

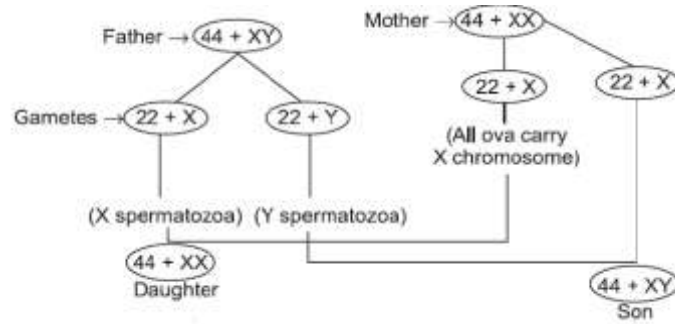
# Assignments in Science Class X

Topic: - Heredity and Evolution

## IMPORTANT NOTES

1. The similarities between parents and their offspring are accounted for by 'heredity' and the dissimilarities by 'variation'. Both heredity and variation are accounted for when we study 'genetics'.
2. Asexual reproduction tends to produce 'clones', i.e., organisms which are genetically identical. Chances of variations are higher in organisms showing sexual reproduction.
3. The differences or dissimilarities between parents and children as individuals of a species are called variations. **Hereditary variations** refer to the differences which are inherited by the progeny from their parents. The inheritance of such heritable variations is determined by the genetic constitution of an individual. Examples of inheritable variations are blood type, skin colour, hair colour, height, etc.
4. **Environmental variations** are caused due to differences in sunlight, water, soil, nutrients and other factors of environment.
5. The type of variation in which individuals can be arranged in a definite increasing order of gradation with respect to particular characteristics, like height, is called **continuous variation**. On the other hand, where no gradation between the distinct features can be seen is called **discontinuous variation**.
6. Causes of variation are — (i) reshuffling of genes during meiosis, (ii) errors in DNA copying, (iii) environment.
7. Gregor Johann Mendel is considered the 'father of genetics'. Mendel attributed contrasting 'factors' coming from the parents and their random combinations, as the cause of 'variation'. Mendel's 'factors' were termed 'genes' by Johannsen. It was observed that the paired condition of the 'factors' is present in the diploid state. But when haploid gametes are formed, the factors 'segregate'. Since chromosomes are paired in its diploid state but separate during gametic meiosis, it is fair enough to judge that the 'factors' are placed on the 'chromosomes'.
8. Chromosomes are made of giant DNA molecules. A DNA molecule consists of two polynucleotide strands forming a double helix. DNA is the genetic material throughout the living world except in a few viruses where RNA serves as the genetic material (e.g., HIV).
9. Each chromosome has two arms called 'chromatids' joined at the centre called 'centrosome'. Eukaryotic chromosomes have basic proteins mixed with DNA and are usually more complex in structure than prokaryotic chromosomes.
10. A gene is the functional unit of DNA that serves as hereditary unit. It is possible to insert a segment of a foreign DNA into the original DNA of a species to make a transgenic organism commonly called GOMs, i.e., Genetically Modified Organisms.
11. Each human nucleus has 23 pairs of chromosomes out of which 22 are same in male and female and are known as 'autosomes'. The 23rd pair is different in male and female and are known as 'sex chromosomes'. Females have 'XX' sex chromosomes and males have sex chromosomes 'XY' type.

12. Sex determination in humans—



13. Evolution is a set of changes brought about by the forces of natural selection on the variation within a population, so that resultant organisms are better adapted to their surroundings.

14. Evidences of evolution can be summarised as follows:

A. **Paleontological or fossil evidence** Fossils are remains or impressions of the organisms of the past. *Archaeopteryx* is a fossil that has both reptilian and avian features, proving that birds have evolved from the reptiles.

B. **Embryological evidence** All the vertebrate embryo up to 6 weeks stage look similar. Hence, the 'biogenetic law' or the 'law of recapitulation' was suggested by Haeckel which states that an organism during the course of its development repeats the developmental history of its race.

C. **Morphological and anatomical evidence**

1. **Homologous organs:** Organs which are similar in structure and origin but different in function and appearance are called homologous organs, e.g., forearm of man, wing of a bat, flipper of a seal, etc.
2. **Analogous organs:** Organs which are similar in appearance and function but different in structure and origin are known as 'analogous organs', e.g., wings of a bird and the wings of a butterfly.
3. **Vestigial organs** are the functionless remnants of the organs, functional in the ancestral forms, e.g., vermiform appendix is the remnant of the caecum (an organ of digestion in the herbivorous ancestors).

15. The most accepted theory of evolution comes from Charles Darwin, whose theory is known as 'Origin of Species by natural selection'. Its tenets are as follows:

1. Organisms have a far higher capacity to reproduce that can be sustained by nature, thereby creating 'competition' or 'struggle for existence'.
2. Offspring vary from one another and from the parents.
3. Those with 'favourable variations' are fit for the 'struggle for existence'.
4. The favourable variations are accumulated over a long time period creating a new species. The weak point of Darwinism is that it could not explain how variations arise.

16. Certain fossils show features which are intermediate between two groups. Such fossils from the **connecting links** and clearly demonstrate stages during the evolutionary process. A very well known example of an extinct animal is **dinosaur that**, existed long ago in large numbers.

## VERY SHORT ANSWER QUESTIONS

### IMPORTANT QUESTIONS

1. What decides that humans give rise to humans?
2. What are hereditary characteristics?
3. Are the variations created by sexual reproduction heritable or non-heritable?

4. What determines the functional property of a gene?
5. What is the basis of sex determination in most plants and animals?
6. Who is known as 'the father of genetics'?
7. Who coined the term 'gene'?
8. What is centrosome?
9. What is haploid?
10. What do you mean by the term paleontology?
11. Name the most accepted theory of evolution.
12. Define the term 'evolution'.
13. Give an example of homologous organ from the plant kingdom.
14. Whose theory influenced Darwin? What did Darwin fail to explain?

## QUESTIONS FROM CBSE EXAMINATION PAPERS

1. What is a gene?
2. Write the scientific term used for 'science of heredity and variation'.
3. What is the function of genes in an organism?
4. Who proposed the theory of inheritance of acquired characters?
5. Give an example of a vestigial organ present in the human.
6. In terms of evolution what is the significance of homology between a human hand and a wing of a bird?
7. Name the scientist who established the laws of inheritance.
8. Define inheritance.
9. One of the examples of two analogous organs can be the wing of parrot and  
(a) flipper of whale (b) foreleg of horse (c) front leg of frog (d) wings of housefly

## SHORT ANSWER QUESTIONS IMPORTANT QUESTIONS

1. What are acquired characteristics?
2. What is variation?
3. Why are asexually reproducing organisms capable of showing hereditary features?
4. What are autosomes?
5. What is the reason that a male is called 'heterogametic'?
6. Define genetics. What is the contribution of Mendel in this branch of Biology?
7. What was the basic study material of Mendel? What did he bring in the term 'factor'?
8. Mention any two similarities between Mendelian factors and chromosomes.
9. How many chromosomes are there in the human (a) ovum (b) liver cell
10. What was the plant chosen by Mendel to work upon? What was his observation?
11. How did the Mendelian 'factors' acquire a change in the terminology? Who changed it?
12. Why can the wings of a bird and the wings of a bat not be considered analogous?
13. What are fossils?
14. Name any four human vestigial organs.
15. Why is *Archaeopteryx* considered to be a connecting link between birds and reptiles?

## QUESTIONS FROM CBSE EXAMINATION PAPERS

1. (a) Write full form of DNA.  
(b) Why are variations essential for the species?
2. (a) State the importance of DNA copying in reproduction.

- (b) Protozoans reproduce by binary fission as well as by multiple fission. In your opinion, which process is better and why?
3. In tobacco plant, the male gametes have 24 chromosomes. State the number of chromosomes in (i) egg nucleus, (ii) zygote, (iii) endosperm and (iv) leaf cell.
  4. (a) DNA copying is an essential part of the process of fertilization. Why?  
(b) How is the process of pollination different from fertilization?
  5. Define variation in relation to a species. Why is variation beneficial to the species?
  6. Describe briefly four ways in which individuals with a particular trait may increase in a population.
  7. "Variations that confer an advantage to an individual organism only will survive in a population." Justify.
  8. A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits — blood group A or O is dominant? Why?
  9. "The sex of the children is determined by what they inherit from their father and not the mother." Justify.
  10. What are fossils? What do they tell about the process of evolution?
  11. In terms of evolution, what is the significance of homology between a human hand and a wing of a bird?
  12. What is meant by analogous organs? Taking a suitable example, explain how they support the theory of Organic Evolution.

## **SHORT ANSWER QUESTIONS**

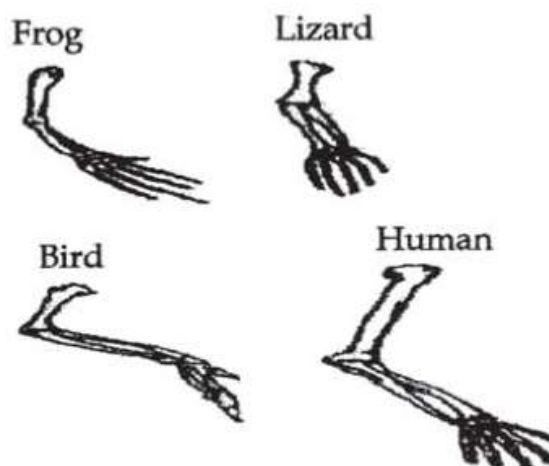
### **IMPORTANT QUESTIONS**

1. What do you mean by environmental variations?
2. Why are environmental variations nonheritable?
3. What is the importance of variation?
4. Who provided the evidence of DNA as a genetic material? Write the names of the components of DNA.
5. How was it established that genes are located on the chromosome?
6. Justify logically that many genes are present on one chromosome.
7. Clarify the terms 'haploid' and 'diploid'. What is the relation between the two terms?
8. Define: (a) homologous organs (b) analogous organs (c) sex chromosome
9. Summarise the modern synthetic theory of evolution. How is continuity of life maintained?
10. Evolution has exhibited a greater stability of molecular structure when compared with morphological structures. Comment on the statement and justify your option.
11. What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor?

## **QUESTIONS FROM CBSE EXAMINATION PAPERS**

1. Distinguish between analogous organs and homologous organs. Identify the analogous and homologous organs amongst the following: Wings of an insect, wings of a bat, forelimbs of frog, and forelimbs of human.
2. Explain with the help of flow chart - "What determines the sex of a child genetically?"
3. What is the importance of DNA copying in reproduction? Why is variation beneficial to the species but not necessary for the individual? Explain.
4. (a) Define Heredity.  
(b) Differentiate between inherited and acquired traits.

5. The genotype of green stemmed tomato plants is denoted as GG and that of purple stemmed tomato plants is denoted as gg. When these two are crossed with each other:
- What colour of stem would you expect in the F1 progeny?
  - Give the percentage of purple stemmed plants if F1 plants are self pollinated.
  - In what ratio would you find the genotypes GG and gg in the progeny?
- Draw flow chart in support of your answer.
6. What are sex chromosomes? What role do they play in determining genetically the sex of an individual in human beings?
7. Why are some pea plants tall and others short in nature? Explain with reference to the role of genes in controlling characteristics.
8. (a) Why traits such as intelligence and knowledge cannot be passed on to the next generation?  
(b) How can we say that birds are closely related to reptiles and have evolved from them?
9. (a) Explain giving examples how artificial selection has helped in the formation of newer varieties of cauliflower.  
(b) List the steps involved in the formation of new species.  
(c) How different races of human beings belong to the same species?
10. (a) Place the following in the correct sequence Natural Selection / Migration / New species / Gene flow.  
(b) Why are the wings of bat and wings of bird called analogous organs?  
(c) Evolution of cauliflower, broccoli, cabbage, red cabbage are all from wild cabbage. Is this an example of natural selection or artificial selection? Justify.
11. (a) Name the plant used by Mendel to carry out his experiments.  
(b) Study the following cross and answer the questions that follow:  
Parents Green and × Yellow and Round seed Wrinkled seed F1 Generation All Green and Round seeds F2 Generation Green and Green and Round(9) Wrinkled(3) Yellow and Yellow and Round(3) Wrinkled(1)
- List the dominant and recessive characters.
  - Are the characters linked or independent?
12. Illustrate Mendel's experiment to show that traits may be dominant or recessive by taking tall/short plants as a character in garden pea.
13. How do proteins control the characteristics that are inherited? Explain with the help of an example.
14. Describe any three methods of tracing evolutionary relationships among organisms.
15. Acquired characters are not inherited. Justify the statement with an example. The wings of bat and the wings of insects are considered analogous organs. Why?
16. How has the method of artificial selection by humans helped in the evolution of different vegetables? Explain in brief giving an example.
17. How do Mendel's experiments show that traits are inherited independently? Depict with the help of a cross.
18. (a) Write two factors which could lead to the rise of a new species. (b) (i) What is the scientific term of the organs shown below?  
(ii) How do these organs provide evidence in support of evolution?



19. (a) What is speciation? (b) Explain whether the traits like eye colour or height is genetically inherited or not.  
Do power to life weight and reading French also belong to same category? Justify your answer.
20. (a) Why are traits acquired during the life time of an individual not inherited?  
(b) Birds are very closely related to reptiles. Justify your answer with a suitable example.
21. (a) Name the type of sex chromosome present in human male and human female.  
(b) With the help of a flow chart determine genetically in human beings the sex of the offspring if a sperm carrying X-chromosome fertilizes the egg?
22. If a pure tall pea plant is crossed with a pure dwarf plant, then in the first generation only tall plants appear.  
(a) What happens to the traits of the dwarf plant? (b) In the second generation, the dwarf trait reappears. Why?
23. (a) "Recent fossils are found closer to the earth's surface." Comment on the statement stating reason.  
(b) List two factors which could lead to the rise of new species.
24. List three methods to limit the family size. State the principle involved in each.
25. What is speciation? Describe in brief the factors that control the process of speciation.
26. In pea plant round seed is dominant over the wrinkled. If a cross is carried between these two plants, give answer to the following questions.  
(a) Mention the genes for the traits of parents. (b) State the trait of F1 hybrids.  
(c) Write the ratio of F2 progeny obtained from this cross. What is the name of the cross?
27. Guinea pig having black colour when crossed with guinea pig having same colour produced 100 offsprings out of which 75 were black and 25 were white. Now find out.  
(a) What is the possible genotype of the guinea pig? (b) Which trait is dominant and which trait is recessive?  
(c) What is cross called as and what is the ratio of F2 progeny obtained from these cross?
28. Give appropriate terms for the following:  
(a) The trait which can express itself in next generation. (b) The trait an organism has due to inheritance.  
(c) Origin of a new species from pre-existing one.
29. (a) What are fossils? (b) Explain the importance of fossils in evolutionary relationship.
30. (a) What is genetic drift?  
(b) Which type of organism will have more variation - sexually or asexually reproducing organism? Justify your answer.
31. Answer the following questions:  
(a) What enables bacteria to survive better in a heat wave?  
(b) How is the stability of DNA of the species ensured?  
(c) Differentiate between acquired and inherited traits.
32. How do Mendel's experiments show that the traits may be dominant or recessive? Illustrate with the help of a cross.
33. When a plant with purple flower was crossed with a plant having white flower, in F1 generation all flowers appeared were purple. If F1 generation plants are self-fertilized, what is expected in F2 progeny? Explain with the help of a flow chart.
34. What is the homology between fore limb of frog, fore limb of lizard and wing of a bird?  
What does it indicate? State one function each of fore limbs of:  
(i) human being (ii) birds
35. The human beings who look so different from each other in terms of colour, size and looks are said to belong to the same species. Why? Justify your answer.

36. Distinguish between acquired and inherited traits by giving one example of each. Why are traits acquired during the lifetime of an individual not inherited?
37. Define 'evolution'. Describe Darwin's theory of evolution.
38. What is a gene?
  - (b) Where are genes located?
  - (c) What is the nature of gene?
39. Who proposed the "Theory of Natural Selection"? What are vestigial organs? Give some examples of human vestigial organs.

## **LONG ANSWER QUESTIONS**

### **IMPORTANT QUESTIONS**

1. How will you substantiate the statement that heredity and its concepts were known to the ancient civilisations? How did resistance to drugs evolve in bacteria?
2. Discuss the example of insecticide resistance in insects.
3. Define the term 'heredity'. In which types of organisms is heredity supposed to be better defined – in sexually reproducing or asexually reproducing kind? Why? What are the steps associated with the making of transgenic organisms?
4. What are transgenic organisms? Is it correct to hold the spermatozoa of the father responsible for deciding the sex of the foetus? Explain very briefly.
5. Does geographical isolation of individuals of a species lead to formation of a new species? Provide a suitable explanation.
6. 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.
7. All the human races like Africans, Asians, Europeans, Americans and other might have evolved from a common ancestor. Provide a few evidences in support of this view.

## **QUESTIONS FROM CBSE EXAMINATION PAPERS**

1. (i) What are 'chromosomes'? Where are they located in the cells?  
(ii) What is a sex chromosome? (iii) Explain the mechanism of sex determination in human beings.
2. (i) What is 'genetics'? (ii) Give the common name of the plant on which Mendel performed his experiments.  
(iii) If tall pea plant (TT) is crossed with dwarf pea plant (tt). What will be the type of pea plant in F1 generation? Show with the help of cross? What will be the percentage of dwarf pea plant in F2 generation?