10. Origin and Evolution of Life

10.0 : Introduction

Q.1. What is Big Bang?

Ans: The universe approximately 15,000 million years ago was a single piece of concentrated matter. The exploding of the matter is called Big Bang.

Q.2. Write a note on origin of earth.

OR

Explain : Universe might have been originated by large explosion according to Big-bang hypothesis.

Ans: i) The earth is estimated to be five billion years old and our present solar system is presumed to be formed from a rotating cloud of hot gases with dust, pieces of rocks and metals called Nebulous.

ii) This mass of gas exploded with a Big bang into several small pieces.

iii) After a few thousands of years the earth began to cool.

iv) It is presumed that the Universe came into existence with a single titanic explosion called the "Big Bang" about 15,000 million (15 billion) years ago.

v) With the Big bang, all the matter and tremendous energy came into existence. The fragments of the fire ball expanded and cooled to give rise to many more celestial bodies.

vi) In due course of time this resulted in the formation of our solar system consisting of the sun and planets. The earth is presumed to have originated about 4.6 billion years ago.

10.1 : Origin of Life

Q.3. What kind of atmosphere was existing on the primitive earth?

Ans: Primitive earth atmosphere was strongly reducing and contained hydrogen, methane, ammonia and water vapours, free oxygen was absent.

Q.4. What is protobiogenesis? Which are the different theories of origin of life?

Ans: The origin of life on the earth is called protobiogenesis.

There are different theories put forth to explain the origin of life. They are

i) Theory of special creation.

ii) Cosmozoic theory.

iii) Theory of spontaneous generation or Theory of abiogenesis.

iv) Theory of biogenesis.

Q.5. Explain in brief the theory of special creation.

Ans: i) Theory of special creation is the oldest of all the theories.

ii) It was proposed by Spanish monk Father Sudrez.

iii) According to this theory, all living beings on the earth were created by God or by, a supernatural power.

iv) This theory is purely based on religious belief.

v) It has no scientific evidence.

vi) Therefore, it is not accepted by the scientific world.

Q.6. Write a short note on Cosmozoic theory.

Ans: i) Cosmozoic theory was given by Richter in 1865 and is also known as panspermia theory.

ii) According to Richter, life on earth came from a distant planet in the form of spores or microorganisms.

iii) It was called cosmozoa or panspermia which were preserved inside meteorites (mass of matter from outer space).

iv) These meteorites struck the barren earth to release the cosmozoa and helped in development of various creatures.

v) This theory failed to explain the origin of life on the planet, hence this theory is not accepted.

7. What is abiogenesis? E plain the theory of spontaneous generation or theory of abiogenesis.

Ans: Abiogenesis: It is the hypothetical process by which living organisms are believed to have developed from non-living matter.

Theory of spontaneous generation:

i) It is also called the theory of autobiogenesis (auto = self, bios = life, genesis = formation)
ii) According to this theory, life originated form non-living material spontaneously, without any interruption.
iii) It as initially putforth by Greek Philosopher in 600 B.C. and was supported by Aristotle.
iv) The Greek Philosophers believed that air, water, fire and earth are vital forces or the active principles hich have the capacity to transform non-living matter into living organism.
v) Louis Pasteur finally disproved the theory of spontaneous generation and gave the scientific explanation that life originates only from pre-existing life or biogenesis.

Q.8. Explain in brief Oparin-Haldane theory of chemical evolution.

OR

Describe Oparin - Haldane theory of chemical origin of life.

Ans: The Russian scientist Alexander Ivanovich Oparin (1924) and British scientist J.B.S. Haldane (1929) proposed the theory of chemical evolution of life.

According to this theory life originated from non-living matter, some three billion years ago, in a primitive atmosphere, through a process of chemical evolution.

The entire process of chemical evolution can be divided into following steps:

i) Origin of earth and its primitive atmosphere:

a) The origin of life on earth is closely related to the origin of earth itself.
b) Evidences suggest that earth originated about 4.6 billion years ago.
c) When it was broken from the sun, it was a glowing fire and a rotating cloud of hot gases, vapours of various elements and pieces of rocks and metals called ebulous.
d) This mass of gas exploded with a Big Bang into several small pieces. The earth, as pieces was broken from the sun.
e) As the earth was moving away from the sun, it was getting cool. This led to the condensation of gases.
f) The heavy elements like iron ,nickel etc. sank to the centre and formed the solid core of earth.
g) The lightest elements like helium, hydrogen, oxygen, nitrogen, carbon etc. occupied the atmosphere of the earth.
h) The geological conditions on the primitive earth about 3600 million years ago were much different from those found today. In fact the atmosphere of primitive earth was reducing type and there was no free oxygen.

ii) Formation of ammonia, water and methane:

a) The prebiotic environment had very less resemblance with the present day environment.
b) The earth was very hot initially and so the atoms could not combine with each other very easily.
c) The primitive earth contained a large amount of hydrogen, nitrogen, carbon and oxygen.
d) Of these, hydrogen was very active.
e) It combined with nitrogen to form ammonia (NH_3), with oxygen to form water (H_2O); and with carbon to form methane (CH_4).
f) As the temperature was high, ammonia and methane remained as gases and water as steam.
g) As years passed, the temperature of the earth decreased.
h) Steam condensed into water which resulted in rain and the earth became cold.
i) Water gradually accumulated and this led to the formation of rivers, streams, lakes, seas and oceans.
j) Compounds like ammonia, methane, etc. were dissolved in rain water and were accumulated in the sea. Thus the first chemicals formed on the earth were water, ammonia, methane and others.

iii) Synthesis of simple organic compounds:

a) The next steps in molecular evolution was the formation of micromolecules.
b) As the earth surface considerably cooled, the highly reactive free radicals – CH – CH_2 condensed to form a variety of both saturated and unsaturated hydrocarbon.
c) The simple inorganic molecules of the oceanic water interacted with one another simple organic molecules such as sugar, fatty acids, glycerol, amino acids, purin pyrimidines.
d) The energy for these reaction was provided by the electrical discharges (lighting) ultraviol rays (solar radiations), volcanic activities and decay of radioactive elements

$CH_4 + NH_3 + H_2O \rightarrow$ amino acids.
$CH_4 + HCN + NH_3 + H2O \rightarrow$ purines + pyrimidines
$CH_4 + H2O \rightarrow$ sugar + glycerol + fatty acids.
Haldane proposed that these simple organic compounds gradually accumulated in these water bodies and finally a 'hot thin soup or pre – biotic soup or broth was formed.

iv) Formation of complex organic compounds:
The hot dilute soup was sterile and oxygen free.
Simple organic substances came together in increasing numbers.
They colloided , reacted and aggregated forming new complex molecules such as polysaccharides, fats, proteins, nucleosides and nucleotides.
The protein molecules made their existence by polymerization of amino acids.
These proteins showed enzymatic reaction and were called protoproteins.
Due to their enzymatic nature these proteins accelerated the rate of other chemical reactions.
The formation of protein molecules is considered as a landmark in the origin of life.

v) Formation of nucleic acid:
The next step in the chemical evolution was formation of nucleic acid.
It was formed by the aggregation of phosphoric acid, sugar, purines and pyrimidines.
They were linked in various combinations to form different types of nucleotides.
Thousands of nucleotides joined together to form nucleic acid.
It acquired self replication ability, which is a fundamental property of living forms.

vi) Formation of Protobiont or precells:
The nucleic acid along with inorganic and organic molecules formed the first form of life and were called **protobionts** or **precells.**
The proteins formed colloidal hydrophilic complexes surrounded by water molecules.
Oparin and Sidney Fox demonstrated the formation of this aqueous suspensions of polymers.
Oparin called these aggregates as Coacervates while Sydney Fox called them Protenoids or Microspheres.

vii) Formation of First Cell:
The nucleic acids in pre-cells had the capacity to multiply but gradually it started directing a series of chemical reactions and in this context protein synthesis was very important.
That was the significant step in the transformation of pre-cell into a cell.
This chemical evolution gave rise to the biological evolution.

viii) Biological evolution:
The first cells or primitive cells were marine and heterotrophic in nature.
They obtained their food from the surrounding areas.
Growth and multiplication of these cells caused depletion in the food and increase in CO_2 due to fermentation.
These were the favourable circumstances for mutation, which resulted in the development of chromophores .
The chromophores had the ability to trap light energy and convert it into chemical energy.
This event helped in the transformation of heterotrophs into autotrophs.
Due to release of oxygen as a by product of photosynthesis the primitive reducing atmosphere was slowly and gradually converted into an oxidizing atmosphere.

Coacervate theory of Oparin: In 1938 Oparin performed experiment in which he explained that the formation of protein molecule was a very crucial event in the course of chemical evolution.
He also tried to explain the transformation of non-living substances into living forms.
He suggested the formation of coacervates.
Thus Oparin suggested that they might have originated from the primitive earth, substances from which the first cell like forms might have come into existence.
He called them 'Protobionts' or 'Eubionts'.

Q.9. Describe Microsphere theory of Sydney Fox.

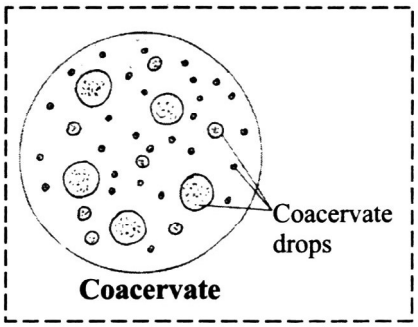
Ans: i) In 1959 Dr. Sydney Fox studied Oparin's coacervate theory and performed the experiments by stimulating prebiotic environmental conditions in the laboratory.

ii) In his experiments he heated the amino acids which polymerized into protein like droplet called proteinoids.
iii) These aggregated into spherical colloidal droplets which were called microspheres.
iv) So it can be concluded from Oparin's and Fox's experiments that coacervates and the microspheres were the fore runners of the first form of life on this earth.

Q.10. Write a short note on coacervates.

Ans: Coacervates (formation of polymers/molecules aggregate):

i) Oparin observed that if a mixture of a large protein and a polysaccharide is shaken, coacervates are formed.
ii) Coacervates contains mainly protein, polysaccharides and some water.
iii) Oparin's coacervates also show a simple form of metabolism theory of oparin.
iv) As these coacervates do not have outer lipid membrane hence they cannot reproduce.
v) Microsphere are another protobionts.
vi) Thus Oparin suggested that they might have originated from the primitive earth.



Assembly of organic compounds :

Q.11. Give an account of Miller's experiment.

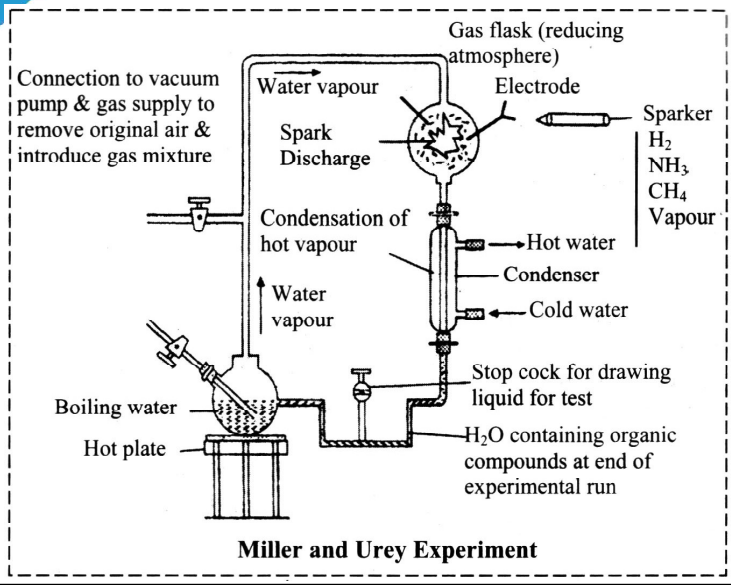
Ans: i) Stanley Miller and Urey created condition similar to primitive atmosphere.
ii) The apparatus had a spark chamber with two tungsten electrodes, flask for boiling water, side tube connected to a vaccum pump condenser and V-shaped trap.
iii) The electric discharge was created by using electrodes in a spark chamber containing methane, ammonia, hydrogen and water vapours in the ratio 1 : 2 : 2 without air. This was done to create prebiotic environment.
iv) The flask containing water was heated to provide water vapour.
v) They passed the mixture through a condenser.
vi) They circulated the gases continuously in this way for one week and then ana lysed the chemical composition of the liquid inside the apparatus.

Observation:

They observed a large number of simple organic compound including some amino acids such as alanine, glycine and aspartic acid.

Conclusions:

All these complex organic compounds including amino acids, were synthesized non-enzymatically.
This proved that complex organic compounds could be synthesized in reducing atmosphere without the help of enzymes and thus supported the theory of chemical evolution.



Miller and Urey Experiment

10.2 : Organic Evolution

Q.12. What is meant by organic evolution?

Ans: Organic evolution is "the process of orderly change by which present day forms of life have descended from those of the past organisms (ancestors) with modification."

Q.13. Describe Darwin's theory of natural selection. State the objections raised against this theory.

Ans: Charles R. Darwin was a British biologist. He postulated the "Theory of origin of species by natural selection".

Principles of Darwinism:

Darwin's theory of organic evolution by natural selection is based on the following principles:

i) **Over production or prodigality of production :**
All organisms have a natural tendency to over produce.
If this tendency is not checked, then even a single species of a plant or animal will occupy the entire space available on the earth.

ii) **Struggle for existence:**
Organisms multiply in geometric ratio but space and food remain constant leading to competition for survival. Increase in number of species leads to a competition called struggle for existence.

iii) **Variations and Heredity:**
The differences which occur between the closely related organisms are called variations.
It is universal law of nature. Variations may be favourable or unfavourable.

iv) **Survival of the fittest or natural selection:**
According to Darwin, in the struggle for existence the fittest individuals survive and reproduce while the unfit individual die out without reproducing.

v) **Origin of new species:**
According Darwin, useful variations appear in every generation and are inherited from one generation to another.

Objections to Darwin's natural selection theory:

i) Natural selection theory explained "survival of the fittest" but not "arrival of the fittest".
ii) He was not clearly aware of hereditary principles.
iii) Certain useless characters are also inherited. He cannot explain the inheritance of useless variations.
iv) He was unable to differentiate variation as hereditary and environmental variations.

Q.14. Write a note on "Struggle for existence".

Ans: Struggle for existence: According to Darwin individuals multiply in geometric ratio but the space and food remain constant. This lead to competition for getting requirements of life. This competition is called struggle for existence. The struggle may be intra-specific, inter-specific or environmental.

i) **Intra-specific struggle:**
It is the competition among the individuals of the same species.
This type of struggle is very severe, because the need and approach of all competing organisms is precisely same.
e.g. struggle between cow and cow, horse and horse, deer and deer etc. for getting grass.

ii) **Inter-specific struggle:**
It is the struggle between the organisms of different species living together. Individuals of one species compete with other species for food, shelter and breeding place. e.g. Struggle between cow, horse nd deer for getting grass.

iii) **Environmental struggle:**
It is struggle of all living forms against adverse environmental conditions i.e. against natural calamities like extreme heat or cold, drought, storms, earthquakes, volcanic eruptions etc.

Q.15. Describe the concept of "Survival of the fittest".

Ans: Survival of the fittest or Natural selection:

i) The Organisms provided with favourable variations succeed in the struggle for existence.
ii) While the organisms with unfavourable variations are unfit to survive and they perish.
iii) This mean survival of the fittest.

iv) The nature selects the organisms which are provided with favourable variations and these are fittest to survive, hence, the theory is known as natural selections.

Q.16. What are the important postulates of Hugo De Vries' Mutation theory?

Ans: Mutation theory of Hugo de Vries states that evolution is a jerky process. New varieties and species are formed by mutations or discontinuous variations that function as raw material for evolution.

Salient features of Mutation Theory are

i) Mutations are the raw material for evolution.
ii) Mutations appear suddenly and become operational immediately.
iii) The same type of mutations can appear in a number of individuals of a species.
iv) Since they are changes in genetic material all mutations are potentially inheritable. Somatic mutations have least chances of getting transmitted.
v) Mutations are unpredictable and appear in all conceivable directions.
vi) Useful mutations are selected by nature. Lethal mutations get eliminated.
vii) Sometimes, useless and less harmful mutations continue to persist in the progeny.
viii) Accumulation of variations produce new species.
ix) Sometimes, a new species is produced from a single mutation.
x) All in all evolution is a jerky and discontinuous process.

Q.17. What were the objections to Hugo de-Vries theory of mutation?

Ans: i) Sudden appearance of large discontinuous variations observed by Hugo de Vries were not really gene mutations, but were actually due to chromosomal aberrations that have little value in evolution.
ii) Mutation is actually a change in structure of gene and brings about a minor variation.
iii) Rate of mutation is very slow i.e. one per million or several millions.
iv) Mutation is one of the many agents of evolution. Gene mutations are the raw material on which natural selection can act to bring about evolutionary changes.

Modern synthetic Theory of Evolution :

Q.18. Give the three key factors of the modern synthetic theory of evolution.

Ans: Genetic variation, natural selection and isolation are the key factors of modern synthetic theory.

Q.19. Give the important features of modern synthetic theory.

OR

Explain modern synthetic theory of evolution.

Ans: Julian Huxley proposed term modern synthesis. This theory was based on work of Dobzansky. It is mainly based upon genetical variation, natural selection and isolation.

The other factors are hybridization, gene frequencies, genetic drift etc.

The salient features are as follows.

i) Mendelian population was considered as unit of evolution.
ii) Sum total of genes of all individuals of Mendelian population are called gene pool.
iii) In struggle genetic variation plays important role and can bring about new gene combination.
iv) The favourable variations are preserved by natural selection through differential reproduction, genetic drifts and isolation. Gene mutation, genetic recombination, genetic drift and chromosomal abberration are the causes of variations.
v) Reproductive isolation prevents interbreeding which in course of time leads to speciation as a result of change in gene pool.
Change in gene pool is an important step in speciation.

Q.20. Define Gene pool.

Ans: The sum total of all the genes of all individuals of interbreeding population is called gene pool.

Q.21. Explain the terms: Gene pool and Gene frequency.

Ans: Gene pool:

i) It refers to the sum total of all the genes of all individuals of interbreeding population.
ii) Changes in gene pool results in evolution.

Gene frequency: The proportion of an allele in the gene pool as compared with other alleles at the same locus is called gene frequency.

Q.22. Write a note on "Genetic drift".

Ans: i) Any alteration in allele frequency in the natural population by pure chance is called genetic drift.

ii) Genetic drift or allelic drift is the change in the relative frequency with which a gene variant (allele) occurs in a population that results from the fact that alleles in offspring are a random sample of those in the parents, and because of the role of chance in determining whether a given individual survives and reproduces.

iii) A population's allele frequency is the fraction of the gene copies that share a particular form.

iv) It is also called Sewall Wright effect.

Q.23. Derme:

i) Mutation

ii) Mutagens

Ans: i) Mutation : A sudden large and inheritable changes in the genetic material are called mutations.

ii) Mutagens : Mutation causing agents are called mutagens.

Q.24. Name the mechanism by which new alleles appear in a population.

Ans: Mutation is the mechanism by which new alleles appear in a population.

Q.25. State the important factors that can alter the gene frequency.

Ans: Following factors alter the gene frequency in genetic equilibrium:

i) Gene mutation:

Changes in the chemical make up of a gene is called gene mutation or point mutation.
These mutations are the cause for new alleles that introduce variations in the gene pool and it accounts for the change in gene frequency.

ii) Gene flow:

Transfer of gene between populations that differ genetically from one another is called gene flow.
For e.g. when animal migrate from an area to another they contribute their genes to the gene pool of that area and hence a change in gene frequency.

iii) Genetic recombination:

In sexually reproducing organisms, during gametogenesis, the homologous chromosomes exchange genetic material by the process of crossing over.
This produces new combinations and the phenomenon is called genetic recombination.
It adds variability to individuals.

iv) Genetic drift:

Any alteration in allele frequency, in the natural population by pure chance is called genetic drift.
For e.g. elimination of a particular allele from a population due to events like accidental death prior to mating of an organism that is the sole possessor of particular allele. Smaller populations have greater chances for genetic drift. It is also called Sewall Wright effect.

v) Chromosomal aberrations:

It refers to the structural alterations in a chromosome causing changes in the gene arrangement. e.g., deletion, duplication, translocation and inversion.
They also cause variations in the Mendelian populations.

Q.26. What is gene flow? [Mar 2014]

Ans: Transfer of genes between population that differ genetically from one another is called gene flow.

Q.27. How does gene flow contribute in evolution?

Ans: i) Gene flow is also called as gene migration.

ii) When a section of population migrates to another population, gene pool of both the populations change, as some alleles are lost from first population while they are added to second population.

iii) When animals migrate from an area to another, they contribute their genes to the gene pool of that area and hence a change in gene frequency.

Q.28. Explain natural selection with a suitable example.

OR

Explain the action of natural selection with reference to industrial melanism.

Ans: Natural selection: It is a fundamental and the only operating mechanism of evolution.

It is a link between changes in the environment and genetic variations of the species attempting to survive and reproduce.

It brings about evolutionary changes by favoring differential reproduction of genes that brings about changes in gene frequency from one generation to another.

Natural selection invariably encourages those genes that assure highest degree of adaptive efficiency between population and its environment.

The natural selection in action can be appreciated by studying the example of 'Industrial melanism'.

Example:

Industrial Melanism:

i) Industrial Melanism is one of the best examples for natural selection in action which refers to development of dark coloured peppered moths in response to air pollution during the industrial revolution in Great Britain.

ii) The dark coloured moths developed as a result of random mutation.

iii) It was first reported by scientist Kettlewell.

iv) Before the industrial revolution (1845) light coloured peppered moths called Biston betularia were prevalent in very high numbers.

v) The peppered moths are nocturnal in habit.

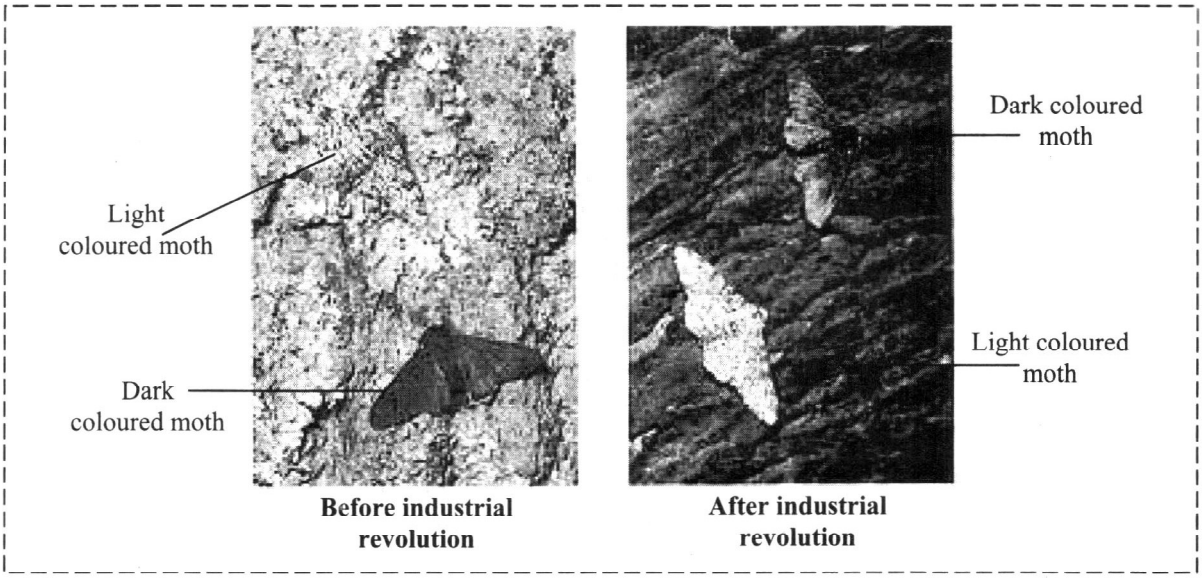
vi) During daytime they rest on the tree trunk.

vii) Their pale body colour camouflaged well with the lichen covered trees that helped them to escape from the predatory birds.

viii) On the contrary, the Black coloured moth called Biston carbonaria, resting on lichen covered tree trunks were very conspicuous and were easy victims for the predatory birds hence they were rare.

ix) During the industrial revolution large number of industries came up in Great Britain.

x) The Industries released black sooty smoke that killed the lichens growing on trees and turned the trees black due to the sooty deposits.



xi) This change became an advantage to the black coloured moths that camouflaged well with the black tree trunks and their population increased, while the pale coloured moths became easy victims to predatory birds and so their population drastically reduced.

Thus, natural selection has resulted in the establishment of a phenotypic trait in changing the environmental conditions.

Q.29. Explain the statement 'natural selection is differential reproduction'.

Ans: i) The difference in the rate and frequency of reproduction in the members of population is called as differential reproduction.

ii) Those members best adapted to the environment reproduces at a higher rate and produce more offspring than those which are less adapted.

iii) More adapted member contribute proportionally greater percentage of genes to the gene pool of next generation, while less adapted produce fewer offspring,

iv) If differential reproduction continues for many generation then gene of individual which produce more offspring will become predominant in the gene pool of the population.
v) Members of any population do not reproduce with same rate, some individuals produce more offspring with faster rate while others produce few offspring with slower rate.
vi) Any organism survive by producing more offspring favourable variation are preserved by natural selection because of differential reproduction.

Isolation:

Q.30. Define isolation. Describe the types of isolation.

Ans: Isolation: Separation of a single population into several sub-units is called Isolation,

No interbreeding between isolated groups occurs. Each group may develop a set of new traits that lead to evolutionary changes and towards formation of new species.

The isolating mechanisms are of two types namely, geographical isolation and reproductive isolation.

i) Geographical isolation:
a) It occurs when an original population is separated into two or more groups by geographical barriers such as river, mountain, ocean, island formation, forests etc.
b) The separated groups are exposed to different kinds of environmental factors. Hence, each group acquires variations by developing mutations, recombination etc.
c) These variations are processed by natural selection. This leads to progressive genetic divergence. The separated populations develop distinct gene pool and they do not interbreed. Thus, the species are formed by geographical isolation.
d) The classic example of geographical isolation is that of Darwin's finches.
e) Darwin's finches living on Galapagos islands differ not only among themselves but also from mainland finches in size, colour, beak and food habits.

ii) Reproductive isolation:
a) Reproductive isolation is brought about by the change in genetic material, gene pool and structure of genital organs.
b) It prevents interbreeding between populations whether they are geographically isolated or living close together.

Q.31. Describe various types of premating isolating mechanism.

Ans: Pre-mating or pre-zygotic isolating mechanisms:

i) **Habitat isolation:** In this isolation members of a population living in the same region occupy different habitat. Thus potential mates do not meet.
ii) **Seasonal isolation:** In this isolation members of a population attain sexual maturity at the different times, thus preventing interbreeding.
iii) **Ethological isolation:** In this isolation members of two populations have different mating behaviours. This prevents interbreeding.
iv) **Mechanical isolation:** In this isolation the members of two populations have difference in the structure of reproductive organs. So interbreeding is not possible.

Q.32. Explain the various types of post mating isolating mechanism.

Ans: Post-mating or post zygotic isolating mechanisms are:

i) **Gamete mortality:** Sperms transfer takes place but egg is not fertilized.
ii) **Zygote mortality:** Egg is fertilized but zygote dies
iii) **Hybrid sterility:** Hybrids are sterile

Evidences:

Q.33. Define.

i) Palaeontology:

Ans: The scientific study of life of the geologic past involving plants, animals and microbes fossils is called Palaeontology.

ii) Fossils:

Ans: Fo sils (from Latin fossus, literally "having been dug up") are the dead remains or traces of animals, plants, and other organisms from the remote past.

Q.34. Which are the e idences that support the process of evolution?

Ans: Process of e olution is supported by evidences provided by various branches of biology: They are

i) Palaeontology ii) Comparative Anatomy iii) Embryology iv) Genetics

Q.35. Describe an two biological evidences of evolution.

Ans: i) Palaeontological evidence of evolution.

a) Fossils are defined as the dead remains of plants and animals that lived in the past in various geological layers.

b) Unlike the evidences from other branches of biology, evidence from fossils are sound, direct and reliable.

c) Fossils are described as the true witnesses or documents of evolution.

d) The development in the field of Geology reveals that the primitive forms of organisms occupy the lower layers and the advanced forms occupy the upper layers of the earth during fossilization.

e) Fossils are found in sedimentary rocks, amber, volcanic ash, ice, peat bogs and soil etc.

ii) Anatomical evidences of evolution:

The study of internal structure of organism is called anatomy.

a) Anatomical evidences are of three types, viz homologus organ, analogous organs and vestigial organs.

b) Though the animals belonging to different groups vary greatly in their external morphology, yet they show the same structural plan internally i.e. in their anatomy.

c) The organs having common origin but performing different functions are known as homologous organs and the phenomenon is called homology.

Homology is the result of divergent evolution.

Homology of organ indicate their common ancestry.

e.g. forelimbs of whales, bat, birds, amphibians and humans as all have basic anatomical structure with bones humerus, radius - ulna, carpals, meta - carpals and phalanges.

1. Analogous organs

i) The organs having different ongm but performing same function are called analogous organs and the phenomenon is called analogy.
e.g. wings of butterfly (insects) and birds.

ii) Analogy is the result of convergent evolution.

2. Vestigial organs

i) Organs are functionless and rudimentary to the possessor but were functional in the ancestors and are also functional in related animals.
e.g.
a) caecum and vermiform appendix
b) nictitating membrane
c) Coccyx or tail vertebrae

Q.36. Give the importance of fossil in support of organic evolution. [Oct. 2013]

Ans: Refer Q.35 (i)

Q.37. Describe the anatomical evidences of evolution.

Ans: Refer Q. 35 (ii)

Q.38. Write about the categories of fossils.

Ans: The categories of fossils are as follows:

i) Actual remains: These are the most common type of fossils.
Actual remains are generally formed in the deep oceans.
Whenever the plants or animals die their dead bodies sink to the bottom of the sea.
Here either the entire body or its hard parts get surrounded by minerals forming part of the stones.
Another way of formation of actual remains is incorporation of the entire body or part of the body in the ice.

ii) Moulds and casts: A mould is an impression of the body parts left on the soft mud of the oceanic floor.
When the cavities of the mould get filled with minerals, it hardens into stones and forms cast.

Q.39.State the significance of palaeontological evidences.

Ans: i) It is useful in reconstructing the phylogeny i.e. the evolutionary history of the organisms.
ii) Palaeontology helps in studying various other forms and structures of extinct animals.
iii) Fossils are important tools which help in understanding the habit and habitat of the extinct organisms.
iv) Fossil records provide the connecting links between two groups of organisms.

Q.40. Why is Archaeopteryx called connecting link? Or Explain 'connecting link' in evolution with example.

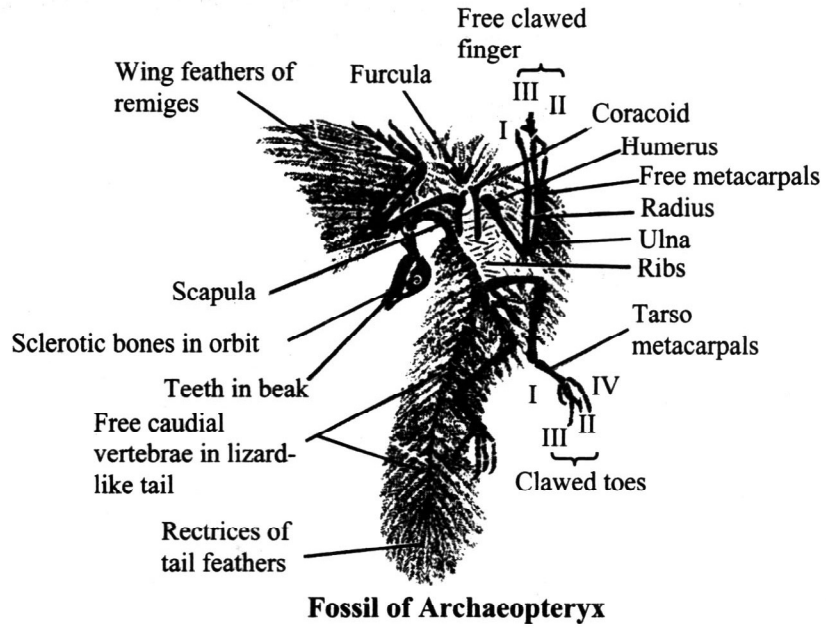
Ans: Organisms showing characters of two groups (kingdoms, phyla, classes etc.) are called connecting links between the two groups.

Archaeopteryx shows characters of birds as well as of reptiles.

Like birds it has skull bones completely fused: cranium rounded with large orbits and a single condyle
Jaws modified into beak.
Forelimbs modified into wings.
Limbs bones have their first toe opposable.
Foot with clawed digits.

But like Reptiles it has

Jaw with homodont teeth.
Ribs with single head.
Abdominal ribs somewhat like those seen in crocodiles.
Wings with digits and claws.
The hind limb had four digits ending with claws.
Long tail.
So the Archaeopteryx is a connecting link between classes, Aves and Reptilia.



Fossil of Archaeopteryx

Q.41. Name the organism which is connecting link between reptiles and aves.

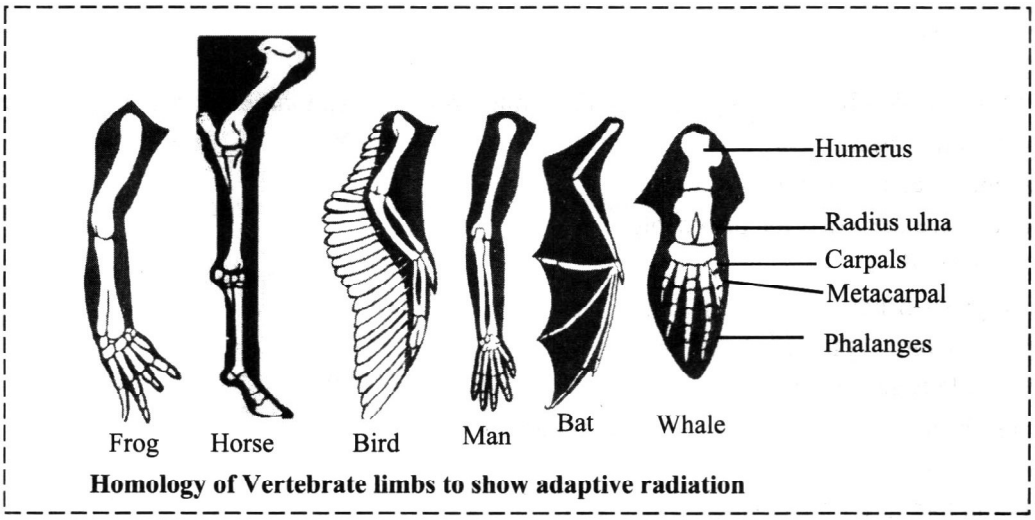
Ans: Archaeopteryx is the connecting link between reptiles and aves.

Q.42. Find out from newspapers and popular science articles any new fossil discoveries or controversies about evolution.

Ans: i) Huxley proposed that man evolved from the apes but palaeontological evidences revealed that man and apes had common ancestry.
ii) Earlier the spermatophytes were considered to be the first seed-bearing plants but the fossil studies have shown that pteridophytes (seed ferns) were first land plants to develop seed habit. These act as missing link between the ferns and Gymnosperms.

Q.43. Describe in brief homologous organs to support evolution.

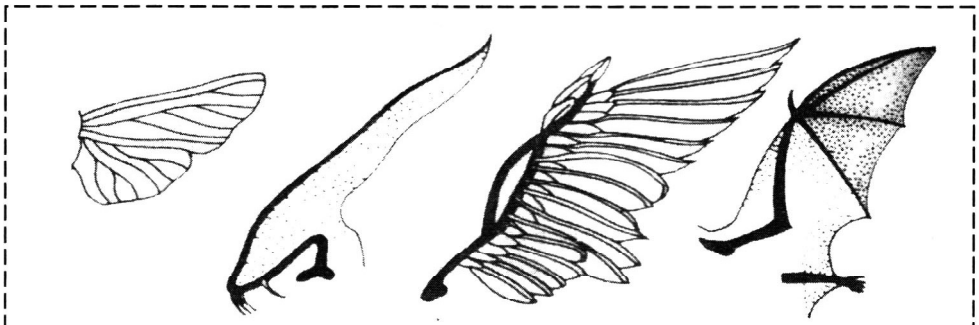
Ans: Homologous organs :



Homology of Vertebrate limbs to show adaptive radiation

i) The organs or parts that are similar in basic structural plan of development but different in functions are called homologous organs.
ii) A study of hand of man, fins of whale, wings of bird, forelimb of horse suggest that all these organs of the animals belonging to different groups show similar internal organization i.e. presence of humerus, radio-ulna, carpals, metacarpals and phalanges.
iii) However, the external appearance of hand of man, fins of whale, wing of bird, forelimb of horse is different.
iv) Not only that, these organs perform different functions, hand of man for holding, wings of bird for flying, forelimb of horse for running, fins of whale for swimming.
v) The study of homologous organs suggests that these animals belonging to different groups have descended from common ancestor. In other words, they have evolved from common ancestor.

Q.44. Write a short note on analogous organs.
Ans:


Wing of Insect **Wing of Pterodactyl** **Wing of Bird** **Wing of Bat**

i) The phenomenon of occurrence of analogous organs is called analogy.
ii) Organs are structurally dissimilar and functionally similar are called analogous organs wings of insects and wings of birds are used for flying but wings of insects are the expansion of exoskeletons where as wings of birds are modification of fore limbs for flying.
iii) Organs which exhibit similar external appearance perform same function but differ in their internal organisation are analogous organs. egowings of insects and wings of birds.
iv) Butterfly wings and bat wings serve the same function of flying and wings in both types of animals are flat but structurally they differ very much. Butterfly wings have chitinous deposition without bones. Bat wings have the typical basic plan of limb bones viz. humerus, radius, ulna, carpals; metacarpals and phalanges.

Q.45. Explain what are 'homologous' organs and what is 'analogy'. Give example of each.
Ans: Refer Q. 43 and 44

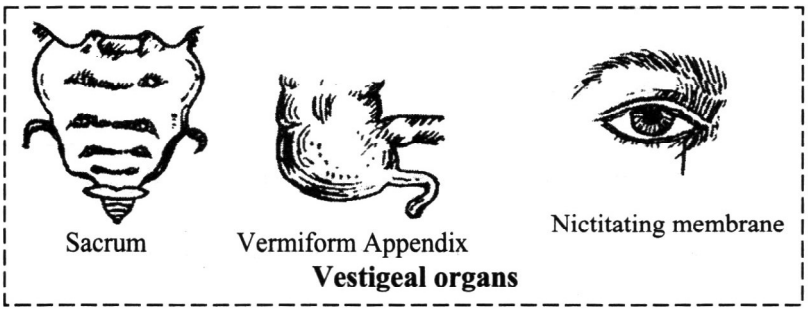
Q.46. Differentiate between homologous and analogous organs and give one example for both from animals and plants.

Ans: Difference between homologous and Analogous Organs:

No.	Homologus organs	Analogous Organs
i)	Homologous organs have common developmental origin.	Analogous organs have different developmental origin.
ii)	They have similar basic structure and may have different functions, e.g., wings of birds and forelimbs of humans, heart of all vertebrates.	They have different structure but similar functions, e.g., wings of birds and wings of insects.
iii)	Homologous organs lead to divergent evolution.	Analogous organs lead to convergent evolution.

Q.47. Explain in briefvestigeal organs to support evolution.

Ans:



Vestigeal organs

i) Vestigeal organs are those, which are present in reduced state in the organism and are functionless. Hence their presence is not required.

ii) However, they continue to exist before they degenerate and disappear in the process of evolution.

iii) They were well developed and functional in the ancestors but became reduced and functionless in the present day organisms due to change in habitat and habit.

iv) The study of vestigeal organs suggests the process of evolution. It explains that present organisms have evolved from ancestor, slowly, gradually and orderly.

v) In man presence of the following organs indicates its use in the past:

a) Caecum and vermiform appendix: It is still seen in man as a functionless organ. It helps in cellulose digestion in herbivorous mammals.

b) Nictitating membrane: It is present in the eyes of humans and is a remnant of the third eyelid.

c) Coccyx or tail vertebrae: It is the remnant of a tail in human.

Q.48. Define developmental biology.

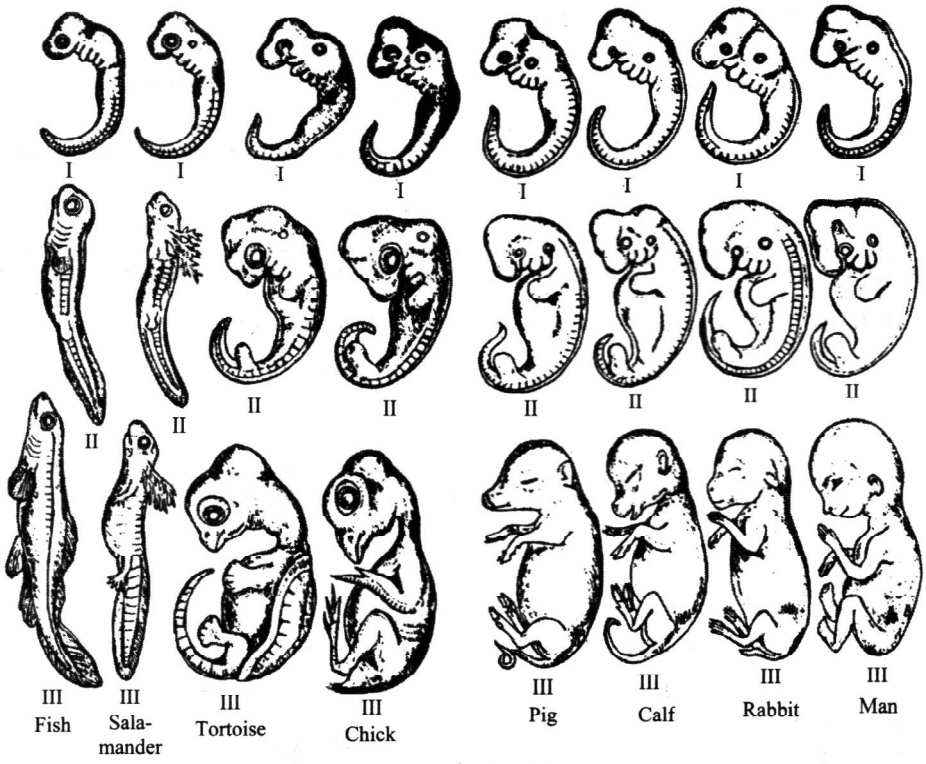
Ans: It is a branch of biology which deals with the development of an organism from the egg stage to adult stage.

Q.49. Give an account of embryological evidences of evolution.

OR

Explain embryological evidences of evolution.

Ans: All living organisms in their early developmental stages show presence of the following distinct features:



Embryology Evidences

i) Development in sexually reproducing organisms begins from a single diploid cell stage i.e. a fertilized egg or zygote.

ii) Zygote undergoes cleavage, blastulation and gastrulation. At the end of gastrulation three germ layers are formed which give rise to various organs and organ systems.

iii) Embryos of different vertebrates i.e. from fishes to mammals look alike particularly with reference to gill slits, gill clefts and tail.
From these similarities it can be concluded that all these groups have evolved from the same ancestral stock.

Q.50. Write a note on molecular evidence.

Ans: i) Cell forms the basic structural and functional unit of life all living organism.

ii) All organisms show presence of endoplasmic reticulum, Golgi bodies, mitochondria as cell organelles.

iii) Similarities in proteins and genes performing a given function among diverse organisms proves common ancestry.

iv) Basic processes like catabolic activities to liberate energy synthesis of macromolecules like protein, carbohydrates and nucleic acids etc. are similar. ATP is the energy currency in all the living organisms.

Q.51. What is geological time scale?

Ans: Geological time scale is the arrangement of major divisions of geological time into eras, periods and epochs on the time scale.

Q.52. Explain the division of timescale.

Ans: i) Geological time scale is divided on the basis of significant events occurred in the organization of organisms.

ii) Major divisions of time scale are called eras.

iii) Eras are divided into periods and periods into epochs.

Q.53. Enlist the era in geological time scale.

Ans: i) Azoic ii) Archeozoic iii) Proterozoic iv) Paleozoic v) Mesozoic vi) Cenozoic

Adaptive radiation

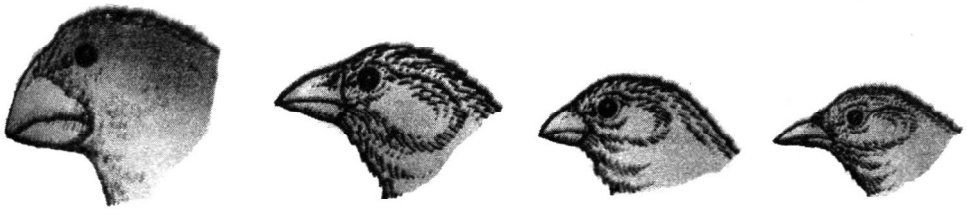
Q.54. Describe one example of adaptive radiation.

Ans: i) The process of evolution which results in transformation of original species to many different varieties is called adaptive radiation

a) Darwin's finches:

Darwin's observed many different varieties of finches in the same island.
All varieties had evolved form original seed eating finches.
Within alteration in beaks some become insectivorous and some vegetarian.

b) Marsupials of Australia:



Variety of beaks of finches that Darwin found in Galapagos Island

In Australia Kangaroo is the most known marsupial mammals.
Within the Australian continent many different marsupials or pouched animals are seen.
These evolved from a common ancestral stock.
A variety of placental mammals have evolved which appear similar to a corresponding marsupial
Adaptive radiation is also called parallel evolution.

Q.55. How do Darwin's finches explain adaptive radiation?

Ans: i) Darwin's finches of different islands showed variations, but yet they closely resembled one another.

ii) These finches radiated to different geographical areas where they had undergone profound adaptive changes, especially in the form of beaks.

iii) Living in isolation for long, new kinds of finches have evolved which could survive better in the new environment or new habitats.

iv) Adaptive radiation is the process of evolution starting from a point (of common ancestor) in a geographical area and literally radiating to other geographical areas (habitats) leading to formation of new species adapted to new habitats and new ways of life.

Q.56. Discuss Adaptive Radiation in mammals.

OR

Describe one example of adaptive radiation.

Ans: The process of evolution which results in transformation of original species to many different varieties is called adaptive radiation.

Adaptive radiation in the ammals:

In Australia kangaroo is the most known marsupial mammals.
Within the Australian continent many different marsupials or pouched animals are seen.
These evolved from a common ancestral stock.
A variety of placental mammals have evolved which appear similar to a corresponding marsupial.
Adaptive radiation is also called parallel evolution.

Q.57. Explain Hardy-Weinberg's principle as binomial expansion.

Ans: i) G.H. Hardy and Weinberg independently developed a method, to relate evolutionary changes and population genetics.

ii) It is known as Hardy-Weinberg equilibrium principle.
The principle states that allele frequencies in a population of sexually reproducing organisms are stable and remain constant (genetic equilibrium) from generation to generation; the sum total of all the allele frequencies is one.

iii) Let us assume that a gene has two alleles A (dominant) and a (recessive) and their frequencies are named p and q respectively.

a) The frequency of AA individuals in a population is p^2, i.e. the probability that an allele A with a frequency of p appear on both the chromosomes of a diploid individual.

b) Similarly, the frequency of aa individuals in a population is q^2.

c) The frequency of Aa individuals is 2 pq. Hence, $p^2 + 2pq + 2q^2 = 1$, which is the binomial expansion of $(p + q)^2$.

iv) When the frequency measured differs from the expected values, the difference indicates the extent

of evolutionary change.

v) Five factors are known to affect Hardy-Weinberg equilibrium; they are:
   a) Gene migration
   b) Genetic drift
   c) Mutation
   d) Genetic recombination and
   e) Natural selection

Q.58. Give the graphical representation of Hardy-Weinberg's principle in the form of Pun net Square. [Oct 2013]

Ans: Graphical representation of Hardy Weinberg's principle in the form of Pun net Square:

		Hybrid	Aa
		A(p)	a(q)
Hybrid Aa	A(P)	AA (p^2)	Aa (pq)
	a(q)	Aa (pq)	aa (q^2)

10.3 : Origin and Evolution of Human Being

Q.59. Who proves that apes are closest relatives of man?

Ans: Thomas Huxley.

Q.60. Write a note on lemurs.

Ans: i) Lemurs are small arboreal animals mainly found in Madagascar.
ii) They have grasping hands and feet, flat snouts, large eyes facing more in front than lateral sides and long bushy tails.

Q.61. Write a note on tarsiers.

Ans: i) Tarsiers are arboreal, nocturnal, insectivorous primates found on islands of East Indies.
ii) Their eyes are large, directed forward and have binocular vision.
iii) The limbs have five digits with adhesive pads and most of the digits ha e nails except the second and third toes of hind limb bear claws.
iv) Their hind limbs are longer with elongated tarsals. From tarsier like ancestor, evolved the earliest anthropoids.

Q.62. Describe the anthropoids.

Ans: Anthropoids or sub-order anthropoidae includes following animals:

i) New world monkeys:
The have flat noses with widely separated nostrils, long prehensile tails and primitive dentition, 36 teeth. They are found in south and Central America. e.g. squirrel monkey, spider monkey etc.

ii) Old world monkeys:
They have narrow noses, short non-prehensile tails and 32 teeth. The old world monkeys are found in tropical regions of Africa and Asia. e.g. baboons, macaques, langurs etc.

iii) Hominoidea (hominoids):
It includes apes and man.
Probably they have evolved simultaneously and from the common ancestors.
Modem apes such as gibbons, orangutans, chimpanzees and gorillas are originated from primitive apes.

Q.63. Write the names of animal which belong to order primates.

Ans: Lemurs,lorises,tarsiers,new world monkeys,old world monkeys,apes and man belong to order primates.

Q.64. Try to trace the various components of human evolution (hint : brain size and function, skeletal structure, dietary perference, etc.).

Ans: During human evolution, ancestral human types had undergone a number of remarkable changes in their brain size (cranial cavity), skeletal features, dietary perference, etc., as shown in the following table:

No.	Human type	Cranial cavity	Skeletal features	Dietary perference
i.	*Australopithecus*	600 cm^3	Prognathous, well developed supra-orbital ridges and chinless.	Primarily fruit-feeder but also hunted with stones.
ii.	*Homo habilis*	650 – 800 cm^3	– do –	Primarily herbivorous.
iii.	*Homo erectus*	870 cm^3 (850 – 1200 cm^3)	– do –	Primarily a meat-eater.
iv.	H. *sapiens neanderthalensis*	1450 cm^3 (1300 – 1600 cm^3)	– do –	Primarily carnivorous.
v.	*H. Sapiens fossilis*	1600 cm^3	Flat forehead, no supraorbital ridges, chin present.	Primarily carnivorous.
vi.	*H. sapiens sapiens*	1450 – 1650 cm^3	– do –	Primarily carnivorous.

Q.65. Arrange the following stages of the human evolution in the order of their increasing cranial capacity. **[Mar. 2013]**

A. eanderthal man
B. Cro - agnon man
C. Homo erectus
D. Homo habilis

Ans: Correct sequence is as follows:
D. Homo habilis (650-800 cc)
C. Homo erectus (850-1200 cc)
A. Neanderthal man (1450 cc)
B. Cro-Magnon man (1600 cc)

Q.66. Find out through internet and popular science articles whether animals other than men have selfconsciousness.

Ans: Yes, the apes, like.the human beings, have well developed facial muscles for showing facial gestures and also have property of selfconsciousness.

Q.67. Can we call human evolution as adaptive radiation?

Ans: Human evolution from Australopithecus (African ape-man) having many ape-like structural characteristics to Homo sapiens sapiens (modem man) having many advanced features cannot be considered as adaptive radiation. It is the case of descent with modification in which more advanced types are evolved from the simpler forms. In human evolution, there appears a parallel evolution of human brain and language.

Q.68. Give the biological name of modern man.

Ans: Homo sapiens sapiens.

Q.69. Give a short account of Australopithecus in relation to modern man.

Ans: Australopithecus africanus is commonly called as African ape man because its fossils were found in Africa in the early 1920s.

It is believed to be more than one million year old. Zoologist believe that the fossils of Australopithecus are the remains of some very primitive form having characteristics of both man family and the ape family and it is difficult to say exactly which group they belonged.

Q.70. Compare the characteristics of Australopithecus to Modern man.

Ans: i) The skull of African ape-man resembled the skull of an ape. Its volume was about that the volume of man's skull, its cranial capacity being about 600 c.c.
ii) Jaws and teeth were like that of man.
iii) Its forehead was also like that of man.
iv) The structure of its pelvic girdle showed that it could walk erect.

The Australopithecus appears to have been animal hunting, flesh eating and shell cracking primate. Zoologist believe that these animals were the ancestors of man or a man with ape brain.

Q.71. State the advantages of erect posture and large brain volume which are beneficial to humans over other primates.

Ans: Erect Posture: The erect posture helped the man in the following ways:

i) Because of this man is able to have bipedal mode of locomotion.
ii) The feet of man form a kind of stable platform which helps him to walk erect and balance properly.
iii) The hands of man are shorter and free to handle work.
iv) The thumbs of man is better developed. The thumb closes in on the other fingers of hand.
v) Man can use his hands more delicately. This type of thumb is called opposable.
vi) Man can handle even small tools and other instruments because of the position of thumbs and fingers with great dextricity.

Large Brain Size: The following are advantages of large brain size.

i) Brain becomes more developed. Its brain ratio is more than the other as compared to body weight.
ii) Large sized brain had greater intelligence, thinking power and correlation of facts and events.
iii) Shifting of information.
iv) Capacity of reasoning developed.
v) Senses become more powerful.
vi) Reflexes become more prominent.
vii) In fact it is the hand and the brain that made the man a super animal.

Q.72. Write note on Java man and Peking man.

Ans: i) Java man :

a) Homo erectus fossils of Java were called Java man.
b) Its fossils were invented by Dubois (1891) and these were named Pithecanthropus erectus.
c) It was connecting link between ape and man. The cranial capacity was 940cc.
d) It used his own made crude stone tools. The chin was absent, bony eyebrow ridge was present.
e) It was more ape like than man like, hence it is also called as Java Ape Man.
f) However, he might have made use of fire.
g) The original species of Pithecanthropus erectus has been named as Homo erectus erectus by Mayer (1950)
h) It Ii ed in the middle pleistocene epoch about 5,00,000 years ago.
i) It as about five feet in height and walked erect.
j) Its face was prognathous and the jaws were massive with huge teeth.
k) However, he might have made use of fire. The original species of Pithecanthropus pekinensis.

ii) Peking man (Homo erectus pekinensis):

a) It has cannabilistic feeding habit and it used fire for protection.
b) The fossils of this prehistoric man were discovered in cave near Peking, China.
c) As they showed similarities with Java man, they were named as Pithecanthropus pekinensis.
d) Mayer (1950) considered it a sub species of Java man and hence it has been named as Homo erectus pekinensis.
e) It lived in the middle Pleistocene epoch about 5,00,000 years ago. It was very similar to java man with heavy bony eye brow ridges, low slanting forehead and chinless face.
f) Their cranial capacity was much larger than Java man ranging from 850 to 1200c.c.

Q.73. Why Australopithecus is considered as connecting link between ape and man?

Ans: Australopithecus can be considered as connecting link between ape and man.

The ape-like characters of Australopithecus:

i) The jaws and teeth are larger than those of modem man.
ii) Face was prognathous and a chin was absent.
iii) The eye-brow ridges projected over the eyes.
iv) Their cranial capacity ranged from 450-600 c.c.
v) They used fire and a variety of tools.

The man-like characters of Australopithecus:

i) It was about four feet in height, walked nearly or completely straight.
ii) The vertebral column had a distinct lumbar curve.
iii) With broad basin like pelvic girdle.
iv) Dentition was man like because the dental arch was smoothly rounded parabola and a simian gap was absent.
v) Hands were used for non-locomotory functions like making tools. They used weapons of bones.

Thus, Australopithecus is rightly described as a man with ape brain.

Q.74. Name the ancestor of human which is described as a man with ape brain.
Ans: Australopithecus is described as a man with ape brain.

Q.75. What are the similarities between apes and man?
OR
Explain the similarities between apes and man.
Ans: Similarities between apes and man are as follows:

i) Absence of tail.
ii) Comparatively larger head.
iii) Broad chest due to flattening of sternum.
iv) Molar teeth with five cusps.
v) Capable of sound production.
vi) Menstrual cycle in females.
vii) Highly developed facial musculature for expressions.
viii) The remarkable similarity in the DNA, haemoglobin, and albumin molecules of chimpanzee, gorilla and man.

Q.76. Differentiate between apes and man.
Ans:

	Apes	Man
i.	They do not walk fully erect.	They walk fully erect.
ii.	Apes has prognathous face and slanting forehead.	Man has orthognathous face and straight forehead.
iii.	Locomotion is quadrupedal.	Locomotion is bipedal.
iv.	The arms are longer than the legs and come below the knees.	The arms are shorter than the legs and do not reach the knees.
v.	Cranial/brain capacity is only about 400 cc.	Cranial capacity is about 1500cc.
vi.	Pelvic girdle is narrow and elongated.	Pelvic girdle is broad and flattened.
vii.	Vertebral column forms a simple curving arch.	Vertebral column has S-shaped curve.
viii.	Neck is short and head burried in heavy shoulder.	Erect neck with distinct head and neck muscles.
ix.	They cannot use spoken or written language for communication.	They can use both spoken and written language for communication.
x.	Foramen magnum in skull is directed backward.	Foramen magnum in skull is directed downward.

Q. 77. Describe in brief the palaeontological evidences of human evolution.
OR
Write notes on :

i. Propliopithecus **ii) Dryopithecus**
iii. Ramapithecus **iv) Homo habilis**
v. Homo erectus **vi) Neanderthal Man**
vii. Cromagnon Man **viii) Modern Man**

Ans: i) Propliopithecus:

a) It was an ape-like primate.
b) It lived in the Oligocene epoch about 30 million years ago.
c) The fossil of first known ape was obtained from Fayum deposits of Egypt.
d) It was represented by the fossil jaw and teeth. No doubt more or less ape- like.
e) Its incisors were vertical rather than directed forward.
f) Simpson (1967) presumed that Propliopithecus might be the ancestor of modem apes and man.

ii) Dryopithecus:

a) It is also called proconsul.
b) The fossil of this ape was discovered by L.S.B. Leakey in 1930 on an island in Lake Victoria of Africa.
c) It is ape, that lived in Miocene epoch about 20 million years ago.

d) It exhibits close similarity to chimpanzee.
e) Its legs heels indicate that it must have assumed a semi-erect posture.

iii) Ramapithecus:

a) It was an ape-man like primate.
b) The teeth and jaw bones of Ramapithecus were found in the rocks of Siwalik Hills in India by G.E.Lewis (1930).
c) It lived during late Miocene and early Pliocene epoch about 14 to 12 million ago.
d) Fossils of similar features were discovered from Kenya in Africa called Kenvapithecus.
e) They walked erect on their hind limbs.
f) On the basis of these features, some scientists believe that Dryopithecus evolved into Ramapithecus which is on direct line of human evolution.

iv) Homo habilis:

a) The fossils of this primitive man were discovered from the Olduvai Gorge, Tanzania (Africa) b Leakey (1964).
b) One of the first known hominids, it was nicknamed 'handy man' Homo habilis evolved in Africa in late Pliocene or early Pleistocene epoch about 2.5 to 1.4 million years ago.
c) It lived in open grassy land, moved erect and was omnivorous.
d) The lower jaw was lightly built and the dentition was more like that of modem man.
e) It had smaller molars and made tools from stones.
f) Its cranial capacity was about 650 to 800 c.c. It was called handy man or tool maker.

v) Homo erectus:

a) Homo erectus was the first true man. This primitive man lived in Java and Peking.
b) The Homo erectus fossils of Java were called Java man.First fossils were obtained from rocks on the bank of solo river in Java by Dubois.
c) Original species of Pithecanthropus erectus has been named as Homo erectus erectus by Mayer.
d) The cranial capacity was about 1300 cc.

vi) eanderthal Man (Homo neanderthalis):

a) Its fossils were invented by J.K. Fuhlort (1856) in Neanderthal valley.Germany,
b) Its cranial capacity was 1450 ml.
c) It lived in caves and so it was called 'Cave man'.
d) It used fire first for cooking food.
e) These were heavily built and short.
f) They had prominent brow ridges, the skull bones were thick, forehead was low and slanting, the jaw were deep than that of modem man with no chin.
g) They were quite intelligent to use and construct flint tools.
h) They buried their dead bodies along with their tools and was supposed to perform ceremonies.
i) Some evidences show that there was ceremonial burrial of dead bodies.

vii) Cromagnon Man (Homo sapiens Jossilis):

a) It is closest ancestor of modem man.
b) It lived in France and Spain and made paintings inside caves and ornaments from ivory.
c) It was an omnivore having the aesthetic sense.
d) The Cro-magnons were about 180 em in height with large skull, rounded forehead, distinct chin, narrow nose, eyebrow ridges thin and broad face.
e) The cranial capacity was about 1600 c.c.
f) They lived in caves with families.
g) They were expert in hunting and painting. They made tools and weapons such as spear-heads, bows and arrows.
h) They made ornaments from ivory and decorated their bodies.
i) They use hides of animals to protect their body and buried their dead according to their customs.

vii) Modern an (Homo sapiens sapiens) :

a) It includes all the human beings existing today on the earth.
b) He has intelligence. Cranial capacity is 1450 cc.
c) He made clothes. He evolved language to communicate.
d) He live a social life. He started with agriculture and domestication of animals.

e) A complex symbolic culture permits modem civilization to direct the course of hominid evolution through the manipulation of environment, the control of reproduction etc.

Q.78. Where was the fossil of Neanderthal man discovered? Mention any four characteristics of Neanderthal man.

Ans: Neanderthal valley in Germany.

Characteristics:

i) The Neanderthal man resembled us, but were relatively short and stocky and more powerfully built.
ii) He used animal hides as clothing.
iii) He built hut-like structures to live in.
iv) He buried their dead.
v) He had a cranial capacity of 1400-1600 cc.

Q.79. Where was the fossil of Cromagnon man found? When did he appear on the earth? Write any four characteristics of Cro-magnon man.

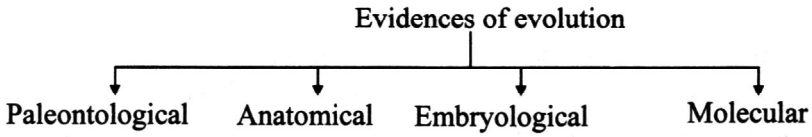
Ans: i) Cro-magnon rocks of France.
ii) 34000 years ago.

Characteristics of Cro- magnon man:

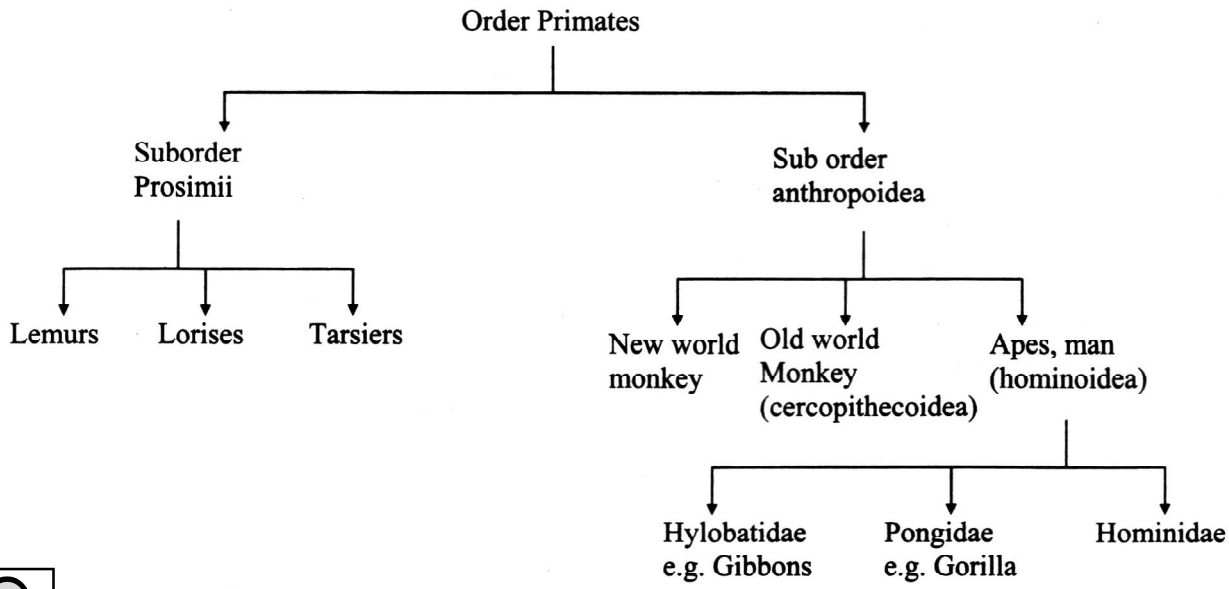
a) He was about 1.8 meter tall, with a well built body.
b) His cranial capacity was about 1650 cc.
c) He had left behind elaborate cave paintings.

Quick Review :

Evidences :



Human Evolution :



Multipal Choice Questions

1. According to scientists, the Big Bang occurred approximately ____ years ago.
   a) 100 million b) 100 thousand
   c) 1 billion d) 15 billion
2. The prebiotic atmosphere of the earth was
   a) aerobic
   b) anaerobic
   c) partially aerobic
   d) without any gas
3. Miller- Urey's experiment mixture had the following except
   a) Methane b) CO_2
   c) Hydrogen d) Water vapour
4. Theory of 'Spontaneous generation' was based on
   a) blind beliefs not subjected to scrutiny
   b) careful experimentation
   c) some observations from normal life
   d) worldwide consensus of natural scientists
5. Which of the following theory states that, the life originated on the earth from non-living matter?
   a) Theory of Chemical evolution
   b) Physical Theory
   c) Mutation theory
   d) Biogenesis
6. Oparin's theory is based on
   a) artificial synthesis
   b) spontaneous generation
   c) will of God
   d) all of these
7. According to the "biochemical origin of life" theory
   a) first life was originated from non-living material
   b) first life came into existence by the combination of chemical compounds by constant chemical reactions over long periods of time
   c) first life was originated in the form of micro organisms
   d) first life was originated in the form of meteorites
8. In Urey and Miller's experiment the ratio of methane: ammonia: hydrogen was
   a) 1 : 2 : 2 b) 2 : 2 : 1
   c) 1 : 2 : 1 d) 1 : 1 : 2
9. Which term did Darwin use to describe the ability of an individual to survrve and reproduce?
   a) Evolution b) Diversity
   c) Adaptation d) Fitness
10. Finches observed by Darwin were
    a) reptiles b) birds
    c) insects d) toads
11. The phenomenon of industrial melanism demonstrates **[Oct. 2013]**
    a) natural selection
    b) induced mutations
    c) reproductive isolation
    d) geographical isolation
12. In industrial melanism survey dark moths were found to
    a) manage to survive on dark bark
    b) manage to survive on light bark
    c) thrived on dark bark
    d) thrived on light bark
13. 'Struggle for existence' is the ultimate result of
    a) prolific reproductive capacity of organisms.
    b) geometric increase of organisms and arithmetic increase of means of subsistence.
    c) disproportionate increase with disadvantage to the animal side.
    d) all of these.
14. The sum total of genes present 10 all individuals of interbreeding or Mendelian population is called
    a) Gene frequency
    b) Gene pool
    c) Gene flow
    d) Gene mutation
15. The struggle between organisms of different species is called
    a) Intraspecific struggle
    b) Interspecific struggle
    c) Environment struggle
    d) Struggle against Natural Calamities
16. A group of individuals with a common gene pool is called
    a) population b) ecosystem
    c) community d) species
17. Genetic drift operates only in
    a) island populations
    b) smaller populations
    c) larger populations
    d) mendelian populations
18. What does adaptive radiation indicate?
    a) Use of radiation for adaptation
    b) Migration from unsuitable to suitable place
    c) Suitable modifications 10 different organisms for different environment
    d) Adaptation to different environments by the animals of same class
19. Natural selection theory of Darwin is objected, because it
    a) stresses upon slow and small variations
    b) stresses upon inter specific struggle
    c) explains naturel calamities with heavy toll
    d) none of these
20. The most common types of fossils are

[Mar. 2014]

a) moulds b) casts
c) actual remains d) models

21. 'Archaeopteryx' is a proof of close, evolutionary relationship between
a) reptiles and aves
b) reptiles and mammals
c) aves and mammals
d) none of these

22. Tail bone is an example of
a) homology b) analogy
c) atavism d) vestigeal organ

23. Which of the following are homologous organs?
a) Wings of butterfly, wings of flying fish and wings of birds
b) Tail of scorpion, tail of bird and tail of monkey
c) Sting of honey bee, sting of scorpion and poison fangs of snakes
d) Paddles of whale, front legs of horse and arms of man

24. Darwin's theory of evolution fails to explain
a) the role of environment
b) the origin and transmission of variations
c) over production
d) survival of the fittest

25. What is best explained in modem synthetic theory of evolution?
a) Genesis of variations
b) Improvement of variations in quantity
c) Improvement of variations in quality through generations
d) All of these

26. After industrialization, with respect to Biston betularia, what was the result regarding its population?
a) Light coloured moth decreased 10 number
b) Black coloured moth increased 10 number
c) Population of black co loured moth remained static and unchanged
d) Light coloured moth increased to number

27. Struggle of all organisms against natural calamities such as earthquake, volcanic eruption is said to be
a) inter-specific struggle
b) intra-specific struggle
c) environmental struggle
d) both (a) and (b)

28. Genetic drift is a change of
a) gene frequency in same generation
b) appearance of recessive genes
c) gene frequency from one generation to another
d) appearance of only dominant genes

29. Geological time scale consists of how many eras?
a) Six b) Five
c) Four d) Three

30. Which human ancestor is chronologically nearest to us?
a) Australopithecus africanus
b) Homo erectus
c) Australopithecus robustus
d) Neanderthal man

31. The correct equence of stages in the evolution of modem man (Homo sapiens), is
a) eanderthal man, Australopithecus, Cro- agnon man, Homo erectus, modem man.
b) Austra lop ithecus , Homo erectus, eanderthal man, Cro-Magnon man, modem man.
c) Homo erectus, Australopithecus, eanderthal man, Cro-Magnon man, modem man.
d) Australop ithecus , Neanderthal man, Cro-Magnon man, Homo erectus, modem man.

32. The apes differ from humans in having
a) semi erect posture
b) arms longer than legs
c) smaller size of brain
d) all of these

33. Scientific name of human is
a) Homo humanis
b) Homo neanderthalensis
c) Homo sapiens sapiens
d) Piltdown man

34. Which of the following fossil of man had strong musculature, highest cranial capacity and used burial customs as well as started domestication?
a) Neanderthal man
b) Java man
c) Peking man
d) Cro-Magnon

35. Recently, an almost complete lower jaw of a Dryopithecus has been obtained from
a) Fayum deposits of Egypt
b) Cave near Peking in China
c) eanderthal valley in Germany
d) Haritalyanga in Bilaspur district of Himachal Pradesh

36. The cranial capacity of Neanderthal man was about
a) 600 c.c. b) 940 c.c.
c) 1450 c.c. d) 1600 c.c.

37. Australopithecus was considered connecting link between
a) Lemurs and Tarsiers
b) Tarsiers and Monkeys
c) Monkeys and Apes
d) Apes and man

38. The cranial capacity of Cro-magnon man was about
a) 800 c.c. b) 900 c.c.
c) 1450 c.c d) 1600 c.c.

39. Dryopithecus lived about 20 million years ago in
a) Miocene epoch
b) Oligocene epoch
c) Palaeocene epoch
d) Pleistocene epoch

40. Which of the following primitive man was nicknamed as handy man?
a) Homo habilis
b) Homo soloensis
c) Homo erectus
d) Homo heidelbergensis

Answer Keys

1. d)	**2.** b)	**3.** b)	**4.** c)	**5.** a)	**6.** a)	**7.** b)	**8.** a)	**9.** d)	**10.** b)
11. a)	**12.** c)	**13.** d)	**14.** b)	**15.** b)	**16.** a)	**17.** b)	**18.** c)	**19.** a)	**20.** c)
21. a)	**22.** d)	**23.** d)	**24.** b)	**25.** d)	**26.** b)	**27.** c)	**28.** c)	**29.** a)	**30.** d)
31. b)	**32.** d)	**33.** c)	**34.** d)	**35.** d)	**36.** c)	**37.** d)	**38.** d)	**39.** a)	**40.** a)