



Mentor Guru

Class 12 – Biology

Chapter 6 – Evolution

Short types question with answer

Q.1. What do you mean by “survival of the fittest”?

A.1. The term “survival of the fittest” was coined by Darwin in support of his theory of natural selection. The organisms that adapt to the changing environmental conditions and overcome the competitions for food and space are selected by nature to survive. In simple terms, the organisms that are physically in good shape and health are considered “fit”. The ones that aren’t are eliminated. This is known as “survival of the fittest”.

Q.2. Comment on the statement, “Migration may increase or decrease the effects of selection”.

A.2. Migration is the movement of individuals from one place to another. The individuals can either move to a different population or move into a particular population. Movement of individuals to a different population might remove certain alleles that confer better adaptations. Movement into a particular population might add certain alleles that blur the effects of selection. Thus we can say that migration can increase or decrease the effects of selection.

Q.3. Explain the terms:

1. **Race**
2. **Breed**
3. **Cultivars**
4. **Variety**

A.3.

1. **Race**– Race may be different phenotypic populations within the same species. It is used as rank higher than the strains but lower than the species. Eg., Mongoloid, Negroid
2. **Breed**– Breed is a morphologically and physiologically distinct sub-group of a race where crossing occurs within the sub-group to maintain its individuality. For eg., Rhode island red, Plymouth red.
3. **Cultivars**– It is a group of plants selected by plant breeders for desirable characteristics that can be maintained by propagation. Eg., roses, daffodils
4. **Variety**– It is a morphologically, physiologically, and genetically distinct sub-group of species. Eg., cauliflower, cabbage

Q.4. How is nascent oxygen toxic to aerobic living organisms?

A.4. Nascent oxygen is very reactive and can react with all types of biomolecules present in living organisms, such as DNA, proteins and enzymes. It can cause mutation in DNA and can degrade proteins and enzymes on reactions, hence, toxic to aerobic life forms.

Q.5. Creation and presence of variation are directionless, but natural selection is directional as it is in the context of adaptation. Comment.

A.5. Variation is considered directionless because it is spontaneous and random. It is seen in sexually reproducing organisms which occurs as a result of crossing over during meiosis or fusion of gametes. The variations which help the individuals in adapting to the environment are passed on to successive generations. Natural selection is directional because it leads only to one path, i.e., selection. It is an evolutionary change that leads to the survival of the fittest and elimination of the unfit individuals.

Q.6. Comment on the statement with reference to industrial melanism, “Evolution is apparently reversible”.

A.6. The peppered moth resided on the surface of the lichens and protected itself from the predators due to camouflage. During industrialization in Europe, the surface of the lichens turned black due to the emissions from the coal-based industries. The moths were now easily visible to the predators and got eliminated gradually. A mutant of peppered moth flourished during this period. It was not visible to the predators due to its black colour and hence

was selected by nature. Clean air legislation was passed in Europe in 1956 as a result of which the emission of smoke decreased. The non-melanic peppered moth is appearing again along with the lichens. This proves that evolution is reversible.

Q.7. What is genetic drift?

A.7. Genetic drift is a mechanism of evolution in which the allele frequencies change over generations as a matter of chance. It occurs in populations of all sizes but its effect is the maximum in a small population. Genetic drift is observed when there is a sudden decline in the population due to natural disasters (bottleneck effect), or when a new population separates from the original population to form a colony (founder effect). Genetic drift does not take into account whether the allele is beneficial or harmful to the individual carrying it. It is possible that a beneficial allele is lost and a harmful allele persists.

Q.8. Explain adaptive radiation. Give examples in support of your answer.

A.8. Adaptive radiation is the process in which a living organism diversifies from a single ancestor into multiple new forms. This is mainly due to changes in the environment. **Darwin's Finches** is one fine **example** of adaptive radiation. The finches of the Galapagos island are seen with a variety of beaks depending upon the type of food they feed on. A single species got adapted to the environmental and nutritional conditions and developed respective beak types over the years.

Q.9. How is convergent evolution different from divergent evolution?

A.9. When two or more species belonging to different ancestors develop similar characteristics due to adaptation to a particular environment, it is known as convergent evolution. On the contrary, when the species belonging to the same ancestors develop different characteristics due to environmental changes and evolve into some new species, it is known as divergent evolution.

Q.10. State the Hardy-Weinberg principle.

A.10. The Hardy-Weinberg principle states that in a large population not affected by the evolutionary processes such as mutation, selection or migration, the allele frequencies and the genotype frequencies are constant from one generation to the other. The principle can be explained by the simple

equation: $(p+q)^2 = p^2 + q^2 + 2pq = 1$ Where, p = frequency of allele A q = frequency of allele a p^2 = frequency of individual AA q^2 = frequency of individual aa $2pq$ = frequency of individual Aa.

Q.11. How does genetic variation help in evolution?

A.11. Genetic variation is important in evolution because it allows natural selection to increase or decrease the frequency of alleles already present in the population. These variations enable a few individuals to adapt to the environment.

Long Answer Type Questions

Q.1. Enumerate the key concepts in the evolution theory of Darwin.

A.1. The two key concepts of Darwin's theory of evolution are:

- Branching Descent
- Natural Selection

Branching Descent- It is the process in which new species originate from a single ancestor. They became adapted to the new environment through reproductive isolation. For eg., Darwin's finches which evolved from a single grain eater species.

Natural Selection- In this process, the variations in an individual facilitate better survival of species. They reproduce in large numbers. These variations are passed on to successive generations which help them to survive in the changing environmental conditions. For eg., few giraffes have long necks while others have short necks. If the low-lying shrubs are eliminated for some reason, the giraffes with short necks would be replaced by giraffes with long necks.

Q.2. Describe the phenomenon in which two organisms occupying the same geographical area show the same strategies of adaptation.

A.2. The phenomenon is convergent evolution. In this process, two organisms belonging to different species, descending from different ancestors, evolve similar traits in order to adapt to a similar environment. For eg., the streamlined body of sharks and dolphins. Sharks are fishes while dolphins are mammals but both of them have developed streamlined bodies to adapt themselves to swift swimming. Spines are modified leaves and thorns are

modified stems. Both look alike and have a similar function of protecting the plants, but are distantly related to each other.

Q.3. What is the driving force behind divergent evolution? Explain.

A.3. Adaptation is the driving force behind divergent evolution. Divergent evolution is the phenomenon in which the organisms descending from common ancestors evolve gradually into a new species. The new species thus formed adapt themselves to the new habitat and environmental conditions. For eg., the forelimbs of bats, cheetahs, whales and humans have the same anatomical structures but perform different functions. Thus, in these animals, the same structure evolved into different forms according to the needs of the animals.

Q.4. Which law states that the sum of allelic frequencies in a population is constant? List the five factors that influence the law.

A.4. The law is Hardy-Weinberg equilibrium. The five factors influencing the law are:

- Genetic drift
- Mutation
- Gene flow
- Genetic Recombination
- Natural Selection

Q.5. If the industries were removed, what impact would it have on the population of moths in England?

A.5. The two variants of peppered moths, black and grey, were already existing in the population. They resided on the surface of the lichens. Before industrialization, the grey moths were not spotted by the predators due to the camouflage. However, the black moths were easily visible and killed by the predators. If the industries were removed, the population of the black variants would have reduced to a large extent leaving behind the grey population of peppered moths.

Q.6. What are the types of evolution

A.6. The different types of evolution are:

1. **Convergent evolution**– It is the process, which evolves independently, under similar selection pressures. For example, flying insects, birds and other flying species have all evolved the ability to fly, but independently of each other.
2. **Coevolution evolution**–It is the process in which two or more species evolve in tandem by exerting selection pressures on each other. For example, host and parasites, predators and prey, flowering plants and pollinating insects and mutualistic or symbiotic interactions.
3. **Adaptive radiation**–It is the process in which a species splits into a number of new forms when a change in the environment makes new resources available or creates new environmental challenges. For example, finches on the Galapagos Islands have developed different shaped beaks to take advantage of the different kinds of food available on different islands.



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