CHAPTER 6



EVOLUTION

(A) NCERT QUESTIONS & SOLUTIONS

1. Explain antibiotic resistance observed in bacteria in light of Darwinian selection theory.

Ans. Darwinian selection theory states that individuals with favourable variations are better adapted than individuals with less favourable variation.

- It means that nature selects the individuals with useful variation as these individuals are better evolved to survive in the existing environment. An example of such selection is antibiotic resistance in bacteria. When bacterial population was grown on an agar plate containing antibiotic penicillin, the colonies that were sensitive to penicillin died, whereas one or few bacterial colonies that were resistant to penicillin survived.
- This is because these bacteria had undergone chance mutation, which resulted in the evolution of a gene that made them resistant to penicillin drug. Hence, the resistant bacteria multiplied quickly as compared to nonresistant (sensitive) bacteria, thereby increasing their number. Hence, the advantage of an individual over other helps in the struggle for existence.

2. Find out from newspapers and popular science articles any new fossil discoveries or controversies about evolution.

Ans. A recent study of fossil revealed a small terrestrial dinosaur with feathers covering the limb and body. This finding established that feathers evolved earlier than wing and may be functioning as thermoregulator to face adverse condition. These newly developed feather earlier helped in gliding and then flying

3. Attempt giving a clear definition of the term species.

Ans. Species can be defined as a group of organisms which have the capability to interbreed in order to produce fertile offspring.

4. Try to trace the various components of human evolution.

Ans.

S.No	Human ancestor	Time of Origin	General Features
1	*Dryopithecus*	15 mya	Ape-like, hairy, arms and legs of same length, large brain, ate soft fruits and leaves
2	*Ramapithecus*	14-15mya	More man-like, walked more erect, teeth like modern man.
3	*Australopithecus*	3-4 mya	Fossils found in Tanzania and Ethiopia, manlike primates, 4 feet tall, walked upright, ate fruit, hunted with stone weapons, brain capacity was 400-600
4	*Homo habilis*	2 mya	Fossils found in East Africa, first human like being, brain capacity 650-800 cc, did not eat meat
5	*Homo erectus (Java man)*	1.5 mya	Fossils found in Java, brain capacity 900cc,
6	*Homo neanderthalensis*	100,000-40,000 year ago	Fossils found in east and central Asia, brain size 1400 cc, used hides to protect body, buried their dead.
7	*Homo sapiens (Modern man)*	75,000-10,000 year ago	Developed cave art, agriculture, started human civilization.

5. Find out through internet and popular science articles whether animals ot s self-consciousness.

Ans. There are many animals other than humans, which have self consciousness. An example of an animal being self conscious is dolphins. They are highly intelligent. They have a sense of self and they also recognize others among themselves and others. They communicate with each other by whistles, tail-slapping, and other body movements. Not only dolphins there are certain other animals such as crow, parrot, chimpanzee, gorilla, orangutan, etc., which exhibit self-consciousness.

6. List 10 modern-day animals and using the internet resources link it to a corresponding ancient fossil. Name both.

Ans.

S.No	Modern Name of Animal	Corresponding ancient fossil
1.	Man	*Homo neanderthalensis*
2.	Chimpanzee	*Dryopithecus*
3.	Gorilla	*Dryopithecus*
4.	Orangutan	*Dryopithecus*
5.	Gibbon	*Propliopithecus*
6.	Nautilus	Gypceros
7.	Octopus	Belemnite
8.	Elephant	Stegolophpdon
9.	Camel	Procamelus
10.	Horse	Pliohippus

7. Describe one example of adaptive radiation.

Ans. Darwin's finches in the galapogos island once had a common ancestor but with evolution they modified into different types according to their food habitat.

8. Can we call human evolution as adaptive radiation?

Ans. No, human evolution cannot be called as adaptive radiation because parent species of *Homo sapiens* have evolved by progressive evolution from *Homo habilis* to *Homo sapiens* lineage.

9. Using various resources such as your school library or the internet and discussions with your teacher, trace the evolutionary stages of any one animal, say horse. [IMP.]

Ans. The evolution of horse is represented as following:-

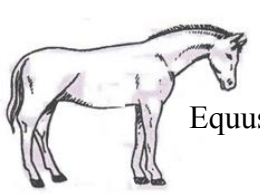
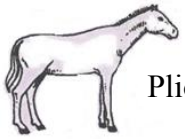
(A) Eohippus:- This stage is characterized by a short head and neck .It had four functional toes and a splint of 1 to 5 on each hind limb and a splint of 1 to 3 in each forelimb. The molars were short crowned that were adapted for grinding the plant dies.

(B) Mesohippus:- It was slightly taller than Eohippus. It had three toes in each foot.

(C) Merychippus:- it had the size of approximately 100 cm. Although it still has three toes in each foot, but it could run on one toe. The side toe did not touch the ground. The molars were adapted for chewing the grass.

(D) Pliohippus:- It resembled the modern horse and was around 120 cm tall .It had a single functional toe with splint of second and fourth in each limb,

(E) Equus :- Pliohippus gave rise to Equus or the modern horse with one toe in each foot. They have incisors for cutting grass and molars for grinding food.

Epochs	Height (in cm)	Appearance	Horse	Bones of Limbs	No. of toes
Pleistocene	160	Modern Horse	 Equus		1 – toed (2 Splint bones)
Pliocene	120	Pony like	 Pliohippus		1 – toed (2 Splint bones)
Miocene	100	Donkey like	 Merychippus		3-toed (No Splint bones)
Oligocene	60	Sheep like	 Mesohippus		3 – toed (1 Splint bones)
Eocene	40	Fox like	 Eohippus		4 – toed (1 Splint bones)

Evolutionary stages of horse

(B) PREVIOUS YEAR QUESTIONS

1. At which stage during evolution did human use hides to protect their bodies and buried their dead? **[CBSE-2023]**

(1) *Homo habilis* (2) Neanderthal man (3) Java man (4) *Home erectus*

Ans. (2) Neanderthal man

2. Mention Darwin's observations made on finches during his visit to Galapagos Islands. Write the explanation given by Darwin on his observations. [CBSE 2023]

Ans. During his journey Darwin went to Galapagos Islands.

- There he observed an amazing diversity of creatures of particular interest, small black birds later called Darwin's Finches amazed him.
- He realised that there were many varieties of finches in the same island.
- All the varieties, he conjectured, evolved on the island itself. From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches .
- This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.

3. Industrial melanism in England after 1850 is an excellent example of Natural selection. Explain how? [CBSE 2023]

Ans. Industrial melanism in England after 1850 is an excellent example of Natural selection. It is because, before industrialization the air quality of England was good due to which lichen were able to grow on tree barks. Lichens were white in color. Hence, moths living on tree bark evolved with time to have a more white population due to less melanin production. This reduced the number of black moths in the population. This was an adaptation to hide from predators.

With time as industrialization grew the air quality reduced. This eliminated the lichens from the region. Now the dark brown to black color of tree bark was exposed. Due to this, moth population evolved to have more melanin giving them black color. This reduced the number of white moths in the population. This was an adaptation to hide from predators' attacks.

In short, evolving with the situation gave moths' population a benefit due to natural selection.

4. How would the gene flow or genetic drift affect the population in which either of them happen to take place? [CBSE 2019]

Ans. Results in changed frequency of genes (or alleles) in both populations, causing variation, leading to evolution / speciation / founder effect

5. According to Darwinian theory of natural selection the rate of appearance of new forms is linked to the life-cycle or the life-span of an organism. Explain with the help of an example.

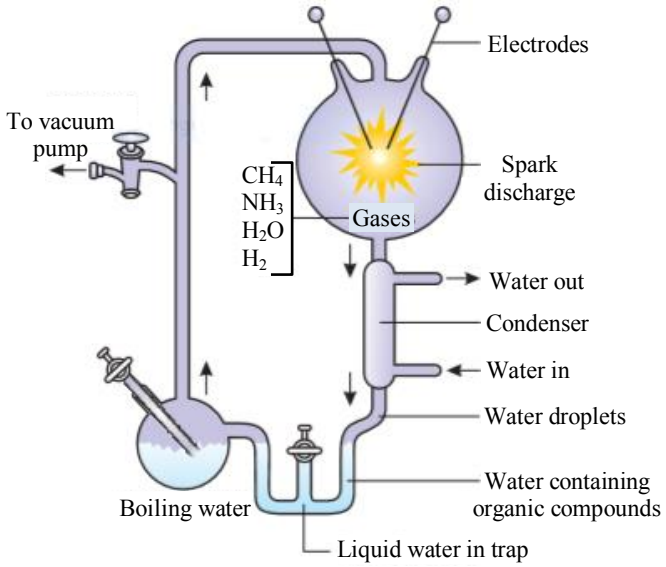
[CBSE 2019]

Ans. A colony of bacteria (say A) growing in a given medium has built in variation in terms of ability to utilise a feed component, a change in the medium composition would bring out only that part

of the population(say B) that can survive under the new conditions , In due is variant population outgrows the others and appears as new species thus organisms with shorter life-cycle or life-span will undergo evolution faster / for the same thing to happen in fish or fowl would take millions of years as life spans of these animals are in years.

6. Describe S.L. Miller's experiment. Comment on the observations he made and his contribution towards the origin of life on Earth. [CBSE 2019]

Ans. High temperature (800º C), high energy radiation, reducing atmosphere created, by electric discharge in a closed flask, containing CH_4 + H_2 + NH_3, and water vapours in the experimental setup.



Observation and Contribution

- Formation of amino acids

- The first form of life arose slowly through evolutionary forces from non- living molecules/ abiogenesis.

7. "Appearance of melanized moths post-industrialization in England is a classic example of evolution by natural selection." Explain. [CBSE 2019]

Ans. Before industrialization more white winged moth than dark winged moth existed in England, post industrialization tree trunks became dark as smoke and soot deposited, lichens could not grow due to pollution, due to higher predation of white winged moth on a darker background, dark winged moth survived, nature selected the fittest organism.

8. According to the Hardy-Weinberg principle, the allele frequency of a population remains constant. How do you interpret the change of frequency of alleles in a population? [CBSE 2019]

Ans. (i) Resulting in evolution/Speciation/original drifted population becomes founders.

9. (a) How does the Hardy-Weinberg equation explain genetic equilibrium?

(b) Describe how this equilibrium is disturbed that may lead to founder effect. [CBSE 2019]

Ans. (a) Allelic frequencies in a population are stable and remains constant from generation to generation / the sum total of all the allelic frequencies is one.

(b) gene migration / gene flow / genetic drift / mutation / gene recombination / natural selection leads to disturbance in equilibrium , when changes in allelic frequencies occur many times in a population , leads to the formation of a new species , original drifted population becomes the founders and the effect is called founders effect.

10. Charles Darwin during his famous sea voyage around the world in a ship (HMS Beagle), concluded that there has been gradual evolution of life. Answer the following questions:

(a) What is his theory known as ? Explain the silent features of his theory.

(b) Name a scientist who arrived at a similar conclusion as that of Charles Darwin.

[CBSE 2019]

Ans. (a) - Theory of Natural Selection

- Any population has built in variation , those characteristics which enables some to survive better (in natural condition) will outbreed others that are less endowed to survive / better adapted individuals will survive , those individuals would leave more progeny / reproductively fit individuals , they will survive more and hence selected by nature

(b) Alfred Wallace (a Naturalist)

11. Write the names of the following : (a) A 15 mya primate that was ape-like (b) A 2 mya primate that lived in East African grasslands [CBSE 2018]

Ans. (a) Dryopithecus

(b) Australopithecines/Australopithecus/Homo habilis

12. With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations ? [CBSE 2018]

Ans. In a population of diploid organisms

If frequency of allele A = p

and frequency of allele a = q

Expected genotype frequency under random mating are

$AA = p^2$ (for the AA homozygotes)

$aa = q^2$ (for the aa homozygotes)

$Aa = 2pq$ (for the Aa heterozygotes)

(In absence of selection , mutation , genetic drift or other forces allelic frequency p and q are constant through generation) Therefore $p^2 + 2pq + q^2 = 1$

13. (a) Differentiate between analogous and homologous structures.

(b) Select and write analogous structures from the list given below :

(i) Wings of butterfly and birds

(ii) Vertebrate hearts

(iii) Tendrils of bougainvillea and cucurbita

(iv) Tubers of sweet potato and potato [CBSE 2018]

Ans. (a) Analogous - Anatomically not similar though perform similar functio f convergent evolution,

Homologus - Anatomically similar (but perform different functions)/are a result of divergent evolution.

(b) Option (i) Wings of butterfly and birds /(iv) Tubers of sweet potato and potato (Any one)

14. State two postulates of Oparin and Haldane with reference to origin of life. [CBSE 2017]

Ans. (i) First form of life could have come from pre-existing non-living organic molecules/RNA & Protein.

(ii) Formation of life was preceded by chemical evolution/formation of diverse organic molecules from inorganic constituents.

15. Write the characteristics of Ramapithecus, Dryopithecus and Neanderthal man. [CBSE 2017]

Ans. Ramapithecus : hairy/ walked like gorillas and chimpanzees , more man like.

Dryopithecus : hairy/ walked like gorillas and chimpanzees , more ape- like.

Neanderthal man : brain size is 1400cc, used hides to protect their body/buried their dead.

(C) MULTIPLE CHOICE QUESTIONS

1. Primitive atmosphere was made up of the mixture of :

(1) Oxygen, ammonia, methane, water

(2) Hydrogen, ammonia, methane, oxygen

(3) Hydrogen, steam, methane, ammonia

(4) Oxygen, methane, water, nickle

Ans. (3) Hydrogen, steam, methane, ammonia

2. Which compounds were formed in the direction of the origin of life :

(1) Urea, nucleic-acid (2) Urea, amino-acid

(3) Proteins, nucleic-acid (4) Protein, amino-acid

Ans. (3) Proteins, nucleic-acid

3. What is most important for origin of life :

(1) Carbon (2) Oxygen (3) Water (4) Nitrogen

Ans. (3) Water

4. Pasteur succeeded in disproving the theory of spontaneous generation because :

(1) The laboratory was clean

(2) He pulled out the neck of flask into a tube

(3) He was lucky

(4) Yeast used in flask were dead

Ans. (2) He pulled out the neck of flask into a tube

5. Now the basis of origin of life is :

(1) Spontaneous generation (2) God's desire

(3) Sunlight on mud (4) None of them

Ans. (4) None of them

6. Oxygen in atmosphere has been formed by :

(1) Evaporation of water (2) Photosynthesis of blue green algae

(3) Metabolism of microorganisms (4) Decaying organisms

Ans. (2) Photosynthesis of blue green algae

7. Primitive atmosphere was reducing because :

(1) Hydrogen atoms were few

(2) Hydrogen atoms were active and in greater number

(3) Nitrogen atoms were more

(4) Oxygen atoms were more

Ans. (2) Hydrogen atoms were active and in greater number

8. Who called larger colloidal particles of primitive sea as coacervates :

(1) Fox (2) Oparin (3) Empedocles (4) Haldane

Ans. (2) Oparin

9. Who called water of primitive sea as pre biotic soup :

(1) Haldane (2) Oparin (3) Fox (4) Huxley

Ans. (1) Haldane

10. Oparin's theory is based on :

(1) Artificial synthesis (2) Spontaneous generation

(3) God's will (4) All

Ans. (1) Artificial synthesis

11. Which biologist gave most logical biochemical theory of origin of life ?

(1) Urey (2) Oparin (3) Stanley Miller (4) Haeckel

Ans. (2) Oparin

12. During the course of origin of life what was the sequence of substances which appeared on earth :

(1) Water, oxygen, nucleic acids, enzymes

(2) Amino acids, ammonia, phosphates, nucleic acids

(3) Glucose, amino acids, nucleic acids, proteins

(4) Ammonia, Amino acids, proteins, nucleic acids

Ans. (4) Ammonia, Amino acids, proteins, nucleic acids

13. Which of the following sets do not have homologous organs :

(1) Wings of mosquito and butterfly (2) Wings of butterfly and bat

(3) Mouth parts of cockroach and butter fly (4) None of them

Ans. (2) Wings of butterfly and bat

14. Wings of locust, pigeon, and bat are example of :

(1) Vestigial organs (2) Analogous organs

(3) Homologous organs (4) Exoskeleton

Ans. (2) Analogous organs

15. Homology is exhibited by :

(1) Wings of butterfly, birds and bat

(2) Paddle of whale, forearm of horse and forelimbs of man

(3) Tail of monkey and bird

(4) Sting of scorpion and honey bee

Ans. (2) Paddle of whale, forearm of horse and forelimbs of man

16. Golden age of Dinosaurs was during :

(1) Cenozoic era (2) Palaeozoic era (3) Archeozoic era (4) Mesozoic era

Ans. (4) Mesozoic era

17. Evolution of birds and mammals occured in :

(1) Eocene and oligocene periods

(2) Silurian and devonian periods

(3) Carboniferous and Permian periods

(4) Cretaceous and triassic periods

Ans. (4) Cretaceous and triassic periods

18. The mesozoic era of earth is called the :

(1) Age of amphibians (2) Age of armoured fishes

(3) Age of primitive man (4) Age of ruling reptiles

Ans. (4) Age of ruling reptiles

19. An era "age of birds and mammals" is :

(1) Mesozoic (2) Palaeozoic (3) Cenozoic (4) Cretaceous

Ans. (3) Cenozoic

20. Origin of life took place in which of the following era :

(1) Mesozoic (2) Palaeozoic (3) Precambrian (4) Proterozoic

Ans. (3) Precambrian

(D) ASSERTION – REASON QUESTIONS

Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(3) If Assertion is true but Reason is false.
(4) If both Assertion and Reason are false.

1. **Assertion :** The primitive atmosphere was reducing once *i.e*., without oxygen.
Reason : In the primitive atmosphere, oxygen was involved in forming ozone.
Ans (1)

2. **Assertion :** Organic compounds first evolved in earth required for origin of life were protein and nucleic acid.
Reason : All life forms were in water environment only.
Ans (2)

3. **Assertion :** Coacervates are believed to be the precursors of life.
Reason : Coacervates were self-duplicating aggregates of proteins surrounded by lipid molecules.
Ans (4)

4. **Assertion :** The earliest organisms that appeared on the earth were non-green and presumably anaerobes.
Reason : The first autotrophic organisms were the chemoautotrophs that never released oxygen.
Ans (2)

5. **Assertion:** We have lost all the direct evidence of origin of life.
Reason: The persons responsible for protecting evidences were not skilled.
Ans (3)

6. **Assertion:** Thorns and tendrils of *Bougainvillea* and cucurbita represent homology.
Reason: Homologous organs have similar functions but are different in their structural details and origin.
Ans (3)

7. **Assertion:** Analogous structures are different in appearance with same function.
Reason: Divergent evolution leads to analogy.
Ans (3)

8. **Assertion :** Natural selection is the outcome of difference in survival and reproduction among individuals that show variation in one or more traits.
Reason : Adaptive forms of a given trait tend to become more common; less adaptive ones become less common or disappear.
Ans (1)

9. **Assertion :** Java Ape-man, Peking man and Heidelberg man are the fossils of *Homo erectus*.
Reason : *Homo erectus* evolved from *Homo habilis*.
Ans (2)

10. **Assertion :** Hardy Weinberg principle explains the variations occurring in population and species over a number of generations.
Reason: This principle is applicable only when genetic drift occurs.
Ans (4)

(E) VERY SHORT ANSWER QUESTIONS

1. Write the name of Famous palaeontologist/Palaeobotanist of India.

Ans. B.Sahni

2. What is the basis of Darwin's Theory of Natural Selection?

Ans. Enormous rate of reproduction in organisms, struggle for existence and survival of the fittest

3. Who was give the theory of inheritance of acquired characters?

Ans. Lamarck

4. What is genetic drift ?

Ans. The chance of elimination of genes from a small population is know as genetic drift:

5. Write the name of most recent man found as fossil.

Ans. Cro-magnon man

6. What was the cranial capacity of java man.

Ans. 900 cc

7. Fulhrott made an important discovery in evolution and he discovered.

Ans. Neanderthal man

8. Characteristics of primitive monkey which was in the direction of evolution of man.

Ans. 32 teeth

9. What is the greatest advantage of bipedal movement ?

Ans. Fore arms becoming free for carrying out order of brain

10. Which is the most primitive ancestor of man ?

Ans. Ramapithecus

(F) SHORT ANSWER QUESTIONS

1. Explain Oparin-Haldane theory of chemical evolution of life.

Ans. The first life form could have come from the pre-existing, non-living organic molecules (like RNA, Proteins, etc.) and that formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecules from inorganic constituents.

2. Distinguish between convergent and divergent evolution giving one example of each.

Ans. Divergent Evolution - Development of different functional structures from a common ancestral form is called divergent evolution.

Homologous organs show divergent evolution.

Examples: Darwin's Finches, Australian Marsupials, locomotion in mammals.

Convergent Evolution - Development of similar adaptive functional structures in unrelated groups of organisms is called convergent evolution.

Analogous organs show convergent evolution.

Examples: Australian Marsupials and Placental mammals, various aquatic vertebrate and wings of insect, bird and bat.

3. How did Louis Pasteur disprove spontaneous generation theory?

Ans. Louis Pasteur showed that in pre-sterilized swan neck flasks, life did not come from killed yeast while in another flask open to air, new organisms arose from 'killed yeast. Because germ laden dust particles in the air were trapped by the curved neck which serves as filter.

4. Define homologous organs? Give one example of organ homologous to hand of man?

Ans. Homologous organs are those organs which are similar in basic structure & embryonic developments but perform different functions. e.g. bones of forelimbs of whales, bat, birds and human beings.

5. What is the role of variation in evolution?

Ans. Variations are useful for survival of species in changed environmental situations. If a population of reproducing organisms are suited to a particular niche & if the niche is drastically altered the population could be wiped out however if some variations were to be present in few individuals, there would be some chances for them to survive.

6. Describe one evidence which decisively proves that birds have evolved from reptiles?

Ans. Missing link between birds & reptiles called. Archaeopteryx showed that "Birds have evolved from reptiles". These are organisms which show the characters of both birds (e.g. presence of wings & feathers in the body) as well as of reptiles (e.g. gong tail & jaws with identical teeth).

7. What is the study of fossils called? Mention any three points how the foss n past life?

Ans. Study of fossils is known as paleontology.

→ Cross-section of the earth's crust indicates the arrangement of sediments one over the other during the long history of Earth.

→ Different sediments contain different life forms which probably died during the formation of particular sediment.

→ Connecting or missing link – which contains characters of different groups.

8. Why has natural selection not eliminated sickle – cell anaemia?

Ans. Sickle cell anaemia is not eliminated during natural selection because in some cases, sickle cell anaemia is beneficial as it provides natural defense against malarial parasite.

9. Life originated from the earth's inorganic atmosphere in the post, but this no longer happens today. Give two reasons?

Ans. Life cannot be originated in the present day atmosphere because:-

(i) The temperature of present day atmosphere is much less than that of primitive atmosphere.

(ii) The present day atmosphere is oxidizing & not reducing due to presence of oxygen.

(G) LONG ANSWER QUESTIONS

1. What is adaptive radiation? Explain with an example.

Ans. Adaptive radiation is an evolutionary process that produces new species from a single, rapidly diversifying lineage. This process occurs due to natural selection. An example of adaptive radiation is Darwin finches, found in Galapagos Island. A large variety of finches is present in Galapagos Island that arose from a single species, which reached this land accidentally. As a result, many new species have evolved, diverged, and adapted to occupy new habitats. These finches have developed different eating habits and different types of beaks to suit their feeding habits. The insectivorous, blood sucking, and other species of finches with varied dietary habits have evolved from a single seed eating finch ancestor.

2. (i) State the Hardy-Weinberg principle.

(ii) When there is a disturbance in the Hardy-Weinberg equilibrium, what would it result in?

(iii) According to this principle, what is the sum total of all allelic frequencies?

Ans. (i) The allele frequency in a population are stable and constant from generation to generation.

(ii) Evolution.

(iii) One.

3. Classify the following as examples of homology and analogy

(i) Hearts of fish and crocodile

(ii) Wings of butterfly and birds

(iii) Eyes of Octopus and Mammals

(iv) Tubers of potato and Sweet potato

(v) Thorns of Bougainvillea and spines of Opuntia

(vi) Thorn of Bougainvillea and tendrils of cucurbits.

Ans. (i) Homology (ii) Analogy

(iii) Analogy (iv) Analogy

(v) Analogy (vi) Homology

4. Stanley Miller and Harold Urey performed an experiment by recreating in the laboratory the probable conditions of the atmosphere of the primitive earth.

(i) What was the aim of the experiment?

(ii) In what forms was the energy supplied for chemical reactions to occur?

(iii) For how long was the experiment run continuously? Name two products formed.

Ans. (i) To prove Oparins theory of origin of life.

(ii) Electric discharge using electrodes.

(iii) One week : Amino acids and Sugar.

(H) CASE-STUDY BASED QUESTIONS

1. Read the following and answer the questions given below:-

About 15 mya, primates called Dryopithecus and Ramapithecus were existing. They were hairy and walked like gorillas and chimpanzees. Ramapithecus was more man-like while Dryopithecus was more ape-like. Few fossils of man-like bones have been discovered in Ethiopia and Tanzania. These revealed hominid features leading to the belief that about 3-4 mya, man-like primates walked in eastern Africa. They were probably not taller than 4 feet but walked up right. Two mya, Australopithecines probably lived in East African grasslands. Evidence shows they hunted with stone weapons but essentially ate fruit. Some of the bones among the bones discovered were different. This creature was called the first human-like being the hominid and was called Homo habilis. The brain capacities were between 650-800cc. They probably did not eat meat. Fossils discovered in Java in 1891 revealed the next stage, i.e., Homo erectus about 1.5 mya. Homo erectus had a large brain around 900cc.

(i) Whom did Ramapithecus look like?

Ans. Ramapithelus was more man like.

(ii) Where have been discovered few fossils of man like bones?

Ans. Few fossils of man like bones have been discovered in Ethiopia and Tanzania.

(iii) What is the cranial capacity of Java man?

Ans. Cranial Capacity of Java man is 900 cc.

(iv) Where lived Australopithecines?

Ans. Australopithecines probably lived in East - African grasslands.

(v) Who was Homo - habilis?

Ans. The first human like being the hominid was called Homo - habilis.

2. Read the following and answer the questions from given below:-

In a given population one can find out the frequency of occurrence of alleles of a gene or a locus. This frequency is supposed to remain fixed and even remain the same through generations. Hardy-Weinberg principle stated it using algebraic equations. This principle says that allele frequencies in a population are stable and is constant from generation to generation. The gene pool (total genes and their alleles in a population) remains a constant. This is called genetic equilibrium. Sum total of all the allelic frequencies is 1. Individual frequencies, for example, can be named p, q, etc. In a diploid, p and q represent the frequency of allele *A* and allele *a*. The frequency of *AA* individuals in a population is simply p^2. This is simply stated in another ways, i.e., the probability that an allele A with a frequency of p appear on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e., p^2. Similarly of aa is q^2, of Aa 2pq. Hence, $p^2+2pq+q^2=1$. This is a binomial expansion of $(p+q)^2$.

(i) Explain the Genetic drift

Ans. The spread of genes from one breeding population to another by migration which may result in change in gene frequency is called genetic drift.

(ii) Where genetic drift operates?

Ans. Genetic drift operates only in smaller populations.

(iii) State what do 'p' and 'q' denote in the equation $p^2 + 2pq + q^2 = 1$.

Ans. In this equation p and q are individual freqeuencies of different alleles.

(iv) What is Hardy - weinberg principle says.

Ans. Hardy - weinberg principle says that alleles frequencies in a population are stable and is constant from generation to generation.

(v) If any fluctuation in genetic equilibrium. what will happen?

Ans. Any functuation in genetic equilibrium leads to evolution.

3. Read the following and answer the questions from given below:-

The origin of life is considered a unique event in the history of universe. The universe is vast. Relatively speaking the earth itself is almost only a speck. The universe is very old – almost 20 billion years old. Huge clusters of galaxies comprise the universe. Galaxies contain stars and clouds of gas and dust. Considering the size of universe, earth is indeed a speck. The Big Bang theory attempts to explain to us the origin of universe. It talks of a singular huge explosion unimaginable in physical terms. The universe expanded and hence, the temperature came down. Hydrogen and Helium formed sometime later. The gases condensed under gravitation and formed the galaxies of the present day universe. In the solar system of the milky way galaxy, earth was supposed to have been formed about 4.5 billion years back. There was no atmosphere on early earth. Water vapour, methane, carbon di oxide and ammonia released from molten mass covered the surface. The UV rays from the sun broke up water into Hydrogen and Oxygen and the lighter H_2 escaped. Oxygen combined with ammonia and methane to form water, CO_2 and others. The ozone layer was formed. As it cooled, the water vapor fell as rain, to fill all the depressions and form oceans. Life appeared 500 million years after the formation of earth, i.e., almost four billion years back.

(i) Name the scientist who disproved the spontaneous generation theory.

Ans. Louis Pasteur disproved the theory of spontaneous generation. He proved biogenesis

(ii) Name the different gases contained in the flask used as an experimental setup by S.L. Miller.

Ans. CH_4, NH_3, H_2O and H_2.

(iii) What provided energy for abiotic synthesis on primitive earth?

Ans. Very high temperatures due to lightning or UV – rays provided energy for abiotic synthesis.

(iv) When did life appear on earth?

Ans. Life originated sometimes 3600 million years ago.

(v) Mention the type of nutrition in the cells that originated first during the origin of life.

A c nutrition

4. Read the following and answer the questions given below:-

Comparative anatomy and morphology shows similarities and differences among organisms of today and those that existed years ago. Such similarities can be interpreted to understand whether common ancestors were shared or not. For example whales, bats, Cheetah and human (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Hence, in these animals, the same structure developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry. Other examples are vertebrate hearts or brains. In plants also, the thorn and tendrils of *Bougainvillea* and *Cucurbita* represent homology. Homology is based on divergent evolution whereas analogy refers to a situation exactly opposite. Wings of butterfly and of birds look alike. They are not anatomically similar structures though they perform similar functions. Hence, analogous structures are a result of convergent evolution - different structures evolving for the same function and hence having similarity.

(i) Why are analogous structures, a result of convergent evolution ?

Ans. Analogous structures are a result of convergent evolution because they are not anatomically similar structures though they perform similar functions.

(ii) Identify the examples of convergent evolution from the following :

(a) Flippers of penguins and dolphins

(b) Eyes of octopus and mammals

(c) Vertebrate brains

Ans. Flippers of penguins and dolphins and Eyes of octopus and mammals.

(iii) "Sweet potato tubers and potato tubers are the result of convergent evolution." Justify the statement.

Ans. Sweet potato tuber is a root modification and potato tuber is a stem modification but they show convergent evolution because both of them are unrelated and perform the functions similar like storage of food and vegetative reproduction.

(iv) Name the type of evolution that has resulted in the development of structures like wings of butterfly and bird. What are such structures called.

Ans. Convergent evolution. Such structures are called analogous structures.

(v) State the evolutionary relationship giving reasons between the thorn of Bougainvillea and tendril of cucurbit.

Ans. Divergent evolution/Homologous organs. Similar in origin but perform different function.