of carbohydrate fermentation and its products. (A.B)

Ans: Page no 246.

Q.5 What are the advantages of fermented foods? (K.B)

Ans:

ADVANTAGES OF FERMENTED FOODS

Fermentation often makes the food:

- More nutritious
- More digestible
- Tastier
- Preserve the food
- Lowering the need for refrigeration

Q.6 What cereal products are produced by fermentation? (K.B) (LHR 2015)

Ans: Page no 248.

Q.7 What are fermented dairy products? (K.B) (LHR 2013, BWP 2014)

OR

How cheese and yogurt will formed?

Ans: Page no 248.

Q.8 Which beverage products produced by fermentations? (A.B)

Ans: Page no 247.

Q.9 Define fermenter. Give its types. (K.B) (LHR 2014, GRW 2016, BWP 2014, 2015, MTN 2015)

Ans: Page no 249.

Q.10 Write down the advantages of using fermenter. (U.B)

Ans: Page no 250.

Q.11 How fermentation is used to preserve vegetables? (A.B)

Ans:

PRESERVATION VEGETABLES

Fermentation is usually used along with salt and acid to preserve like:

- Pickle
- Fruits
- Vegetables

Q.12 What is continuous fermentation? (K.B) (LHR 2016)

Ans: Page no 249

Q.13 Write down the uses of glycerol (A.B) (GRW 2016)

Ans: Page no 248.

Q.14 Write names of any two industrial produced through the process of fermentation

Q.15 Write names of any two industrial produced through the process of fermentation (A.B) GRW 201

Ans: Page no 248.

Q.16 Write a note on alcoholic fermentation (K.B) (LHR 2016)

Ans: Page no 247.

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17.2 MULTIPLE CHOICE QUESTIONS

1. Fermentation is the result of microbial activity was proved by (K.B)
(A) R. Koch (B) A. Fleming
(C) L. Pasteur (D) J. Watson

2. Alcoholic fermentation is carried out by (A.B)
(A) Saccharomyces cerevisiae (B) Lactobacillus bulgaricus
(C) Streptococcus thermophilus (D) Escherichia coli

3. Acetaldehyde is converted to ethanol by (U.B)
(A) Oxidation (B) Carboxylation
(C) Reduction (D) dehydration

4. During anaerobic respiration pyruvic acid is reduced to (U.B)
(A) $CO_2 + H_2O$ (B) Lactic acid
(C) Ethanol (D) Both B & C

5. Pasteur convinced the scientific community that all fermentations are the results of microbial activity in: (K.B)
(A) 1851 (B) 1853
(C) 1855 (D) 1857

6. To preserve fruits, vegetables and pickles, we add: (A.B) **(LHR 2014)**
(A) Water and yogurt (B) Salt and acid
(C) Flour and salt (D) Onion and garlic

7. Microorganisms used in the manufacture of formic acid: (K.B)
(A) Aspergillus (B) Saccharomyces
(C) Bacillus (D) Virus

8. Microorganisms used in the manufacture of ethanol: (K.B)
(A) Aspergillus (B) Saccharomyces
(C) Bacillus (D) Rhizopus

9. Microorganisms used in the manufacture of glycerol: (A.B)
(A) Aspergillus (B) Saccharomyces
(C) Bacillus (D) Spirogyra

10. Microorganisms used in the manufacture of acrylic acid: (A.B)
(A) Aspergillus (B) Saccharomyces
(C) Bacillus (D) Volvox

11. Chemical used as sweetener: (K.B)
(A) Formic acid (B) Ethanol
(C) Glycerol (D) Acrylic acid

12. Chemical used in leather treatment: (K.B)
(A) Formic acid (B) Ethanol
(C) Glycerol (D) Acrylic acid

13. Yogurt is made from milk by different lactic acid: (A.B)
(A) Yeast (B) Bacteria
(C) Fungi (D) Algae

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14. Fermentation is usually used, along with _____ and acid to preserve pickle, fruits and vegetables. (A.B) **(LHR 2014)**

(A) Carbonic feed (B) Salt
(C) Lime (D) Oil

15. Fermentation makes food (U.B)

(A) More Nutritious & digestible (B) More Tastier & preserve able
(C) Lowering the need for refrigeration (D) All of these

16. Cheese is formed by milk (A.B)

(A) Fat emulsification (B) Proteins coagulation
(C) Carbohydrate hydrolysis (D) Demineralization

17. In glycolysis, the glucose molecule is broken down into two molecules of: (U.B) **(GRW 2014, SWL 2015)**

(A) Acetic acid (B) Lactic acid
(C) Pyruvic acid (D) Formic acid

18. When milk protein is coagulated, what is formed? (A.B)

(A) Yogurt (B) Cheese
(C) Alcohol (D) Wine

19. Which product is used in the production of soap? (K.B) **(GRW 2017)**

(A) Glycerol (B) Formic acid
(C) Sulphuric acid (D) Acrylic acid

20. Alcoholic fermentation is processed by: (U.B) **(LHR 2016)**

(A) Virus (B) Bacteria
(C) Fungi (D) Algae

17.3 GENETIC ENGINEERING

LONG QUESTIONS

Q.1 What is genetic engineering? What are its objectives? (A.B) **(GRW 2017, BWP 2014, MTN 2015)**

Ans:

GENETIC ENGINEERING

Definition:

"**Genetic engineering** or **recombinant DNA technology** involves the **artificial synthesis**, **modification**, **removal**, **addition** and **repair** of the **genetic material (DNA)**".

Explanation:

Genetic engineering developed in the mid-**1970s** when it became **possible** to cut **DNA** and to transfer particular **pieces of DNA** from **one type** of **organism** into another. As a result, the **characteristics** of the **host organism** could be changed. If host organism is a **microorganism**, such as a **bacterium**, the transferred DNA is multiplied many times as the microorganism multiplies. **Consequently**, it is possible to obtain millions of copies of a specific DNA inside a **bacterial cell**.

OBJECTIVES OF GENETIC ENGINEERING

The **important objectives** of genetic engineering are as follows:

Gene Therapy:

Isolation of a **particular gene** or part of a gene for **various purposes** such as **gene therapy**

RNA and Proteins:

Production of particular **RNA** and protein molecules

Production of Enzyme:

Improvement in the production of **enzymes**, **drugs** and **commercially important organic chemicals**

Plant Varieties:

Production of **varieties** of plants having particular **desirable characteristics**

Treatment Purposes:

Treatment of **genetic defects** in higher **organisms**

Q.2 Describe achievements of genetic engineering. (A.B) **(BWP 2014, DGK 2015)**

OR

Describe the achievements of genetic engineering in medicine, agriculture and environment. (A.B) **(Understanding the Concept Q.3)**

Ans: **ACHIEVEMENTS OF GENETIC ENGINEERING**

Various achievements of genetic engineering are as follows

Preparation of Insulin:

Human insulin gene was transferred into **bacteria**. The genetically **modified bacteria** became able to **synthesize insulin**. **Diabetics** are now receiving this **insulin**.

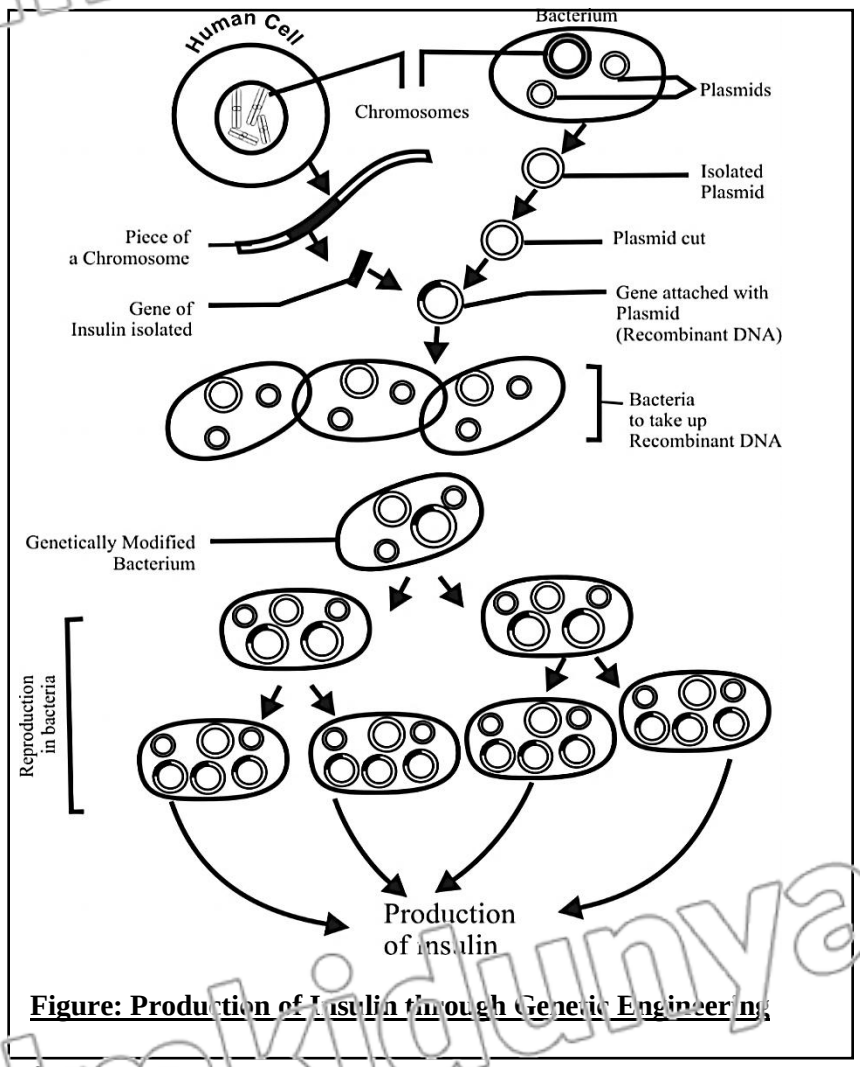

Figure: Production of Insulin through Genetic Engineering

Preparation of Human Growth Hormone:

In **1977** an **E. coli bacterium** was created that was capable of **synthesizing** the **human growth hormone**.

Preparation of Thymosin:

The hormone **thymosin** which may prove effective against **brain and lung cancer** has been produced by **genetically modified microorganisms**.

Preparation of Beta-endorphin:

Beta-endorphin, a **pain killer** produced by **the brain**, has also been produced by **genetic engineering techniques**.

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Preparation of Vaccines:

Genetic engineers **produced** a **safe** vaccine against the **foot and mouth disease** (a viral disease in cattle, goats and deer). Similarly many **vaccines** have been **produced** against **human** diseases such as **hepatitis B**.

Preparation of Interferons:

Interferons are **anti-viral proteins** produced by cells infected with **viruses**. In **1980** interferon was produced in the **genetically modified microorganisms**, for the first time.

Preparation of Urokinase:

The enzyme **urokinase**, which is used to **dissolve blood clots**, has been produced by **genetically modified microorganisms**.

Elimination of Inherited Diseases:

It has become possible to modify the genes in the **human egg cell**. This can lead to the elimination of inherited **diseases like hemophilia**.

Cure of Blood Diseases:

Genetic engineering techniques can also be used to cure **blood diseases** like **thalassemia** and **sickle-cell anemia**, which result from defects in single genes. Normal genes could be transferred into the bone marrow.

Nitrogen Fixation:

Genetic engineers have developed plants that can **fix nitrogen** directly from the atmosphere. Such plants need less **fertilizers.**

Figure: Some Medicine Produced by Genetic Engineers

Q.3 Describe basic steps of genetic engineering. (K.B) **(LHR 2017, DGK 2014, SWL 2015) (Understanding the Concept Q.4)**

OR

What basic steps a genetic engineer adopts during the manipulation of genes? (K.B)

Ans:

BASIC STEPS OF GENETIC ENGINEERING

Definition:

"Genetic engineering or recombinant DNA technology involves the artificial synthesis, modification, removal, addition and repair of the genetic material (DNA)".

BASIC STEPS OF GENETIC ENGINEERING

The following basic steps are involved in genetic engineering:

1. **Isolation of the Gene of Interest:**

In the **first step**, the genetic engineer **identifies** the **gene of interest** in a **donor organism**. **Special enzymes**, called **restriction endonucleases**, are used to cut the **identified gene** from the total **DNA** of donor organism.

2. **Insertion of the Gene into a Vector:**

A **vector** is **selected** for the **transfer** of the **isolated gene of interest** to the **host cell**. The vector may be a **plasmid** (the extra-chromosomal DNA present in many bacteria) or a **bacteriophage**. The gene of interest is **attached** with the **vector DNA** by using endonuclease (breaking enzymes) and **ligase** (Joining enzymes). The vector DNA and the attached gene of interest are collectively called **recombinant DNA**.

3. Transfer of Recombinant DNA:
Recombinant DNA is **transferred to the target** host. In this way, **host organism** is transformed into a genetically modified organism **(GMO)**.

4. Growth of the GMO:
The **GMO** are **provided suitable culture** medium for **growth** to give as **much copies** of the **gene of interest** as needed.

5. Expression of the Gene.
The GMO **contains** the gene of interest and manufactures the desired product, which is isolated from **culture medium**.

17.3 SHORT QUESTIONS

Q.1 Define glycolysis. (K.B) **LHR -2017**
Ans: Page no 246.

Q.2 Define genetic engineering. (K.B) **LHR -2017**
Ans: Page no 253.

Q.3 Write two benefits of the use of fermenter. (K.B) **GRW -2015**
Ans Page no 249.

Q.4 Write two objectives of genetic engineering. (U.B)
Ans: Page no 253.

Q.5 Define Vector. (K.B) **(GRW 2015)**

OR

What is vector in genetic engineering? **(LHR 2016)**
Ans: Page no .

Q.6 Name the bacterium which is used to prepare human growth hormone. (K.B)
Ans: Page no 254.

Q.7 Write use of hormone thymosin. (A.B) **(DGK 2015)**
Ans: Page no 254.

Q.8 What is beta-endorphin? (A.B) **(DGK 2015, LHR 2016)**

OR

What is the function of beta-endorphin?
Ans: Page no 254.

Q.9 What are Interferon's? (K.B) **(LHR 2015, SWL 2015)**
Ans: Page no 255.

Q.10 Write the use of enzyme urokinase? (A.B) **(LHR 2015, SWL 2015)**
Ans: Page no 255.

Q.11 Name the diseases which can be cured by genetic engineering. (K.B) **(LHR 2015)**
Ans: Page no 276.

Q.12 What is recombinant DNA? (K.B) **(LHR 2017)**
Ans: Page no 255.

Q.13 What is meant by gene therapy? (K.B) **(LHR 2016)**
Ans: Page no 241.

Q.14 Describe any two achievements of genetic engineering. (K.B) **(GRW 2017)**
Ans: Page no 254.

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17.3 MULTIPLE CHOICE QUESTIONS

1. Gene of interest is excised by (A.B)
(A) Restriction endonuclease (B) Exonuclease
(C) Ligase (D) nuclease

2. Recombinant DNA is (U.B)
(A) Gene of interest + Donor genome (B) Host DNA + Plasmid
(C) Vector DNA + Plasmid (D) Vector DNA + Gene of interest

3. Which of the following can be used as biotechnological vector (A.B)
(A) Plasmid (B) Bacteriophage
(C) Virus (D) Either of these

4. An antiviral protein is: (K.B) **(DGK 2014)**
(A) Insulin (B) Thymosin
(C) HGH (D) Interferon

5. Insulin is a: (K.B)
(A) Hormone (B) Antiseptic
(C) Antifungal (D) Sedative

6. The enzymes that are used to cut the identified gene from the DNA of donor organism: (A.B) **(LHR 2013)**
(A) Restriction endonucleases (B) Ligases
(C) Lipases (D) Amylases

7. Diabetes is cured by: (K.B)
(A) Human Growth Hormone (B) Insulin
(C) Glucagon (D) Parathormone

8. A painkiller produced by brain: (U.B) **(BWP 2014)**
(A) Thymosin (B) Beta-endorphin
(C) Insulin (D) Human Growth Hormone

9. Beta endorphin, a pain killer, is produced by (A.B)
(A) Liver (B) Kidney
(C) Brain (D) Pancreas

10. How many sheep brains are required to produce 5 mg human growth hormone:(K.B)
(A) 10,000 (B) 1,000
(C) 100,000 (D) 500,000

11. Genetic engineers have developed plants that can fix _____ directly from the atmosphere such plants need less fertilizers. (K.B)
(A) Carbon (B) Nitrogen
(C) Nitrous oxide (D) Carbon

12. Interferon was produced in the genetically modified microorganisms, for first time in: (K.B)
(A) 1981 (B) 1982
(C) 1980 (D) 1992

13. E.coli bacterium was created that was capable of synthesizing the human growth hormone in: (K.B)
(A) 1975 (B) 1976
(C) 1977 (D) 1981

14. _____ are used to cut the identified gene from the total DNA of donor organism. (K.B)
(A) Ligase (B) Endonucleases
(C) Restriction endonucleases (D) Urokinase

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15. Genetic engineering technique can also be used to cure: (A.B)
(A) Blood pressure diseases (B) Blood diseases
(C) Respiratory disease (D) Heart diseases

16. The enzyme which are used to dissolve blood clots is: (U.B) **(GRW 2017)**
(A) Beta-endorphin (B) Thymosin
(C) Urokinase (D) Interferon

17. The hormone which many prove effective against brain and lung cancer which is produced by genetically modified organism. (U.B) **(GRW 2016)**
(A) Insulin (B) Thymosin
(C) Ligase (D) Urokinase

17.4 SINGLE-CELL PROTEIN

LONG QUESTIONS

Q.1 Write a note on single-cell protein. (K.B) **(GRW 2015)**

OR

What is single-cell proteins describe their importance. (K.B) **(Understanding the Concept Q.5)**

Ans:

SINGLE-CELL PROTEIN

Definition:

"The **process** in which the **protein content extracted** from pure or **mixed cultures** of algae, yeasts, fungi or bacteria, is called **single-cell protein (SCP)**".

Explanation:

- It is known as **single-cell protein** because the microorganisms are used as producers are **unicellular** or **filamentous individuals**.
- The **microorganisms** are **grown** in fermenters where they **produce** a **high yield** of **protein**.
- This technique was introduced by Prof. **Scrimshow of Massachusetts Institute** of **Technology**.

Substrates:

For the **production** of single-cell proteins, the **microorganisms** are grown in fermenters.
These microorganisms **utilize** a **variety of substrates** like:

- **Agricultural wastes**
- **Industrial wastes**
- **Natural gas like methane**

Growth of Microorganisms:

Microorganisms **grow** very **vigorously** and **produce** a high **yield of protein**. The protein content produced by microorganisms is also known as novel **protein or minifood**.

Need of (SCP):

Due to **over-population**, the world is facing the **problem** of **food shortage**. In future, the **conventional agricultural** methods might **not** be able to provide a **sufficient supply** of food **(especially proteins).** For a **better** management of food **shortage problems** (in humans and domestic animals), the use **of microbes** as the **producers** of **single-cell proteins** has been successful on experimental basis.

Substitute Food:

Scientist and food technologists believe that **single-cell proteins** will **substitute** the other **protein-rich foods** in human and animal feeds.

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ADVANTAGES

All scientists recognize the **significance** of the production of single-cell proteins.

High Yield of Protein:

The microorganisms grow very **vigorously** and produce a **high yield**.

It has been calculated that **50 kilogram** of **yeast** produces about **250 tons of protein** within 24 hours.

Algae grown in ponds produce 20 tons (dry weight) of protein per acre/year. This yield of protein is **10-15** times higher than **soybeans** and **20-50** times higher than corn.

High Vitamin Contents:

When single-cell proteins are **produced** by **using yeasts**, the **products** also contain high **vitamin content**.

Industrial Wastes:

In the production of single- cell proteins, **industrial wastes** are used as **raw materials** for microorganisms. It helps in **controlling pollution**.

Essential Amino Acids:

The **use** of single-cell proteins has **good prospects** in future because they contain all **essential amino acids**.

Seasonal Variations:

The **production** of single-cell proteins is **independent** of **seasonal variations**.

Limited Land Area:

SCP is gaining popularity day by day because it requires **limited land area** for production.

17.4 SHORT QUESTIONS

Q.1 Define single-cell protein. (K.B) **(GRW 2013, 16, DGK 2014, SWL 2015, LHR 2016)**

OR

What is meant by single-cell protein? **(LHR 2016)**

Ans: Page no 258.

Q.2 What is mini food? (K.B)

Ans: Page no 258.

Q.3 What is the contribution of Prof. Scrimshow? (K.B)

Ans:

CONTRIBUTION OF PROF. SCRIMSHOW

The concept of single-cell protein (SCP) was introduced by Prof. Scrimshow of Massachusetts Institute of Technology.

Q.4 What are the advantages of single-cell protein? (A.B)

Ans: Page no 259.

Q.5 Name microorganisms which are used in single-cell protein. (K.B)

Ans: Page no 258.

Q.6 How the microorganisms produce cell protein? (A.B) **(LHR 2017)**

Ans: Page no 258.

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17.4 MULTIPLE CHOICE QUESTIONS

1. How much yeast is required to produce 250 tons of protein in one day? (K.B)

(A) 20 kg (B) 30 kg

(C) 40 kg (D) 50 kg

2. The technique of single-cell protein was introduced by: (K.B)

(A) Prof. Robert (B) Prof. Hudgson

(C) Prof. Scrimshow (D) Prof. Hook

3. How much protein (dry weight) per acre per year is produced by algae grown in ponds? (K.B)

(A) 20 tons (B) 25 tons

(C) 30 tons (D) 35 tons

4. Microorganism grow very vigorously and produce a high yield of protein. The protein content produced by microorganism is: (K.B)

(A) Novel protein (B) Mini food

(C) Single cell protein (D) All of these

5. It is known as single-cell protein because the microorganism used as producers are: (U.B)

(A) Unicellular (B) Filamentous individual

(C) Algae (D) Both A and B

6. Single cell protein can be obtained from: (K.B) **(LHR 2017)**

(A) Insect (B) Cow

(C) Bird (D) Algae

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

17.1 IMPORTANCE OF BIOTECHNOLOGY

1	A	**2**	D	**3**	D	**4**	D	**5**	C	**6**	C
7	D	**8**	B	**9**	D	**10**	B	**11**	B	**12**	A
13	C	**14**	A								

17.2 FERMENTATION

1	C	**2**	A	**3**	C	**4**	D	**5**	D	**6**	B	**7**	A
8	B	**9**	B	**10**	C	**11**	C	**12**	A	**13**	B	14	B
15	D	**16**	B	**17**	C	**18**	B	**19**	A	**20**	C		

17.3 GENETIC ENGINEERING

1	A	**2**	D	**3**	D	**4**	D	**5**	A	**6**	A	**7**	B
8	B	**9**	C	**10**	D	**11**	B	**12**	C	**13**	C	**14**	C
15	B	**16**	C	**17**	B								

17.4 SINGLE CELL PROTEIN

1	D	**2**	C	**3**	A	**4**	D	**5**	D	**6**	D

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Find the correct match for the fermentation product and the organism involved. (K.B)

(a) Formic acid – Saccharomyces (b) Ethanol - Saccharomyces

(c) Ethanol - Aspergillus (d) Glycerol - Aspergillus

2. Which one is NOT an objective of genetic engineering? (U.B)

(a) Production of cheese and yogurt by lactic acid bacteria

(b) Isolation of a particular gene or part of a gene

(c) Production of RNA and protein molecules

(d) Correction of genetic defects in higher organisms

3. Which of these is an antiviral protein? (K.B)

(a) Urokinase (b) Thymosin

(c) Insulin (d) Interferon

4. The first step in genetic engineering is; (K.B)

(a) Growth of the genetically modified organism

(b) Transfer of the Recombinant DNA into the host organism

(c) Isolation of the gene of interest

(d) lnsertion of a gene into a vector

ANSWER KEY

1	b	2	a	3	d	4	c

SHORT QUESTIONS

1. How would you define fermentation with reference to biotechnology? (U.B)

Ans:

FERMENTATION

Definition:

"In biotechnology the term "fermentation" means the production of any product by the mass culture of micro-organisms".

2. Name any two industrial products made by fermentation. Also describe their uses in industry. (K.B) **(GRW 2016)**

Ans:

INDUSTRIAL PRODUCTS

The industrial products made by fermentation are as follows:

Industrial Products	Some Uses
Formic acid	• Textile dyeing • Leather treatment • Electroplating • Rubber manufacture
Ethanol	• Used as solvent • Production of vinegar • Production of beverages.

3. What are the products of the two types of carbohydrates fermentation? (K.B)

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Ans: **CARBOHYDRATES FERMENTATION**

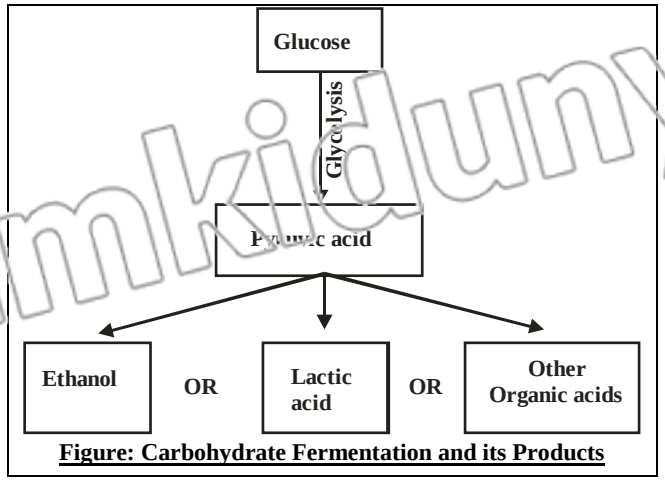

Figure: Carbohydrate Fermentation and its Products

4. Give an example how biotechnology is helping for the better environment. (K.B)

Ans: **BIOTECHNOLOGY AND ENVIRONMENT**

Biotechnology is also being used for dealing with environmental issues like:

- Pollution control
- Development of renewable sources for energy
- Restoration of degraded lands
- Biodiversity conservation

5. In biotechnology, what is meant by Genetically Modified Organism (GMO)? How is it made? (U.B)

Ans: **GMO**

Definition:

"The organism in which DNA (gene) from some other organism has been transferred is called Genetically Modified Organism (GMO)".

Example:

Bacterium with human insulin gene is an example of Genetically Modified Organism (GMO).

Transfer of Recombinant DNA into Host Organism:

Recombinant DNA is transferred to the target host. In this way, host organism is transformed into a genetically modified organism (GMO).

UNDERSTANDING THE CONCEPT

1. Define biotechnology and describe its importance. (U.B)

Ans: See LQ.1 (Topic 17.1)

2. What is a fermenter? What are the two types of fermentation carried out in fermenters? (K.B)

Ans: See LQ.3 (Topic 17.2)

3. Describe the achievements of genetic engineering in medicine, agriculture and environment. (A.B)

Ans: See LQ.2 (Topic 17.3)

4. What basic steps a genetic engineer adopts during the manipulation of genes? (A.B)

Ans: See LQ.3 (Topic 17.3)

5. What are single-cell proteins? Describe their importance. (A.B)

Ans: See LQ.1 (Topic 17.4)

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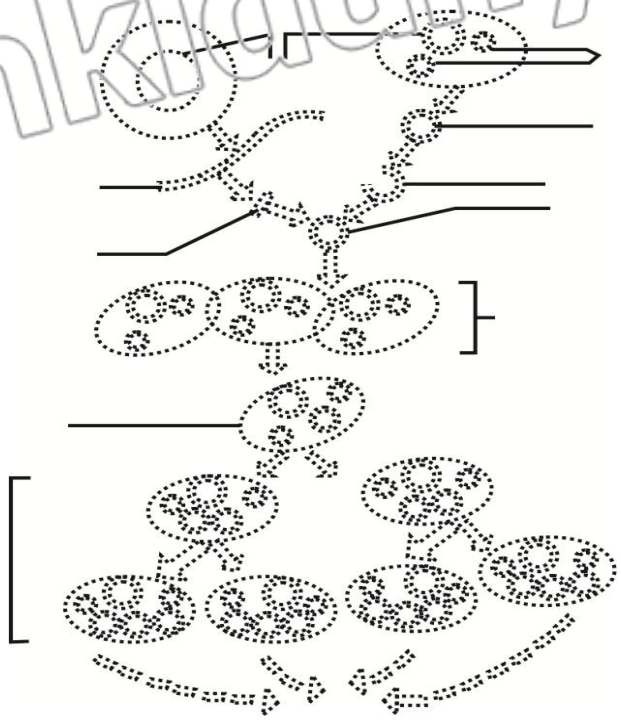
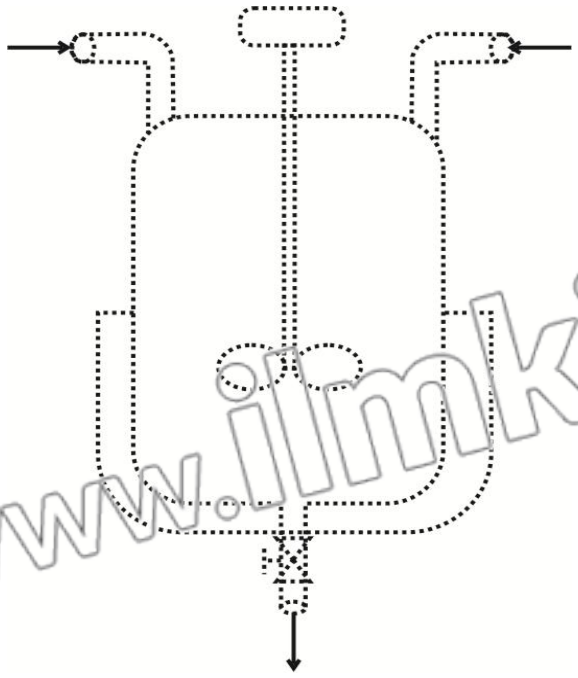
ASSIGNMENT

PRACTICE DIAGRAM AND LABEL

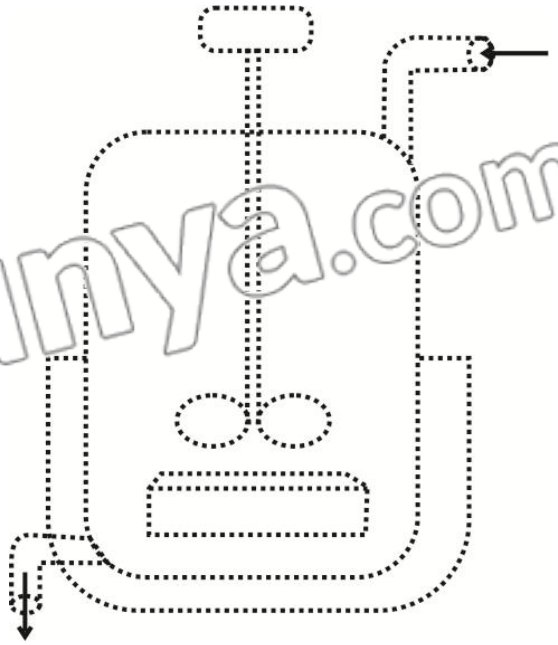
PRODUCTION OF INSULIN THROUGH GENETIC ENGINEERING



BATCH FERMENTER



CONTTINUOUS FERMETER



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CUT HERE

SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. (6×1=6)

1. Insulin is effective against: (K.B)

(A) Blood pressure **(B)** Heart diseases

(C) Nervous disorders **(D)** Diabetes mellitus

2. Sheep Dolly was produced in: (K.B)

(A) 1993 **(B)** 1995

(C) 1997 **(D)** 1999

3. Microorganisms used in the manufacture of glycerol: (K.B)

(A) Aspergillus **(B)** Saccharomyces

(C) Bacillus **(D)** Spirogyra

4. A painkiller produced by brain: (A.B)

(A) Thymosin **(B)** Beta-endorphin

(C) Insulin **(D)** Human growth hormone

5. The technique of single-cell protein was introduced by: (K.B)

(A) Prof. Robert **(B)** Prof. Hudgson

(C) Prof. Scrimshow **(D)** Prof. Hook

6. How much protein (dry weight) per acre per year is produced by algae grown in ponds? (A.B)

(A) 20 tons **(B)** 25 tons

(C) 30 tons **(D)** 35 tons

Q.2 Give short answers to following questions. (5×2=10)

(i) What is advantage of single-cell protein? **(A.B)**

(ii) What are mini food? **(K.B)**

(iii) What are beta-endorphin? **(K.B)**

(iv) Define fermenter? Give its types n ames. **(K.B)**

(v) What is human genome project? **(K.B)**

Q.3 Answer the following questions in detail. (5+4=9)

(a) What is a fermenter? Describe types of fermentation. What are the advantages of using fermenters? **(A.B)**

(b) What is genetic engineering? What are its objectives? **(A.B)**

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.

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18.1 MEDICINAL DRUGS

LONG QUESTIONS

Q.1 Describe different sources of medicinal drugs with examples. (A, B)

OR

What are the sources of drugs? Give examples. **(Understanding the Concept Q.1)**

Ans:

MEDICINAL DRUGS

Definition:

"Any **chemical substance** used in the **diagnosis**, **cure**, **treatment** and **prevention of disease** is called **medicinal drug** or **pharmaceutical drug**".

Example:

Antibiotics are the **examples** of medicinal drugs which are used against **bacterial diseases**.

SOURCES OF MEDICINAL DRUGS

Drugs are obtained from the following sources:

- **Synthetic drugs**
- **Drugs from plants and fungi**
- **Drugs from animals**
- **Drugs from minerals**
- **Drugs from bacteria**
- **Drugs from soil**

Synthetic Drugs:

Such drugs do **not occur naturally** but are **synthesized in laboratory**. Pharmaceutical companies produce these drugs.

Example:

- Aspirin

Drugs From Plants:

Many important **medicines** are obtained from **plants**. These medicines include:

- **Antibiotics**
- **Cardiotoincs**
- **Certain analgesics**

Examples:

Digitalis:

It is a **cardiotoincs** which is used to **stimulate the heart**.

Source:

It is made from the leaves of **purple flowered plant, foxglove**.

Morphine:

It is a **pain reliever**.

Source:

It is obtained from **opium**, which comes from the juice of **opium poppy plant**.

Drugs From Fungi:

Some **medicines** are obtained from **fungi**.

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Example:

The **antibiotic penicillin** is obtained from a **fungus, *Penicillium notatum***.

Drugs From Animals:

Drugs obtained from **animals** are usually their **glandular products**.

Examples:

The following are obtained from animal **sources**:

- **Fish liver oils**
- **Musk**
- **Bees wax**
- **Certain hormones**
- **Antitoxins**

Drugs From Minerals:

Several common **drugs** are produced from **minerals**:

Examples:

Iodine:

The **mineral iodine** is used in making **tincture of iodine**.

Function:

It is a **liquid** that helps to **prevent infection** when applied to cuts and **bruises**.

Silver Nitrate:

The **powder** form of **silver nitrate** is applied on **wounds** to **stop bleeding** and **prevent infections**.

Drugs From Bacteria:

Many **antibiotics** are obtained from **bacteria**:

Example:

Streptomycin

Drugs From Soil:

Researchers of a **pharmaceutical** company spent **two years testing soil** from all parts of the **world** to find new **antibiotics**. The project **resulted** in the **development** of one **antibiotic**.

Example:

Terramycin is used to **treat** many **infections**.

Q.2 Describe principal usage of important medicinal drugs. *(A.B)* **(GRW 2014)**

Ans: **PRINCIPAL USAGE OF IMPORTANT MEDICINAL DRUG**

The drugs are **classified** on the basis of:

- **Chemical properties**
- **Modes of action**

The **principal** usage of important medicinal drugs are as follow:

Analgesics:

These are the **pain killers**. These **reduce pain**.

Examples:

- **Aspirin**
- **Paracetamol**

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Antibiotics:

These **inhibit** or **kill bacteria** with in or on the body and treat **bacterial infections**.

Examples:

- **Tetracycline**
- **Cephalosporins**

Sedatives:

These **induce sedation** by reducing **irritability or excitement**.

Example:

Diazepam

Vaccines:

These are used to **develop immunity** against **viral** and **bacterial infections**.

Examples:

Vaccines against:

- **Smallpox**
- **Whooping cough**
- **Hepatitis B**

Antiseptics:

These reduce the possibility of **infections on skin**.

Example:

- **Tincture of iodine**

Disinfectants:

These **destroy microorganisms** found on **non-living objects**.

Examples:

- **Phenyl**
- **Detol**

Q.3 Write precautions for the use of medicinal drugs. ***(U.B)***

Ans: **PRECAUTIONS FOR THE USAGE OF MEDICINES**

Medicines can **help** you **feel better**. But if medicines are **taken incorrectly**, they can actually make you **feel worse**. The following **precautions** should be kept in mind.

- Dosage
- Expiry Date
- Self-Medication
- Duration
- Treatment Discontinuation
- Dosage for Children
- Darkness
- Carriage
- Children's Reach
- Tampered Medicines

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Dosage:

Always **check** the **instructions** on **doctor's prescription** slip and make sure you take the **doses** of medicine **strictly** as your doctor prescribed.

Expiry Date:

Always **check** the **expiry** date printed on the medicine pack. The expired medicines may prove poisonous.

Self-Medication:

Never take medicines **prescribed** for **someone else**, even if you **think** you have the **same medical problem**.

Duration:

Some medicines - such as **antibiotics** - must be **taken** for a **specific** number of **days**. Make sure you take the **medicine** for the **stated time**. Otherwise, the **problem** may come **back again**.

Treatment Discontinuation:

Always **check** with your **doctor** before you **stop taking** a medicine or **consider** a new **treatment**.

Dosage for Children:

Some medicines are **not suitable** for **children**, and there are **special** children's **dosages** for many **medicines**.

Darkness:

Do not take **medicine** in the **dark**.

Carriage:

If your **prescription medicines** are **crucial for your health** and life, **carry medicines** and **dosage instructions** with you, whenever you are **out of home.**

Children's Reach:

Always **keep** healthcare products **out** of the **reach of children.**

Tampered Medicines:

Do not use the **medicine** if there are **signs** of **tampering**. Inform the **pharmacist** and the manufacture of the medicine about it.

18.1 SHORT QUESTIONS

Q.1 Define pharmacology. (K.B) **(LHR 2015)**

Ans: **PHARMACOLOGY**

Definition:

"The study of drug composition, properties and medical application, is called Pharmacology. The sources of drugs are also studied in Pharmacology."

Q.2 Define drug. Also name its two groups. (K.B) **(LHR 2014, GRW 2014)**

Ans: Page no 257.

Q.3 What are prescription drugs? (K.B) **(GRW 2017)**

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Ans: Page no 269.

Q.4 What are pharmaceutical drugs? (K.B) **(GRW 2013, 2014, MTN 2015)**

Ans:

PHARMACEUTICAL DRUGS

Definition:

"A pharmaceutical drug or medicinal drug is defined as any chemical substance used in the diagnosis, cure, treatment or prevention of disease."

Example:

- Antibiotics

Q.5 What are addictive drugs? (K.B) **(GRW 2013,17, MTN 2015)**

Ans:

ADDICTIVE DRUGS

Definition:

Some drugs often make person dependent on them, or addicted. These may be called as addictive drugs.

Example:

Marijuana and heroin are examples of addictive drugs.

Q.6 What are synthetic drugs? (K.B) **(GRW 2013, 16, LHR 2014, 16, BWP 2014, DGK 2015, SWL 2015)**

Ans: Page no 266.

Q.7 Write historical background of pharmacology? (U.B)

Ans:

HISTORICAL BACKGROUND OF PHARMACOLOGY

Clinical pharmacology was present in the middle ages. Early pharmacologists focused on natural substances

Q.8 What is the difference between prescription drugs and non-prescription drugs? *(K.B)*

Ans:

DIFFERENTIATION

The differences between prescription drugs and non-prescription drugs are as follows:

Prescription Drugs	Non-Prescription Drugs
Definition	
• Prescription drugs are sold only on physician's prescription.	• Non-prescription drugs are sold over the counter because these are considered safe enough.
Examples	
• Barbiturates • Tranquillizers • Antibiotics	• Aspirin • Cough medicines

Q.9 Which drugs are obtained from plants and fungi? (K.B) **(LHR 2015, GRW 2016)**

Ans: Page no 257, 263.

Q.10 Which drugs are obtained from animals? (K.B)

Ans: Page no 263.

Q.11 Which drugs are obtained from minerals? (K.B)

Ans: Page no 268.

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Q.12 Which antibiotic is developed from soil testing? (K.B)

Ans: Page no 268.

Q.13 What are analgesics and antiseptics? (K.B) **(LHR 2016)**

OR

What are analgesics? Give examples **(GRW 2016)**

Ans: Page no 268.

Q.14 What are antibiotics and vaccines? (K.B)

(GRW 2014, 2015, BWP 2014, 2015, DGK 2015, LHR 2016)

Ans: Page no 269.

Q.15 What is analgesics drug? Give an example. **(GRW 2016)**

Ans: Page no 258.

Q.16 How drugs are classified on the basis of their chemical properties and modes of action? (U.B)

Ans: Page no 268.

Q.17 What are disinfectants? (K.B)

Ans: Page no 269.

Q.18 What is the contribution of Sir Alexander Fleming? (K.B) **(GRW 2016)**

Ans: Page no 2.

Q.19 Who developed the idea of sterile surgery? (U.B) **(LHR 2013, GRW 2017)**

Ans: Page no 2.

Q.20 What are the different sources of drugs? (K.B) **(GRW 2017)**

Ans: Page no 267.

18.1 MULTIPLE CHOICE QUESTIONS

1. Pharmacology is the study of: (K.B)

(A) Drug's composition (B) Drug's medical application
(C) Drug's sources and properties (D) All of these

2. Early Pharmacologist focused on natural substances, mainly: (K.B)

(A) Plant extracts (B) Animal's hormones
(C) Fungal products (D) Antibiotics

3. Pharmacology developed into biomedical science in: (K.B)

(A) 17^{th} century (B) 20^{th} century
(C) 18^{th} century (D) 19^{th} century

4. Drugs are broadly classified into how many types? (K.B)

(A) Three (B) Four
(C) Two (D) Five

5. Medicinal drug is a chemical substance used in disease's (A.B)

(A) Diagnosis (B) Cure or treatment
(C) Prevention (D) All of these

6. Streptomycin is obtained from _____. (K.B) **(GRW 2013)**

(A) Bacteria (B) Virus
(C) Fungi (D) Micro organism

7. Penicillin is obtained from: (K.B)

(A) Plant (B) Fungus
(C) Alga (D) Animal

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8. Digitalis is used to stimulate: (K.B)
(A) Heart (B) Brain
(C) Kidney (D) Lungs

9. Morphine is derived from: (K.B)
(A) Iodine (B) Foxglove
(C) Opium (D) Aspirin

10. Which drugs are obtained from animals? (K.B) **(DGK 2014)**
(A) Fish liver oil (B) Bee's wax
(C) Antitoxins (D) All of these

11. The drugs used to reduce pain are known as _____. (K.B) **(LHR 2013, 2015 GRW 2015, DGK 2015)**
(A) Analgesics (B) Antiseptics
(C) Antibiotics (D) Sedatives

12. To which group of drugs aspirin belong? (U.B) **(LHR 2014)**
(A) Obtained from animals (B) Obtained from plants
(C) Synthetic (D) Obtained from bacteria

13. Which one is a sedative? (U.B) **(LHR 2017)**
(A) Tetracycline (B) Aspirin
(C) Diazepam (D) Cephalosporin

14. Which medicines are used to develop immunity against viral and bacterial infections? (A.B)
(A) Analgesics (B) Sedatives
(C) Antibiotics (D) Vaccines

15. Which medicines reduce the possibility of infections on skin? (K.B) **(LHR 2015, BWP 2015)**
(A) Analgesics (B) Antiseptics
(C) Antibiotics (D) Disinfectants

16. Sir Alexander Fleming was awarded Nobel Prize in: (A.B) **(LHR 2016)**
(A) 1940 (B) 1945
(C) 1950 (D) 1955

17. Who promoted the idea of sterile surgery for the first time? (A.B)
(A) Alexander Fleming (B) Louis Pasteur
(C) Robert Brown (D) Joseph Lister

18. Which drug is produced form minerals? (U.B) **(GRW 2016)**
(A) Tincture of iodine (B) Musk
(C) Opium (D) Streptomycin

19. Diazepam is: (K.B) **(LHR 2017)**
(A) Vaccine (B) Narcotics
(C) Hallucinogens (D) Sedative

20. Penicillin is discovered by: (A.B) **(LHR 2017)**
(A) Edward Jenner (B) Joseph lister
(C) Bu-Ali Sina (D) Alexander Flemming

21. Expired drugs can cause damage to: (K.B)
(A) Liver (B) Kidney
(C) Intestine (D) Colon

22. Until _____ the subject of Pharmacology was known as Meteria Medica. (A.B)
(A) 1880 (B) 1890
(C) 1870 (D) 1815

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18.2 ADDICTIVE DRUGS

LONG QUESTIONS

Q.1 Define addictive drugs. Describe different types of addictive drugs. *(K.B)* (LHR 2014)

OR

What are addictive drugs? Describe three types of addictive drugs. *(K.B)* (GRW 2016)

OR

Write a note on sedatives, narcotics and hallucinogens. *(K.B)*(Understanding the Concept

Q.2

Ans:

ADDICTIVE DRUGS

Definition:

"The drugs that make person **dependent** on them or **addicted** are called **addictive drugs**."

Examples:

- **Narcotics**
- **Marijuana**

Effect:

By **using** addictive drug, the person's **body** becomes **familiar** to it and the user **cannot function well** without it.

TYPES OF ADDICTIVE DRUGS

The following are **major categories** of addictive drugs:

- **Sedatives**
- **Narcotics**
- **Hallucinogens**

Sedatives:

These **drugs induce sedation** by **reducing irritability** or **excitement**.

Mode of Action:

These drugs **interact** with **central nervous system** to **depress** its **activities.**

Effects:

Sedative drugs **induce:**

- **Dizziness**
- **Lethargy**
- **Slow brain function**
- **Depression**

Long Term Use:

Long term use of sedative drugs **induces suicidal thoughts**.

Narcotics:

Narcotics are **strong pain killers**.

Prescription:

These drugs are often **prescribed** in **conjunction** with other **less potent pain killers** like **paracetamol** or **aspirin**.

Usage:

These are **used** to **relieve pain** for patients with **chronic diseases** such as **cancer**. These are also **used** to **relieve acute pain** after **operations**.

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Drug Abuse:
Some people may **abuse** narcotics for **ecstatic effects**.

Figure: The Fruits of the Opium Poppy Plant

Examples:
Morphine:
Morphine is **derived** from **opium** (poppy). It acts **directly** on **central nervous system** to **relieve pain**. Morphine has a **high potential** for **addiction**.
Codeine:
It is also **derived** from **opium**.
Heroin:
It is the **most** commonly **abused narcotic**. It is **semi-synthetic drug** from **morphine**. It **effects** on **central nervous system** and causes **drowsiness**.
Usage in Western Countries:
In many **western countries, heroin** is **prescribed** as a **strong analgesic** under the **name diamorphine**. Its **use** includes **treatment** for **acute pain**, such as:

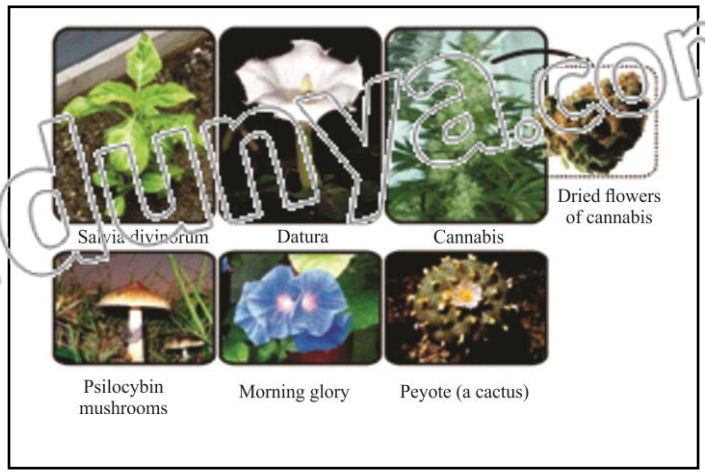
- **Severe physical trauma**
- **Myocardial infarction**
- **Post-surgical pain**

Hallucinogens:
Hallucinogens are the **drugs** that **cause changes** in:

- **Perception**
- **Thought**
- **Emotion**
- **Consciousness**

Mode of Action:
Physiologically, hallucinogens **effect** on the **sympathetic nervous system** causing:

- **Dilation of pupils**
- **Constriction of some arteries**
- **Rise in blood pressure**



Examples:
Mescaline:
Mescaline is **derived** from **cactus**.
Psilocin:
Psilocin is **derived** from a **mushroom**.
Marijuana (Hashish):
Marijuana is a **hallucinogen**, which is **smoked**.
Sources:
It is **obtained** from the **flowers**, **stems** and **leaves** of the **marijuana plant**.
Cannabis sativa
Cannabis indica
Effect of Less Dosage:
Small doses of marijuana **result** in a **feeling** of **wellbeing** that lasts for **two to three hours**.
Effect of High Dosage:

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High doses **increase heart rate**.

Adverse Effects:

It also **effects** the production of **sperms in men** and also **weakens** the **short-term memory**.

Usage:

Marijuana is one of the **most** commonly **used** drugs in the **world**, followed by **caffeine**, **nicotine** and **alcoholic beverages** in popularity.

Q.2 What are the problems related to drug addiction? *(U.B)*

OR

Describe drugs addiction. (LHR 2016)

Ans:

PROBLEMS WITH DRUG ADDICTION

There is a long list of drugs associated problems, some of them are as follow:

Withdrawal of Social Contact:

Drug abusers go through **withdrawal** of **social contact** or communication. The addicts are very **weak** in their **social behavior**. They face **social stigma** i.e. the **society dislikes** them because of their **unpredictable behaviors**.

Problems for Government:

The **jails and prisons** of our country are **full** of such **people** who have **committed** no other crime than the **illegal possession of narcotics**.

Increase in Crime Rate:

Many studies by the experts of social sciences **prove** that there exists a **close relationship** between **drug addiction and crime**. The compulsion for narcotic drug makes every drug **addict a criminal**.

Law Violator:

The drug addicts are **law violators**. Mere possession of a narcotic drug is violation of the law. Thus, every drug addict is **subject** to **arrest** by the police.

Psychic Patients:

Drug addicts may commit **violent crimes** since so many become **psychic patients**.

Other Crimes:

Most narcotic addicts get involved in various **types of crimes**, like:

- **Robbery**
- **Shop lifting**
- **Burglary**
- **Embezzlement**

18.2 SHORT QUESTIONS

Q.1 Define Vaccine. Give its working briefly. *(K.B)* **LHR 2015**

Ans: Page no 269.

Q.2 Sulpha drugs are used against which disease? *(K.B)* **GRW 2017**

Ans: Page no 298.

Q.3 What are narcotics? *(K.B)*

Ans: Page no 275.

Q.4 Who was Joseph Lister? What was his contribution? **GRW 2017**

Ans:

Q.5 What are morphine and codeine? *(K.B)*

Ans: Page no 275.

Q.6 What is diamorphine? Write its uses. *(K.B+A.B)* **(DGK 2015)**

Ans: Page no 275.

Q.7 What are hallucinogens? Write its effects? *(K.B)* **(LHR 2016)**

OR

Define hallucinogens. *(K.B)* **(LHR 2016)**

Ans: Page no 298.

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Q.8 What is marijuana? And what are its sources? (A.B) **(GRW 2014, LHR 2015, BWP 2015)**
Ans: Page no 299.
Q.9 Name the plants from where hallucinogens are obtained. (K.B)
Ans: Page no 275.
Q.10 Name some crimes which are related to drug addiction. (A.B)
Ans: Page no 299.
Q.11 What is social stigma? (K.B)
Ans: Page no 276.

18.2 MULTIPLE CHOICE QUESTIONS

1. Which of the following is strong pain killer? (U.B)
(A) Sedative (B) Hallucinogens
(C) Marijuana (D) Narcotics

2. Narcotics are prescribed with other less potent : (A.B)
(A) Antibiotics (B) Antiseptics
(C) Analgesics (D) Sedatives

3. Which of the following addictive drugs is obtained from opium: (K.B) **(LHR 2014, 16)**
(A) Morphine (B) Marijuana
(C) Mescaline (D) Psilocin

4. The medicines used to relieve acute pain after operations: (A.B) **(GRW 2014)**
(A) Sedatives (B) Narcotics
(C) Hallucinogens (D) Antibiotics

5. Which one is a narcotic drug? (K.B)
(A) Codeine (B) Mescaline
(C) Psilocin (D) Marijuana

6. Marijuana is obtained from: (A.B)
(A) Fungi (B) Algal
(C) Bacteria (D) Plant

7. Perceptions that have no basis in reality, but that appear entirely realistic: (U.B)
(A) Hallucinogens (B) Narcotics
(C) Emotions (D) Hallucinations

8. Which one is a hallucinogen? (K.B)
(A) Morphine (B) Codeine
(C) Heroin (D) Psilocin

9. Medicine obtained from cactus: (A.B) **(MTN 2015)**
(A) Morphine (B) Codeine
(C) Mescaline (D) Tetracycline

10. Psilocin is obtained from: (A.B) **(SWL 2015, GRW 2017)**
(A) Mushroom (B) Bacterium
(C) Algae (D) Animal

11. Marijuana is: (K.B)
(A) Injected (B) Taken orally
(C) Used topically (D) Smoked

12. Drugs addiction relates to which of the following: (U.B)
(A) Enjoyment (B) Competition
(C) Peace (D) Crime

13. Medicines which induce sedation by reduction irritability and excitement are called: (A.B) **(GRW 2016)**
(A) Analgesics (B) Antibiotics
(C) Sedatives (D) Vaccines

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14. This group includes mescaline and psilocin: (K.B) **(GRW 2017)**

(A) Sedatives (B) Narcotics
(C) Hallucinogens (D) Vaccines

15. _____ is one of the most commonly used drugs in the world, following only caffeine, nicotine

(A) Marijuana (B) Codeine
(C) Hashish (D) Heroin

18.3 ANTIBIOTICS AND VACCINES

LONG QUESTIONS

Q.1 What are antibiotics? Write its major groups. (K.B) **(LHR 2013)**

OR

Describe the main groups of antibiotics. (K.B) **(Understanding the Concept Q.3)**

Ans:

ANTIBIOTICS

Definition:

"An **antibiotic** is a drug that **kills or retards** the **growth** (reproduction) of **bacteria**. They are the **chemicals** produced by or **derived** from **microorganisms** like **bacteria and fungi**".

Antibiotics are among the **most frequently** prescribed **medications** in modern medicine.

Types of Antibiotics:

There are **two main** types of antibiotics:

- Bactericidal antibiotics
- Bacteriostatic antibiotics

Bactericidal Antibiotics:

The antibiotics that **kill the bacteria** are called bactericidal antibiotics.

Bacteriostatic Antibiotics:

The antibiotics that **work by stopping** the **bacterial growth** are called bacteriostatic antibiotics.

GROUPS OF ANTIBIOTICS

There are **three major groups** of antibiotics:

- Cephalosporins
- Tetracyclines
- Sulpha Drugs – Sulfonamides

Cephalosporins:

Mode of Action:

Cephalosporins interfere with the **synthesis** of **bacterial cell wall**.

Category:

These are **bactericidal antibiotics**.

Treatment:

Cephalosporins are used to **treat**.

- **Pneumonia**
- **Sore throat**
- **Tonsillitis**
- **Bronchitis**

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Tetracyclines

Mode of Action:

Tetracyclines **inhibit bacterial protein synthesis**.

Category:

These are **broad-spectrum bacteriostatic antibiotics.**

Treatment:

Tetracyclines are **used** in the **treatment** of **infections** of:

- **Respiratory tract**
- **Urinary tract**
- **Intestine**

Prohibited for Children:

Tetracyclines are **not used** in **children** under the **age of 8**, and especially during **periods of tooth development**.

Sulpha drugs – sulfonamides:

Composition:

Sulpha drugs are **synthetic antibiotics** that **contain sulfonamide** group.

Category:

Sulfonamides are **broad-spectrum bacteriostatic antibiotics.**

Mode of Action:

They **inhibit** the **folic acid synthesis in bacteria.**

Treatment:

They are used to **treat**:

- **Pneumonia**
- **Urinary tract infections**

Sulfonamide Group:

The sulfonamide group is also **present** in **other medications** that are **not antibiotics**

Example:

- **Thiazide diuretics** (medicines for lowering blood pressure.)

Q.2 Explain how bacteria show resistance to different antibiotics. (U.B) (GRW 2014, DGK 2015)

OR

Write an note on resistance against antibiotics. (Understanding the Concept Q.4)

Ans: **ANTIBIOTIC RESISTANCE**

Definition:

"The **ability** of **bacteria not** to be **affected** by the **particular antibiotic** is called antibiotic resistance".

Explanation:

- When **bacteria** are **exposed** to the **same antibiotic** over and over, they can **change** and are **no longer affected** by the **drug**.
- Antibiotics are extremely **important** in **medicine**, but unfortunately **bacteria** are capable of **developing resistance** to them. Such bacteria are not affected by commonly used antibiotics.

Developing Resistance:

Bacteria have number of ways of developing resistance.

Internal Mechanism:

Sometimes, their **internal mechanism stops** the **working** of antibiotic.

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Transfer of Genes:

Bacteria can also **transfer the genes** responsible for **antibiotic resistance** between them. So such resistance bacteria make it **possible** for other bacteria to **acquire resistance**.

Unaffected Usage:

Another **reason** for increasing antibiotic resistance in bacteria is their **use in diseases** in which they have **no efficacy** (e.g. antibiotics are not effective against infections caused by viruses).

A Growing Problem:

Resistance to antibiotics poses a **serious** and **growing problem**, because some **infectious diseases** are becoming more **difficult to treat**. Some of the **resistant bacteria** can be **treated** with more **powerful antibiotics**, but there are **some infections** that **do not eliminate** even with new **antibiotics**.

Q.3 Define vaccine. Explain mode of action of vaccines. (A.B)

(Understanding the Concept Q.5) (LHR 2016, DGK 2015)

Ans:

VACCINES

Definition:

"A **material** containing **weakened** or **killed pathogens** and is used to **produce immunity** to a disease by **stimulating** the production of **antibodies** is called a vaccine".

Example:

Future immunity against **polio** and **smallpox** diseases are the examples of vaccination.

Work of Edward Jenner:

In **1796**, a **British physician**, **Edward Jenner**, infected a **young boy** with **cowpox**, by injecting pus cells. After the boy had **recovered** from **cowpox**, Jenner **injected** the pus cells from a **smallpox** patient into him. The boy **did not** get smallpox.

Result:

So it became clear that intentional infection with cowpox protected people from smallpox.

Vaccination:

This method was named "vaccination" and the substance used to vaccinate was called a "vaccine".

MODE OF ACTION OF VACCINES

Antigens:

Pathogens contain **special proteins** called "**antigens**".

Antibodies:

When pathogens **enter the body** (blood) of host, these proteins **stimulate** the **immune** response in host i.e. **synthesis** of "antibodies". Antibodies **bind** to **pathogens** and **destroy them**.

Production of Memory Cells:

In addition, "**memory cells**" are **produced**, which **remain** in **blood** and provide **protection** against future **infections** with the **same pathogen**.

Stimulation of White Blood Cells:

When a **vaccine** i.e. weakened or dead pathogen is **introduced** into **bloodstream**, the **white**

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blood cells are **stimulated**.

Recognition by B-lymphocytes:

B-lymphocytes recognize the weakened or dead pathogens as **enemies** and start **producing antibodies** against them.

Protection against Pathogens:

These antibodies remain in blood and provide **protection** against pathogens. If **real pathogens** enter **blood**, the already **present antibodies** kill them.

18.3 SHORT QUESTIONS

Q.1 What are broad-spectrum and narrow spectrum antibiotics? (K.B) **(DGK 2015)**

Ans:

DIFFERENTIATION

The differences between broad-spectrum and narrow spectrum antibiotics are as follows:

Broad Spectrum Antibiotics	Narrow Spectrum Antibiotics
Definition	
• Some antibiotics can be used to treat a wide range of infections and are known as "broad-spectrum" antibiotics.	• Some antibiotics are only effective against a few types of bacteria are called narrow spectrum antibiotics.
Example	
• Tetracyclines	• Penicillin

Q.2 What are bactericidal and bacteriostatic antibiotics? (K.B) **(LHR 2016, BWP 2015)**

Ans:

DIFFERENTIATION

The differences between bactericidal and bacteriostatic antibiotics are as follows:

Bactericidal	Bacteriostatic
Definition	
• Some antibiotics are bactericidal, meaning that they kill bacteria.	• Some antibiotics are bacteriostatic meaning that they work by stopping bacterial growth.
Examples	
• Cephalosporins.	• Tetracyclines.

Q.3 What are three major group of antibiotics? (A.B)

Ans: Page no 279.

Q.4 What are the two method in which antibiotics get resistance? (U.B)

Ans: Page no 284.

Q.5 Define vaccines. (K.B) **(LHR 2014)**

OR

What are vaccines? **(GRW 2016)**

Ans: Page no 281.

Q.6 What is the contribution of Edward Jenner? (K.B)

Ans: Page no 281.

Q.7 What are antigen and antibodies? (K.B)

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Ans: Page no 279.

Q.8 Name different diseases which are decreased by vaccination of children. (A.B)

Ans: Page no 304.

Q.9 Sulpha drugs are used for which disease? (A.B) **(GRW 2017)**

Ans: Page no 304.

Q.10 What are tetracyclines? Give examples. (K.B) **(LHR 2017)**

Ans: Page no 280.

18.3 MULTIPLE CHOICE QUESTIONS

1. Antibiotics used to treat wide range of infections: (A.B)

(A) Broad spectrum (B) Narrow spectrum

(C) Vaccines (D) Antiseptics

2. Who first time infected a young boy with cowpox by injecting pus cells? (K.B)

(A) Alexander Fleming (B) Joseph Lister

(C) Robert Hooke (D) Edward Jenner

3. Pathogens contain special proteins called: (K.B) **(MTN 20**

(A) Antigens (B) Antibodies

(C) B-lymphocytes (D) T-lymphocytes

4. Which cells remain in blood and provide protection against future infections with the same pathogen? (K.B)

(A) Lymphocytes (B) Monocytes

(C) Memory cells (D) Thrombocytes

5. Which cells recognize the weakened or dead pathogens as enemies and start producing antibodies: (K.B)

(A) B-lymphocytes (B) T-lymphocytes

(C) M-lymphocytes (D) O-lymphocytes

6. Some vaccines do not provide lifetime immunity, for example, tetanus vaccines are only effective for a limited period of time. In such cases _____ are necessary to maintain continuous protection. (A.B)

(A) 1st years dose (B) 3 years dose

(C) 5 years dose (D) Booster dose

7. In _____ a British physician, Edward Jenner, infected a young boy with cowpox, by injecting pus cells. (K.B)

(A) 1796 (B) 1773

(C) 1793 (D) 1776

8. Tetracyclines are not used in children under the age of _____ and specifically during periods of tooth development. (K.B)

(A) Six years (B) Eight years

(C) Ten years (D) Five years

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ANSWER KEY

MULTIPLE CHOICE QUESTIONS

18.1 MEDICINAL DRUGS

1	D	**2**	A	**3**	D	**4**	C	**5**	D	**6**	A
7	B	**8**	A	**9**	C	**10**	D	**11**	A	12	C
13	C	**14**	D	**15**	B	**16**	B	**17**	D	18	A
19	D	**20**	D	**21**	B	**22**	B				

18.2 ADDICTIVE DRUGS

1	D	**2**	C	**3**	A	**4**	B	**5**	A	**6**	D	**7**	D
8	D	**9**	C	**10**	A	**11**	D	**12**	D	**13**	C	14	C
15	A												

18.3 ANTIBIOTICES AND VACCINES

1	A	**2**	D	**3**	A	**4**	C	**5**	A
6	D	**7**	A	**8**	B				

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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Antibiotics are used for the: (A.B)

(a) Treatment of viral infections (b) Treatment of bacterial infections

(c) Immunization against infections (d) Both a and b

2. The substances used for the treatment, cure, prevention or diagnoses of diseases are called: (K.B)

(a) Medicinal drugs (b) Narcotics

(c) Hallucinogens (d) Sedatives

3. Aspirin is categorized as: (U.B)

(a) A drug from animals (b) A synthetic drug

(c) A drug from plants (d) A drug from minerals

4. The drugs used to reduce pain are known as; (A.B)

(a) Analgesics (b) Antiseptics

(c) Antibiotics (d) Sedatives

5. Which of the following drugs obtained from plants? (K.B)

(a) Aspirin (b) Opium

(c) Cephalosporin (d) Insulin

6. Which of these addictive drugs are also used as painkillers? (K.B)

(a) Narcotics (b) Sedatives

(c) Hallucinogens (d) All can be used

7. Sulfonamides affect bacteria in the following way;(A.B)

(a) Break the cell wall (b) Inhibit protein synthesis

(c) Stop the synthesis of new cell wall (d) Stop the synthesis of folic acid

8. What is true about vaccines? (U.B)

(a) Protect against the future viral and bacterial infections

(b) Treat the existing bacterial infections only

(c) Treat existing infections and also protect against future infections

(d) Protect against viral infections only

ANSWER KEY

1	b	2	a	3	b	4	a	5	b
6	a	7	d	8	a				

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SHORT QUESTIONS

Q.1 Define pharmacology and distinguish it from pharmacy. (K.B)

Ans:

PHARMACOLOGY

The study of drug composition, properties, medical applications sources of drugs is called pharmacology.

Difference from Pharmacy:

Pharmacology is not synonymous with pharmacy, which is the name used for a profession though in common usage the two terms are confused.

Q.2 Differentiate between medicinal drug and addictive drug. (K.B)

Ans:

DIFFERENTIATION

The differences between medicinal drug and addictive drug are as follows:

Medicinal Drug	Addictive Drug
Definition	
• Any chemical substance used in the diagnosis, cure, treatment and prevention of disease is called medicinal drug or pharmaceutical drug.	• The drugs that make person dependent on them or addicted are called addictive drugs.
Example	
• Antibiotics are the examples of medicinal drugs which are used against bacterial diseases.	• Narcotics and marijuana are the common examples of addictive drugs.

Q.3 Differentiate between analgesics and antibiotics. (K.B) **(LHR 2016)**

Ans:

DIFFERENTIATION

The differences between analgesics and antibiotics are as follows:

Analgesics	Antibiotics
Definition	
• These are the pain killers. These reduce pain.	• These inhibit or kill bacteria with in or on the body and treat bacterial infections.
Examples	
• Aspirin • Paracetamol	• Tetracycline • Cephalosporins

Q.4 What is marijuana? To which category of addictive drugs it belongs? (K.B)

Ans:

MARIJUANA

Marijuana is a hallucinogen, which is smoked.

Sources:

It is obtained from the flowers, stems and leaves of the marijuana plant.

- Cannabis sativa
- Cannabis indica

Effect of Less Dosage:

Small doses of marijuana result in a feeling of wellbeing that lasts for two to three hours.

Effect of High Dosage:

High doses increase heart rate.

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Adverse Effects:

It also effects the production of sperms in men and also weakens the short term memory

Usage:

Marijuana is one of the most commonly used drugs in the world, followed by caffeine, nicotine and alcoholic beverages in popularity.

Q.5 Differentiate between narcotics and hallucinogens. (K.B)

Ans:

DIFFERENTIATION

The differences between narcotics and hallucinogens are as follows:

Narcotics	Hallucinogens
• Narcotics are strong pain killers. • These drugs are often prescribed in conjunction with other less potent pain killers like paracetamol or aspirin. • These are used to relieve pain for patients with chronic diseases like cancer. These are also used to relieve acute pain after operations.	• Hallucinogens are the drugs that cause changes in perception thought emotion and consciousness. • Physiologically, hallucinogens effect on the sympathetic nervous system causing: • Dilation of pupils • Constriction of some arteries • Rise in blood pressure
Examples	
• Morphine • Codeine • Heroin	• Mescaline • Psilocin

UNDERSTANDING THE CONCEPT

Q.1 What are the sources of drugs? Give examples. (A.B)

Ans: See the LQ.1 of (Topic 18.1)

Q.2 Write a note on sedatives, narcotics and hallucinogens. (K.B)

Ans: See the LQ.1 of (Topic 18.2)

Q.3 Describe the main groups of antibiotics. (K.B)

Ans: See the LQ.1 of (Topic 18.3)

Q.4 Write a note on resistance against antibiotics. (U.B)

Ans: See the LQ.2 of (Topic 18.3)

Q.5 Describe the mode of action of vaccines. (A.B)

Ans: See the LQ.3 of (Topic 18.3)

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THE TERMS TO KNOW

Terms	Definitions
Addictive drug	The drug which makes the person dependent on it or addicted
Analgesic	The medicines that reduce pain
Antibiotics	The medicines that inhibit or kill bacteria
Aspirin	Acetaminophen; A pain killer medicine
Bactericidal	The antibiotics that work by killing bacteria
Bacteriostatic	The antibiotics that work by stopping bacteria to multiply.
Cardiotonics	Medicines for giving stimulate heartbeat.
Cephalosporins	A group of antibiotics; interfere with synthesis of bacterial cell wall
Hallucinogen	Drug that causes changes in perception, thought, emotion and consciousness
Heroin	A commonly abused narcotic; derived from morphine; affects the central nervous system and causes drowsiness, disorientation, hypotension etc.
Marijuana	A hallucinogen and addictive drug; obtained from the flowers, stems and leaves of the marijuana plant
Medicinal drug	Any chemical substance intended for use in the medical diagnosis, cure, treatment or prevention of disease
Morphine	A commonly used narcotic; derived from the juice of opium; acts directly on the CNS to relieve pain; has a high potential for addiction
Narcotics	Strong painkiller drugs; also used as addictive drugs; commonly abused narcotics include heroin, morphine, methadone etc
Pharmacology	The study of drug composition, properties and medical applications
Sedatives	Types of drugs that interact with the central nervous system to depress its activities; make a person calm or drowsy
Sulfonamides	Sulpha drugs; synthetic antibiotics that contain the sulfonamide group; bacteriostatic in action
Tetracyclines	Broad spectrum bacteriostatic antibiotics; inhibit bacterial protein synthesis

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Vaccines	The material used to produce immunity against a disease by stimulating the production of antibodies.

SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. (6×1=6)

1. Digitalis is used to stimulate: (K.B)

(A) Heart **(B)** Brain
(C) Kidney **(D)** Lungs

2. Morphine is derived from: (K.B)

(A) Iodine **(B)** Foxglove
(C) Opium **(D)** Aspirin

3. The medicines used to relieve acute pain after operations: (K.B)

(A) Sedatives **(B)** Narcotics
(C) Hallucinogens **(D)** Antibiotics

4. Which one is a narcotic drug? (U.B)

(A) Codeine **(B)** Mescaline
(C) Psilocin **(D)** Marijuana

5. Which cells recognize the weakened or dead pathogens as enemies and start producing antibodies: (A.B)

(A) B-lymphocytes **(B)** T-lymphocytes
(C) M-lymphocytes **(D)** O-lymphocytes

6. Which of the following drugs obtained from plants? (K.B)

(A) Aspirin **(B)** Opium
(C) Cephalosporin **(D)** Insulin

Q.2 Give short answers to following questions. (5×2=10)

(i) Define pharmacology and distinguish it from pharmacy.

(ii) What are broad-spectrum and narrow spectrum antibiotics?

(iii) What are hallucinogens and its effects?

(iv) What is the contribution of Sir Alexander Fleming?

(v) How many drugs are classified on the basis of their chemical properties and modes of action?

Q.3 Answer the following questions in detail. (5+4=9)

(a) Write a note on addictive drugs.

(b) Explain major groups of antibiotics and mode of action of vaccine.

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NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.

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