Heredity and Evolution

MULTIPLE CHOICE QUESTIONS

1. Mendel went on to study science and mathematics at the:-
(a) University of Vienna
(b) University of Austria
(c) University of Australia
(d) None

2.In human males all the chromosomes are paired perfectly except one. This/these unpaired chromosome is/are
(i) large chromosome (ii) small chromosome (iii) Y-chromosome (iv) X-chromosome
(a) (i) and (ii)
(b) (iii) only
(c) (iii) and (iv)
(d) (ii) and (iv)

3. If a normal cell of human body contains 46 pairs of chromosomes then the numbers of chromosomes in a sex cell of a human being is most likely to be:
(a) 60
(b) 23
(c) 22
(d) 40

4.Which part of the DNA provides information for a protein?
(a) Chromosome
(b) Mitochondria
(c) RNA
(d) Gene

5. In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to
pure short plants in F2 generation will be:
(a) 1 : 3
(b) 3 : 1
(c) 1 : 1
(d) 2 : 1

6. A trait in an organism is influenced by
(a) paternal DNA only
(b) maternal DNA only
(c) both maternal and paternal DNA

(d) Both (b) and (c)

9. What is the ancient name for all human beings?
(a) Monkey
(b) Chimpanzee
(c) Homo sapiens
(d) Invertebrates

10.The genetic constitution of an individual organism is known as its
(a) phenotype
(b) homozygous
(c) genotype
(d) allele

Dominant traits - The traits that express themselves in an organism in every possible combination and can be seen are called Dominant traits.
Recessive traits - A trait which is not expressed in the presence of a dominant allele is known as recessive.

4. Who is known as father of genetics?
Gregor Mendel

5. What is the genetic constitution of human sperm?
The genetic constitution of sperm is 22+ X chromosome or 22 + Y chromosome.

6. What is meant by contrasting traits or characters?
A trait is generally represented by two forms. When these two forms are opposite to each other they are termed as contrasting trait. For example, contrasting trait for height is tall and dwarf.

7. What is the probability that a human progeny wiil be a boy?
50% probability

SHORT ANSWER QUESTIONS

1. What is DNA copying? State its importance.
DNA copying is the process of producing two identical replicas from one original DNA molecule during cell division. DNA is necessary to make all the RNA and proteins needed for cells to carry out necessary reactions and cellular processes in order to survive.

2. An elephant learns a trick at the circus. Will his offspring's also know the trick by birth? Support your answer with reasons.
Learning a trick at the circus is not an inherited trait. It is an acquired trait which cannot be transferred into the progeny. So, his offspring's will not know the trick by birth.

3. How do Mendel's experiments show that traits are inherited independently?
Mendel performed an experiments in which he took a tall plant with round seeds and a short plant with wrinkled-seeds. In F1, They were all tall and had round seeds. Tallness and round seeds were thus dominant traits. When, he used these F1 progeny to generate F2 progeny by self-pollination, he found that some F2 progeny were tall plants with round seeds, and some were short plants with wrinkled seeds. At the same time there tall plants, but had wrinkled seeds, while others were short, but had round seeds. Thus,Mendel's experiments show that the tall/short trait and the round seed/wrinkled seed trait are independently inherited.

4.Why are we humans not an exact copy of one of our parents?
Some of the people resemble one of their parents because of genes. Every person has two copies of each gene inherited from each parent. The dominant gene form is expressed in their body.

5. "The chromosome number of the sexually reproducing parents and their offspring is same." Justify the statement.
In sexually reproducing organisms, male and female gametes / reproductive cells with only half the number of chromosomes (as in the parent cell) are produced. during fertilization, when male and female gametes fuse to give to a zygote, original number of chromosomes are restored.

6.What indication do we get by the reappearance of dwarf plants in the F2 generation?

After obtaining progeny in F2 generation in a di hybrid cross, Mendal concluded that when two pairs of traits are combined in a hybrid, one pair of character segregates independently of the other pair of character.

7. Give an example where sex is determined by the environmental factors.
In some snails and turtles sex is determined by the environmental factors like temperature of water.

8. Define the following terms.
a. Heredity , b. Gene , c. Alleles
Heredity – Transmission of characters from one generation to another or from parents to offspring.
Gene – It is the basic unit of inheritance. It consists of a sequence of DNA, which is the genetic material. Genes can mutate and can take two or more alternative forms.
Alleles – The alternative forms of genes. They affect the same characteristics or traits in alternate forms. They are located on the same place of the chromosome.

9. How the genes, chromosomes and DNA are inter related to each other?
Genes are segments of DNA , which is wound compactly into chromosomes.DNA is genetic material of an organism, genes are the functional part of this material and chromosomes are the vehicles of heredity as they carry genes.

10. A body builder builds his muscles. Will his child be born with strong muscles? If not, why strength of muscles didn't pass on to the next generation?
If a body builder builds his muscles, this trait is acquired and restricted to muscles only; these changes don't affect the DNA of germs cells hence don't pass on to the next generation.

11. What is variation? How is variation created in a population? What is the importance of variation for survival of a species?
The differences in the traits shown by the individuals of a species and also by the offsprings (siblings) of the same parents are referred to as variation. New variation may arise during the process of DNA copying that already has variations accumulated from previous generations. Species having suitable variations have more chance of survival if there is change in environmental conditions.

LONG ANSWER QUESTIONS

1. a) Why did Mendel choose garden pea for his experiments? Write two reasons.
b) 'Different species use different strategies to determine sex of a newborn individual. It can be environmental cues or genetically determined.' Explain the statement by giving examples for each strategy.

(a) Reasons:
(i) Pea plant is small and easy to grow.
(ii) A large number of true breeding varieties of pea plant are available.
(iii) Both self and cross-pollination can be made possible. Because this plant has a short life cycle, the results may be gathered and evaluated more quickly.
(iv) The garden pea possesses a number of features that are diametrically opposed to one another.
b) Environmental 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 a boy.

2. Sahil performed an experiment to study inheritance pattern of genes. He crossed tall pea plants (TT) with short pea plants (tt) and obtained all tall plants in F1 generation.
a) What will be the set of genes present in the F1 generation?
b) Give reason why only tall plants are observed in F1 progeny.
c) When F1 plants were self pollinated, a total of 800 plants were produced. How many of these would be tall, medium height or short plants? Give the genotype of F2 generation.

a) Tt
b) Tallness is a dominant character and dwarfness is a recessive character.
c) Out of 800 plants 600 plants will be tall and 200 plants will be small, 1 TT: 2Tt: 1tt

3. If we cross pure-bred tall (dominant) pea plants with pure-bred dwarf (recessive) pea plants we will get pea plants of F1 generation. If we now self- cross the pea plant of F1 generation, then we obtain pea plants of F2 generation.
(a) What do the plants of the F2 generation look like?
(b) State the ratio of tall plants to dwarf plants in F2 generation.
(c) State the type of plants not found in F2 generation but appeared in F2 generation, mentioning the reason for the same.
(d) State Mendel's laws of inheritance.

a) All plants of the F1 generation will be tall plants.
(b) 3:1
(c) Dwarf trait is recessive trait which was not expressed in the F1 generation, the recessive trait gets expressed in the F2 generation after self pollination.
(d) Laws of Mendel
•Law of Dominance says that a gene has two contrasting alleles and one always expresses itself in the organism.
•Law of Segregation says that traits get segregated completely during the formation of gametes without any mixing of alleles.
•Law of Independent Assortment says that the traits can segregate independently of different characters during gamete formation.

CASE STUDY QUESTION

Reproduction results in variation from one generation to the next. The variation produced in the organisms during the successive generation gets accumulated over a long period of time in an organism. After several generations these variations come up in the organisms and the organisms start showing different characteristics and hence leads to the appearance of new species. The main advantage of variation in a species is that it increases the chance of its survival in a changing environment. The organisms which show positive variation, survive. Those who do not show variations get extinct.
a) What are variations?
b) Why are the variations accumulated over generations?
c) What are the positive variations?
a) The difference in the characteristics of individuals in a population is called variation.
b) Due to their inheritance.
c) Variations that provide survival advantage to an organism.