

Saras

Science

10

**Only Book having Objective Questions
framed line by line from the Text Book**

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II

Science

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III

Preface

A student who has just entered the portals of higher studies in schools finds it difficult to understand the subjects taught to him. This difficulty is mainly due to his poor standard of English. While preparing this Book the authors had in mind this particular difficulty of our students. This Book is written in a very simple and easy style. It is up-to-date and exhaustive in covering the syllabus.

We are immensely thankful to the authors for their kind co-operation in preparing the Book. We are immensely thankful to Saras Printers and Binders, Sivakasi for neatly printing the book. Suggestions for the improvement of the book are always welcome.

-Publisher

Why to Buy this Book

- *This Book is written solely for **Examination going Students**.*
- ***Examination** oriented.*
- ***Easy to Answer the Questions**.*
- ***Very Simple**.*
- *Point by point description.*
- *Points are arranged **sequentially**.*
- *Hence easy to **remember**.*
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- *Neat Diagrams.*
- *Helps in **Practical Examination**.*
- *Helps in writing Observation Note Book.*
- *Helps in preparing **Competitive Exams**.*
- *Important topics are given as **Highlights**.*

**Every Life Science Student Must
Buy and Keep One Copy of this
Book**

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Biology

18 Heredity

Book Back Solved Questions

I. Choose the Correct Answer

1. According to Mendel alleles have the following character

- a) Pair of genes
- b) Responsible for character
- c) Production of gametes
- d) Recessive factors

2. 9 : 3 : 3 : 1 ratio is due to

- a) Segregation
- b) Crossing over
- c) Independent assortment
- d) Recessiveness

3. The region of the chromosome where the spindle fibres get attached during cell division

- a) Chromomere
- b) Centrosome
- c) Centromere
- d) Chromonema

4. The centromere is found at the centre of the _____ chromosome.

- a) Telocentric
- b) Metacentric
- c) Sub-metacentric
- d) Acrocentric

5. The _____ units form the backbone of the DNA.

- a) 5 carbon sugar
- b) Phosphate
- c) Nitrogenous bases
- d) Sugar phosphate

6. Okazaki fragments are joined together by _____.

- a) Helicase
- b) DNA polymerase
- c) RNA primer
- d) DNA ligase

7. The number of chromosomes found in human beings are _____.

- a) 22 pairs of autosomes and 1 pair of allosomes.
- b) 22 autosomes and 1 allosome
- c) 46 autosomes
- d) 46 pairs autosomes and 1 pair of allosomes.

8. The loss of one or more chromosome in a ploidy is called _____.

- a) Tetraploidy
- b) Aneuploidy
- c) Euploidy
- d) polyploidy

II. Fill in the blanks

1. The pairs of contrasting character (traits) of Mendel are called _____.

2. Physical expression of a gene is called _____.

3. The thin thread like structures found in the nucleus of each cell are called _____.

4. DNA consists of two _____ chains

5. An inheritable change in the amount or the structure of a gene or a chromosome is called _____.

1. (b) 2. (c) 3. (c) 4. (b) 5. (d) 6. (d) 7. (a) 8. (b)

II. 1. Alleles 2. phenotype 3. chromosomes 4. polynucleotide 5. mutation

III. Identify whether the statements are True or False. Correct the false statement

1. A typical Mendelian dihybrid ratio of F_2 generation is 3:1.

False

Correct Statement: A typical Mendelian dihybrid ratio of F_2 generation is 9:3:3:1.

2. A recessive factor is altered by the presence of a dominant factor.

False

Correct Statement: A recessive factor is *masked* by the presence of a dominant factor.

3. Each gamete has only one allele of a gene.

True

4. Hybrid is an offspring from a cross between genetically different parent.

True

5. Some of the chromosomes have an elongated knob-like appendages known as telomere.

False

Correct Statement: Some of the chromosomes have an elongated knob-like appendages known as *satellite*.

6. New nucleotides are added and new complementary strand of DNA is formed with the help of enzyme DNA polymerase.

True

7. Down's syndrome is the genetic condition with 45 chromosomes.

False

Correct Statement: Down's syndrome is the genetic condition with 47 chromosomes.

IV. Match the following

- | | | |
|----------------------|---|-------------------------------------|
| 1. Autosomes | - | Trisomy 21 |
| 2. Diploid condition | - | 9:3:3:1 |
| 3. Allosome | - | 22 pair of chromosomes |
| 4. Down's syndrome | - | 2n |
| 5. Dihybrid ratio | - | 23 rd pair of chromosome |

Ans:

- | | | |
|----------------------|---|-------------------------------------|
| 1. Autosomes | - | 22 pair of chromosomes |
| 2. Diploid condition | - | 2n |
| 3. Allosome | - | 23 rd pair of chromosome |
| 4. Down's syndrome | - | Trisomy 21 |
| 5. Dihybrid ratio | - | 9:3:3:1 |

V. Answer in a Sentence

1. What is a cross in which inheritance of two pairs of contrasting characters are studied?

Dihybrid cross

2. Name the conditions when both the alleles are identical?

Homozygous

3. A garden pea plant produces axial white flowers. Another of the same species produced terminal violet flowers. Identify the dominant trait?

Axial violet flowers

4. What is the name given to the segments of DNA, which are responsible for the inheritance of a particular character?

Genes

5. Name the bond which binds the nucleotides in a DNA.

Phosphodiester bond

VI. Short answers questions

1. Why did Mendel select pea plant for his experiments?

1. Pea plant is naturally *self-pollinating* plant.

2. Easy to raise *pure breeding* plants.

3. It has a *short life* span. Hence it is possible to follow *several generations*.

4. It is an *annual*.

5. Easy to *cross-pollinate*.

6. It has deeply defined *contrasting characters*.

7. The flowers are *bisexual*.

2. What do you understand by the term phenotype and genotype?

Phenotype

External expression of a particular trait.

Genotype

The *genetic expression* of an organism.

3. What are allosomes?

1. *Sex chromosomes* or *heterochromosomes*.

2. Determine *the sex of an individual*.

3. They are of *two* types. They are

• *X - chromosomes*

• *Y - chromosomes*

4. What are Okazaki fragments?

Short DNA segments synthesized during *replication*.

5. Why is euploidy considered to be advantageous to both plants and animals?

1. Euploidy plants produce *increased fruit* size.

2. They produce increased *flower size*.

3. The euploid animals are *healthier* and *live longer*. Eg. *Mules*

6. A pure tall plant (TT) is crossed with pure dwarf plant (tt), what would be the F₁ and F₂ generations? Explain.

F₁ Generation

1. Tall plants

2. Heterozygous -Tt

F₂ Generation

1. Phenotypic ratio = **3:1**

3 - Tall plants

1 - Dwarf plant

2. Genotypic ratio = **1:2:1**

1 - Homozygous dominant-TT

2 - Heterozygous - Tt

1 - Homozygous recessive-tt

Explanation

It is a *monohybrid experiment*

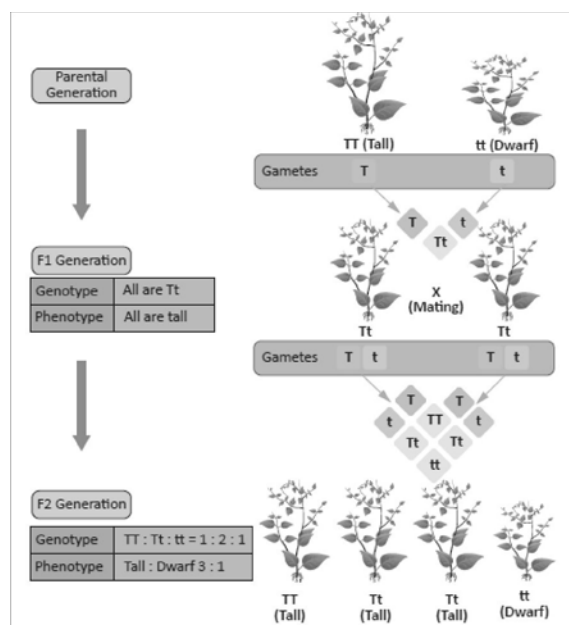


Fig. Monohybrid cross.

1. Pure breeding **tall** plant - TT is crossed with a pure breeding **dwarf** plant - tt.
2. Seeds from the crossed pure breeding parents are collected.
3. These seeds are raised into F₁ generation.
4. The F₁ plants are called **mono hybrids**. They are **tall**.
5. F₁ monohybrids are self crossed to produce the **F₂ generation**.
6. **Tall** and **dwarf** plants are obtained.
7. The actual number of tall plants are **787**.
8. The actual number of dwarf plants are **277**.
9. The **phenotypic** ratio is **3:1, Tall 3; Dwarf 1**.
10. The **genotypic** ratio is 1:2:1.
 - * Tall Homozygous-TT (pure)-1
 - * Tall Heterozygous-Tt -2
 - * Dwarf Homozygous-tt -1

7. Explain the structure of a chromosome.

- Chromosome is a **thin, long** and **thread** like structure.
- It consists of the following parts:
 1. **Sister chromatids or arms**
 2. **Centromere or Primary constriction**
 3. **Secondary constriction**
 4. **Chromonema**
 5. **Chromomeres**
 6. **DNA**
 7. **RNA**
 8. **Chromosomal proteins**
 9. **Metallic ions**
 10. **Telomere**
 11. **Satellite**

- Sister chromatids are **identical arms**.
- They are held together by the **centromere**.
- Centromere is the **central region**. It is also called **primary constriction**. It holds together the two chromatids. It attaches to the **spindle fibres** during cell division.
- Secondary constriction founds at any point in addition to primary constriction. It is also known as the **nucleolar zone** or **nucleolar organizer**. It helps the formation of **nucleolus**.
- Chromonema is the **spirally coiled thin** structure.
- Chromomeres are **bead** like structures. They are arranged along the chromonema.
- DNA and RNA are the **nucleic acids**. They found in chromosome.
- Chromosomal proteins are the **histones** and **non-histones**. They provide **structural support** to the chromosome.
- Metallic ions are also found in the chromosome.
- Telomere is the **end** of the chromosome. It **maintains** and provides **stability** to the chromosomes.
- Satellite is an elongated **knob**-like appendage. It founds at one end of the chromosome.

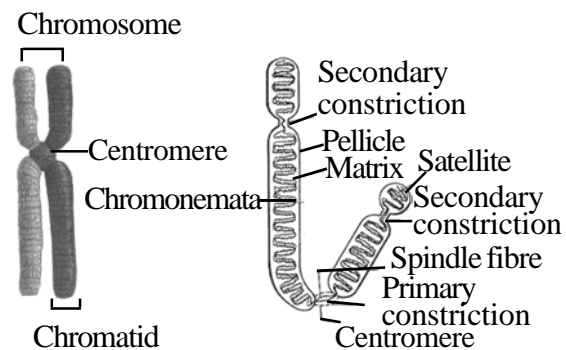
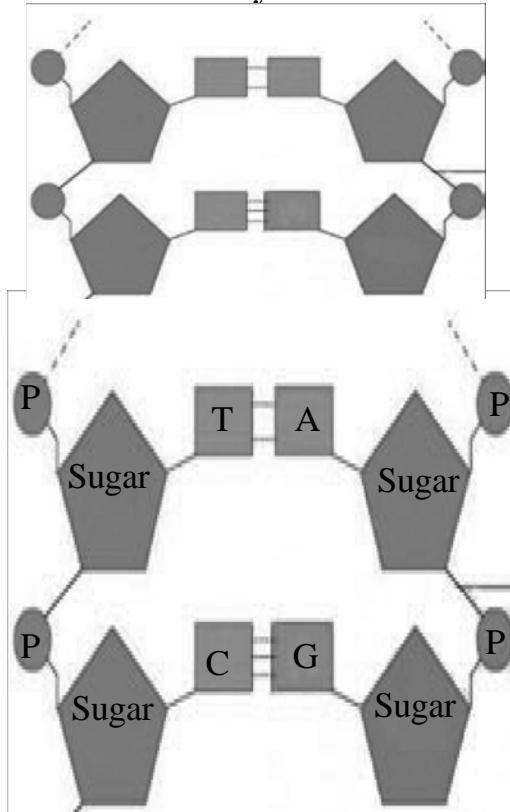


Fig. Structure of chromosome.

8. Label the parts of the DNA in the diagram given below. Explain the structure briefly.



Watson and Crick model of DNA. Structure

1. DNA molecule consists of *two polynucleotide* chains.

2. These chains form a *double helix* structure. They run *anti-parallel* to one another.

3. *Nitrogenous bases* in the centre are linked to *sugar-phosphate* units.

4. Sugar-phosphate units form the *back bone of the DNA*.

5. Pairing between the *nitrogenous bases* is very *specific*.

6. Pairing is always between *purine* and *pyrimidine*; They are linked by *hydrogen bonds*.

7. *Adenine* (A) links *thymine* (T) with *two hydrogen* bonds. (A=T).

8. Cytosine (C) links *Guanine* (G) with *three hydrogen* bonds (C≡G). This is called *complementary* base pairing.

9. *Hydrogen bonds* between the nitrogenous bases make the DNA molecule *stable*.

10. Each turn of the double helix is 34\AA .

11. There are *ten base* pairs in a complete turn.

12. The nucleotides in a helix are joined together by *phosphodiester* bonds.

VII. Long Answer Questions

1. Explain with an example the inheritance of dihybrid cross. How is it different from monohybrid cross?

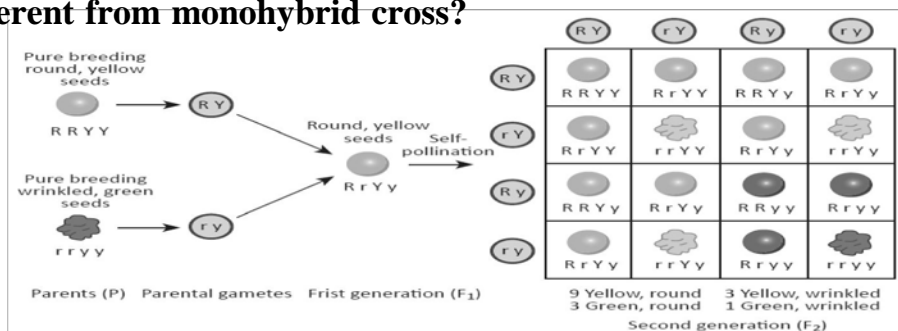


Fig. Dihybrid cross.

Dihybrid Cross

“*Dihybrid cross involves the inheritance of two pairs of contrasting characteristics at the same time*”.

1. The *two pairs* of contrasting characteristics chosen by **Mendel** were the following:

- * *Shape and colour of seeds*
- * *Round-yellow seeds-Dominant traits*
- * *Wrinkled-green seeds-Recessive traits*

2. Mendel crossed pure breeding pea plants having *round yellow seeds* with pure breeding plants having *wrinkled green seeds*.

3. *Only round yellow seeds* were produced in the *first generation* (F_1).

4. *No wrinkled green-seeds* were obtained in the F_1 generation.

5. So, round shape and yellow were *dominant traits*.

6. The wrinkled shape and green colour were *recessive traits*.

7. Hybrids of F_1 generation were crossed by *self pollination*.

8. *Four types* of seeds were obtained in *second generation* (F_2). They were

1. *Round yellow* - 9
2. *Round green* - 3
3. *Wrinkled yellow* - 3
4. *Wrinkled green* - 1

9. The phenotypic ratio in the F_2 generation is **9:3:3:1**.

10. This is known as the *dihybrid ratio*.

Conclusion

1. The factors for each character or traits remain *independent*.

2. They maintain their *identity* in the gametes.

Results of a Dihybrid Cross**1. Four Types of Plants**

A dihybrid cross produced *four types* of F_2 offspring in the ratio **9:3:3:1**.

2. New Combinations

Two new combinations had appeared in the dihybrid cross.

- *Round green*
- *Wrinkled yellow*

Differences between dihybrid and monohybrid cross.

<i>Dihybrid</i>	<i>Monohybrid</i>
1. It involves inheritance of <i>two pairs</i> of contrasting characters.	1. Inheritance of <i>one pair</i> of contrasting character.
2. Based on <i>two different genes</i> .	2. Based on <i>two alleles of a gene</i> .
3. Phenotypic ratio 9:3:3:1	3. Phenotypic ratio 3:1
4. Law of <i>independent assortment</i> .	4. Law of <i>segregation</i> .
5. Produces <i>four</i> types of gametes.	5. Produces <i>two</i> types of gametes.

2. How is the structure of DNA organised? What is the biological significance of DNA?

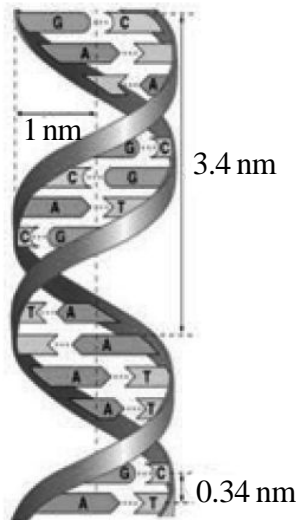


Fig: Structure of DNA

Structure of DNA

- * DNA is the *hereditary* material.
- * It contains the *genetic information*.
- * It was proposed by *James Watson* and *Francis Crick*.
- * They proposed the *three-dimensional model* of DNA on the basis of *X-ray diffraction*.
- * *X-ray diffraction* of DNA obtained by *Rosalind Franklin* and *Maurice Wilkins*.

Chemical Composition of DNA Molecule

1. DNA is a large molecule consisting of *millions of nucleotides*.
2. It is made up of two *polynucleotide* chains.
3. Each polynucleotide has many *nucleotide* units.

4. Each nucleotide consists of *three* components.

1. A sugar molecule-*Deoxyribose sugar*

2. A *nitrogenous base*

3. A *phosphate group*

5. There are *two types* of *nitrogenous bases*.

a) *Purines-Adenine, Guanine*

b) *Pyrimidines-Cytosine, Thymine, nucleoside and nucleotide*

- *Nucleoside* = Nitrogen base + sugar

- *Nucleotide* = Nucleoside + phosphate

6. The polynucleotide chains form a *double helix structure* with two strands.

7. They run *anti-parallel* to one another.

8. *Nitrogenous bases* in the centre are linked to *sugar-phosphate* units. Which form *back bone* of the DNA.

9. Pairing between the *nitrogenous bases* is very specific. It is always between *purine* and *pyrimidine*. They are linked by *hydrogen bonds*.

- *Adenine* links *Thymine* with *two hydrogen bonds* (A=T).

- *Cytosine* (C) links *Guanine* (G) with *three hydrogen bonds* (C≡G).

- This is called *complementary base pairing*.

10. *Hydrogen bonds* make the DNA molecule *stable*.

11. Each turn of the double helix is *34Å°*.

12. There are *ten base pairs* in a complete turn.

13. The nucleotides in a helix are joined together by *phosphodiester* bonds.

Significance

1. DNA transmits *hereditary information* from one generation to next generation.

2. It contains information for the formation of *proteins*.

3. It controls the *developmental process* and *life activities* of an organism.

3. The sex of the new born child is a matter of chance and neither of the parents may be considered responsible for it. What would be the possible fusion of gametes to determine the sex of the child?

1. Human beings have *23 pairs* of chromosomes.

2. *22 pairs* are *autosomes* and *one pair* is the *sex chromosome*.

3. Human females are *homogametic*. Hence the eggs are similar.

4. All the eggs have similar Chromosome-*'X'* chromosome.

5. The human males are *heterogametic*-dissimilar gametes.

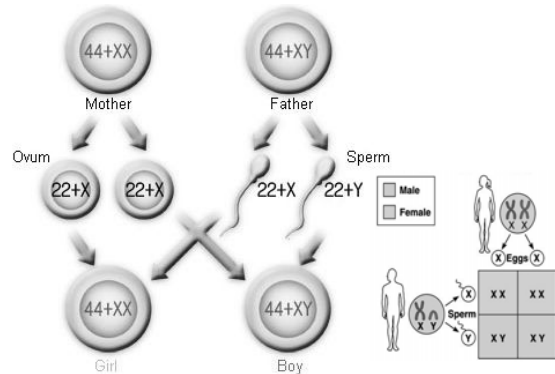
6. The male gametes or sperms are of *two* types bearing *X* chromosome or *Y* chromosome.

7. If the *egg (X)* is fused by the *X-bearing sperm*, an *XX individual* (female) is produced.

8. If the egg (X) is fused by the *Y-bearing sperm*, an *XY individual* (male) is produced.

9. Sperm determines the *sex of the child*.

10. The mother is *not responsible* in determining the *sex of the child*.



VIII. Higher Order Thinking Skills (HOTS)

1. Flowers of the garden pea are bisexual and self-pollinated. Therefore, it is difficult to perform hybridization experiment by crossing a particular pistil with the specific pollen grains. How Mendel made it possible in his monohybrid and dihybrid crosses?

1. Mendel removed the *stamen* from the flower of the plant.

2. It was taken up as the *female parent*.

3. He transferred pollen from another plant-male.

4. Further he kept the *stigma* covered.

5. *Self pollination* will *not* be *possible* in this flower.

6. So no *other pollen* will *fall* on the *stigma*.

2. Pure-bred tall pea plants are first crossed with pure-bred dwarf pea plants. The pea plants obtained in F₁ generation are then cross-bred to produce F₂ generation of pea plants.

a. What do the plants of F₁ generation look like?

- b. What is the ratio of tall plants to dwarf plants in F_2 generation?
 c. Which type of plants were missing in F_1 generation but reappeared in F_2 generation?

a-Tall plant

b-3:1

c-Dwarf plants

3. Kavitha gave birth to a female baby. Her family members say that she can give birth to only female babies because of her family history. Is the statement given by her family members true. Justify your answer.

✦ *No*, the statement given by her family members is *false*.

✦ The *eggs* always have only *X-chromosomes*.

✦ The *sperm* always has *X* and *Y* chromosomes.

✦ So the sex of the baby depends on the type of sperm which fertilizes the ovum.

IX. Value based question

1. Under which conditions does the law of independent assortment hold good and why?

Conditions

1. *Two pairs* of contrasting characters must be considered.
2. Each trait must be determined by a *pair of alleles*.
3. The inheritance of all the alleles governing the two traits must be independent of each other.

Reason

1. The factors are independent to each other and pass to the offspring through gametes.
2. They do not *influence* each other.

Additional Questions

I. Choose the Correct Answer

1. are responsible for the physical out look and biological functions.

a) *Genes* b) *Alleles*
 c) *Variation* d) *Biology*

2. was an Austrian monk.

a) *Crick* b) *Watson*
 c) *Mendel* d) *Golf*

3. The birth place of Mendel is

a) *Germany* b) *Europe*
 c) *Czechoslovakia* d) *India*

4. Mendel had worked on nearly pea plants of different varieties.

a) *10000, 34* b) *16000, 38*
 c) *20000, 40* d) *10000, 40*

5. In monohybrid cross the genotypic ratio is

a) *1:2:1* b) *1:3*
 c) *7:2* d) *1:1:1:1*

6. Factors are now referred to as

a) *genes* b) *alleles*
 c) *chromosomes* d) *allelomorphs*

7. The are the carrier of genetic material which contain the hereditary information.

a) *chromosomes* b) *genes*
 c) *alleles* d) *factors*

- I. 1. (a) 2. (c) 3. (c) 4. (a) 5. (a) 6. (a) 7. (a)

- 8. Highly condensed coiled chromatin fibres are**
 a) genes b) alleles
 c) factors d) chromosomes
- 9. V-shaped chromosome is called**
 a) metacentric b) acrocentric
 c) telocentric d) sub-metacentric
- 10. The haploid condition in a human cell refers to chromosomes.**
 a) 44 b) 46
 c) 23 d) 22
- 11. It is not a nitrogenous base.**
 a) Adenine b) Cytosine
 c) Thymine d) Leucine
- 12. Choose the correct pair**
 a) $A \equiv T$ b) $G \equiv C$
 c) $A \equiv C$ d) $T \equiv G$
- 13. Down's syndrome is a case of.....**
 a) Deletion b) Addition
 c) Euploidy d) Aneuploidy
- 14. It is a gene mutation.**
 a) Deletion b) Translocation
 c) Ploidy d) Duplication
- 15. It acts as aging clock in every cell.**
 a) Telomere b) Chromatid
 c) Locus d) Gene
- 16. Formation of nucleolus in the nucleus is called**
 a) nucleolar organizer
 b) chromatid
 c) Locus
 d) Chromonema
- 17. It maintains and provides stability to the chromosomes.**
 a) Genes b) Telomere
 c) Haemoglobin d) Alleles
- 18. Male and female have equal number of**
 a) Autosomes b) Allosomes
 c) Chromosomes d) Mesosomes
- 19. are formed according to the purines and pyrimidines present in them.**
 a) Nucleotides b) Adenine
 c) Guanine d) Uracil
- 20. DNA molecule consists of polynucleotide chains.**
 a) Two b) Three
 c) Four d) Six
- 21. The fragments of DNA are joined together by the enzyme**
 a) Ligase b) Polymerase
 c) Ptyalin d) Renin
- 22. The short segments of DNA synthesized are called strand.**
 a) Leading b) Lagging
 c) Terminus d) Primer
- 23. Sex is determined by the of an individual**
 a) Chromosome b) Gene
 c) Locus d) RNA
- 24. The sex chromosome in a human cell refers to the.....**
 a) 22nd pair b) 20th pair
 c) 23rd pair d) 21st pair
- 25. 'L' shaped chromosomes are**
 a) acrocentric b) metacentric
 c) submetacentric d) telocentric

8. (d) 9. (a) 10. (c) 11. (d) 12. (b) 13. (d) 14. (a) 15. (a)
 16. (a) 17. (b) 18. (a) 19. (a) 20. (a) 21. (a) 22. (b) 23. (a)
 24. (c) 25. (c)

26. An enzyme binds to the origin of replication site is.

- a) *Replicase* b) *Helicase*
c) *Amylase* d) *Ligase*

27. In human each cell normally consists of of chromosomes.

- a) *23 pairs* b) *22 pairs*
c) *20 pairs* d) *21 pairs*

28. Hydrogen bonds between the nitrogenous bases make the DNA molecule

- a) *unstable* b) *stable*
c) *disturbed* d) *unbalanced*

29. is caused by the mutation of a single gene.

- a) *Sickle cell anaemia* b) *Fever*
c) *Cold* d) *Down's syndrome*

II. Fill in the Blanks

- experiments are the foundation for modern genetics.
- Mendel had chosen pairs of contrasting characters for his study.
- is a checker board.
- The term chromosome was first coined by
- are quite apparent among closely related groups of organisms.
- Down's syndrome was first identified by ain 1866.

7. results in abnormal protein formation in an organism.

8. is the diagrammatic representation of karyotype of species.

9. is not responsible in determining the sex of the child.

10. is one of the basic process that occurs with in a cell.

11. is the most important constituent of a chromosome.

12. The number of chromosomes in any living organism is

13. Franklin and Wilkins carried out studies of DNA.

14. A cross involving two traits is called

15. Mendel was a native of

16. The protein part ofmolecule is disturbed in sickle cell anaemia

17. The chromosomes with satellites are called

18. The laws of heredity were proposed by

19. The number of chromosomes present in human cell is

20. The spindle fibres are attached to the of a chromosome.

21. The end of a chromosome is called

26. (b)

27. (a)

28. (b)

29. (a)

II. 1. Mendel

2. 7

3. Punnet square

4. Waldeyer in 1888

5. Variations

6. Langdon Down

7. Gene alteration 8. Idiogram

9. Mother

10. DNA replication

11. DNA

12. Constant

13. X-ray diffraction

14. Dihybrid cross

15. Austria

16. Haemoglobin

17. Sat chromosomes

18. Mendel

19. **46**

20. Centromere

21. Telomere

22. stated base pair rule.
 23. DNA is a chain.
 24. The term mutation was coined by
 25. De Vries first observed mutation inplant.
 26. Adenine and Guanine are
 27. Thymine and Cytosine are
 28. There are base pairs in one complete turn of a DNA molecule.
 29. Purines and pyrimidines are
 30. causes our cells to age.
 31. provide structural support to the chromosomes.
 32. The genetic information is passed from one generation to another by
 33. The human males are
 34. Mutation is an inheritable
 35. Triploid plants and animals are typically
 36. plants often result in increased fruit and flower size.
 37. $2n-2$ condition is called
 38. is the loss or gain of one or more chromosomes in a set.
 39. Mendel's laws are now called as Mendel's laws of
 40. Pea plant is naturally

III. Match the Following

- I. A) DNA polymerase - 1) Separates the double helix above the replication fork
 B) Topo isomerase - 2) Separates the two strands
 C) DNA ligase - 3) Joins the DNA fragments
 D) Helicase - 4) Adding nucleotides

Ans: A-4, B-1, C-3, D-2

- II. A) $2n-2$ - 1) Trisomy
 B) $4n$ - 2) Tetraploidy
 C) $2n+1$ - 3) Nullisomy
 D) $2n-1$ - 4) Monosomy

Ans: A-3, B-2, C-1, D-4

- III. A) Leading strand - 1) Principles of heredity
 B) Lagging strand - 2) Continuous strand
 C) Mendel - 3) Three dimensional model of DNA
 D) Watson and Crick - 4) Short segments of DNA

Ans: A-2, B-4, C-1, D-3

- IV. A) Monohybrid cross - 1) 9:3:3:1
 B) Dihybrid cross - 2) 3:1
 C) Histones - 3) Satellite
 D) Knob-like appendage - 4) Proteins

Ans: A-2, B-1, C-4, D-3

- | | | | |
|--------------------|----------------------|-------------------|-----------------------|
| 22. Chargaff | 23. polynucleotide | 24. Hugo De Vries | 25. evening primrose |
| 26. purines | 27. pyrimidines | 28. 10 | 29. nitrogenous bases |
| 30. Telomere | 31. Proteins | 32. cell division | 33. heterogametic |
| 34. Sudden changes | 35. sterile | 36. Tetraploid | 37. Nullisomy |
| 38. Aneuploidy | | | |
| 39. Heredity | 40. Self pollinating | | |

IV. Whether the following statements are True or False. Correct the false statement.

1. Deletion is a kind of point mutation.
True
2. Triploid plants and animals are fertile.
False
Correct statement: Triploid plants and animals are *sterile*.
3. Tetraploid plants are disadvantageous to the farmer.
False
Correct statement: Tetraploid plants are *advantageous* to the farmer.
4. Sperms are heterogametic.
True
5. DNA is a hereditary material.
True
6. Male and female have equal number of autosomes.
True
7. There are 12 base pairs in a complete turn of DNA.
False
Correct statement: There are *10* base pairs in a complete turn of DNA.
8. Ligase separates the two strands of the DNA
False
Correct statement: *Helicase* separates the two strands of the DNA.
9. Eggs are heterogametic.
False

Correct statement: Eggs are *homogametic*.

10. Sex of the baby depends on human sperm.

True

11. Adenine links with Thymine and Guanine links with Cytosine.

True

V. Answer in One word

1. The unit responsible for transmission of hereditary characters.

Gene

2. Genotypic ratio of monohybrid cross.

1:2:1

3. Dominant trait for seed colour in peas.

Yellow

4. Dominant trait for pod colour in peas.

Green

5. The number of contrasting characters chosen by Mendel for his experiment.

7

6. Ratio obtained in a dihybrid cross.

9:3:3:1

7. Who received Nobel Prize for his work on role of chromosomes in heredity?

T.H.Morgan

8. Who coined the term chromosomes?

Waldeyer

9. Point of location of a gene on a chromosome.

Locus

10. Point of attachment of chromatids of a chromosome.

Centromere

11. Bead like structures along the length of a chromonema.

Chromomeres

12. Another name for secondary constriction of a chromosome.

Nucleolar organizer

13. Knob like appendages present at one end of the chromosome.

Satellite

14. Combination of a sugar, phosphate and nitrogenous base.

Nucleotide

15. Name the process by which DNA makes copies of itself.

Replication

16. Enzyme which separates the double helix during replication.

Helicase

17. Enzyme which helps in lengthening the new DNA strand during replication.

Polymerase

18. Short segments of DNA formed in the new strand during replication of DNA.

Okazaki fragment

19. Condition involving changes in number of chromosomes present in a cell.

Ploidy

20. Chromosomal composition of a human egg.

$22 + X$

21. Type of bonds found between nitrogenous bases in DNA.

Hydrogen bonds

22. Another name for Down's Syndrome.

Trisomy 21

VII. Short Answers Questions

1. What is meant by Genetics?

The *branch of biology* that deals with the *genes, genetic variation* and *heredity of living organisms*.

2. Define heredity.

Transmission of characters from *one generation* to the *next generation*.

3. Define variation

The *differences* shown by the *individuals* of the *same species* and also by the *offspring* of the *same parents*.

4. What is a checker board or Punnett square?

1. Punnett square is a *checker board*.

2. It is a *graphical representation*.

3. It is used to calculate the *probability* of all possible *Phenotypes* and *genotypes* of *offspring*.

5. Define a gene

1. A *segment of DNA*.

2. It is responsible for the *inheritance* of a particular *phenotypic character*.

6. What is a karyotype?

The *number, size and shape of chromosomes* in the cell nucleus of an organism.

7. What is an idiogram?

The *diagrammatic representation* of *karyotype* (chromosomes) of a species.

8. What is meant by alleles?

1. *Two factors* controlling up a *pair of contrasting characters*.

2. It is also called *allelomorphs*.

9. What is meant by dominant and recessive condition?

1. The character which *expresses* in the F_1 generation is called *dominant condition*.

2. The character which is *masked* in the F_1 generation is called *recessive condition*.

10. What is meant by locus?

Specific position of a gene on the *chromosome*.

11. What is meant by chromosomes?

Thin thread like structures present in the *nucleus*.

12. What is replication of DNA?

A process by which *DNA molecule produces exact copies* of its *own structure*.

13. Name the enzymes involved in DNA replication.

1. DNA polymerase
3. Helicase
2. Topoisomerase
4. DNA ligase

14. What is Telomere?

1. Telomere is the *end of chromosome*.
2. It provides *stability* to the chromosome.
3. *Protective sequence of nucleotides*.
4. It acts as *ageing clock*.

15. What is meant by Allosomes?

1. Sex *chromosomes*.
2. They *determine the sex of an individual*.
3. They are also called *heterochromosomes*.

16. What is diploid condition?

- * Paired *chromosomes* in a cell.
- * Represented as (2n).

17. Enumerate Chargaff rule of DNA base pairing.

1. In DNA *proportion* of *adenine* is always *equal* to that of *thymine*.

2. The *proportion* of *guanine* always *equal* to that of *cytosine*.

18. What is meant by sex determination?

The formation of *zygote* into *male* or *female sex* during *development*.

Sex is determined by *sex chromosomes*, X and Y.

19. Define mutation?

An *inheritable sudden change* in the *genetic material* (DNA) of an organism.

20. What is nucleolar organizer?

1. *Secondary constriction* of the chromosome.

2. It is also known as the *nucleolar zone*.

21. Mention the symptoms of Down's syndrome.

- Mental retardation
- Delayed development
- Behavioural problems
- Weak muscle tone
- Vision disability
- Hearing disability

22. Write short note on sickle cell anaemia.

1. In sickle cell anaemia, the *red blood cells* (RBC) are *sickle shaped*.

2. It is caused by *mutation* of a single gene.

3. This causes change in the protein structure of *haemoglobin*.

VII. Answer in a Sentence**1. What is RNA primer?**

A *short segment* of *RNA nucleotides*.

2. Mention the types of gene or point mutation.

- * Substitution * Insertion
- * Deletion * Inversion

3. What is okazaki fragments?

The *short segments of DNA*

4. What does mean addition or deletion in the number of chromosomes?

Ploidy

5. What is meant by haploid?

A *single set* of *chromosome* in a cell.

6. Name the genetic condition in which there is an extra copy of chromosome 21.

Down's syndrome

7. What is gene mutation?

Changes occurring in *nucleotide sequence of a gene*.

8. Which is situated opposite to origin of replication site?

Terminus

9. What is the basic process that occurs with in a cell?

DNA replication

10. What is autosome?

Chromosome that *determines* the *somatic characters*.

11. Who was awarded Nobel Prize in 1933 for determining the role of chromosomes in heredity?

T.H.Morgan

IX. Additional Questions - Long Answer**1. List traits of pea plant selected by Mendel for his experiments and mention their dominant and recessive form.**

<i>Characters studied</i>	<i>Dominant Characters</i>	<i>Recessive Characters</i>
1. Seed shape	Round	Wrinkled
2. Seed colour	Yellow	Green
3. Flower colour	Violet	White
4. Pod shape	Inflated	Constricted
5. Pod colour	Green	Yellow
6. Flower position	Axillary	Terminal
7. Stem length	Long	Short

2. Explain Mendel's laws of heredity.

They are

1. *Law of Dominance*
2. *Law of segregation or Law of purity of gametes*
3. *Law of independent assortment*

1. Law of Dominance

When *two homozygous* individuals with one or more set of *contrasting characters* are crossed, the characters that appear in the *F₁ hybrid* are *dominant* and those that do not appear in *F₁* are *recessive characters*.

2. Law of Segregation or Law of purity of gametes

“When a pair of *contrasting factors* or *genes* or *allelomorphs* are brought together in a *heterozygote* or *hybrid* the two members of the *allelic* pair remain together *without mixing*. When gametes are formed, the *two separate out*. So that *only one enters each gamete*”.

3. Law of Independent Assortment

“In case of *inheritance* of *two* or *more* pairs of characters simultaneously, the *factors* or *genes* of *one pair* assort out *independently* of the *other pair*”.

3. How are chromosomes classified based on the position of centromere?

1. Telocentric
3. Sub metacentric
2. Acrocentric
4. Metacentric

1. Telocentric

1. The centromere is found on the *proximal end*.

2. Chromosome is *rod shaped*

2. Acrocentric

1. The centromere is found at *one end*.

2. Chromosome is *rod-shaped*.

3. It has *short* and *long arms*.

3. Sub metacentric

1. The centromere is found near the *centre* of the chromosome.

2. Chromosome is *J-shaped* or *L-shaped*.

3. It forms two *unequal* arms.

4. Metacentric

1. The centromere occurs in the *centre* of the *chromosome*.

2. Chromosome is *‘V’ shaped*.

3. It forms two *equal* arms.

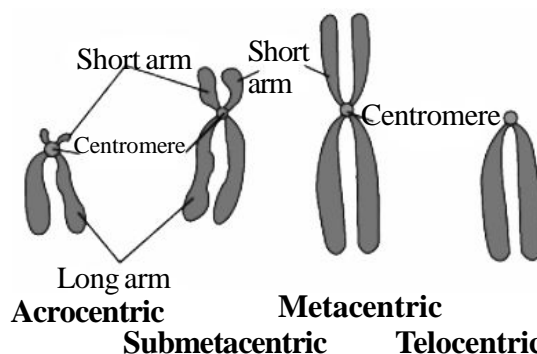


Fig. Types of chromosomes based on position of centromere.

4. Write a note on DNA replication.

DNA replication produces *exact copies* of *its own* structure.

It involves 4 steps.

1. *Origin of Replication*
2. *Unwinding of DNA Molecule*
3. *Formation of RNA Primer*
4. *Synthesis of New Complementary Strand*

1. Origin of Replication

1. The *specific point* on the *DNA* where replication begins is the *site of origin* of replication.

2. The *two strands open*.

3. They *separate* at this point.

4. A *replication fork* is formed.

2. Unwinding of DNA Molecule

1. The enzyme *helicase* binds to the origin of *replication site*.

2. *Helicase* separates the *two strands* of the *DNA*.

3. The enzyme *topoisomerase* separates the *double helix* above the replication fork.

4. It removes the *twist* formed during the *unwinding* process.

5. Each separated **DNA strand** functions as a **template**.

3. Formation of RNA Primer

1. **RNA primer** is a **short segment** of **RNA nucleotides**.

2. The primer is synthesized by the DNA template close to the origin of replication site.

4. Synthesis of New Complementary Strand

1. After the formation of **RNA primer**, **nucleotides** are added with the help of an enzyme **DNA polymerase**.

2. A new **complementary strand** of **DNA** is formed from each of the **parent strand**.

3. The synthesis is **unidirectional**.

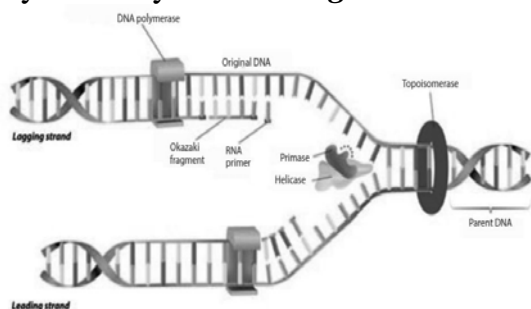
4. In one strand, the daughter strand is synthesized as a **continuous** strand called **leading strand**.

5. In the other strand, **short segments** of **DNA** are synthesized.

6. This strand is called **lagging strand**.

7. The short segments of DNA are called **Okazaki fragments**.

8. The fragments are joined together by the enzyme **DNA ligase**.



9. The **replication** stops when the **replication fork** of the **two sides** meet at a site called **terminus**.

10. It is situated opposite to **origin** of **replication site**.

5. Write notes on mutation.

1. **Mutation** is an **inheritable sudden change** in the **genetic material (DNA)** of an **organism**.

2. The term mutation was introduced by **Hugo De Vries** in **1901**.

3. He observed phenotypic changes in the **evening primrose plant** **Oenothera lamarckiana**.

4. **Mutation** is classified into **two main types**.

1. **Chromosomal mutation**
2. **Gene mutation**

1. Chromosomal Mutation

1. The **sudden change** in the **structure** or **number** of **chromosomes**.

1. This may result in two ways:

A) **Changes in the structure of chromosomes**

B) **Changes in the number of chromosomes**

A) **Changes in the structure of chromosomes**

1. **Structural changes** in the chromosomes occur due to **errors in cell division**.

2. The following structural predicted changes occur.

- ★ **Deletion**
- ★ **Duplication**
- ★ **Inversion**
- ★ **Translocation**

3. Changes in the number and arrangement of genes take place.

B) Changes in the number of chromosomes

1. They involve **addition** or **deletion** in the **number of chromosomes**.

2. This is called **ploidy**.

3. There are **two types** of ploidy.

1. *Euploidy*

2. *Aneuploidy*

1. Euploidy

“The individual bears **more than the usual number of diploid** ($2n$) **chromosomes**.

It is of two types namely

1. *Triploidy* 2. *Tetraploidy*

Triploidy ($3n$):

1. An individual has **three haploid sets of chromosomes**.

2. Triploid plants and animals are typically **sterile**.

Tetraploidy ($4n$):

1. An individual has **four haploid sets of chromosomes**.

2. Tetraploid plants are advantageous.

3. They produce **large flower** and **fruits**.

2. Aneuploidy

1. “It is the **loss** or **gain** of **one** or **more chromosomes**.

2. It is of **3** types.

1. *Monosomy* ($2n-1$)

2. *Trisomy* ($2n+1$)

3. *Nullisomy* ($2n-2$)

3. **Down’s syndrome** is an **aneuploid condition**.

2. Gene or point mutation

1. Gene mutation is the **changes occurring in nucleotide sequence of a gene**.

2. It involves

☞ *Substitution*

☞ *Deletion*

☞ *Insertion*

☞ *Inversion*

3. Gene alteration results in **abnormal protein formation** in an organism.

6. Describe Mendel’s interpretation on monohybrid cross.

1. The **‘factors’** are passed on from one generation to another.

2. That factors are now referred to as **genes**.

3. Tallness and Dwarfness are determined by a pair of **contrasting factors**.

4. Tall plant was represented by the letter **‘T’ -Dominant**.

5. Dwarf plant was represented by the letter **‘t’ -recessive**.

6. Similar factors are called **homozygous-*TT***

7. Dissimilar factors are called **heterozygous-*Tt***.

8. Two factors making up a pair of contrasting characters are called **alleles** or **allelomorphs**.

9. The character which expresses itself in the F_1 generation is called **dominant**.

10. The character which is masked in the F_1 generation is called **recessive**.

11. The factors are always **pure**.

12. Factors for tallness (T) and dwarfness (t) are **separate entities**.

13. When F_1 hybrids are **self crossed**, the two entities separate and then unite **independently** to produce **tall** and **dwarf plants**.

7. Write short notes on idiogram.

1. The *diagrammatic* representation of karyotype of a species.

2. It consists of all the *metaphasic chromosomes*.

3. The metaphasic chromosomes are arranged in *homologous pair*.

They are arranged according to decreasing order in the following characters:

- * *Length*
- * *Thickness*
- * *Position of centromere*
- * *Shape, etc.*

4. The sex chromosomes are placed at the *end*.

X. Higher Order Thinking Skills (HOTS)

1. In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?

1. Sex of the baby is determined by the *sperm*.

The sperm carries either X or Y chromosome.

2. The egg has only one type of chromosome (X).

3. If the sperm having X chromosome fertilizes the ovum (X), the resulting zygote (XX) will become a female.

4. If the sperm having Y-chromosome fertilizes the ovum (X), the resulting zygote (XY) will become a male.

XI. Value Based Questions

1. Mala had a huge scar on her cheek after she met with road accident. She is worried if her baby would inherit the scar she had acquired. "She clarified with her doctor. She need not worry about it, as her scar is an acquired trait" the doctor said.

(i) What are acquired traits?

(ii) How is it different from inherited trait?

(i) Acquired traits are the characters that *cannot be passed* from one generation to the next generation.

(ii)

Acquired trait	Inherited trait
1. Cannot be passed to progeny.	Can be <i>passed to progeny</i> .
2. Forms the changes in <i>somatic cells</i> .	Forms the changes in <i>germ cells</i> .
3. Acquired during the <i>life</i> of individual.	Inherited from the <i>parents</i> .
4. Eg. Skills like <i>painting, singing</i> .	Eg. <i>Eye colour, Hair colour</i> .

2. Expand the following abbreviations.

1. DNA - Deoxyribo Nucleic Acid
2. RNA - Ribo Nucleic Acid
3. RBC - Red Blood Cells

