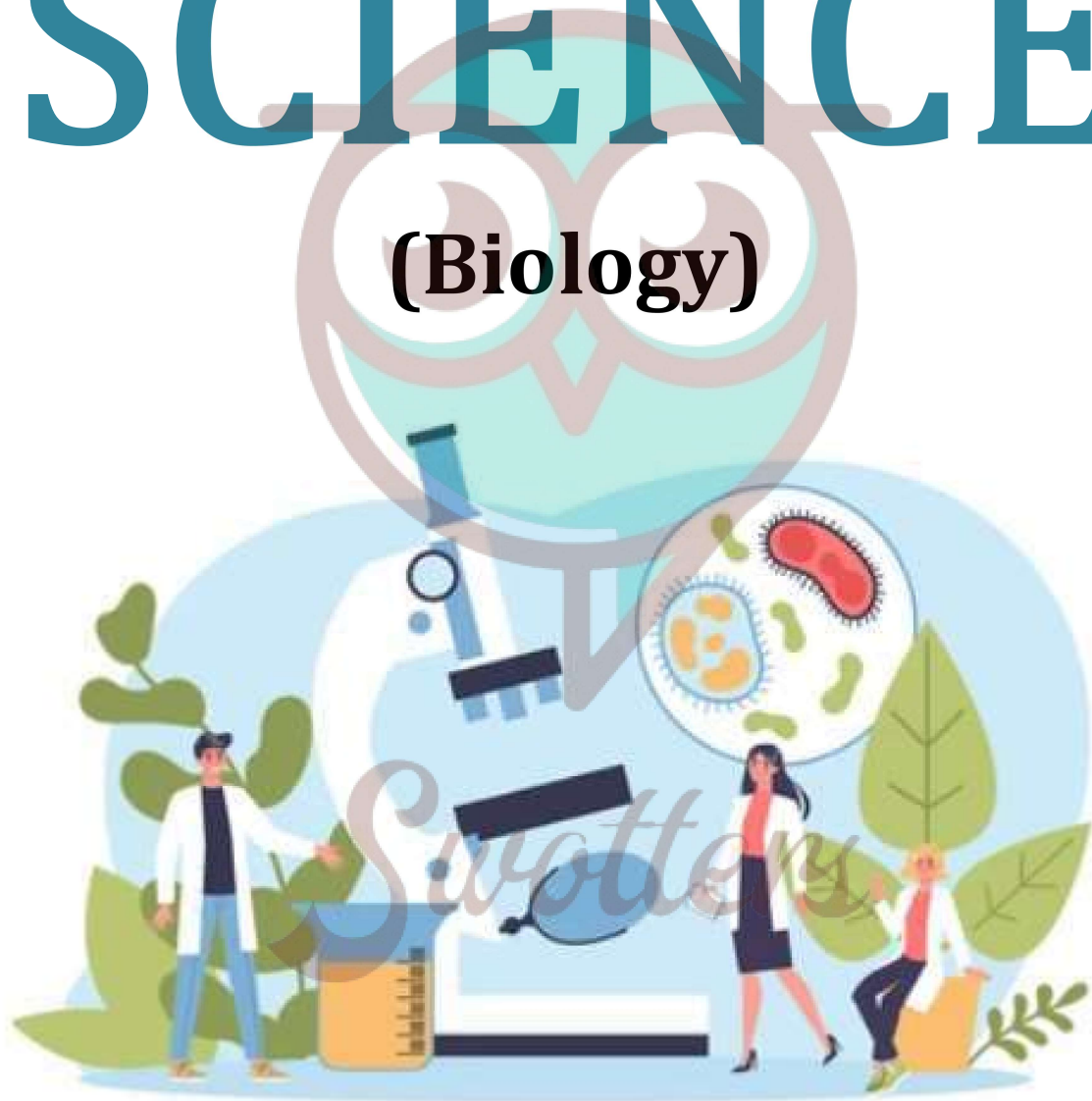


# SCIENCE

**(Biology)**



## Important Questions

### ➤ Multiple Choice Questions:

- Human offspring's sex is determined
  - through father's sex chromosomes.
  - through mother's sex chromosomes.
  - by hormones.
  - by enzymes.
- Wing of a bird and wing of an insect are
  - Homologous organs
  - analogous organs
  - vestigial organ
  - both (a) and (b)
- Which concept was not included in Charles Darwin's theory of Natural Selection?
  - Struggle for existence
  - Punctuated equilibrium
  - Survival of the fittest
  - Overproduction of offspring.
- The remains (or impressions) of dead animals or plants that lived in the remote past are known as
  - extinct species
  - fossils
  - naturally selected species
  - none of the above
- Natural selection is called 'survival of the fittest'. Which of the following statements best describes an organism?
  - How strong it is compared to other individuals of the same species.
  - How much food and resources it is able to gather for its offspring.
  - The ability to adapt to the environment in the niche it occupies.
  - The number of fertile offspring it has.
- The process by which new species develop from the existing species is known as
  - Evolution
  - Natural selection
  - Artificial selection
  - Speciation
- 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.

8. A cross between two individuals results in a ratio of 9 : 3 : 3 : 1 for four possible phenotypes of progeny. This is an example of a

- (a) Monohybrid cross
- (b) Dihybrid cross
- (c) Test cross
- (d) F1 generation

9. Two pink colored flowers on crossing results in 1 red, 2 pink and 1 white flower progeny. The nature of the cross is:

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

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

- (a) Hair colour
- (b) Eye colour
- (c) Weight
- (d) Sex

### ➤ Very Short Question:

1. Who proposed the theory of inheritance of acquired characters?
2. Give an example of a vestigial organ present in human body.
3. Who proposed the theory of natural selection?
4. In terms of evolution, what is the significance of homology between a human hand and a wing of a bird?
5. Name the scientist who established the laws of inheritance.
6. Define inheritance.
7. What is the function of genes in an organism?
8. What is gene?
9. What is speciation?
10. List any two factors that could lead to speciation.

### ➤ Short Questions:

1. What are fossils? How do they tell us about process of evolution?
2. Describe briefly four ways in which individuals with a particular trait may increase in population.
3. "Variations that confer an advantage to an individual organism only will survive in a population." Justify.
4. "The sex of the children are determined by what they inherit from their father and not the mother." Justify.
5. Give one example of each of the characters that are inherited and the ones that are acquired in humans.

Mention the difference between the inherited and the acquired characters.

6.
  - (a) Write foil form of DNA.
  - (b) Why are variations essential for the species ? (CCE 2011)
7. How do sexual and asexual reproduction lead to speciation? Give one point for each.
8. List four tools used to study evolutionary relationships.

### ➤ Long Questions:

1.
  - What is genetics?
  - Give the common name of the plant on which Mendel performed his experiments.
  - What for did Mendel use the term factors and what are these factors called now?
  - What are genes? Where are the genes located?
2.
  - What are chromosomes? Where are they seated?
  - What is a sex chromosome?
  - Explain the mechanism of sex determination in human beings.
3.
  - (a) What is geographical isolation?
  - (b) Illustrate formation of a species with the help of an example where individuals are very different from each other and are capable of reproduction among themselves.

### ➤ Assertion Reason Questions



1. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
  - a. Both A and R are true, and R is correct explanation of the assertion.
  - b. Both A and R are true, but R is not the correct explanation of the assertion.
  - c. A is true but R is false.
  - d. A is false but R is true.

**Assertion:** In grasshoppers, females are hetero gametic and males are homo gametic.

**Reason:** In grasshoppers, male has only one sex chromosome (XO) whereas the female has sex chromosomes (XX).

2. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
  - a. Both A and R are true, and R is correct explanation of the assertion.
  - b. Both A and R are true, but R is not the correct explanation of the assertion.
  - c. A is true but R is false.
  - d. A is false but R is true.

**Assertion:** A child which has inherited X chromosome from father will develop into a girl child.

**Reason:** Girl child inherits X chromosome from father and Y chromosome from mother.

### ➤ Case Study Questions:

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

Sex determination is the method by which distinction between males and females is established in a species. The sex of an individual is determined by specific chromosomes. These chromosomes are called sex chromosomes or allosomes. X and Y chromosomes are called sex chromosomes. The normal chromosomes other than the sex chromosomes of an individual are known as autosomes.

- i. In XX-XO type of sex determination:
  - a. Females produce two different types of gametes.
  - b. Males produce two different types of gametes.
  - c. Females produce gametes with Y chromosome.
  - d. Males produce gametes with Y chromosome.
- ii. A couple has six daughters. What is the possibility of their having a girl next time?
  - a. 10%
  - b. 50%

- c. 90%
  - d. 100%
- iii. Number of autosomes present in liver cells of a human female is:
- a. 22 autosomes.
  - b. 22 pairs.
  - c. 23 autosomes.
  - d. 23 pairs.
- iv. XX-XO type of sex determination and XX-XY type of sex determination are the examples of
- a. Male heterogamety.
  - b. Female heterogamety.
  - c. Male homogamety.
  - d. Both (b) and (c).
- v. Select the incorrect statement.
- a. In male grasshoppers, 50% of sperms have no sex chromosome.
  - b. Female fruit fly is heterogametic.
  - c. Human male produces two types of sperms 50% having X chromosome and 50% having Y chromosomes.
  - d. In turtle, sex determination is regulated by environmental factors.
2. Read the following and answer any four questions from (i) to (v).

In human, the allele for brown eyes (B) is dominant over that for blue eyes (b). A brown eyed woman marries a blue-eyed man, and they have six children. Four of the children are brown eyed and two of them are blue eyed.

- i. What is the genotype of blue-eyed offspring?
- a. BB
  - b. Bb
  - c. bb
  - d. Cannot be determined.
- ii. What is the woman's genotype?
- a. BB
  - b. Bb
  - c. bb

- d. Cannot be determined.
- iii. The ovum, produced by the mother carries the gene regarding eye colour is:
- BB
  - Bb
  - B or b
  - B only.
- iv. The ratio of brown eyed children to blue eyed children in this family is 2 : 1, which deviates from typical phenotypic ratios for monohybrid inheritance. What might be the reason?
- Gametes carrying the brown eyed allele are more viable than those with the blue-eyed allele.
  - A different pattern of inheritance other than monohybrid inheritance is involved.
  - Not all of their babies survived childbirth, thus causing a distortion in the actual ratio.
  - The actual ratio differs from the expected ratio because the sample size is too small.
- v. What is the gene carried by of the man's sperm regarding the eye colour?
- BB
  - Bb
  - b only
  - b or B.

✓ Answer Key-

➤ Multiple Choice Answers:

- (a) through father's sex chromosomes.
- (a) Homologous organs
- (b) Punctuated equilibrium
- (b) fossils
- (c) The ability to adapt to the environment in the niche it occupies.
- (d) Speciation
- (a) More closely they are related and more recently they had a common ancestor.
- (b) Dihybrid cross
- (a) cross fertilization
- (c) Weight

➤ Very Short Answers:

1. Answer: Jean Baptiste Lamarck (1809).
2. Answer: Vermiform appendix.
3. Answer: Charles Darwin (1859) proposed the theory of natural selection.
4. Answer: Homology indicates that there is common ancestry between a human hand and a wing of a bird. They have the same fundamental structure but are different in external morphology and functions.
5. Answer: Gregor Johann Mendel.
6. Answer: The transmission of characters from parents to offspring is known as inheritance.
7. Answer: Genes are the carrier of the genetic information for body functions and passage from one generation to another.
8. Answer: Gene is a unit of inheritance which consists of a linear segment of chromosome or DNA that takes part in expressing a particular character.
9. Answer: Speciation: It is the formation of newer species from the pre-existing ones due to accumulation of variations through various processes like isolation, stoppage of gene flow, genetic drift, and natural selection that lead to inability to interbreed.
10. Answer: It is the formation of newer species from the pre-existing ones due to accumulation of variations through various processes like isolation, stoppage of gene flow, genetic drift, and natural selection that lead to inability to interbreed.

### ➤ Short Answer:

1. Answer: Fossils: They are remains or impressions of past organisms that lie buried in the rocks and other structures belonging to various ages.

#### Fossils Indicate Evolution

- Different types of organisms appeared in different ages. Many of them have later on disappeared. Some gave rise to other organisms while a few are persisting even now.
- Early forms were simple. Most of the later forms became more and more complex.
- Fossils of different ages indicate the path of evolution,

*e.g.*, fishes → amphibians → reptiles  $\begin{cases} \rightarrow \text{Birds} \\ \rightarrow \text{Mammals} \end{cases}$

- Some fossils have characteristics intermediate between two groups, e.g., Archaeopteryx between reptiles and birds. They indicate the path of evolution.
- Phylogeny of some organisms has been worked out with the help of fossils e.g., Horse.

2. Answer:

The individuals with a particular trait will increase in number if the trait provides:

**More Food:** The trait helps in obtaining more food that leads to increased growth and reproduction.

**Useful Variations:** The trait helps the individuals to adapt to environment and achieve greater success in struggle for existence.

**Genetic Drift:** It causes genetic fixation of a trait which, therefore, occurs, in whole of the progeny.

**Differential Reproduction:** The trait gives extra benefit to the individuals in survival and reproduction.

3. Answer: Useful variations give advantage to individuals in obtaining more food, adaptation to environmental changes and higher success in the struggle for existence. They give benefit in survival and reproduction. Differential reproduction increases the useful variations in the populations. Other individuals with harmful variations will be eliminated. For example, some bacteria have ability to tolerate high temperature. In warm environment non-tolerant bacteria will be killed. Others with tolerance to high temperature will survive and multiply.

4. Answer: Ovum produced by would-be-mother is always of one type ( $22 + X$ ). Sperms produced by would-be father are of two types, gynosperms ( $22 + X$ ) and androsperms ( $22 + Y$ ). If gynosperm ( $22 + X$ ) fertilizes the ovum ( $22 + X$ ), the sex of the child will be female ( $44 + XX$ ). If androsperms ( $22 + Y$ ) fuses with the ovum ( $22 + X$ ), the child born will be boy ( $44 + XY$ ). Therefore, only father is responsible for the sex of the children.

5. Answer:

**Inherited Trait:** Fused and Free ear lobes.

**Acquired Trait:** Muscular body of a wrestler.

**Difference:** Acquired trait develops during the life time of an individual which affects somatic parts and dies with the death of the individual. Inherited trait is obtained from the parents, influences genes or germ cells and is passed on to the next generation.

6. Answer:

(a) DNA. Deoxyribose nucleic acid.

(b) Many of the variations have no immediate benefit to the species. They function as preadaptation's which can be beneficial under certain environmental conditions like heat tolerance variation if the temperature of the area rises.

7. Answer:

Sexual reproduction produces a lot of variations due to reshuffling of chromosomes and crossing over.

Variations help in natural selection and speciation.

Asexual reproduction also develops variations occasionally due to errors in DNA replication. These variations help in natural selection and speciation.



8. Answer:

Study of fundamental and correlated characters.

Study of homologous organs.

Study of fossil ancestors.

Molecular phylogeny.

### ➤ Long Answer:

1. Answer:

- Genetics: It is the branch of biology that deals with the study of heredity and variations.
- Garden or Edible Pea.
- Factors: They are particulate inheritable entities which control the expression of traits of a character, e.g, T for tallness, t for dwarfness. The factors are now called genes.
- Genes: They are units of inheritance that take part in expression of particular characters. Genes are located over the chromosomes as linear segments.

2. Answer:

- In case of asexually reproducing organisms, there is no gametogenesis and fertilization. Chance separation and chance pairing of genes and their chromosomes are absent. Therefore, asexually developed individual carries the same genes and their chromosomes as are present in its parent.
- Allosomes (Gk. alios— other, soma—boay) or sex chromosomes are those chromosomes which determine the sex of the individual in unisexual organisms. Human beings have 23 pairs of chromosomes.
- Establishment of male and female individuals through differential development of their sex organs is called sex determination. In some organisms sex is determined by environmental conditions. In others including human beings, it is determined genetically.

Environmental Determination of Sex:

- Crepidula (marine mollusc) and Bonellia (marine worm) develop into females if growing alone. In the company of a female, they develop into males.
- In turtle, *Chrysema picta* an incubation temperature above 33°C produces females while a temperature below 28°C produces only males.
- In lizard, *Agama agama*, high incubation temperature produces male offspring.
- Annelid *Ophryotrocha* is male in young state and female later on. Snails are also known to change sex.

3. Answer:

(a) Geographical Isolation. Prevention of mating between breeding groups due to geographical or physical barriers (e.g., Valley, Mountain, Water body) is called geographical isolation. The isolated populations develop different variations and changes in physiology and behaviour to form new species.

(b) Over 160 breeds of dogs have come up due to selective breeding and artificial selection. Similarly, there are about 800 breeds of cattle. They differ in size, height, features, behaviour, colour and other traits. However, all dogs belong to one species of *Canis familiaris* while all cattle belong to one species of *Bos indiens*. Despite their structural and behaviour differences all the breeds belonging to the same species can interbreed and produce fertile offspring. However, if interbreeding is prevented by spatial isolation these different breeds can develop reproductive isolation and form new species, e.g., Porto Santo rabbits, Galapagos finches.

### ➤ Assertion Reason Answer:

1. (d) A is false but R is true.

#### Explanation:

In grasshoppers, the male has only one sex chromosome (XO) whereas the female has two sex chromosomes i.e., homo gametic. This type of sex determination mechanism is called XX-XO mechanism.

2. (c) A is true but R is false.

#### Explanation:

Father produces two types of sperms, one with X and one with Y chromosome, whereas mother produces all egg with X chromosome. Zygote that inherits X chromosome from father has XX chromosomes and develops into baby girl, whereas zygote which inherits Y chromosome from father has XY chromosomes and develops into baby boy.

### ➤ Case Study Answer:

1. i (b) Males produce two different types of gametes.

#### Explanation:

In XX-XO type and XX-XY type of sex determining mechanisms, males produce two different types of gametes, either with or without X-chromosome (XO type), or some gametes with X-chromosome and some with Y-chromosome (XY type). Such type of sex determination mechanism is designated to be the example of male heterogamety. In both, females are homogametic and produce X type of gametes in both the cases and have XX genotype.

ii. (b) 50%

#### Explanation:

The possibility of having a girl or boy child is equal i.e., 50%, as 50% male gametes are Y type and 50% are X type. Fusion of egg with X type sperm will produce a girl child.

- iii. (b) 22 pairs.

**Explanation:**

In humans, number of autosomes are  $2n = 44$  or 22 pairs regardless of the sex.

- iv. (a) Male heterogamety.  
v. (b) Female fruitfly is heterogametic.

**Explanation:**

Male fruitfly is heterogametic whereas female fruitfly is homogametic.

2. i (c) bb  
ii. (b) Bb

**Explanation:**

According to the given passage some children show recessive trait, i.e., homozygous. So, the woman must be heterozygous.

- iii. (c) B or b

**Explanation:**

Human ova are haploid; hence they only contain one copy of each gene. Since the woman has a Bb genotype her ova would contain either B or b allele.

- iv. (d) The actual ratio differs from the expected ratio because the sample size is too small.

**Explanation:**

According to the given passage, within a single family, the sample size of offspring in each generation is very small. Hence, the actual phenotypic and genotypic ratios often deviate from expected ratios. It is only when sample sizes of offspring is large that actual ratios approach theoretical or expected ratios more closely.

- v. (c) b only

**Explanation:**

Human sperm is haploid; hence they only contain one copy of each gene. Since the man has bb genotype, his sperm would contain allele b only.