

For BioResire students



NEET Biology Material

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EVOLUTION

Origin of Life:

- The origin of life is considered unique events in the history of universe. Huge cluster of galaxies comprises the universe. Galaxies contain stars and clouds of dust and smoke.
- Big Bang Theory attempts to explain the origin of universe. According to this theory, a huge explosion occurs that forms the different galaxies.
- In solar system of Milky Way galaxies, earth has been supposed to be formed about 4.5 billion years ago. There was no atmosphere in early earth. Water vapour, methane, carbon dioxide and ammonia released from molten mass covered the earth surface.
- UV rays from sun splits the water into hydrogen and oxygen. Life appeared 500 million years after the formation of earth.

There are different theories regarding the origin of life on earth:

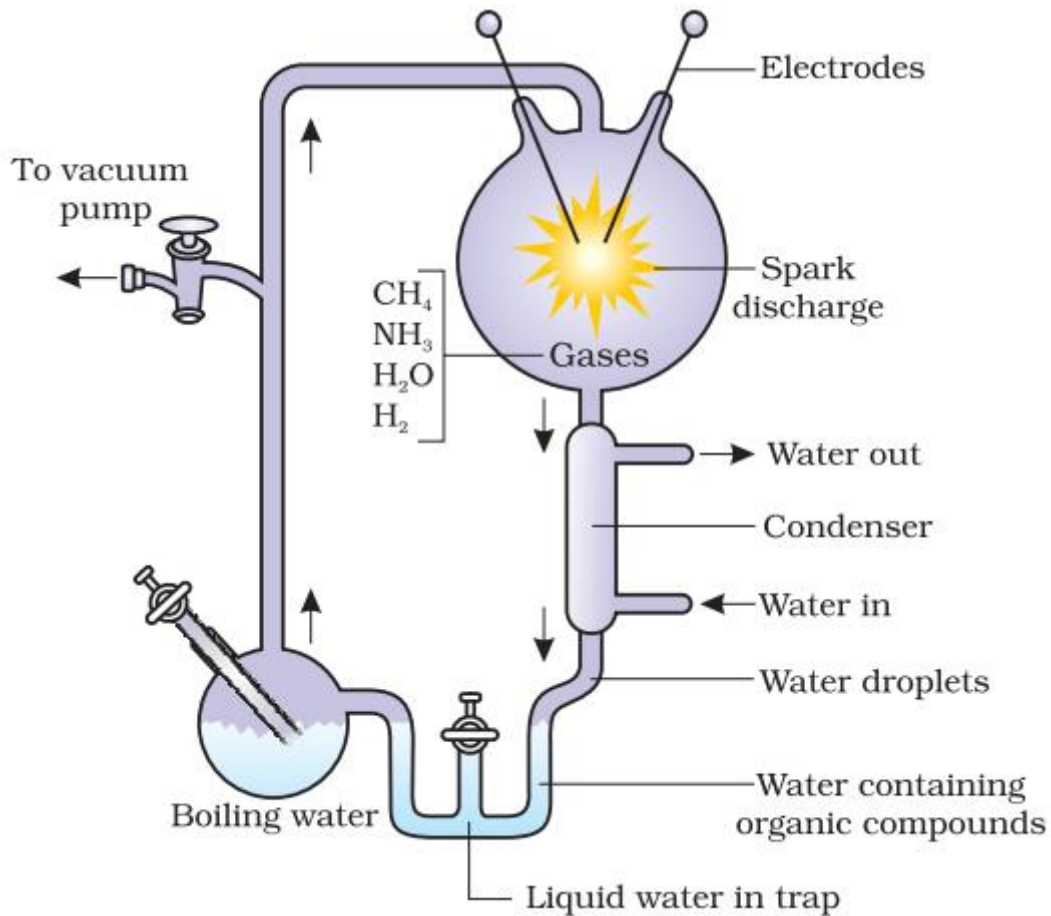
- Some scientist believes that life comes from other planets. Early Greek thinker thoughts that unit of life is called spores transferred from other planets.
- According to other theory, life comes out of dead and decaying matters like straw and mud. This theory is called theory of spontaneous origin.
- Louis Pasteur experimentally proved that life arises only from pre-existing life. Spontaneous theory of origin of life is dismissed after that.
- Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules like RNA and protein etc. The formation of life preceded by chemical evolution. At that time condition on earth were- high temperature, volcanic eruption, reducing atmosphere containing CH_4 and NH_3 .

Experimental representation of Miller's experiment:

- Miller experiment of Origin of Life- S.L. Miller in 1953, conducted an experiment to show the origin of life on earth in the physical environment similar to condition prevails at that time.
- Miller created similar condition of temperature and pressure in laboratory scale. He created electric discharge in a flask containing CH_4 , H_2 and NH_3 and water vapour at 8000°C .
- He observed formation of amino acids in flask after 15 days of electric discharge. Similar experiment by other scientist found formation of sugars, nitrogen bases, pigments and fats.
- Analysis of meteorite content also reveals similar compounds that reveal that similar process are occurring elsewhere in the space. This experimental evidence about the origin of life is called chemical evolution of life.
- The first non-cellular forms of life could have originated 3 billion years back.

They could have been giant molecules like RNA, Protein, and Polysaccharide etc.

- The cellular form of life was probably single cell and originates in water medium. The theory that first form of life arose slowly through evolutionary forces from non-living molecules is called biogenesis.



Darwin Theory & Natural Selection:

Charles Darwin concluded that existing living forms share similarities to varying degrees not only among themselves but also with life forms that existed millions of years ago. Many such life forms do not exist anymore. There has been gradual evolution of life forms. according to Darwin, refers ultimately and only to reproductive fitness. those who are better fit in an environment, leave more progeny than others. will survive more and hence are selected by nature. He called it natural selection Alfred Wallace, a naturalist who worked in Malay Archeipelago had also come to similar conclusions around the same time. All the existing life forms share similarities and share common ancestors. The geological history of earth closely correlates with the biological history of earth.

Evidence of Evolution:

Evidence that evolution of life forms has taken place on earth have many proofs as mentioned below:

Paleontological evidence:

Paleontological evidence different aged rock sediments contain fossils of different

life forms that probably died during the formation of particular sediment. Fossils are remains of hard parts of life-forms found in rocks. The study showed that different form varied over time and certain life forms are restricted geological time span. Hence, new forms of life have arisen at different times in history of earth.

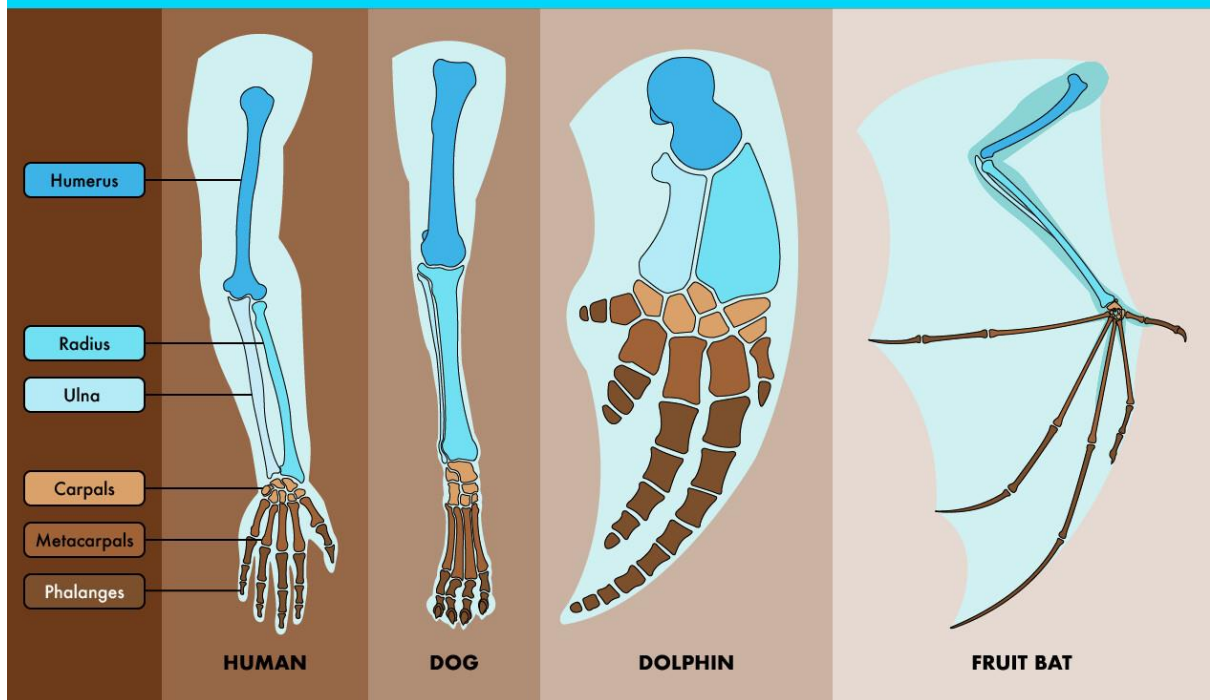


Homologous organs: Homologous organs those organs that perform different function but have similar origin and structure are called homologous organs. For e.g. human, cheetah, bat and whales share similarities in pattern of bones of forelimbs although these forelimbs perform different functions in these animals. In these animal similar structure developed along different directions due to adaptation of different needs. This is called divergent evolution.

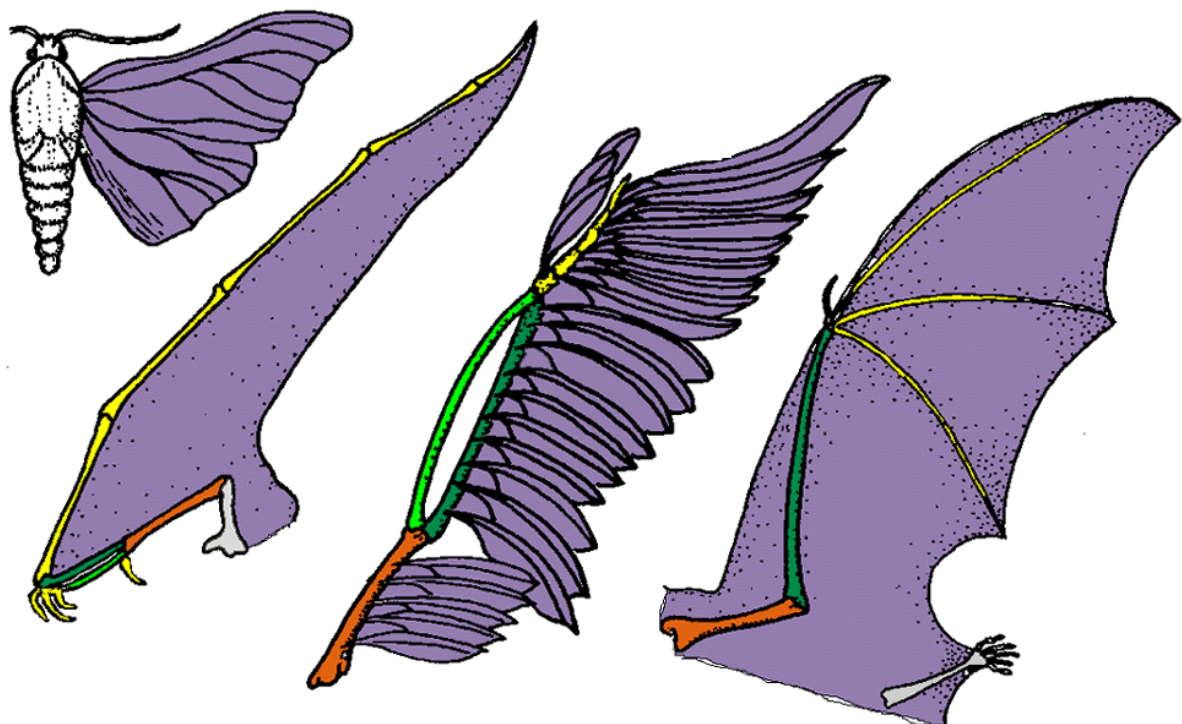
Homologous structures: Homologous structures are organs or skeletal elements of animals and organisms that, by virtue of their similarity, suggest their connection to a common ancestor. These structures do not have to look exactly the same, or have the same function. The most important part, as hinted by their name, is that they are structurally similar.

HOMOLOGOUS STRUCTURES

Homologous structure: similar organs shared among organisms of different taxa that suggest a common ancestor



Analogous Structures: Bird, Insect and Bat Wings. Unlike creatures with homologous structures, where organisms' shared traits can determine a Fish and Penguin Fins/Flippers. Fish and penguins are both vertebrates that use fins to swim in deep waters. However, Duck and Platypus Bills. The duck-billed platypus, which is a mammal, seems like a perplexing example of evolution.



Biochemical evidences:

Similarities in proteins and genes performing a given function among diverse

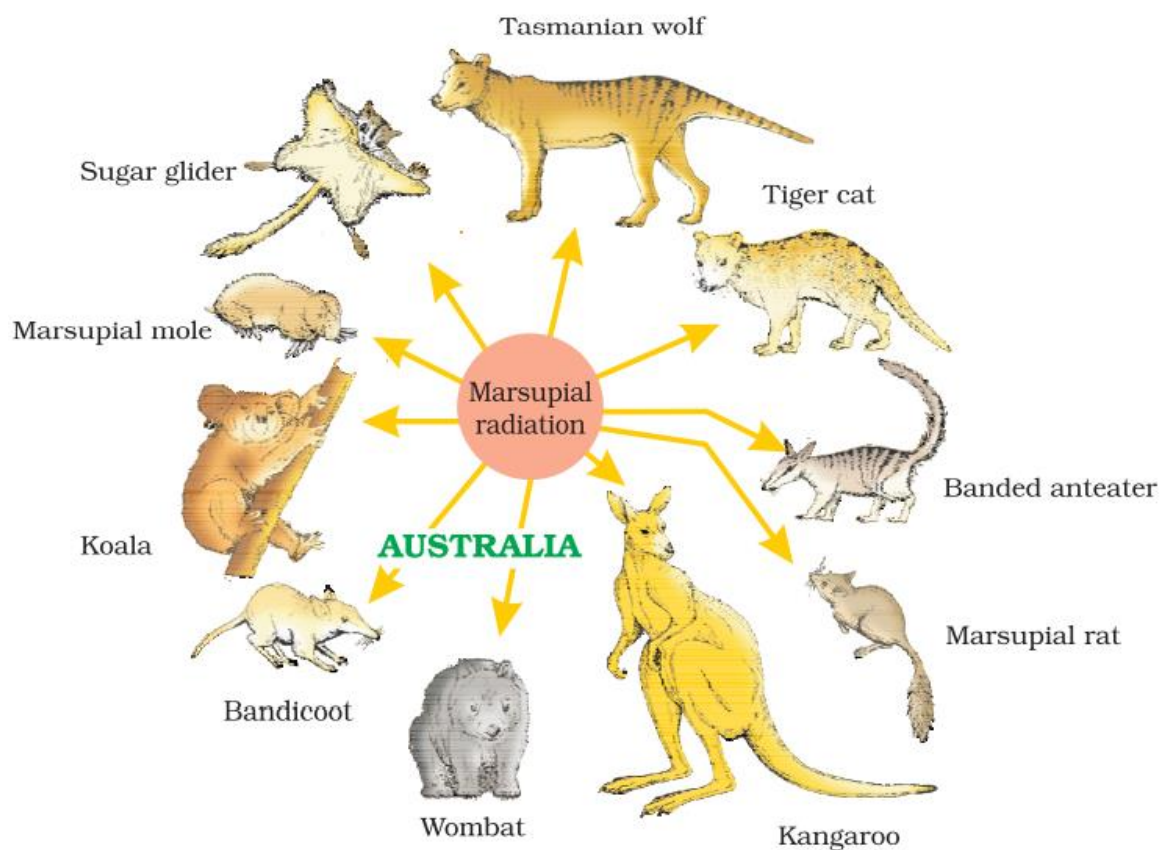
organisms give hints to common ancestry. These biochemical similarities point to the same shared ancestry as structural similarities among diverse organisms.

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.

Adaptive Radiation:

The process of evolution of different species in given geographical area starting from a point and radiating to other areas of geography (habitat) is called adaptive radiation. Darwin's finches represent one of the best examples of adaptive radiation. Australian marsupials, each with different from other evolved from one ancestral stock, but all within Australian island continents.



Adaptive radiation of marsupials of

When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), we can call this convergent evolution e.g. Placental mammals and Australian marsupials.

Biological Evolution:

The nature select for fittest and fitness is based on characteristics which are inherited. Some organisms are better adapted to survive in otherwise hostile environment. Fitness is the end result of the ability to adapt and get selected by nature.

Lamarck had said that evolution of life form had occurred but driven by use and disuse of organs. He gave the example of giraffe to evolve their neck by foraging leaves on tall trees and had to adapt by elongation of their necks.

Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution.

Darwin theory of natural selection was based on certain observations like:

- Limited natural resources.
- Over population
- Competition for resources
- Struggle for existence
- Survival of the fittest.

Mechanism of Evolution:

Hugo DeVries based on his work on evening primrose brought forth the idea of mutation. Mutation is the large difference arising suddenly in a population.

Mutations are random and directionless while Darwin variations are small and directional. Hugo DeVries believed that mutation causes speciation and hence called saltation (single step large mutation).

Hardy Weinberg Principle:

Hardy Weinberg Principle in a given population, frequency of occurrence of alleles or genes can be finding out. These frequencies remains fixed and even remain the same through generation. This fact was represented by Hardy-Weinberg principles using algebraic equation.

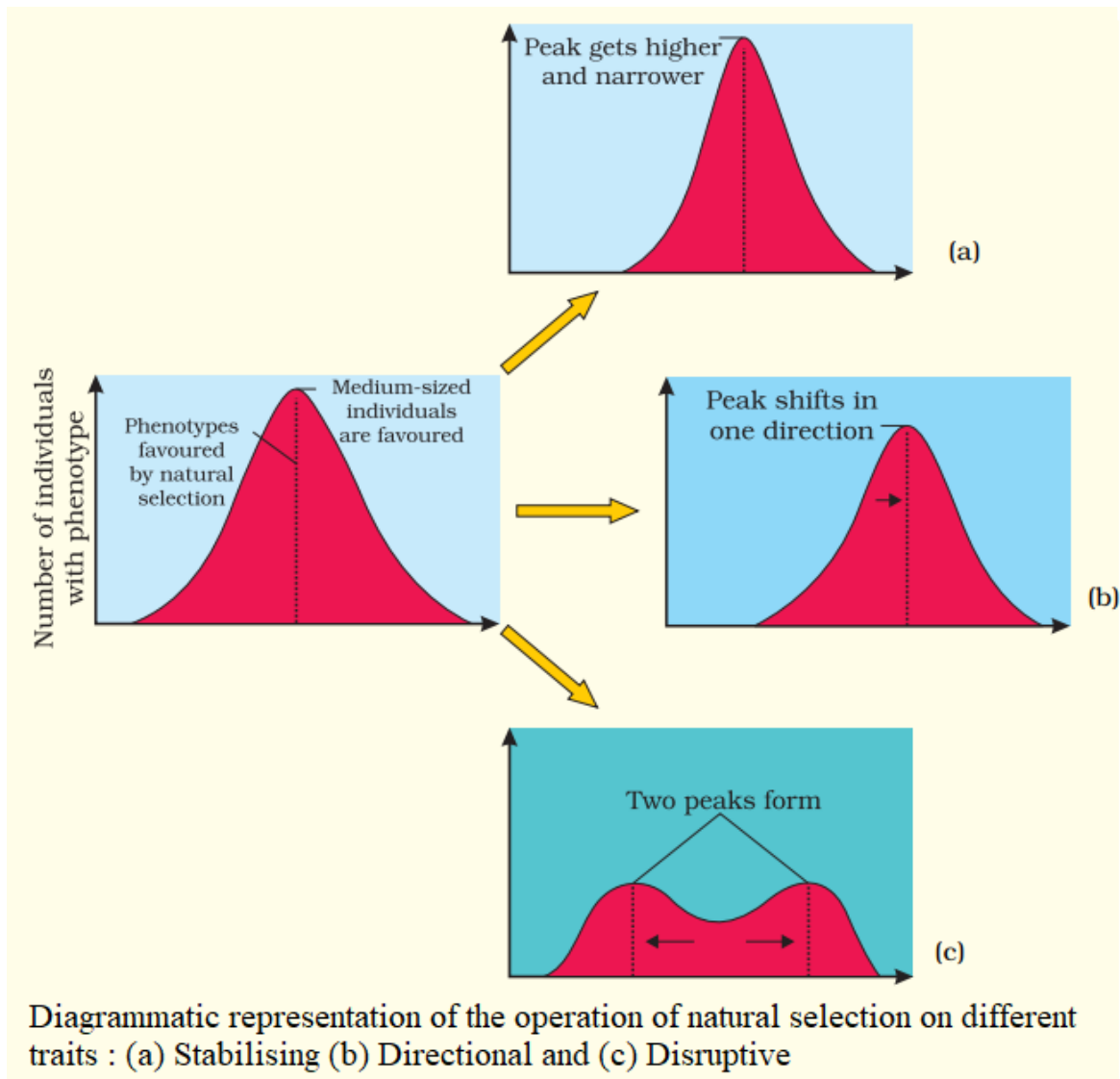
This principle states that allele frequencies in a population are stable and is constant from generation to generation. The gene pool remains constant. This is called genetic equilibrium and sum total of all the allelic frequencies is 1.

Binomial expansion of $(p + q)^2 = p^2 + 2pq + q^2 = 1$ where p and q represent the frequency of allele A and allele a in a population. 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, $p^2 + 2pq + q^2 = 1$.

When frequency is measured, the actual value varies that indicates the extent of evolutionary changes. Change of frequency in a allele (Hardy-Weinberg equilibrium) in a population resulted due to evolution.

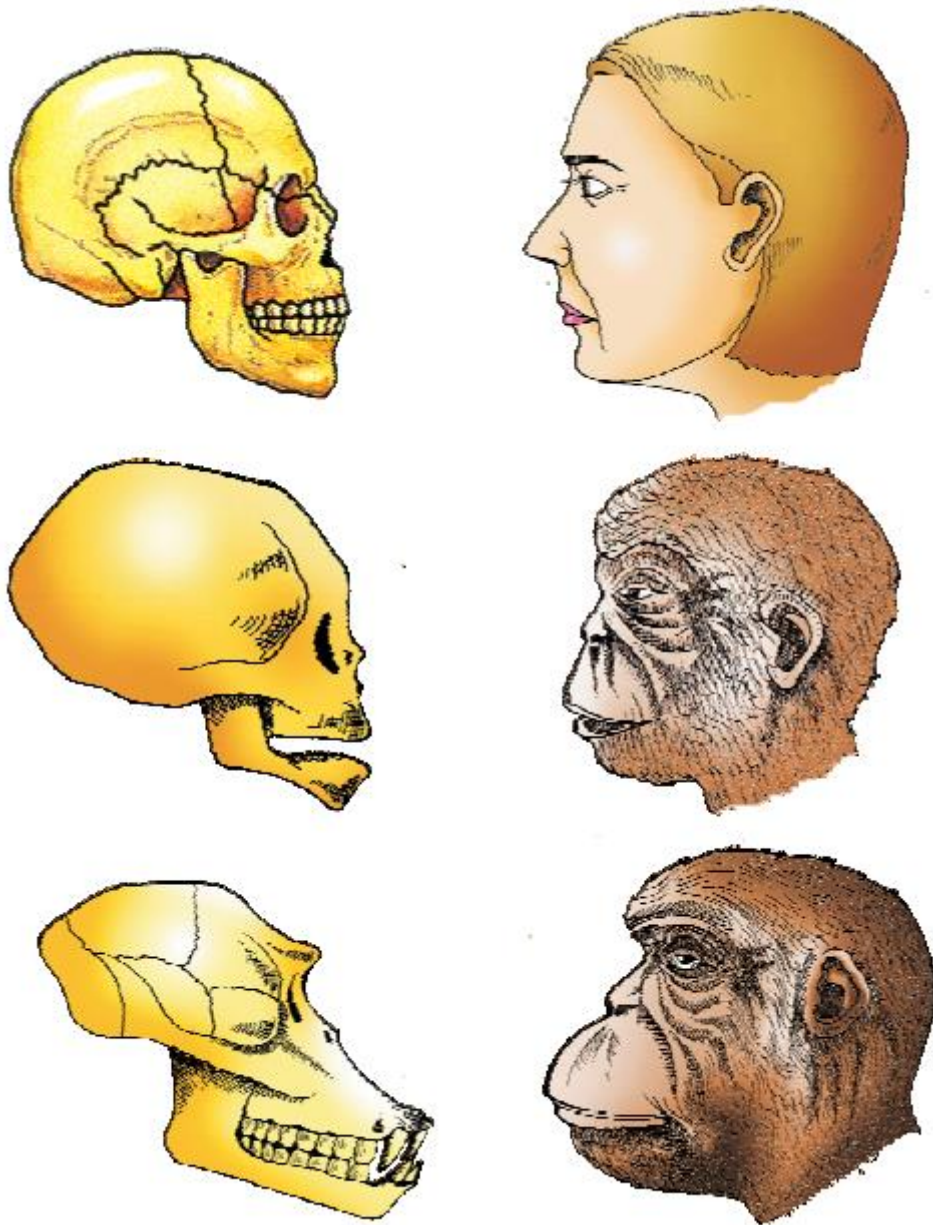
The factors that affect Hardy-Weinberg equilibrium are:

- Gene migration or gene flow.
- Genetic drift
- Mutation
- Genetic recombination
- Natural selection.
- During genetic drift, sometimes change in alleles frequency is so different in a sample of population that they become a different species. The original drifted population becomes founder and that effect is called founder effect.



Origin and evolution of man:

About 15 mya, primates called Dryopithecus and Ramapithecus were existing. Hairy walk like gorillas Ramapithecus was more man-like while Dryopithecus was more ape-like. about 3-4 mya, man-like primates walked in eastern Africa taller than 4 feet walked right Australopithecines probably lived in East African ate fruit. This creature was called the first human-like brain capacities 650-800cc. Homo erectus large brain around 900cc ate meat. Homo sapiens brain size of 1400cc.



NCERT LINE BY LINE QUESTIONS

PARA 7.1 AND 7.2

ORIGIN OF LIFE AND EVOLUTION OF LIFE FORMS

1. The study of the history of life forms of the earth is called [Pg 126,E]

- A) Evolutionary Biology
- B) Ecology
- C) Environmental biology
- D) Comparative anatomy

2. Match Column-I with Column-II. [Pg 127,E]

Column-I

- (a) Origin of the universe
- (b) Origin of earth
- (c) Origin of life
- (d) Origin of first eukaryotes

Column-II

- (1) 4.5 billion years ago
- (2) 4 billion years ago
- (3) 2.7 billion years ago
- (4) 20 billion years ago

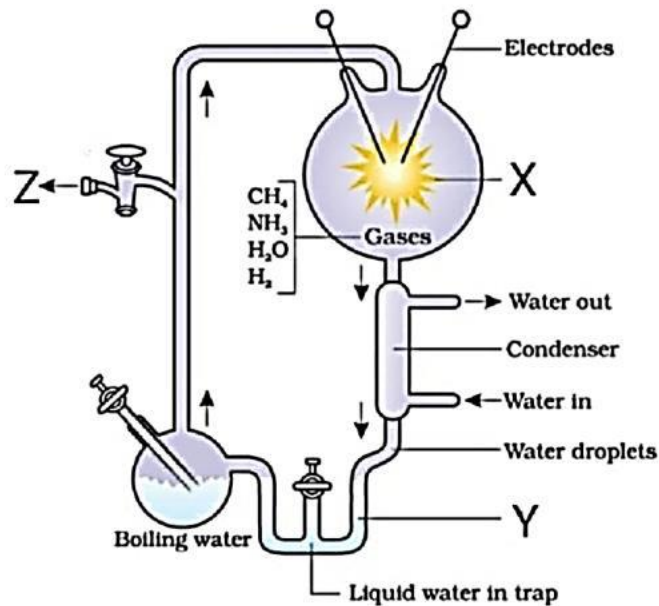
Select the correct option.

- a b c d

- A) 1 4 2 3
 B) 4 1 2 3
 C) 4 2 1 3
 D) 4 1 3 2
3. Select the correct statement among the following. **[Pg 127,E]**
 A) The universe is very old – almost 20000 million years old.
 B) Huge clusters of galaxies comprise the universe. Galaxies contain stars and clouds of gas and dust.
 C) The Big Bang theory attempts to explain to us the origin of universe.
 D) All of these.
4. Select the correct statement about the Big Bang theory. **[Pg 127,E]**
 A) It talks of a many huge explosions unimaginable in physical terms.
 B) The universe expanded and hence, the temperature increased. Hydrogen and Helium formed sometime later.
 C) The gases condensed under gravitation and formed the galaxies of the present day universe.
 D) In the solar system of the Milky Way galaxy, earth was supposed to have been formed about 4.5 million years back.
5. Select the correct statement about early Earth 4.5 billion year ago. **[Pg 127,M]**
 A) There was a thick atmosphere on early Earth.
 B) Water vapour, hydrogen, carbondioxide and ammonia released from molten mass covered the surface.
 C) The UV rays from the sun brokeup water into Hydrogen and Oxygen and the lighter O₂ escaped. Oxygen combined with ammonia and methane to form water, CO₂ and others.
 D) The ozone layer was formed. As it cooled, the water vapor fell as rain, to fill all the depressions and form oceans.
6. When did life appear on earth? **[Pg 127,E]**
 A) 500 billion years after the formation of Earth
 B) Almost four billion years back.
 C) Both A and B
 D) Almost three billion years back
7. Select the correct statement among the following. **[Pg 127,M]**
 A) Some scientists believe that life came from outside.
 B) Early Greek thinkers thought units of life called spores were transferred to different planets including earth.
 C) ‘Panspermia’ is still a favourite idea for some astronomers.
 D) All of these
8. For a long time it was also believed that life came out of decaying and rotting matter like straw, mud, etc. This was the theory of _____. **[Pg 127,E]**
 A) Biogenesis
 B) Spontaneous generation
 C) Non-Spontaneous generation
 D) Both A and B
9. Select the incorrect statement among the following. **[Pg 127,M]**
 A) Louis Pasteur by careful experimentation demonstrated that life comes only from pre-existing life.
 B) Louis Pasteur showed that in presterilised flasks, life did not come from killed yeast while in another flask open to air, new living organisms arose from ‘killed yeast’.
 C) Spontaneous generation theory was dismissed by Louis Pasteur.
 D) Louis Pasteur answered how the first life form came on earth.
10. How many statements are incorrect among the following? **[Pg 127,M]**
 i. Oparin of England and Haldane of Russia proposed that the first form of life could have come from pre-existing non-living organic molecules (e.g.RNA, protein, etc.) and that formation of life was preceded by chemical evolution
 ii. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere containing CH₄, O₂ , etc.
 iii. In 1952, S.L. Miller, an American scientist created similar conditions in a laboratory scale

- iv. S.L. Miller created electric discharge in a closed flask containing CH₄, H₂, NH₃ and water vapour at 8000C.
- v. With limited evidence, the first part of the conjectured story, i.e., chemical evolution was more or less accepted.
- A) 2 B) 3 C) 4 D) 5
11. In S.L. Miller's electric discharge experiment, he observed formation of _____. [Pg 127,E]
A) Amino sugar B) Glucosamine C) Amino acid D) Proteins
12. In experiments similar to S.L. Miller's discharge experiment others observed, formation of how many of the following substances. [Pg 127,E]
Sugars, Nitrogen gas, Pigment, Fats, Nitrogen bases, Amino sugar
A) 3 B) 4 C) 5 D) 6
13. Select the incorrect statement among the following. [Pg 127,128,M]
A) We have no idea about how the first self replicating metabolic capsule of life arose.
B) The first non-cellular forms of life could have originated 3 billion years back. They would have been giant molecules (RNA, Protein, Polysaccharides, etc.). These capsules reproduced their molecules perhaps.
C) The first cellular form of life did not possibly originate till about 2 million years ago. These were probably single-cells.
D) All life forms were in water environment only. This version of biogenesis, i.e., the first form of life arose slowly through evolutionary forces from non-living molecules is accepted by majority.
14. Chemical evolution refers to- [Pg 128,E]
A) Formation of diverse inorganic molecules from organic constituents
B) Formation of diverse organic molecules from radioactive constituents
C) Formation of diverse organic molecules from inorganic constituents
D) Formation of diverse non-reducing molecules from inorganic constituents
15. Conventional religious literature tells us about the theory of – [Pg 128,E]
A) Religious Creation
B) Abiogenetic creation
C) Spontaneous creation
D) Special creation
16. Special creation theory has three connotations. Select the correct connotation among the following. [Pg 128,E]
A) All living organisms (species or types) that we see today were created as such.
B) The diversity was always the same since creation and will be the same in future also.
C) Earth is about 40000 years old
D) Both (A) and (B)
17. Select the correct statement among the following. [Pg 128,M]
A) All the ideas of Special creation theory were strongly challenged during the eighteenth century.
B) Based on observations made during a sea voyage in a sail ship called H.M.S. Beagle round the world, Charles Darwin concluded that existing living forms share similarities to varying degrees not only among themselves but also with life forms that existed millions of years ago. Many such life forms do exist anymore.
C) There had been extinctions of different life forms in the years gone by just as new forms of life arose at same periods of history of earth.
D) Any population has built in variation in characteristics.
18. How many statements among the following are incorrect? [Pg 129,M]
i. Those characteristics which enable some to survive better in natural conditions (climate, food, physical factors, etc.) would outbreed others that are less-endowed to survive under such natural conditions.
ii. The fitness, according to Darwin, refers ultimately and only to reproductive fitness.
iii. Those who are better fit in an environment leave more progeny than others. These, therefore, will survive more and hence are selected by nature. Darwin called it natural selection and implied it as a mechanism of evolution.
iv. Alfred Wallace, a physicist worked in Malay Archipelago.
v. The geological history of earth closely correlates with the physical history of earth.

19. The history of Earth can be studied in terms of- [Pg 129,E]
 A) Epochs B) Periods C) Eras D) All of these
20. Select the correct option about the given figure. [Pg 128,E]

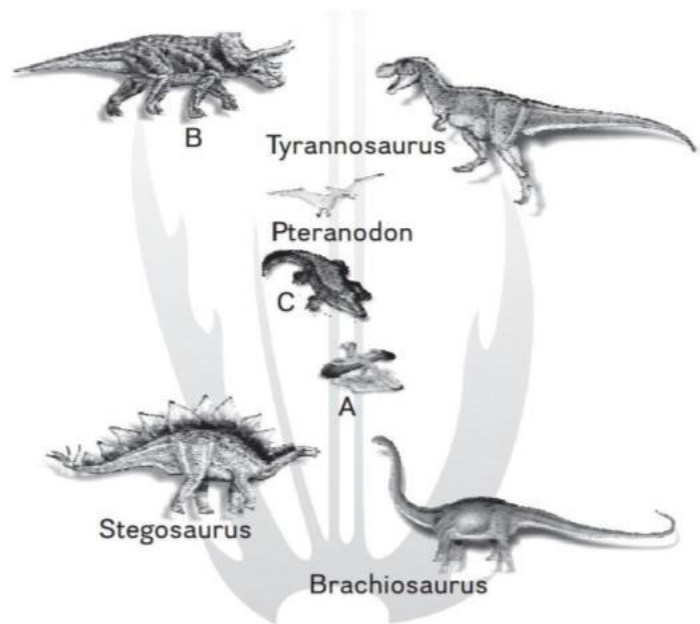


- A) The given figure represents diagrammatic representation of Miller's Experiment.
 B) X- Vacuum pump
 C) Y – Water containing inorganic compounds
 D) Z – Spark discharge

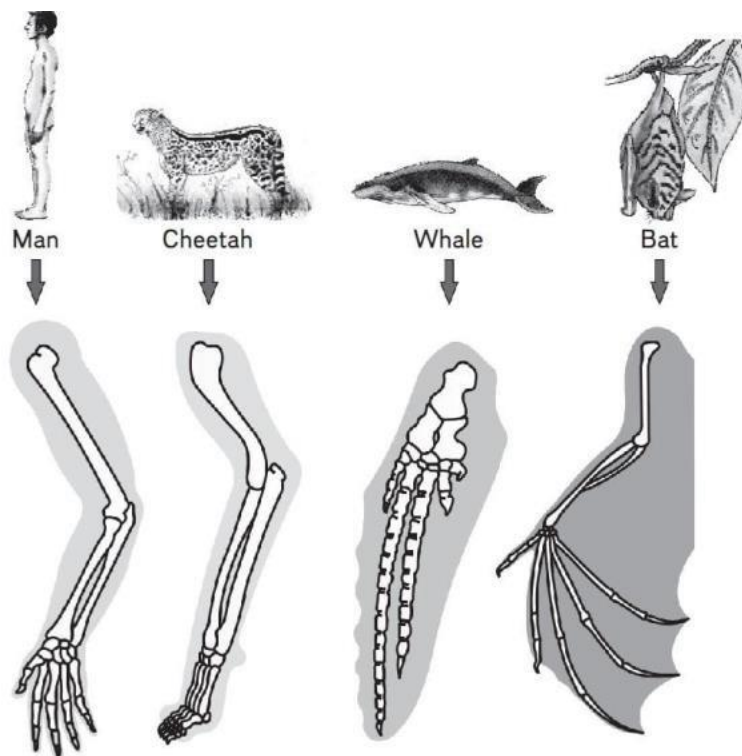
PARAGRAPH- 7.3

THE EVIDENCES FOR EVOLUTION

21. Fossils are _____ [Pg 129,E]
 A) The preserved remains of the past life forms.
 B) Mineralized form of hard body parts such as bones, teeth, etc.
 C) Found mainly in the layers of sedimentary rocks.
 D) all of these
22. Consider the following statements about fossils: [Pg 129,M]
 (a) Rock sediments of different ages contain fossils of life forms that died during the formation of that particular layer of sediment.
 (b) Fossil records are based on the sequence of occurrence of fossils in various strata of sedimentary rocks.
 Select the correct option.
 A) Both (a) and (b) are true. B) (a) is true but (b) is false.
 C) Both (a) and (b) are false. D) (a) is false but (b) is true.
23. Which of the following represents the paleontological evidence of evolution? [Pg 129,M]
 A) Preserved remains of Dinosaurs obtained from sedimentary rocks.
 B) Presence of homologous structures.
 C) Presence of analogous structures.
 D) Presence of vestigial parts.
24. Fossils serve as one of the evidence of evolution because [Pg 129,M]
 (a) Fossil records show that various groups of organisms dominated earth during the different course of evolution.
 (b) Many organisms are extinct today.
 (c) Certain groups of organisms are restricted to a certain geological time period.
 Select the option with all correct statements.
 A) Only a B) Only b C) Both b and c D) a, b and c
25. Given below is the family tree of dinosaurs and their living present day counterpart organisms. Which of the given options correctly name A, B and C? [Pg 130,E]



- A) A: Triceratops; B: Archaeopteryx; C: Crocodilian
 B) A: Triceratops; B: Crocodilian; C: Archaeopteryx
 C) A: Archaeopteryx; B: Triceratops; C: Crocodilian
 D) A: Archaeopteryx; B: Crocodilian; C: Triceratops
26. Embryological support for evolution was proposed by _____ based upon the observation of certain features during embryonic stage common to all vertebrates that are absent in adult. [Pg 129,E]
 A) Ernst Mayr B) JBS Haldane C) Ernst Haeckel D) Charles Lyell
27. Sweet potato is a ___(I)___ modification whereas potato is a ___(II)___ modification. [Pg 131,E]
 A) (I)- Stem B) (II)- Root C) Both A and B D) None of these
28. Which of the given statement is incorrect about radiometric dating? [Pg 131,M]
 A) A method to determine the absolute age of the fossils.
 B) It is based on the process of decay of radioactive isotopes.
 C) A method to determine the relative age of the fossils.
 D) Organisms accumulate isotopes of substances during their lifetime.
29. Consider the following statements: [Pg 129,130,H]
 (a) Comparative anatomical and morphological details of different but related organisms demonstrate a basic similarity.
 (b) The same structures in different organisms are derived from a common ancestor.
 Choose the correct option.
 A) Both (a) and (b) are true.
 B) (a) is true but (b) is false.
 C) Both (a) and (b) are false.
 D) (a) is false but (b) is true.
30. The similar structures with different functions present in different species because of their common ancestry is known as _____. [Pg 130,E]
 A) Analogous structures
 B) Homologous structures
 C) Vestigial organs
 D) Homoplasy
31. Presence of homologous structures in different but related organisms is the result of _____. [Pg 130,E]
 A) Common ancestry
 B) Divergent evolution
 C) Convergent evolution
 D) Both A and B
32. The image shows the forelimbs of a whale, bat, cheetah and human (all mammals). Choose the correct option regarding the same. [Pg 131,E]



- A) The basic similarities in the arrangement of bones in forelimbs of whales, bats, cheetahs and humans reflect their common ancestry.
 B) The forelimbs of whales, bats, cheetahs and humans are analogous structures.
 C) The image represents structures that evolved from convergent evolution.
 D) The image represents vestigial structures.
33. Which of the following structures represent homology? [Pg 131,H]
 A) Wings of butterflies and birds
 B) Eyes of octopus and mammals
 C) Thorns and tendrils of Bougainvillea and Cucurbita
 D) Flippers of penguins and dolphins
34. Which of the following structures is homologous to the wing of a bird? [Pg 131,M]
 A) Wing of a moth
 B) Hind limb of the rabbit
 C) Flipper of the whale
 D) The dorsal fin of a shark
35. Independent evolution of structures with similar functions but different anatomy in distantly related organisms is known as _____. [Pg 131,E]
 A) Convergent evolution B) Divergent evolution
 C) Homology D) Mutation
36. The process of _____ evolution develops similar features in organisms with separate ancestries. [Pg 131,E]
 A) Divergent B) Convergent C) Homology D) Speciation
37. Analogous structures are a result of _____. [Pg 131,M]
 A) stabilizing selection B) divergent evolution
 C) convergent evolution D) shared ancestry
38. Match Column-I with Column-II. [Pg 130,131,M]
Column-I **Column-II**
 (a) Cactus spine and pea tendril (1) Analogous structures
 (b) Wings of insects and birds (2) Vestigial structures
 (c) Hind limb bones of whales (3) Natural selection

(d) Darwin's finches

(4) Homologous structures

Select the correct option.

- | | a | b | c | d |
|----|----------|----------|----------|----------|
| A) | 1 | 4 | 2 | 3 |
| B) | 4 | 1 | 2 | 3 |
| C) | 4 | 2 | 1 | 3 |
| D) | 4 | 1 | 3 | 2 |

39. The wings of a bird and the wings of an insect are [Pg 131,M]
A) homologous structures and represent divergent evolution
B) phylogenetic structures and represent divergent evolution
C) analogous structures and represent convergent evolution
D) homologous structures and represent convergent evolution
40. Which of the following examples does not represent analogous organs? [Pg 131,M]
A) Eyes of octopus and mammals.
B) Sweet potato and potatoes.
C) The spine of barberry and thorns of hawthorn.
D) Eyes of cave-dwelling animals.
41. Match Column-I with Column-II. [Pg 131,132,M]

Column-I

- (a) Common proteins and genes present in diverse organisms
(b) Vertebrates heart or brain
(c) Animal husbandry and plant breeding
(d) Industrial melanism

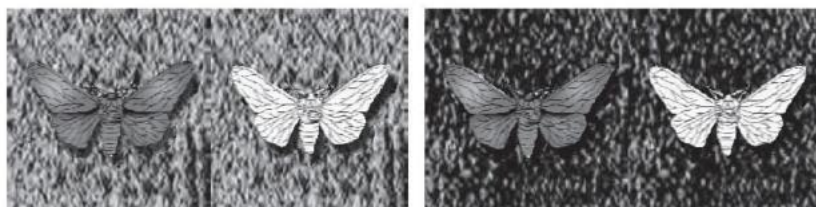
Column-II

- (1) Artificial selection
(2) Anatomical evidence of evolution
(3) Natural selection
(4) Biochemical evidence of evolution

Select the correct option.

- | | a | b | c | d |
|----|----------|----------|----------|----------|
| A) | 1 | 4 | 2 | 3 |
| B) | 4 | 1 | 2 | 3 |
| C) | 4 | 2 | 1 | 3 |
| D) | 4 | 1 | 3 | 2 |

42. Select the incorrect match from the following options. [Pg 131,M]
A) Tendrils and passionflower and thorns of pomegranate – homologous organs.
B) Tendrils of Vitis and thorns of Carissa – homologous organs.
C) Tendrils of balloon vine and bulbils of Agave – homologous organs.
D) Scale leaves of onion and spines of Opuntia – analogous organs.
43. Industrial melanism is an example of [Pg 132,E]
A) Neo Darwinism
B) Natural selection
C) Mutation
D) Neo Lamarckism
44. The given image shows white-winged and dark-winged moths. [Pg-132,M]



I

II

- (a) Image I represents the survival advantage of white winged moths in unpolluted areas.
(b) Image II represents the survival advantage of dark winged moths in polluted areas.

Select the correct option.

- A) Both (a) and (b) are true.
B) (a) is true but (b) is false.
C) Both (a) and (b) are false.
D) (a) is false but (b) is true.

45. Which of the following serves as an indicator of atmospheric pollution? [Pg-132,E]
 A) Lichens B) Rhizopus C) Penicillin D) Lycopodium
46. Match Column-I with Column-II. [Pg-30,M]

Column-I

- A) Herbicide resistant varieties
 B) Brachiosaurus
 C) Stegosaurus
 D) Pteranodon

Column-II

- (1) A herbivore sauropod
 (2) Bony plates on the back
 (3) A flying reptile
 (4) Evolution by anthropogenic action

Select the correct option.

- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 1 | 4 | 2 | 3 | |
| B) 4 | 1 | 2 | 3 | |
| C) 4 | 2 | 1 | 3 | |
| D) 4 | 1 | 3 | 2 | |

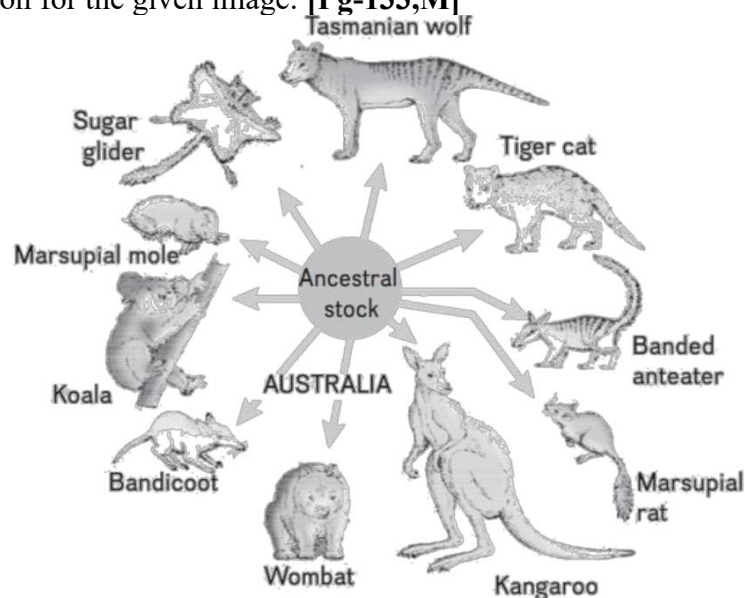
47. **Assertion:** Archaeopteryx is a dead connecting link between reptiles and birds.
Reason: Archaeopteryx is the earliest known bird. [Pg-130,H]
 A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
 C) Assertion is true, but Reason is false.
 D) Assertion is false, but Reason is true.
48. **Assertion:** Evolution is not a directed process in the sense of determinism.
Reason: Evolution is based on chance events that occur in nature. [Pg-132,H]
 A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
 C) Assertion is true, but Reason is false.
 D) Assertion is false, but Reason is true.
49. Select the correct order of extinction of following dinosaurs? [Pg-130,E]
 I. Stegosaurus II. Brachiosaurus
 III. Pteranodon IV. Triceratops V. Tyrannosaurus
 A) II, I, III, V, IV B) II, I, V, IV, III
 C) III, V, IV, II, I D) None of these

PARAGRAPH-7.4

ADAPTIVE RADIATION

50. The mechanism of adaptive radiation was first explained by [Pg-132,E]
 A) Darwin B) Morgan C) Lamarck D) Hugo de Vries
51. Consider the following statements. [Pg-132,133,M]
 (a) Darwin compared the animals and plant species of Galapagos Islands with those of mainland of South America.
 (b) He found observable and distinct similarities and differences among them.
 (c) Flora and fauna of the Galapagos Islands do not exhibit resemblances to that of the South American mainland.
 Select the correct option.
 A) Both (a) and (b) are true. B) (a) is true but (b and c) are false.
 C) Both (a) and (b) are false. D) All are false.
52. Lamarck was a _____. [Pg-134,E]
 A) French zoologist B) German botanist C) French naturalist D) British botanist
53. Diversification of single ancestral species into many species in a relatively short period of time is called [Pg-133,E]
 A) Artificial selection B) Adaptive radiation
 C) Homology D) Natural selection
54. Adaptive radiation occurs when [Pg-133,E]
 A) lineages of an ancestral species encounter an empty niche.
 B) populations of a species exhibit random mating.

- C) gene flow between the populations of a species continues.
 D) adaptive radiation does not occur in nature.
55. Darwin's finches are an example of [Pg-133,E]
 A) adaptive radiation
 B) microevolution
 C) genetic drift
 D) gene flow
56. Evolution of different species in a given area starting from a point and spreading to other geographical areas is known as [Pg-133,E]
 A) Adaptive radiation
 B) Natural selection option
 C) Migration option
 D) Divergent evolution
57. Consider the following statements: [Pg-133,H]
 (a) Adaptive radiation occurs when numerous unexploited ecological opportunities are available.
 (b) Islands have a large number of empty ecological niche as compared to the mainland present in the same geographical location.
 Choose the correct answer.
 A) Both (a) and (b) are true.
 B) (a) is true but (b and c) are false.
 C) Both (a) and (b) are false.
 D) All are false.
58. _____ and _____ are the two key concepts of Darwinian theory of Evolution. [Pg-134,E]
 A) Branching descent
 B) Natural Selection
 C) Both A and B
 D) None of these
59. The evolution of multiple species by the process of adaptive radiation cannot occur [Pg- 133,E]
 A) on remote islands
 B) in Darwin's finches
 C) in Australian marsupials
 D) in a habitat with a large number of existing species
60. Select the incorrect statement among the following. [Pg-134,135,M]
 A) Lamarck said that evolution of life forms had occurred but driven by use and disuse of organs.
 B) Lamarck gave the examples of Giraffes who in an attempt to forage leaves on tall trees had to adapt by elongation of their necks.
 C) Giraffes passed on this acquired character of elongated neck to succeeding generations, Giraffes, slowly, over the years, came to acquire long necks.
 D) Everybody believes Lamarck's conjecture today.
61. Which of the following statements does not reflect adaptive radiation in marsupials? [Pg-134,135,M]
 A) Australia was geographically isolated from the rest of the world during the continental drift.
 B) The geographical isolation of Australia prevented the immigration of placental mammals to the continent.
 C) Marsupials were the dominant mammals on the land of the Australian continent.
 D) Geographical isolation of Australia followed the migration of placental mammals to the continent.
62. Select the correct option for the given image: [Pg-133,M]



- A) Convergent evolution in Australian marsupials
 B) Gene flow
 C) Adaptive radiation in Australian marsupials
 D) Both a and c are correct

63. A population of a species invades a new area. Which of the following condition will lead to adaptive radiation? **[Pg-133,H]**
 A) Area with many habitats occupied by a large number of species.
 B) Area with large number of habitats having very low food supply.
 C) Area with a single type of vacant habitat
 D) Area with many types of vacant habitats.
64. When more than one (i) appeared to have occurred in an isolated geographical area (representing different habitats), one can call this (ii). **[Pg-133,134,M]**
 Select the correct option regarding the given statement.
 A) (i) Adaptive radiation; (ii) Divergent evolution
 B) (i) Adaptive radiation; (ii) Convergent evolution
 C) (i) Convergent evolution; (ii) Adaptive radiation
 D) (i) Divergent evolution; (ii) Adaptive radiation
65. Australian marsupials correspond to the placental mammals present in North America because **[Pg-133,M]**
 A) gene flow occurred between Australian marsupials and North American placental mammals.
 B) adaptive radiation in Australian marsupials paralleled the evolution of placental mammals in North America.
 C) some North American placental mammal served as founder population for Australian marsupials.
 D) some Australian marsupials served as founder population for North American placental mammals.
66. Match the placental mammals given in Column-I to their corresponding Australian marsupials given in Column-II. **[Pg-134,M]**

Column-I

- (a) Mole
 (b) Anteater
 (c) Mouse
 (d) Lemur

Column-II

- (1) Marsupial mole
 (2) Marsupial mouse
 (3) Spotted cuscus
 (4) Numbat

Select the correct option.

- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 1 | 4 | 2 | 3 | |
| B) 4 | 1 | 2 | 3 | |
| C) 4 | 2 | 1 | 3 | |
| D) 4 | 1 | 3 | 2 | |

67. Match the placental mammals given in column-I to their corresponding Australian marsupials given in column-II. **[Pg-134,M]**

Column-I

- (a) Flying squirrel
 (b) Bobcat
 (c) Wolf
 (d) Rabbit

Column-II

- (1) Tasmanian tiger cat
 (2) Tasmanian wolf
 (3) Long-eared bandicoot
 (4) Flying phalanger

Select the correct option.

- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 1 | 4 | 2 | 3 | |
| B) 4 | 1 | 2 | 3 | |
| C) 4 | 2 | 1 | 3 | |
| D) 4 | 1 | 3 | 2 | |

PARAGRAPH-7.5 AND 7.6

BIOLOGICAL EVOLUTION AND MECHANISM OF EVOLUTION

68. According to Darwin, the driving force of evolution is **[Pg-134,E]**
 A) mutation B) natural selection C) gene flow D) migration
69. Evolution by natural selection requires **[Pg-134,E]**
 A) presence of acquired variations among the individuals
 B) presence of genetic variations among the individuals
 C) isolated habitat

- D) constant environmental conditions
70. Consider the following statements:
 (a) Evolution by natural selection started with the origin of cellular life forms with differences in metabolic capability.
 (b) The theory of natural selection was given by Lamarck.
 Select the correct option. [Pg-134,M]
 A) Both (A) and (B) are true.
 B) (A) is true but (B) is false.
 C) Both (A) and (B) is false.
 D) (A) is false but (B) is true.
71. The rate of evolution of new species in fishes is slower than that of in bacterial populations because [Pg-134,M]
 A) the evolution of new species is linked to their lifespan.
 B) evolution of new species is linked to the habitat.
 C) both fishes and bacteria exhibit the same rate of evolution.
 D) species do not evolve at all.
72. Evolution of antibiotic-resistant bacterial population represents the fact that [Pg-134,E]
 A) acquired traits are inherited.
 B) nature selects for fitness.
 C) genetic variations are not a prerequisite factor for natural selection.
 D) the theory of spontaneous generation of life holds true.
73. Fitness refers to [Pg-134,E]
 A) the ability of some organisms to survive under hostile conditions due to the presence of adaptive genetic features.
 B) the ability of an organism to survive hostile conditions due to acquired features with no genetic basis.
 C) the ability of organisms to migrate.
 D) both a and b are true.
74. _____ is the end result of the ability to adapt and get selected by nature. [Pg-134,E]
 A) Mutation B) Fitness C) Adaptation D) Acclimatization
75. Which of the following options correctly represent the two key features of Darwin's theory of evolution? [Pg-134,E]
 A) Mutation and natural selection.
 B) Artificial and natural selection.
 C) Branching descent and natural selection.
 D) Branching descent and mutation.
76. Saltation is referred as- [Pg-135,E]
 A) Single step small mutation
 B) Multiple step small mutation
 C) Single step large mutation
 D) None of these
77. Match Column-I with Column-II. [Pg-134,135,M]

Column-I	Column-II
(a) Branching descent	(1) Unity and diversity of life
(b) Natural selection	(2) Source of new genes
(c) Mutation	(3) Lamarck
(d) Inheritance of acquired features	(4) Tendency of organisms to become adapted to the environment

 Select the correct option.

a	b	c	d
A) 4	1	3	2
B) 1	4	2	3
C) 4	1	2	3
D) 4	2	1	3
78. The first scientist to propose that evolution is a natural process rather than a divine intervention was [Pg-135,E]

- A) Darwin B) Lamarck C) Pasteur D) Hugo de Vries
79. Select the correct option regarding Lamarck's principles of evolution [Pg-134,135,E]
 A) Use and disuse; inheritance of acquired characters.
 B) Natural selection; fitness.
 C) Mutation; inheritance of acquired characters.
 D) Inheritance of acquired characters; gene flow.
80. Evolution of long and muscular neck of present day giraffe occurred as giraffes stretched their necks higher to reach the higher canopy of tall trees. The given statement represents the view of about evolution. [Pg-135,E]
 A) Darwin B) Lamarck C) Louis Pasteur D) Cuvier
81. Match Column-I with Column-II. [Pg-134,135,M]
- | Column-I | | | | Column-II | | | |
|--|--|--|--|-----------------------|--|--|--|
| (a) Innate drive to become complex | | | | (1) Use and disuse | | | |
| (b) An Essay on the Principle of Population | | | | (2) Thomas Malthus | | | |
| (c) Evolution of longnecked giraffe population | | | | (3) Natural selection | | | |
| (d) Industrial melanism | | | | (4) Lamarck | | | |
- Select the correct option.
- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 4 | 1 | 3 | 2 | |
| B) 4 | 1 | 2 | 3 | |
| C) 1 | 4 | 2 | 3 | |
| D) 4 | 2 | 1 | 3 | |
82. Natural selection is based on certain observations which are factual. Such observations are- [Pg-134,M]
 A) Natural resources are limited.
 B) Populations are stable in size except for seasonal fluctuation.
 C) Members of a population vary in characteristics (infact no two individuals are alike) even though they look superficially similar, most of variations are inherited.
 D) All of these
83. Match the aspects of Darwin's theory of natural selection in Column-I with the correct description in Column-II. [Pg-134,M]
- | Column-I | | Column-II | |
|---------------------------------------|--|---|--|
| (a) Variation | | (1) Competition for limited available resources | |
| (b) Overproduction | | (2) Increases the survival | |
| (c) Struggle for existence | | (3) More offspring | |
| (d) Differential reproductive success | | (4) Geometric increase in population size | |
- Select the correct option.
- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 2 | 4 | 1 | 3 | |
| B) 4 | 1 | 3 | 2 | |
| C) 4 | 1 | 2 | 3 | |
| D) 4 | 2 | 1 | 3 | |
84. Hugo Devries explained mutations as a source of genetic variations while working on [Pg-135,E]
 A) evening primrose
 B) garden pea
 C) finches
 D) fruit fly
85. Variations caused by mutation, as proposed by Hugo de Vries, are [Pg-135,E]
 A) random and directional
 B) random and directionless
 C) small and directional
 D) small and directionless
86. According to Hugo Devries and Darwin, the driving factor for evolution is _____ and _____ respectively. [Pg-135,M]
 A) minor variations, mutation

- B) natural selection, mutation
 C) mutation, minor variations
 D) mutation, acquired variations
87. Mutations are random and directionless while Darwinian variations are [**Pg-135,M**]
 A) small and directional
 B) large and directional
 C) small and directionless
 D) large and directionless
88. Consider the following statements [**Pg-135,H**]
 (a) For Darwin, evolution was gradual and driven by small genetic variations.
 (b) For de Vries, evolution was a single step process driven by large mutation.
 Select the correct option.
 A) Both (a) and (b) are true.
 B) (a) is true but (b) is false.
 C) Both (a) and (b) are false.
 D) (a) is false but (b) is true.
89. The mutation is directionless as [**Pg-135,H**]
 A) it can change any DNA sequence and is always beneficial for the individual.
 B) it can change any DNA sequence and may be beneficial or harmful for the individual.
 C) mutation imparts small variations.
 D) mutation imparts large variations.
90. Which of the following statements is incorrect? [**Pg-133-135,M**]
 A) No variant is completely wiped out in the case of dark-winged and white winged moths in England.
 B) The essence of Darwinian theory about evolution is natural selection.
 C) Microbes that divide fast have the ability to multiply and become millions of individuals within hours.
 D) When we say that fitness of B is better than that of A under the new conditions, it means that A is better adapted than B under new conditions.
91. According to Hugo de Vries, large differences among the individuals evolve by _____ without any intermediate forms. [**Pg-135,E**]
 A) gradual and small changes
 B) natural selection
 C) saltation
 D) gene flow
92. Assertion: Evolution refers to modification in the lines of descent.
 Reason: Natural selection is the equal survival success of individuals of a population. [**Pg-134,H**]
 A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
 C) Assertion is true, but Reason is false.
 D) Assertion is false, but Reason is true.
93. Assertion: Darwin's theory of evolution was based on the inheritance of adaptive genetic variations.
 Reason: He could not recognize the mechanism of inheritance. [**Pg-133,134,H**]
 A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
 C) Assertion is true, but Reason is false.
 D) Assertion is false, but Reason is true.

PARAGRAPH-7.7

HARDY-WEINBERG PRINCIPLE

94. Select the incorrect statement among the following. [**Pg-136,M**]
 A) $p^2 + 2pq + q^2 = 1$. This is binomial expansion of $(p + q)^2$.
 B) When frequency measured, differs from expected values, the difference (direction) indicates the extent of evolutionary change.
 C) Hardy-Weinberg principle says that phenotype frequencies in a population are stable and is constant from generation to generation.
 D) 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.

95. How many of the following factors are known to affect Hardy-Weinberg equilibrium? **[Pg-137,M]**
Gene migration, gene flow, genetic drift, mutation, genetic recombination, natural selection
A) 4 B) 5 C) 6 D) 3
96. Total genes and their alleles in a population make **[Pg-137,E]**
A) gene pool B) genotype C) phenotype D) mutation
97. Consider the following statements: **[Pg-136,M]**
(a) Allele frequencies are supposed to remain constant over generations.
(b) Hardy Weinberg equation is the algebraic representation of the allele frequencies of a population.
Select the correct option.
A) Both (a) and (b) are true.
B) (a) is true but (b) is false.
C) Both (a) and (b) are false.
D) (a) is false but (b) is true.
98. Genetic equilibrium represents that **[Pg-136,M]**
A) the population is not evolving for the locus under study.
B) the allele frequencies and genotype frequencies remain constant over generations.
C) the allele frequencies remain constant over generations but genotype frequencies change.
D) both (A) and (B) are correct.
99. The sum total of all allele frequencies for a particular locus is always _____ **[Pg-136,E]**
A) 0 B) 1 C) more than 1 D) cannot be determined
100. The frequency of an allele in a population ranges from **[Pg-136,E]**
A) 0 to 1 B) more than 1 C) less than 0 D) can be any number
101. Select the incorrect match: **[Pg-137,E]**
A) Frequency of a dominant allele in the population – p.
B) Frequency of a recessive allele in the population – q.
C) Frequency of heterozygous dominant genotype – 2pq.
D) Frequency of homozygous dominant genotype – q^2 .
102. In the Hardy-Weinberg equation, the frequency of heterozygous individual is represented by **[Pg-137,E]**
A) p^2 B) $2pq$ C) pq D) q^2
103. The binomial expansion of $(p + q)^2$ is **[Pg-137,E]**
A) $p^2 + 2pq + q^2 = 1$ B) $p^2 + q^2 = 1$ C) $p^2 + 2pq = 1$ D) $p + q = 1$
104. Differences between expected and observed allele frequencies in a population represent that **[Pg-137,M]**
A) the population is at hardy-Weinberg equilibrium.
B) the population is evolving.
C) the population is deviating from hardy-Weinberg equilibrium.
D) both (B) and (C) are correct.
105. A gene locus has two alleles A, a. If the frequency of dominant allele A is 0.4, then what will be the frequency of homozygous dominant, heterozygous and homozygous recessive individuals in the population? **[Pg-137,H]**
A) 0.36(AA); 0.48(Aa); 0.16(aa)
B) 0.16(AA); 0.24(Aa); 0.36(aa)
C) 0.16(AA); 0.48(Aa); 0.36(aa)
D) 0.16(AA); 0.36(Aa); 0.48(aa)
106. In a population at Hardy-Weinberg equilibrium, the frequency of homozygous dominant genotype is 0.36. What are the frequencies of dominant and recessive alleles for the locus? **[Pg-137,H]**
A) $p = 0.4$; $q = 0.6$ B) $p = 0.6$; $q = 0.4$ C) $p = 0.36$; $q = 0.4$ D) $p = 0.4$; $q = 0.36$
107. A population will not exist in Hardy-Weinberg equilibrium if **[Pg-137,M]**
A) there is no migration
B) the population is large
C) individuals mate selectively
D) there are no mutations
108. Consider the following statements: **[Pg-137,M]**
(a) Gene flow, genetic drift, mutation, natural selection and genetic recombination deviate the population from the Hardy-Weinberg equilibrium.

(b) Small population size is required to maintain constant allele frequencies over generations.

Select the correct option.

- A) Both (a) and (b) are true.
- B) (A) is true but (B) is false.
- C) Both (A) and (B) are false.
- D) (A) is false but (B) is true.

109. Select the correctly matched option. [Pg-137,M]

- A) Gene flow: Changes in allele frequencies by a chance event.
- B) Mutation: Migration of individuals of the population.
- C) Random mating: Equal chances of each individual in a population to mate with any other individual.
- D) Natural selection: Selection of mate on the basis of morphological features.

110. Addition or removal of alleles from the gene pool of a population due to migration of individuals is known as [Pg-137,E]

- A) genetic drift B) gene flow C) natural selection D) artificial selection

111. Genetic drift operates in [Pg-137,E]

- A) a small isolated population B) large isolated population
- C) non-reproductive population D) slow reproductive population

112. Match the terms in Column-I with the correct description in Column-II. [Pg-137,M]

Column-I

- (a) Genetic drift
- (b) Founder effect
- (c) Bottleneck effect

Column-II

- (1) Genetic drift due to small colonizing population
- (2) Change in allele frequency by a chance event
- (3) A major factor to introduce variations in sexually reproducing populations
- (4) Adverse environmental factors

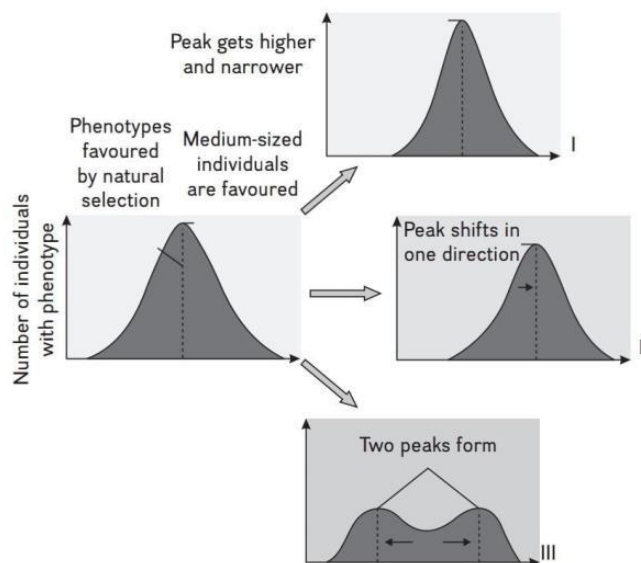
(d) Genetic combination
Select the correct option.

- | | a | b | c | d |
|------|----------|----------|----------|----------|
| A) 1 | 4 | 2 | 3 | 3 |
| B) 2 | 1 | 4 | 3 | 3 |
| C) 3 | 2 | 4 | 1 | 1 |
| D) 4 | 1 | 3 | 2 | 2 |

113. A small number of finches from the mainland were blown by a cyclone to a new island. The resultant new population of finches had distinct gene pool from the source population. It represents the [Pg-137,E]

- A) gene flow B) mutation C) founder effect D) selective mating

114. Name the types of natural selection as depicted in images I, II and III. Select the correct option. [Pg-137,E]



- | | | |
|-------------------|-----------------|-----------------|
| A) I-Stabilizing; | II-Disruptive; | III-Directional |
| B) I-Stabilizing; | II-Directional; | III-Disruptive |
| C) I-Directional; | II-Stabilizing; | III-Disruptive |

- D) I-Disruptive; II-Stabilizing; III-Directional
115. In a species, the weight of the newborn ranges from 2 to 5 kg. 97% of newborns with an average weight between 3 to 3.3 kg survive whereas 99% of the infants born with weight from 2 to 2.5 kg or 4.5 to 5 kg die. Which type of selection process is taking place? **[Pg-137,M]**
- A) Directional selection
B) Stabilizing selection
C) Disruptive solution
D) Cyclical Solution
116. Name the type of natural selection that tends to reduce the genetic variations in the population without affecting the mean. **[Pg-137,M]**
- A) Disruptive selection
B) Directional selection
C) Stabilizing selection
D) Both a and b are correct
117. The black-bellied finches with large beak sizes are able to feed on the most abundant food types in the habitat while the finches intermediate and small beak size die at a young age due to starvation. This represents: **[Pg-137,H]**
- A) Disruptive selection
B) Directional selection
C) Stabilizing selection
D) Sexual selection
118. Natural selection in which more individuals acquire mean character value is known as _____ while the one wherein more individuals acquire peripheral character value at both ends of the distribution curve is _____. **[Pg-137,M]**
- A) stabilizing selection; disruptive selection
B) disruptive selection; stabilizing selection
C) disruptive selection; directional selection
D) stabilizing selection; directional selection
119. Which of the given statement is incorrect? **[Pg-137,M]**
- A) The peak of the distribution curve gets higher and narrower by stabilizing selection.
B) Directional selection shifts the peak of the distribution curve in one direction.
C) Disruptive selection does not affect the peak of the distribution curve.
D) Stabilizing selection does not affect the mean of the phenotype.
120. Artificial selection to obtain cows yielding higher milk output represents _____ **[Pg-137,H]**
- A) directional selection as it pushes the mean of the character in one direction.
B) disruptive selection as it splits the population into two, one yielding higher output and the other lower output.
C) stabilizing selection followed by disruptive selection as it stabilizes the population to produce higher-yielding cows.
D) stabilizing selection as it stabilizes this character in the population.
121. The northern elephant seal of North America and nearby islands was nearly hunted to extinction. The conservation efforts restored the population size. However, the restored population is vulnerable to extinction due to _____ **[Pg-137,M]**
- A) Stabilizing selection
B) Bottleneck effect
C) Founders effect
D) Natural selection

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PARAGRAPH-7.8

A BRIEF ACCOUNT OF EVOLUTION

122. Sea weeds and few plants existed probably around - **[Pg-138,E]**
- A) 0.32 bya
B) 400 mya
C) 500 mya

- D) 3.2 bya
123. Jawless fish probably evolved around - [Pg-138,E]
 A) 400 mya
 B) 350 mya
 C) 450 mya
 D) 600 mya
124. Select the correct statement among the following. [Pg-138,M]
 A) By the time of 500 mya, invertebrates were formed but were not active.
 B) The first organisms that invaded land were plants. They were widespread on land when animals invaded land.
 C) The amphibians evolved into reptiles. They lay thin-shelled eggs which do not dry up in sun unlike those of amphibians
 D) After amphibians in the next 2000 million years or so, reptiles of different shapes and sizes dominated on Earth.
125. _____ were present but they all fell to form coal deposits slowly. [Pg-140,E]
 A) Giant grass
 B) Giant ferns
 C) Pteridophytes
 D) Both B and C
126. Select the incorrect statement among the following. [Pg-139,140,E]
 A) Some of these land reptiles went back into water to evolve into amphibians like reptiles probably 200 mya (e.g. Ichthyosaurs).
 B) About 65 mya, the dinosaurs suddenly disappeared from the earth.
 C) The first mammals were like shrews. Their fossils are small sized. Mammals were viviparous and protected their unborn young inside the mother's body.
 D) Mammals were more intelligent in sensing and avoiding danger at least. When reptiles came down mammals took over this earth.
127. South America mammals resembled how many of the following animals? [Pg-140,E]
 Horse, Cow, Monkey, Hippopotamus, Bear, Deer, Rabbit
 A) 5 B) 4 C) 3 D) 2
128. Select the incorrect statement among the following. [Pg-140,M]
 A) Due to continental drift, when South America joined North America, these animals were overridden by North American fauna.
 B) Due to continental drift pouched mammals of Australia survived because of lack of competition from any other mammal.
 C) Evolution of horse, elephant, virus, etc., are special stories of evolution.
 D) The most successful story is the evolution of man with language skills and self-consciousness.
129. Select the correct statement about cells with a membranous envelope. [Pg-139,M]
 A) The mechanism of how non-cellular aggregates of giant macromolecules could evolve into cells with membranous envelope is not known.
 B) Some of these cells had the ability to release O₂.
 C) The reaction could have been similar to the light reaction in photosynthesis where water is split with the help of solar energy captured and channelised by appropriate light harvesting pigments.
 D) All of these
130. Fish with stout and strong fins could move on land and go back to water. This was about - [Pg-138,E]
 A) 360 mya B) 350 mya C) 0.4 bya D) 3.5 bya
131. Select the correct statement about Coelacanth. [Pg-138,M]
 A) In 1938, a fish caught in South America happened to be a Coelacanth which was thought to be extinct
 B) Coelacanth called lobefins evolved into the first reptile that lived on both land and water.
 C) There are no specimens of Coelacanth left with us.
 D) Coelacanth were ancestors of modern day frogs and turtles.
132. Select the correct statement about *Tyrannosaurus rex*? [Pg-140,E]
 A) *Tyrannosaurus rex* had huge fearsome dagger like teeth.
 B) *Tyrannosaurus rex* was about 20 feet in height.

- C) *Tyrannosaurus rex* was biggest of all dinosaurs.
 D) All of these
133. The probable reason for disappearance of dinosaur was/were- [Pg-140,E]
 A) Climatic changes killed them B) Most of them evolved into birds.
 C) Both (A) and (B) D) Dinosaurs did not disappear.
134. How many of the following animals live wholly in water? [Pg-140,E]
 Whales, Shark, Dolphins, Turtles, Seals, Sea cows
 A) 5 B) 4 C) 3 D) 2

PARAGRAPH-7.9
ORIGIN AND EVOLUTION OF MAN

135. Consider the following statements: [Pg-140,M]
 (a) Dryopithecus and Ramapithecus lived on Earth about 15 mya.
 (b) They were primates with a hairy appearance and walked like gorillas.
 Choose the correct option.
 A) Both (a) and (b) are true.
 B) (a) is true but (b) is false.
 C) Both (a) and (b) are false.
 D) (a) is false but (b) is true.
136. Ramapithecus was more _____ while Dryopithecus was more _____ [Pg-140,E]
 A) great ape-like; man-like B) man-like; ape-like
 C) ape-like; man-like D) both a and b are true
137. Which of the following is the immediate ancestor of genus Homo? [Pg-140,E]
 A) Dryopithecus B) Ramapithecus
 C) Australopithecines D) Sahelanthropus

138. Match Column-I with Column-II. [Pg-140,141,M]

Column-I

- (a) Australopithecus africanus
 (b) Homo habilis
 (c) Homo erectus
 (d) Neanderthal man

Select the correct option.

a b c d

- A) 1 4 2 3
 B) 4 1 2 3
 C) 2 4 1 3
 D) 4 1 3 2

Column-II

- (1) The oldest member of genus Homo
 (2) Java man
 (3) Cave painting
 (4) Lucy

139. Consider the following statement. [Pg-140,M]
 (a) Homo habilis is also known as 'handy man' and could cook food using fire.
 (b) Homo erectus was about 5 feet tall upright hominid and exhibited improved hunting skills. Select the correct option.
 A) Both (a) and (b) are true.
 B) (a) is true but (b) is false.
 C) Both (a) and (b) are false.
 D) (a) is false but (b) is true.

140. Which of the following hominid has a brain capacity of 1400cc and used hide to protect their body. [Pg-141,E]
 A) Homo habilis B) Homo erectus
 C) Homo sapiens D) The Neanderthal man

141. The chronological order of human evolution from early to the recent is [Pg-140,141,E]
 A) Australopithecus > Ramapithecus > Homo habilis > Homo erectus
 B) Ramapithecus > Australopithecus > Homo habilis > Homo erectus
 C) Ramapithecus > Homo habilis > Australopithecus > Homo erectus
 D) Australopithecus > Homo habilis > Ramapithecus > Homo erectus

142. Match the hominids with their correct brain size.

[Pg-140,141,M]

Column-I

- (a) Homo habilis
- (b) Homo neanderthalensis
- (c) Homo erectus
- (d) Homo sapiens

Column-II

- (1) 900 cc
- (2) 1350 cc
- (3) 650–800 cc
- (4) 1400 cc

Select the correct option.

a b c d

- A) 4 1 3 2
- B) 3 4 1 2
- C) 4 1 2 3
- D) 2 4 1 3

143. Which of the following had the smallest brain capacity?

[Pg-140,E]

- A) Homo neanderthalensis
- B) Homo habilis
- C) Homo erectus
- D) Homo sapiens

NCERT LINE BY LINE 186

144. Which of the following pair is incorrectly matched?

[Pg-141,E]

- A) Australopithecines – Fruit eater
- B) Pre-historic cave art – 18000 years ago
- C) Agriculture and human settlements – 10000 years back
- D) Origin of modern Homo sapiens – 1,00,000–40,000 years back

145. Assertion: Ramapithecus was more manlike while Dryopithecus was more apelike.

Reason: Ramapithecus had a thick layer of enamel.

[Pg-140,H]

- A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
- C) Assertion is true, but Reason is false.
- D) Assertion is false, but Reason is true.

146. Assertion: Evolution of modern humans exhibited a gradual increase in brain size.

Reason: Homo habilis had the smallest brain capacity. [Pg-141,H]

- A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
- C) Assertion is true, but Reason is false.
- D) Assertion is false, but Reason is true.

NEET PREVIOUS YEARS QUESTIONS

1. The similarity of bone structure in the forelimbs of many vertebrates is an example of : [2018]
 - (a) Homology
 - (b) Analogy
 - (c) Adaptive radiation
 - (d) Convergent evolution
2. Among the following sets of examples for divergent evolution, select the incorrect option. [2018]
 - (a) Forelimbs of man, bat and cheetah
 - (b) Heart of bat, man and cheetah
 - (c) Eye of octopus, bat and man
 - (d) Brain of bat, man and cheetah
3. According to Hugo de Vries, the mechanism of evolution is: [2018]
 - (a) Multiple step mutations
 - (b) Saltation
 - (c) Minor mutations
 - (d) Phenotypic variations
4. Which of the following represents order of Horse'? [2017]
 - (a) Perissodactyla
 - (b) caballus
 - (c) ferus
 - (d) Equidae
5. Which of the following structures is homologous to the wing of a bird? [2016]
 - (a) Dorsal fin of a Shark
 - (b) Wing of a Moth
 - (c) Hind limb of Rabbit
 - (d) Flipper of Whale

6. Following are the two statements regarding the origin of life. [2016]
 (A) The earliest organisms that appeared on the earth were non-green and presumably anaerobes.
 (B) The first autotrophic organisms were the chemoautotrophs that never released oxygen.
 Of the above statements which one of the following options is correct?
 (a) (A) is correct but (B) is false. (b) (B) is correct but (A) is false.
 (c) Both (A) and (B) are correct. (d) Both (A) and (B) are false.
7. Analogous structures are a result of : [2016]
 (a) Divergent evolution (b) Convergent evolution
 (c) Shared ancestry (d) Stabilising selection
8. Industrial melanism is an example of : [2015]
 (a) Natural selection (b) Mutation
 (c) Neo Lamarckism (d) Neo Darwinism
9. Which of the following had the smallest brain capacity? [2015]
 (a) Homo sapiens (b) Homo neanderthalensis (c) Homo habilis (d) Homo erectus
10. A population will not exist in Hardy - Weinberg equilibrium if : [2015]
 (a) There are no mutations. (b) There is no migration.
 (c) The population is large. (d) Individuals mate selectively.
11. Forelimbs of cat, lizard used in walking; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of : [2014]
 (a) Analogous organs (b) Adaptive radiation
 (c) Homologous organs (d) Convergent evolution
12. Which one of the following are analogous structures? [2014]
 (a) Wings of Bat and Wings of Pigeon. (b) Gills of Prawn and Lungs of Man.
 (c) Thorns of Bougainvillea and Tendrils of Cucurbita.
 (d) Flippers of Dolphin and Legs of Horse.
13. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is [2014]
 (a) 0.4 (b) 0.5 (c) 0.6 (d) 0.7
14. A gene locus has two alleles A, a. If the frequency of dominant allele A is 0.4 then what will be the frequency of homozygous dominant, heterozygous and homozygous recessive individuals in the population? [NEET-2019]
 (1) 0.36 (AA); 0.48(Aa); 0.16 (aa) (2) 0.16 (AA); 0.24 (Aa); 0.36 (aa)
 (3) 0.16 (AA); 0.48 (Aa); 0.36 (aa) (4) 0.16 (AA); 0.36 (Aa); 0.48 (aa)
15. Variations caused by mutation, as proposed by Hugo de Vries, are [NEET-2019]
 (1) random and directional (2) random and directionless
 (3) small and directional (4) small and directionless
16. In a species, the weight of newborn ranges from 2 to 5 kg. 97% of the newborn with an average weight between 3 to 3.3kg survive whereas 99% of the infants born with weights from 2 to 2.5 kg or 4.5 to 5 kg die. Which type of selection process is taking place ? [NEET-2019]
 (1) Directional Selection (2) Stabilizing Selection (3) Disruptive Selection (4) Cyclical Selection
17. Match the hominids with their correct brain size : [NEET-2019]
 (a) Homo habilis (i) 900 cc
 (b) Homo neanderthalensis (ii) 1350 cc
 (c) Homo erectus (iii) 650-800 cc
 (d) Homo sapiens (iv) 1400 cc
 Select the correct option.
 (a) (b) (c) (d) (a) (b) (c) (d) (a) (b) (c) (d) (a) (b) (c) (d)
 (1) (iii) (i) (iv) (ii) (2) (iii) (ii) (i) (iv) (3) (iii) (iv) (i) (ii) (4) (iv) (iii) (i) (ii)
18. In Australia, marsupials and placental mammals have evolved to share many similar characteristics. This type of evolution may be referred to as : [NEET-2019 ODISSA]
 (1) Adaptive Radiation (2) Divergent Evolution (3) Cyclical Evolution (4) Convergent Evolution
19. A population of a species invades a new area. Which of the following condition will lead to Adaptive Radiation ? [NEET-2019 ODISSA]
 (1) Area with large number of habitats having very low food supply

- (2) Area with a single type of vacant habitat
 (3) Area with many types of vacant habitats
 (4) Area with many habitats occupied by a large number of species
20. Which of the following is against the rules of ICBN? **[NEET-2019 ODISSA]**
 (1) Hand written scientific names should be underlined.
 (2) Every species should have a generic name and a specific epithet.
 (3) Scientific names are in Latin and should be italicized.
 (4) Generic and specific names should be written starting with small letters.
21. Which of the following statements is correct about the origin and evolution of men? **[NEET-19 ODISSA]**
 (1) Agriculture came around 50,000 years back.
 (2) The Dryopithecus and Ramapithecus primates existing 15 million years ago, walked like men.
 (3) Homo habilis probably ate meat.
 (4) Neanderthal men lived in Asia between 1,00,000 and 40,000 years back.
22. The phenomenon of evolution of different species in a given geographical area starting from a point and spreading to other habitats is called :- **[NEET-2020 COVID]**
 (1) Saltation (2) Co-evolution (3) Natural selection (4) Adaptive radiation
23. A Hominid fossil discovered in Java in 1891, now extinct, having cranial capacity of about 900 cc was:
 (1) Homo erectus (2) Neanderthal man (3) Homo sapiens (4) Australopithecus
24. Embryological support for evolution was proposed by :
 (1) Ernst Heckel (2) Karl Ernst von Baer (3) Charles Darwin (4) Alfred Wallace
25. After about how many years of formation of earth, life appeared on this planet?
 (1) 500 billion years (2) 50 million years (3) 500 million years (4) 50 billion years
26. Which of the following refer to correct example (s) of organisms which have evolved due to changes in environment brought about by anthropogenic action? **[NEET-2020]**
 a) Darwin's Finches of Galapagos islands b) Herbicide resistant weeds
 c) Drug resistant eukaryotes d) Man – created breeds of domesticated animals like dogs
 1) only (d) 2) only (a) 3) (a) and (c) 4) (b), (c) and (d)
27. Embryological support for evolution was disapproved by **[NEET-2020]**
 1) Oparin 2) Karl Ernst von Baer 3) Alfred Wallace 4) Charles Darwin
28. Flippers of Penguins and Dolphins are examples of **[NEET-2020]**
 1) Natural selection 2) Adaptive radiation 3) Convergent evolution 4) Industrial melanism
29. From his experiments S.L. Miller produced amino acids by mixing the following in a closed flask **[NEET-2020]**
 1) CH_3, H_2, NH_3 and water vapour at $600^\circ C$ 2) CH_4, H_2, NH_3 and water vapour at $800^\circ C$
 3) CH_3, H_2, NH_4 and water vapour $800^\circ C$ 4) CH_4, H_2, NH_3 and water vapour at $600^\circ C$
30. The factor that leads to founder effect in a population is **[NEET-2021]**
 1) Genetic recombination 2) Mutation
 3) Genetic drift 4) Natural selection
31. Match List-I with List-II **[NEET-2021]**

List_I		List_II	
A	Adaptive radiation	I	Selection of resistant varieties due to excessive use of herbicides and pesticides
B	Convergent evolution	II	Bones of forelimbs in Man and Whale
C	Divergent evolution	III	Wings of Butterfly and Bird
D	Evolution by anthropogenic action	IV	Darwin Finches

Choose the correct answer from the options given below

- | | | | | | | | | | |
|----|-----|----|-----|----|----|----|-----|----|-----|
| | A | B | C | D | | A | B | C | D |
| 1) | III | II | I | IV | 2) | II | I | IV | III |
| 3) | I | IV | III | II | 4) | IV | III | II | I |

32. Natural selection where more individuals acquire specific character value other than the mean character value, leads to
 (a) Stabilising change

- (b) Directional change
- (c) Disruptive change
- (d) Random change

[NEET 2024]

33. Given below are some stages of human evolution.

Arrange them in correct sequence. (Past to Recent)

- A. Homo habilis
- B. Homo sapiens
- C. Homo neanderthalensis
- D. Homo erectus

Choose the correct sequence of human evolution from the options given below:

- (a) D-A-C-B
- (b) B-A-D-C
- (c) C-B-D-A
- (d) A-D-C-B

[NEET 2022]

34. Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

- (a) Analogy, convergent
- (b) Homology, divergent
- (c) Homology, convergent
- (d) Analogy, divergent

[NEET 2025]

NCERT LINE BY LINE QUESTIONS – ANSWERS

1) A	2) B	3) D	4) D	5) D	6) B	7) D	8) B	9) D	10) B
11) A	12) B	13) C	14) C	15) D	16) D	17) B	18) C	19) D	20) A
21) D	22) A	23) A	24) D	25) C	26) C	27) D	28) C	29) A	30) B
31) C	32) A	33) C	34) C	35) A	36) B	37) C	38) B	39) C	40) D
41) C	42) D	43) B	44) A	45) A	46) B	47) D	48) A	49) A	50) A
51) A	52) C	53) B	54) A	55) A	56) A	57) A	58) C	59) D	60) D
61) D	62) C	63) D	64) B	65) B	66) A	67) B	68) B	69) B	70) B
71) A	72) B	73) A	74) B	75) C	76) C	77) B	78) B	79) A	80) B
81) D	82) B	83) A	84) A	85) B	86) A	87) A	88) A	89) B	90) D
91) C	92) C	93) A	94) C	95) C	96) A	97) A	98) D	99) B	100) A
101) D	102) B	103) A	104) D	105) C	106) B	107) C	108) B	109) C	110) B
111) A	112) B	113) C	114) B	115) B	116) C	117) B	118) A	119) C	120) A
121) B	122) A	123) B	124) B	125) B	126) D	127) B	128) C	129) D	130) B
131) C	132) D	133) C	134) B	135) A	136) B	137) C	138) B	139) A	140) D
141) B	142) B	143) B	144) D	145) A	146) B				

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

- 1 (a)
- 2 (c)
- 3 (b)
- 4 (a)
- 5 (d)
- 6 (c)
- 7 (b)

8 (a)	9 (c)	10 (d)	11 (c)	12 (b)	13 (c)	14 (3)
15 (2)	16 (2)	17 (3)	18 (2)	19 (3)	20 (4)	21 (4)
22 (4)	23 (1)	24 (1)	25 (3)	26 (4)	27 (2)	28 (3)
29 (2)	30 (3)	31 (4)	32(b)	33(d)	34(a)	

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (a)
2. (c) Divergent evolution demonstrates how species can have common (homologous) anatomical structures, whereas eye of octopus, bat and man are examples of analogous organs which have similar function showing convergent evolution.
3. (b) As per mutation theory given by Hugo de Vries, the evolution is a discontinuous phenomenon or saltatory phenomenon/saltation.
4. (a)
5. (d) Wings of a bird and flippers of a whale are modified forelimbs.
6. (c) Both statements (A) and (B) are correct because primitive atmosphere was reducing and chlorophyll appeared later on. Chemoautotrophs were the first autotrophic organisms unable to perform photolysis of water and never released oxygen.
7. (b)
8. (a) Industrial melanism occurred in England due to industrial revolution. It causes black coating of moths for the adaptation in the present environment.
9. (c) Brain capacity in decreasing order:-
Homo sapiens (1300 - 1600 c.c)
Homo neanderthalensis (approx. 1400 c.c.)
Homo erectus (600 - 700 c.c.)
Homo habilis (550 - 687 c.c.)
 Thus, the lowest brain capacity is of *Homo habilis* as shown above. *Homo habilis* lived in early Pleistocene period and used tools of chipped stones.
10. (d) The theory of Hardy- Weinberg equilibrium states that in the absence of disturbance on the level of genetic structure, a population's existence will not continue.
 Thus, mating should be in a random way.
11. (c)
12. (b) Analogous organs are those that perform similar functions but have entirely different embryonic origins.
13. (c) According to Hardy Weinberg principle:
 $p^2 + 2pq + q^2 = 1$; $(p + q)^2 = 1$
 (AA) $p^2 = 360$ out of 1000 individual or $p^2 = 36$ out of 100.
 $q^2 = 160$ out of 1000 or $q^2 = 16$ out of 100
 so $q = .16 = .4$.
 As $p + q = 1$ so p is 0.6.
26. Herbicide resistant weeds, drug resistant eukaryotes and man-created breeds of domesticated animals like dogs are examples of evolution by anthropogenic action.

 Darwin's Finches of Galapagos islands are example of natural selection and adaptive radiation.
27. Embryological support for evolution was disapproved by Karl Ernst von Baer.

 According to Baer, the embryos never pass through the adult stages of other animals during embryonic development.
28. Flippers of Penguins and Dolphins are examples of analogous organs.
29. In 1953, S.L. Miller, an American scientist created electric discharge in a closed flask containing CH_4 , H_2 , NH_3 and water vapor at $800^\circ C$

30. Genetic drift

31.Ans (b)

Explanation

Option (b) is correct because in directional natural selection more individuals acquire value other than the mean character value.

Option (c) is incorrect because in disruptive change, more individuals acquire peripheral character value at both ends of the distribution curve.

Option (d) is incorrect because there is no random change in natural selection.

Option (a) is incorrect because natural selection leads to stabilisation when more individuals acquire mean character value.

32.Ans. (d)

Explanation

Correct answer is option (d) because the correct sequence of stages of human evolution from past to recent is

Homo habilis → Homo erectus → Homo neanderthalensis → Homo sapiens

34.Ans. (a)

Explanation

Potato is a stem modification (tuber) while Sweet potato is a root modification (root tuber). Both store food and perform similar functions, but have different origins. This means they are analogous organs (similar function, different origin), which arises due to Convergent evolution i.e. unrelated organisms independently evolve similar traits as a result of having to adapt to similar environments or ecological niches.

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