BIOLOGY

Important Questions

➢ Multiple Choice Questions:

1. All genes located on the same chromosome:

   (a) form different groups depending upon their relative distance
   (b) form one linkage group
   (c) will not form any linkage groups
   (d) form interactive groups that affect the phenotype

2. Conditions of a karyotype 2n + 1 and 2n ± 2 are called:

   (a) Aneuploidy
   (b) Polyploidy
   (c) Allopolyploidy
   (d) Monosomy.

3. Distance between the genes and advantage of recombination shows:

   (a) a direct relationship
   (b) an inverse relationship
   (c) a parallel relationship
   (d) no relationship.

4. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is:

   (a) Autosomal dominant
   (b) Autosomal recessive
   (c) Sex-linked dominant
   (d) Sex-linked recessive.

5. In sickle cell anaemia glutamic acid is replaced by valine. Which one of the following triplets codes for valine?

   (a) GGG
   (b) AAG
   (c) GAA
   (d) GUG.

6. Person having genotype $I^A I^B$ would show the blood group as AB. This is because of:

   (a) Pleiotropy
   (b) Co-dominance
   (c) Segregation
   (d) Incomplete dominance.

7. ZZ / ZW type of sex determination is seen in:

   (a) Platypus
   (b) Snails
   (c) Cockroach
   (d) Peacock.

8. A cross between two tall plants resulted in offspring having a few dwarf plants. What would be the genotypes of both the parents?

   (a) TT and Tt
   (b) Tt and Tt
   (c) TT and TT
   (d) Tt and tt.

9. In a dihybrid cross, if you get 9 : 3 : 3 : 1 ratio it denotes that:

   (a) The alleles of two genes are interacting with each other
   (b) It is a multigenic inheritance
   (c) It is a case of multiple alleles m
   (d) The alleles of two genes are segregating independently.

10. Which of the following will not result in variations among siblings?

   (a) Independent assortment of genes
   (b) Crossing over
   (c) Linkage
   (d) Mutation.

11. Mendel's law of independent assortment holds good for genes situated on the:

   (a) non-homologous chromosomes
   (b) homologous chromosomes
   (c) extra nuclear genetic element
   (d) same chromosome.

12. Occasionally, a single gene may express more than one effect. The phenomenon is called:

   (a) multiple allelism
   (b) mosaicism
   (c) pleiotropy
   (d) polygeny.

13. In a certain taxon of insects some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosome-bearing organisms are:

   (a) males and females, respectively

(b) females and males, respectively
(c) all males
(d) all females.

14. The inheritance pattern of a gene over generations among humans is studied by the pedigree analysis. Character studied in the pedigree analysis is equivalent to:

(a) quantitative trait
(b) Mendelian trait
(c) polygenic trait
(d) maternal trait.

15. It is said that Mendel proposed that the factor controlling any character is discrete and independent. This proposition was based on the:

(a) results of F3 generation of a cross.
(b) observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending.
(c) self-pollination of F1 offsprings
(d) cross-pollination of parental generations.

➢ Very Short Question:

1. Name any one plant that shows the phenomenon of incomplete dominance during the inheritance of its flower colour.

2. Name the base change and the amino acid change, responsible for sickle cell anaemia.

3. Name the disorder with the following chromosome complement.

(i) 22 pairs of autosomes + X X Y

(ii) 22 pairs of autosomes + 21st chromosome + XY.

4. A haemophilic man marries a normal homozygous woman. What is the probability that their daughter will be haemophilic?

5. A test is performed to know whether the given plant is homozygous dominant or heterozygous. Name the test and phenotypic ratio of this test for a monohybrid cross.

6. Name the phenomena that occur when homologous chromosomes do not separate during meiosis.

7. Name one trait each in humans & in drosophila whose genes are located on sex chromosome.

8. What is meant by aneuploidy?

9. What genetic principle could be derived from a monohybrid cross?

10. Which one change is the cause of sickle – cell anaemia?

➢ Short Questions:

1. Mention two differences between Turner s syndrome and Klinefelter's syndome.
2. The human male never passes on the gene for haemophilia to his son. Why is it so?
3. Mention four reasons why Drosophila was chosen by Morgan for his experiments in genetics.
4. Differentiate between point mutation and frameshift mutations.
5. Give any two similarities between behavior of genes (Mendel's factor) during inheritance & chromosomes during cell division.
6. Which law of Mendel is universally accepted? State the law?
7. Why do sons of haemophilic father never suffer from this trait?
8. How is the child affected if it has grown from the zygote formed by an XX-egg fertilized by Y-carrying sperm? What do you call this abnormality?

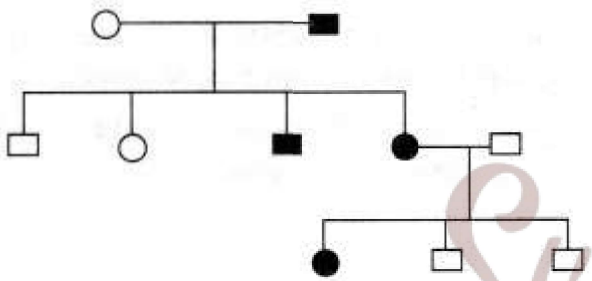
➢ Long Questions:

1. Study the given pedigree chart and answer the questions that follow:

   (a) Is the trait recessive or dominant?

   (b) Is the trait sex-linked or autosomal?

   (c) Give the genotypes of the parents shown in generation I and their third child is shown in generation II and the first grandchild shown in generation III.



2. Mention the advantages of selecting a pea plant for the experiment by Mendel.
3. What is recombination? Discuss the applications of recombination from the point of view of genetic engineering.

➢ Assertion and Reason Questions:

1. For question two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

c) Assertion is true, but reason is false.
d) Both assertion and reason are false.

Assertion: Number of chromosomes in one genome is equal to number of linkage groups.
Reason: Two homologous chromosomes form a linkage group.

2. For question two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

Assertion: Linked gene show dihybrid ratio of 9 : 3 : 3 : 1.
Reason: Linked gene undergo independent assortment.

➢ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v) given below:

While studying inheritance of characters, a teacher gave the example of inheritance of attached earlobe and hypertrichosis of the ear to her students. A man with attached earlobes and extensive hair on pinna married a woman having free earlobes. The couple had four children, one son with attached earlobes and hairy pinna, one son with a free earlobes and hairy pinna and two daughters with attached earlobes. One of the daughters married a man with free earlobes and sparse hair on pinna. Teacher said if this couple would have sons there would be equal chances for both having free or attached earlobes and sparse hair on pinnae.

(i) Attached and free earlobe are respective example of?

a) Dominant and recessive traits.
b) Recessive and recessive traits.
c) Recessive and dominant traits.
d) Dominant and dominant traits.

(ii) Hypertrichosis of the ear is.

a) X linked trait
b) Y linked trait
c) Autosomal dominant trait
d) Autosomal recessive trait.

(iii) If a female with attached earlobe married a male homozygous for free earlobe sparse hair on pinna then what would be the chances of daughter to have attached earlobe?

a) 0%

b) 100%
c) 25%
d) 75%

(iv) If a man with attached earlobe and hairy pinna married a woman with attached earlobe then what would be the chances of son to have hairy pinna?

a) 50%
b) 100%
c) 75%
d) 0%

(v) A male with attached earlobe, sparse hair on pinna married a female with attached earlobe. Which of the following is correct regarding their progenies?

a) All sons have a free earlobe with hairy pinna.
b) All daughters have an attached earlobe.
c) 50% daughters have an attached earlobe whereas 50% daughters have a free earlobe.
d) 50% sons have attached earlobe with hairy pinna and 50% sons have a free earlobe

2. Read the following and answer any four questions from (i) to (v) given below:

According to Mendel, one gene control the expression of one character only. The ability of a gene to have multiple phenotypic effect because it influences a number of characters is an exception. The gene having a multiple phenotypic effect because of its ability to control of two or more characters can be seen in cotton. In cotton, a gene for the lint also influences the height of plant, size of the ball, number of ovules and viability of seeds.

(i) Genes with multiple phenotypic effects are known as?

a) Hydrostatic genes.
b) Duplicate genes.
c) Pleiotropic genes.
d) Complimentary genes.

(ii) Which of the following disorder is an example of genes with multiple phenotypic effects?

a) Phenylketonuria.
b) Haemophilia.
c) Sickle cell anaemia.
d) Both (a) and (c)

(iii) Which of the following is an example of gene with multiple phenotypic effect?

a) Drosophila white eye mutation.
b) Kernel colour in wheat.
c) Height in human beings.
d) Skin colour in human beings.

(iv) Which of the following statements is not correct regarding genes with multiple phenotypic effect?

a) It is not essential that all the traits are equally influenced.
b) Occasionally a number of related changes are caused by a gene.
c) It occurs due to effect of the gene on two or more inter-related metabolic pathways.
d) None of these.

(v) Assertion: In garden pea, the gene which controls the flower colour also controls the colour of the seed coat and presence of red spots in the leaf axils.

Reason: A pleiotropic gene influences more than one trait.

a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

✓ Answer Key-

➢ Multiple Choice Answers:

1. (b) form one linkage group

2. (a) Aneuploidy

3. (a) a direct relationship

4. (d) Sex-linked recessive.

5. (d) GUG.

6. (b) Co-dominance

7. (d) Peacock.

8. (b) Tt and Tt

9. (d) The alleles of two genes are segregating independently.

10. (c) Linkage

11. (a) non-homologous chromosomes

12. (c) pleiotropy

13. (a) males and females, respectively

14. (b) Mendelian trait

15. (b) observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending.

➢ Very Short Answers:

1. Dog flower (Snapdragon or Antirrhinum sp.)
2. GAG changes as GUG, Glutamic acid is substituted by valine.
3. Ans.(i) Klinefelter s Syndrome (ii) Downs syndrome
4. Their daughter can never be haemophilic. (0%).
5. Test cross 1 : 1.
6. Non – disjunction.
7. Humans – Colorblindness

   Drosophila – Eye colour
8. Aneuploidy is the phenomena of gain or loss of one or more chromosomes that results due to failure of separation of members of homologous pair of chromosomes during meioses.
9. Law of dominance.
10. It is caused due to a point mutation at 6th position in B-chain of hemoglobin in which glutamic acid is replaced by valine.

➢ Short Answer:

1. Turners Syndrome : The individual is female and it has 45 chromosomes

   i.e., one X chromosome is less.

   Klinefelters Syndome : The individual is male and has 47 chromosomes

   i.e., one extra X chromosome.
2. The gene for haemophilia is present on X chromosome. A male has only one X chromosome which he receives from his mother and Y chromosome from father. The human male passes the X chromosome to his daughters but not to the male progeny (sons).
3.

   i. Very short life cycle (2-weeks)

   ii. Can be grown easily in laboratory

   iii. In single mating produce a large no. of flies.

   iv. Male and female show many hereditary variations

   v. It has only 4 pairs of chromosomes which are distinct in size and Shape.
4. Point Mutations : Arises due to change in a single base pair of DNA e.g., sickle cell anaemia. Frame shift mutations : Deletion or insertion/duplication/addition of one or two bases in DNA.
5. (i). In diploid cells, the chromosomes are found in pairs just like that of mendelian factors.

   (ii). During meiosis, the chromosomes of different homologous pairs are assorted independently into gametes at random showing parallelism with mendelian factors.

6. Mendel's law of segregation is universally accepted It states that – "the two alleles of a gene remain separate & do not contaminate each other in F1 or the hybrid. At the time of gamete formation two alleles separate & pars into deferent gametes.
7. Since haemophilic is a sex – linked character, it shows criss – cross inheritance i-e from father to his daughter therefore son of haemopilic father is never haemophilic.
8. If a child has grown from the zygote formed by XX-egg fertilized by Y-sperm, the child will suffer from klinefiter syndrome & will have XXY genotype. It is characterized by prominent feminine characters e.g. tall stature with feminised physique, Breast development pubic hair pattern, poor beard growth & sterility.

➢ Long Answer:

1. (a) Dominant.

   (b) Autosomal.

   (c) The genotype of parents in generation I – Female: aa and Male: Aa

   The genotype of a third child in generation II-Aa Genotype of the first grandchild in generation III – Aa

2. Advantages of selecting pea plant as experimental material:

   Mendel selected pea plant (Pisum sativum) because:

   i. Many varieties were available with observable alternative forms for a trait or a characteristic.
   ii. Peas normally self-pollinate; as their corolla completely encloses the reproductive organs until pollination is complete.
   iii. It was easily available.
   iv. It has pure lines for experimental purpose, i.e. they always breed true.
   v. It has contrasting characters. The traits were seed colour, pod colour, pod shape, flower shape, the position of flower, seed shape and plant height.
   vi. Its life cycle was short and produced a large number of offsprings.
   vii. The plant can be grown easily and does not require care except at the time of pollination.

3. Answer: Recombination refers to the generation of a new combination of genes which is different from the parental types. It is produced due to crossing over that occurs during meiosis prior to gamete formation.

   Applications of recombination:

   i. It is a means of introducing new combinations of genes and hence new traits.
   ii. It increases variability which is useful for natural selection under changing environment.

iii. It is used for preparing linkage chromosome maps.

iv. It has proved that genes lie in a linear fashion in the chromosome.

v. Breeders have to select small or large population for obtaining the required cross-overs. For obtaining cross-overs between closely linked genes, a very large population is required.

vi. Useful recombinations produced by crossing over are picked up by breeders to produce useful new varieties of crop plants and animals. Green revolution and white revolution were implemented using the selective recombination technique.

➢ Assertion and Reason Answers:

1. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation:

Linkage group is linearly arranged groups of genes which fail to show independent assortment as these are present on the same chromosomes.

2. (d) Both assertion and reason are false.

Explanation:

Linked genes are those genes which occurs on the same chromosome while unlinked genes are the ones found on different chromosomes. Linked gene show dihybrid ratio of 3 : 1. Linked genes do not show independent assortment.

➢ Case Study Answers:

1.

(i) (c) Recessive and dominant traits.

Explanation:

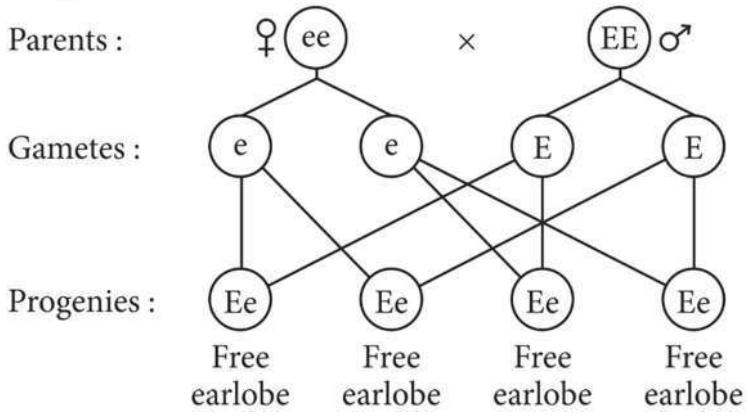
In humans, free earlobes is dominant over attached earlobes

(ii) (b) Y linked trait

(iii) (a) 0%

Explanation:

If a female with attached earlobes (ee) married a male with free lobe (EE) and sparse hair on pinna then chance of any progeny to have attached ear lobe is zero. It can be depicted as follows



(iv) (b) 100%

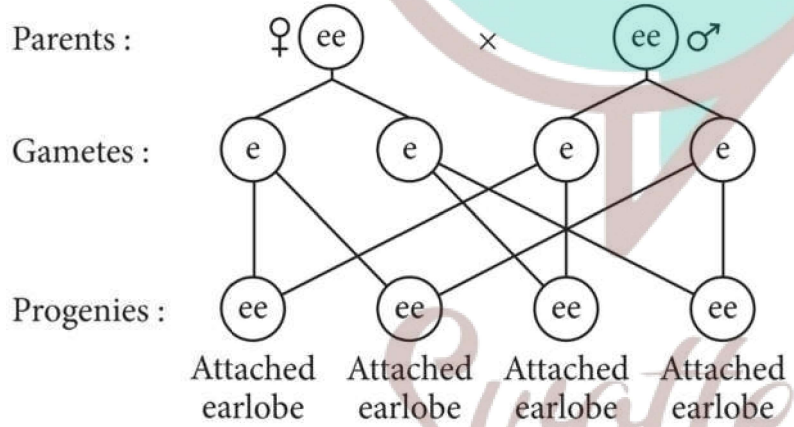
Explanation:

If a man with attached earlobe (ee) and hairy pinna married a woman with attached earlobes (ee) than 100% chances of sons to have hairy pinna as hypertrichosis or hairy pinna is Y linked feature.

(v) (b) All daughters have an attached earlobe.

Explanation:

If a male with attached earlobe sparse hair on pinna married a female with attached earlobe then all daughters have an attached earlobe.



2.

(i) (c) Pleiotropic genes.

(ii) (d) Both (a) and (c)

Explanation:

The ability of a gene to have multiple phenotypic effects because it influences a number of characters simultaneously is known as pleiotropy. In human beings pleiotropy is exhibited by syndromes, i.e., sickle cell anaemia and phenylketonuria.

(iii) (a) Drosophila white eye mutation.

Explanation:

Kemel colour in wheat, height in human beings and skin colour in human beings are examples of polygenic inheritance, i.e., inheritance controlled by three or more genes. ln Drosophila, white eye mutation pleiotropic effect, it causes depigmentation in many part of the body.

(iv) (d) None of these.

(v) (a) Both assertion and reason are true and reason is the correct explanation of assertion.