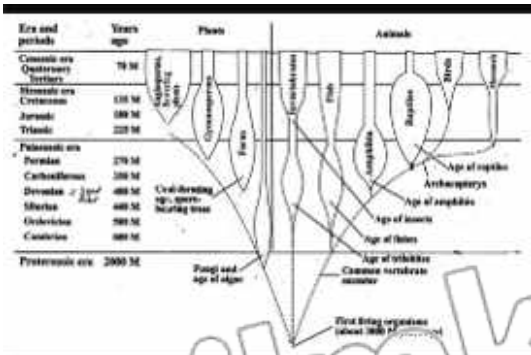


Chapter 1

Introduction

1.1 BIOLOGY

Meaning

Biology has been derived from two ***Greek*** words:

Bios	-	*Life*
Logos	-	*Study*

Thus, it literally means ***study of life***.

1. Define Life. (BWP 2021)

Definition

"Scientific study of **living things** is called ***biology*****"**

A biologist deal with;

- ***Living part*** of nature
- ***Non-Living*** things that affect the living things in any way.

LIFE

- It is very difficult to define **life** in biology because there are many aspects of life, which are beyond the scope of the science of biology like the answer to questions:
    1) What is meaning of life?
    2) Why should there be life?

  Answers to these questions are left to philosophers and theologians. Biologist mainly deals with matters relating to how life works.

Life, for biologists, is a set of characteristics that distinguish living organisms from non-living objects (including dead organisms).

Life and Living Organisms

Life is associated with living organisms because they have following characteristics:

- They are highly organized **complex** entities ***(Complexity)***
- Composed of one or more **cells** ***(Composition)***
- Contain **genetic** program of their characteristics ***(Inheritance)***
- Can acquire and use energy ***(Respiration)***
- Can carry out and control numerous chemical **reactions** ***(Metabolism)***
- Can grow in **size** ***(Growth)***
- Maintain a fairly **constant internal environment** ***(Homeostasis)***
- Produce **offsprings** similar to themselves. ***(Reproduction)***
- Respond to **changes** in environment ***(Sensitivity)***

Any object possessing all these characteristics can be declared as living thing.

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1.2 BIOLOGY AND ITS DIVISIONS

Science of biology is a very wide based study. It includes every aspect of living things.

In order to be convenient, biology has been divided into a number of branches e.g,

1. **Define parasitology and molecular biology. (MTN 2021)**
2. **The study of fossils is called: (LHR 2022)**

Branch	Definition
Morphology	Study of **form** and **structure**
External morphology	Study of **external features**
Internal morphology (Anatomy)	Study of **internal structure**
Paleontology	Study of **fossils** and their relation with evolution
Histology	Study of **tissues**
Evolution	Study of **changes** in organisms with time
Genetics	Study of **transmission** of characters from **parents** to **off-springs**
Zoogeography	Study of Geographical **distribution of animals** on earth
Ecology	Study of **inter-relationship** between **organisms** and their **environment**
Embryology	Study of **development** of embryo
Physiology	Study of **functions** of different organs and organelles

Some other branches of biology are defined as:

1) Molecular Biology

Molecular biology is a branch of biology, which deal at **molecular level** with the structure of organisms, the cells and their organelles. For example, study of amino acids, nucleic acids (DNA and RNA) proteins, carbohydrates, and lipids, along with their compositions, interactions, structure, and functions in the life processes.

2) Environmental Biology

It is the study of organisms in **relation to their environment**. This includes interaction between the organism and their inorganic and organic environment, especially as it relates to human activities. For example, how the addition of a particular parasite will influence the plant and other animals of the particular area

3) Microbiology

It is the study of microorganisms. For example study of bacteria, viruses, protozoa and microscopic algae and fungi.

4) Fresh Water Biology

It deals with the organisms living in **freshwater** body's i.e, rivers, lakes etc and **physical** and **chemical parameters** of these water bodies.

5) Marine Biology

It is the study of life in **seas** and **oceans**. It includes the study of the marine life and the physical and chemical characteristics of the sea acting as a factor for marine life.

6) Parasitology

It deals with the study of **parasites**. The structure, mode of transmission, life histories and host-parasite relationship are studied in parasitology.

7) Human Biology

It deals with the study of **man**. It includes form, structure, function, histology, anatomy, morphology, evolution, genetics, cell biology and ecological studies.

8) Social Biology

It deals with the study of *social behaviour* and *communal life* of human beings.

9) Biotechnology

It deals with the use of living organisms, systems or processes in manufacturing and service industries.

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MULTIPLE CHOICE QUESTIONS

(1) Zoogeography is study of distribution of what in nature: **(LHR 2021)**
(A) Animals (B) Plants
(C) Trees (D) Zoos

(2) Percentage of calcium in human body is: **(BWP 2023)**
(A)1% **(B) 2%**
(C) 3% (D) 10%

(3) A group similar cells that perform similar function is: **(RWP 2021)**
(A) Organ (B) Organelles
(C) Tissue (D) System

EXTENSIVE QUESTIONS

(1) Explain the terms Biology and Life in detail.
(2) Define any eight branches of biology. **(DGK 2021)**
(3) Define following branches of Biology
Molecular Biology, Microbiology, Marine Biology, Biotechnology.
(Exercise Question i)

1.3 LEVELS OF BIOLOGICAL ORGANIZATION

1.3.1 Bioelements

Elements, which occur in a particular organism, are called bioelements.

1. Define bioelements, name six elements which form 99% total mass in human body. (DGK 2023)

Bioelements in Living Organisms

- **Hundreds of** *biochemical reactions* **are involved in** *maintaining life* **of even the simplest organism.**
- Out of ***92 naturally*** occurring chemical elements, ***only 16*** are commonly used in forming chemical compounds from which living organism are made.
- Properties of these bioelements differ from those present in non-living world and these properties make them particularly appropriate as basis for life.
- These 16 elements are bioelements are given below with their percentage.

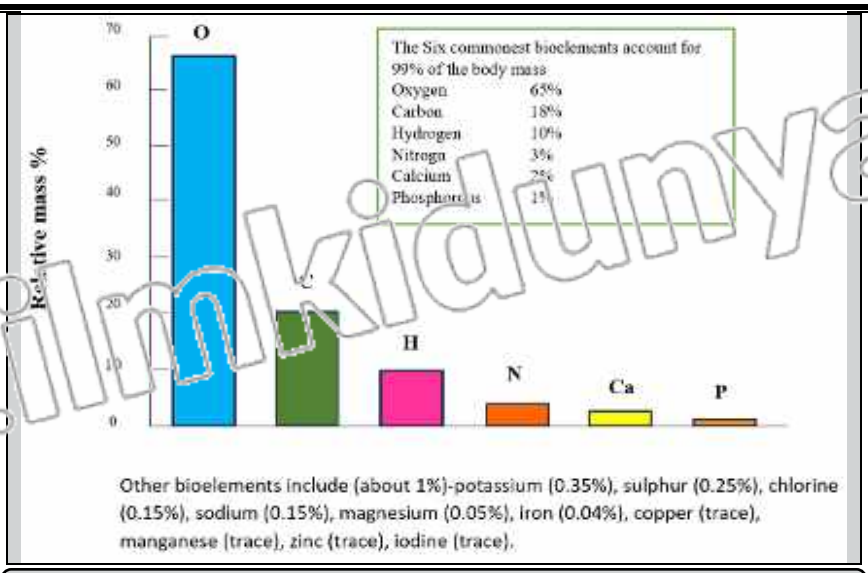
Bioelements in Humans

In the human body, only ***six*** bioelements account for ***99%*** of the total mass. Other ***ten*** bioelements form only ***1%.***

Six bio-elements that account for 99%	Relative %	Ten bio-elements that account for only 1%	Relative %
Oxygen	65%	Potassium	0.35%
Carbon	18%	Sulphur	0.25%
Hydrogen	10%	Chlorine	0.15%
Nitrogen	3%	Sodium	0.15%
Calcium	2%	Magnesium	0.05%
Phosphorous	1%	Iron	0.004%

- Copper, manganese, zinc, and iodine are in ***traces***.

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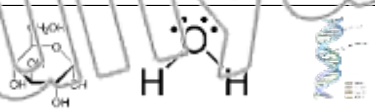
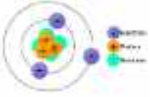
1.1 Percentage composition of bioelements by mass of a human being

BIOLOGICAL ORGANIZATION

- A living thing is composed of highly structured living substance or ***protoplasm.***
- In order to understand various phenomena of life, we study biological organization at different levels starting from the very basic level of sub atomic and atomic particles to the organism itself and beyond which the study of population and community, and entire world are included.

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VARIOUS LEVELS OF BIOLOGICAL ORGANIZATION

Bioshpere	That part of earth inhibited by living organisms; include both the living and the non-living components.	
Ecosystem	A community together with its nonliving surroundings	
Community	Two or more poluations of different species living and interacting in the same area.	
Population	Members of one species inhabiting the same area	
Species	Very similar, potentially interbreeding organism	
Multiellular Organism	An indivirdual living thing composed of many cells	
Organ System	To or more oragns working together in the exceution of a specific body function.	
Organ	A structure normlly composed of several tissue types that form a functional unit.	
Tissue	A group of similar cells that perform a specific function.	
Cell	The unit of life.	
Orgnelle	A structre within a cell that peforms a specific function.	
Micromolecules and Marcomolecules	A combination of atoms.	
Atom	The smallest particle of an element that retains the properties of that element.	
Subatomic Particles	Particles that make up an atom.	

1.2 Levels of organization

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1.3.2 Atomic and subatomic level

1. **Differentiate between micro and macromolecules (LHR 2018)**

Atom is the **smallest particle** of matter and consists of three fundamental subatomic particles, electron, proton and neutron. All living and non-living things are formed of atoms and sub-atomic particles.

1.3.3 Molecular level

In organisms, elements usually do not occur in isolated forms. The atoms of different **elements combine** with each other through **ionic or covalent bonding** to produce compounds. This stable from is called a molecule.

Biological Molecules forming Atoms

Hydrogen, carbon, oxygen, nitrogen, phosphorous and sulphur are the most common atom found in biological molecules. A great variety of complex biological molecules are constructed on the basis of different types of bonding arrangement.

Biological Molecules

Biological molecules are of two types;

i) Micro-molecules

ii) Macro-molecules

An **organism** usually consists of enormous number of **micro** and **macromolecules** of hundreds of different types. These molecules are **organic** and **inorganic** compound.

i) Micro-molecules

- These molecules are with **low molecular weight.**
- Some common examples are CO_2, H_2O etc.
- Most of the micro-molecules present in living organisms are **inorganic.**

ii) Macro-molecules

- These molecules are with **higher molecular weight.**
- Some common examples are starch, proteins etc.
- Most of the macromolecules present in living organisms are **organic**.

1.3.4 Organelles and cells

1. **Differentiate between organ and organelle. (SWL 2023)**

Different and enormous number of **micromolecules** and **macromolecules** arrange themselves in a particular way to form **cells** and their **organelles.**

Organelles

Numerous **sub cellular** tiny structures of cell are called organelles e.g mitochondria, Golgi bodies, endoplasmic reticulum, ribosomes etc.

Functions of the cells are accomplished by these specialized structures comparable to the organs of the body.

- ***Prokaryotes*** have a limited number and type of organelles.
- ***Eukaryotes*** are rich in number and kind of membrane bounded organelles.

Cell membrane is present in all cells whether prokaryotic or eukaryotic.

Cell

Cell is basic **unit of life.**

- In case of simple organisms like bacteria and most protists, the entire organism consists of a single cell (***unicellular***).
- In most **fungi plants** and **animals**, the organism may consist of upto **trillions of cells** (***multicellular***).

1.3.5 Tissue level

Group of similar cells organized into loose sheets and bundles performing a specific function is called tissue.

Examples

***Muscle tissues*:** Specialized for contraction.
***Glandular Tissue*:** Specialized for secretion.
***Xylem tissue*:** Specialized for conduction of water.
***Phloem tissue*:** Specialized for conduction of food.

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1.3.6 Organ and organ system

Organ

Different **tissues** having **related functions** assemble together in an organ to perform particular function.

1. Why organ system is less complex in plants as compared to animals? (FSD 2022)

Examples

For example, stomach, heart, lung etc.

Tissues in Stomach

Stomach is an organ, which has a function of food digestion (protein part). It has

- **Secretory epithelial tissue** which secretes gastric juice.
- **Muscular tissue** (smooth) for contracting walls of stomach for grinding and pushing food to posterior end.

Formation of an Organ

Formation of an organ is a selective process related to specific function of organism. In different organs, tissues vary qualitatively and quantitatively according to their specific functions.

Organ Level in Animals and Plants

- ***In animals*** there is complex and defined organ level.
- ***In plants***, organ level is less definite than animals. At most we might distinguish roots, stems, leaves and reproductive structures.
  We can assign distinguishing features to these parts. e.g. ***Roots*** are involved in anchoring the plant, storage of food and procuring water and minerals.
- ***Shoot*** supports the entire plant.
- **Leaves** are primary organs for food manufacture.
- ***Flowers*** or other reproductive structures are involved in reproduction.

Organ System

Different **organs join** to form organ system where total functions involved in one process or phenomenon are carried out.

Examples

Digestive system, respiratory system etc.

Complexity of an Organ System

Complexity of organ system of animal is associated with ***range of functions*** and ***activities***.

1.3.7 Individual (whole organism)

Various organs in plants and various organ systems in animals are assembled to from an individual, the whole organism.

Individuality of an Organism

The whole organism has its individuality as far as its characteristics are concerned. It is different from other members of same species in certain respects.

Coordination in an Organism

- Various **functions, processes** and **activities** of an organism are **coordinated**.
- **Coordination** is the working together of different body parts in regular manner with timing and perfection. In animals, all the systems work in coordination with each other.

Example

- If a man is engaged in continuous and hard exercise then
- Muscles work actively and there is
- Increase in rate of respiration.
- Increased heartbeat.
- Increased flow of blood.
- Increased supply of oxygen and food to muscles.

  Thus muscular system, circulatory system and respiratory system work in coordination with each other.

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Attainment of Coordination

- In animals, coordination is achieved by;
  - **i) Nervous system**
  - **ii) Endocrine system**
- In **plants**, only long-term regulation of activities is brought about by ***hormones***.

1.3.8 Population

A **population** is a group of living organisms of **same species** located at the same place at the same time.

1. How does Population differ from Community? (BWP 2023)

2. Write any four attributes of population. (SGD 2023)

Examples

Examples are the number of rats in a field of rice, number of students in biology class, humans or population in a city.

Attributes of Population

Population is a higher level of biological organization than individual. It has its own attributes, which are due to its members, living together. Some of the attributes are gene frequency, gene flow, age distribution, population density, population pressure etc.

1.3.9 Community

Population of **different species** (plants and animals) living in the same habitat form a community.

Some Features of Community

- Communities are ***dynamic collection*** of organisms, in which one population may increase and other may decrease due to fluctuation in biotic factors.
- Some communities are **complex** and well interrelated.
- Some communities are **simple** in which any change can have **drastic** and **long lasting** effect.

Interaction in Organisms

Interaction between organisms in an ecosystem can take many shapes. It may be predation, parasitism, commensalism, mutualism and competition.

1.3.10 Living world in space

Living world of today is enormous in size. It has been reproducing and evolving since ongoing of earth.

Today living organisms are present in almost every part of world. Their distribution in world can be studied through ***biomes***.

1. What do you know about biome? (MTN 2022)

Biome

A ***biome*** is a **large regional community**, primarily determined by **climate**.

In a biome, major type of plants determines the other kind of plants and animals.

Naming of Biomes

Biomes are **named** on base of

- ***Major plants*** e.g., forest ecosystem, grass land ecosystem.
- ***Major feature of ecosystem*** e.g., tropical rain forest, temperate deciduous forest.

MULTIPLE CHOICE QUESTIONS

(1) In human body amount of oxygen is: (LHR 2017)

(A) 50 % **(B) 65 %**
(C) 70 % (D) 40 %

(2) Which one is not a viral disease: (LHR 2018)

(A) Cow pox (B) Mumps
(C) Tetanus (D) Measles

(3) Population of different species living in the same Habitat form: (BWP 2019)

(A) Community **(B) Population**
(C) Biome (D) Biosphere

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EXTENSIVE QUESTIONS

(1) Explain Bioelements and its percentage.
(2) Write note on Molecular level.
(3) Explain biological organization in detail.
(4) Write a note on population and community level biological organization. (LHR 2018)

1.4 LIVING WORLD IN TIME

1. How can we determine the age of rocks? (SWL 2023)

2. Define phyletic lineage and biodiversity? (RWD 2021)

Since the time of origin of life on earth, various organisms were evolved and dominated during various periods of geological time chart.
This has been found from

- Discovery and study of fossils
- Sedimentation of earth.

Different information obtained from these are:

i) During **geological time**, new **layers of sediments** are laid down. If sequence of layers has not been disturbed, the **older organisms** should be in **deeper layers**.

ii) **Age of rocks** in layers can be determined or compared by amount of certain ***radioactive isotopes.*** The **older sediment** layers have **less** of these specific **radioactive isotopes** than the **younger** layers.

iii) A comparison of the layers gives an indication of the relative age of the fossils found in the rocks.

1.4.1 Biodiversity

The number and **variety of species** in a place is called biodiversity.
There are nearly ***2,500,000 known species of organisms***. Out of them, there are nearly

- ***53.1%*** *insects*
- ***19.9%*** *all other animals*
- ***17.6%*** *vascular plants*
- ***9.4%*** *fungi, algae, protozoa, and other prokaryotes.*
- This list is not complete. Total number of species to be estimated is between **5*** ***to 30 million***. Out of the only ***2.5 million*** have been identified so far.

Increase in Biodiversity

Evolutionary changes often produce **new species** and then increases diversity.

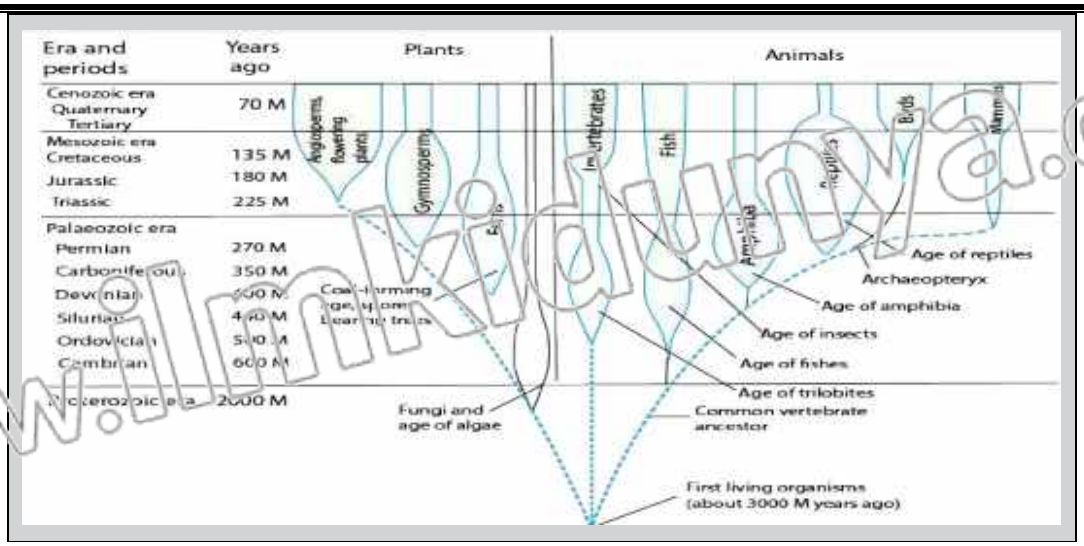
1.4.2 Phyletic lineage

A phyletic lineage is an **unbroken series of species** arranged in **ancestor to descendant** sequence with each later species having evolved from one that immediately preceded it. The **life** today has come into existence through **phyletic lineage** or evolving population of the organisms living in the remote past.

Importance

- If we had a complete record of history of life on earth, then every lineage would extend back in time to the common origin of all early life. We lack that record due to absence of fossils of many soft-bodied organisms

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1.3 Fossil record of plants and animals shown in a geological time chart

MULTIPLE CHOICE QUESTIONS

(1) The geological period starting from 225 million year ago is: **(SGD 2022)**

(A) Jurassic (B) Permian
(C) Triassic (D) Silurian

(2) Mammals become dominant in: **(GRW 2022)**

(A) Proterozoic era (B) Paleozoic era
(C) Mesozoic era **(D) Cenozoic era**

(3) The oldest period of Mesozoic era is: **(SWL 2023)**

(A) Jurassic (B) Cretaceous
(C) Triassic (D) Silurian

EXTENSIVE QUESTIONS

(1) Discuss phyletic linage briefly.
(2) Discuss briefly phyletic lineage in biological organization. (Exercise Question ii)
(3) Write notes on the following. (Exercise Question iii)
Living world in space and time.
(4) Describe briefly phyletic lineage in biological organization. (SGD 2023)

1.5 BIOLOGICAL METHOD

Introduction

Science is a **systematized knowledge**. Like other sciences, biological sciences also have a set methodology. It is based on experimental inquiry.

1. What is inductive reasoning give one example? (LHR 2021)
2. How does theory differ from law? (DGK 2021)

Components

i) Observation
ii) Data
iii) Hypothesis
iv) Tests/Experiments
v) Theory
vi) Scientific Law

These are explained below:

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i) OBSERVATIONS

Observations are made with ***five senses*** i.e, vision, hearing, smell, taste and touch, depending upon their functional ability.

Observation can be ***qualitative*** and ***quantitative***.

Quantitative observations have accuracy over qualitative as the former are measurable and are recorded in terms of numbers.

ii) DATA

Observations made by observer are organized into ***data*** form.

iii) HYPOTHESIS

Hypothesis is a tentative explanation of observations.

Ways of Devising Hypothesis

i) Deductive reasoning

ii) Inductive reasoning

i) DEDUCTIVE REASONING

Principle

In deductive reasoning, we move from ***general to specific***. It involves drawing specific conclusion from some principle / assumption. Deductive logic "if to then" is frequently used to frame testable hypothesis.

Example 1

For example

- If we accept that all birds have wings (premise # 1)
- And sparrows are birds (premise # 2)

Then we conclude that sparrows have wings.

Example 2

- If all green plants require sunlight for photosynthesis

Then any green plant when placed in dark would not synthesis glucose, the end product of photosynthesis.

ii) INDUCTIVE REASONING

Principle

It is reasoning from ***specific to general***. It begins with specific observations and leads to the formation of general principles.

Example

- If we know that sparrows have wings and are birds (premise # 1)
- And we know that eagle, parrot, hawk, crow are birds (premise # 2)

Then we induce (draw conclusion) that all birds have wings.

Since mostly uses inductive methods to generalize from specific events.

Other Ways to form a Hypothesis

Sometimes, scientists also use some other ways to form a hypothesis, which may include;

1) Intuition or imagination.

2) Esthetic preference.

3) Religious or philosophical ideas.

4) Comparison and analogy with other processes.

5) Discovery of one thing while looking for other thing.

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iv) TESTS TESTS/EXPERIMENTS

Hypotheses are then subjected to testing. Any hypothesis that is tested again and again without ever being falsified is considered well supported and is generally accepted. It may be used as the basis for formulating further hypothesis.

v) THEORY

A **series of hypothesis** supported by the results of many tests is then called a **theory**.

Features

A good theory;

- Is predictive
- Has explanatory power.

Productive Theory

A **good theory** which may **suggest new** and different **hypothesis** is called as ***productive*** theory.

vi) SCIENTIFIC LAW

Many scientists take a **productive theory as a challenge** and exert greater efforts to disprove it by performing different tests. If a theory survives this skeptical approach and continues to be supported by experimental evidences becomes a scientific law. A scientific law is a **uniform** or **constant** fact of nature; it is a virtually **irrefutable theory**. It is more general than theory and **answers** to even more **complex questions**.

Laws in Biology

Biology is short in laws because of elusive nature of life. Examples of biological laws are ***Hardy-Weinberg law*** *and* ***Mendel's laws of inheritance***.

MULTIPLE CHOICE QUESTIONS

(1) A _____ is based upon observations.

(A) Hypothesis (B) Deductions
(C) Theory (D) Law

(2) The reasoning which moves from specific to general: **(LHR 2023)**

(A) Productive (B) Inclusive
(C) Deductive **(D) Inductive**

(3) The reasoning that moves from general to specific is called: **(LHR 2021)**

(A) Inductive **(B) Deductive**
(C) Scientific (D) None of these

EXTENSIVE QUESTIONS

(1) What is biological method? Discuss it under following headings. (LHR 2021)
(a) Theory (b) Law

(2) Describe Biological Methods under following headings. (DGK 2019)
(a) Deductive and Inductive reasoning
(b) Theory and Law

(3) How can you solve biological problem with help of biological method? (FSD 2023)

(4) Describe the various steps of biological methods to solve a biological problem. (MTN 2023)

(5) How scientific problem is resolved? Write its methodology. (LHR 2023)

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1.6 BIOLOGY AND SERVICE OF MANKIND

1. **Differentiate between Biopesticides and biological control. (SWL 2022)**
2. **Give two advantages of tissue culture techniques. (FSD 2023)**

The science of biology has been helping mankind in many ways e.g.

- In increasing food production
- In combating diseases
- In protecting and conserving environment

ROLE IN FOOD PRODUCTION

Biology has played a tremendous role in food producing by;

i. Production of different varieties.
ii. Protection of plants from diseases.
iii. Biological control by biopesticides.

1) PRODUCTION OF DIFFERENT VARIETIES

Improving existing varieties and developing new **high yield** and **disease resistant varieties** of plants and animals have **increased our food**. Different methods, which have been adopted in this context, are as under.

i) Plant and animal breeders have developed, through **selective breeding** using the principles of genetics, new better varieties of wheat, rice, corn, chicken, cow and sheep. **Poultry breeders** have developed **broilers** for getting quick and cheap **white meat**.

ii) Genes of disease resistant and other desirable characters are introduced into plants by using the techniques of ***genetic engineering***. Plants having foreign DNA incorporated into their cells are called ***transgenic plants***.

iii) Transgenic plants can be propagated by ***cloning*** (production of genetically identical copies of organisms/cells by asexual reproduction) using special techniques such as ***tissue culture techniques***.

2) PROTECTION OF PLANTS FROM DISEASES

i) Integrated Disease Management

Effective control of **particular** disastrous disease or all the common diseases of a plant can be achieved using all **relevant**, **appropriate methods** of disease control. Such an approach of disease control is called integrated disease management.

ii) Use of Chemical Pesticides

Plant pathogenic fungi and insects (pests) of crops, which weaken the plants and reduces the yield, had traditionally been controlled by using chemical fungicides and insecticides (pesticides). Some **disadvantages** of using chemical pesticides are;

- Use of these chemicals poses **toxicity** problems for human being as well as environmental pollution.
- There are chances of **insects** becoming **resistant** to the effects of these chemicals.

iii) Biological Control By Biopesticides

Control of diseases by some living organisms is called ***biological control***. It eliminates all the hazards of chemical pesticides. In biological control, pests are destroyed by using some living organisms that compete or even eat them up.

Examples

- An ***aphid*** that attacks ***walnut tree*** is being controlled biologically by a ***wasp*** that **parasites** this ***aphid.***
- Some ***bacteria*** are being used as ***bio-pesticides.***

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Essential Nutrients for Plants

Soil is **complex medium** containing all the **nutrients** required for plant growth. It is impossible to conduct experiments on nutrient requirements of plants by growing them in soil.

Such a technique by which mineral requirement of plants can be found is called ***hydroponic culture technique.***

Hydroponic forming is not feasible but may be used by **astronauts** for ***growing vegetable.***

3) FOOD PRESERVATION

Different techniques of food preservation have been developed for protecting food from spoilage and for its use and transport over long distances without damaging its quality. One of these is ***Pasteurization***, developed by Louis Pasteur. It is being widely used for preservation of milk and milk products.

DISEASE CONTROL

1) PREVENTIVE MEASURES

The advances in biological science have provided us information about the causative agents of the diseases and their mode of transmission.

Examples

i) The ***AIDS (Acquired Immune Deficiency Syndrome)*** is caused by HIV (human immuno deficiency virus) and it spreads through.

- Free sexual contact
- Blood transfusion
- Using contaminated syringes or surgical instruments etc.

Therefore, doctors advise us to take precautions on these fronts, so that we do not contract such diseases, which is at present incurable.

ii) ***Hepatitis*** is caused by Hepatitis viruses, which is spread through blood transfusion by using contaminated syringes and surgical instruments etc. In this case also, doctors advise us to be careful and avoid the point of contact.

2) VACCINATION / IMMUNIZATION

It is a preventive measure by which immunity is produced against specific type of viruses and diseases.

Discovery

Edward Jenner first developed the technique of **vaccination** in *1796*, ***cowpox pus*** is known as vaccine (from **Latin** *vacca = cow*). From this word evolved the present term vaccination and vaccine.

Importance

i) Inoculation or vaccination is carried out to ***make people immune*** against exposure to viruses and bacteria at the time of epidemics or sometime in early life to make them immune to some common diseases.

ii) **Many diseases** such as polio, whooping cough, measles, mumps etc can be easily **controlled** by vaccination or "shots".

iii) It is claimed that ***small pox*** has been totally **eliminated** from world by using this method. Scientists are making continuous efforts to develop vaccine against other diseases.

iv) Even **vaccine against AIDS** is being administrated in humans **on experimental basis**.

3) CURATIVE MEASURES

Integrated Disease Management

- Combating of disease by utilizing all methods as and when required and ensuring a participation of community in this program is known as integration disease management.
- This requires an awareness of the community about the severity of the problem, its causes and its remedies. This is a very effective program for elimination and control of the dangerous disease from human society.
- Integrated disease management usually includes **drug treatment** and **gene therapy** as curative measures.

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A) DRUG TREATMENT

Drug treatment involves various ways e.g,

1. What is the use of chemotherapy?

(LHR 2023)

i) Use of Antibiotics

After sickness from a disease, patients are usually given antibiotics. These are useful in bacterial diseases and only in those condition in which bacteria have not developed resistance to antibiotics.

ii) Radiotherapy and Chemotherapy

In cancer, radiotherapy and chemotherapy are also used.

- In **radiotherapy**, the cancerous part is exposed to short wave radiations from the radioactive material repeatedly at regular intervals.
- **Chemotherapy** consists of administrating certain anticancer chemicals to the patients at regular intervals. These chemicals may kill both cancerous as well as normal cells.

B) GENE THERAPY

A new technique, which has been developed to repair the defective gene, involving isolation of normal gene and its insertion into the host through bone marrow cells, is called gene therapy.

CLONING

Cloning is a technique for achieving **eugenic aims.**

Clone

A Clone is defined as "A **cell** or **individual** and it's **asexually** produced offsprings."

- All members of a clone are **genetically identical** except when a ***mutation*** occurs.
- Generally, no normal animal reproduces naturally by cloning. Several insects and many plants do, in some circumstances whereas few do so regularly.

Ways of Cloning

In *1997*, scientists in *Scotland* first time succeeded in **cloning a sheep**. Other mammalian species (mice and cows) have since been cloned.

Cloning may be in following ways:

i) Replacement of Nucleus

Nucleus from a fertilized egg is **removed** and a **nucleus** from a cell of a fully developed individual is inserted in its place. The altered zygote is then implanted in a suitable womb where it completes its development. The new individual formed in this way is a genetically identical clone of the individual whose nucleus was used. Thus cloning could make multiple copies of a desired genotype

ii) Division of Fertilized Egg

Another type is the division of a single fertilized egg or early embryo into one or more separate embryos. This is the same process that normally creates identical twins. Offsprings from this type of cloning are genetically identical but carry chromosomes from each of the two parents. This type of cloning has already been used to produce genetically identical cattle and other farm animals.

Man and Cloning

Man is likely to adopt cloning techniques for commercial production of valuable animals of known ***pedigree*** such as ***horse*** etc. At some places, scientists are making attempt to clone **human embryo**, which they believe can serve, as ***transplant donor*** but there is lot of controversy on this.

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MULTIPLE CHOICE QUESTIONS

(1) Technique likely to be adopted for commercial production of animal of known pedigree:

(A) Hydroponics (B) Gene therapy

(C) Cloning (D) Integrated disease management

(2) In biological control an aphid is being controlled by: **(SWL 2021)**

(A) Honey bee **(B) Wasp**

(C) Mosquito (D) Dragon fly

(3) Which of the following is the best technique of controlling diseases in human?

(A) Biological control (B) Bio pesticides

(C) IDM (D) None of these

EXTENSIVE QUESTIONS

(1) Explain the role of biology in health.

(2) Write note on following.

(a) Preventive measure of disease.

(b) Vaccination.

(3) Discuss the role of biology in disease control.

(4) What is cloning? Give its applications. **(SWL 2023)**

(5) How vaccination, dry treatment and gene therapy helped in improving human health? **(SWL 2023)**

(6) Describe the role of biology to control the diseases by preventive measures. **(GRW 2023)**

(7) How study of biology is useful to help mankind in food production and disease control? **(GRW 2023)**

1.7 PROTECTION AND CONSERVATION OF ENVIRONMENT

Industrialization has helped mankind to **raise the standard** of living but has also destroyed our environments.

1. **Define bioremediation and endangered species.** **(SWL 2017)**
2. **How a biologist can help to reduce environment pollution?** **(SWL 2022)**

Environmental Pollution

Environmental pollution has reached at alarming level in some countries. Tons of industrial wastes and effluents in solid, liquid or gas form are being injected into the environment by the industries.

- These effluents frequently contain sizeable amount of certain very toxic even carcinogenic materials.
- Heavy metals like ***lead*** from **automobiles**, ***chromium*** from **tanneries,** are playing havoc to human health.

Need of Control

Environmental pollution needs to be addressed. It will become out of control leading to irrepairable loss of bio components of world ecosystem and loss of life from our planet.

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Role of Biology in Protection and Conservation of Environment

The biology has helped mankind in attracting attention to this problem and the biologists are trying to solve this problem.

- Several ways of ***bioremediation*** (removal or degradation of environmental pollutants or toxic material, by living organisms) are under investigation. For example algae have been found to reduce pollution of heavy metal by bio absorption.
- The biologists are also working out the list of **endangered species** of plants and animals which if not protected would soon be **extinct.** They have therefore stressed the needs for their protection.

Environmental Pollution in Pakistan

- It is our national problem. Our rivers, canals are polluted with city sewage and industrial wastes.
- Freshwater life especially fishes have been affected adversely. Exhaust from our vehicles is enormously adding lead into atmosphere. It can be controlled by using lead free petrol.

MULTIPLE CHOICE QUESTIONS

(1) Environmental pollutants can be degraded by the process of:

(A) Bioabsorption (B) Biodegradation

(C) Biomining (D) Bioleaching

(2) Bioremediation is:

(A) Usage of microbes to produce new organisms

(B) Usage of microbes to destroy environmental pollutants

(C) Usage of algae and fungi to produce new antibiotics

(D) Usage of living organisms to produce new vaccines

(3) Exhaust of automobiles is adding _____ to atmosphere.

(A) Lead (B) Nitrogen

(C) Oxygen (D) All of the above

EXTENSIVE QUESTIONS

(1) How biology has helped mankind in conservation of environment? (LHR 2018)

(2) Write down a note on protection and conservation of environment. (LHR 2019, GRW 2018, 2021)

(3) The environment of Pakistan is deteriorating day by day; suggest various measures to conserve it. (LHR 2021)

(4) Discuss the role of Biology in protection and conservation of Environment. (BWP 2023)

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GLOSSARY

Abiotic factors:

These are non-living factors of an ecosystem. For example, water, air, soil, light etc.

Biotic factors:

These are living components of an ecosystem. For example, plants, animal and microorganism.

Phyletic lineage:

Phyletic means evolutionary origin of a species. Lineage means family history. So organisms are arranged on the basis of their evolutionary origin. For example, Fish, amphibians, reptile mammals have common ancestor (forefather). So they are placed in a single lineage of Chordates.

Aesthetic preferences:

Sometimes, a person likes a thing. He makes hypothesis on basis of his personal likings or disliking.

Hardy-Weinberg law:

Under certain conditions of stability, a population remains constant. It does not change

Genetic Engineering:

The manipulation of gene is called genetic engineering. In this case a biologist uses gene according to his will. He removes a gene or he adds gene, etc.

Pest:

The animal which destroys our crops or storage grains is called pest. A pest may be an insect or any other animals like rat. Pesticide is a chemical that kills the pests. Pesticides can kill all the pests including insects. Insecticides are used only against insects.

Eugenic aim:

It means to produce a human race with superior characters. Plato gave this concept. He believes only selected persons with good characters should be allowed to produce babies. These babies will have superior character. Cloning can be used for eugenic aim. All genes of superior characters like intelligence, beauty can be transferred in to single zygote. It will produce a superior human race.

Cancer:

An uncontrolled growth or cell division is called cancer. A cancer cell starts dividing without any check and weakens the body.

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EXERCISE

Q.1 Fill in the Blanks.

i) _____ is the study of organisms in relation to their environment.

ii) The study of organisms living in fresh water bodies like rivers, lakes etc. is called _____

iii) _____ is the branch of biology, which deals with the study of social behaviour and commercial life of human beings.

iv) In the _____ body, only six bioelements account for 99% of the total mass.

v) All living things and non-living things are formed of simple units called _____.

vi) Various organs in plants and various organ systems in animals are assembled together to form a _____.

vii) A _____ is based upon observations.

viii) A hypothesis is a result of deductive reasoning or it can be the consequence of _____ reasoning.

Ans: i) Environmental Biology
ii) Fresh Water Biology
iii) Social Biology
iv) Human
v) Atoms
vi) Individual
vii) Hypothesis
viii) Inductive

Q.2 Encircle the Correct Answer From The Multiple Choices:

i) Which one of the following is correct sequence in biological method?
(a) Observations - Hypothesis - Law - Theory
(b) Observations - Hypothesis - Deduction - Testing of deduction
(c) Hypothesis - Observations - Deduction - Testing of deduction
(d) Law - Theory - Deduction - Observations

ii) Which one of the following is employed in treatment of cancer?
(a) Antibiotics and vaccination
(b) Radiotherapy and chemotherapy
(c) Chemotherapy and antibodies
(d) All of the above

iii) Which of the following is not a viral disease?
(a) Cowpox
(b) Mumps
(c) Tetanus
(d) Small pox

iv) Which one of the following is not related to cloning?
(a) Replacement of the nucleus of zygote by another nucleus of the same organism
(b) Separation of cells of embryo to form more embryos
(c) The individuals resulting have similar genetic make up
(d) Removal of piece of DNA or gene from the cell and incorporating another gene or piece of DNA in its place.

ANSWER KEY

i	b	ii	b	iii	c	iv	d

Q.3 Write whether the statement is 'true' or 'false' and write the correct statement, if it is false.

i) Penicillin was discovered by Edward Jenner from a fungus Penicillium. **(False)**
Vaccine was discovered by Edward Jenner from cowpox pus.

ii) Many diseases such as polio, whooping cough, measles, mumps etc. can be controlled by antibiotics. **(False)**
Many diseases such as polio, whooping cough, measles, mumps etc. can be controlled by vaccines.

iii) Exposure to the small pox virus allows the body to develop immunity against cow` pox virus. **(False)**
Exposure to the cow pox virus allows the body to develop immunity against small pox virus.

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iv) AIDS is caused by HIV and it spreads through sexual contacts, blood transfusion, by contaminated syringes or surgical instruments. **(True)**

Q.4 Short Questions.

i) What do you mean by hypothesis?

Ans: A hypothesis is an assumption that is made based on some evidence. This is the initial point of any investigation that translates the research questions into predictions. It includes components like variables, population and the relation between the variables. A research hypothesis is a hypothesis that is used to test the relationship between two or more variables.

Characteristics of Hypothesis

Following are the characteristics of the hypothesis:

- The hypothesis should be clear and precise to consider it to be reliable.
- If the hypothesis is a relational hypothesis, then it should be stating the relationship between variables.
- The hypothesis must be specific and should have scope for conducting more tests.
- The way of explanation of the hypothesis must be very simple and it should also be understood that the simplicity of the hypothesis is not related to its significance.

ii) How does law differ from theory?

Theory	Law
Definitions	
Theory is a set of verified explanations or statements about a phenomenon	A law is a generalization that describes what happens when certain conditions are met.
Explanation	
Explain the cause of phenomenon	Describe the nature of phenomenon
Revision	
Can be revised	Not typically revised
Example	
Endosymbiont theory	Mendel's Laws

iii) What is deduction?

Ans: Logical consequences (statements) of a hypothesis are called deductions. Deduction is highly accurate when performed properly. Here's what that looks like.

Examples:

1. Flowers are plants.
2. Sunflowers are flowers.
3. Therefore, sunflowers are plants.

This example of deductive reasoning takes a general fact (flowers are plants), adds a second fact (sunflowers are flowers), and draws a narrower conclusion than the general fact (sunflowers are plants).

iv) Define vaccination.

Ans: Inoculation of vaccine in the body is called vaccination.

Vaccines contain a microorganism or virus in a weakened, live or killed state, or proteins or toxins from the organism. In stimulating the body's adaptive immunity, they help prevent sickness from an infectious disease.

v) Write a short note on cloning.

Ans: Definition:

Cloning is a technique in which identical copies are produced by asexual means

Clone:

A cell or individual and all its asexually produced off springs.

Methods:

(1) The nucleus from a fertilized egg is removed and a nucleus from a cell of a

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fully developed individual is inserted in its place.

The altered zygote is then fixed in a suitable womb where it completes its development.

(2) Another type of cloning is the division of a single egg or early embryo into one or more separate embryos.

vi) Extensive Questions.

i. Define following branches of Biology: Molecular Biology, Microbiology, Marine Biology, Biotechnology.

Ans: (See article 1.2)

ii. Discuss briefly phyletic lineage in biological organization.

Ans: (See article 1.4.2)

iii. Write notes on the following:

a. Living world in space and time

Ans: (See article 1.3.10 & 1.4.2)

b. Population

Ans: (See article 1.3.8)

c. Community

Ans: (See article 1.3.9)

iv. Explain the biological method for solving a biological problem. How deductive reasoning and inductive reasoning play an important role in it?

Ans: (See article 1.5)

v. What is role of Biology in welfare of mankind?

Ans: (See article 1.6)

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SHORT QUESTIONS
BIOLOGY AND ITS DIVISIONS
KNOWLEDGE BASED QUESTIONS

Q.1 What are the characteristics of life?

Q.2 Define morphology and physiology.

Q.3 Differentiate between molecular biology and biotechnology. **(FSD 2019)**

Q.4 Define biotechnology. **(LHR 2019, LHR 2021)**

Q.5 Define parasitology and molecular biology. **(MTN 2021)**

Q.6 Define microbiology. **(MTN 2021)**

Q.7 Differentiate fresh water biology from Marine biology. **(MTN 2023)**

Q.8 Differentiate between parasitology and microbiology. **(GRW 2023)**

Q.9 Define Life. **(BWP 2021)**

Answer

Life

Life is set of characteristics by which we distinguish living from non-living.

Characteristics

Following are important characteristics of living organisms that represent presence of life in them;

(1) They are highly organized and complex bodies.
(2) They are composed of one or more cells.
(3) They contain genetic material (program) which forms characters.
(4) They can get and use energy.
(5) They can carry out and control chemical reactions (metabolism).
(6) They can grow in size.
(7) They can maintain homeostasis (a fairly constant internal environment).

Q.10 Define the term fresh water biology and biotechnology. **(MTN 2017)**

Answer

Fresh Water Biology

It deals with the organisms living in freshwater body's i.e., rivers, lakes etc. and physical and chemical parameters of these water bodies.

Biotechnology

It deals with the use of living organisms, systems or processes in manufacturing and service industries.

Q.11 Define molecular biology? **(GRW 2018)**

Answer

Molecular biology is a branch of biology which deals with the structure of organisms, the cells and their organelles at molecular level.

Example: DNA replication

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Q.12 Define social biology. **(BWP 2019)**

Answer

This is the branch of biology which deals with the study of social behaviour and communal life of human beings.

Example:

Research on the mating behavior of birds.

Q.13 Define parasitology. **(FSD 2019, FSD 2021)**

Answer

This is the branch of biology which deals with the study of parasites. The structure, mode of transmission, life histories and host - parasite relationships are studied in parasitology.

Example:

Study of the malaria parasite, specifically various species of the genus plasmodium.

CONCEPT BASED QUESTIONS

Q.14 What was the atmosphere of primitive earth?

Answer

It is believed that the primitive earth had an atmosphere of methane, ammonia, water-vapour, hydrogen sulphide and hydrogen. These simple substances gradually combined into complex molecules which served as models for organizing chemical substances around them. In his respect, Quran emphasizes:

"See they not how Allah originates creation, and then repeats it: truly that is easy for Allah."

Q.15 Plasmodium requires female mosquitoes for its transmission from a diseased person to a healthy one. What will be the consequences if we destroy its primary host? Discuss the branch of biology that deals with the study of the above scenario.

Answer

If we remove the primary host (a mosquito) from the plasmodium life cycle, parasites will be unable to transfer from an affected individual to a healthy one. So, disease transmission can be stopped.

The branch of biology that deals with the host-parasite relationship is called parasitology. In which we study structure, mode of transmission, life histories, and host-parasite relationships.

Q.16 Differentiate between molecular biology and biotechnology. **(SGD 2017)**

Answer

Molecular Biology	Biotechnology
Definition	
Molecular biology is a branch of biology, which deal at molecular level with the structure of organisms, the cells and their organelles.	It deals with the use of living organisms, systems or processes in manufacturing and service industries.
Example	
Study of role of phospholipids in plasma membrane comes under molecular biology.	DNA fingerprinting comes under biotechnology.

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Q.17 Differentiate between anatomy and morphology. **(LHR 2018)**

Answer

Anatomy	Morphology
Definition	
It deals with the study of the internal and external structures of living organisms.	It is a broader term that encompasses the study of the form and structure of organisms, including their external and internal features, as well as their shape, size, and organization.
Example	
The arrangement of tissues in a plant leaf, or the structure of the digestive system in a frog.	Birds wings Fins in the fishes

Q.18 Differentiate between fresh water and marine water biology. **(GRW 2021)**

Answer

Fresh Water	Marine Water
Definition	
This branch of biology deals with the organisms living in freshwater bodies i.e., rivers, lakes etc and physical and chemical parameters of these water bodies.	This is the study of life in seas and oceans. This includes the study of the marine life and the physical and chemical characteristics of the sea acting as factors for marine life.
Example	
Common carp living in freshwater ecosystem	Whale living in marine environment.

Q.19 Why is it difficult to define life? **(SGD 2023)**

Answer

It is very difficult to define life. There are certain aspects of life that lie beyond the scope of the science of biology like the Answers to the questions: what is the meaning of life? Why should there be life? These are the questions not usually taken up by Biologists and are left to philosophers and theologians.

Biologists mainly deal with the matters relating to how life works. Life, for biologists, is a set of characteristics that distinguish living organisms from non-living objects (including dead organisms).

Q.20 Differentiate between Microbiology and Biotechnology. **(SWL 2021)**

Answer

Microbiology	Biotechnology
Definition	
This is the study of microorganisms which include Bacteria, Viruses, Protozoa and microscopic algae and fungi.	It deals with the use of living organisms, systems or processes in manufacturing and service industries.
Example	
Life cycle of bacteria.	Production of insulin through genetic engineering by the use of bacteria.

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LEVELS OF BIOLOGICAL ORGANIZATION

KNOWLEGED BASED QUESTIONS

Define bioelements. Give two examples. **(LHR 2017)**

Q.1 What are the different levels of biological organization?

Answer

Different levels of biological organizations are given below:

(1) Atomic and sub atomic level
(2) Molecular level
(3) Organelles and cell
(4) Tissue level
(5) Organ and system
(6) Individual (whole organism)
(7) Population
(8) Community
(9) Ecosystem
(10) Biosphere

Q.2 Define the term species with example. **(SGD 2022)**

Answer

Definition

Very similar, potentially interbreeding organisms that produce fertile off-springs are grouped under species.

Examples

Examples may include *Homo sapiens.*

Q.3 Define population and give its four attributes. **(LHR 2022)**

Answer

Definition:

"A population is a group of living organisms of the same species located in the same place at the same time."

Attributes:

- Gene frequency
- Gene low
- Age distribution
- Population density
- Population pressure

Q.4 Define biome and community. **(GRW 2022, RWP 2022)**

Answer

Biome:

A biome is a large regional community primarily determined by climate. It has been found that the major type of plant determines the other kind of plants and animals.

These biomes have, therefore, been named after the type of major plants or major feature of the ecosystem.

Example: Tropical rainforests, Grassland example of community

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Community:

Populations of different species (plants and animals) living in the same habitat form a community. Communities are dynamic collections of organisms, in which one population may increase and others may decrease due to fluctuation in abiotic factors.

Example: Forest, ponds are example of community.

CONCEPT BASED QUESTIONS

Q.5 Differentiate between micro and macromolecules. (LHR 2018)

Answer

Micromolecules	Macromolecules
Definition	
The molecules with low molecular weight are called micro-molecules.	The molecules with large molecular weight are said to be macromolecules.
Examples	
Example: CO_2, H_2O	Example: Starch, proteins, lipids etc.

Q.6 Differentiate between population and community.

Answer

Population	Community
Definition	
A population is a group of living organisms of the same species located in the same place at the same time.	Population of different species (plants and animals) living in the same habitat form a community.
Example	
Number of rats in field of rice.	All plants and animals in an area

Q.7 Compare between organelle and organ.

Answer

Organelle	Organ
Definition	
The sub-cellular structures of the cell are called organelles.	A group of different tissues, performing same function is called organ.
Examples	
Mitochondria, Golgi complex, endoplasmic reticulum, ribosome etc.	Stomach, heart etc.

Q.8 What type of interactions occur in community level?

Answer

In a community the organism interaction occurs in many shapes. It may be predation, parasitism, commensalism, mutualism etc.

Q.9 Why organ system is less complex in plants as compared to animals? (FSD 2022)

Answer

The organ level of organization is much less definite in plants than it is in animals. At the most, we might distinguish roots, stems, leaves and reproductive structures. Clear cut functions, the distinguishing features, can be assigned to each of these structures. The complexity of the organ systems of animals is associated with a far greater range of functions and activities than is found in plants.

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Q.10 How biome differ from biosphere? (FSD 2017)

Answer

Biome	Biosphere
Definition	
A biome is a large regional community primarily determined by climate. It has been found that the major type of plant determines the other kind of plants and animals.	The biosphere refers to the part of the Earth and its atmosphere where living organisms exist. It encompasses all ecosystems, habitats, and environments on Earth where life is found.
Examples	
Tropical rainforests, Grassland	Amazon Rainforest

Q.11 What is community? Give two interactions among organisms of a community. (FSD 2019, 2021)

Answer

Populations of different species (plants and animals) living in the same habitat form a community. Communities are dynamic collections of organisms, in which one population may increase and others may decrease due to fluctuation in abiotic factors.

Interactions among organisms:

The organisms, interaction can take many shapes. It may be predation, parasitism, commensalism, mutualism and competition.

Q.12 Define bioelements, name six elements which form 99% total mass in human body. (DGK 2023)

Answer

Bioelements

"Elements, which occur in a particular organism, are called bioelements."

Examples

Some important bioelements found in humans are oxygen (65%), carbon (18%), hydrogen (10%), nitrogen (3%), calcium (2%) and phosphorous (1%).

Q.13 Differentiate between organ and organelle. (SWL 2023)

Answer

Organelle	Organ
Definition	
The sub-cellular structures of the cell are called organelles.	A group of different tissues, performing same function is called organ.
Examples	
Mitochondria, Golgi complex, endoplasmic reticulum, ribosome etc.	Stomach, heart etc.

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Q.14 How does Population differ from Community? (BWP 2023)

LIVING WORLD IN TIME AND SPACE

KNOWLEDGED BASED QUESTIONS

Q.15 What does biodiversity mean? (BWP 2017)

Answer

Definition

The number and variety of species in a place in particular time is called biodiversity. Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

Example:

Q.16 Define biome. How is it named?

Answer

Definition

A biome is a large regional community primarily determined by climate. It has been found that the major types of plants determine the other kinds of plants and animals.

Naming

These biomes have been named after the type of major plants or major features of the ecosystem. (Forest, Grasslands, Deserts).

Q.17 Write the names of four eras of geological time chart. (DGK 2017,MTN 2017,SWL 2019)

Answer

Four eras of geological time chart are given below;

1. Proterozoic Era
2. Palaeozoic Era
3. Mesozoic Era
4. Cenozoic Era

Q.18 Define biodiversity. Give percentage of different groups of organisms. (LHR 2023)

Answer

The number and variety of species in a place in particular time is called biodiversity. Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

We find that there are nearly 2,500,000 species of organisms, currently known to science. More than half of these are insects (53.1%) and another 17.6 % are vascular plants. Animals other than insects are 19.9 % (species) and 9.4 % are fungi, algae, protozoa, and various prokaryotes.

Q.19 Define phyletic lineage. (LHR 2017, MTN 2019)

CONCEPT BASED QUESTIONS

Q.20 How can we determine the age of rocks? (SWL 2023)

Q.21 How can we date/age the rocks?

Answer

The age of a rock can tell about the age of a fossil present in it.

Study of fossils:

The fossils can be dated by the following two methods.

Sedimentary method:

The age is determined by counting the layers of rocks.

With the passage of geological time, new layers of sediments are laid down.

Therefore the older organisms are in deeper layer (if the sequence of the layers is not disturbed)

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Radioactive Method:
It is also possible to determine the age of a rock by comparing the amounts of radioactive isotopes they contain.
The older sediment layers have less radioactive isotopes than the younger layers.
By comparing the layers we can describe the age of the fossils.
We can say that the fossils of same layer were alive during the same geological period.

BIOLOGICAL METHOD

KNOWLEDGE BASED QUESTIONS

Q.22 What is theory? Write down properties of a good theory. (GRW 2021

Q.23 Define deductive reasoning with example. (DGK 2021)

Q.24 Define the term hypothesis. (DGK 2022)

Q.25 What is deductive reasoning? (LHR 2019)

Answer

Definition
It involves drawing specific conclusion from some general principle to the specific. Here "if and then" is used to make hypothesis.

Example - 1
If all birds have wings, and sparrows are birds, then sparrows have wings.

Example - 2
If all green plants need sunlight for photosynthesis, then any green plant placed in the dark would not synthesize glucose. (Glucose is the end product of photosynthesis)

Q.26 List all the ways, by which Biologists or scientists form a hypothesis, OR form basis for hypotheses.

Answer

These are:
(1) Deductive reasoning
(2) Inductive reasoning
(3) Imagination
(4) Esthetic preference
(5) Religious or philosophical ideas
(6) Comparison and similarity with other processes
(7) Discovery of one thing while looking for some other thing

CONCEPT BASED QUESTIONS

Q.27 Differentiate between Law and Theory. (MTN 2017, RWP 2021)

Q.28 How deductive reasoning is different from inductive reasoning. (MTN 2019)

Q.29 Differentiate between inductive and deductive Reasoning. (RWP 2019, 2022, MTN 2022)

Q.30 What is inductive method to formulate a hypothesis? Give an example. (GRW 2022, RWP 2022)

Q.31 Differentiate between deductive and inductive reasoning. (LHR 2017)

Answer

Deductive Reasoning	Inductive Reasoning
Definition	
In deductive reasoning moves from the general to the specific. It involves drawing specific conclusions from some general principles.	In inductive reasoning moves from the specific to general. It begins with specific observation and leads to the formation of the general principles.
Example	
If we accept that all birds have wings, and sparrows are birds then sparrows have wings.	If we know that a sparrows have wings and are birds, and we know that eagle, parrot, hawk and crow are also birds. Then we conclude that all bird have wings.

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Q.32 How does theory differ from law? (SGD 2022)

Answer

Theory	Law
Definitions	
Theory is a set of verified explanations or statements about a phenomenon	A law is a generalization that describes what happens when certain conditions are met.
Explanation	
Explain the cause of phenomenon	Describe the nature of phenomenon
Revision	
Can be revised	Not typically revised
Example	
Endosymbiont theory	Mendel's Laws

Q.33 How hypothesis is formed by an observer? (MTN 2023)

Answer

An observer organizes observations into data form and gives a statement as per experience and background knowledge of the event. This statement is the hypothesis, which is tentative explanation of observations.

There are two ways of formulating hypothesis. A hypothesis can be the result of deductive reasoning or it can be the consequence of inductive reasoning.

BIOLOGY AND THE SERVICE OF MANKIND

KNOWLEDGE BASED QUESTIONS

Q.34 Define transgenic plants.

Answer

Definition

Transgenic plants are the plants having foreign DNA incorporated in their cells. The aim is to introduce a new trait to the plant which does not occur naturally in the species.

Explanation

A few examples of transgenic plants are cotton, corn, potato, and tobacco. These plants are genetically engineered to which prevents the action of various pests.

Q.35 What do you mean by integrated disease management? (SWL 2017)

Answer

Definition

Combating disease by utilizing all methods as and when required and ensuring a participation of community in these programs is known as integrated disease management.

Q.36 Define hydroponic culture technique and give its application. (GRW 2017)

Answer

Definition

In this technique the plants are grown in aerated water to which nutrient essential for plants growth are been added. Or the technique of growing plants using a water-based nutrient solution rather than soil.

Significance

- It is used to test whether certain nutrient is essential for plants or not.
- It is used by astronauts to grow vegetables and fruits in space.

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Q.37 What do you mean by gene therapy? (Conceptual)

Answer

Gene Therapy

Gene therapy is a recently introduced technique developed to repair the defective gene. This consists of isolating the normal gene and inserting it into the host through bone marrow cells.

Example:

Gene therapy for cancer.

Q.38 What is pasteurization? (DGK 2021)

Answer

Technique use for sterilization of a substance and especially milk and its products at specific temperature for a specific time that destroys pathogenic microorganisms. Technique was developed by **Louis Pasteur**.

Temperature used for this technique are as;

1. 63C for 30 minutes
2. 71C for 15 seconds

Q.39 Define endangered species. (SWL, 2021)

Answer

Various animals which if not protected would soon be extinct. Such animals are said to be endangered species.

Example: Amur tiger, red panda and Asiatic elephant etc.

Q.40 What is cloning? Write one method of cloning. (LHR 2019)

Answer

Cloning:

Cloning is a technology for achieving eugenic aims. A clone is defined as a cell or individual and all its asexually produced offspring. All members of a clone are genetically identical except when a mutation occurs.

In this procedure the nucleus from a fertilized egg is removed and a nucleus from a cell of a fully developed individual is inserted in its place. The altered zygote is then implanted in a suitable womb where it completes its development. The new individual formed in this way is genetically identical to the individual whose nucleus was used.

Example: Dolly sheep

Q.41 What is Hydroponic culture techniques?

(RWP 2017, MTN 2017, 2021, LHR 2019, 2021, GRW 2019, DGK 2019, 2021, 2023)

Q.42 Define bioremediation. Give one example. (SGD 2017)

Q.43 Define bioremediation and endangered species. (SWL 2017

Q.44 What is biological control? Give its example. (GRW 2019, MTN 2019)

Q.45 Give two advantages of tissue culture techniques. (FSD 2023)

CONCEPT BASED QUESTIONS

Q.46 Differentiate between biopesticides and biological control. (DGK 2017, GRW 2021)

Q.47 What is Integrated Disease Management?

(BWP 2017, 2021, 2023, SWL 2019, MTN 2021, GRW 2021, LHR 2022, DGK 2022)

Q.48 Differentiate between chemotherapy and radiotherapy. (DGK 2019)

Q.49 Differentiate between radiotherapy and gene therapy. (RWP 2019, 2021)

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Q.50 How a biologist can help to reduce environment pollution? (SWL 2022)

Q.51 What are adverse effects of use of chemicals during its use to control pests? (FSD 2022)

Q.52 What type of therapy or treatment is used for cancer patients?

Answer

1) Radiotherapy

In radiotherapy, the cancerous part is exposed to short wave radiations from the radioactive material. This process is repeated at regular intervals.

In Pakistan there are several centers which are carrying out radiotherapy to control cancer.

2) Chemotherapy

In chemotherapy certain anticancer chemicals are given to the patients at regular intervals. These chemicals may kill both cancerous as well as normal cells.

3) Gene Therapy

In this technique the defective gene is repaired. In this case the normal gene is isolated and is inserted into host though bone marrow cells.

Q.53 Differentiate between biological control and bioremediation. (DGK 2017, LHR 2019)

Answer

Biological control:

In biological control, pests are destroyed by using some living organisms that compete with or even eat them up.

Example:

An aphid that attacks walnut tree is being controlled biologically by a wasp that parasitizes this aphid.

Biopesticides:

Biopesticides are chemical substances or agents derived from natural sources, such as plants, microorganisms, or naturally occurring compounds, that are used to control pests.

Example: Some bacteria are being used as bio-pesticides.

Q.54 What do you understand by bioremediation? What is its advantage?

Answer

Bioremediation

It is defined as removal or degradation of environmental pollutants or toxic materials by living organism.

Example

Algae reduce pollution of heavy metals by bioabsorption.

Q.55 What measures you suggest for endangered species? (GRW 2023)

Answer

Biologists are also working out the list of endangered species of plants and animals which if not protected would soon be extinct. Measures which can be used for the protection of endangered species are development of botanical gardens, zoo, national parks, ban on hunting, impose heavy fine according to law for hunting these animals, reduce contact of human with wild life etc.

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SELF-IMPROVEMENT TEST (SIT)

Q.No.1 Choose the Correct Answer by Filling the Circle. **(10 × 1 = 10)**

1. Which of the following is not studied under biotechnology?
- Ⓐ Replacement of defective gene from body
- Ⓑ insulin production for diabetic patient from bacteria
- Ⓒ Removal of environmental pollutants
- **Ⓓ Treatment of infectious diseases**

2. Which one of the following is the simplest level of biological organization?
Ⓐ Molecular level Ⓑ Cellular level Ⓒ Individual level Ⓓ Organ level

3. Highest concentration of bioelements present in the cell is:
Ⓐ Sodium Ⓑ Iodine Ⓒ Sulphur Ⓓ Magnesium

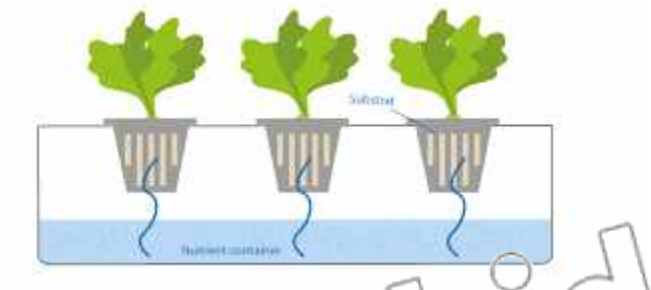
4. Herd of pronghorn antelope is an example of:
Ⓐ Community Ⓑ Population Ⓒ Biome Ⓓ Biosphere

5. Biomes named on basis of:
- Ⓐ Types of major animals inhabiting the biome
- Ⓑ Features of the ecosystem
- Ⓒ Soil condition of that biome
- Ⓓ Both A & B

6. According to fossils record of plants and animals in geological time chart, age of spore forming trees comes under.
Ⓐ Cenozoic era Ⓑ Mesozoic era
Ⓒ Proterozoic era Ⓓ Paleozoic era

7. Uniform and constant fact of nature is:
Ⓐ Theory Ⓑ Hypothesis Ⓒ Scientific law Ⓓ Intuition

8. There are multiple techniques used in biology to serve human beings in different fields. Identify the technique given in the following diagram.



Ⓐ Integrated disease management Ⓑ Hydroponic culture technique
Ⓒ Tissue culture technique Ⓓ Genetic engineering

9. According to study which of the following disease is eradicated from the world?
Ⓐ Polio Ⓑ Whooping cough Ⓒ AIDS Ⓓ Small pox

10. Cloning is a type of asexual reproduction which naturally occur in some of the:
Ⓐ Vertebrates Ⓑ Insects Ⓒ Horses Ⓓ Man

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Q.No.2 Write Short Answer. **(5 × 2 = 10)**

(i) Complete the following table

Features	**Prokaryotes**	**Eukaryotes**
Mitochondria		
Ribosomes		
Cell membrane		
Genetic material		

(ii) How tissue culture technique helps mankind in food production and preservation?

Q.No.3

(i) Enlist different types of hazardous metals with their sources, which are toxic for aquatic life.

(ii) Transmission of hepatitis can be controlled by using what type of preventive measures?

Q.No.4

(i) What is vaccination? Give examples.

(ii) What are different types of community? Give examples

SECTION II

Q.No.5 Extensive Questions. **(4 × 2 = 08)**

(a) Write a detailed note on phyletic lineage. **(4)**

(b) Define hypothesis. Explain different methods of formulating hypothesis to solve a biological problem. **(4)**

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