MULTIPLE CHOICE QUESTIONS
1. Which of the following is used as an atmospheric pollution indicator?
a. Lepidoptera
b. Lichens
c. Lycopersicon
d. Lycopodium
Solution:
Option (b) is the answer.

2. The theory of spontaneous generation stated that:
a. life arose from living forms only
b. life can arise from both living and non-living
c. life can arise from non-living things only.
d. life arises spontaneously, neither from living nor from the
non-living.
Solution:
Option (c) is the answer.

3. Animal husbandry and plant breeding programmes are examples of:
a. reverse evolution
b. artificial selection
c. mutation
d. natural selection
Solution:
Option (b) is the answer.

4. Palaeontological evidences for evolution refer to the:
a. development of embryo
b. homologous organs
c. fossils
d. analogous organs.
Solution:
Option (c) is the answer.

5. The bones of forelimbs of whale, bat, cheetah and man are similar in
structure, because:
a. one organism has given rise to another
b. they share a common ancestor
c. they perform the same function
d. the have biochemical similarities
Solution:
Option (b) is the answer.

6. Analogous organs arise due to:
a. divergent evolution
b. artificial selection

c. genetic drift
d. convergent evolution
Solution:
Option (d) is the answer.

7. $(p+q)^2 = p^2 + 2pq + q^2 = 1$ represents an equation used in:
a. population genetics
b. mendelian genetics
c. biometrics
d. molecular genetics
Solution:
Option (a) is the answer.

8. The appearance of antibiotic-resistant bacteria is an example of:
a. adaptive radiation
b. transduction
c. pre-existing variation in the population
d. divergent evolution
Solution:
Option (c) is the answer.

9. Evolution of life shows that life forms had a trend of moving from:
a. land to water
b. dryland to wetland
c. freshwater to seawater
d. water to land
Solution:
Option (d) is the answer.

10. Viviparity is considered to be more evolved because:
a. the young ones are left on their
b. the young ones are protected by a thick shell
c. the young ones are protected inside the mother's body and are
looked after they are born leading to more chances of survival
d. the embryo takes a long time to develop
Solution:
Option (c) is the answer.

11. Fossils are generally found in:
a. Sedimentary rocks
b. Igneous rocks
c. Metamorphic rocks
d. Any type of rock
Solution:
Option (a) is the answer.

12. For the MN-blood group system, the frequencies of M and N alleles are 0.7 and 0.3, respectively. The expected frequency of MN-blood group bearing organisms is likely to be
a. 42%
b. 49%
c. 9%
d. 58%
Solution:
Option (a) is the answer.

13. Which type of selection explains industrial melanism observed in the moth, Boston Bulgaria:
a. Stabilising
b. Directional
c. Disruptive
d. Artificial
Solution:
Option (b) is the answer.

14. The most accepted line of descent in human evolution is:
a. Australopithecus → Ramapithecus → Homo sapiens → Homo habilis
b. Homo erectus → Homo habilis → Homo sapiens
c. Ramapithecus → Homo habilis → Homo erectus → Homo sapiens
d. Australopithecus → Ramapithecus → Homo erectus → Homo habilis → Homo sapiens.
Solution:
Option (c) is the answer.

15. Which of the following is an example for link species?
a. Lobe fish
b. Dodo bird
c. Seaweed
d. Chimpanzee
Solution:
Option (a) is the answer.

16. Match the scientists listed under column 'I' with ideas listed column 'II'.

Column I	Column II
A. Darwin	i. abiogenesis
B. Oparin	ii. use and disuse of organs
C. Lamarck	iii. continental drift theory
D. Wagner	iv. evolution by natural selection

a. A-i; B-iv; C-ii; D-iii
b. A-iv; B-i; C-ii; D-iii
c. A-ii; B-iv; C-iii; D-i
d. A-iv; B-iii; C-ii; D-i
Solution:

Option (b) is the answer.

**17. In 1953 S. L. Miller created primitive earth conditions in the laboratory
and gave experimental evidence for the origin of the first form of life from preexisting non-living
organic molecules. The primitive earth conditions
created include:**
a. low temperature, volcanic storms, atmosphere rich in oxygen
b. low temperature, volcanic storms, reducing atmosphere
c. high temperature, volcanic storms, non-reducing atmosphere
d. high temperature, volcanic storms, reducing atmosphere
containing CH4, NH3 etc.
Solution:
Option (d) is the answer.

18. Variations during mutations of meiotic recombinations are:
a. random and directionless
b. random and directional
c. small and directional
d. random, small and directional
Solution:
Option (a) is the answer.

VERY SHORT ANSWER TYPE QUESTIONS

1. What were the characteristics of life forms that had been fossilised?
Solution:
i. The early fossils were simple life forms which evolved into complex life forms later.
ii. Fossilised organisms hard body surface which allowed them to get preserved and fossilised.

2. Did aquatic life forms get fossilised? If yes where do we come across such fossils?
Solution:
Yes, many aquatic life forms did get fossilised. Such fossils of sea creatures are found in mountains as opposed to deep-sea beds.

3. What are we referring to when we say 'simple organisms' or 'complex organisms'?
Solution:
'Simple Organisms' are primitive organisms whereas 'complex organisms' are advanced organisms.

4. How do we compute the age of a living tree?
Solution:
The age of a living tree is calculated by either counting the number of rings present in the trunk of the tree or by comparing the diameter of the trunk of the tree with an average growth factor of that tree

5. Give an example of convergent evolution and identify the features towards which they are converging.
Solution:

The presence of wings in birds and butterfly is referred to as convergent evolution and they are adapted for flying. Convergent evolution forms analogous structures.

6. How do we compute the age of a fossil?
Solution:
The age of a fossil can be calculated by radioactive dating. A comparison is done between the naturally occurring radioactive isotopes with that of the decay product, using known decay rates.

7. What is the most important pre-condition for adaptive radiation?
Solution:
The most important pre-condition for adaptive radiation is a geographic barrier or an isolated habitat.

8. How do we compute the age of a rock?
Solution:
The age of a rock can be computed by natural radioactive decay of certain elements.

9. When we talk of functional macromolecules (e.g. proteins as enzymes, hormones, receptors, antibodies etc), towards what are they evolving?
Solution:
Functional macromolecules are evolving towards the creation of a complex organism.

10. In a certain population, the frequency of three genotypes is as follows:

Genotype	BB	Bb	bb
Frequency	22%	62%	16%

What is the likely frequency of B and b alleles?
Solution:
Frequency of B allele = all of BB + 1/2 of Bb = 22 + 31 = 53%
Frequency of b allele = all of bb + 1/2 of Bb = 16 + 31 = 47%

11. Among the five factors that are known to affect Hardy-Weinberg equilibrium, three factors are gene flow, genetic drift and genetic recombination. What are the other two factors?
Solution:
Natural selection and mutation are the other two factors.

12. What is the founder effect?
Solution:
Founder effect is the phenomenon that occurs when a small group of organisms becomes isolated from a larger population and becomes so genetically different from the original population that they become a new population altogether.

13. Who among the Dryopithecus and Ramapithecus was more man-like?
Solution:
Ramapithecus was more man-like while Dryopithecus was more ape-like with the same length of arms and legs.

14. By what Latin name was the first hominid known?

Solution:
The Latin name for the first known hominid is Homo habilis.

15. Among Ramapithecus, Australopithecines and Homo habilis - who probably did not eat meat?
Solution:
Among Ramapithecus, Australopithecines and Homo habilis – Homo habilis did not eat meat.

SHORT ANSWER TYPE QUESTIONS

1. Louis Pasteur's experiments, if you recall, proved that life can arise from only pre-existing life. Can we correct this as life evolves from pre-existent life or otherwise we will never answer the question as to how the first forms of life arose? Comment.
Solution:
Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules (e.g., RNA, protein, etc.) so we can correct the statement of Louis Pasteur.

2. The scientists believe that evolution is gradual. But extinction, part of evolutionary story, is 'sudden' and 'abrupt' and also group-specific. Comment whether a natural disaster can be the cause for the extinction of species.
Solution:
An earthquake can be cause for the extinction of species which is a natural disaster. The third mass extinction occurred during the End Permian. 96% of the total species were lost due to acid rain following a massive release of volcanic gases.

3. Why is nascent oxygen supported to be toxic to aerobic life forms?
Solution:
Nascent oxygen is a highly reactive substance; it is a permanent oxidising agent. It can easily react with various kinds of molecules like DNA, proteins present in the aerobic life forms.

4. While creation and presence of variation are directionless, natural selection is directional as it is in the context of adaptation. Comment.
Solution:
Natural selection is directional as it is in the context of adaptation because it leads to only one path that is the selection of better-adapted individuals.

5. The evolutionary story of moths in England during industrialisation reveals, that 'evolution is reversible'. Clarify this statement.
Solution:
It was observed that more white-winged moths on trees than dark-winged or melanised moths. But after industrialisation, there were more dark-winged moths in the same area, i.e., the proportion was reversed. Before industrialisation period, the white moths survived because the tree bark was covered with white lichens, so they were unnoticed by predators. After the industrialisation, the tree trunks became dark due to industrial smoke and soot and predators got identified.

6. Comment on the statement that "evolution and natural selections are result or consequence of

some other processes but themselves are not processed".
Solution:
We can see evolution as a process that results in all these changes. But, when we talk about life itself we say that evolution is a consequence of natural selection. We treat evolution as a consequence of natural selection. It is still not clear whether evolution and natural selection as processes or result of unknown processes.

7. State and explain any three factors affecting allele frequency in populations.
Solution:
1. Gene migration or gene flow – it is the movement of alleles into a gene pool or out of a gene pool.
2. Genetic drift – If the movement of alleles into a gene pool or out of a gene pool takes place by chance is called Genetic Drift.
3. Mutation – It is the large difference arising suddenly in a population, they are random and occur in all directions.

8. Gene flow occurs through generations. Gene flow can occur across language barriers in humans. If we have a technique of measuring specific allele frequencies in a different population of the world, can we not predict human migratory patterns in pre-history and history? Do you agree or disagree? Explain your answer.
Solution:
Yes, gene flow occurs through generations. By studying specific allele frequencies in a different population of the world we can predict human migratory patterns in pre-history and history.

9. How do you express the meaning of words like race, breed, cultivars or variety?
Solution:
Race – It is a classification system used to categories human into many groups or populations.
Breed – It is a specific group of domestic animals or plants having the homogenous appearance, characteristics or behaviours that distinguish it from other animals or plants of the same species.
Cultivators – A selected group of plants selected for desirable characteristics which can be raised through vegetative propagation.
Variety – Variety is similar to race but is used for the plants.

10. When we say "survival of the fittest", does it mean that
a. those which are fit only survive, or
b. those that survive are called fit? Comment.
Solution:
Survival of the fittest means those who survive are fit. Those individuals who survive and reproduce in their respective environment are called fit

11. Enumerate three most characteristic criteria for designating a Mendelian population.
Solution:
i. The population must be sufficiently large.
ii. It should have the potential for the free flow of genetic materials is ensured through sexual reproduction.
iii. There should be negligible or nil migration in the population.

12. "Migration may enhance or blur the effects of selection". Comment.
Solution:
Migration enhances the gene pool of such alleles that are being selected for, or blur the effects of selection through replenishment of alleles that were selected against by nature.

LONG ANSWER TYPE QUESTIONS

1. Name the law that states that the sum of allelic frequencies in a population remains constant. What are the five factors that influence these values?
Solution:
The law that states that the sum of allelic frequencies in a population remains constant is the Hardy-Weinberg principle. He represented it using the algebraic equation $(p+q)^2 = p^2 + 2pq + q^2 = 1$
Gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection are the five factors.

2. Explain divergent evolution in detail. What is the driving force behind it?
Solution:
In Divergent evolution, two species have common ancestors, but they develop different characteristics because of changes in the environment to which they adapt slowly and giving rise to new species. Divergent evolution can occur due to changes in abiotic factors (temperature, pH, sunlight level etc) or biotic factors (living components of the ecosystem). The driving force behind the divergent evolution is adaptations to a new habitat and changing environmental conditions.

3. You have studied the story of Pepper moths in England. Had the industries been removed, what impact could it have on the moth population? Discuss.
Solution:
The story of Pepper moths in England happened because, in the post industrialisation period, the lichens did not survive due to increased pollution. Soot covered the tree trunks making them dark. Now, had the industries be removed, the pollution level would have gone down, allowing lichen to grow back and the number of white-winged moths would have gone up again.

4. What are the key concepts in the evolution theory of Darwin?
Solution:
Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution. Branching descent is defined as a process by which new species originate from a single common descendant. Natural Selection is a process in which heritable variations enabling better survival are selected and passed on from parent to progeny over generations. That is nature selects only those traits which help an organism to survive changed conditions.

5. Two organisms occupying a particular geographical area (say desert) show similar adaptive strategies. Taking examples, describe the phenomenon.
Solution:
Two organisms occupying the same areas would show convergent evolution. They adapt to the environment which is a benefit to them. For example, we can take the drought-resistant plants in the deserts like orchids, agaves aloes etc. They are morphologically different but they store mucilage and water.

6. We are told that evolution is a continuing phenomenon for all living things. Are humans also evolving? Justify your answer.
Solution:
Evolution is a dynamic process. This means that it is constantly happening. In this process, human beings are also involved. We can have some examples of the phenomenon.
1. The appearance of mutation in the lactose tolerance gene: Lactose containing products like milk was not consumed by the human on earlier period but now it has been worldwide the usage of the products by human beings.
2. Another evolutionary change that happened can be observed in the population living in malaria-prone regions. Sickle cell anaemia was developed by the people over there to fight malaria-causing protozoa.

7. Had Darwin been aware of Mendel's work, would he be able to explain the origin of variations? Discuss.
Solution:
Darwin is credited with the theory of natural selection. Darwin did not know about the source of these variations. He was aware of Mendel's work. Darwin just ignored the inheritable 'factors' influencing phenotype of Mendel and he would have been able to explain the origin of variation. In both Mendel's and Darwin's theories, genes were playing a role but they remained unaware of it. Darwin believed that changes were occurring and accumulating, so the possibility of Darwin explaining the source of variation is high.