Heredity and Evolution

Very Short Answer Type Questions (1 marks each)

Q. 1. 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? [CBSE, 2018]

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

Q. 2. The following vegetables are kept in a basket:

Potato, Tomato, Radish, Brinjal, Carrot, Bottle-gourd

Which two of these vegetables correctly represent the homologous structures?

(a) Carrot and Tomato
(b) Potato and Brinjal
(c) Radish and Carrot
(d) Radish and Bottle-gourd

[CBSE OD, Term 2, Set 1, 2017]

Ans. **(c)** Radish and Carrot

Q. 3. Select the set of homologous organs from the following:

(a) Wings of pigeon and a butterfly
(b) Wings of bat and a pigeon
(c) Forelimbs of cow, a duck and a lizard
(d) Wings of butterfly and a bat

[CBSE Delhi, Term 2, Set 1, 2017]

Ans. **(c)** Forelimbs of cow, a duck and a lizard.

Q. 4. Why is variation important for a species? [CBSE OD, Term 2, Set 3, 2017]

Ans. Variation is necessary for the survival of species as variation makes species more adapted to survive with the changing environmental conditions. The variant species are more adapted to changing environment. Therefore, they can survive better and reproduce to pass the genes to the offsprings.

Q. 5. If you are asked to select a group of two vegetables, out of the following, having homologous structures which one would you select?

(a) Carrot and radish
(b) Potato and sweet potato
(c) Potato and tomato
(d) Lady finger and potato

[CBSE OD, Term 2, Set 1, 2016]

Ans. **(a)** Carrot and radish

Q. 6. Which of the following is a correct set of homologous organs?

(a) Forelimbs of frog, bird and lizard
(b) Spine of cactus and thorn of bougainvillea
(c) Wings of bat and wings of butterfly
(d) Wings of a bird and wings of a bat

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(a)** Forelimbs of frog, bird and lizard

Q. 7. What is DNA?

[CBSE Delhi, Term 2, Set 2, 2016]

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

Q. 8. Given below is the list of vegetables available in the market. Select from these the two vegetables having homologous structures:

Potato, sweet potato, ginger, radish, tomato, carrot, okra (Lady's finger)

(a) Potato and sweet potato
(b) Radish and carrot
(c) Okra and sweet potato
(d) Potato and tomato

[CBSE OD, Term 2, Set 1, 2015]

Ans. **(b)** Radish and carrot

Q. 9. Four students A, B, C and D reported the following set of organs to be homologous. Who is correct?

(a) Wings of a bat and a butterfly
(b) Wings of a pigeon and a bat
(c) Wings of a pigeon and a butterfly
(d) Forelimbs of cow, a duck and a lizard

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. **(d)** Forelimbs of cow, a duck and a lizard

Q. 10. What is speciation?

[CBSE Delhi, Term 2, Set 3, 2015]

Ans. Speciation is the formation of new species from the pre-existing population.

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Short Answer Type Questions-II (3 marks each)

Q. 1. (a) Classify the following as homologous or analogous pairs :
(i) Broccoli and Cabbage
(ii) Ginger and Raddish
(iii) Forelimbs of birds and lizard
(iv) Wings of a bat and Wings of a bird.
(b) State the main feature that categorises a given pair of organs as homologous or analogous. [CBSE OD, Set 1, 2020]

Ans. (a) (i) Broccoli and cabbage are analogous pairs.
(ii) Ginger and raddish are analogous pairs.
(iii) Four limbs of birds and lizard are homologous pairs.
(iv) Wings of bat and wings of a bird are analogous pairs.

(b) Homologous organs are defined as the organs of different animals that are having a similar structure but differ in their functions. Example of homologous organs are the forelimbs of frog, man and the flippers of the whale. The structure of these animals are the same but the functions are different. The flippers are used for swimming, the forelimbs of frogs are used for jumping and propping, and the forelimbs of man are used for writing, eating, holding things, etc. Having a similar structure shows that all these animals have a common ancestor.

Analogous organs are defined as the organs of different animals that are having different structure but perform the same functions. Example of analogous organ are the wings of insects and the wings of the birds. The structure of wings of a bird has bones covered by flesh, skin and feathers whereas the wings of insects are extension of integument. But in both the cases the wings are used for flying. These organisms would have to adapt to the same ecological niche as other organisms. Hence, they may have evolved similar (analogous) organs.

Q. 2 A green stemmed rose plant denoted by GG and a 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 F_1 progeny
(ii) Percentage of brown stemmed plants in F_2 progeny if F_1 plants are self pollinated.
(iii) Ratio of GG and Gg in the F_2 progeny.
(b) Based on the findings of this cross, what conclusion can be drawn?
[CBSE OD, Set 1, 2020]

Ans. (a) (i) Colour of stems in F_1 progeny will be all green.
(ii) The percentage of brown stem will be 25% *i.e.*, one-fourth of the total number of progeny.

F_1 Green	G	g
G	GG	Gg
g	Gg	gg

(iii) GG: Gg is 1: 2

(b) Based on the findings of this cross this can be concluded that green stemmed plants are dominant whereas brown stemmed plants are recessive.

Q. 3. List three factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species and why?
[CBSE OD, Set 2, 2020]

Ans. Speciation is an evolutionary process of the formation of new and distinct species. The species evolve by genetic modification. The new species are reproductively isolated from the previous species *i.e.*, the new species cannot mate with the old species.

There are several factors which lead to speciation.

(i) Due to some geographical changes, few members of a species get isolated

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from other members. Later, this isolated group grows in a different land and eventually evolves as a new species with new adaptations according to its environment.

(ii) Natural selection will have a major role to play in the speciation of the species since it leads to variations in the species.

(iii) Genetic drift is an evolutionary change in allelic frequencies of a population as a matter of chance and it leads to the speciation and separates the population.

Geographical isolation will not be a major factor in the speciation of self-pollinating plant species. Geographical isolation creates the separation of the population. It is because in self-pollinating species, new variants are not formed and they do not show any variation in the population. After self-pollination, homozygous line evolve. In contrast, after cross-pollination, heterozygous line evolve and it results in the variation of traits in the population.

Q. 4. What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor? Justify your answer.

[CBSE Delhi, Set 1, 2020]

Ans. Homologous structures are those structures which have same basic structure but different functions.

For example; forelimbs of humans are for grabbing things but forelimbs of other animals are for various functions. Yes, it is necessary that homologous structures must have common ancestors because everything has its own origin and base and homology indicates common ancestry. Homologous structures gets their origin from their common ancestors. Homologous organs follow the same basic plan of organisation during their development but in the adult condition these organs are modified to perform different functions as an adaptation to different environments.

Q. 5. 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.

[CBSE Delhi, Set 1, 2019

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 is 3 : 1 (Tall : Dwarf)

T T t t

Tt Tt F_1 generation

Tt × Tt

	T	t
T	TT	Tt
t	Tt	tt

F2 generation

Q. 6. List two differences between acquired traits and inherited traits by giving an example of each.

[CBSE Delhi, Set 1, 2019]

Ans.

S. No.	Acquired Traits	Inherited Traits
1.	These are somatic variations and do not bring any change in DNA.	These are genetic variations and bring about change in the DNA.
2.	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.

Q. 7. How does the creation of variations in a species promote survival? Explain with the help of an example. [CBSE, 2019]

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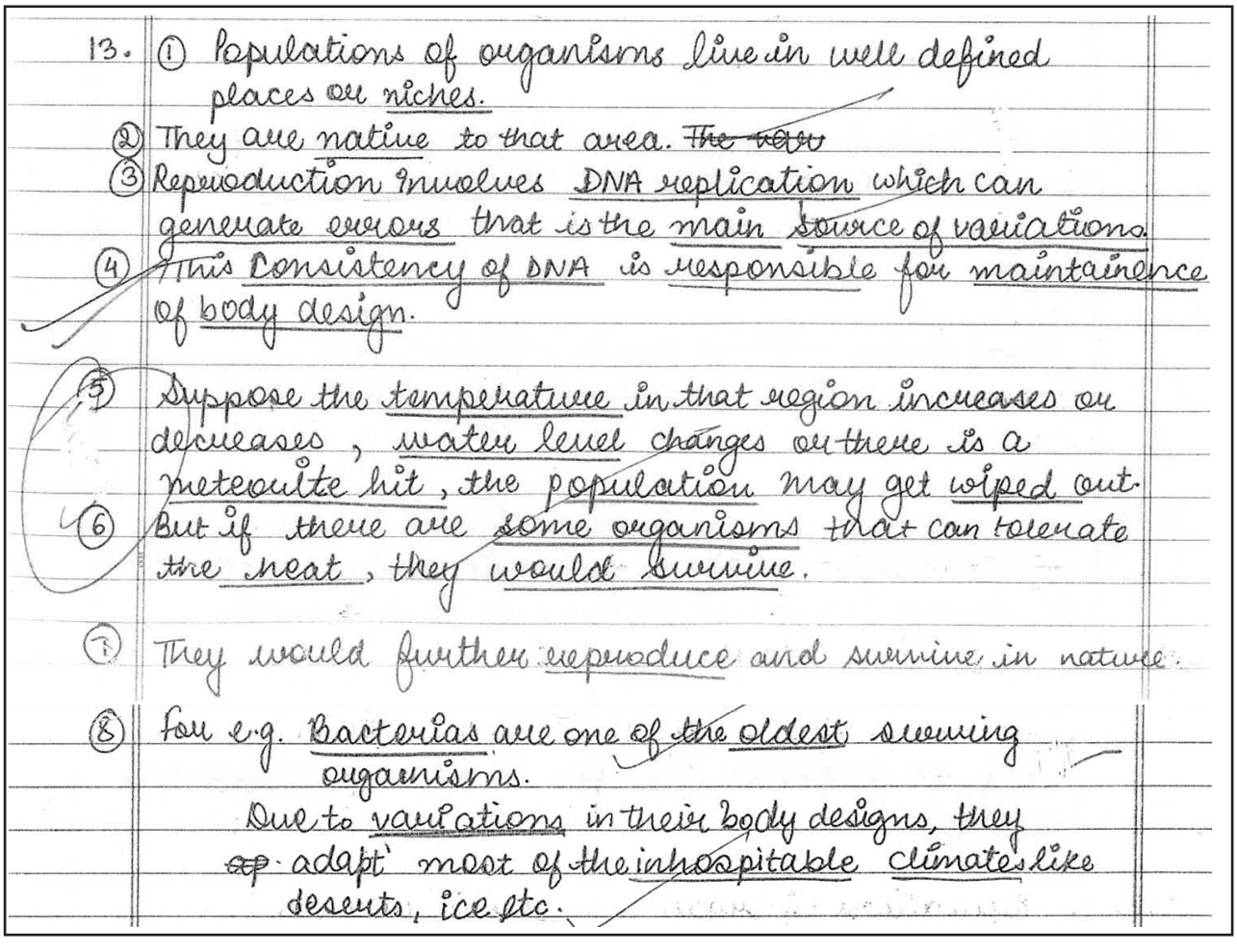
13. ① Populations of organisms live in well defined places or niches.
② They are native to that area. ~~The area~~
③ Reproduction involves DNA replication which can generate errors that is the main source of variations.
④ This Consistency of DNA is responsible for maintainence of body design.
⑤ Suppose the temperature in that region increases or decreases, water level changes or there is a meteorite hit, the population may get wiped out.
⑥ But if there are some organisms that can tolerate the heat, they would survive.
⑦ They would further reproduce and survive in nature.
⑧ Eg. Bacterias are one of the oldest surviving organisms.
Due to variations in their body designs, they ~~ap~~ adapt most of the inhospitable climates like deserts, ice etc.

Q. 8. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?

[CBSE OD, Term 2, Set 1, 2017]

Ans. Some traits that are inherited may not express themselves. Such hidden traits are known as recessive traits. Mendel explained this phenomenon with the help of monohybrid cross. In a monohybrid cross performed by Mendel, tall plant was crossed with a dwarf plant which produced all tall plants in F_1 progeny.

However, when these F_1 tall plants were crossed with each other, 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.

Parent	Tall (TT)	×	dwarf (tt)	
		↓		
F_1 generation	Tt		Tt	
		selfing		
F_2 generation	TT	Tt	Tt	tt

So, dwarfness traits of plants (pea plant) were not lost but are suppressed in the F_1 generation and thus reappeares in F_2 generation.

Q. 9. "Evolution and classification of organisms are interlinked". Give reasons to justify this statement.

[CBSE OD, Term 2, Set 1, 2017]

Ans. Classification refers to the grouping and naming of organisms based on the similarities and difference in their characters. Classification is done on the basis of ancestral characteristics and derived characteristics. So as we move

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from simple life forms to the complex organisms, we are actually tracing the path of evolution. All life forms on earth have progressively changed during evolution. So the hierarchy develops during classification which throws the light on the evolutionary relationship among organisms. Common ancestors can also be predicted with the help of classification.

Q. 10. 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?

[CBSE OD, Term 2, Set 2, 2017]

Ans. The experiences and qualifications that a person earns during their lifetime are examples of acquired traits. These traits are not inherited, they do not affect the genetic makeup. They are developed due to direct affect of the environment. Thus they are not passed to the next generation. Piercing of ears or large sized muscles of the wrestler are not carried by the next generation. Traits can only be passed on to the next generation only when they have some direct effect on the genes. For example, mutation is caused in the germ cells of a person due to exposure to some harmful radiations, it is likely that the mutation will be passed on to the subsequent generations.

Q. 11. What is an organic evolution? It cannot be equated with progress. Explain with the help of a suitable example.

[CBSE OD, Term 2, Set 3, 2017]

Ans. Organic evolution refers to the gradual changes that occur in living organisms over time. It is the result of change in the genetic makeup of the organism due to mutation and other sources of variations. The favourable mutations are accepted by nature and provide the organism an adaptive advantage, leading to its evolution.

Evolution cannot always be equated to progress because it does not always lead to the formation of a new species. In fact, most of the times, it leads to the generation of diversity. One species does not necessarily get eliminated to give rise to a new ones in prevailing environments. Also, the newly formed species may have complex organisation because of evolution but it cannot be considered better than the earlier species. Many older and simpler designs still survive in the nature. For example, bacteria are one of the simplest life forms on earth and still they can survive in the most adverse conditions, such as hot springs, deep sea thermal vents etc. Therefore, having more complex body designs does not make any species superior to others.

Q. 12. Distinguish between the acquired traits and the inherited traits in tabular form, giving one example for each.

[CBSE Delhi, Term 2, Set 1, 2017]

Ans.

S. No.	Acquired traits	Inherited traits
1.	Acquired traits are those that are developed by an individual during his/her life time.	Inherited traits are the qualities or characteristics present in an individual since birth.
2.	They are the result of changes in non-reproductive tissues.	They are the result of changes in the DNA.
3.	They cannot be passed on to the progeny, *e.g.*, Pierced ear, large muscle size etc.	They are transmitted to the progeny. *e.g.*, Colour of eyes, skin or hair colour etc.

Q. 13. Explain with the help of an example each, how the following provide evidences in favour of evolution:

(a) Homologous organs

(b) Analogous organs

(c) Fossils

[CBSE Delhi, Term 2, Set 1, 2017]

Ans. **(a) Homologous organs:** These organs are similar in form but perform different functions in different organisms. These organs provide strong evidences in favour of evolution. For example: the bone structure observed in the fore limbs of birds and bats, flippers of dolphins

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and arms of human beings are similar and have same pentadactyl plan but they perform different functions.

(b) **Analogous organs:** These organs have different origin and different basic structure but perform same functions. For example, wings of birds and wings of bat have different structures but perform same function of flying. Thus, these organs provide evidences for evolution that they are different in origin but evolved to perform same function to survive in hostile environmental conditions.

(c) **Fossils:** Fossils are the preserved remains or traces of animals, plants and other organisms from the remote past. For example, Archaeopteryx is a connecting link between birds and reptiles and it suggests that the present animals have evolved from the existing ones through the process of continuous evolution.

Q. 14. "Natural selection and speciation leads to evolution." Justify this statement.
[CBSE Delhi, Term 2, Set 2, 2017]

Ans. Natural selection is the phenomenon by which the nature selects those species which possess survival advantage over the other species. According to theory of natural selection, there is "Struggle for existence" within the species of a population for the environmental resources and this struggle leads to survival of certain organisms and elimination of the less competent species. Thus, in this competition, some organisms might undergo genetic changes which help them in their survival. The better adapted organism would, thus, survive and pass on their traits to next generations, gradually leading to evolution. Speciation is a process of formation of new species from the existing one due to reproductive isolation of a part of its population. This reproduction and isolation can occur due to geographical isolation of a part of population with time, the genetic drift will accumulate different variations in each of the geographically separated, sub-population, ultimately, all the individuals of these two groups will isolate reproductively thus, leading to formation and evolution of new species. Thus, we can say that both natural selection and speciation lead to the evolution of species on earth.

Q. 15. How do Mendel's experiment show that traits are inherited independently?
[CBSE OD, Term 2, Set 1, 2016]

Ans. Mendel performed an experiment in which he took a tall plant with round seeds and short plant with wrinkled seeds. In F_1 progeny all tall with round seeds were produced. Tallness and roundness were thus dominant traits. When he used these F_1 progeny to generate F_2 progeny by self-pollination, he found that some F_2 progeny were tall plants with round seeds, while others were short, but had round seeds. Thus Mendel's experiment shows that tall or short traits and round or wrinkled seed traits are independently inherited.

Q. 16. "Two areas of study namely 'evolution' and 'classification' are interlinked". Justify this statement.
[CBSE OD, Term 2, Set 1, 2016]

Ans. Modern classification system is based on the phylogenetic resemblances and evolutionary relationships between the species. Systematic deals with the classification of living beings on the basis of evolution. Thus, evolution of organisms gives a hint about its position in classification system and vice versa. Hence, we can say that evolution and classification are two interlinked areas of study.

Q. 17. With the help of an example justify the following statement:
"A trait may be inherited, but may not be expressed."
[CBSE OD, Term 2, Set 2, 2016]

Ans. Characters are inherited by parents. But not all the characters are expressed. Some characters are recessive and they are suppressed by dominant genes.

E.g., In one of the Mendel's experiments when pure tall pea plants are crossed with pure dwarf pea plants in F_1 generation all tall pea plants are obtained. On selfing F_1 generation pea plants both tall and dwarf pea plants were obtained in F_2 generation.

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Q. 18. How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. During asexual reproduction organisms undergo only mitotic divisions. The DNA of the cells involved are copied and then equally divided among the two daughter cells formed. Thus, chromosome number remains unchanged. In sexual reproduction, organisms produce gametes through meiosis, in which the original number of chromosomes becomes half. These two gametes combine to form the zygote and the original number of chromosome is restored.

For example, in humans, the parents each have 46 or 23 pairs of chromosomes. In the gametes, the sperm has half the number of chromosomes, *i.e.*, 23 and the egg also has 23 chromosomes. When the sperm and the egg fuse, the zygote has 46 or 23 pairs of chromosomes.

Q. 19. In one of his 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 plants appear.

(a) What happens to the traits of the dwarf plants 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 it happened? Explain briefly.

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(a)** The dwarf traits of the plants is not expressed in the presence of the dominant tall traits.

(b) In F_2 generation all tall and dwarf traits are present in the ratio of 3:1, this showed that both tallness and dwarfness traits were present in F_1 generation but only tallness trait appeared being dominant trait.

Q. 20. List three distinguishing features, in tabular form, between acquired traits and the inherited traits.

[CBSE Delhi, Term 2, Set 1, 2016]
[CBSE Delhi, Term 2, Set 3, 2015]

Ans.

S. No.	Acquired traits	Inherited traits
1.	Do not bring changes in the DNA of germ cells.	Bring changes in the DNA of germ cells.
2.	Cannot bring direct evolution.	Can bring direct evolution.
3.	Cannot be passed on to the progeny.	Can be passed on to the progeny.

Q. 21. How did Mendel interpret his result to show that traits may be dominant or recessive? Describe briefly.

[CBSE Delhi, Term 2, Set 2, 2016]

Ans. Mendel conducted breeding experiments on pea plants:

He selected pure breed tall and dwarf plants. He cross pollinated these plants. In the F_1 generation obtained only tall plants, tallness is the dominant trait.

Then, he produced F_2 generation by selfing of hybrids of F_1 generation. He found that 3/4th of the plants were tall and 1/4th were dwarf. The trait which remains hidden in F_1 generation plants is the recessive trait.

Q. 22. 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.

[CBSE Delhi, Term 2, Set 3, 2016]

Ans. Yes, the scientist may arrive at the law of dominance according to which the trait that is expressed in the F_1 generation is the dominant trait, although both the dominant and recessive traits are present in the F_1 generation. In F_2 generation recessive trait is expressed alongwith dominant trait.

Q. 23. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:

(a) Homologous organs

(b) Analogous organs

(c) Fossils

[CBSE OD, Term 2, Set 1, 2015]

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Ans. **(a)** Study of homologous organs suggests that the organs having same structures but performing different functions have evolved from a common ancestor.

e.g., Forelimbs of a frog, lizard, birds and man.

(b) Analogous organs shows adoption of organs for common use.

e.g., Wings of butterfly and wings of bat.

(c) Fossils–Provides the missing links between two species.

e.g., Archeopteryx

Q. 24. Explain the following:

(a) Speciation

(b) Natural Selection

[CBSE OD, Term 2, Set 1, 2015]

Ans. **(a) Speciation:** Speciation is the evolution of new species from pre-existing species. It occurs due to accumulation of variations. By the processess like genetic drift, barriers like mountains, rivers etc. leading to incapability to reproduce amongst themselves in population.

(b) Natural selection: Change in frequency of some genes in a population. It gives survival advantages to a species from elimination.

Example: In a population of beetles, a new variation (green colour) get survival benefit and this is the advantage to green beetles whereas other one red perishes.

Q. 25. A pea plant with blue colour flower denoted by BB is cross-breed 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 the percentage 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.

[CBSE OD, Term 2, Set 2, 2015]

Ans. **(a)** F_1 progeny will have blue coloured flowers as blue is dominant.

(b) On self pollination in F_2 generation white flowers will be 25%.

(c) Ratio of blue and white in F_2 progeny will be 1 : 2.

Q. 26. What is DNA copying? State its importance. [CBSE Delhi, Term 2, Set 1, 2015]

Ans. A process where a DNA molecule produces two similar copies of itself in a reproducing cell is known as DNA copying.

Importance of DNA copying are:

(i) It makes possible the transmission of characters from parents to the next generation.

(ii) It causes variation in the population.

Q. 27. "We cannot pass on to our progeny the experiences and qualifications earned during our life time". Justify the statement giving reason and examples.

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. Acquired knowledge or skills like dancing, music etc. do not bring any change in the DNA of the reproducing cell or germ cell. Only germ cells are responsible for passing on the characters from the parents to the progeny. Thus due to this fact the characters which we inherit during our life time are not passed to our progeny.

Q. 28. (i) "Planaria, insects, octopus and vertebrates all have eyes. Can we group eyes of these animals together to establish a common evolutionary origin?" Justify your answer.

(ii) "Birds have evolved from reptiles." State evidence to prove the statement.

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. **(i)** The eyes seen in each of these organisms vary differently in their structure but all of them perform the same function of vision. Thus a common evolutionary origin can be established on the basis of eyes.

(ii) "Birds have evolved from reptile," this can be justified as follows:

(a) Fossils of certain dinosaurs or reptiles show imprints of feather along with their bones but they

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could not fly presumably using the feathers for insulation.

(b) Later, they developed and adapted feathers for flight, thus becoming the ancestors of present day birds.

Q. 29. What is speciation? List four factors responsible for speciation.

[CBSE Delhi, Term 2, Set 2, 2015]

Ans. **Speciation:** Formation of new species from the pre-existing population.

Four factors responsible for speciation are:

(i) Genetic drift

(ii) Natural selection

(iii) Geographical isolation

(iv) Change in genes.

Long Answer Type Questions (5 marks each)

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

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

[CBSE Delhi, Set 1, 2020]

Ans. **(a)** The law of dominance states that the allele expressed in the heterozygous condition is termed as dominant and the allele which cannot express itself in the heterozygous condition is called as recessive. Recessive traits are expressed only in homozygous recessive conditions. Let us take an example of tall and dwarf in pea plant. When pure line tall (TT) plant were crossed with pure line dwarf (tt) plants, offspring were all heterozygous tall (Tt). Hence, allele tall (T) is dominant over allele dwarf (t) which is recessive in nature.

(b) The traits acquired during life time of an individual are not inherited because the traits acquired during life time of an individual include his unique hair styles, different type of dressing, consumption of different types of foods, etc. Such traits are not inherited by their progeny it is because these are the changes which do not have any effect on DNA of the germ cells. Any change which affects the DNA arrangement of the germ cell may lead to transfer of the mutation to the progeny cells. The traits acquired by the individual during his life time are practiced by him due to the situation and the environment in which he/she lives after birth. As the traits acquired during life time of an individual does not interfere with the genetic makeup of the DNA of the germ cells, they are not inherited.

Q. 2. (a) What is genetics?

(b) What are genes? Where are the genes located?

(c) State and define three factors responsible for the rise of a new species.

[CBSE Delhi, Set 2, 2020]

Ans. **(a)** Genetics is the branch of biology which deals with the study of genes, heredity and variations of inherited characters.

(b) Genes are short regions of DNA which code for either a protein or RNA molecule. It is the fundamental unit of heredity. Genes are made up of DNA strands and are found in almost every cell's nucleus.

(c) The factors responsible for rise of new species are :

(i) **Natural selection:** All populations respond to changes in their environment. Individuals will respond in different ways depending on their genes. Those individuals whose genes are best suited to the environment are more likely to survive and pass on their genes to the next generation. This is natural selection. Gradually, favourable genes will start to predominate in

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the population and less favourable genes will decline.

(ii) **Genetic drift:** It is caused due to drastic changes in the frequencies of particular genes by chance alone. Genetic drift with changes in the gene flow imposed by isolation mechanism acts as an agent of speciation which ultimately results in evolution.

(iii) **Geographical isolation:** It is a major factor in speciation since it interrupts with gene flow. Geographical isolation is caused by various types of barriers such as mountain ranges, rivers and seas. It leads to reproductive isolation due to which there is no flow of genes between separated groups of population which ultimately results in speciation.

Q. 3. (a) What are homologous structures? Give an example.

(b) "The sex of a newborn child is a 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.

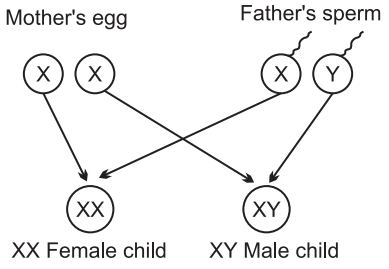
[CBSE OD, Set 1, 2019]

Ans. (a) The structures which have the same basic design or origin but different functions are called homologous structures or homologous organs.

Example: Forelimbs of a man, a lizard, a frog they have same basic design of bones but perform different functions.

(b) The sex of a newborn depends on what happens at the time of fertilization.

1. If a sperm carrying X chromosome fertilizes the ovum carrying X chromosome, then the girl child will be born and the child will have XX combination of sex chromosomes.
2. If a sperm carrying Y chromosome fertilizes the ovum carrying X chromosome, then the child born will be a boy and the child will have XY combination of sex chromosome.



The above presentation clearly shows that it is matter of chance whether the newborn will be a boy or a girl and none of the parents may be considered responsible for it.

Q. 4. (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.

[CBSE OD, Set 2, 2019]

Ans. (a) 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.

(b) Yes; 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.

	Tall		Dwarf		
	TT	×	tt		
F_1	→	All Tall (Tt)			
		TT	×	Tt	
F_2	→	TT	Tt	Tt	tt
		Tall	Tall	Tall	Dwarf

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Q. 5. (a) How do the following provide evidences in favour of evolution in organisms? Explain with an example for each.
(i) Homologous organs
(ii) Analogous organs
(iii) Fossils
(b) Explain two methods to determine the age of fossils. **[CBSE, 2019]**

Topper's Answers

20. I Homologous organs

1. They are the organs that are similar in structure but have been modified to perform different functions.

20: a) For eg.
forelimbs of humans, frog and lizard have similar structures Frog uses it to hop and as a shock absorber, humans use it to write, hold etc; and lizards use it to creep on walls.

They explain that maybe the reptiles, mammals and amphibians had common ancestors and evolved to be in the present form.

Analogous Organs
① They have different structures and appearance but perform similar function.
② For eg. wings of a bat and a bird have different structure, but perform function of flying. [Birds have feathers and wings all over body. / Bat - Thin flap like, webbed wings.]
③ They do not show common ancestory but trace evolution due to which they became capable of flying.

(iii) Fossils

① They are the remains of plants and animals found under earth that lived in remote past.
② They tell us about the evolutionary relationships in the past.
③ For eg. Archaeopteryx has round cranium and wings similar to birds but claws and beak reptiles.

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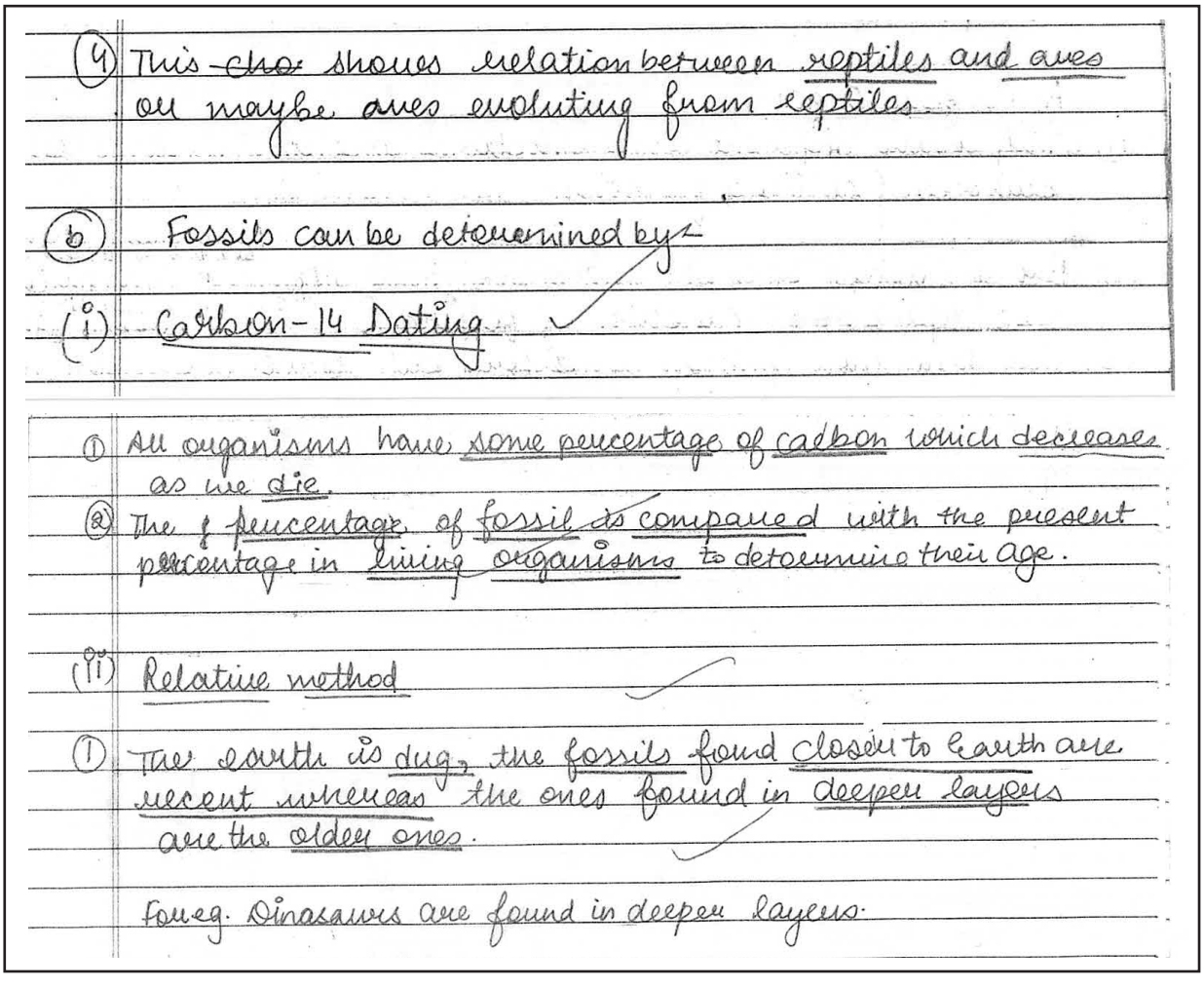

Q. 6. With the help of one example for each, distinguish between the acquired traits and the inherited traits. Why are the traits/experiences acquired during the entire lifetime of an individual not inherited in the next generation? Explain the reason of this fact with an example.

[CBSE OD, Term 2, Set 1, 2017]

Ans.

S. No.	Acquired traits	Inherited traits
1.	Those traits that are developed by the individual during his lifetime.	Those traits which are present in an individual since birth.
2.	They are a result of changes in non-reproductive issues.	They are a result of changes in the DNA.
3.	They cannot be passed on to the progeny, *e.g.*, pierced ear, large muscle size etc.	They are transmitted in the progeny, *e.g.*, colour of eyes, skin or hair.

Traits can be passed on to the next generation only when they have some direct effect on the genes. The traits acquired during the lifetime of an individual cannot be inherited as they do not affect the genetic make up of an organism. In fact, these traits develop due to use and disuse of organs or due to direct effect of environment. Thus, they are not passed on to the next generation. For example, a wrestler develops large muscles because of his training programme, it does not mean that his offspring will necessarily have large muscles. Similarly, if a lady pierces her nose, the children produced to her will not have pierced nose by birth.

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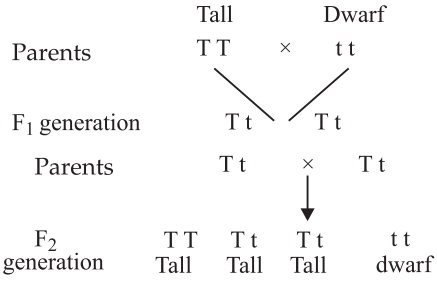
Q. 7. How do Mendel's experiments show that
(a) Traits may be dominant or recessive?
(b) Inheritance of two traits is independent of each other?

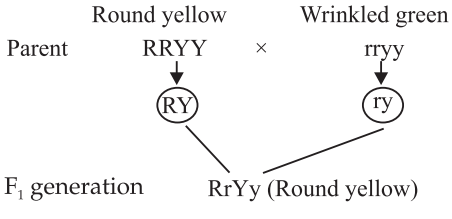
[CBSE Delhi, Term 2, Set 1, 2017]

Ans. **(a)** Mendel demonstrated that traits can be either dominant or recessive through his monohybrid cross. He crossed true breeding, tall (TT) and dwarf (tt) pea plants.



In this experiment Mendel concluded that the F_1 tall plants were not true breeding, they were carrying both short and tall height traits. They appeared tall only because the tall traits were dominant over the dwarf trait. This shows that traits may be dominant or recessive.

(b) Mendel demonstrated that traits are inherited independently through his dihybrid cross. He considered two traits at a time, seed colour and seed shape in which yellow colour (YY) and round shape (RR) are dominant over green colour (yy) and wrinkled (rr).



RY	RYRY Round yellow	RYry Round yellow	RYRy Round yellow	Ryry Round yellow
ry	RYry	rrYY wrinkled	RrYr	rrYy
Ry	RyRY	RyrY	RyRy	Ryry
ry	ryRy	ryry wrinkled	Ryry	ryry wrinkled

Mendel observed that the F_2 progeny of dihybrid cross had a phenotypic ratio of 9 : 3 : 3 : 1 and produces 9 plants with round yellow seeds, three plants with round green seed, 3 plants with wrinkled yellow and one plant with wrinkled green seeds.

In this experiment, he found that round yellow and wrinkled green are parental combination whereas round green and wrinkled yellow are new combination. In a dihybrid cross between two plants having round yellow (RRYY) and wrinkled green seeds (rryy), four types of gametes are produced (RY, Ry, ry, rY). Each of these gametes segregates independently of each other and each has a frequency of 25% of the total gametes produced.

From this experiment, he concluded that when two pairs of traits are combined together in a hybrid, one pair of character segregates independent of the other pairs of character. This is known as the law of independent assortment.

Q. 8. Define evolution. How does it occur? Describe how fossils provide us evidences in support of evolution.

[CBSE OD, Term 2, Set 1, 2016]

Ans. Evolution is change in the heritable traits of biological populations over successive generation. It occurs due to continued mutation of natural selection.

They provide gradual change in phenotype with respect to shape and size of organism which also indicates adaptation with respect to changing environmental conditions.

Fossils are the remains or impressions of prehistoric plants or animals embedded in rock and preserved in petrified form. Fossils provide the evidence that present animals and plants have originated from previously existed ones through the process of continous evolution.

For example: Fossils of Archaeopteryx shows characteristics of both reptiles and birds. It shows that aves have evolved from reptiles.

Q. 9. What is meant by 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. Give reason to justify your answer.

[CBSE Delhi, Term 2, Set 1, 2016]

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Ans. Speciation is the process of formation of a new species from a pre-existing one. Factors leading to speciation are:

(i) Genetic drift
(ii) Mutation
(iii) Natural selection
(iv) Geographical isolation

Q. 10. How do Mendel's experiments show that the

(a) traits may be dominant or recessive,
(b) traits are inherited independently?

[CBSE OD, Term 2, Set 1, 2015]

Ans. **(a)** When Mendel cross pollinated pure tall pea plants with pure dwarf pea plants, only tall plants were obtained in F_1 generation in 3:1 ratio. Thus appearence of tall character in both F_1 and F_2 shows that it is a dominant character. The absence of dwarf in F_1 generation reappears in F_2 shows dwarfness in the recessive character.

(b) When Mendel conducted a dihybrid cross having two sets of characters, he obtained only one set of parental characters in F_1 generation whereas in F_2 generation he obtained both the set of parental characters as 9:3:3:1 ratio. Thus appearance of new generation or recombinants in the F_2 generation along with parental type shows that traits are inherited independently.

Q. 11. What are fossils? How are they formed? Describe in brief two methods of determining the age of fossils. State any one role of fossils in the study of the process of evolution.

[CBSE OD, Term 2, Set 2, 2015]

Ans. Fossils may be defined as the remains of the organisms which have been preserved in the form of moulds or casts in rocks etc. since pre-historic ages. When a plant or an animals dies, their remains fall on the ground. Over a period of time their body gets covered by sediments brought by rivers winds. These sediments keep on getting accumulated for over hundreds of years and when that land gets eroded, the fossils can be seen. The age of the fossils can be determined by the following ways.

(i) Radiometric dating: The age of fossil can be determined by tracing the radio-active elements present in the rocks and examining its traces.

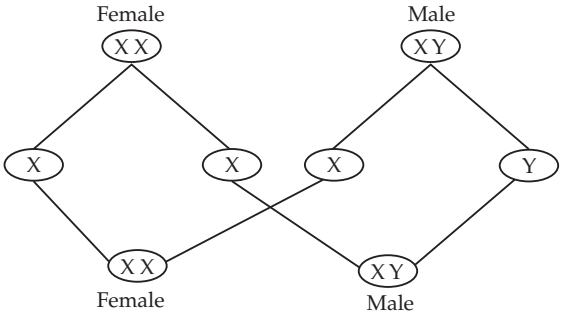
(ii) Relative dating: The fossils found in the sedimentary rocks in the form of layers accumulated over large span of time. So using this fact, age of the fossils can be found by knowing where the fossils were present in the layer. Fossil found at the bottom is older than found above them.

Q. 12. How many pairs of chromosomes are present in human beings? Out of these how many types of sex chromosomes are found in human beings?

"The sex of a newborn child is a matter of chance and none of the parents may be considered reponsible for it." Draw a flow chart showing determination of sex of a newborn to justify this statement.

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. There are 23 pairs of chromosomes in human beings, out of these one pair of sex chromosome is there.



Female has one type of chromosome *i.e.*, X and male has two types of chromosomes *i.e.*, X and Y. Thus, sex of the child depends on the sex chromosomes of the father.

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