

1. Define genetics.

Genetics is a branch of biology which deals with a systematic study of heredity, variations and factors responsible.

2. Define heredity.

Heredity is the inheritance of parental characteristics by their off springs.

3. Mention the reasons as to why Mendel selected pea plants for his experiments.

- a) Pea plants can be grown easily in open ground or even in pots.
- b) They have a short growth period and life cycle.
- c) They give self-pollinating flowers and also it is easy to conduct cross pollination artificially.
- d) They produce large number of seeds.
- e) They show contrasting heritable characters.
- f) They produce fertile hybrids on cross pollination.

4. Mention the seven contrasting characteristics considered by Mendel in his experiments.

	Character	Contrasting forms	
1	Stem length	Tall	Dwarf
2	Seed colour	Yellow	Green
3	Shape of the seed	Round	Wrinkled
4	Colour of the seed coat	Grey	White
5	Colour of the pod	Green	Yellow
6	Nature of the pod	Inflated	Constricted
7	Position of the flower	Axial	Terminal

5. How did Mendel obtain pure or true breeding varieties of the contrasting forms of pea plants?

Mendel obtained pure or true breeding varieties of pea plants by allowing them to self pollinate for several generations.

6. What is meant by monohybrid cross?

A cross between two plants which differ in one specific character is called monohybrid cross.

7. What is meant by F₁ or first filial generation?

The plants obtained by Mendel by cross pollinating plants

Mendel collected the seeds of the cross pollinated plants and sowed them in the next season. The plants obtained were called as F₁ or first filial generation.

8. What is meant by F₂ or second filial generation?

Mendel planted the F₁ generation seeds. When the plants flowered, he allowed them to self pollinate. He collected and sowed the seeds. The plants which germinated were called the F₂ or second filial generation.

9. What is monohybrid cross ratio?

The ratio obtained in the F₂ generation by crossing of two different traits of a single character is called monohybrid cross ratio. It is 3:1

10. What is meant by dominant trait/factor?

The factor which expresses itself in the generations is called dominant trait/factor.

Example: In the F₂ generation of pea plants, the factor for tallness is called as dominant factor.

11. What is meant by recessive trait/factor?

The factor which remains hidden or concealed in the generations is called recessive trait/factor. Example: In the F₂ generation, the factor for dwarfness remained hidden so it is called recessive factor.

12. Give reason:**a) Tallness is called dominant factor in the F₂ generation of pea plants.**

In the F₂ generation tallness was the factor which expressed hence it is called the dominant factor.

b) Dwarfness is called recessive factor in the F₂ generation of pea plants.

In the F₂ generation dwarfness was hidden or concealed, hence it is called the recessive factor.

13. State Mendel's principle of dominance.

"When two factors responsible for a pair of contrasting forms of a single character come together, normally one expresses itself, while the other does not".

14. Mendel crossed a tall plant with a dwarf plant. Write a checker board/Punnet squares to represent the result obtained in F₂ generation.

15. Draw the checker board to represent crossing the plants grown from pure round (RR) seeds with plants grown from pure wrinkled (rr).

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16. What is phenotype?

The character expressed by an organism or the observable characteristics of an organism is called phenotype.

17. Write the phenotypic ratio of monohybrid cross.

3:1 (3 tall & 1 dwarf)

18. What is genotype?

The genetic characteristics of an organism are called genotype.

19. Write the genotypic ratio of monohybrid cross.

1:2:1 (1 pure tall, 2 tall & 1 pure dwarf)

20. Differentiate between phenotype and genotype.

Phenotype	Genotype
The character expressed by an organism	The genetic characteristics of an organism
It is 3:1 for monohybrid cross	It is 1:2:1 for monohybrid cross

21. What is dihybrid cross?

A cross between two plants which differ in two specific characters is called dihybrid cross.

22. What is dihybrid cross ratio?

The ratio obtained in the F₂ generation by crossing of two different traits of two characters is called monohybrid cross ratio. It is 9:3:3:1

23. Mendel crossed a tall plant with red flowers with a dwarf plant with white flowers. Write a checker board/Punnet squares to represent the result obtained in F₂ generation.

24. Write the phenotype ratio with the types of plants produced in Mendel's dihybridisation experiment.

The phenotype ratio is 9 : 3 : 3 : 1

The type of plants used by Mendel was Tall plant with red flowers and dwarf plants with red flowers.

25. State Mendel's law of segregation or law of purity of gametes.

"The pair of factors for a given character separates in equal ratio at the time of gamete formation during meiosis".

26. Explain Mendel's law of segregation.

The two pairs of factors separate during the formation of gametes. They do not blend but separate into different gametes. The gametes combine together by random fusion at the time of gamete formation.

27. State Mendel's law of Independent Assortment.

"Factors controlling separate characters normally move independent of each other during gamete formation."

28. Explain Mendel's law of Independent Assortment.

Combinations of characters which are not present in the parental forms are produced in the next generation.

When there are two pairs of contrasting characters, the distribution of the members of one pair into the gametes is independent of the distribution of the other pair.

29. What is meant by Mendelian type of inheritance?

When the results of hybridization experiments are similar to that of Mendel's experiment then it is called Mendelian type of inheritance.

30. What is incomplete dominance? Illustrate and explain Carl Correns experiment of incomplete dominance.

When the results of monohybrid cross and dihybrid crosses do not follow the Mendel's principles then it is called incomplete dominance.

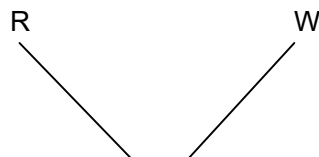
Carl Correns conducted hybridization experiments using the Four 'O clock plant. He crossed a homozygous plant with red flowers (RR) with another homozygous plant with white flowers (ww). The F1 generation produced all plants with only pink flowers. This was deviation from Mendelian inheritance. This is called incomplete dominance.

31. Name the type of plants obtained by Carl Correns experiment and write the phenotype ratio.

Carl Correns selected Four 'O clock plant with red flowers and white flowers. In the F1 generation he obtained all pink flowers. In the F2 generation he obtained red, pink and white flowers in the ratio 1:2:1.

32. Write a schematic representation of monohybrid cross of 4'O clock plant with red flowers (R) and white flowers (W)

Gametes



F1 Generation RW (Pink)
 F2 Generation RR, RW, RW, WW
 (Red), (Pink), (Pink), (White)

33. Draw the checker board to represent crossing the 4'O clock plant with Red flowers (r) and white flowers (W)

34. Explain why there is deviation in the F1 generation of the 4'O clock plants with red and white flowers.

Red colour is expressed only in homozygous condition and the white colour is also expressed only in homozygous condition. But in heterozygous condition both the genes express. Hence intermediate pink coloured flowers are produced.

35. Differentiate between homozygous and heterozygous plants.

Homozygous	Heterozygous
The condition in which a single trait or character with both the factors same (RR)	The condition in which a trait or character with different factors (RW)

36. Write the structure of chromosomes.

A nucleus has long, diffused and thin thread like structure called chromatin thread or chromatin network in the nucleoplasm.

Chromosomes are made of two main substances proteins and nucleic acids.

37. What are chromatids?

The two parallel stands of chromosomes are called chromatids.

38. What is centromere?

The chromatids are held together by centromere.

39. What are genes?

The thousands of hereditary units in the DNA molecule are called genes.

40. Explain the Watson - Crick Model of DNA.

The structure of DNA molecule resembles a spirally twisted ladder called double helix. It has a pair of polynucleotide chain running anti-parallel (run parallel to each other but with opposite alignments) to each other.

Each polynucleotide unit consists of Deoxyribose sugar, phosphate and a nitrogenous base.

The Deoxyribose sugar is a pentose sugar ($C_5H_{10}O_5$). Each strand of the ladder is made up of Deoxyribose sugar and phosphate arranged alternatively.

The nitrogenous bases connect the two opposite strands like the rungs of a ladder.

41. What are nucleotides composed of?

Each polynucleotide unit consists of Deoxyribose sugar, phosphate and a nitrogenous base.

42. What are purines and pyrimidines?

Nitrogenous bases Adenine (A) and Guanine (G) are called purines.

Nitrogenous bases Cytosine (C) and Thymine (T) are called pyrimidines.

43. Name the nitrogenous bases in a DNA molecule.

The four nitrogenous bases are Adenine (A), Guanine (G), Cytosine (C) and Thymine (T).

44. What is meant by complimentary base pairing?

The pairing of Adenine (A) with Thymine (T) and Guanine (G) pairing with Cytosine (C) is called complimentary base pairing.

45. Give reason: The two strands of DNA molecule are complementary to each other but are not identical.

The two strands of DNA are not identical because the nitrogenous bases are different in pairing. A purine base of one polynucleotide chain always pairs with a pyrimidine base on the other. Adenine (A) pairs with Thymine (T) and Cytosine (C) pairs with Guanine (G). Hence the two strands of DNA are complementary.

46. Give reason: Genetic material present in the mother cell must get doubled.

The daughter cells produced by cell division must receive the same genetic materials in same quantity so as to resemble the parent cell. Hence the genetic material present in the mother cells must be doubled.

47. What is meant by DNA replication?

DNA replication is the process of producing two identical replicas from one original DNA molecule.

48. Briefly explain DNA replication.

DNA replication is the process of producing two identical replicas from one original DNA molecule. The process of replication begins with the breaking of hydrogen bonds between the nitrogenous bases of complementary nucleotide strands.

The two unwound strands of DNA helix serves as templates for the assembly of new but complementary nucleotides to form the daughter strands. The assembly of nucleotides on the parent DNA template is brought about by some enzymes.

49. 'Replication of DNA is a significant phenomenon'. How?

Replication of DNA ensures equal distribution of the genetic material to the future daughter cells.

50. Mention the significance of DNA.

- a) DNA has the coded information for controlling all the metabolic activities of the cell both directly and indirectly.

- b) By the property of self replication, it ensures the equal distribution of similar genetic material to off springs and thus responsible for heredity.
- c) DNA indirectly helps in protein synthesis.
- d) DNA sometimes undergoes mutation and recombination which brings about variations in the characters of the off springs.

51. What is meant by mutations?

Any change in the structure or composition of genetic materials such as gene or chromosomes is called mutation.

52. Mention the types of mutations. How do they occur?

Mutations are of two types – gene mutation and chromosome mutation.

Gene mutation can occur naturally or it can be induced. Mutations are due to change in the base sequence of DNA.

53. What is the significance of DNA technology?

Knowledge of DNA technology has led us to study the possibilities of many genetically related physical and physiological problems.

Knowledge of DNA technology helps in improving the quality of plants and animals.

It helps even to obtain materials from plants and animal species for the human benefit.

It has applications in the field of agriculture, health, food management, conservation of environment etc.

54. What is meant by biotechnology?

The application of technological procedures on organisms or their processes or their products to obtain new substances for human welfare is called biotechnology.

55. What is meant by genetic engineering?

The technique of inducing desirable changes in the genetic material such as DNA of an organism is called genetic engineering.

56. What is meant by recombinant DNA technology?

The technique of manipulating the genes in the laboratory is called recombinant DNA technology.

It involves the separation of desirable or useful gene from a cell and introduce it into another cell where it is made to express.

57. Mention one application of recombinant DNA technology.

Recombinant DNA technology is used to transfer nitrogen fixing gene from bacteria into plants which enable them to get nitrogen.

58. Mention any two applications of recombinant DNA technology in

a) Animals breeding b) Plant breeding

Recombinant DNA technology is used for improving the quality of animal breeds.

It is used to transfer nitrogen fixing gene from the bacteria into plants to enable them to obtain nitrogen.

59. What is meant by DNA finger print technology?

The technique in biotechnology used for identifying individuals by determining the genetic relationships is called DNA finger print technology.

60. Explain DNA finger print technology.

The technique in biotechnology used for identifying individuals by determining the genetic relationships is called DNA finger print technology.

The technique involves breaking down the DNA of individual into short segments using specific enzymes. The fragments get separated on the basis of size and net electrical charge. They get arranged to form a finger print.

61. What is gel electrophoresis?

The technique of breaking down the DNA of individual into short segments using specific enzymes is called gel electrophoresis.

62. Write the importance of gel electrophoresis during DNA finger print technology.

Gel electrophoresis helps to break down the DNA of an individual into short fragments from which a DNA finger print can be obtained.

63. On what basis the short fragments of DNA arrange themselves?

The short fragments of DNA get separated on the basis of their size and net electrical charge.

64. What is DNA finger print?

The series of bands in the form of fingerprint with a unique pattern is called DNA finger print.

65. What is meant by cloning?

The technique of obtaining genetically similar molecules, cells, tissues or organism from a common precursor invitro process is called cloning.

66. What is a clone?

The group of molecules or cells or organism which is derived from the same parent by an asexual process is called a clone.

67. Name the first clone and the person who developed it?

The first clone was a sheep called Dolly. It was developed by Dr.Wilmut.

68. Mention the applications of biotechnology.

- a) Biotechnology helps in large scaled synthesis of life saving drugs like antibiotics, vaccines, artificial hormones.
- b) It helps in improvement of plant and animal breeds, pests and pathogen control in agriculture.

- c) It helps in the synthesis of acceptable additives (preservatives, colouring agents and artificial flavours) in food processing and management industries.
- d) It is used in synthesis of biocatalyst & biopolymers.
- e) It is used in pollution control, sewage treatment and water recycling.
- f) It is used to transfer nitrogen fixing gene from bacteria into plants which enable them to get nitrogen.

69. Give reason: Though biotechnology is a boon to mankind, it may cause serious threat in future.

OR

Mention the limitations of biotechnology.

- a) The use of biotechnology in plants has resulted in seed sterility which causes severe threat to the conservation of plant species.
- b) Genetically modified foods are a threat to human and animal health.
- c) It is against nature and upset the delicate balance of the nature.
- d) Cloning pose a very serious social, ethical, moral and cultural problems.
- e) Cloning can be used for illegal purposes and destructive activities.

70. Production of genetically modified plants is both a boon and bane. Explain.

By genetically modifying plants we can increase the yield, improve the plant breeds, make them pest and disease resistant. We can also transfer nitrogen fixing gene.

The greatest disadvantage of genetically modified plants is the sterility of seeds which is a threat to conservation of plant species.

Fill in the blanks:

1. The branch of biology which deals with a systematic study of heredity, variations and factors responsible is called **genetics**.
2. The inheritance of parental characteristics by their off springs is called **heredity**.
3. The 'Father of modern genetics' is **Gregor Johann Mendel**.
4. The reproductive structure of a plant is **flower**.
5. A cross between two plants which differ in one specific character is called **monohybrid cross**.
6. The ratio of monohybrid cross in F₂ generation is **3:1**.
7. Mendel called the factor which showed in the generations as **dominant factor**.
8. Mendel called the factor which is hidden or concealed in the generations is called **recessive factor**.
9. The character expressed by an organism is called **phenotype**.
10. The genetic characteristics of an organism are called **genotype**.
11. The phenotype ratio of monohybrid cross is **3:1**.
12. The genotype ratio of monohybrid cross is **1:2:1**.
13. The cross between two plants which differ in two characters is called **dihybrid cross**.
14. The ratio of dihybrid cross is **9:3:3:1**.
15. The pair of factors for a given character separates in equal ratio at the time of gamete formation during meiosis is Mendel's law of **segregation**.
16. Mendel's law of segregation is also called law of purity of gametes.

17. Factors controlling separate characters normally move independent of each other during gamete formation is Mendel's law of **independent assortment**.
18. The type of dominance which deviates from the Mendelian inheritance is called **incomplete dominance**.
19. The genetist who proposed incomplete dominance is **Carl Correns**.
20. Carl Correns used **4'O clock plants** for his experiments on incomplete dominance.
21. The condition in which a single trait or character with both the factors same is called **homozygous**.
22. The condition in which a trait or character with different factors is called **heterozygous**.
23. The two parallel strands of chromosomes are called **chromatids**.
24. The chromatids are held together by **centromere**.
25. The thousands of hereditary units in the DNA molecule are called **genes**.
26. Polynucleotide unit consists of **Deoxyribose sugar, phosphate and a nitrogenous base**.
27. Nitrogenous bases Adenine (A) and Guanine (G) are called **purines**.
28. Nitrogenous bases Cytosine (C) and Thymine (T) are called **pyrimidines**.
29. The pairing of Adenine (A) with Thymine (T) and Guanine (G) pairing with Cytosine (C) is called **complimentary base pairing**.
30. The process of producing two identical replicas from one original DNA molecule is called **DNA replication**.
31. Any change in the structure or composition of genetic materials such as gene or chromosomes is called **mutation**.
32. The application of technological procedures on organisms is called **biotechnology**.
33. The technique of inducing desirable changes in the genetic material such as DNA of an organism is called **genetic engineering**.
34. The technique of manipulating the genes in the laboratory is called **recombinant DNA technology**.
35. The technique in biotechnology used for identifying individuals by determining the genetic relationships is called **DNA finger print technology**.
36. The technique of breaking down the DNA of individual into short segments using specific enzymes is called **gel electrophoresis**.
37. The short fragments of DNA get separated on the basis of their **size and net electrical charge**.
38. The series of bands in the form of fingerprint with a unique pattern is called **DNA finger print**.
39. The technique of obtaining genetically similar molecules, cells, tissues or organism from a common precursor invitro process is called **cloning**.
40. The first clone was a **sheep** called **Dolly**.
41. The first clone Dolly was produced by **Wilmur**.
42. The greatest application of DNA finger print technology is in the filed of **forensic science**.
43. One of the greatest applications of biotechnology is in the production of **artificial hormones**.
44. One of the disadvantages of biotechnology in plants is **sterility of seeds**.
