Grade X - Science

Lesson 8. Heredity and Evolution

Objective Types Questions

(1 mark each)

I. Multiple choice questions

1. Which of the following statement is incorrect?

   a. For every hormone there is a gene.

   b. For every protein there is a gene.

   c. For production of every enzyme there is a gene.

   d. For every molecule of fat there is a gene.

2. 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.

3. 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.

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

   a. a boy.

   b. a girl

   c. X-chromosome does not determine the sex of a child.

   d. either boy or girl.

5. From the list given below, select the character which can be acquired but not inherited.

   a. colour of eye

   b. colour of skin

   c. size of body

   d. nature of hair.

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

a. Double fertilisation.

b. Self-pollination.

c. Cross fertilisation.

d. No fertilisation

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

a. Tallness is the dominant trait.

b. Shortness is the dominant trait.

c. Tallness is the recessive trait.

d. Height of pea plant is not governed by gene 'T' or 't'.

8. The number of pair (s) of sex chromosomes in the zygote of human is:

a. One b. Two c. Three d. Four

II. Multiple choice questions

1. 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 another.

c. Reeta eats meat, but her sister Geeta is a vegetarian.

d. Two children have different eye colours

2. Differences between organisms in a species are described as variations. Which of the following would you describe as continuous variation?

a. Hair growth b. Eye colour

c. Weight d. Sex

3. The more characteristics two species have in common:

a. More closely they are related and more recently they had a common ancestors.

b. More distantly they are related and more recently they have common ancestors.

c. More closely they are related and more distantly they have common ancestors.

d. More distantly they are related and more distantly they have common ancestors.

4. To study the natural phenomenon inheritance, Mendel selected the pea plants. Which of the following properties were suitable for their studies?

(i) Plants would easily self pollinate r cross pollinate in nature.

(ii) Plants were easily grown in garden soil with a considerably shorter generation time.

(iii) Peas plants do not require the true- breeding for hybridisation experiments.

(iv) Many parts of the plant such as pod, seed, flower, cotyledons showed distinct phenotypes.

a. (i), (ii) and (iii).
b. (ii) and (iv)
c. (i) and (ii).
d. (ii), (iii) and (iv)

5. What is the difference between genetic drift and change due to natural selection?

a. **Genetic drift does not require the presence of variation.**
b. Genetic drift never occurs in nature, natural selection does.
c. Genetic drift does not involve competition between members of a species.
d. There is no difference.

6. Which concept was not included in Charles Darwin's theory of Natural selection?

a. Struggle for existence
b. Punctuated equilibrium
c. Survival of the fittest
d. Overproduction of offspring.

7. Natural selection is called 'survival of the fittest'. Which of the following best describes an organism?

a. How strong it is compared to other individuals of the same species.
b. How much food and resources it is able to gather for its offspring.
c. The ability to adapt to the environment in the niche it occupies.
d. The number of fertile offspring it has.

8. Human offspring's sex is determined

a. through father's sex is determined.
b. through mother's sex chromosomes.
c. by hormones
d. by enzymes.

9. Wild cabbage has evolved into new varieties like cabbage, broccoli cauliflower by

a. genetic drift
b. natural selection
c. reproductive isolation
d. artificial selection

10. The fossil remains of Archaeopteryx is a connecting link between

a. reptiles and mammals
b. reptiles and bird
c. fish and amphibian
d. amphibian reptile

11. 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 determiners the sex
d. sex is determined by chance

12. Some dinosaurs had feathers although they could not fly but birds have feathers that help them to fly. In the context to evolution this means that

a. reptiles have evolved from birds.
b. there is no evolutionary connection between reptiles and birds
c. feathers are homologous structures in both the organisms.
d. birds have evolved from reptiles.

I. Assertion & Reason

Directions: In the following questions, A statement of Assertion (A) if followed by a statement of Reason (R). Mark the correct choice as.

(A) Both assertion (A) and reason (R) are true and assertion (R) is the correct explanation of (A).

(B) Both assertion (A) and reason (R) are true but assertion (R) is NOT the correct explanation of (A).

(C) Assertion (A) is true but reason (R) is false.

(D) Assertion (A) is false and reason (R) is true.

1. **Assertion** : When pure breed tall plants are crossed with pure breed short plants, all the plants in F_1 progeny are tall. When the tall plants of F_1 progeny are crossed, short plants re-appear in F_2 progeny

Reason : Traits are independently inherited.

Ans. Option (a) is correct.

2. Assertion : Variation high in sexually reproducing organisms compared to asexually reproducing organisms.

Reason : In accuracies during DNA coping give rise to variation.

Ans. Option (b) is correct.

3. Assertion : Acquired trait cannot be passed on from one generation to next generation.

Reason : In accuracy during DNA coping of acquired trait is minimum.

Ans.Option (c) is correct

4. Assertion : Human, frog and bird have a common ancestor.

Reason : Limbs of human, bird and frog are homologous.

Ans. Option (a) is correct.

5. Assertion : Speciation is the reproductive isolation among one interbreeding population.

Reason : Genetic drift, Natural selection and serve DNA change can cause speciation.

Ans. Option (a) is correct.

II. Assertion & Reason

Directions: In the following questions, A statement of Assertion (A) if followed by a statement of Reason (R). Mark the correct choice as.

(A) Both assertion (A) and reason (R) are true and assertion (R) is the correct explanation of (A).

(B) Both assertion (A) and reason (R) are true but assertion (R) is NOT the correct explanation of (A).

(C) Assertion (A) is true but reason (R) is false.

(D) Assertion (A) is false and reason (R) is true.

1. **Assertion** : A geneticist crossed a pea plant having violet flower with a pea plant having white flower, he got all violet flowers in first generation.

Reason : White colour gene is not passed on to next generation.

Ans. Option (C) is correct.

2. **Assertion (A)** : Mendel chose a number of varieties of garden pea as plant material for his experiments.

   Reason (R) : Garden pea has well defined characters and is bisexual.

   Ans. Option (D) is correct.

3. **Assertion (A)** : In humans, males play an important role in determining the sex of the child.

   Reason (R) : Males have two X chromosomes.

   Ans. Option (C) is correct.

4. **Assertion (A)** : Learning a skill such as dance and music is an acquired trait.

   Reason (R) : Acquired traits develop in the life time of an individual and do not pass to the progeny.

   Ans. Option (A) is correct.

5. **Assertion (A)** : Traits like eye colour or height are inherited to young traits.

   Reason (R) : Inherited trait are not transferred from parent to young ones.

   Ans. Option (C) is correct.

6. **Assertion (A)** : Zygote with two X chromosomes develops into a boy.

   Reason (R) : If the egg cell carrying X chromosomes fuses with the sperm carrying a Y chromosome, the resulting child would be a boy.

   Ans. Option (D) is correct.

7. **Assertion (A)** : Mendel proposed the law of inheritance or traits from the first

   Reason (R) : He studied single character at one time.

   Option (D) is correct.

Fill in the blanks

1. The number of pair(s) of sex chromosomes in the zygote of human is _____.

   Ans. One.

2. _____ genes are those which decide the appearance of an organism only in the presence of another identical gene.

   Ans. Recessive.

3. Chromosomes are thread like structures in the nucleus of a cell formed of DNA which carriers the _____.

   Ans. Genes

4. _____ is the description of genes present in an organism.

   Ans. Genotype.

5. Genes always work in ____

   Ans. Pair.

6. The cut tail of an mice is an ____ trait.

   Ans. acquired.

7. Evolution led to the formation of a new _____

   Ans. species.

8. ___ was the British scientist who proposed that life must have developed from simple inorganic molecules.

   Ans. J.B.S.Haldane.

9. The theory of evolution of species by natural selection was given by _____

   Ans. Darwin.

True or False

1. Acquired variation in somatic traits are not passed from generation to generation.

   Ans. True.

2. Human height is a trait which shows variations.

   Ans. True.

3. Variation decreases the changes of survival of an organism in a changing environment.

   Ans. False.

4. Genes controls the development of inherited characteristics such as hair colour, **skin** colour, etc.

   Ans. True.

5. The theory of origin of life on earth proposed by Haldane was confirmed by Stanley L. miller and Harold C Urey.

   Ans. True.

Match the following

Column I	Column II
(i) Variation	(A) Reproductive isolation among once interbreeding population.
(ii) Heredity	(B) Difference in traits among individuals of a species.
(iii) Evolution	(C) Gradual changes to give rise species.
(iv) Speciation	(D) Transmission of traits from parents to offsprings.

Ans. (i) (B), (ii) (D), (iii) (C), (iv) (A)

Very Short Answer Type Question

(1 mark each)

1. **Mendel took tall pea plants and short pea plants and produced F1 progeny through cross-fertilisation. What did Mendel observe in the F1 progeny?**

   Ans. All pea plant were tall in F2 generation.

2. **A Medellian experiment consisted of breeding pea plants bearing violet flowers with pea pants bearing white flowers. What will be the result in F1 progeny?**

   Ans. Violet flowers.

3. **What is DNA?**

   Ans. DNA is the carrier of hereditary information from parents to the next generation.

4. **Where is DNA found in a cell?**

   Ans. DNA is found in the cell nucleus.

5. **What is heredity?**

   Ans. The transmission of characteristics from one generation to another is known as heredity.

6. **Name the information source for making proteins in the cells.**

   Ans. Cellular DNA is the information source for making proteins in cells.

7. Define variation.

Ans. Variation is defined as the differences in the characters or traits among the individuals of a species.

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

Ans. All the variations do not have equal changes of survival as some variations might not be beneficial and would ultimately be eliminated.

9. Why variations are more in human beings?

Ans. Because human being reproduce sexually and variation are more is sexually reproducing organisms.

10. Name two human which show variation.

Ans. (i) Colours of eye (ii) Height

11. What is a gene?

Ans. Gene is the unit of inheritance. It is the part of a chromosome which controls the appearance of a set of hereditary characters.

12. Name the branch of science that deals with heredity and variation.

Ans. Genetics.

13. Name the genetic material that is responsible for inheritance of traits.

Ans. Gene.

14. Where are genes located?

Ans. Genes are located on DNA present in chromosomes.

15. Who is the father of Genetics?

Ans. Gregor Johann Mendel is the father of genetics.

16. Define genetic drift.

Ans. The change in the frequency of certain genes in a population over generations.

17. What is DNA?

Ans. Deoxyribonucleic Acid (DNA) is a molecules which carry the hereditary characters of traits in a coded from one generation to the next in all the organisms.

18. No two individuals are absolutely alike in a population. Why? It is

Ans. because of the variation which take place during DNA coping.

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

Ans. Because cutting of tails is an acquired trait and is not inherited.

20. **What is monohybrid cross?**

Ans. The cross between two individuals with one pair of contrasting character is called monohybrid cross.

21. **Why is the progeny always tall when a tall pea plant is crossed with a short pea plant?**

Ans. Some genes are dominant and others are recessive. Tallness is a dominant trait and hence the progeny is always tall when crossed with a short plant.

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

Ans. All plants in F_1 generation will bear violet flowers.

23. **Write the scientific name of men and garden pea.**

Ans. Men – *Homo sapiens*

Garden pea – *Pisum sativum*

24. **Where did life originate on earth?**

Ans. Life originated in the sea water.

25. **Name the scientist who said life originated from in animate matter.**

Ans. J.R.S Haldane

26. **Name any two organism which are now extinct and are studied from their fossils.**

Ans. Ammonite, trilobite, knightia and Rajasaurus. (any two)

27. **Give as example where sex determination is regulated by environmental factors.**

Ans. In snail, sex is determined by environmental factors such as temperature.

28. **What is Heredity?**

Ans. It refers to the transmission of characters of traits from the parent to their offspring.

29. **What determines the sex of a child?**

Ans. Whether a child inherits X chromosome or Y Chromosome from father determines the sex of the child.

30. **What is evolution?**

Ans. Formation of reproductive isolation among once interbreeding population.

31. How can you determine evolutionary relationship?

Ans. By comparing DNA of different species.

32. Both birds and bar have wings. What name is given to this relationship?

Ans. Analogous organs.

33. What do you cal the organs having same design but different function?

Ans. Homologous organs.

34. Will geographical isolation be a major factor in speciation of sexually reproducing animals? How?

Ans. Yes, because it interrupts the flow of genes between their isolated populations through the gametes.

35. The human hand, cat paw and the horse foot, when studied in detail show the same structure of bones and point towards a common origin.

(i) What do you conclude from this?

(ii) What is the term given to such structures?

Ans.(i) In course of evolutions they have been modified to perform different functions.

(ii) Homologous organs

36. Name the scientist who proposed the theory of evolution.

Ans. Charles Darwin.

37. Give one characteristic to show that birds are closely related dinosaurs.

Ans. Presence of feathers on birds.

38. Is it necessary that homologous structures always have a common ancestor?

Ans. Yes, it is necessary that homologous structures always have a common ancestor in order to carry out the different activities. Otherwise there cannot be any similarity in basic plan, internal structure, development or organ.

39. Name five varieties of vegetables which have a been produced from 'wild cabbage' by the process of artificial selection.

Ans. Vegetables like cabbage, broccoli, cauliflower, kohlrabi and kale are formed from artificial selection.

40. Name the ancestor where human species have genetic roots.

Ans. Africa.

Short Answer Type Questions -

(2 marks each)

1. **Mustard was growing in the fields- A and B. While Field A produced brown coloured seeds, field B produced yellow coloured seeds.**

   It was observed that in field A, the offsprings showed only the parental trait for consecutive generations, whereas in field B, majority of the offsprings showed a variation in the progeny.

   What are the probable reasons for these?

   Ans. In field A, the reason for parental trait in consecutive generations of the offsprings is self-pollinations.

   In field B, variation is seen to occur because of recombination of genes as cross-pollination.

   In field B, variation is seen to occur because of recombination of genes as cross-pollination is taking place.

2. **In a asexually reproducing species, if a trait X exists in 5% of a population and trait Y exists in 70% of the same population, which of the two trait is likely to have arisen earlier? Give reason.**

   Ans. Trait Y which exists in 70% (larger fraction) of the population is likely to have arisen earlier because in sexual reproduction, identical copies of DNA are produced and variations do not occur.

   New traits come in the population due to sudden mutation and then are inherited. 70% of the population with trait Y is likely to have been replicating that trait for a longer period than 5% of population with trait X.

3. **" The chromosome number of the sexually reproducing parents and their offspring is the same." Justify this statement.**

   Ans. Male individual have 46 chromosomes but because the gametes are always haploid i.e., they have half the number chromosomes; sperms will be haploid(23 chromosomes). Female individual also contains only 23 chromosomes is egg. It is the fusion of the sperm and egg which leads to an offsprings with 46 chromosomes.

4. Differentiate between dominant and recessive traits.

Ans. (a) Dominant trait: The character which gets expressed in the presence of its contracting form is termed as dominant trait.

(b) Recessive trait: The trait which remains unexpressed in the presence of its contrasting form is called recessive trait.

5. 'Gene control traits'? Explain this statement with an example.

Ans. Gene controls the trait by synthesising the specific enzyme. Consider tallness as trait. Plant height depends upon particular plant hormone which in turn will depend on the efficiency of the process for making it. If the enzyme responsible for the production of this hormone is efficient, plant will be tall. If the gene for that enzyme has an alteration that makes enzyme less efficient, the amount of hormone will be less and plant will be short.

6. In one of this experiments with pea plants Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plant, in the first generation (F_1) only tall pants appear.

(a) What happens to the trait of dwarfness in this case?

(b) When the F_1 generation plants were self-fertilised, he observed that in the plants of second generation, F_2 both tall plants and dwarf plants were present. Why is happened? Explain briefly.

Ans. (a) In the F_1 generation, the trait of dwarfness is recessive.

(b) Both parents contribute equally in sexual reproduction. So each pea plant inherited genes of both tallness and dwarfness in the F_1 generation. But only the dominant trait, tallness got expressed. When F_1 plants are crossed, in the F_2 generation, there are some plants (25%) which carry only the dwarfness character and hence the same got expressed in the F_2 generation.

7. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?

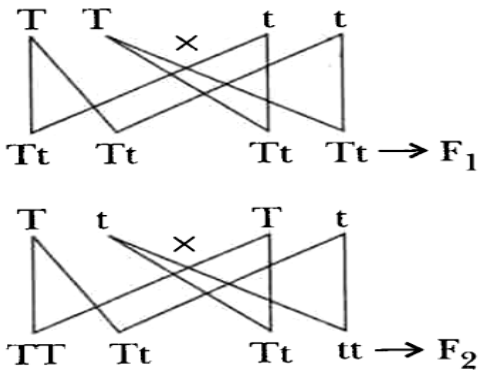
Ans. – Mendel crossed a tall pea plant with a short pea plant.

- All the plants produced in the F_1 generation were tall.
- When the F_1 tall plants were self- pollinated, the F_2 generation consisted of both tall and short plants.

- It explains that the dominant trait expresses itself in the F_1 plants, where the recessive trait (shortness) is hidden.
- The appearance of short plants in the F_2 indicated that the trait shortness has been inherited by the F_1 plants, but not expressed.

8. In a monohybrid cross between tall ea 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 you answer.

Ans. On the basis of the experiment, the scientist can arrive at a law as below:



(i) Birth the parents must be contributing a copy of the same gene.

(ii) Foe each trait, a plant carries two copies, one from each parents.

(iii) If the copies of the traits are not same, the dominant trait shall gets expressed.

(iv) When F_1 generation are crossed, the recessive trait of F_1 generation shall also get expressed in the F_2 generation at a ratio of 3:1

9. (a) Why is variation beneficial for the species, but not necessarily for the individual?

(b) We see eyes in planaria, insects, octopus and vertebrate. Can eyes be grouped together in case of the above mentioned animals to establish a common origin? Why?

(ii) State one evidence to prove that birds have evolved from reptiles.

Ans. (a) Accumulation of variation in a species enables them to adapt according to the changes and the new needs. But an individual does not get any advantage due to variation that takes place on him. Thus, variation is beneficial for a species, but not necessary for the individual.

(b) (i) No, eyes of these animals do not show any evolutionary relationship as they are analogus organs.

(ii) The presence of feathers both in dinosaurs and birds evolved from reptiles.

10. (a) Define variation in relation to a species. Why is variation beneficial to the species?

(b) What are 'chromosomes'? Where are they located in the cell?

Ans. (a) variation refers to the differences in the characters or traits among the individuals of a species.

Variation is beneficial to the species because:

(i) It enables the organisms to adapt themselves in changing environment.

(ii) It forms the basis of heredity.

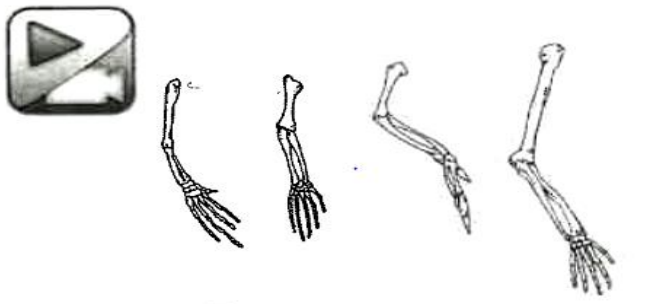
(iii) It forms the raw materials for evolution and development of new species.

(b) 'Chromosomes' are long thread-like structures which contain hereditary information of the individual and are therefore the carriers of genes.

Chromosomes are located in the nucleus of a cell.

11. What are homologues organs? Give wings of a bat be regarded a homologues? Give reason in support of your answer.

Ans. Homologous organs are those organs indifferent groups of organisms which are similar in their basic structure, but are modified to perform different functions.



Homologous organs

e.g. forelimbs of mammals, and those reptiles and amphibians.

- The wings of a butterfly and those of a bat cannot be considered as homologous, because they have a common function (flying), but their origin and basic structure are different .

- They are analogus organs because they have a common, though the basic structure is different.

12. (a) Why did Mendel select pea plants for conducting his experiments on inheritance?

(b) What is a sex chromosome?

Ans. (a) Mendel selected pea plant for this experiment because-

(i) Many varieties of pea plants are available with observable contrasting traits.

(ii) Peas are normally self pollinating and the flower structure is also suitable for cross pollination.

(b) Sex Chromosome is a chromosome that operates in the sex-determining mechanism of a species. Many animals have two different types of sex chromosomes.

13. (a) What is F_2 generation?

(b) Why traits such as intelligence and knowledge cannot be passed on to the next generation?

(c)" The sex of the children is determined by what they inherit from their father and not their mother." Justify.

Ans. (a) The generation produced by the offspring of F_1 generation, i.e first generation as parent is called F_2 generation.

(b) Trait such as intelligence and knowledge are acquired traits which do not bring any change in the DNA of the germ cell and therefore, cannot passed to next generation.

(c)It is because a child who inherits an X chromosome from will be a girl and one who inherits a y Chromosome from father will be a girl and one who inherits a Y chromosome from father will be a boy. But all children will inherit an X chromosome from their mother regardless of whether they are boys or girls.

14. "We cannot pass onto our progeny the experiences and qualifications earned during our life time". Justify the statement giving reason and examples.

Ans. Experiences of life and qualifications we earn do not make any change in the gene are individual. Changes made in the gene are only passed on from on e generation to the next. These qualities are acquired by an individual in his life, and are called acquired traits which cannot be passed on to future progeny. For example, if a person reads a book on birds, the knowledge he earns by reading the book does not make any change in his genes.

Hence his knowledge he earns by reading the book does not make any change in this genes. Hence, this knowledge will not automatically transmitted to his next generation.

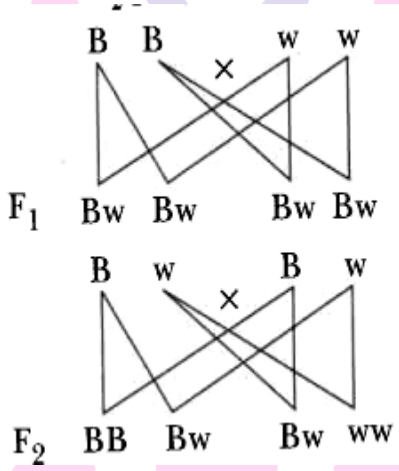
15. A pea plant with blue colour flower denoted by BB is cross-bred with a pea plant with white flower denoted by ww.

(a) What is the expected colour of the flowers in their F_1 progeny?

(b) What will be percentage of plants bearing white flower in F_2 generation, when the flower of F_1 plants were selfed?

(c) State the expected ration of the genotype BB and Bw in the F_2 progeny.

Ans.



(a) All flower in F_1 progeny will blue in colour.

(b) When F_1 progeny are selfed, 25% of the flowers in F_2 progeny will be white.

(c) Expected ration of the genotype BB and Bw will be 1:2

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

Ans. Mendel crossed tall pea plants with dwarf pea plants:

Parents	:	(TT)	X	(tt)
		Pure tall plant		Pure short plant
F_1 generation	:	(Tt) (Tt)		(Tt) (Tt)
Selfing of F_1	:	(Tt)	X	(Tt)
F_2 generation	:	(TT) (Tt)		(Tt) (tt)

Observation : F_1 generation __ No 'medium –height plants were there. All plants were tall. Only one of the parental trait was seen, not some mixture of the two.

F_2 progeny __ Not all plants were tall. One quarter of them were short. This indicates that both the tallness and shortness traits were inherited in the F_1 plants, but only the tallness trait was expressed. Mendel proposed that something was being passed unchanged from generation to generation which we called 'father'. Factors contain and carry hereditary information.

17. How do Mendel's experiment show that traits are inherited independently?

Ans. Mendel performed traits like tall and dwarf plant and round and wrinkled seeds. In second(F_2) generation, some plants were tall with round seeds and some were dwarf plants having round seeds. Thus, the tall/short and round/Wrinkled seed Traits are independently inherited.

18. Explain with the help of suitable examples why certain traits cannot be passed on to the next generation. What are such traits called?

Ans. There are certain traits which are developed during the lifetime of an individual. For example, many people get their gall bladder removed by surgery due to certain complications. But the children of these people are born with gall bladder. Thus, this trait is not passed on from one generation to the next generation. Traits whose characteristics are not genetically controlled and cannot be passed on from one generation to the next generation are called acquitted traits.

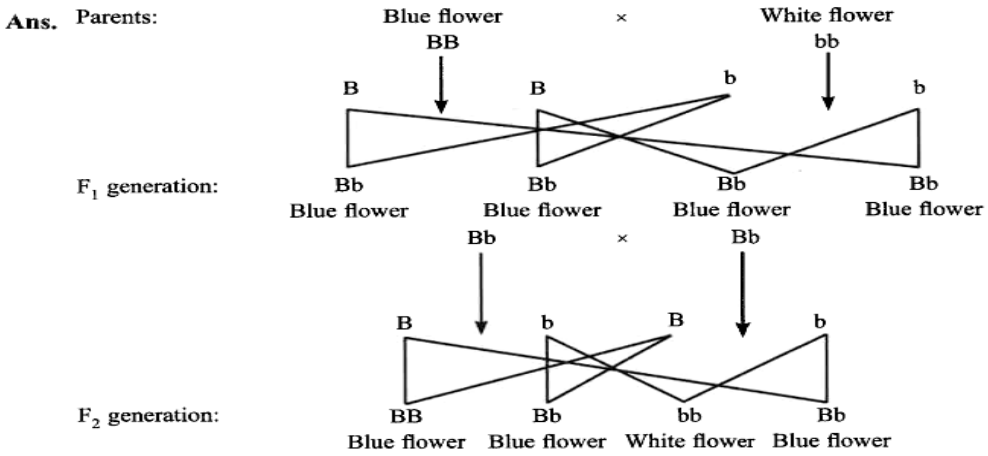
19. A blue coloured flower plant denoted by BB is crossbred with that of white coloured flower plant denoted by bb.

(a) State the colour of flower you would expect in their F_1 generation plants.

(b) What must be the percentage of white flower plants in F_2 generation of F_1 plants are self pollinated?

(c)State the expected ration of the genotypes BB and in the F_2 progeny.

Ans.



(a) The colour of all the flowers in F_1 generation will be blue.

(b) Percentage of white flower plants in F_2 generation will be 25.

(c) The ration of genotypes BB and Bb in F_2 progeny will be 1 : 2

20. If we cross – bred tall (dominant pea plant with pure-breed dwarf (recessive) pea plant, we will get plants of F_1 generation. If we now self-cross the pea plant of F_1 generation, we obtain pea plants of F_2 generation.

(i) What do the plants of F_1 generation look like?

(ii) State the ratio of tall plants to dwarf plants in F_2 generation.

(iii) State the type of plants not found in F_1 generation but appeared in F_2 generation. Write the reason for the same.

Ans. (i) The plant of F_1 generation will be tall like the dominant parent.

(ii) Tall plants 3 : Dwarf plants 1, i.e., 3 : 1.

(iii) – Dwarf plants are not found in F_1 generation.

- It s because, when two copies of gene(alleles) exist together in the F_2 plants, only the trait; tallness is expressed, i.e. it is dominant.
- The other trait dwarfness remains hidden as it is a recessive trait.

21. List two differences in tabular form between dominant trait and recessive traits. What percentage/ Proportion of the plants in the F_2 generation/progeny were round, in Mendel's cross between round and wrinkled pea plants?

Ans.

Dominant Trait	Recessive trait
(i) When both dominant and recessive traits are inherited, the dominant trait gets expressed (ii) A single copy of dominant trait is enough to get it expressed.	(i) When both dominant and recessive traits are inherited, the recessive traits does not get expressed. (ii) Both the copies of trait should be recessive to get it expressed.

75% of the plants in F_2 generation were round in Mendel's cross between round wrinkled pea plants.

22. Explain with the help of an example each, how the following provide evidences in flavours of evolution:

(a) Homologous organs

(b) Analogous organs

(c) Fossils.

Ans. (a) Homologous organs are those in different groups of organisms, which are similar in their basic structure/anatomy but are different in their functions. Such a similarity indicates that they are inherited from a common ancestor and the two species are closely related. For example, forelimbs of vertebrates like humans, wings of binds.

(b) Analogous organs are those organs/structure in different groups of organisms, that are similar in their function, but are dissimilar in their basic structural plan design and origin. Such organs do not indicate common ancestry of the species. For example, wings of birds and those of bats.

(c) Fossils are the preserved traces of organisms that lived in the pat. A fossil indicates the time periods when the different groups of organisms lived in the earth. For example, dinosaurs are reptilian fossils, some of which show resemblance to birds in having feathers.

23. "Evolution and classification of organisms are interlinked". Give reasons to justify this statement.

Ans. – We group organisms into groups based on the similarities in their characteristics.

- Certain basic characteristics are shared by most or all the organisms, like the cell is the basic unit of life in all organisms.

- The characteristics at the next level of classification would be shared by most organisms, but not by all organisms.
- By taking the fundamental design differences, a hierarchy is developed that allows making of classification groups.
- We can work out the evolutionary relationships of the species by identifying the hierarchies of characters
- The more characteristic two species will have in common, the more closely related they are.
- The more closely related the two species, they would have had a recent common ancestor.
- Thus, classification of species is a reflection of their evolutionary relationship.

24. "It is possible that a trait is inherited but may not be expressed. "Give a suitable example to justify this statement.

Ans. The statement "It is possible that a trait is inherited but may not be expressed" can be explained with one visible contrasting character.

Mendel took pure breeding pea plant with one visible contrasting character viz. height of the plant (tall and short plant). The pure breed tall and short plant crossed and it was found that all the plants in the F_1 progeny were tall. Mendel then allowed the F_1 progeny Plants for self – pollination. It was found that all the F_2 progeny plants are not tall, some are short. This indicates that both tallness and shortness traits were inherited that both tallness and shortness traits were inherited separately in the F_1 progeny but shortness trait was not expressed in the F_1 progeny.

25. Give an example of the characteristics being used to determine how close two species are in evolutionary terms.

Ans. The homologous characteristics help to determine an evolutionary relationship between different species.

Homologous organs are those organs in different groups/species of organisms that have a similar basic structural design, but different functions.

The hands/forelimbs of humans, wings of a bird and the forelimbs of other mammals like cow, horses etc, are homologous and have a similar basic structural design and origin.

The structural designs are similar because they are inherited from a common ancestor.

26. List in tabular form distinguishing features between acquired traits inherited traits, with one example of each.

OR

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

Ans.

Acquired traits	Inherited traits
(i) These traits are the characteristics which are developed during the lifetime of an individual. (ii) Their effect is only in the somatic cells, which does not get inherited to another generation. E.g Acquired trait: Loss of body weight due to starvation.	(i) These are the characteristics transmitted from parents to the offspring. (ii) Inherited trait is genetically determined characteristic that distinguishes a person. (iii) These have effects on the non-somatic cells which pass to the progeny. E.g. Inherited trait: Colour of hair and eye.

27. (i) We see eyes in planaria, insects, octopus and vertebrates. Can eyes be grouped together in case of the above-mentioned animals to establish a common evolutionary origin? Why?

(ii) State one evidence of prove that birds have evolved from reptiles.

Ans. (i) Yes, eye can be grouped together, which have evolved over generation from imperfect eyes in planaria to perfect eyes in vertebrates.

(ii) Dinosaur is a type of reptile which has wings. Birds also have wings, so it can be opined that birds also have evolved from reptiles.

28. How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.

Ans. In sexually reproducing organisms the parents are diploid (2N) as each of them has 2 sets of chromosomes. They form haploid (1N) male and female gametes through the process of meiosis. The haploid gamete has one set of chromosomes. Since these gamete has one set of chromosomes. Since these gamete has one set of chromosomes the original number of chromosome is restored in the offspring.

In asexually reproducing organisms only one parent is involved. The part of the body which develops into a new organism contains cells having same number of chromosomes as any other cell in the body of the organism. This separated part only develops into a new organism.

29. Define the term 'evolution'. "Evolution should not be equated with progress. "Give reason to justify this statement.

Ans. Evolution is the sequence of gradual changes which takes places in primitive organisms over millions of years and new organisms are formed.

Evolution cannot be equated with the progress from lower forms to higher forms. It seems to have given rise to more complex body designs even while the simpler body continue to flourish. For example, human beings have not evolved from chimpanzees, but both has common ancestor.

Some bacteria can survive in extreme cold or heat where many modern organisms even cannot survive.

30. Distinguish between homologous organs and analogous organs. In which category would you place wings of a bird and wings of a bat? Justify your answer giving a suitable reason.

Ans. Differences:

Homologous organs	**Analogous organs**
(i) They have same basic structural design. (ii) They perform different functions (iii) Their appearances are different.	(i) They have different basic structural designs. (ii) They perform similar functions (iii) They have similar appearance.

Wings of a bird and wings of a bat are analogous organs as they have different basic structural design but have similar appearance and perform similar function.

31. State and describe in brief any three main factors responsible for the rise of a new species.

Ans. Factors responsible for rise of a new species are:

(i) Genetic drift: Over generation, genetic drift may lead to the accumulation of different changes which lead to the formation of a new species.

(ii)Natural selection: Natural selection may work differently in different locations. Due to this, variation may occur which lead to the formation of a new species.

(iii) DNA Change: Variation during Copying often leads to formation of a new species.

32. How are fossils formed? Describe, in brief two methods of determining the age of fossils.

Ans. When organisms die, their bodies decompose due to the action of microorganisms. However, specimen the body or at least some parts of the body may be in such an environment that does not let it decompose completely. All such preserved traces if living organisms are called fossils.

The age of fossil can be estimated by the following two methods-

(i) If we dig into the earth and start finding fossils it can be assumed that the fossils closer to the surface are more recent to these found in the deeper layers.

(ii) By detecting the ratios of different isotopes of the same element in the fossil material.

33. List three roles of fossils in tracing evolutionary relationships.

Ans. Fossils and their study is useful in knowing about the species which are no longer alive. They provide evidence and missing links between two closes. They are also helpful in forming a sequence of organisms in the pathway of evolutionary relationship.

34. Describe any three ways in which individuals with a particular trait may increase in population.

Ans. The different ways in which individuals with a particular trait may increase in a population are as follows:

(i) Due to accidental death of individuals with a particular trait in a population, the individuals with another trait may increase.

(ii) The individual with special traits survive the attack of their predators and multiply while the others will perish.

(iii) Genetic drift results in development of individuals with a new trait in a population.

35. Give an example of body characteristics used to determine how close two species are in terms of evolution and explain it.

Ans. Homologous organs help to identify the relationship between organisms. These characteristics in different organisms would be similar because they have been inherited from a common ancestor. For example, Forelimbs of humans and wings of birds show

closeness between the two species because the organs have similar basics structural design of limbs though they have been modified to perform different functions.

36. **Explain how evolutionary relationships can be traced the study of homologous organs.**

Ans. Homologues organs characteristics help to identify an evolutionary relationship between different species. The characteristics of these organs in different organisms would be similar because they are inherited from a common ancestor. For example forelimbs of mammals have same basic structural design as the wings of birds, however their functions get modified.

37. **Name two homologous structures in vertebrates. Why are they so called? Hoe do such organs help in understanding an evolutionary relationship?**

Ans. Forelimb of human and wing of a bird and homologous organs.

They have same basic structural design and development origin but they different functions and appearance.

Homologous organs help us to understand that the organisms have evolved from a common ancestor. The more common characteristics, the two species have the more closely they are related.

38. **With the help of suitable example explain natural selection.**

Ans. Let us assume that there exist a group of red beetles in some green bushes. Due to variation during sexual reproduction one green beetle evolved among them. This green beetle can pass the trait of colours to its progeny which would be green beetle. Crows cannot see green beetles in green bushes and therefore, cannot eat them. Thus, the progeny of green beetles are not eaten while the progeny of red beetles continued to be eaten. As a result there are more and more green beetles in the beetle population. The progeny of green beetles increase due to natural selection which given them survival advantage.

39. **What are chromosomes? Explain how in sexually reproduce organisms the number of chromosome in the progeny is maintained.**

Ans. Chromosome are the structures that bear the DNA or gees , they carry the DNA or genes to the progeny cells.

- There are special lineages of cells in the sexually – reproducing organisms.
- These cells undergo a special type of cell division, called meiosis; consequently, the germ cells formed have only half the number of chromosomes as the parents cell.

- When two such germ cells (with half the numbers of chromosomes) fuse, a zygote/new individual is formed with the same number of chromosomes as the parent organism.

40. A group of grasshoppers – some green and some brown lived in grassland having dry bushes and dry grass.

(a) Which one would normally be picked up by predatory birds and why?

(b) Population of which grasshoppers will increase?

(c) Name this phenomenon.

Ans. (a) Green grasshoppers, because they stand out, against brown background of dry bushes.

(b) Population of brown grasshoppers will increase.

(c) This phenomenon is called natural selection.

41. Describe Darwin's theory of evolution.

Ans. Darwin;s theory of evolution. Charles Robert Darwin's theory of evolution. Charles Robert Book, 'The Origin of species'. They theory of evolution proposed by Darwin is known as 'The Theory of Natural selection'. It is also called 'Darwinsim'.

According to Darwin's theory of evolution:

(i) There is natural variation within any population and some individuals have more favourable variations than others.

(ii) Population remains fairly constant even though all species produce a large number of offsprings.

(iii) This is du to 'competition' or struggle for existence between same and different species.

(iv) The struggle for survival within population eliminates the unfit individuals and those with 'favourable variations' survive and pass on these variations to their progeny to continue. This is called natural selection.

(v) The favourable variations are accumulated over a long time period leading to the origin of a new species.

42. Explain the following:

(a) Speciation **(b) Natural Selection**

Ans. (a) Speciation : It is the evolution of reproductive isolation among once- interbreeding populations, i.e. the development of one or more species from an existing species.

(b) Natural Selection: It is the process, according to Darwin, which brings about the evolution of new species of animals and plants.

It was noted that the size of any population tend to remain constant despite the fact that more offsprings are produced than are needed to maintain.

Darwin found that variations existed between individuals of the population and concluded that disease, competition eliminated those individuals which are less well-adapted to their environment.

The surviving population would pass the hereditary advantageous characteristics to their offsprings.

43. The human hand, cat paw and horse foot, when studied in detail show the structure of bones and point towards a common origin.

(a) What do you conclude from this?

(b) What is the term given to such structures?

Ans. (a) Human hand, paw and horse hand have an evolutionary relationship. They have similar bone structures, but they have varied functionalities.

(b) Homologous organ is the term given to such structures.

44. What are acquired traits? Why are these traits generally not inherited over generations? Explain.

Ans. - Acquired traits are those traits which an individual acquired after birth during it life-time.

- These are changes in the non-reproductive tissues.
- The DNA or gene of the germ cells is not influenced/changed by these characters; hence, they cannot be passed on to next generation.

45. Distinguish between inherited traits and acquired traits giving on example of each.

Ans. Differences:

Inherited traits	**Acquired traits**
- Those traits which are passed on from parents to offspring are called inherited traits	- The traits, which an individual acquired after Individual acquires after birth during its life-time
- The trait is transmitted through generations	The trait is not transmitted to the next generation.

- Since the acquired traits do not affect the DNA of the germ cells, they are not

Short Answer Type Questions - II

(3 mark each)

1. **Two pea plants one with round yellow seeds (RRYY) and another with wrinkled green (rryy) seeds produce F1 progeny that have round, yellow (RrYY) seeds.**
   When F1 plants are self-pollinated, which new combination of characters is expected in F2 progeny? How many seeds with these new combination of character will be produced when a total 160 seeds are produced in F2 generation? Explain with reason.
   Ans. Round green: 30
   Wrinkled yellow: 30
   New combinations are produced because of the independent inheritance of seed shape and seed colour trait.
2. **After self-pollination in pea plants with round yellow seeds, flowing types of seed were obtained by Mendel:**

Seeds	Number
Round, Yellow	630
Round, green	216
Wrinkled, yellow	202
Wrinkled, green	64

Analyse the result and describe the mechanism of inheritance which explains these results.
Ans. The approximate ration obtained is 9 : 3 : 3: 1 in which parental as well as new combinations are observed . This indicates that progeny plants have not inherited the whole set of genes from each parent.
Every germ cell takes one chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, segregation of one pair of characters is independent of other pair of characters.

3. **In humans, there in 50% probability of the birth of a boy and 50% probability that a girl will be born. Justify the statement on the basis of the mechanism of sex-determination in human beings.**

Ans. In human beings, the genes inherited from our parents decide whether it will be a boy or girl. Women have a perfect pair of sex chromosomes(XX). But, men have a mismatched pair (XY).

All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of the children will be determined by what they inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy.

4. **A green stemmed rose plant denoted by GG and brown stemmed rose plant denoted by gg are allowed to undergo a cross with each other.**

(a) List your observations regarding.

(i) Colour of stem in their F1 progeny.

(ii) percentages of brown stemmed plants in F2 progeny if F1 plants are self pollinated.

(iii) Ratio of GG and Gg in the F2 progeny.

(b) Based on the findings of this cross, what conclusion can be drawn?

Ans. (a) (i) Green

(ii) 25%

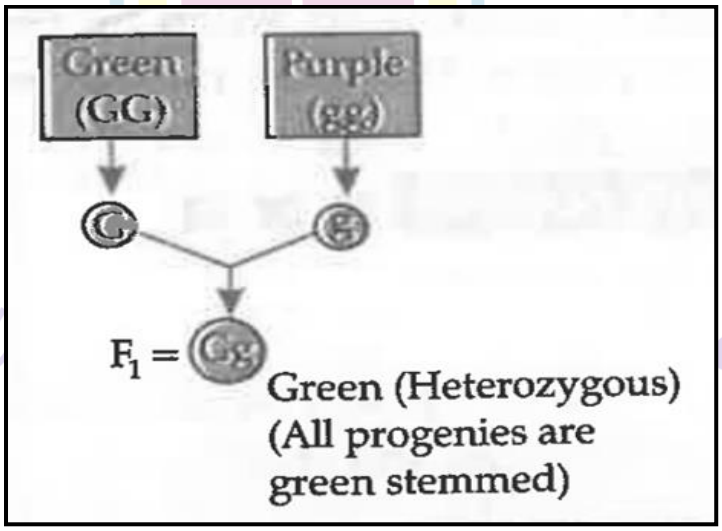
(iii) GG : Gg

1 : 2

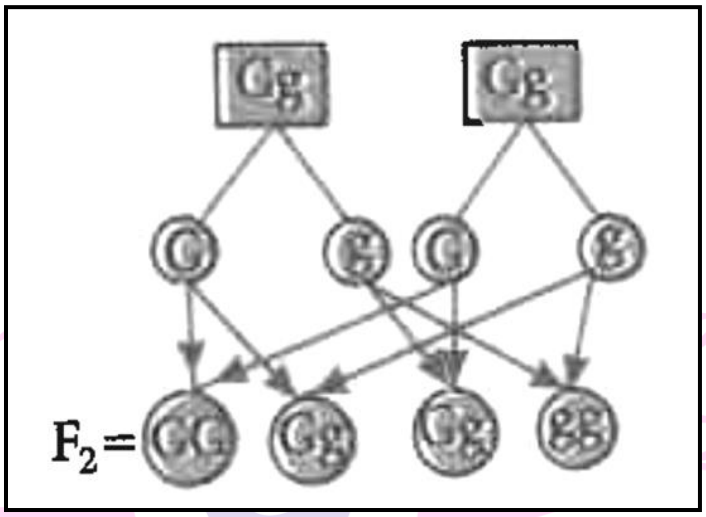
(b) The traits which are expressed in F1 progeny are called dominant traits, whereas the traits which are unable to express themselves in F1 progeny are called recessive traits.

Detailed answer:

(a) (i) Colour of the stem in F1 progeny : All green



(ii)Percentage of brown stem : 25%



(iii) GG : Gg is 1 : 2

(a) Based on the above cross, it can be concluded that green colour is dominant and get expressed in F1 generation. The brown stem, which does not get express itself in the F1 generation, is the recessive character. This is the law of dominance.

5. In a pea plant, the trait of flowers bearing purple colour (pp) is dominant over white colour (pp). Explain the inheritance pattern of F1 and F2 generations with the help of cross following the rules of inheritance of traits. State the visible characters of F1 and F2 progenies.

Ans. Let purple trait be represented by: PP and White trait be: PP

Parental PP X PP

F1 generation PP X Pp (Selfing)

Selfing F1

Gametes of F2

	P	p
P	PP	Pp
P	Pp	PP

Visible characters of F! progeny all purple coloured flowers and in F_2 Progenies 3 are purple coloured and 1 is white coloured flower.

6. Name the plant, Mendel used for his experiment. What type of progeny was obtained by Mendel in F1 and F2 generations When he crossed the tall and short plants? Write the ration he obtained in F2 generation plants.

Ans. Pea Plant / Garden pea / Pisum sativum

F1 – All tall; F2 – Tall and short

Ratio – Tall: short

3 : 1 / 1:2:1

Detailed Answer:

Mendel used pisum sativum (Pea plant) for his experiment.

Mendel took a tall pea (TT) plant and a short generation (F_2) obtained were tall. When F1 progeny was self-pollinated all plants obtained in F2 generation were not all. Instead, three tall pea (dominant) Plants and one short pea (recessive) Plant was obtained.

Parents : TT X tt

(tall) (short)

F1 generation

Tt

(Tall)

Selfing of F1 : TI X Tt

(Tall) (Tall)

t

T

F_2 T

t

TT Tall	Tt Tall
Tt Tall	Tt Short

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

Ans.

Acquired Trait	Inherited Trait
1. These traits are not transferred from one generation to the next generation	These traits are transferred from one generation to the next.
2. They do not bring about change in DNA	They bring about changes in DNS

8. If we cross-bred tall (dominant) Pea plant with pure-bred dwarf (recessive) Pea Plant, We will get pea plant of F1 generation. If we now self-cross the pea plant of F1 generation, we obtain pea plants of F_2 generation.

(i) What do the plants of F1 generation look like?

(ii) State the ration of tall plant to dwarf plants in F_2 generation.

(iii) State the type of plants not found in F1 generation but appeared in F_2 generation. Write the reason for the same.

Ans. (i) Tall

(ii) 3 : 1

(iii) Dwarf

Reason : Being a recessive trait, dwarfness can only be expressed in the recessive homozygous condition or in the absence of dominant trait.

9. How do Mendel's experiment show that traits are inherited independently?

Ans. (i) When a cross was made between a tall pea plant with round seeds, the F1 progeny plants are all tall with round seeds. This dominant traits.

(ii) When the F1 plants are self-pollinated, the F_2 progeny consist of some tall plants with round seeds and some short plants with wrinkled seed which are the parental traits.

(v) There were also some new combinations like tall plants with wrinkled seeds and short plants with round seeds.

(iv)Thus, it may be concluded that tall and short traits and round and wrinkle seed traits have been inherited independently

OR

A flow chart depicting the same.

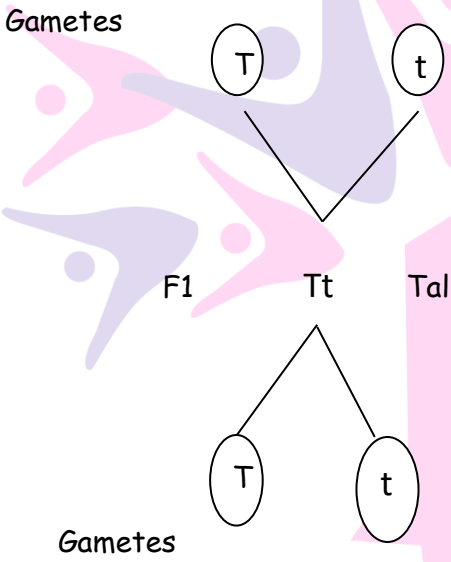
Note: Any other contrasting characters can also be taken.

10. In one of his experimental with pea plants, Mendel observed that when pure tall pea plant is generation, F1, only tall plants appear.

(i) What happens to the traits of the dwarf plants in this case?

(ii) When the F1 generation plants were self-fertilised, he observed that in the plants were present. Why it happened? Explain briefly.

Ans. (i) Parents TT tt



The dwarf traits of the plants is not expressed due to the presence of the dominant tall trait.

F_2 TT Tt Tt tt

Tall Tall Tall Dwarf

Tall: Dwarf = 3 : 1 ratio

(ii) In the F_2 generation, both the tall and dwarf traits are present in the ratio of 3 : 1. This shower that the traits for tallness and dwarfness are present in the F_1 generation, but the dwarfness are present in the F_1 generation, but the dwarfness, being the recessive trait, does not express itself in the presence of tallness, the dominant trail.

11. 'Different species are different strategies to determine sex of a newborn individual. It can be environment cues or genetically determined. Explain the statement by giving example for each strategy.

Ans. Environment Cue: (i) In some animals, the temperature at which fertilised eggs are kept determines whether the developing animal in egg is male or female.

(ii) In some animals like snail, individual can change sex.

Genetical Cue: A child who inherits an X-Chromosome from her father will be a girl and one who inherits a Y-chromosome from the father will be boys.

12. What DNA copying ? State its importance.

Ans. DNA replication or DNA copying is the process if producing two identical replicas from one original DNA molecule during cell division.

Importance of DNA copying.

(i) DNA replication needs to occur so that during cell division, new cells will also have a copy of organisms' DNA.

(ii) DNA is necessary to make all the RNA and proteins needed for cells to carry in order to survive.

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

Ans. No, Mother have no role in determining the sex of the new born. Mothers have a pair of X chromosome and all children will inherit an 'X' Chromosome from their mother regardless of whether they are boys or girls. Only presence or absence of Y chromosome present in males gamete determine the sex of new born.

14. Mention three important feature of fossils which help in the study of evolution.

Ans. The three important features of fossils that help in the study of evolution are as follows:

(i) It helps in establishing the time period in which the organisms lived.

(ii) It helps in establishing the evolutionary traits among organisms and their ancestors.

(iii) It is the mode of preservation of ancient species.

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

Ans. The sex of a child is determined by the type of sex chromosome contributed by male gamete. The statistical probability of getting either a male or female child 50 : 50, because the ratio of male gametes containing X chromosome and those containing Y chromosome is 50 : 50.

16. A very small population of a species faces a greater threat of extinction than a larger population. Provide a suitable genetic explanation.

Ans. A small population of a species impose extensive inbreeding among them, which limits the appearance of variations and put the species at a disadvantages. Also they fail to cope up with the environmental changes, thus become extinct.

17. Evolution has exhibited a greater stability of molecular structure when compared with morphological structures. Comment on the statement and justify your opinion.

Ans. There is immense diversity size, form, structure and morphological features in the living world. At the molecular level these diverse types of organisms exhibit similarity of the basic bio molecules like DNA, RNA, carbohydrates, proteins, etc.

Evolution is not related to complexity of body, therefore, it is difficult to ray that complex organisms are more evolved than the simpler organisms.

18. Does the occurrence of diversity of animals on earth suggest their diverse ancestry also? Discuss this point in the light of evolution.

Ans. Diversity of animals does not mean that they have diverse ancestry because common ancestry greatly limit the extent of diversity. If the animals are inhabiting in the same habitat their evolution by speciation and geographical isolation is also not likely. Animals having a common ancestor have developed new traits forming various groups of animals.

19. Give the pair of contrasting traits of the following character in ea plant and mention which is dominant and recessive.

(i) Yellow seed

(ii) round seed

Ans. (i) seed colour - Yellow (dominant) green (recessive)

(ii) seed shape - Round (dominant) wrinkled (recessive)

20. **A woman has only daughters. Analyse the situation genetically and provide a suitable explanation.**

Ans. The women produces ova with 'X' chromosome and man produces sperms with X and Y chromosome. It the husband of the woman transfer X chromosome, then child will be a girl. On the other hand, if the husband transfers Y chromosome, the child will be a boy. In the case, the husband is always transferring X chromosome and hence, all the children are girl.

21. **Give reasons why acquired characters are not inherited.**

Ans. Acquired characters are not inherited because they do not produce change in the DNA of germ cells only those characters which have a gene for them can be inherited.

22. **Why do all the gametes formed in human females have an X-Chromosome?**

Ans. All the gametes formed in human females have an 'X' Chromosome because during meiosis at the time of gamete formation, one X chromosome enters each gamete.

Long Answer Type Questions

(5 marks each)

1. **(a) What is the law of dominance of traits? Explain with an example.**

(b) Why are the traits acquires during the life time of an individual not inherited ? Explain.

Ans. (a) Law of dominance of traits: -In a cross between a pair if contrasting characters, only one parental character will be expressed in F_1 generation which is called dominant trait and the other is called recessive trait.

For example – in pea plants, when a tall pea plant (TT) is crossed with a short pea plant (TT), all the progeny produced in F_1 generation are tall (Tt).

All plants in F_1 generation were tall proving that the gene for tallness is dominant over the gene for dwarfness/ short, which is not able to express itself in the presence of dominant trait. (any other example)

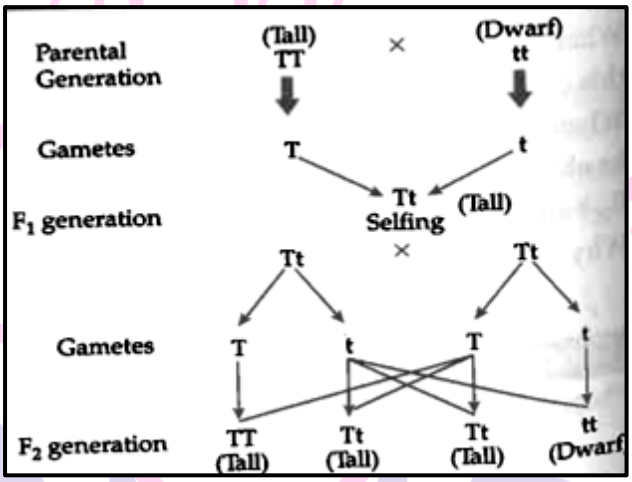
(b)Traits acquired by an organism during its lifetime are known as acquired traits.

These traits are not inherited because they cause any change in the DNA of the germ cells.

Detailed Answer:

(a) Law of dominance of traits: It states the "When parents having pure contrasting characters are crossed then only one character is the dominant character and the character which cannot express itself is called recessive character".

Let us take an example of tall and dwarf in pea plant. When pure line tall (TT) plants were crossed with pure line dwarf (tt) plants, offspring of all Tall plants in the F_1 generation shows that tallness is the dominant character while dwarfness is the recessive character. The ration of Tall of Dwarf in F_2 generation is 3 : 1



(b) Characters that a person acquires during one's life times are known as acquires characters/traits. Such changes do not occur in the reproductive tissues. Changes in the non-reproductive tissues are not passed on the DNA of the germ cells and therefore not inherited by the next generation.

2. (a) What are dominant and recessive traits?

(b)"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. (a) Dominant Trait: The trait which expresses itself in F_1 (first) generation after crossing contrasting (opposite) trait is known as dominant character (trait).

Recessive Trait: The trait which is not expressed itself in F_1 (first) generation after crossing contrasting (opposite) trait.

(b) Yes

3. How do Mendel's experiments show that

(a) Traits may be dominant or recessive?

(b) Inheritance of two traits is independent of each other?

Ans.(a) Mendel conducted a Monohybrid cross/(crossed pure tall pea plants with pure dwarf pea plants) he observed only tall pea plants in the F_1 generation, but on self crossing of the F_1 progeny, both tall and dwarf pea plants were observed in F_2 generation in the ration 3 : 1. Appearance of tall character in F_1 and F_2 generations shows tallness to be a dominant

character. But absence of dwarf character in F_1 and its reappearance in F_2 conforms that dwarfness is recessive character.

(b) Mendel conducted a dihybrid cross and observed that though he started with two types of parents, he obtained four types of individuals in F_2 generations along with parental type characters showed that traits are inherited independently of each other.

4. **With the help of one example for each, distinguish, between the acquits traits and the inherited traits., Why are the traits/experiences acquired during the entire lifetime of an individual not inherited the entire lifetime of an individual not inherited in the next generations? Explain the reason of this fact with an example.**

Ans. Acquired traits: Traits which develop in the life time of an individual and do not pass to the progeny.

Example: Learning a skill such as dance/music/loss of body parts/weight/any other example.

Example: Skin colour/eyebrows/any other example.

Reason: Traits/characteristics acquired during one's life time do not bring any change in the DNA of the reproducing cells/germ cells.

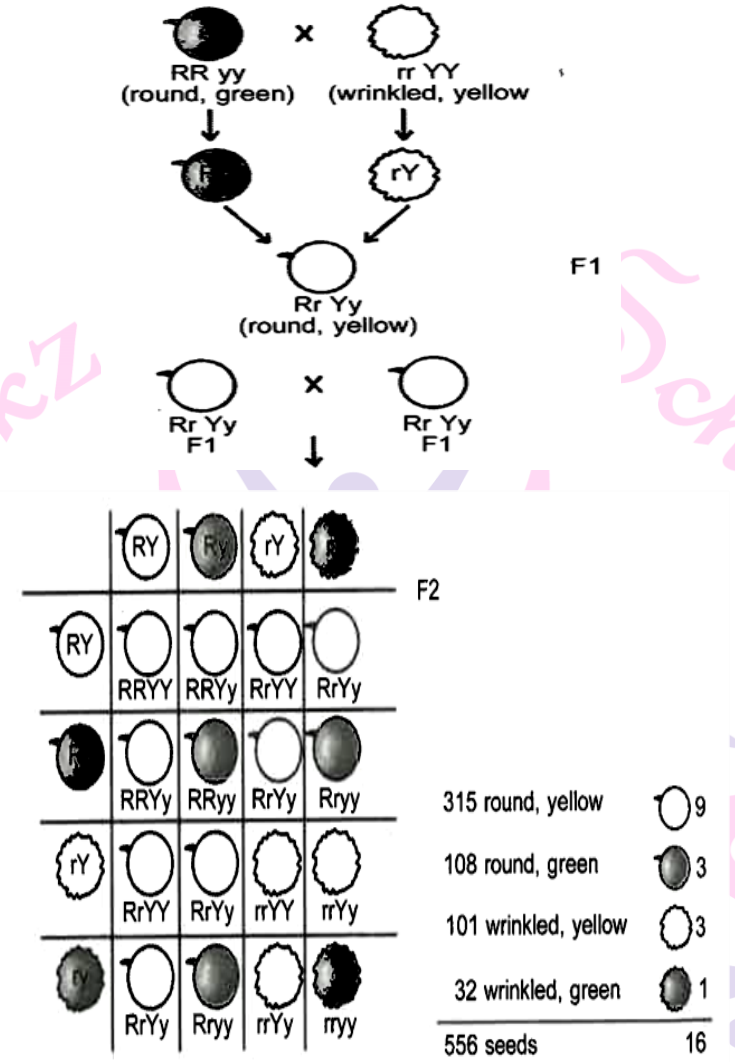
Example: Decrease in boy weight of beetles due to starvation do not pass on to the next generation because there is no change in the germ cells of beetles.

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

(a) traits may be dominant or recessive.

(b) traits are inherited independently?

Ans. Mendel's Experiments on inheritance of Traits. Mendel used a number of visible contrasting characters of garden pea like round/Wrinkled seeds, tall/short plants, white/violet flowers, etc.



Independent inheritance of two separate traits, shape and colour of seeds

Independent inheritance of two separate traits, shape and colour of seeds.

(i) Traits may be dominant or recessive :

- Mental used a number of visible constructing pairs of characters in garden pea.

- He made crosses between pea plants with different characters; there were no halfway or intermediate characters.

- Only one of the parental traits appeared in the F_1 generational it is called dominant trait and the trait which remains hidden, is called recessive trait.

- When the F_1 plants were self-pollinated the F_2 progeny consisted of plants with the dominant trait the recessive trait in the ratio of 3 : 1; it proves that traits may be dominant or recessive.

(ii) Traits are inherited independently:

- When a cross is made between a tall plant with round seeds, (when inheritance of two traits is considered), with a short plant with wrinkled seeds, the F_1 progeny were all tall with round plants.
- When the F_1 plants are self-pollinated, the F_2 progeny are self-pollinated, the F_2 progeny consisted of some tall plants with round seed and some short plants with wrinkled seeds; these two are the parental types of combination of traits.
- There wer also some new combinations like tall plants with wrinkled seeds and short plants with round seeds.
- Thus it is clear that the tall and short traits and round and wrinkled seed traits are inherited independently of each other.

6. (a) With an example, explain how genes control the characteristics.

(b) Which of the following traits can be passed on to the progeny and which cannot?

(i) Hair type and colour.

(ii) The cut tail of a mouse.

(iii) Preferance for certain types of food.

(iv) Red colour of beetles.

(c) Define species. Give two examples of plant species and two animals.

Ans. (a) Genes are the units of heredity. Each gene exercise its function by synthesizing specific protein which is responsible for the expression of characteristic.

For example, consider the height as a characteristic of the plant. We know that plants have hormones that can trigger growth. So, height of plants depend upon the amount of particular hormone. However, if the gone has alternation that makes the enzyme less efficient, the amount of the hormone will be less and plant will be dwarf. The clearly indicates that characteristics are under the control of genes.

(b) Traits which can be passed on to progeny are:

(i) Hair type and colour.

(ii) Red colour of beetles. Traits which control be passed on to progeny are:

(iii) The cut tail of a mouse.

(iv) Preference for certain types of food

(c)It refers to a population of organism, consisting of similar individuals which can breed together and produce fertile offsprings.

Two example of animals species are lion and elephant.

7. (a) Describe briefly three ways in which individual with a particular trait may increase in a population.

(b) From the set of figures given below, make a pair of homologous and analogous organs each and give one reason in case of both, to justify you answer.

Ans. (a) The four ways in which individuals with a particular trait may increase in a population are as follows:

(i) Sexual reproduction results into increase in population.

(ii) The individuals with special traits survive the attack of their predator and multiply while the other will perish.

(iii) Genetic drift provides diversity without any adaptation.

(iv) Variations I the species may lead to increased survival of the individuals with a particular trait.

(b) Bird's wing and Bat's wing – Analogous organs, basic structural designs are different but functions are same.

Human's forelimb and Birds wing – Homologous organs, basic structural design is same but functions are different.

8. (a) Can the wing of a butterfly and the wing of a bat be regarded as homologous? Why?

(b) What is speciation? State any two factors which could lead to speciation.

(c)Name the vegetables made wild cabbage by artificial selection when farmers:

(i) Opted for swollen stems.

(ii) Opted for sterile flowers

(iii) opted for arrested flowers

(iv) opted for large leaves.

Ans. No, the wings of a butterfly and the wing of a bat cannot be considered homologous organs because they have a common function of flying but their origin and basic structural design are not common. So, they are analogous organs.

(a) – Speciation refers to the phenomenon in which new species are formed form the existing species.

(b) – The factors leading to speciation are:

(i) genetic drift and (ii) natural selection

(c) (i) Kohlrabi

(ii) Cauliflower

(iii) Broccoli

(iv) Kale

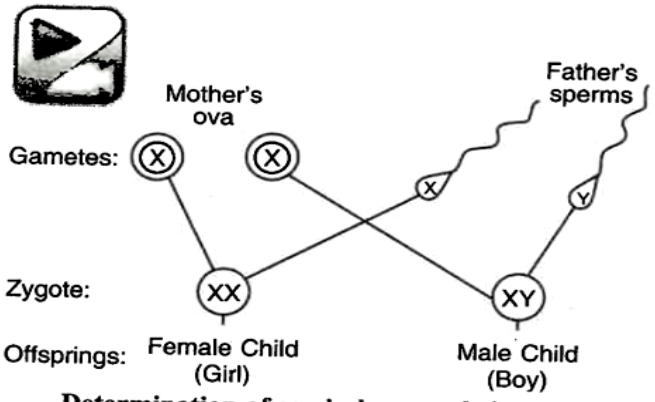
9. (a) What are homologous structures? Give an example.

(b) "The sex of a new born child is matter of chance and none of the parents may be considered responsible for it". Justify this statement with the help of a flow chart showing sex-determination in human beings.

Ans. (a) Homologues organs are those organs indifferent groups of organism which are similar in their basic structure, but are modified to perform different functions.

e.g. forelimbs of mammals, and those of reptiles and amphibians.

(b) Sex of a child depends on what happens during fertilization:



Determination of sex in humans beings

(i) The female gamete, ova always contributes an X chromosome during fertilization.

(ii) The male gamete, sperm contributes either X or Y chromosome during fertilization. Whether sperm will contribute the chromosome or Y chromosome is matter of chance and the man does not have any control on it.

(iii) If a sperm carrying X chromosome fertilizes an egg which always carries a X chromosome, then the child born will be a girl. But if a sperm carrying Y chromosome fertilizes an egg which always carries X chromosome, then the child born will be a boy.

(iv) Thus, sex of a new born child is a matter of chance and none of the parents may be considered responsible for it.

10. What is speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Explain

Ans. Speciation: Speciation is the evolution of reproductive isolation among once-interbreeding population. Factors which can lead to speciation are:

(i) Genetic drift : Over generation, genetic drift may lead to the accumulation of different changes which lead to speciation.

(ii) Natural selection : Natural selection may work differently in different location which may give rise to speciation.

(iii) Serve DNA Change: Variations during of DNA copying often leads to speciation.

(iv) A variation may occur which does not allow sexual act between two group.

Out of these , severe DNA change is not a major factor in the speciation of a self – pollinating plant species because.

(v) Variation is the differences in the characters among the individuals of species. In self-pollinating species, pollen grains fall on the stigma of the same flower or another flower of the same plant. Since self pollination is taking place in the same plant, so changes among the flowers of the same plant is negligible and hence variation in self-pollinating plant do not have any major effect in speciation of a self pollinating plant.

(vi) Due to serve DNA change, individuals may vary from each other. In case of self pollinating plants, pollination take place within the same plant and hence severe DNA change among individual plants do not have any major impact.

11. (a) What is variation? How is variation created in a population? How does the creation of variation in a species promote survival?

(b) Explain how, offspring and parents of organisms reproducing sexually have the same number chromosomes.

Ans. (a) Variation refers to the differences in the characteristics among the individuals of a species.

- Variations is created in a population by

(i) Errors in DNA copying

(ii) Recombination during reproduction.

- In case of a drastic change in the environment of the niche of the population, at least some variant would have chances of survival.
- There are special lineages of cells in specialised organs in multicellular organisms.
- Such cells undergo a special type of cell division, called meiosis , and the germ cells(gametes) formed have only half the amount of chromosomes as the parent cell.
- When two such germ cells (with half the number of chromosomes) fuse, a zygote/new individual is formed with the re-establishment of the number of chromosome as in parent organism.

12. Define evolution. How does it occur? Explain how fossils provide evidences in support of evolution.

Ans. – Evolution is defined as the phenomenon of gradual changes occurring over millions of years, resulting in complex body designs and new species from the pre-existing simpler ones, steps in evolution.

Gene flow occurs between two populations of a species that are only partly, but not completely separated.

If the two populations are completely isolated, the gene flow between them is much reduced.

Over generation, generic drift will accumulate different changes in these sub-populations.

Natural selection may also operate differently in these different geographic locations.

Together, the processes of genetic drift and natural selection make these two populations different and in capable of reproducing with each other.

They have become two new species, i.e evolution has occurred

Fossils provide evidences in support of evolution.,

(i) Fossils indicate the time period in the history of the earth, when different species lived.

(ii) Fossils indicate the evolutionary relationships among different species.

(iii) The fossils found closer to the surface of earth are more complex than fossils found deeper layer of the earth.

13. In the following crosses write the characteristics of the progeny:

Cross	Progeny
(a) RRYY X RRYY Round, yellow and Round, yellow	…… ……
(b) RrYy X RrYy Round, yellow and Round, Yellow	…… ……
(c) rryy X rryy Wrinkled, green and wrinkled, green	…… …… …… ……
(d) RRYY X rryy Round, yellow and wrinkled green	……

Ans. (a) Round yellow

(b) Round yellow, Round green

Wrinkled yellow, Wrinkled green

(c)Wrinkled green

(d) Round Yellow

14. Study the following cross and showing self-pollination in F_1 fill in the blanks and answer the question that follows:

Parents	**RRYY** **X** **rryy** **Round, yellow** **Wrinkled, green**
F_1 _	**RrYy** **X** **?**

Ans. RrYy Round , yellow.

15. In previous questions, what are the combinations f character in the F_2 progeny? What are their ratios?

Ans. Round Yellow – 9 : Round green – 3

Wrinkled yellow : Wrinkled green -1

i.e. 9 : 3 : 3 : 1.

16. Give reasons for the appearance of new combinations of characters in the F_2 progeny.

Ans. An organism can inherit each character independently. SO, in the F_2 progeny new combination of character appear. Tall/short and Round/Wrinkled seed trait are independently inherited.

17. Does geographical isolation of individual of a species lead to formation of a new species? Provide a suitable explanation.

Ans. Yes, geographical isolation of individual of a species lead to formation of a new species. Geographical isolation of a population leads to genetic drift and there will be no gene flow between it and the parent species. Inbreeding in small population will reproduce aong themselves and generate new variations. Accumulation of those variations over several generations will lead to formation of new species.

18. Bacteria have a simpler body plan when compared with human beings. Does it mean that human beings are more evolved than bacteria? Provide a suitable explanation.

Ans. No, it does not mean that human beings are more evolved than bacteria and human beings perform all activities of life to live in their environment. Human beings have more complex organisation and differentiation which are absent in bacteria. However, bacteria can survive in extreme conditions and inhospitable places such as hot springs, deep-sea thermal rents, craters of volcanoes, in the ice of Antarctica, etc. in which human cannot.

19. All the human races like Africans, Asians, Europeans. Americans and other might have evolved in support of this view.

Ans. All the human races have evolved from a common ancestor because they possess:

(i) Common body plan

(ii) Common structure

(iii) Common physiology

(iv) Common metabolism

(v) Common chromosome number

(vi) Common genetic blue – print

(vii) Free inter breeding

20. Give the basic features of the mechanism of inheritance.

Ans. Basic features for the mechanism of Inheritance are as follows:

(i) Characters are controlled by genes.

(ii) Each gene controls one character.

(iii) Genes are located on chromosomes

(iv) There may be two or more forms of gene.

(v) An individual posses two forms of genes whether similar or dissimilar

(vi) One form may be dominant over the other

(vii) The two alleles separate at the time of gamete formation.

(viii) The two forms are brought together in the zygote.

(ix) Alleles of different genes located on separate chromosomes behave independent of one another.

Competency Based Questions

I. Read the passage and answer the following questions.

In a cross between plants with purple flowers and plants with white flowers, all the offspring of F_1 generation had white flowers. When the F_1 generation was self-crossed, it was observed in the F_2 generation that out of 100, 75 flowers were white. Make a cross and answer the following questions:

1. The above cross is known as:

a. Monohybrid cross b. Dihybrid cross

c. Test cross d. Back cross

2. In a monohybrid cross between two heterozygous individuals, percentage of pure homozygous individuals obtained in generation is:

a. 25% **b. 50%** c. 75% d. 100%

3. Which of these is not the genotype of F_2 progeny?

a. WW b. Ww c. ww **d. Wp**

4. The ratio of 'white: Purple' flowers in the F_2 generation is:

a. 3 : 1 b. 1 : 2 c. 1 : 3 d. 2 : 1

II. Study the given cross showing self pollination in F_1 and answer the following questions from Q.1 to Q.4.

RRYY X rryy

Parents

(Round yellow) (Wrinkled Green)

RrYy X _____ F_1

generation

1. The missing blank in the above cross is:

   a. **RrYy** b. RRYY c. RryY d. rryy

2. The combination of characters in the F_2 progeny are:

   a. Round Yellow: Round Green : Wrinkled Yellow : Wrinkled Green

   b. Round Green: Round Yellow : Wrinkled Yellow : Wrinkled Green

   c. Round yellow: Round Green : Wrinkled Green : Wrinkled Yellow

   d. Round Green: Round Yellow : Wrinkled yellow : Wrinkled Green

3. The ratio of the combination of characters in the F_2 progeny is:

   a. 3 : 1 b. 1 : 2 : 1 c. 1 : 1 : 1 **d. 9 : 3 : 3 : 1**

4. A Mendelian experiment consists of breeding tall pea plants bearing violet flowers with short pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were shot. The suggest that the genetic make-up of the tall parents cod depicted as

   a. TTWW b. TTww **c. TtWW** d. TtWw

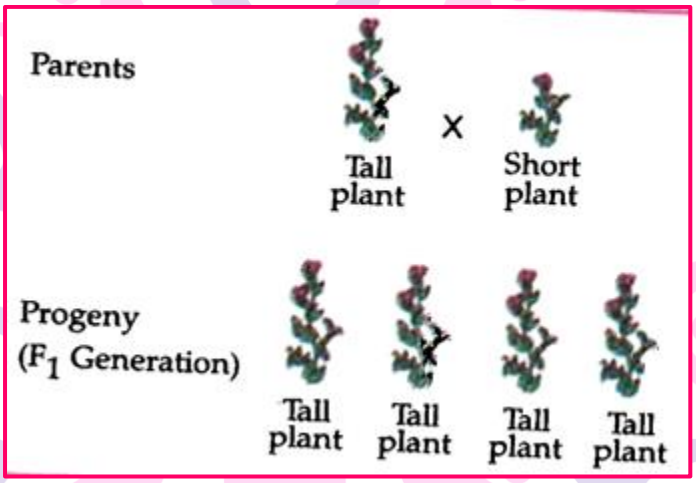
All must have gene for violet flower. As violet colour appears in hybrids thus it must be the dominant character. So, white flowered plant should have WW genes to shoe recessive white character. It indicates that all progenies got allele W (Violet colour) from tall-violet flowered plant, thus all of its gametes should have this allele. To serve the purpose, Plant must have this allele. To serve this purpose, plant must have WW genes. But, tallness was found in 50% progenies thus half of its gametes contained T gene and other half contained t gene. Inclusively, the tall plant had TtWW genotype.

Case based Subjective Questions

I. Read the passage given below and answer the following questions.

Shali performed an experiment to study the inheritance pattern of genes. He crossed tall peas plants (TT) with short pea plants (tt) and obtained all tall pea plants in generation.

1. When F_1 plants were cross pollinated with plants having it genes, a total of 800 plants were produced. How many of these would be tall, medium height or short plants? Give the genotype of F_2 generation.



Ans. 1. Tt

2. Traits like T are called dominant traits, while those that behave like 't' are called recessive traits. /Alternatively accept the definition of dominant and recessive traits with examples of T and t respectively/Alternatively accept the law of Dominance with examples of T and t.
3. Out of 800 plants 600 plants will be tall and 200 plants will be small. 1TT : 2Tt : 1tt
4. In the cross between Tt X tt, 400 Tall (Tt) and 400 short (tt) plants will be produced.