

Students Learning Outcomes

After Studying this chapter, students will be able to:

- Sketch the structure of chromosomes.
- Define genotype and phenotype, allele, homozygous, heterozygous, dominant, recessive
- Illustrate Mendelian inheritance laws through monohybrid and dihybrid cross.
- Outline function of DNA as carrier of hereditary information
- Describe briefly the structure of RNA as single stranded macromolecule made of nucleotides with nitrogenous base overhangs.
- Outline the function of RNA as aid in converting hereditary information into useful proteins.
- Outline how information in the DNA is converted to information on RNA and then into proteins.

Subjective Type Questions

Long Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

7.1

Structure of Chromosome

Q.1: Briefly explain Inheritance. Where does the information stored within a cell?

Ans. An organism is made up of many structural and behavioural characteristics. Organisms are able to pass these characteristics to their offspring. Offspring get some characteristics from each parent. They also get characteristics which are not present in their parents. The process by which characteristics are transferred from parents to offspring is called inheritance or heredity.

Every cell in the body contains the instructions for making characteristics. Inside the cells, this information is present in long molecules of Deoxyribonucleic acid (DNA). The cells use the information in their DNA to produce particular proteins. The proteins made by a cell determine its characteristics.

Q2. Write a note on the structure and composition of chromosome.

Ans. Chromatin:

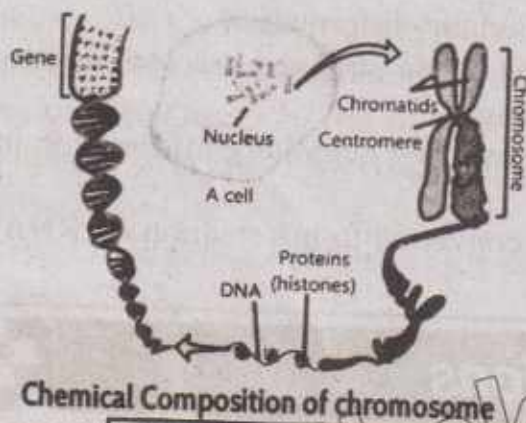
- In eukaryotes, chromosomes are made up of thread-like material called chromatin.
- Chromatin consists of DNA and histone proteins.
- In chromatin, a long molecule of DNA is wrapped around the bundles of histones.

Structural changes: When a cell is not dividing, chromatin appears as fine, thin threads, scattered in the nucleus. During cell division, chromatin coils and makes compact structures of chromosomes.

Anatomy of Chromosome:

- A chromosome is rod-shaped and consists of two identical halves. Each half of chromosome is called a chromatid.
- The two chromatids of a chromosome are attached at a point called centromere.
- The centromere holds the two chromatids together until they separate during cell division.

Chromosome in Prokaryotes: The prokaryotes have only one chromosome which is made of a circular DNA molecule. It is not bound by a nuclear envelop and is present in cytoplasm.



Chemical Composition of chromosome

7.2

DNA and RNA

Q. What does it mean for a body cell to be diploid ($2n$)?

Ans. • All the cells of the organisms of a species have a constant number of chromosomes.

• The body cells are diploid ($2n$). It means that the chromosomes are in pairs (homologous chromosomes).

Q. How DNA ensures that daughter cells receive the correct information?

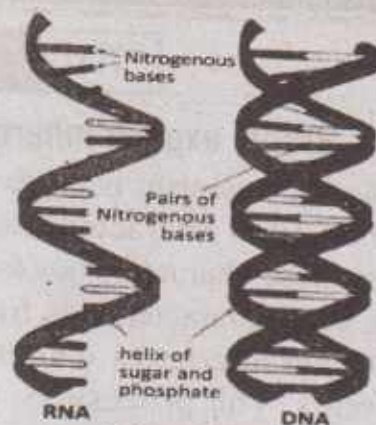
Ans. Before cell division, the DNA makes a copy of itself. In this way, chromatids are formed. When the cell divides, each daughter cell receives one chromatid from each chromosome.

Q.3: Compare DNA and RNA on the basis of their structure.

Ans. DNA:

Deoxyribonucleic acid is a double-stranded, helical molecule. Each nucleotide of DNA is made of a deoxyribose sugar, a phosphate group and a nitrogenous base (adenine, thymine, cytosine or guanine). The two strands are held together by base pairing (A with T, and C with G)

RNA: RNA is single-stranded chain of nucleotides. Its nucleotide have a sugar called ribose, a phosphate group and nitrogenous base (adenine, uracil, cytosine and guanine).



RNA and DNA

Q4. Describe how DNA and RNA take part in the synthesis of a protein.

Ans. Functioning of DNA and RNA:

Gene: A gene is a segment of DNA that has the information for making a particular protein. The following processes occur for making a proteins according to the information present in a gene:

(i) The segment of DNA (gene) acts as a template. A type of RNA, called messenger RNA (mRNA), is synthesised according to this template. In this way, DNA transfers the information to mRNA. This process is called transcription. mRNA acts as aid in converting information into proteins.

(ii) The mRNA moves out into the cytoplasm. Here, ribosome attaches with mRNA. The ribosome joins amino acids according to the information present on mRNA. In this way, a protein is produced. This process is called translation.

This concept of the working of a gene is called central dogma and is symbolized as;

Q5. Discuss the relationship between Gene and allele.

Ans. Gene: A gene is a segment of DNA that contains the information for a hereditary character. For example, the gene for eye colour, gene for earlobe shape, and gene for the hair texture. Genes are located on chromosomes. The locations or positions of genes on chromosomes are known as loci (singular locus). Like chromosomes, genes are also in pairs.

Allel: The alternate (different) forms of a gene are called its alleles.

The pair of genes on homologous chromosomes may not contain identical genes. The homologous chromosomes may have different forms of the same gene. For example, the gene of hair colour can have two alleles. One allele makes hair pigments while the other does not make pigments.

Q.6: What is Genotype? Describe its types.

Ans. Genotype: The combination of the alleles is called genotype.

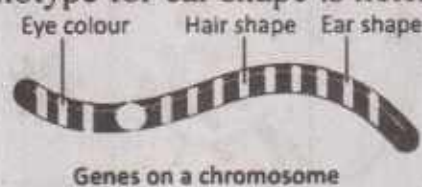
Homozygous genotype: The genotype, in which both alleles are same is called homozygous.

Heterozygous genotype: The genotype in which both alleles are different, is called heterozygous.

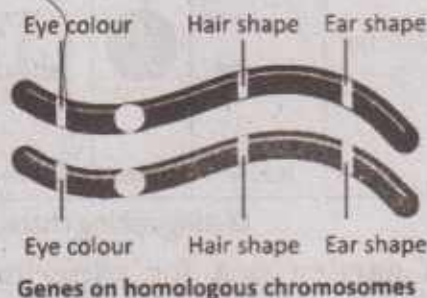
Homozygous example:

When both alleles of the eye colour gene are similar, the genotype is homozygous.

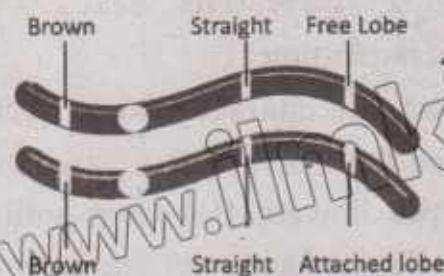
Heterozygous example: The alleles of the ear shape gene make different characteristics. One allele makes free earlobe while the other allele makes attached earlobe. It means that the genotype for ear shape is heterozygous.



Genes on a chromosome

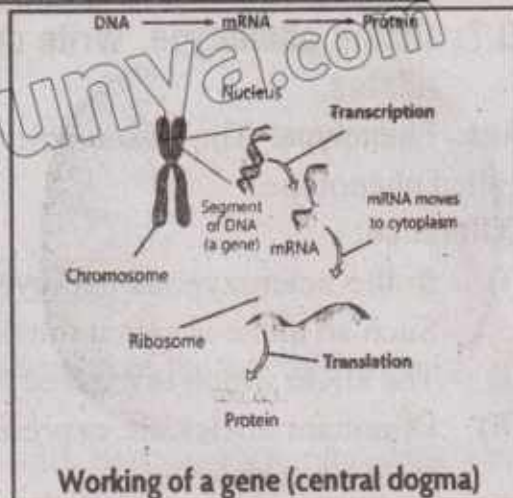


Genes on homologous chromosomes



Alleles and genotype

- Alleles of eye colour gene are similar (homozygous).
- Alleles of hair shape gene are similar (homozygous).
- Alleles of ear shape gene are different (heterozygous).



Working of a gene (central dogma)

Q.7: Define phenotype. Write down the difference between dominant and recessive alleles.

Ans. Phenotype: The observable outcome of genotype, in the form of characteristic, is called phenotype.

Difference:

- (i) In the heterozygous genotype one allele may mask the working of the other allele. Such an allele is called the dominant allele.
- (i) The allele which is masked (not expressed) is called recessive allele.
- (ii) Dominant alleles are expressed by Capital letters the recessive alleles are expressed by lowercase letters.
- (iii) In the pair Tt, the dominant alleles T is responsible for tall plant the recessive allele t is for dwarf plant.

7.3

Mendel's Law of Inheritance

Q8. Why Mendel choose pea plants for his genetic experiment?

Ans. Gregor Mendel was an Austrian monk, working in monastery. From 1856 to 1863, he performed experiments on garden pea. The results of these experiments cleared the views of heredity.

	Flower colour	Seed colour	Seed shape	Pod colour	Pod shape	Flower position	Plant height
Character 1	 Purple	 Yellow	 Round	 Green	 Flat	 Axial	 Tall
Character 2	 White	 Green	 Wrinkled	 Yellow	 Constricted	 Terminal	 Short (dwarf)

Distinguishing characters in plant, studied by Mendel

Selection of garden pea for experiments: Mendel selected the garden pea for his experiments. His choice was a good one for several reasons.

- (i) Pea plants have a relatively short generation time.
- (ii) Pea plant has seven easily distinguishable characteristics, such as round versus wrinkled seeds and purple versus white flowers.
- (iii) Normally, self-pollination occurs in pea flowers. But cross-pollination can also be performed. For this purpose, the stamens of a flower are removed and its pollen grains are transferred to the flower of another plant.



Self and Cross-pollination in pea plants

Q9. What is monohybrid cross? Give the experimental verification of monohybrid cross.

Ans. True Breeding Plant:

If a plant with a characteristic produces offspring with the same characteristic on self pollination, it means that the plant is true breeding for that characteristic.

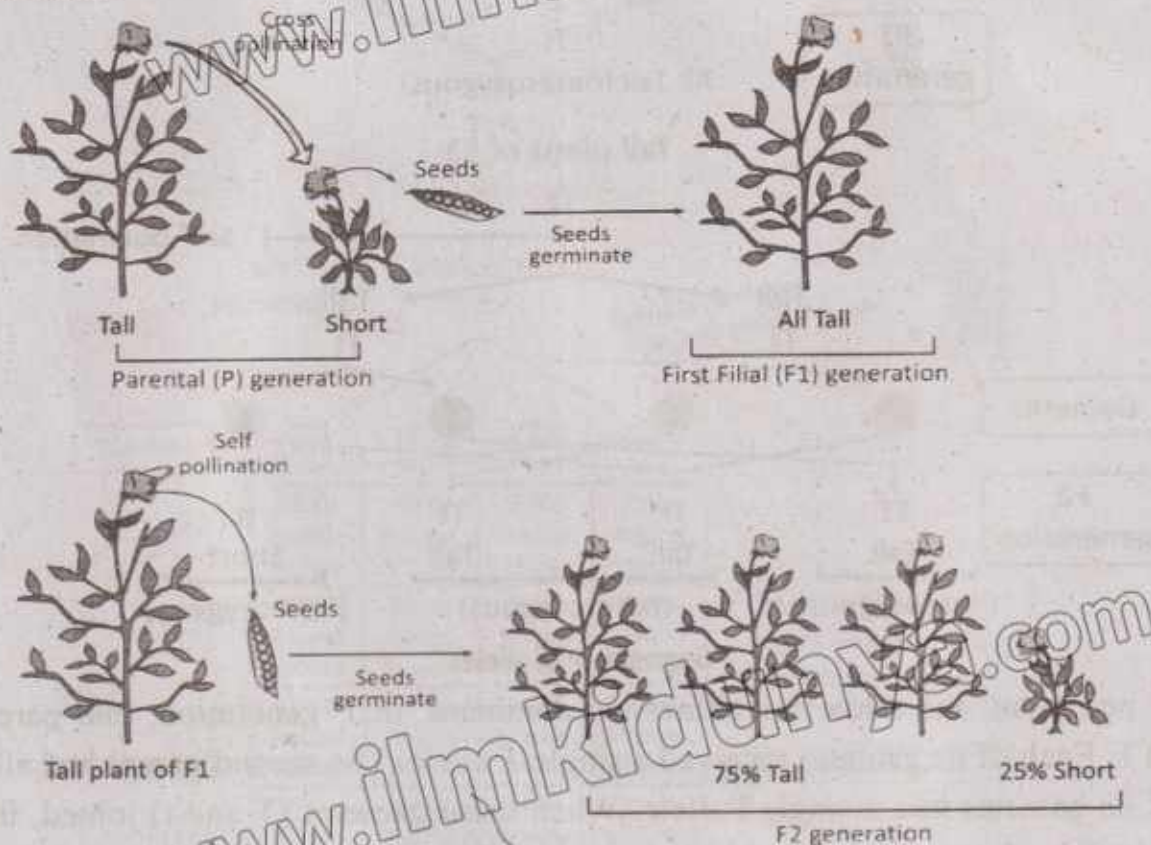
Monohybrid cross: It is a cross in which only one characteristic is studied.

Experiment: Mendel crossed a true-breeding tall plant with a true-breeding short plant. He called these true-breeding parents as P generation. The offspring of this cross were called the first filial generation, or F₁ generation. All offspring of F₁ were all tall.

Q. What did most people believe about inheritance during Mendel's time?

Ans. During Mendel's time, most people believed that characteristics of both parents are mixed together and are passed to offspring. For example, if a short plant is crossed with a tall plant, the offspring will be medium sized.

Next, Mendel allowed the tall plants of F₁ generation to self-pollinate. He called the next generation as F₂ generation. He found that 75% of F₂ offspring were tall, while 25% were short.



Mendel's experiment

Mendel found the same results over and over again with all the characteristics.

Conclusions

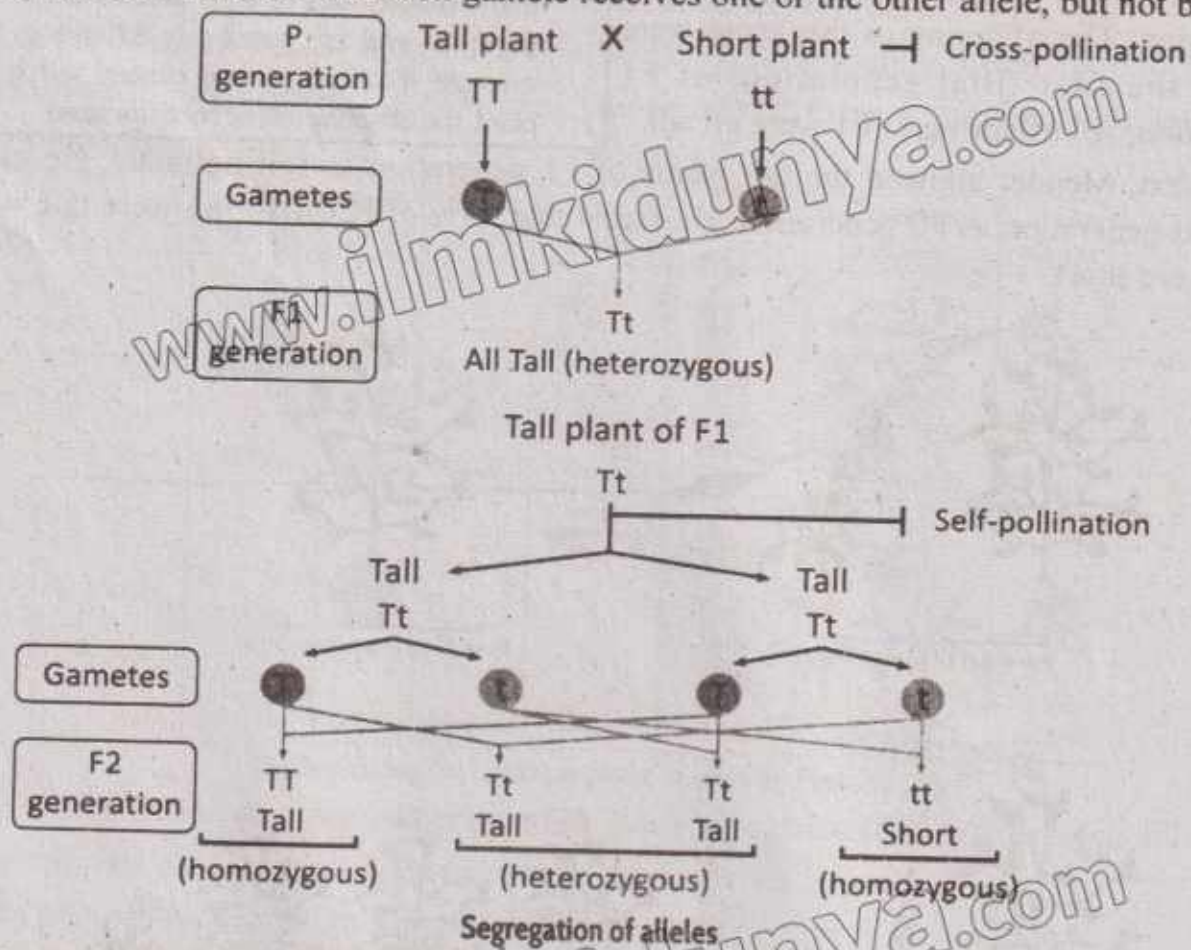
Concept of Dominance:

Mendel explained his results and proposed that there were two forms (alleles) of the gene of plant height. When two different alleles are together in an organism, one allele may mask the expression of the other. The allele that shows its effect is called dominant, while the one that is hidden is called recessive. This is called as the concept of dominance.

Q.10: Discuss how Mendel proved the law of segregation.

Ans. Law of Segregation:

Mendel explained that each parent has two alleles of a gene. But a parent can only pass one allele to the offspring. During gamete formation, the alleles separate and there is only one allele in each gamete. When fertilization occurs, the offspring has the two alleles again. It is called the law of segregation. It states that "the alleles are separated during gamete formation and each gamete receives one or the other allele, but not both".



In pea plant, the allele for tallness is dominant. In P generation, one parent had alleles TT. Each of its gametes received a single T allele. The second parent had alleles tt. Each of its gametes had a single t allele. When these gametes (T and t) joined, the new plants in F1 plant received the pair as Tt. So, all F1 plants were tall. When self-pollination was allowed in F1 tall plant, the results were:

- 25% of the F₂ generation received both alleles of shortness i.e., tt. So, they were short.
- 50% plants of F₂ received one T allele and one t. So, they were tall (Tt).
- 25% plants of F₂ received both alleles of tallness i.e., TT. So, they were also tall.

Q11. Describe Mendel's experiment on two-character inheritance and state the law he proposed.

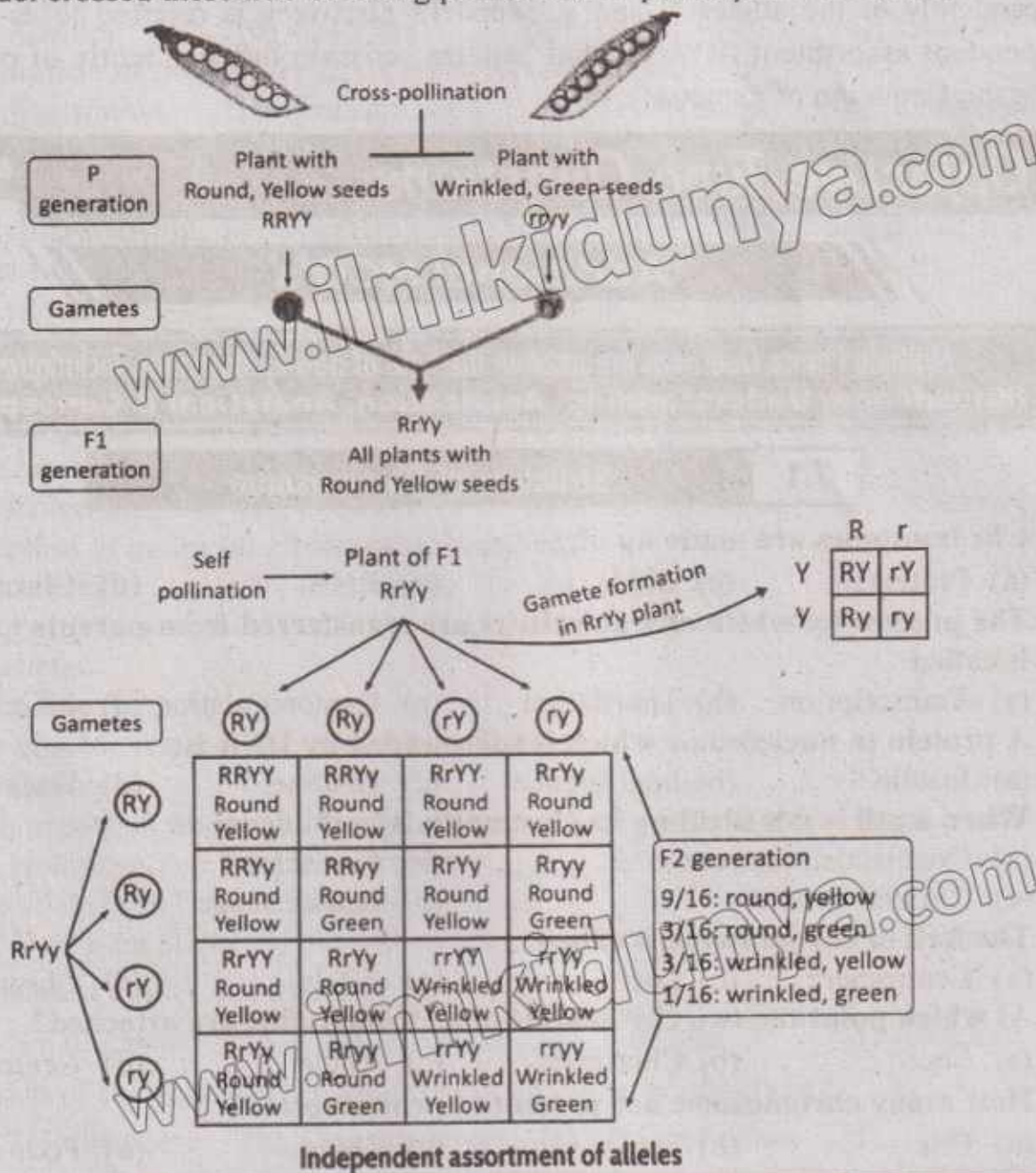
Ans. Dihybrid cross:

In a dihybrid cross, the inheritance of two characteristics is studied at the same time.

Experiment:

In this experiments Mendel studied the characteristics of seed shape (round or wrinkled) and seed colour (yellow or green). He first grew true-breeding varieties of pea plants. One plant had round yellow seeds and the other had wrinkled green seeds.

Mendel crossed these true-breeding plants. All F₁ plants produced round



yellow seeds. It proved that the allele for round seeds (R) is dominant over the allele for wrinkled seeds (r). Similarly, the allele for yellow seeds (Y) is dominant over the allele for green seeds (y). All the F₁ plants were heterozygous for both seed shape and seed colour (genotype: RrYy).

He allowed self-pollination in the F₁ plants and got the F₂ generation. The F₂ generation had the following four phenotypes:

- 9/16 that have round, yellow seeds (genotypes: RRYy, RRYy, RrYY, and RrYy)
- 3/16 that have round, green seeds (genotypes: RRyy and Rryy)
- 3/16 that have wrinkled, yellow seeds (genotypes: rrYY and rrYy)
- 1/16 that have wrinkled, green seeds (genotype: rryy)

Conclusions:

Law of Independent Assortment: The F₁ plants (RrYy), produced four types of gametes i.e., RY, Ry, rY, and ry. When these plants were allowed to self-pollinate, there were 16 combinations of alleles in F₂ generation. It means that alleles R and r segregated independently of the alleles Y and y. Mendel's discovery is referred to as the law of independent assortment. It states that "alleles separate independently of one another during the formation of gametes".

Objective Type Questions

Additional MCQ's

Multiple Choice Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

7.1

Structure of Chromosome

1. Chromosomes are made up of:
(a) Proteins (b) DNA (c) RNA (d) Chromatin
2. The process by which characteristics are transferred from parents to offspring is called:
(a) Transcription (b) Translation (c) Osmoregulation (d) Inheritance
3. A protein in nucleosome which is surrounded by DNA is:
(a) Insulin (b) Interference (c) Histone (d) Haemoglobin
4. When a cell is not dividing its chromatin is in the form of:
(a) Compact structure (b) Fine thread
(c) Circular structure (d) Square shape
5. The half of chromosome is called:
(a) Centromere (b) Loci (c) Allele (d) Chromatid
6. At which point the two chromatids of a chromosome are attached?
(a) Loci (b) Chiasmata (c) Allele (d) Centromere
7. How many chromosome are present in prokaryotes?
(a) One (b) Two (c) Three (d) Four

8. A double-stranded, helical molecule is:
(a) RNA (b) DNA (c) Proteins (d) Carbohydrates
9. Each nucleotide of DNA is made of:
(a) Deoxyribose sugar (b) Phosphate group
(c) Nitrogenous base (d) All of these
10. Chromatin material is made of:
(a) Protein (b) DNA
(c) RNA and Protein (d) DNA and Protein
11. A single stranded chain of nucleotides is:
(a) DNA (b) RNA (c) Protein (d) Lipids
12. Genes consist of:
(a) RNA (b) mRNA (c) Protein (d) DNA
13. All nitrogenous bases are present in DNA except:
(a) Adenine (b) Cytosine (c) Uracil (d) Guanine
14. Formation of messenger RNA from DNA is called:
(a) Translation (b) Transcription (c) Transduction (d) Translocation
15. The process of formation of protein is called:
(a) Translation (b) Duplication (c) Mutation (d) Replication
16. In transcription, the specific sequence of DNA nucleotides is copied in the form of:
(a) rRNA (b) tRNA
(c) mRNA (d) RNA-polymerase
17. In DNA molecule adenine pairs with:
(a) Cytosine (b) Guanine (c) Uracil (d) Thymine
18. Alternate form of gene is called:
(a) Chromatin (b) Locus (c) Chromosome (d) Allele
19. Location of genes on chromosomes called:
(a) Alleles (b) Phenotypes (c) Genotypes (d) Loci
20. _____ is a segment of DNA that contains the information for a hereditary character.
(a) Allele (b) Gene (c) Phenotype (d) Traits
21. The combination of the alleles is called:
(a) Genotype (b) Phenotype (c) Mutation (d) Replication
22. If an organism has two different alleles for a single trait, its genotype is said to be:
(a) Homozygous (b) Hemizygous (c) Heterozygous (d) Homologous
23. The allele which is masked is known as:
(a) Dominant allele (b) Recessive allele (c) Phenotype (d) Zygous
24. Dominant alleles are expressed by:
(a) Small letters (b) Capital letters (c) Full stop (d) Brackets
25. Which of the following is observable outcome of genotype?
(a) Dominance (b) Heterozygous (c) Transcription (d) Phenotype

26. Mendel performed experiments on:
 (a) Tomatoes (b) Garden pea (c) Ants (d) Mice
27. Pea plant has:
 (a) Relatively short generation time (b) Easily distinguishable characteristics
 (c) Ability of self-pollination (d) All of these properties
28. A true breeding tall plant self-pollinates, it will always produce:
 (a) Short plants (b) Tall plants
 (c) Some short and some tall plants (d) None of these
29. A cross in which only one characteristic is studied is:
 (a) Simple cross (b) Monohybrid cross (c) Dihybrid cross (d) Mutalism
30. What was the percentage of the Mendel's Monohybrid cross:
 (a) 50:50 (b) 50:40 (c) 70:30 (d) 75:25
31. How many percent plants of F₂ generation received one T allele and one t allele?
 (a) 25% (b) 50% (c) 75% (d) 65%
32. According to the punett square for the F₂ generation, what is the probability of an offspring having the genotype "rryy"?
 (a) 9/16 (b) 3/16 (c) 1/16 (d) 4/16
33. Which of the following best describes the phenotypic ratio of the F₂ generation in a standard dihybrid cross?
 (a) 3:1 (b) 1:2:1 (c) 9:3:3:1 (d) 1:1:1:1
34. "Alleles separate independently of one another during the formation of gametes." is the statement of:
 (a) Law of segregation (b) Law of inheritance
 (c) Law of independent assortment (d) Mendel's law

Answers

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (d) | 3. (c) | 4. (b) | 5. (d) | 6. (d) | 7. (a) |
| 8. (b) | 9. (d) | 10. (d) | 11. (b) | 12. (d) | 13. (c) | 14. (b) |
| 15. (a) | 16. (c) | 17. (d) | 18. (d) | 19. (d) | 20. (b) | 21. (a) |
| 22. (c) | 23. (b) | 24. (b) | 25. (d) | 26. (b) | 27. (d) | 28. (b) |
| 29. (b) | 30. (d) | 31. (b) | 32. (c) | 33. (c) | 34. (c) | |

Additional Short Questions

Short Answer Questions prepared in the light of new Examination Techniques
 (Knowledge, Understanding, Application, Analytical & Conceptual)

1. Define inheritance.

Ans. The process by which characteristics are transferred from parents to offspring is called inheritance or heredity.

2. How would you differentiate between chromatin and chromosomes.

Ans. Chromatin: Chromatin is a thread-like material.

- Chromatin consists of DNA and special proteins called histones.
- In chromatin, a long molecule of DNA is wrapped around the bundles of histones.

Chromosomes: A chromosome is rod-shaped and consist of two identical halves. Each half of chromosome is called a chromatid.

3. What do you know about centromere? Write down its function.

Ans. Centromere: The two chromatids of a chromosome are attached at a point called centromere.

Function: The centromere holds the two chromatids together until they separate during cell division.

7.2

DNA and RNA

4. Write down the key differences between DNA and RNA.

Ans.	DNA	RNA
•	DNA is deoxyribonucleic acid.	RNA is ribonucleic acid.
•	DNA is a double-stranded helical molecule.	RNA is a single-stranded chain of nucleotides.
•	Each nucleotide of DNA is made of a deoxyribose sugar, a phosphate group and nitrogenous bases.	Each nucleotide of RNA is made of a ribose sugar, a phosphate group and nitrogenous bases.

5. Which nitrogenous bases are present in DNA and RNA? Name them.

Ans. Nitrogenous bases of DNA: Nitrogenous bases of DNA are adenine, thymine, cytosine or guanine.

Nitrogenous bases of RNA: Nitrogenous bases of RNA are adenine, uracil, cytosine and guanine.

6. How does DNA works?

Ans. DNA is the genetic material i.e. contains the instructions to direct all the functions of cells. It performs its role by giving instructions for the synthesis of specific proteins.

7. How strands of DNA are arranged?

Ans. The strands of DNA are coiled around each other and form a double helix structure. There is a phosphate-sugar backbone on the outside and the nitrogenous base on the inside.

8. Define the term "gene".

Ans. Gene: A gene is a segment of DNA that contains the information for a hereditary character.

For example: Gene of eye colour, gene for earlobe shape and gene for hair texture.

9. What is locus?

Ans. Locus: The locations or positions of genes on chromosomes are known as loci (singular locus).

10. What is central dogma?

Ans. The working method of a gene is called central dogma.

It is symbolized as:

DNA → RNA → Protein

11. What is meant by transcription?

Ans. **Transcription:** Transcription is the process in which DNA make a copy of its information in the form of mRNA.

- It happens in the nucleus.

12. What is meant by translation?

Ans. **Translation:** Translation is the process in which the mRNA is read by ribosomes to make a protein.

- It happens in the cytoplasm at the ribosomes.

7.3

Mendel's Law of Inheritance

13. Why Mendel selected pea plant in his experiment?

Ans. Mendel selected the garden pea for his experiment due to the following reasons:

- Pea plants have a relatively short generation time.
- Pea plant has seven easily distinguishable characteristics.
- Normally, self pollination occurs in pea flowers but cross-pollination can also be performed.

14. How would you describe a true-breeding plant?

Ans. If a plant with a characteristic produces offsprings with the same characteristic on self-pollination, it means that the plant is true-breeding for that characteristic.

15. What will be genotype of plants produced as a result of cross between two plants having Genotype Rr?

Ans. If two Rr genotypes plants are crossed then the genotype of resulting plants will be 3:1. It means 75% are round shape seeds and 25% are wrinkled seeds will produce.

16. Why do some F₂ pea plants turn out short even through their F₁ parents were both tall?

Ans. This happens because the F₁ parents are heterozygous (Tt), meaning they each carry a hidden recessive allele. During self-pollination, there is a 25% chance on offspring will inherit the tt genotype (one "t" for each parent), which results in a short plant.

17. What will be the four phenotypes of the Mendel's dihybrid cross?

Ans. The F₂ generation had the following four phenotypes:

- 9/16 that have round, yellow seeds.
- 3/16 that have round, green seeds.
- 3/16 that have wrinkled, yellow seeds.
- 1/16 that have wrinkled, green seeds.

Exercise Questions (Solved)



A. Select the correct answers for the following questions.

1. Chromosomes of eukaryotes are made of;

- Lipids and proteins
- Lipids and DNA
- RNA and proteins
- DNA and proteins

2. What is the relationship between a gene and an allele?

- Alleles are alternative forms of a gene
- Genes are alternative forms of an allele
- Genes mask the effects of genes
- Alleles and genes are unrelated

3. Which molecule is formed during transcription?
(a) DNA (b) Protein (c) mRNA (d) Ribosome?
4. The central dogma of molecular biology is best represented by;
(a) DNA + RNA = Protein (b) DNA → RNA → Protein
(c) DNA → RNA → Protein (d) Protein → RNA → DNA
5. What happens during transcription?
(a) A new polypeptide is created (b) RNA is scanned by a ribosome.
(c) A new copy of DNA is produced (d) A copy of RNA is made
6. What is the role of DNA in protein synthesis?
(a) Produces amino acids (b) Provides the template for mRNA formation
(c) Transports proteins (d) Stores proteins
7. The allele that is expressed, when two separate alleles are inherited;
(a) Dominant (b) Recessive (c) Homozygous (d) Heterozygous
8. Which of these is a reason why pea plants were suitable for Mendel's experiments?
(a) Long lifecycle (b) Easy to cross-pollinate
(c) Few seeds produced per plant (d) No variation in traits
9. What does Mendel's Law of Segregation state?
(a) Genes are linked together
(b) Each allele separates during gamete formation
(c) Dominant traits appear in all generations
(d) Alleles blend together
10. In peas, allele for purple flower (P) is dominant over the allele for white flower (p). If a white flower is crossed with a heterozygous purple flower (Pp), what will be the ratio of offspring?
(a) 100% purple (b) 75% purple and 25% white
(c) 50% purple and 50% white (d) 100% white

Answers

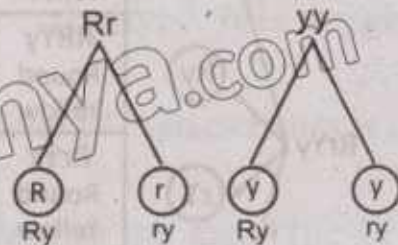
- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (d) | 2. (a) | 3. (c) | 4. (b) | 5. (d) |
| 6. (b) | 7. (a) | 8. (b) | 9. (b) | 10. (c) |

Write short answers.

1. Write down the combination of alleles in the gametes of a plant, which has genotype Rryy.

Ans. Gametes formation

According to the law of segregation that alleles separate during gamete formation, the possible combination are Ry and ry.



2. State Mendel's law of segregation.

Ans. Law of segregation: The alleles are separated during gametes formation and each gamete receives one or the other allele, but not both.

3. **State Mendel's law of independent assortment.**

Ans. Law of independent assortment states that: "Alleles separate independently of one another during the formation of a gametes".

4. **Define monohybrid cross and a dihybrid cross and give an example of each.**

Ans. Monohybrid cross: It is a cross in which only one characteristic is studied.

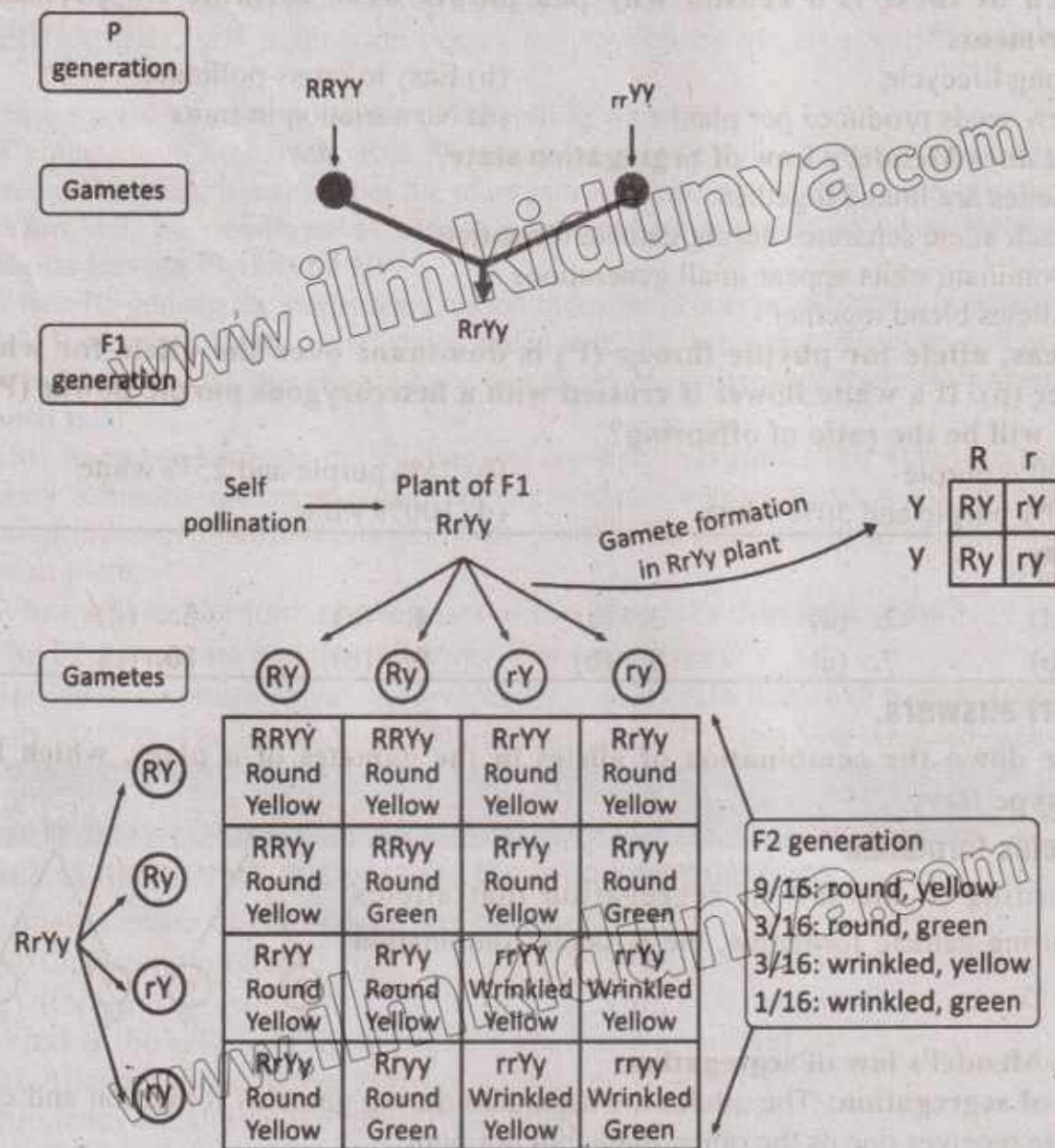
Example: Crossing tall (Tt) and short (tt) plants to study height only.

Dihybrid Cross: In a dihybrid cross, the inheritance of two characteristics is studied at the same time.

Example: Crossing plants difference in height (T/t) and seed colour (y/y) at the same time such as TtYy × TtYy.

5. **Draw a cross between two pea plants. One of them has round green seeds (RRyy) while the other has wrinkled yellow seeds (rrYY).**

Ans.



6. Differentiate between:

- (i) Gene and allele
- (ii) F1 and F2 generations
- (iii) Dominant and recessive
- (iv) Homozygous and heterozygous
- (v) Genotype and phenotype

Ans. (i) Gene: A gene is a segment of DNA that contains the information for a hereditary character.

For example: Gene of eye colour gene for hair texture etc.

Allele: The alternate (different) forms of a gene are called alleles.

For example: The gene of hair colour can have two alleles. One allele makes hair pigments while the other does not make pigments.

(ii) F1 generation	F2 generation
• Set of offsprings produced by crossing P(parent) generation.	It is produced by allowing the F1 plants to self-pollinate.
• Only dominant trait is visible.	Both dominant and recessive traits appears.
• All offsprings are identical.	Offsprings show genetic variation.

(iii) Differentiate between dominant and recessive alleles.

Ans. Dominant allele: In the heterozygous genotype one allele may mask the working of other allele. Such an allele is called dominant allele.

- It is represented by capital letter (e.g. T)

Recessive allele: An allele that expresses only when two copies are present. The allele which is not expressed, is called recessive allele.

- It is represented by small letters (e.g.t)

(iv) Differentiate between homozygous and heterozygous:

Ans. Homozygous: A genotype in which both alleles are same, is called homozygous.

Example: TT or tt

Heterozygous: A genotype in which both alleles are different, is called heterozygous.

Example: Tt.

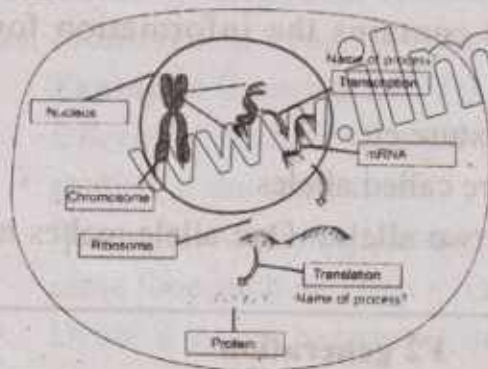
(v) **Genotype:** The combination of the alleles is called genotype. It is the genetic makeup of an organism. (like TT, Tt, tt).

Phenotype: Observable outcome of genotype in the form of characteristics is called phenotype. (like tall or short).

Example of Genotype and Phenotype: If a plant has the genotype Tt (one dominant tall and one recessive short allele), its phenotype will be tall, because the dominant T alleles expresses the trait.

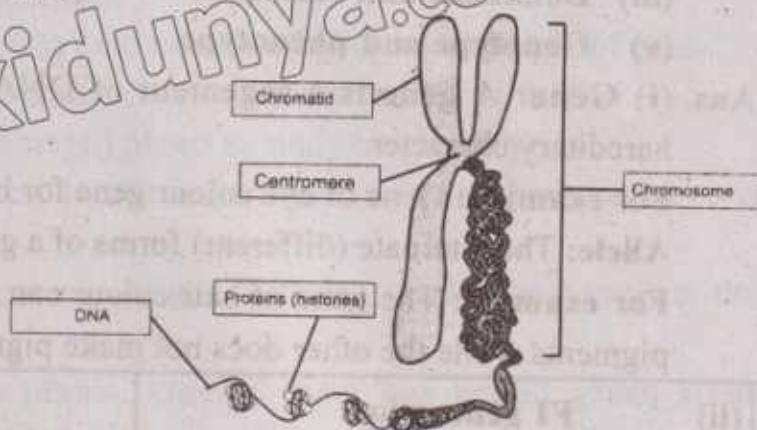
7. In the following diagram of a cell, label the components and the process.

Ans.



8. Label the components in the following diagram.

Ans.



C. Write answers in detail.

1. Write a note on the structure and composition of chromosome.

Ans. For answer see Q's 2

2. Why did Mendel choose pea plants for his genetic experiments?

Ans. For answer see Q's 8

3. Describe Mendel's experiment on two-character inheritance and state the law he proposed.

Ans. For answer see Q's 11

4. Describe Mendel's Law of Segregation? Give an example.

Ans. For answer see Q's 10

5. Describe how DNA and RNA take part in the synthesis of a protein.

Ans. For answer see Q's 4

D. Inquisitive questions

1. How do genes control the traits and characteristics of an organism?

Ans. Genes control traits because they carry instructions (DNA) to make proteins, which determine an organism's characteristics. Different alleles of a gene create variations in traits. Offspring's inherit alleles from parents and the combination (genotype) determines the observable trait (phenotype).

Example: In pea plant T(tall) is dominant and t(short) is recessive.

TT or Tt → tall

tt → short.

2. Why can different alleles of the same gene lead to different physical traits??

Ans. Different alleles lead to different traits because they contain slightly different nucleotide sequence within the same gene. In this way the structure, function or amount of the protein produced by that gene changes.