Evolution

Case Study Based Questions

Case Study 1

Evolution of Life Forms

Darwin developed his ideas on descent with modification and the pressures of natural selection. A variety of evidence has been gathered supporting the theory of evolution. Fossil evidence shows the changes in lineages over millions of years, such as in hominids and horses. Studying anatomy allows scientists to identify homologous structures across diverse groups of related organisms, such as leg bones. Vestigial structures also offer clues to common ancestors. Using embryology, scientists can identify common ancestors through structures present only during development and not in the adult form. Biogeography offers further clues about evolutionary relationships. The presence of related organisms across continents indicates when these organisms may have evolved. For example, some flora and fauna of the Northern continents are similar across these landmasses but distinct from that of the Southern continents. Islands such as Australia and the Galapagos chain often have unique species that evolved after these landmasses separated from the mainland. Finally, molecular biology provides data supporting the theory of evolution.

Q1. Which living organisms evolved first during evolutionary order?

a. Amphibians
c. Reptiles
b. Marine
d. Vertebrates

Q2. Which word is proper for the similarity in their morphology, anatomy and embryology?

a. Analogous organs
c. Homologous organs
b. Vestigial organs
d. None of these

Q3. Which of the following is/ are an example of homologous organs?

a. Wings of insects, birds and bats.

b. The thorns and tendrils of Bougainvillea and Cucurbita.
c. The forelimbs of higher vertebrates.
d. Both b. and c.

Q4. The organs which are superficially similar but anatomically dissimilar doing similar functions are called.....

a. Analogous organs.
b. Homologous organs.
c. Vestigial organs.
d. None of the above.

Q5. Which of the following is an example of analogous organs?

a. Vermiform appendix.
b. Nictitating membrane and ear muscles.
c. Both a. and b.
d. The thorns and tendrils of Bougainvillea and Cucurbita.

Answers

1. (b)
2. (c)
3. (d)
4. (a)
5. (b)

Case Study 2

Hardy-Weinberg Principle

As per Hardy-Weinberg Principle, "Allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. These influences include mate choice, mutation, selection, genetic drift, gene flow and meiotic drive". The gene pool remains a constant. The total genes and their alleles in a population make the gene pool. Sum total of all the allelic frequencies is 1. Hence, $p^2+2pq + q^2 = 1$

When frequency differs from expected values, the difference (direction) indicates the degree of evolutionary change. Thus, disturbance in Hardy- Weinberg Equilibrium would then be said to result in evolution. Factors that affect Hardy-Weinberg Equilibrium are

Gene Migration or Gene Flow, Genetic Drift, Mutation, Genetic Recombination and Natural Selection.

Q1. What is the importance of Hardy-Weinberg law?

a. Evolution
b. Gene pool
c. Genetics
d. Genetic variation

Q2. The sum total of genes present in a Mendelian population is called:

a. gene pool
b. gene frequency
c. genetic variation
d. genetics

Q3. How many years ago the earth was originated?

a. 6000
b. 5500
c. 5000
d. 6500

Q4. Random genetic drifts in a population are a result of:

a. small size of population.
b. major genetic differences in individuals.
c. interspecific hybridisation.
d. slower rate of mutation.

Q5. Match the columns and find out the correct option from the following:

S.No.	Column I		Column II
(i)	Genetic drift	(p)	The gene frequencies are found to fluctuate purely by chance.
(ii)	Gene flow	(q)	The genes of one population are transferred into another population.
(iii)	Gene frequency	(r)	It refers to the ratio of a gene in a gene pool.
(iv)	Gene pool	(s)	It is the sum total of genes present in a Mendelian population.

a. (i-q), (ii-r), (iii-p), (iv-s)
b. (i-r), (ii-s), (iii-q), (iv-p)
c. (i-p), (ii-q), (iii-r), (iv-s)
d. (i-s), (ii-p), (iii-r), (iv-q)

Answers

1. (a)
2. (a)
3. (c)
4. (a)
5. (c)

Case Study 3

Origin of Life

The universe is about 20 billion years old. The earth was formed about 4.5 billion years ago. The atmosphere was not present on early earth. The earth was covered with water vapour, methane, carbon dioxide and ammonia. The UV rays from the sun split water into hydrogen and oxygen. The oxygen reacted with ammonia and methane to form water, carbon dioxide and other gases. When the earth cooled down further, water vapour fell as rain, to form oceans. Life appeared on earth about 4 billion years back.

Various theories are given for the origin of life on Earth like Theory of Abiogenesis, Biogenesis, Panspermia, Spontaneous Generation and Oparin and Haldane theory etc.

Q1. "The world has been evolved and not been created. Non-living substances have reacted to form organic compounds which developed into colloidal systems". Find out the theory proposed in the statements.

Ans. Theory of Organic Evolution has been proposed in the statement.

Q2. Who cleared that interaction of chemical substances initiated origin of life in the past?

Ans. Haeckel cleared that interaction of chemical substances initiated origin of life in the past.

Q3. In the beginning, how much was the temperature of the earth?

Ans. 5000°C to 6000°C was the temperature of the earth in the beginning.

OR

Which chemical is first formed in the earth?

Ans. Ammonia and methane.

Case Study 4

Adaptive Radiation

The process of evolution of many varieties from a single variety of organism in a given geographical area is called adaptive radiation. It happens within a short span of time. Darwin's observation on finches of the Galapagos Islands showed interesting insights. Finches of that island show a wide variety, in terms of types of beaks, suited to different eating habits. Darwin proposed that all the varieties evolved on the island itself. From the original seed-eating features, many other forms (with altered beaks) arose. This shows adaptive radiation. Another example of adaptive radiation is seen in Australian marsupials. Different types of marsupials evolved from one ancestral stock, within the Australian island continent. Placental mammals in Australia also exhibit adaptive radiation.

Read the given passage carefully and give the answer of the following questions:

Q1. Adaptive radiation is nothing but divergence. What causes divergent evolution?

Ans. The divergent evolution is caused by:

(i) need for food
(ii) isolation
(iii) absence of enemies.

Q2. How many types of adaptive radiation are there?
Ans. Three types of adaptive radiations are there.

OR

Give an example of adaptive radiation.
Ans. Australian marsupials.

Q3. What is the other name of de Vries theory?
Ans. The other name of de Vries theory is Theory of mutation.