



Heredity and Evolution



Definitions

1. **Heredity:** Transmission of genetically based characters from one generation to the next generation is called heredity.
2. **Gene:** It is a specific segment of DNA on a chromosome occupying specific position and determines the hereditary characters.
3. **Traits:** The alternative forms of a character are called traits.
4. **Genetics:** It is the branch of biology that deals with the study of heredity and variations.
5. **Monohybrid cross:** A breeding experiment which involves the alternative traits of one single character is called monohybrid cross.
6. **Dihybrid cross:** A cross between two pure breeding individuals taking into consideration alternative traits of two different characters is called a dihybrid cross.
7. **Variation:** It is the differences in the traits shown by the individuals of a species and also by the offsprings of the same parents are called variations.
8. **Sex determination:** The mechanism by which sex of an individual is determined when it begins its life.

Multiple Choice Questions

9. What, according to Mendel, was responsible for the inheritance of specific traits?

- (a) Genes
- (b) Factors
- (b) Chromosomes
- (d) DNA

Ans. (b) Factors

Explanation :

Mendel discovered the laws of inheritance. He attributed these traits being encoded by factors. Later studies showed that these factors are genes.

10. What branch of biology focuses on the study of patterns of inheritance?

- (a) Genetics
- (b) Immunology
- (b) Evolution
- (d) Ecology

Ans. (a) Genetics

Explanation :

Genetics is the branch of biology that deals with questions of inheritance. It uses techniques from various disciplines like Molecular biology, Cell biology, and many more to understand the basis of

inheritance.

11. What determines the differences between the progeny and parents?

- (a) Inheritance
- (b) Heritage
- (b) Genetics
- (d) Variation

Ans. (d) Variation

Explanation :

Variation is the difference between individuals within a population. These arise between the progeny and parents/ancestors and form a backbone for natural selection to act on.

12. The phenomenon where individuals of a species exhibit differences in characteristics are called:

- (a) Adaptation
- (b) Evolution
- (c) Variation
- (d) All of these

Ans. (c) Variation

Explanation :

Any difference between cells, individuals, or groups of organisms of any species produced by genetic differences (genotypic variation) or the effect of environmental conditions on the manifestation of genetic potentials is referred to as variation (phenotypic variation).

13. Which of the following statements is incorrect?

- (a) Gene is a sequence of nucleotides.
- (b) During the process of gene expression, DNA is first copied into RNA.
- (b) Genes can acquire mutations in their sequence.
- (d) Genes cannot acquire mutations in their sequence.

Ans. (c) Genes can acquire mutations in their sequence.

Explanation :

Genes can acquire mutations. A gene mutation is a change in the DNA sequence that makes up a gene that is permanent and differs from the sequence found in most people.

14. Which part of the DNA provides information for a protein?

- (a) Chromosome
- (b) Mitochondria
- (b) RNA
- (d) Gene

Ans. (d) Gene

Explanation :

The information needed to build proteins is stored in the DNA of an organism. A unique portion of DNA is called a gene code for each protein. A gene is a piece of DNA that is required to make a single protein.

15.

Which of the following is controlled by genes?

- (a) Eye colour
- (b) Height

(c) Hair colour

(d) All of these

Ans. (d) All of these

Explanation :

Characters or traits are the characteristics that a person expresses and can be seen in their phenotype. Height, eye colour, and body colour are all controlled by genes and can be inherited.

16. The discipline of Biology that deals with the study of inheritance is

(a) Cytology

(b) Evolution

(b) Genetics

(d) Morphology

Ans. (c) Genetics

Explanation :

Genetics is the branch of biology concerned with the study of the DNA and its inheritance in the organisms.

17. Germinal variations are those variations which

(a) are inheritable

(b) affect only somatic cells

(b) are not inheritable

(d) None of the above

Ans. (a) are inheritable

Explanation :

Germinal variations occur in germ cells that get passed to the next generation through gametes produced by the germ cells.

18. When a gene exists in more than one form, the different forms are termed as

- (a) alleles
- (b) heterozygotes
- (b) genotypes
- (d) homozygotes

Ans. (a) alleles

Explanation :

An allele is a variant form of a gene.

19. The terms 'genotype' and 'phenotype' were coined by

- (a) Darwin
- (b) Bateson
- (b) Johannsen
- (d) Mendel

Ans. (c) Johannsen

Explanation :

Danish botanist Wilhelm Johannsen coined the word gene to describe the Mendelian units of heredity. He also made the distinction between the outer appearance of an individual (phenotype) and its genetic traits (genotype).

20. Two pink coloured flowers on crossing resulted in 1 red, 2 pink and 1 white flower progeny. The nature of the cross will be: **[NCERT**

Exemplar]

- (a) double fertilisation
- (b) self pollination
- (c) cross fertilisation
- (d) no fertilisation

Ans. (c) cross fertilisation

Explanation :

In incomplete dominance, the cross between plants with pure red and white flowers results in F₁ generation plants with all pink flowers. The self-pollination or fertilisation of these plants results in progenies (F₂ generation) with red, pink and white flowers in a ratio of 1 : 2 : 1 respectively.

21. Which of the following statement is true?

- (a) The characteristics or traits of parents are transmitted to their progeny (offspring) through genes present on their chromosomes during the process of sexual reproduction.
- (b) The genes which dominate other genes are called dominant genes and the genes which get dominated are called recessive genes.
- (b) The progeny inherits two genes for each trait from its parent but the traits shown by the progeny depends on which inherited gene is dominant of the two.
- (d) All of the above

Ans. (d) All of the above

Explanation :

Here, all the statements are correct. Hence, the answer will be option [d].

- 22.** Dominant alleles are expressed exclusively in a heterozygote, while recessive traits are expressed only if the organism isfor the recessive allele.

- (a) homozygous
- (b) heterozygous
- (b) normal
- (d) none of these

Ans. (a) homozygous

Explanation :

Mendel's law of dominance states that in a heterozygote, one trait will conceal the presence of another trait for the same characteristic. Rather than both alleles contributing to a phenotype, the dominant allele will be expressed exclusively. The recessive allele will remain "latent," but will be transmitted to offspring by the same manner in which the dominant allele is transmitted. The recessive trait will only be expressed by offspring that have two copies of this allele.

- 23.** From the list given below select the character which can be acquired but not inherited.

[NCERT Exemplar]

- (a) Colour of eye
- (b) Colour of skin
- (b) Size of body
- (d) Nature of hair

Ans. (c) Size of body

Explanation :

Environmental factors influence the development of acquired traits. It is because the availability of less or more food can modify the size of the body, it is an acquired feature. The other three- eye and skin colour, and nature of hair, are inherited characteristics from the parents.

24. Select the group which shares maximum number of common characters.

- (a) Two individuals of a species
- (b) Two species of a genus
- (b) Two genera of a family
- (d) Two genera of two families

Ans. (a) Two individual of a species

Explanation :

As we move from higher taxonomic rank to lower one, common characters increase. Among species, genus, family and families; species is the lowest taxonomic rank. Hence, two individuals of the same species will share maximum number of common characters.

25. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as:

[NCERT]

- (a) TTWW

(b) TTww

(b) TtWW

(d) TtWw

Ans. (c) TtWW

Explanation :

According to the law of dominance, hybridisation between two pure-breeding varieties yields uniform F_1 generation of all dominant offspring. Since here F_1 generation consists of short plants with violet flowers and tall plants with violet flowers in an exceedingly 1:1 ratio, the dominant parent is not pure-bred. The absence of a dominant allele for flower colour (violet) would make the phenotype of the dominant parent tall with white flowers.

- 26.** A cross between a tall plant (TT) and short pea plant (tt) resulted in progeny that were all tall plants because:

[NCERT Exemplar]

(a) tallness is the dominant trait.

(b) shortness is the dominant trait.

(b) tallness is the recessive trait.

(d) height of pea plant is not governed by gene 'T' or 't'.

Ans. (a) tallness is the dominant trait.

Explanation :

A cross between a tall plant (TT) and short pea plant (tt) resulted in progeny that were all tall plants because tallness is the dominant trait. In F_1 generation, the cross between TT and tt will result in all tall plants. Thus, tallness is the dominant trait.

27. The process where characteristics are transmitted from parent to offsprings is called:

- (a) Variation
- (b) Heredity
- (b) Gene
- (d) Allele

Ans. (b) Heredity

Explanation :

The process where characteristics are transmitted from parent to offsprings is called as heredity. During the process of sexual reproduction, characteristics from parents are passed down to offspring which are the combinations of female and male parent. This is known as heredity.

28. _____ is the observable set of characteristics of an organism.

- (a) Phenotype
- (b) Genes
- (b) DNA
- (d) All of these

Ans. (a) Phenotype

Explanation :

The term “phenotype” refers to an organism’s observable physical properties, such as its appearance, development, and behaviour.

29. When a new plant is formed as a result of cross-pollination from different varieties of a plant, the newly formed plant is called:

- (a) Dominant plant
- (b) Mutant plant
- (b) Hybrid plant
- (d) All of these

Ans. (a) Dominant plant

Explanation :

The process of crossing pollen from one flower to the pistils of another flower is known as cross-pollination. When a new plant is formed as a result of cross-pollination from different varieties of a plant, the newly formed plant is called hybrid plant.

30. Which of the following is a recessive trait in pea plants?

- (a) Dwarf stem height
- (b) Violet flowers
- (b) Axial flowers
- (d) Inflated pods

Ans. (a) Dwarf stem height

Explanation :

Recessive traits are the ones that require both alleles to be present to result in the expression of the gene product. Of the mentioned traits, only dwarf stem height is a recessive trait, in pea plants.

31. If you were to sample garden pea plants in Mendel's garden, which of the following statements would hold?

- (a) Round seeds were more abundant than wrinkled seeds.
- (b) Wrinkled seeds were more abundant than round seeds.

(b) Both round and wrinkled seeds were equally abundant.

(d) Answer depends on the time of day when sampling is done.

Ans. (a) Round seeds were more abundant than wrinkled seeds.

Explanation :

Dominant allele can express even in the presence of a recessive allele. Hence, dominant phenotype is more common. Round seeds are dominant over wrinkled seeds; hence would be more abundant.

32. Which of the following can be inherited from parents to offspring?

(a) Swimming technique

(b) Big nose

(b) Sculpted body

(d) All of the above

Ans. (b) Big nose

Explanation :

Big nose is an inherited trait which can be passed from parents to offspring.

33. Which of the following is an example of genetic variation?

(a) One person has a scar but his friend does not.

(b) One person is older than the other.

(b) Reeta eats meat but her sister Geeta is a vegetarian.

(d) Two children have different eye colour.

Ans. (d) Two children have different eye colour.

Explanation :

Variation in gene frequencies is referred to as genetic variation. Eye colour is determined by variations in genes of a person. Two children having different eye colour is an example of genetic variation.

34. In peas, a pure tall (TT) is crossed with a pure short plant(tt). The ratio of pure tall plants to pure short plants in F₂ generation is:

(a) 1:3

(b) 3:1

(b) 1:1

(d) 2:1

Ans. (c) 1:1

Explanation :

In the F₂ generation, the ratio of pure tall plants to pure short plants will be 1:1. The other two plants that are produced will be tall as well, but will not be pure.

35. Humans have two different sex chromosomes, X and Y. Based on Mendel's laws, a male offspring will inherit which combination of chromosomes?

(a) Both the X chromosomes from one of its parents.

(b) Both the Y chromosomes from one of its parents.

(b) Combination of X chromosomes from either of its parents.

(d) Combination of X and Y chromosome from either of its parents.

Ans

- . (d) Combination of X and Y chromosome from either of its parents.

Explanation :

The X and Y chromosomes are found in humans and most other mammals. Males have both X and Y chromosomes in their cells, whereas females have two X chromosomes. X chromosomes are found in all egg cells, while X or Y chromosomes are found in sperm cells.

- 36.** Two pea plants one with round green seeds (RR yy) and another with wrinkled yellow (rrYY) seeds produce F_1 progeny that have round yellow (RrYy) seeds. When F_1 plants are self pollinated, the F_2 progeny will have a new combination of characters. Choose the new combinations from the following.

[NCERT Exemplar]

- (i) Round, yellow
- (ii) Round, green
- (iii) Wrinkled, yellow
- (iv) Wrinkled, green
- (a) (i) and (ii)
- (b) (i) and (iv)
- (b) (ii) and (iii)
- (d) (i) and (iii)

Ans. (b) (i) and (iv)

Explanation :

The new combination in F_2 progeny will be round yellow and wrinkled green. The phenotypic ratio obtained in a dihybrid cross is 9 : 3 : 3 : 1. The phenotypic ratio will be - Round Yellow: Round green: Wrinkled yellow: Wrinkled green = 9 : 3 : 3 : 1.

- 37.** If Mendel would have carried out cross pollination of a pea plant

having tt trait with pea plant having Tt trait then the F1 Progeny plants would have been?

- (a) Two dwarf and Two tall plant
- (b) One dwarf and three tall plant
- (b) All Tall
- (d) All dwarf

Ans. (a) Two dwarf and Two tall plant

Explanation :

The cross will be as shown in the table:

	T	t
t	Tt	tt
t	Tt	tt

So, there will be two tall and two dwarf plants.

38. Mendel conducted his experiments with

- (a) chick pea
- (b) garden pea
- (b) wild pea
- (d) pigeon pea

Ans. (b) garden pea

Explanation :

Garden pea or *Pisum sativum* was used by Mendel to study inheritance. He used this particular plant because it has easily identifiable traits.

39. A pea plant with round and green seeds (RRyy) is crossed with

another pea plant with wrinkled and yellow seeds (rrYY). What would be the nature of seeds in the first generation (F₁ generation).

- (a) Round green
- (b) Wrinkled green
- (b) Wrinkled yellow
- (d) Round yellow

Ans. (d) Round yellow

Explanation :

The characters that appear in the first generation are dominant. In this case, round seeds and yellow colour is dominant.

40. A group of laboratory mice having tails are bred together and their progeny is studied. The progeny had tails. However, the scientist removed the tails surgically and again bred them for four successive generations. In your opinion, what would be the nature of the new progeny?

- (a) All mice born will have tails.
- (b) All mice born will have no tails.
- (b) The ratio of tailless to the tailed mice will be 1 : 3.
- (d) The ratio of tailless to the tailed mice will be 1 : 4.

Ans. (a) All mice born will have tails.

Explanation :

By surgical removal of the tails the scientist is not able to produce any change in the germ cells. Basically, he is not able to influence the cause of germinal variations, which is DNA (genes). Thus, this change of tail removal does not get inherited by the progeny.

41. When a cross is made between two parents with respect to a single character, it is called a

- (a) dihybrid cross
- (b) monohybrid cross
- (b) trihybrid cross
- (d) None of these

Ans. (b) monohybrid cross

Explanation :

A monohybrid cross is a cross between two organisms with different variations at one genetic locus of interest. For example, a cross between a tall pea plant and a dwarf pea plant that is considering only the height of the parents is a monohybrid cross.

42. The genotype of the offspring formed from the cross depicted as $Tt \times tt$ will be

- (a) TT and tt
- (b) Tt and tt
- (b) Only tt
- (d) Only TT

Ans. (b) Tt and tt

Explanation :

This is a test cross. A test cross is a cross of any genotype showing dominant phenotype with a recessive homozygote to determine the genotype of a dominant parent, *i.e.*, whether it is a heterozygous or a homozygous dominant. In the above case, the parent is heterozygous dominant because offspring contains dwarf plants as well.

43. Which of the following statements is not true with respect to variations?

- (a) All variations in a species have equal chances of survival.
- (b) Change in genetic composition results in variation.
- (b) Selection of variants by environmental factors forms the basis of evolutionary processes.
- (d) Variation is minimum in asexual reproduction.

Ans. (a) All variations in a species have equal chances of survival.

Explanation :

All variations in a species do not have equal chances of survival. Some of the variations may be so drastic that the new DNA copy cannot sustain in the cellular environment in which it is inherited.

44. According to Mendel, the genotypic ratio of F₂ generation in a monohybrid cross is

- (a) 3 : 1
- (b) 9 : 3 : 3 : 1
- (b) 1 : 1
- (d) 1 : 2 : 1

Ans. (d) 1 : 2 : 1

Explanation :

A monohybrid cross is mating between individuals who have different alleles at one genetic locus of interest. In a monohybrid cross, the pure breed tall and dwarf homozygous plants are crossed.

Genotype:	TT	X	tt
Gametes:	T		t
Offspring:	Tt		
Selfing of F1:	Tt	X	Tt
Gametes:	T, t		T, t
F2 generation:	TT, Tt, Tt and tt		
Genotypic ratio:	1 : 2 : 1		

45. Recessive genes can be expressed only in

- (a) homozygous condition
- (b) heterozygous condition
- (b) Both of the above conditions
- (d) None of the above conditions

Ans. (a) homozygous condition

Explanation :

In a homozygous condition, recessive allele can express itself as there is no dominant allele to mask its effect.

46. A plant (homozygous for flower colour) with red coloured flowers is crossed with a plant having white flowers. The red and white colour of the flowers is controlled by a single gene. Red is dominant over white. The F1 progeny is self-pollinated and the flower colour in F2 generation is observed.

Given the above information, what is the expected phenotypic ratio of plants with different flower colours in F2?

- (a) All plants will be with red flowers.
- (b) Red : White flowers will be in the ratio of 3 : 1.

(b) Pink : White flowers will be in the ratio of 3 : 1.

(d) Red : Pink : White flowers will be in the ratio of 1 : 2 : 1.

Ans. (b) Red : White flowers will be in the ratio of 3 : 1.

Explanation :

Red is dominant. When the F₁ progeny is self-crossed (Rr X Rr), the cross will yield the following genotypes in the F₂ generation:

F₂ generation—RR, Rr and rr in the ratio of 1 : 2 : 1, but the phenotypic ratio will be Red : White in the ratio of 3 : 1.

47. The sex of the child depends on the chromosomes present in the

(a) egg of the female

(b) sperm of the male

(b) Both (a) and (b)

(d) None of these

Ans. sperm of the male

Explanation :

The sex of the child depends on the male chromosome which is transferred to the offspring. This happens because males have a mismatched pair of sex chromosome (XY) which is responsible for deciding the sex of the child.

48. Which of the following conditions of the zygote would lead to the birth of the normal human female child?

(a) Two X chromosomes

(b) Only one Y chromosome

(b) Only one X chromosome

(d) One X and one Y chromosome

Ans. (a) Two X chromosomes

Explanation :

Human beings contain 44 autosomes and one pair of allosome. In females, the allosome composition is XX and in males it is XY. The other combinations such as XO, XXY, etc., will lead to different genetic disorders.

49. In humans, sex determination is controlled by

(a) allosomes

(b) autosomes

(b) temperature

(d) All of the above

Ans. (a) allosomes

Explanation :

In humans, sex is determined by the sex chromosomes or a pair of allosomes (XX in females, XY in males).

50. In humans, the sex Chromosomes comprises one pair of the total of 23 pairs of chromosomes. The other 22 pairs of chromosome are called:

(a) autosomes

(b) chromosomes

(b) meiosis

(d) all of these

Ans. (a) autosomes

Explanation :

In humans, each cell normally contains 23 pairs of chromosomes, for a total of 46. Twenty-two of these pairs, called autosomes, look the same in both males and females. The 23rd pair, the sex chromosomes, differ between males and females. Females have two copies of the X chromosome, while males have one X and one Y chromosome.

51. The number of pairs of sex chromosomes in the zygote of humans is:

- (a) 1
- (b) 2
- (b) 3
- (d) 4

Ans. (a) 1

Explanation :

In the human zygote, the number of pairs of autosomes and sex chromosomes is the same as in an adult human. A human adult possesses 23 pairs of chromosomes, 22 of which are autosomes and 1 of which is a sex chromosome.

52. In human males all the chromosomes are paired perfectly except one. These unpaired chromosomes are:

- (i) Large chromosome
- (ii) Small chromosome
- (iii) Y-chromosome
- (iv) X-chromosome

- (a) (i), (ii)
- (b) (iii) only
- (c) (iii), (iv)
- (d) (ii), (iv)

Ans. (c) (iii), (iv)

Explanation :

In human males, one pair called as the sex chromosomes are unpaired. Here, one is a normal sized X chromosome while other is a short Y chromosome. Women have a perfect pair of sex chromosomes, both called as X. Whereas the X and Y chromosomes are paired well.

53. Which chromosomes do not play any role in the determination of the sex of an individual?

- (a) Autosomes
- (b) Metacentric chromosomes
- (b) Acrocentric chromosomes
- (d) None of the above

Ans. (a) Autosomes

Explanation :

Autosomes do not play any role in the determination of the sex of an individual since they are alike in both the males and the females and are 22 in pairs.

54. The two versions of a trait which are brought in by the male and female gametes are situated on:

[NCERT Exemplar]

- (a) copies of the same chromosome
- (b) two different chromosomes
- (b) sex chromosomes
- (d) any chromosomes

Ans. (a) copies of the same chromosome

Explanation :

The two versions of a trait which are brought in by the male and female gametes are situated on different copies of the same chromosome, different alleles are present. One chromosome is inherited from the father via the male gamete, while the other chromosome is inherited from the mother via the female gamete. After fertilisation, a zygote with 23 pairs of chromosomes is created, with alleles for a trait present on the homologous pair.

- 55.** In human males, all the chromosomes are paired perfectly except one. This/these unpaired chromosome is/are

[NCERT Exemplar]

- (i) large chromosome
- (ii) small chromosome
- (iii) Y-chromosome
- (iv) X-chromosome
- (a) (i) and (ii)
- (b) (iii) only
- (b) (iii) and (iv)
- (d) (ii) and (iv)

Ans. (c) (iii) and (iv)

Explanation :

In human males, one pair called the sex chromosomes are unpaired. Here, one is a normal-sized X-chromosome while other is a short Y-chromosome. Women have a perfect pair of sex chromosomes, both called X.

56. The maleness of a child is determined by

[NCERT Exemplar]

- (a) the X-chromosome in the zygote.
- (b) the Y-chromosome in zygote.
- (b) the cytoplasm of germ cell which determines the sex.
- (d) sex is determined by chance.

Ans. (b) the Y-chromosome in zygote.

Explanation :

The maleness of a child is determined by the Y-chromosome in zygote inherited from the father. If X-chromosome is inherited from the father, the zygote will develop into girl.

57. A zygote which has an X-chromosome inherited from the father will develop into a

[NCERT Exemplar]

- (a) boy
- (b) girl
- (b) X-chromosome does not determine the sex of child
- (d) either boy or girl

Ans. (b) girl

Explanation :

A zygote that has an X-chromosome inherited from father will develop into a girl. All children whether boys or girls inherit an X-chromosome from their mother. Thus, sex is determined by what they inherit from their father. A child who inherits X-chromosome from her father will be a girl, and one who inherits a Y-chromosome from him will be a boy.

Assertion and Reasoning Based Questions

- 58.** Assertion: Changes in non-reproductive tissues can be passed on the DNA of the germ cells.

Reason: Inherited traits include the traits developed during the lifetime of an individual that cannot be passed on to its progeny.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (d) If assertion is false, but reason is true.

Explanation :

Changes in non-reproductive tissues cannot be passed on the DNA of the germ cells. The traits developed during the lifetime of an individual that cannot be passed on to its progenies are acquired traits. Thus assertion is false, but reason is true.

Reason: It is represented by capital letter, e.g., T.

- 59.** Assertion: Variations are seen in offspring produced by asexual reproduction.

Reason: DNA molecule generated by replication is not exactly identical to original DNA.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (d) If assertion is false, but reason is true.

Explanation :

Variations are not seen in the offspring produced by the asexual reproduction since only a single parent is involved the variations are not there and thus assertion is false, but reason is true.

60. Assertion: The genetic complement of an organism is called genotype.

Reason: Genotype is the type of hereditary properties of an organism.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

The genetic constitution of a cell or an organism is referred to as a genotype. It consists of the total of all recessive and dominant genes and the various genes are the heredity material that serves to transfer the genetic information from one generation to the next. This makes genotype an inherited property of organisms. Hence, the reason is correct. However, it is not a correct explanation for the assertion. Thus, both assertion and reason are true but reason is not the correct explanation of assertion.

61. Assertion: If the weight of the beetle is reduced because of starvation, that will not change the DNA of the germ cells.

Reason: Acquired traits are not inherited.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

Acquired traits are not inherited because they do not cause any change in the DNA of the organism. Therefore, low weight is not a trait that can be inherited by the progeny of a starving beetle. Therefore, even if some generations of beetles are low in weight because of starvation, that is not an example of evolution, since the change is not inherited over generations. Thus, both assertion and reason are true and reason is the correct explanation of the assertion.

62. Assertion: Dominant allele is an allele whose phenotype expresses even in the presence of another allele of that gene.

Reason: It is represented by a capital letter, e.g. T.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

Dominant allele is an allele whose phenotype expresses even in the presence of another allele of that gene and is generally represented by the capital letters. Thus both assertion and reason are true but reason is not the correct explanation of the assertion.

63. Assertion: Mendel was successful in his hybridisation experiments.

Reason: Garden pea proved as an ideal experimental material.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct

explanation of assertion.

Explanation :

The pea plant which Mendel choose for conducting experiments, is most ideal for controlled breeding, since it can easily be subjected to cross pollination. He identified very clear contrasting characters in the pea plants. Thus, both assertion and reason are true and reason is the correct explanation of the assertion.

64. Assertion: Dominant allele is an allele whose phenotype expresses even in the presence of another allele of that gene.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

Dominant allele is an allele whose phenotype will be expressed even in the presence of another allele of that gene. It is represented by a capital Letter, e.g., T. Both assertion and reason are true but reason is not the correct explanation of assertion.

65. Assertion: Chromosomes are capable of self-reproduction and maintaining morphological and physiological properties through successive generations.

Reason:Chromosomes are capable of self-reproduction and maintaining morphological and physiological properties through

successive generations.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

Chromosomes are known as heredity vehicles because they are capable of self-reproduction and maintains the characteristics in an individual generation after generation. Thus both assertion and reason are true and reason is the correct explanation of the assertion.

66. Assertion: Mendel selected the pea plant for his experiments.

Reason:Pea plant is cross-pollinating and has unisexual flowers.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

The flowers of pea plant are bisexual and they are self-pollinating, and thus, self and cross-pollination can easily be performed. They have a shorter life span and are the plants that are easier to maintain. Therefore Mendel choose the pea plant. Thus both assertion and reason are true and reason is the correct explanation of the assertion.

67. Assertion: Mendel self-crossed F_1 yellow with round seeds to obtain F_2 generation.

Reason: F_1 progeny of a yellow with round seeds and a green with wrinkled seeds are all green and wrinkled seeds.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

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Explanation :

Mendel took two contradicting traits together for crossing *i.e.*, colour and shape of seeds. He chose a round yellow seed and a wrinkled green seed and crossed them. He obtained only round yellow seeds in the F_1 generation. Then, F_1 progeny was self-pollinated, which gave

four different combinations of seeds *i.e.*, round-yellow, wrinkled-yellow, round green and wrinkled green seeds in the F_2 generation. So, assertion is true but reason is false.

68. Assertion: A geneticist crossed two pea plants got 50% tall and 50% dwarf in the progeny.

Reason: One plants was heterozygous tall and the other was dwarf.

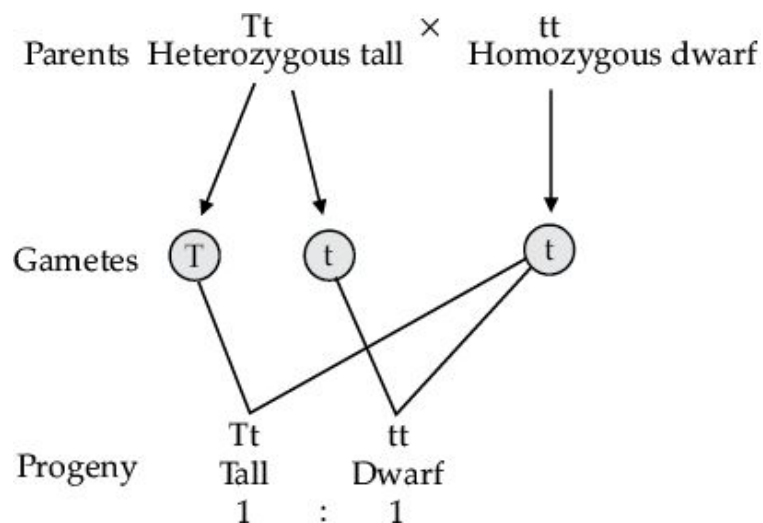
- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

The given cross can be illustrated as follows:

or 50% tall, 50% dwarf progeny.



Thus both assertion and reason are true and reason is the correct explanation of assertion.

69. Assertion: The law of independent assortment can be studied by means of dihybrid cross.

Reason: The law of independent assortment is applicable only to linked genes.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans

- . (c) If assertion is true, but reason is false.

Explanation :

The law of independent assortment states that two factors of each character assort or separate independent of the factors of other characters at the time of gamete formation and get randomly rearranged in the offspring producing both parental and new combinations of traits. The principle of law of independent assortment is applicable to only those factors or genes which are either located distantly on the same chromosome or occur on different chromosomes. Actually, a chromosome bears hundreds of genes. All the genes of factors present on a chromosome are inherited together except when crossing over takes place. Thus assertion is true but reason is false.

70. Assertion: The sex of the children will be determined by chromosome received from the father.

Reason: A human male has one X and one Y chromosome.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true, but reason is false.
- (d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

If a child inherits X-chromosome from the father will be a girl and one who inherits a Y-chromosome will be a boy. Thus, both assertion and reason are true and reason is the correct explanation of assertion.



Case Based Questions

71. Read the passage carefully and answer the following questions from Q 71 (i) to 71 (v).

Heredity is the passing on of some specific characteristics from one generation to the next, from parent to offspring. The study of heredity is called genetics. The traits are passed on by genes in our DNA. A gene gives instructions about making a certain protein to determine a trait for the person like the colour of eyes or hair. The genes are located inside a DNA molecule which is a material found in chromosomes. Genes may be dominant or recessive.

- (i) What was the model organism used by Mendel to give the laws of inheritance?
 - (a) Garden peas

- (b) Wild peas
- (b) Basket peas
- (d) Bottle gourd

(ii) A zygote which has an X-chromosome inherited from the father will develop into a:

- (a) girl.
- (b) boy.
- (c) either boy or girl.
- (d) X-chromosome does not influence the sex of a child.

(iii) The factor which expresses in homozygous and heterozygous states is called _____.

- (a) dominant
- (b) recessive
- (c) gene
- (d) allele

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Rate of chromosomal losses from comparison of fresh prints is calculated

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- (a) Genetics
 - (b) Evolution
 - (c) Offspring analysis
 - (d) Genetical analysis
- (v) In Mendel's experiment, the trait which did not appear in the F1 generation was:
- (a) dominant
 - (b) recessive
 - (b) recession
 - (d) allele

Ans. (i) (a) Garden peas

- (ii) (a) girl
- (iii) (a) dominant
- (iv) (a) Genetics
- (v) (b) recessive

72. Read the passage carefully and answer the following questions from Q 72 (i) to 72 (v).

The study of heredity is called genetics. Traits are characteristics such as hair colour, eye colour, artistic or athletic ability, height, and more. Every living organism, plant, or animal, receives its characteristics or traits from its parents. In plants these traits may include seed colour, flower position, length of stem, and much more. The first person to discover this passing of traits was a scientist

named Gregor Mendel. He is considered as the father of genetics. He studied pea plants and discovered that certain traits were passed on, or inherited from parent to offspring.

- (i) Pure-breed pea plant A is crossed with pure-breed pea plant B. It is found that the plants which look like A do not appear in F_1 generation but re-emerge in F_2 generation. Which of the plants A and B are tall and dwarf?

- (a) A are tall and B are dwarf.
- (b) A are tall and B are also tall.
- (c) A are dwarf and B are also dwarf.
- (d) A are dwarf and B are tall.

- (ii) In humans if gene B gives brown eyes and gene b gives blue eyes, what will be the colour of eyes of the persons having combinations?

- (i) Bb and (ii) BB
- (a) (i) Blue and (ii) Brown
- (b) (i) Brown and (ii) Blue
- (b) (i) Brown and (ii) Brown
- (d) (i) Blue and (ii) Blue

- (iii) If a round, green seeded pea plant (RRyy) is crossed with a wrinkled yellow seeded pea plant (rrYY), the seeds produced in F_1 generation are:

- (a) round and green
- (b) round and yellow
- (c) wrinkled and green

- (d) wrinkled and yellow
- (iv) A cross between two individuals results in a ratio of 9: 3: 3:1 for four possible phenotypes of progeny. This is an example of a:
- (a) Monohybrid cross
 - (b) Dihybrid cross
 - (c) Test cross
 - (d) F_1 generation
- (v) A man with blood group A marries a woman having blood group O. What will be the blood group of the child?
- (a) O only
 - (b) A only
 - (c) AB
 - (d) Equal chance of acquiring blood group A or blood group O

Ans. (i) (d) A are dwarf and B are tall

(ii) (c) (i) Brown and (ii) Brown

(iii) (b) round and yellow

(iv) (b) Dihybrid cross

(v) (d) Equal chance of acquiring blood group A or blood group O.

73. Read the following and answer the following questions from Q. 73 (i) to 73 (v):

Gregor Johann Mendel is known as a “Father of modern genetics” for his work in the field of genetics. He gave three laws of inheritance followed as Law of dominance, Law of segregation and Law of independent assortment. He conducted his experiment on garden

pea plants having contrasting characteristics. He performed self-pollination and cross-pollination to understand the inheritance patterns of traits.

- (i) After cross-fertilisation of true-breeding tall and dwarf plants, the F₁ generation was self-fertilised. The resultant plants have genotype in the ratio:
- (a) 1:2:1 (homozygous tall: heterozygous tall: dwarf).
 - (b) 1:2:1 (heterozygous tall: homozygous tall: dwarf).
 - (c) 3:1 (tall: dwarf).
 - (d) 3:1 (dwarf: tall).
- (ii) Which of the following characteristics of pea plants was not used by Mendel in his experiments?
- (a) Seed colour
 - (b) Seed shape
 - (c) Pod length (d) Flower position
- (iii) Mendel took _____ contrasting characteristics of pea plants.
- (a) eight
 - (b) seven
 - (c) six
 - (d) five
- (iv) The maleness of a child is determined by:
- (a) the X-chromosome in the zygote.
 - (b) the Y-chromosome in zygote.

(c) the cytoplasm of germ cell which determines the sex.

(d) sex is determined by chance.

(v) Test cross determines:

(a) whether two traits are linked or not.

(b) the genotype of F_2 plant.

(c) whether the two species will breed successfully or not.

(d) number of alleles in a gene.

Ans. (i) (a) 1:2:1 (homozygous tall: heterozygous tall: dwarf).

(ii) (c) Pod length

(iii) (b) Seven

(iv) (b) the Y-chromosome in zygote

(v) (b) the genotype of F_2 plant.

74. Read the passage carefully and answer the following questions from Q 74 (i) to 74 (v).

Gregor Mendel, in 1865, paved the way for the analysis of the underlying genetic basis of traits by setting out to understand the principles of heredity. As per Darwin's observations, in nearly all populations individuals tend to produce far more offspring than are needed to replace the parents. He also observed that it is very rare for any two individuals to be exactly alike. All the natural variations among individuals lead to natural selection. Individuals born with variations that present an advantage in obtaining resources or mates have greater chances of living and reproducing offspring who would inherit and carry forward the favourable variations. At the same time, individuals with different variations might be less likely to reproduce.

- (i) VV, Vv and vv are _____, while violet and white are _____.
- (a) genotypes, phenotypes
 - (b) phenotypes, genotypes
 - (c) genotypes, genotypes
 - (d) phenotypes, phenotypes
- (ii) Which one of the following traits is most likely to pass from one generation to other?
- (a) Artificial hair coloured by a mother during pregnancy.
 - (b) Acquired skills by a father.
 - (c) Brown eye colour.
 - (d) Six fingers in right hand of a person.
- (iii) _____ is simply the generation of diversity and the shaping of the diversity by environmental selection.
- (a) Evolution
 - (b) Speciation
 - (c) Heredity
 - (d) Natural selection
- (iv) Which one of the following statements is not true?
- (a) Excavating, time-dating, studying fossils, and determining DNA sequences are tools to study evolution.
 - (b) Variations arising during the process of reproduction cannot be inherited.
 - (c) Variations in the species may confer survival advantages or

merely contribute to the genetic drift.

- (d) Classification of organisms is based on tracing evolutionary relationships.
- (v) Frequency of certain _____ in a population changes over generations to bring about evolution.
 - (a) members
 - (b) progenies
 - (b) genes
 - (d) ideas

Ans. (i) (a) genotypes, phenotypes

(ii) (c) Brown eye colour

(iii) (a) Evolution

(iv) (b) Variations arising during the process of reproduction cannot be inherited

(v) (c) genes

75. Read the passage carefully and answer the following questions from Q 75 (i) to 75 (v).

Inheritance is the acquiring of genetic characteristics or traits from parents by their offspring. In humans, both parents equally contribute to the inheritance of traits. In 1860, Gregor Mendel studied the rules of inheritance of traits. He conducted an experiment on pea plants for the same. He cultivated pea plants and observed their pattern of inheritance from one generation to the next generation. This observation resulted in the discovery of three laws of inheritance, famously known as Mendel's laws of Inheritance.

(i) _____ is the observable set of characteristics of an organism.

- (a) Phenotype
- (b) Genes
- (b) DNA
- (d) All of these

(ii) Select the statements that describe characteristics of genes:

- (A) Genes are specific sequence of bases in a DNA molecule.
- (B) A gene does not code for proteins.
- (C) In individuals of a given species, a specific gene is located on a particular chromosome.
- (D) Each chromosome has only one gene.

- (a) (A), (B)
- (b) (A), (C)
- (c) (A), (D)
- (d) (B), (D)

(iii) A group of moths some brown and some green lived in a grassland having dry bushes and dry grass. This phenomenon is called:

- (a) Variation
- (b) Natural selection
- (b) Mutations
- (d) None of them

(iv) The two versions of a trait which are brought in by the male and female gametes are situated on :

- (a) copies of the same chromosome.

- (b) two different chromosomes.
- (c) sex chromosomes.
- (d) any chromosomes.
- (v) If a round, green seeded pea plant (RRyy) is crossed with wrinkled, yellow seeded pea plant (rrYY), the seeds produced in F1 generation are :
 - (a) round and yellow
 - (b) round and green
 - (c) wrinkled and green
 - (d) wrinkled and yellow

Ans. (i) (a) Phenotype

(ii) (b) (A), (C)

(iii) (b) Natural selection

(iv) (a) copies of the same chromosome

(v) (a) Round and yellow

76. Read the passage carefully and answer the following questions from Q 76 (i) to 76 (v).

A genetic disorder is an inherited medical condition. It can be passed from parents to their children. Examples include cystic fibrosis, sickle cell disease and haemophilia.

Parents who are heterozygous for these conditions are called carriers. They do not usually have the disorder themselves. This is shown in this Punnett square for cystic fibrosis.

An individual who is homozygous (cc) with the recessive allele will develop cystic fibrosis.

	C	c
C	CC	Cc
c	Cc	cc

(i) State the probability percentage of children Without cystic fibrosis

(a) 75%

(b) 25%

(c) 10%

(d) 5%

(ii) State the probability percentage of children with cystic fibrosis.

(a) 75%

(b) 25%

(c) 10%

(d) 5%

(iii) Genetic disorders are:

(a) Inherited

(b) Acquired

(c) Cannot be determined

(d) None of the above

(iv) Which of the following statement is correct in reference to cystic fibrosis?

(a) Two heterozygous parents (carriers) have a two in four chance of passing it to their children.

(b) Two heterozygous parents (carriers) have a one in four chance of

passing it to their children.

- (c) Two heterozygous parents (carriers) have a three in four chance of passing it to their children.
- (d) Two heterozygous parents (carriers) will surely pass it to their children.
- (v) State the probability of percentage of children with cystic fibrosis, if the parents are homozygous (cc) with the recessive allele.
 - (a) 75%
 - (b) 25%
 - (c) 100%
 - (d) 5%

Ans. (i) (a) 75%. Since, An individual who is homozygous (cc) with the recessive allele will develop cystic fibrosis. Without cystic fibrosis – three from four so 75%

(ii) (b) With cystic fibrosis – one from four so 25%

(iii) (a) Inherited

(iv) (b) one

(v) (c) 100%

Very Short Answer Type Questions

77. What is the functional unit of heredity?

Ans. Genes.

78. How many laws were given by Mendel?

Ans. Three laws.

79. What is Law of Dominance?

Ans. Law of Dominance says that a gene has two contrasting alleles and one always expresses itself in the organism.

80. What are homologous chromosome?

Ans. A pair of similar chromosomes (one received from the father and one from the mother) containing the same genes are termed homologous chromosomes.

81. Where are genes located?

Ans. Genes are found on tiny spaghetti-like structures called chromosomes

82. What will be the blood group of an individual with genetic combination IA IB?

Ans. An individual with genetic combination IA IB, will have blood group AB.

83. Which is the safest blood group for donation if an accident victim of an unknown blood group has to be given immediate blood transfusion?

Ans. Sometimes there may not be time or facility available for prior ascertaining of the blood group. Immediate blood transfusion is possible if the blood group is known. If unknown, the safest blood group for transfusion is O negative (O group and Rh-).

84. How can a person be normal for a trait even when carrying one defective gene for that trait?

Ans. The other member of the pair is dominant and masks the effect of the recessive gene.

85. How does the creation of variations in species promote survival?

[NCERT]

Ans. The changes in the environment brings out Variations in the species. Such variations enable stability to the population of various species by preventing them from getting wiped out during adverse conditions. Thus, variations help a species in survival.

86. What are the different ways in which individuals with particular trait may increase in a population?

[NCERT]

Ans. The different ways in which individuals with particular trait may increase in a population are natural selection, genetic drift and availability of food in abundance.

87. Why are traits acquired during the lifetime of an individual not inherited? [NCERT]

Ans. The traits which are acquired during the individual's lifetime do not cause changes in the DNA of germ cells which are transmitted through generations, but they produce changes only in the somatic cells which are not transmitted. Hence traits acquired during the lifetime of an individual are not inherited.

88. What factors could lead to the rise of a new species? [NCERT]

Ans. The factors that could lead to the rise of a new species are genetic variations, genetic drift, reproductive isolation and natural selection.

89. When a black guinea pig is crossed with a white guinea pig, what coloured guinea pigs are obtained in F₁ generation if black colour is dominant over white?

Ans. Guinea pigs of black colour will be obtained in F₁ generation.

90. In a cross between a tall pea plant (TT) and a short pea plant (tt), what will be the characteristics shown by the F₁ generation?

Ans. As Tall is a dominant trait and short is recessive so in F₁

generation plants will be tall (Tt).

- 91.** In a cross between round yellow seeds (RRYY) and wrinkled green seeds (rryy) of pea plant, what is the ratio of plants obtained in F₂ generation?

Ans. The ratio of plants obtained in F₂ generation is 9: 3: 3: 1.

- 92.** In turtle, high incubation temperature leads to the development of female offspring. On the other hand in lizards, high incubation temperature leads to the development of male offspring. What determines the sex of the offspring in these examples?

Ans. In the examples given in the question sex of the offspring is determined by environmental factors.

- 93.** All the variations in a species do not have equal chances of survival. Why?

Ans. According to 'Survival of the fittest', only the species which can adapt themselves to the environment can survive. Selection of the variants occurs by the different environmental factors. This forms the basis for evolution. Also, when a new change or variation occurs it means that the DNA constitution and the bodily cell apparatus also undergo genetic changes which result in the formation of a new variant. However, this change in the DNA might not be able to survive in the new environment. So, the DNA may get damaged and may stop functioning regularly which will affect the survival of the variant. The variations or the changes that are helpful and help in the evolution of the species will survive while the others will perish.

- 94.** How do the variations in a species promote survival?*

Ans. Variations increases the adaptability of an individual to its changing environment thus promotes survival of the species.

95. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plant bearing white flowers. What will be the result in F_1 progeny?*

Ans. All the progeny of F_1 generation will have violet flowers because violet colour is dominant over the recessive white colour.

96. Give the respective scientific terms used for studying:

(i) The mechanism by which variations are created and inherited.

(ii) The development of new type of organisms from the existing ones.

97. What is a recessive trait?

Ans. A trait which is not expressed in the presence of a dominant allele is known as recessive.

98. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plant bearing white flowers. What will be the result in F_1 progeny?*

Ans. All the progeny of F_1 generation will have violet flowers because violet colour is dominant over the recessive white colour.

Ans. (i) Genetics

(ii) Evolution

99. Give any two examples where sex determination is regulated by environmental factors ?

Ans. In turtles and lizards sex determination is regulated by environmental factor temperature. In turtle high incubation temperature leads to development of female offsprings. In lizards high incubation temperature leads to development of male offsprings.

100

- . What will be the sex of a child who inherits Y chromosome from his or her father?

Ans. The child will be a male because the sex chromosome that the child inherits from his or her father will determine the sex as mother has only X chromosome. Here as the child inherits Y chromosome from his father so he will be a male (XY).

101

- . Do genetic combinations of mothers play a significant role in determining the sex of a new born?

Ans. No, because mother has only one type of sex chromosomes *i.e.*, X chromosomes but a father has two types of chromosomes X and Y chromosomes. So all children will inherit X chromosome from mother and whether X or Y bearing sperm from father fertilise the egg will determine the sex of new born.

102

- . How many pairs of chromosomes are autosomes?

Ans. Out of the 23 pairs of chromosomes, 22 pairs are termed autosomes. The 23rd pair (X and X in females and X and Y in males) are called sex chromosomes.

103

- . Why Pre-natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994, was enacted?

Ans. The Pre-natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994, was enacted and brought into operation from 1st January, 1996, in order to check female foeticide. The Act prohibits determination and disclosure of the sex of foetus. It also prohibits any advertisements relating to pre-natal determination of sex and prescribes punishment for its contravention. The person

who contravenes the provisions of this Act is punishable with imprisonment and fine.

104

- . Discuss the types of egg and sperm in reference to X and Y chromosome.

Ans. Ova or eggs are of one kind only. These contain 22 autosomes and a single X chromosome. Sperms are of two kinds (i) having 22 autosomes and one X chromosome, or (ii) having 22 autosomes and a Y chromosome

105

- . If Y bearing sperm fuses with the egg what will be the sex of the child? Also state the chromosomal constitution.

Ans. If Y bearing sperm fuses with the egg then a male child results with chromosomal constitution of 44 autosomes and one X and one Y chromosome.

106

- . How many X chromosomes can be found in the cells of the body of (i) a boy, and (ii) a girl.

Ans. Females have two X chromosomes, while males have one X and one Y chromosome.

107

- . If a X bearing sperm fuses with an egg, what will be the sex of the individual developing from the zygote?

Ans. When X bearing sperm fuses with the egg, a female child results with 44 autosomes, and two X chromosomes.

Reasoning Based Questions

108

- . Give reasons why acquired characters are not inherited?

Ans. The changes in the environment brings out Variations in the species. Such variations enable stability to the population of various species by preventing them from getting wiped out during adverse conditions. Thus, variations help a species in survival.

109 . Why do all the gametes formed in human females have an X-chromosome? [NCERT]

Ans

- . The sex chromosome in human female is homomorphic *i.e.*, they contain same chromo-some XX. During meiosis process at the time of gamete formation all egg cells will get one copy of X chromosome, hence all the gametes formed in human females have an X-chromosome.

Short Answer Type Questions

110.How can variation occur in asexually reproducing organisms?

Ans. There would be only very minor differences in asexual reproduction, generated due to small inaccuracies in DNA copying. Unlike sexual reproduction, asexual reproduction only introduces genetic variation into the population if a random mutation in the organism's DNA is passed on to the offspring.

111.What are mutations? Can mutation be inherited?

Ans. A mutation is a random change in DNA which therefore affects a gene and/or chromosome. Most mutations have no effect on the phenotype. Some influence phenotype to some extent. Very few create a new phenotype. Mutations can be inherited and therefore passed on from one individual to another. If a mutation causes a new phenotype that makes an organism better suited to a

particular environment, it can lead to rapid change in the characteristics of the individuals in that species.

112.(i) State the observation of Mendel on self-pollination of first generation plants.

(ii) Which is a small section of DNA that is the genetic code for a characteristic?

Ans. (i) Mendel cross-breed peas with 7 pairs of pure-breed traits. First-generation (F1) progeny only showed the dominant traits, but recessive traits reappeared in the self-pollinated second-generation (F2) plants in a 3:1 ratio of dominant to recessive traits.

(ii) A gene is a small section of DNA which is the genetic code for a characteristic.

113. Here are the three possible genotypes for hair length in cats. Complete the table below, Remember short hair is dominant.

Genotype	Phenotype
HH (homozygous dominant)	
Hh (heterozygous)	
hh (homozygous recessive)	

Ans.

Genotype	Phenotype
HH (homozygous dominant)	Short hair
Hh (heterozygous)	Short hair - because H is dominant over <i>h</i>
hh (homozygous recessive)	Long hair

114.(i) Will all organisms from a cross between two homozygous dominant organisms would have the same phenotype?

(ii) What proportion of offspring from BB v Bb would be BB?

(iii) What proportion of offspring from Cc v Cc would be cc?

- (iv) What proportion of offspring from $tt \times Tt$ would be tt ?
- (v) What proportion of offspring from two homozygous recessive organisms would be homozygous recessive?

Ans. (i) True, all organisms from a cross between two homozygous dominant organisms would have the same phenotype which would be homozygous dominant.

(ii) 50% of offspring would be BB (homozygous dominant) and the other 50% would be Bb (heterozygous).

(iii) One in four (25%) of offspring would be cc (homozygous recessive). Another 25% would be CC (homozygous dominant) and the final 50% would be Cc (heterozygous).

(iv) 50% of offspring would be tt (homozygous recessive) and the other 50% would be Tt (heterozygous).

(v) All offspring (100%) would be homozygous recessive. Without a dominant gene or genes offspring cannot result in heterozygous or homozygous dominant.

115. Complete the square below for two heterozygous short-haired cats. Work out the probability percentage of genotype and phenotype of the offspring, remember short hair (H) is dominant.

	H	h
H		
h		

Ans.

	H	h
H	HH	Hh
h	Hh	hh

- HH – one from four so 25%
- Hh – two from four so 50%

- hh – one from four so 25%
- Short hair – three from four so 75%
- Long hair – one from four so 25%

116. Characteristics in an individual organism are caused by both genetic and environmental variation. Complete the table below stating whether the characteristic is genetic or environmental variation.

Trait	Genetic only / Environmental only/ can be both
Eye colour	
Tattoos	
Attached earlobes	
Weight	

Ans.

Trait	Genetic only / Environmental only/ can be both
Eye colour	Genetic only
Tattoos	Environmental only
Attached earlobes	Genetic only
Weight	can be both

117. A study found that children with light coloured eyes are likely to have parents with light-coloured eyes. On this basis can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not?[NCERT]

Ans. No we cannot say whether the light eye colour trait is dominant or recessive as the child inherits one copy of the trait from father and other from mother and here nature of the trait is not known. The nature can be known from at least three generations but here data is given only for two generations i.e., parents [P] and offsprings [F1].

118. Only variations that confer an advantage to an individual organism will survive in a Population. Do you agree with this statement? Why

or why not?[NCERT]

Ans. Yes, we agree with this statement that only variations that confer an advantage to an individual organism will survive in a population because those variations which occur in an individual that favours the organism to get adapt to the environment will be able to survive otherwise it may not. The chances of survival depend upon the nature of variations. Different individuals would have different kinds of advantages. For example— A bacteria which can withstand heat will be able to survive in hot springs otherwise it will die. Selection of variants by environmental factors forms the basis for evolutionary process.

119.Gene controls traits. Explain this with an example?

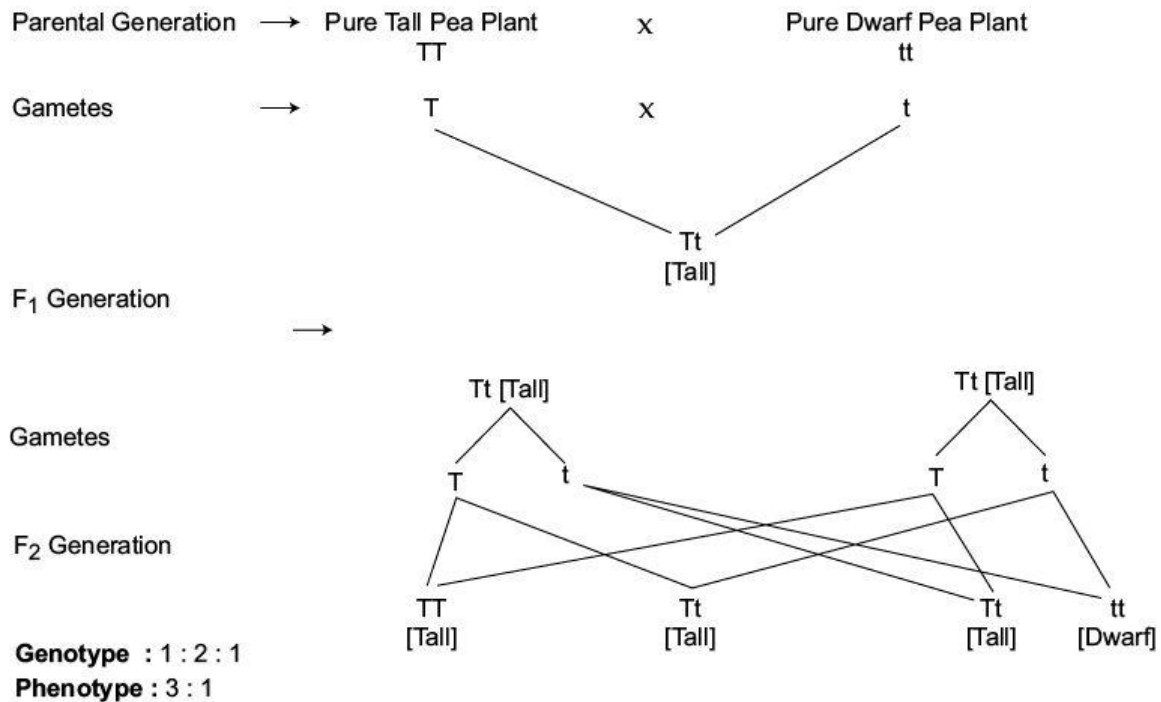
Ans. Genes are a specific sequence on nucleotides on chromosome which encodes a particular protein which express in form of a particular trait in the body. Each gene has two alternative forms for a particular character. These alternative forms are called alleles, one is dominant allele and other is recessive allele. For example – Height of a plant, plant height depends on the amount of hormones synthesised. The amount of hormones synthesised depends upon the efficiency of the process for making it. If the protein needed for this process is synthesised and works efficiently plant would be tall. On the other hand if the gene is altered, the protein synthesised will be less efficient and hence hormones produced would be less and plant would be dwarf.

120

- . How do Mendel's experiments show that traits may be dominant or recessive? [NCERT]

Ans. When Mendel crossed pure tall (TT) pea plants with pure dwarf (tt) pea plants, in F_1 generation he found that all pea plants were tall (Tt). There were no dwarf plants produced in F_1 generation. When

he self-pollinated these F_1 plants, in F_2 generation he obtained tall and dwarf plants in the ratio 3: 1. Thus as three-fourths of the plant in F_2 generation are tall and one-fourth is dwarf so tall is a dominant trait whereas dwarf is a recessive trait [which expressed itself only in homozygous condition]. So he concluded that for a particular trait [here in this example height of the plant] it may be dominant or recessive.



121

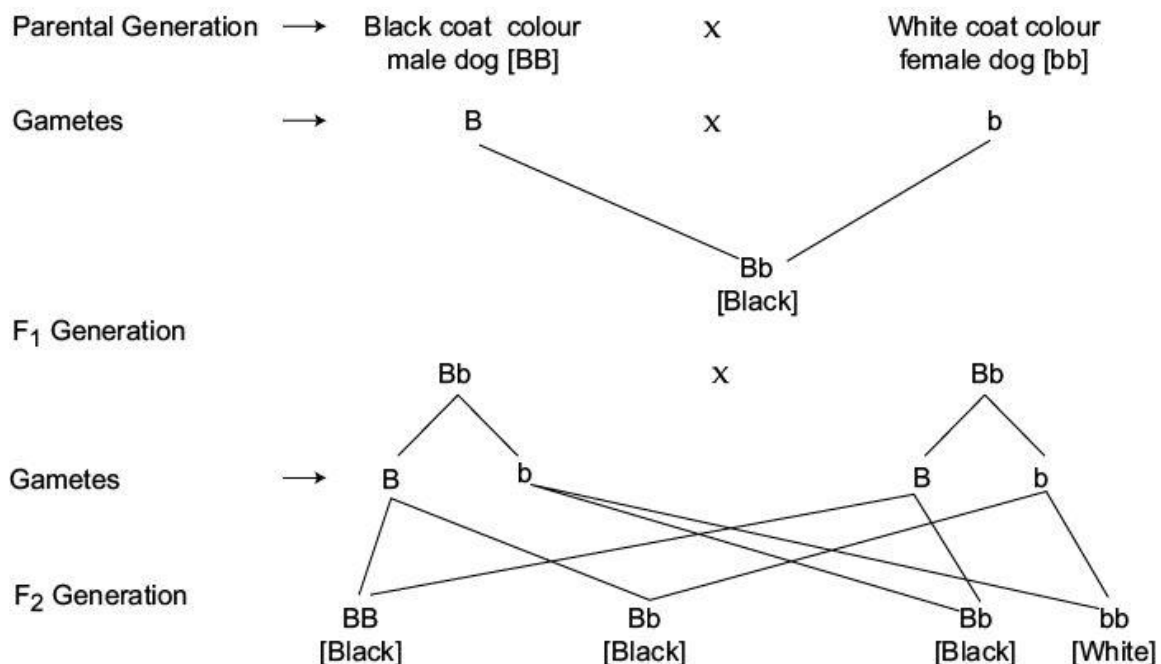
- . If a trait A exists in 10% of a population of an asexually reproducing species and trait B exists in 60% of the same population, which trait is likely to have arisen earlier? **[NCERT]**

Ans. Trait B would have arisen earlier than trait A because as species are asexually reproducing, there would be very minor differences generated due to small inaccuracies in DNA copying which results in variations in trait A. But as trait B occurs in more number in the population as compared to trait A so Trait B would have arisen earlier than trait A.

122

- Outline a project which aims to find the dominant coat colour in dogs.
[NCERT]

Ans. Consider a homozygous black coat colour male dog (BB) breed with homozygous white coat colour female dog (bb). In F_1 generation all dogs with black coat colour are produced. When these are again bred we get black and white coat colour dogs in F_2 generation in the ratio 3 : 1. Thus we can say black colour is dominant over white.



123

- A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits blood group A or O is dominant? Why or why not? [NCERT]

Ans

- No, this information is not enough to find out which blood group is dominant. Blood group A can be represented as IAIA or IAIO which is the father's blood group. Blood group O is represented as IOIO which

is the mother's blood group. The blood group of daughter is also O which might be inherited from her mother or father so it is difficult to assume which blood group is dominant.

124

- . A study found that children with light coloured eyes are likely to have parents with light-coloured eyes. On this basis can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not? [NCERT]

Ans. No, we cannot say whether the light eye colour trait is dominant or recessive as the child inherits one copy of the trait from father and other from mother and here nature of the trait is not known. The nature can be known from at least three generations but here data is given only for two generations *i.e.*, parents [P] and offsprings [F_1].

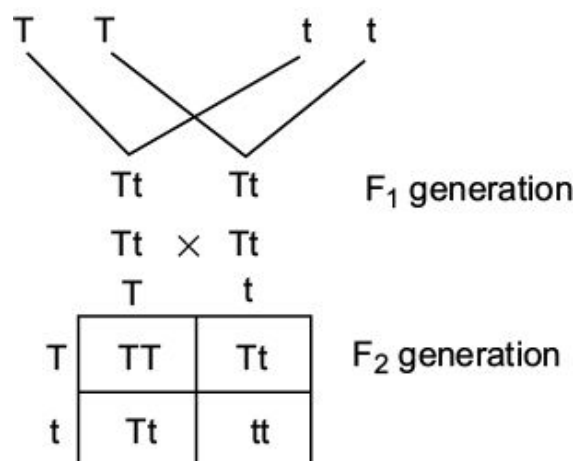
125

- . Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants.**

Ans. Mendel used pea plant (*Pisum sativum*) when he crossed tall and short plants the progeny obtained in F_1 generation were tall. When the F_1 plants were selfed the F_2 generations showed three tall and one dwarf plant. The genotypic ratio of F_2 generation is 1: 2: 1.

(TT: Tt: Tt: tt)

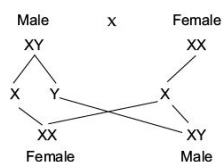
The phenotypic ratio 3: 1 (Tall: Dwarf)



126

. How is the sex of the child determined in human beings? [NCERT]

Ans. In human beings, there are two types of sex chromosome X and Y; female have XX chromosome whereas male have XY chromosome. Females produce eggs which carry only X chromosomes but males contain half of the sperms with X chromosomes and other half with Y chromosomes. During fertilisation when X carrying sperms fuse with an egg which contains X chromosome the offsprings will be a female (XX). But when Y bearing sperms fuse with an egg (X) the offspring will be male (XY). Thus the sex of a child is determined by the type of sex chromosome X or Y received by the male gamete.



127

. Answer the following:

- Who are more closely related— A brother and sister or two cousins? Why?
- Why do all the gametes formed in human females have an X-chromosome ?

Ans. (i) A brother and sister are more closely related than two cousins as they have a common ancestor.

(ii) The sex chromosome in human female is homomorphic *i.e.*, they contain same chromosome XX. During meiosis process at the time of gamete formation all egg cell will get one copy of X chromosome, hence all the gametes formed in human females have an X chromosome.

128

- . How is the equal genetic contribution of male and female parents ensured in the progeny? [NCERT]

Ans. Human beings contain 23 pairs of chromosomes-22 pairs are autosomes and one pair sex chromosomes. During meiosis process gametes are formed in sex cells where the chromosome number is halved(n). At the time of fertilisation when male gamete fuses with female gamete the diploid number ($2n$) is restored back in zygote. Thus half of the chromosomes come from father and other half from mother. In this way meiosis process ensures equal genetic contribution of male and female parents in the progeny.

129

- . Why are human beings who look so different from each other in terms of size, colour and looks said to belong to the same species? [NCERT]

Ans. Human beings belong to a same species called *Homo sapiens*. Based on the study of fossils, molecular phylogeny involving DNA sequence though human beings, who look so different from each other in terms of size, colour and looks belong to a single species. The study of fossils suggests that they have originated in Africa. Gradually their number increases and they spread throughout the whole continent, some also migrate to other parts of the world. The geographical and climatic variations in different regions lead to

variations in their genes as a result their colour, looks, size also varies.

130

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131

- . How many pairs of chromosomes are present in human beings? Out of this how many are sex chromosomes? How many types of sex chromosomes are found in human beings?

Ans. There are 23 pairs of chromosomes present in human beings. One pair is sex chromosome. They are XX and XY. So there are two types of sex chromosomes.

132

- . How many pairs of chromosomes are present in human beings? Out of this how many are sex chromosomes? How many types of sex chromosomes are found in human beings?*

Ans. There are 23 pairs of chromosomes present in human beings. One pair is sex chromosome. They are XX and XY. So there are two types of sex chromosomes.

 **Long Answer Type Questions** 

133

- . Why did Mendel choose pea plants for his experiments? Give any five reasons.

Ans. Mendel is known as the father of modern genetic because of genetic experiments with Pea or *Pisum Sativum*. The reason for the selection of pea plants for the genetic experiments are:

- (a) Easy to grow in the garden.

134

- . Give the basic features of the mechanism of inheritance?

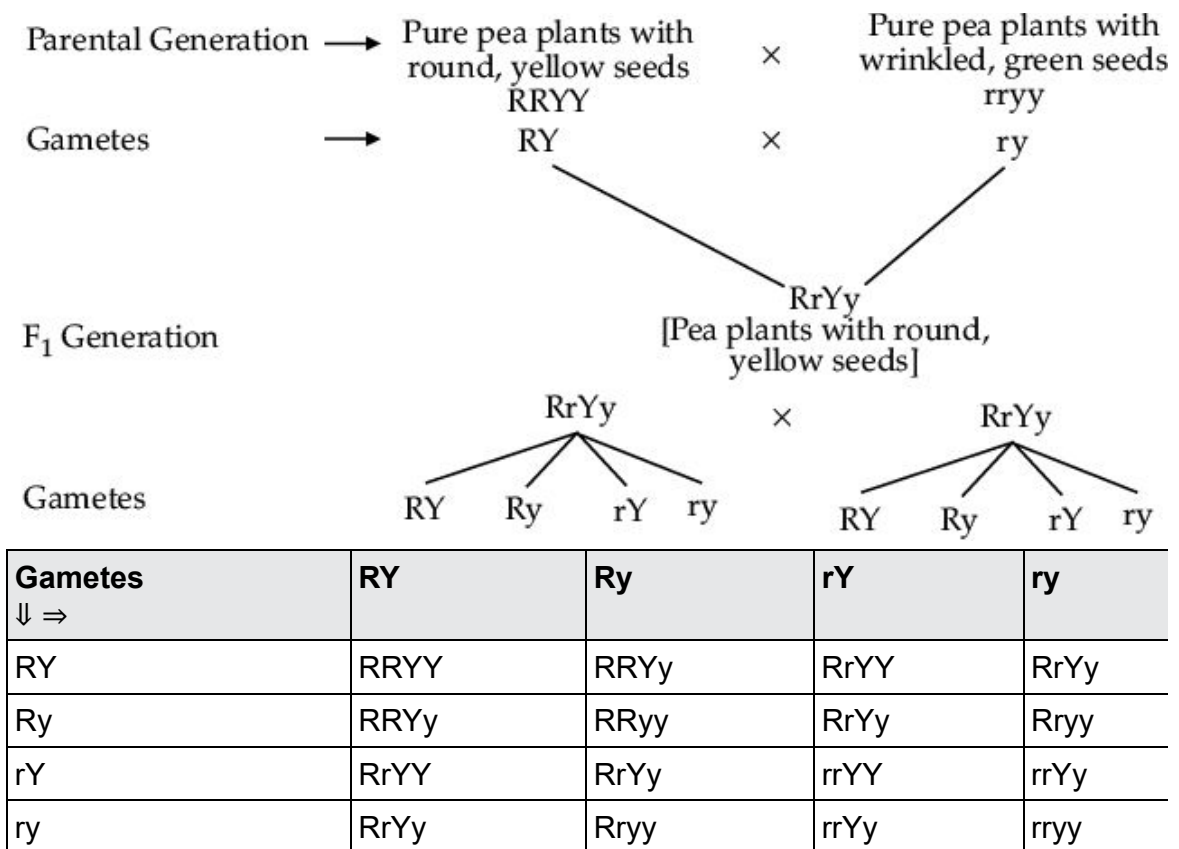
Ans. The basic features of mechanism of inheritance are:

- (a) Traits are controlled by genes.
- (b) Genes are present on chromosome
- (c) Each gene controls one character.
- (d) There may be two or more forms of a gene.
- (e) One form may be dominant over the other.
- (f) An individual possesses two forms of genes which may be similar or dissimilar.
- (g) The two forms of gene separate at the time of gamete formation.
- (h) The two forms of gene are brought together in a zygote after fertilisation.

135

- . Give the cross between RRYy x rryy for both F1 and F2 generation? What are the combinations of characters produced in F2 generation and give reasons for appearance of new progeny?

Ans.



Round-yellow, round-green, wrinkled-yellow, wrinkled-green in the ratio of 9: 3: 3: 1 are produced in F₂ generations. New characters round-green and wrinkled-yellow are produced because when pure round-yellow pea plants are crossed with pure wrinkled-green pea plants the inheritance of one pair of character is independent of other pair i.e., the inheritance of character of round seed is not linked with yellow seed or the inheritance of wrinkled seed is not linked with green seed. The contrasting traits segregate and inherit independently and results in the formation of new combination of characters.

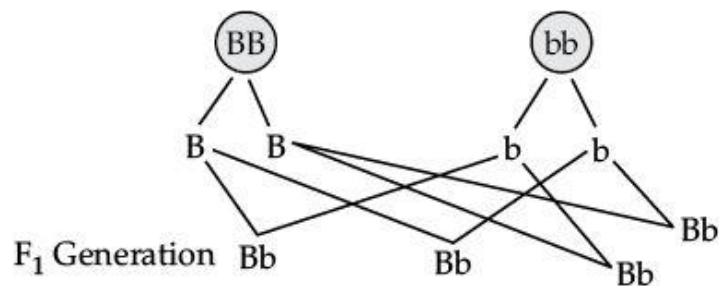
- (b) The flowers of pea plants are hermaphrodite, i.e flowers have bisexual characteristics.
- (c) Easy to obtain pure breed plant through self-fertilisation
- (d) The generation time of pea plants is less.

- (e) They have excellent disease resistance and have an optimal rate of survival.

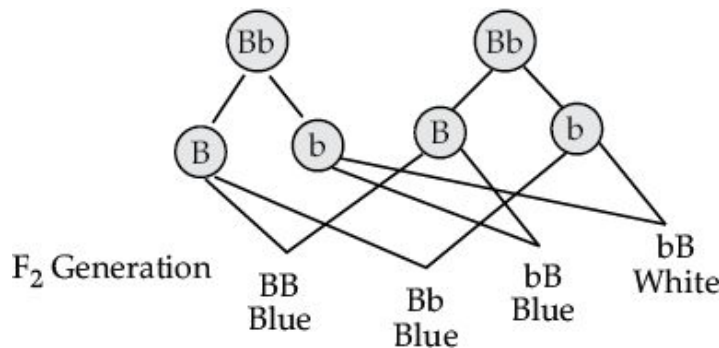
136

- . A blue flower plant denoted by BB is crossed with that of white coloured flower plant denoted by bb.
- (i) State the colour of flower you would expect in their F_1 generation plants.
- (ii) What must be the percentage of white flower plants in F_2 generation if flower of F_1 plants are self – pollinated?
- (iii) State the expected ratio of the genotypes BB and bb in the F_2 progeny?

Ans. (i) In the first generation *i.e.* in F_1 , generation, all the flower plants will be of blue colour. It can be shown as follows:



- (ii) When flowers of f_1 generation are self-pollinated:



So, in F_2 generation, there will be three blue Flowers and one white flower. So the ratio of blue flower plant to ratio of white flower plant is

3 : 1 but we need to find the ratio percentage of white flower which is calculated as follows:

$$\text{Percentage} = \frac{\text{no. of white flower plant}}{\text{Total plants in F}_2 \text{ generation}} \times 100$$

$$\frac{1}{4}$$

$$\text{Percentage} = \quad \times 100$$

So, Ratio percentage of white flower plant is 25%

(iii) The expected ratio of the genotypes BB and Bb in the F₂ progeny is as follows:

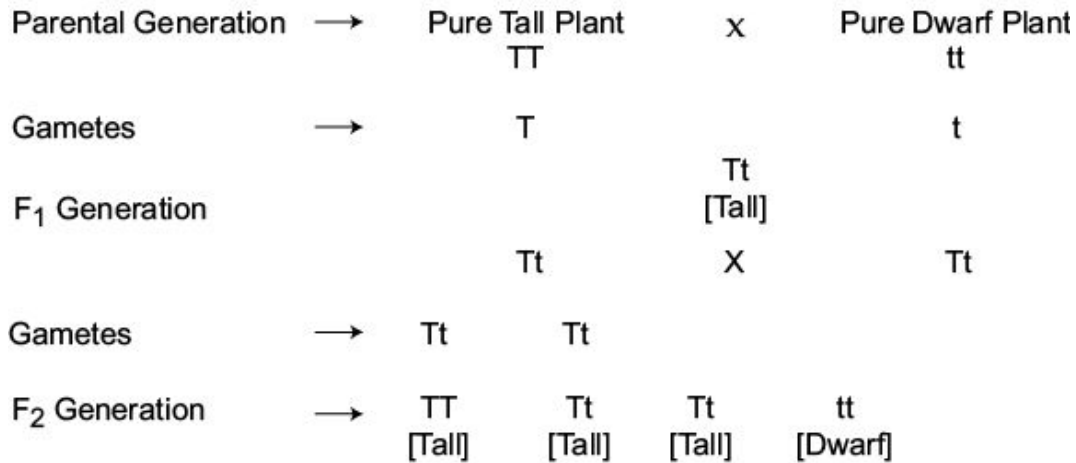
Genotype in F ₂ generation:	BB	Bb	Bb	bb
Phenotype in F ₂ generation:	Blue	Blue	Blue	White

137

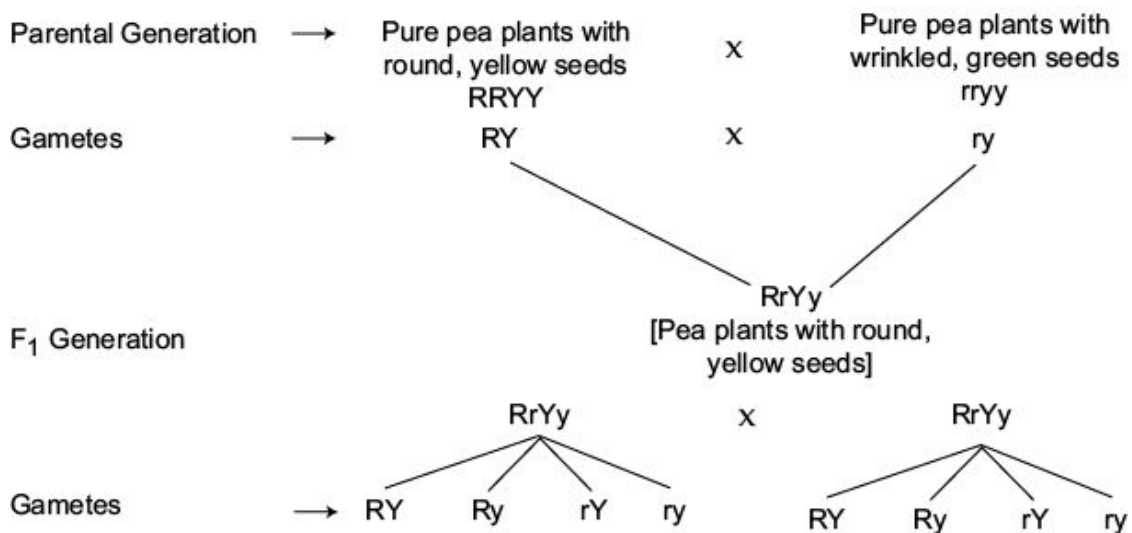
. How do Mendel's experiments show that the:****

- (i) Traits may be dominant or recessive
- (ii) Traits are inherited independently.

Ans (i) When Mendel crossed pure tall pea plants with pure dwarf pea plants in F₁ generation only tall plants were produced. When these F₁ plants were self-pollinated in F₂ generation both tall and dwarf plants were produced in the ratio of 3: 1. In F₁ generation only tall plants were found so it showed that tall is a dominant character. In F₂ generation dwarf plants appeared which shows that dwarf is a recessive trait which is expressed only in recessive condition.



- (ii) When Mendel crossed pure pea plants with round, yellow seeds with pure plants with wrinkled, green seeds in F₁ generation all pea plants with round and yellow seeds were produced. This shows that round and yellow are dominant characters whereas green and wrinkled are recessive characters. Again when these F₁ plants were crossed round, yellow pea plants as well as green, wrinkled seeds pea plants were produced. But in addition to these two new characters were produced i.e., round and green, wrinkled and yellow seeds pea plants were produced. This shows that two pair of characters combine in F₁ generation but they get separated and behave independently in F₂ generation.



Gametes ↓ →	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Round-yellow, round-green, wrinkled-yellow, wrinkled-green – 9: 3: 3: 1

138

. Answer the following questions:

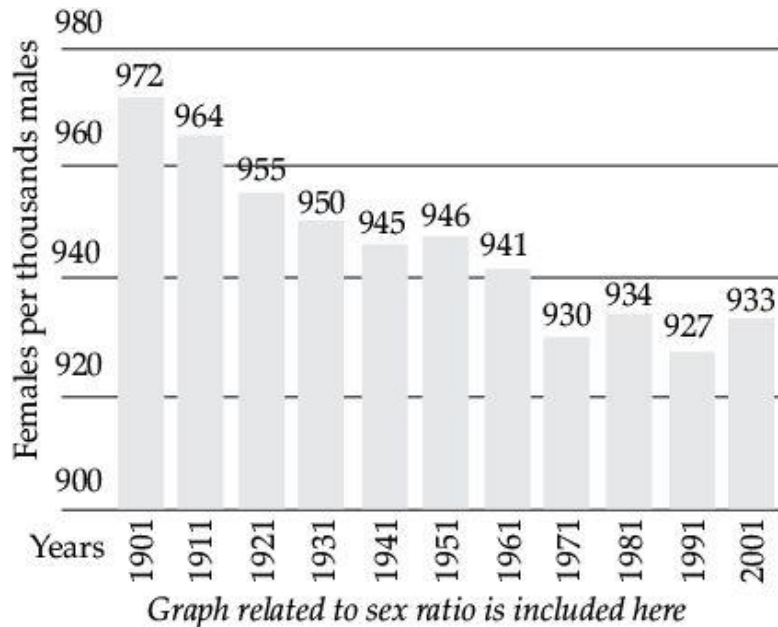
- (i) What are dominant and recessive traits?*
- (ii) “Is it possible that a trait is inherited but may not be expressed in the next generation? Give a suitable example to justify this statement.*

Ans. (i) The trait which can express its effect over contrasting trait is called dominant trait whereas the trait which cannot express its effect over contrasting trait or which gets suppressed by the contrasting trait is called recessive trait. The inherited trait which is not expressed will be a recessive trait.

- (ii) In Mendel's experiment, when pure tall pea plants were crossed with pure dwarf pea plants, only tall pea plants were obtained in F_1 generation. On selfing the pea plants of F_1 generation both tall and dwarf pea plants were obtained in F_2 generation. Reappearance of the dwarf pea plants in F_2 generation proves that the dwarf trait was inherited but not expressed in F_1 generation. The recessive trait does not express itself in the presence of the dominant trait. So, it is possible that one trait may be inherited but may not be expressed in an organism.

139

- . The given box diagram represents the ratio of females to males or the sex ratio in our country for 10 decades (1901 to 2001). Answer the following questions in the light of your knowledge of sex determination and the data presented in the box diagram.*****



- (i) What does the bar diagram show?
- (ii) As per scientific knowledge regarding sex determination, what should be the sex ratio or the male to female ratio at a given point of time?
- (iii) Assign one reason to the trend showing deviation from the expected sex ratio.
- (iv) Suggest a way by which such a trend can be stopped.

Ans. (i) Bar diagram shows the proportion of females in the population over a decade.

(ii) 1 : 1

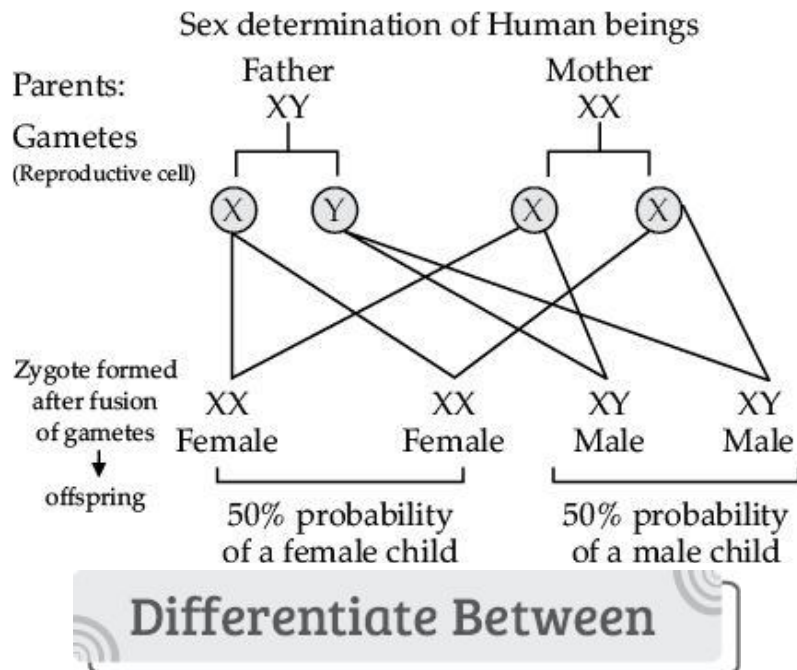
(iii) Female foeticide

- (iv) Banning sex tests of unborn baby; increasing awareness and education.

140

- . The sex of a new born child is a matter of chance and none of the parents may be considered responsible for it. Draw a flowchart showing determination of sex of a newborn to justify this statement.*

Ans. In human beings, there are two types of sex chromosome X and Y; female have XX chromosome whereas male have XY chromosome. Females produce eggs which carry only X chromosomes but males contain half of the sperms with X chromosomes and other half with Y chromosomes. During fertilisation when X carrying sperms fuse with an egg which contains X chromosome the offsprings will be a female (XX). But when Y bearing sperms fuses with an egg (X) the offspring will be male (XY). Thus the sex of a child is determined by the type of sex chromosome X or Y received by the male gamete.



141

- . Difference between Recessive and Dominant Traits

Ans.

Dominant Trait	Recessive Trait
(a) Dominant traits are always expressed when the connected allele is dominant, even if only one copy exists.	Recessive traits are expressed only if both connected alleles are recessive. If one of the alleles is dominant, then the associated characteristic is less likely to manifest.
(b) Dominant allele is denoted by a capital letter.	Recessive allele is denoted by a small letter.

142. List two differences between acquired traits and inherited traits by giving an example of each.*

Ans

Acquired traits	Inherited traits
(a) These are somatic variations and do not bring any change in DNA.	These are genetic variations and bring about changes in the DNA.
(b) These traits develop throughout the life time of an individual. Example, learning of dance and music.	These traits are transferred by or (inherited) by the parents to the offspring. Example, Eye colour, hair colour.

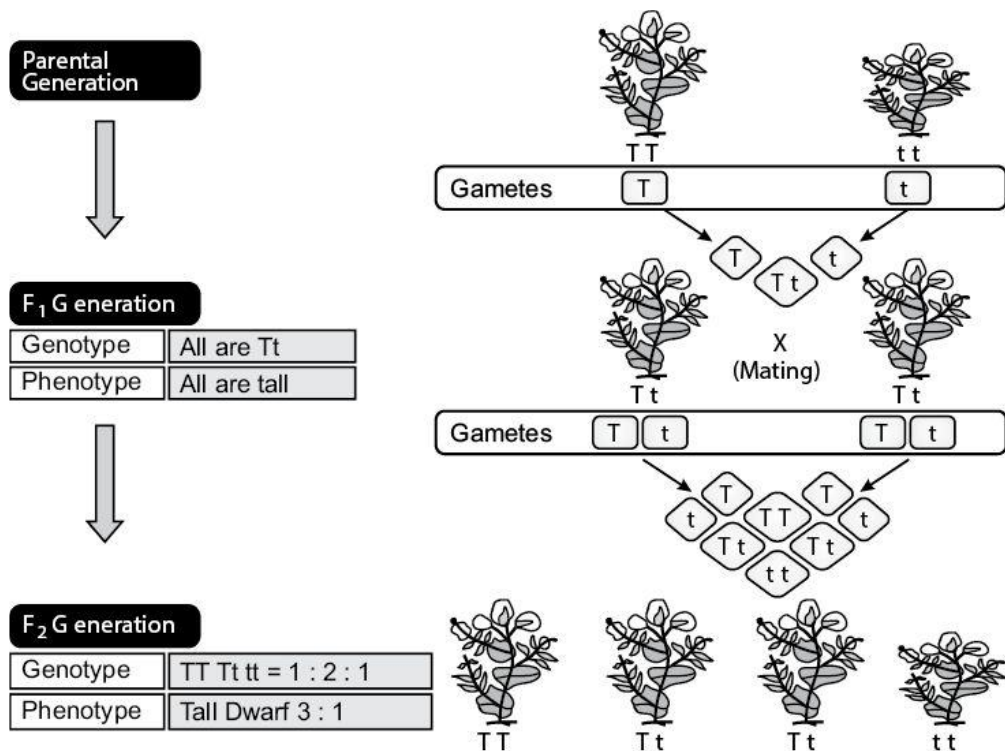
Analysis and Evaluation Based Questions

143

- . Study carefully the given flowchart depicting cross between pea plant with yellow seeds and pea plant with green seeds and answer the following:
 - (i) What kind of cross it depicts?
 - (ii) In which proportions the characters will appear in F_1 and F_2 generation?

- Male pea plant with yellow seeds × Female pea plant with green seeds
- ↓ ↓
-
- F₁ Generation → ?
- ↓ Self pollination
- F₂ Generation → ?

one generation to the other in these plants.



- Name which Mendel's experiments shows that traits are inherited indepe dently?
- What is observed by Mendel in his experiment about the phenotype and genotype?
- Define the term Genotype.
- What do you understand by dominant alleles?

Ans. (i) The Dihybrid cross experiment that Mendel performed with the pea plants, shows that traits are inherited independently. In a cross between two plants with two pairs of contrasting characters, the expression of traits occurs independently.

- In F₂, the phenotype ratio is 9: 3: 3: 1. The genotype ratio is a very complex one.

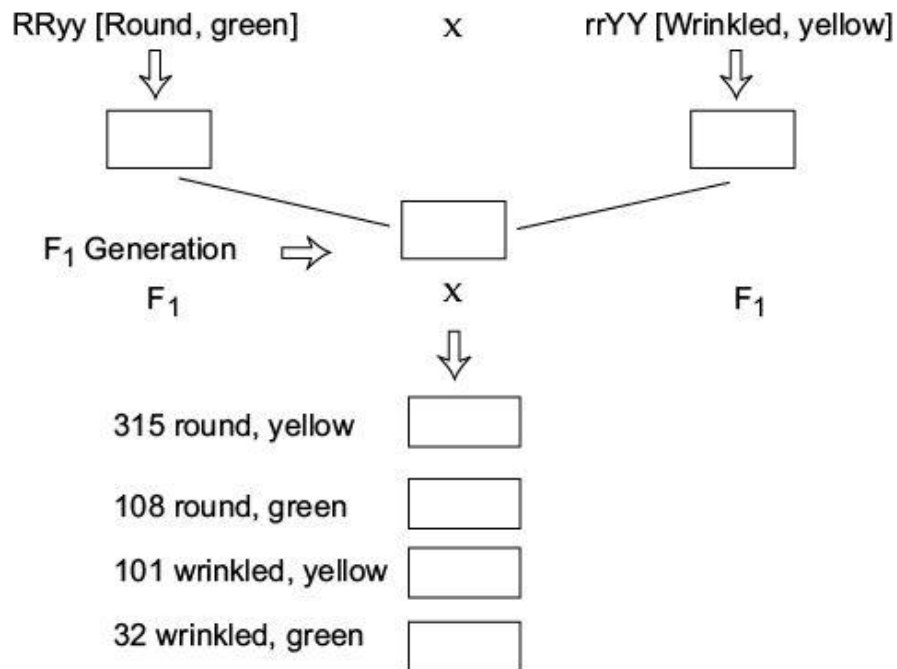
- Genotype:** It is the complete heritable genetic identity of an organism. It is the actual set of alleles that are carried by the

organism.

- (iv) When an allele affects the phenotype of an organism, then it is a dominant allele. It is denoted by a capital letter. For example, 'T' to express tallness.

145

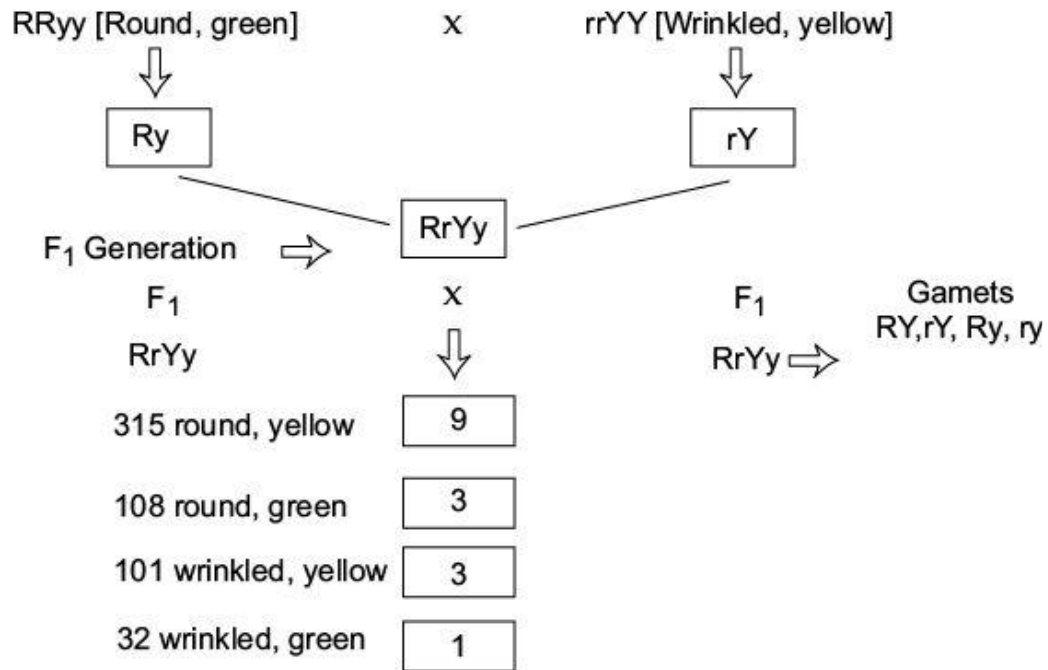
- . Given below is the experiment carried out by Mendel to study inheritance of two traits in garden pea.



- (i) Fill the boxes.
- (ii) Why did Mendel carry experiment with two traits?
- (iii) What were his findings with respect to inheritance of traits in F_1 and F_2 generations?

Ans

- .
(i)



- (ii) Mendel carried out experiment with two traits to study the independent assortment of characters during inheritance.
- (iii) In F_1 generation though both the traits were inherited but only dominant traits [*i.e.*, round, yellow characters] are expressed, the recessive traits, [wrinkled, green] were not expressed. But in F_2 generation both dominant and recessive traits were expressed in the ratio 9: 3: 3: 1.

146

- . Observe the ears of all the students in the class. Prepare a list of students having free or attached earlobes and calculate the percentage of students having each (Fig. below). Find out about the earlobes of the parents of each student in the class. Correlate the earlobe type of each student with that of their parents. Based on this evidence, suggest a possible rule for the inheritance of earlobe types.



(a)

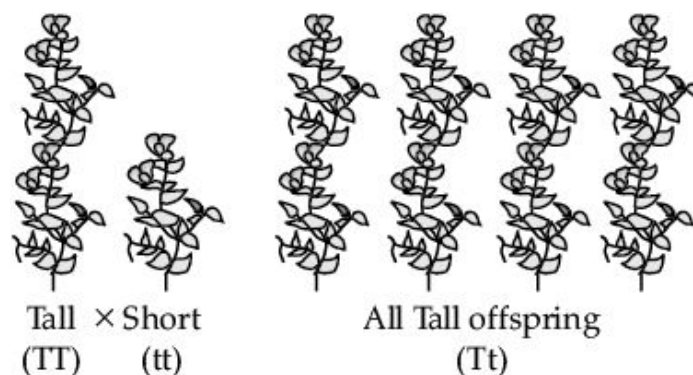


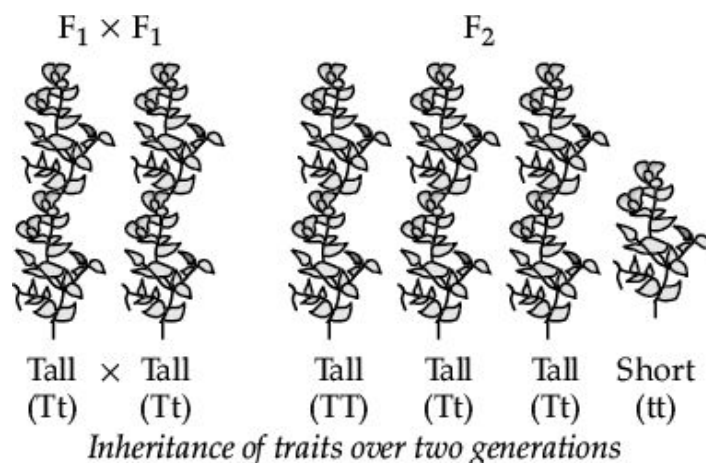
(b)

Ans. It is observed that earlobe is attached to the side of head in some of students and not in others. Majority of students have free ear lobes. After observing the earlobes of parents it is found that free earlobes always occur in those cases where one or both the parents have free ear lobes. However attached earlobes were observed in atleast one of the two parents of children having attached earlobes. Earlobe trait is inherited from parents. Suppose earlobe trait is controlled by two alleles L or l. Individuals with free ear lobe have alleles LL or Ll and attached ear lobes have alleles ll. So free ear lobe is dominant trait and attached earlobe is recessive trait.

147

- In the given figure below, what experiment would we do to confirm that the F_2 generation did in fact have a 1 : 2 : 1 ratio of TT, Tt and trait combinations ?





Ans. When a pure tall pea plant (TT) was crossed with pure short pea plant (tt) then in F_1 generation all hybrid tall pea plants were produced. (Tt) Again pea plants of F_1 were selfed where pure tall (TT), hybrid tall (Tt) and pure short (tt) pea plants were obtained in the ratio 1 : 2 : 1 were obtained.

Parental Generation	→	Pure Tall Plant TT	×	Pure Dwarf Plant tt
Gametes	→	T		t
F_1 Generation	→			Tt [Tall]
		Tt	×	Tt
Gametes	→	Tt	×	T tTy
F_2 Generation	→	TT [Tall], Tt [Tall], Tt [Tall], tt [Dwarf]		

Genotypic ratio is 1 : 2 : 1

Practical Based Questions

148

- . In a monohybrid cross between tall pea plants (TT) and short pea plants (tt) a scientist obtained only tall pea plants (Tt) in the F_1 generation. However on selfing the F_1 generation pea plants he obtained both tall and short plants in F_2 generation. On the basis of

above observations with other angiosperms also can the scientist arrive at a law? If yes, explain the law. If not, give justification for your answer.*

Ans. Yes, the scientist arrives at Law of Dominance according to which the trait that gets expressed in F_1 generation is dominant and the trait which gets expressed along with dominant trait in F_2 generation is recessive trait which expresses itself only in homozygous condition.

Application Based Questions

149

- . Guinea pig having black colour when crossed with a guinea pig having same colour produced 80 offspring, out of which 60 were black and 20 were white. Now find out:

- (i) What is the possible genotype of the guinea pigs?
- (ii) Which trait is dominant and which trait is recessive?
- (iii) What is this cross called and what is its phenotypic ratio?

Ans. (i) The possible genotype of the guinea pigs is $Bb \times Bb$.

(ii) Black colour is dominant and white colour is recessive.

(iii) This is an example of monohybrid cross and its phenotypic ratio is 3 : 1.

150

- . A woman with blonde curly hair married a man with black soft hair. All of their children in first generation had black soft hair but in next generation children had different combinations in the ratio of 9 : 3 : 3 : 1. State the law that governs this expression.

Ans. Law of independent assortment governs this expression which

states that inheritance of factors controlling a particular trait in an organism are independent of each other i.e., during the time of reproduction two pairs of factors of each of the two traits in a dihybrid cross segregate independently during gamete formation and randomly formed combinations in F_2 generations.

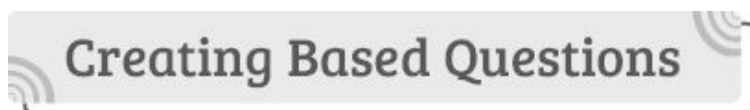
151

- . Mrs. Joshi, an eight months pregnant lady was suggested by her doctor to get an ultrasound done. She went to a radiologist with her husband and got the ultrasound done. When the ultrasound was done, her husband asked doctor about the sex of the baby in the womb.

- (i) Is it ethical to determine the sex of the foetus? Why?
- (ii) What is the chance of giving birth to a girl child in human beings?
- (iii) What has government done to stop female foeticides?

Ans. (i) No, it is not ethical to determine the sex of the foetus because sex determination may lead to female foeticides which results in death of a girl child and thus the sex ratio become unbalanced in a society.

- (ii) The chance of giving birth to a girl child in human beings is 50%.
- (iii) Government has imposed a ban on sex determination techniques to stop female foeticides.



152

- . Ram met with an accident. John his school mate takes him to the hospital where Ram (AB blood group) needs blood transfusion. John also has AB blood group and is willing to donate his blood but Ram's mother object by saying "John belongs to different community so has

different type of blood". Give your opinion about Ram's mother views.

Ans. Blood group does not depend on community, same blood group is same for all communities. Blood group AB has two alleles A and B in the people of all communities.

153

- . Why a mice whose tail has been removed by surgery does not produce tailless mice?

Ans. A mice whose tail has been removed by surgery does not produce tailless mice because tailless character is not present in germ cells of mice so, it is an acquired character which cannot be passed onto the next generation.

154

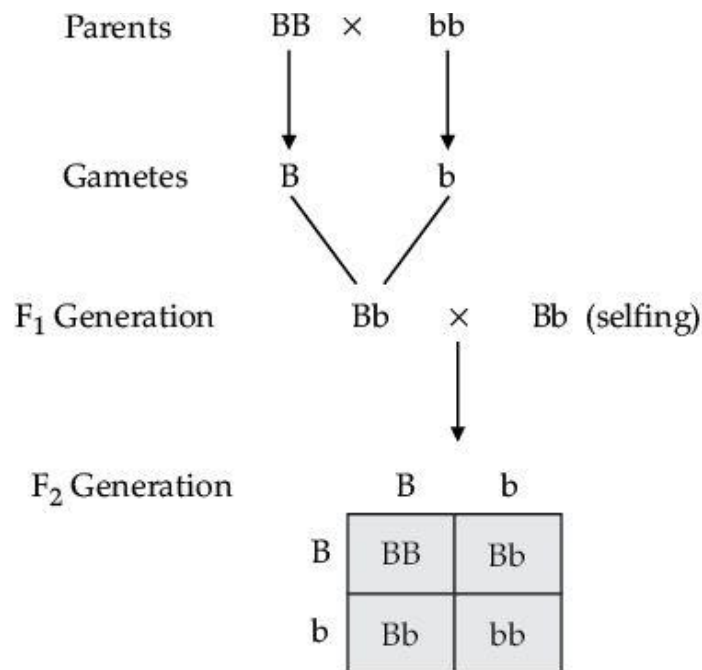
- . A Blue Colour Flower Plant Denoted by Bb is crossbreed with that of White Colour Flower Plant Denoted by bb.

- (i) State the Colour of Flower You Would Expect in Their F1 Generation Plants.
- (ii) What must be the percentage of white flower plants in F2 generation if flowers of f1 plants are self-pollinated?
- (iii) State the expected ratio of the genotypes BB and Bb in the F2 Progeny.

Ans. (i) Blue colour flower plant: BB

(ii) White colour flower plant: bb

(iii) The cross involved is as follows:



- (a) In F₁ generation, all plants will have blue flower.
- (b) In the F₂ generation, 25% of flowers are white in colour.
- (c) The ratio of the genotypes BB and Bb in the F₂ generation would be 1(BB): 2(Bb).

155

- . With the help of two suitable examples, explain why certain experiences and traits earned by people during their lifetime are not passed on to their next generations. When can such traits be passed on?

Ans. Learning skills like swimming, dancing and low weight of beetle due to starvation earned by people during their lifetime are not passed on to their next generation. If a person knows swimming or dancing, it is not necessary that this trait is seen in the progeny because learning a new skill does not change the genes of the germ cells of humans. Also, low weight in a beetle is not a trait that can be inherited by the progeny of a starving beetle. These traits or experiences occur in the somatic cells which do not involve germ cells and genetic materials. Therefore, these traits are not passed

on to their next generation. Traits can be passed only when they have some direct effect on the genes. For example, if a mutation is caused in the germ cells of a person due to exposure to some harmful radiations, it is highly likely that the mutation caused will be passed on to the subsequent generations.

156

- . Study the table given below and answer the questions.

In a human, how many chromosomes are present in:

- (i) a brain cell?
- (ii) a sperm in the testes?
- (iii) an egg which has just been produced by the ovary?
- (iv) a skin cell?
- (v) a fertilised egg?

Ans. (i) 46.

(ii) 23.

(iii) 23.

(iv) 46.

(v) 46.

157

- . Study the table given below and answer the following questions.

Characters	Males	Females
Total number of chromosomes	23 pairs	23 pairs
Number of autosome	22 pairs	22 pairs
Number of sex chromosome	1 pair	1 pair

- (i) What is sex determination?
- (ii) What are the sex chromosomes in the males?
- (iii) What are the sex chromosomes in the females?
- (iv) Is the father responsible for the sex of the child?

Ans. (i) The process by which the sex of a newborn organism is detected is called sex determination.

(ii) The males have two sex chromosomes which are X and Y.

(ii) The sex chromosomes in the females are X and X.

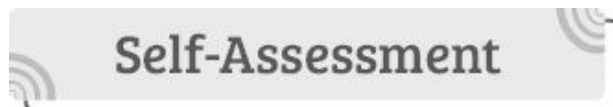
(iv) Yes, it is the father that gives either the X or Y chromosome to the child. In case, the child receives the X chromosome from the father, then it has XX chromosome, and it develops into a female child. However, if the father gives Y chromosome, then the child develops into a male as it gets XY chromosome.

158

- . "A brother and sister are more related to each other in comparison to the case when any one of them is related with his or her cousin". Through this statement what will we get to know about their ancestors?

Ans

- . A brother and sister are more closely related to each other which means that they have common ancestors more recently as compared to the case when any one of them (brother or sister) is related to the cousin. A brother and sister have their "parents" in common while a brother or sister and cousin have "grandparents" in common.



159

- . Write the scientific name of man and garden pea.

160

- . Which of the following type of reproduction sexual or asexual generates more number of successful variations?

161

- . Why do mice whose tails were surgically removed just after birth for generations, continue to produce mice with tails?

162

- . Which of the following represent the round shaped and green coloured seeds of pea plant? [rrYY, RrYy, RRyy, Rryy]

163

- . A pea plant with blue colour flower denoted by BB is cross bred with a pea plant with white flower denoted by ww.

- (a) What is the expected colour of the flowers in F_1 progeny?
- (b) What will be the % of plants bearing white flower in F_2 generation when the flowers of F_1 plants were selfed?
- (c) State the expected ratio of the genotype BB and Bw in the F_2 progeny.

164

- . Explain Mendel's experiment with peas on inheritance of characters considering only one visible contrasting characters.

165

- . Answer the following:
 - (a) Define dominant and recessive traits.
 - (b) Why are two letters like TT, Tt, tt are used to denote the character of height?
 - (c) If a purple pea plant (PP) is crossed with a white coloured pea plant (pp), will we have white flowered pea plant in F_1

generation? Why?

166

- . The gene for red hair is recessive to the gene for black hair. What will be the hair colour of a person if he inherits a gene for red hair from his mother and a gene for black hair from his father?

167

- . Explain with an example, how genes control the characteristics (or traits).

168

- . (i) What is the genotype of dwarf plants which always produced dwarf offspring ?

(ii) What is the genotype of tall plants which always produced tall offspring ?

169

- . In human beings, the statistical probability of getting either a male or female child is 50 : 50. Give a suitable explanation.

170

- . The palisade cells of a species of plant contains 28 chromosomes. How many chromosomes will there be in each gamete produced by the plant?

171

- . Ram met with an accident. John his schoolmate takes him to the hospital where Ram (AB blood group) needs blood transfusion. John also has AB blood group and is willing to donate his blood but Ram's mother object by saying "John belongs to different community so has different type of blood". Give your opinion about Ram's mother views.

172

- . A husband has 46 chromosomes and his wife also has 46 chromosomes. Then why do not their offsprings have 46 pairs of

chromosomes which is obtained by fusion of male and female gametes?

□ □