

29

Evolution

TOPIC 1

Origin of Life

01 After about how many years of formation of earth, life appeared on this planet? [NEET (Oct.) 2020]

- (a) 500 billion years
- (b) 50 million years
- (c) 500 million years
- (d) 50 billion years

Ans. (c)

During the course of evolution, earth probably formed about 4.5 billion years ago. After its formation, life appeared about 500 million years ago in oceans. The first living forms were believed to be heterotrophs and used to derive nutrition from external sources.

02 From his experiments, SL Miller produced amino acids by mixing the following in a closed flask.

[NEET (Sep.) 2020]

- (a) $\text{CH}_3, \text{H}_2, \text{NH}_4$ and water vapour at 800°C
- (b) $\text{CH}_4, \text{H}_2, \text{NH}_3$ and water vapour at 600°C
- (c) $\text{CH}_3, \text{H}_2, \text{NH}_3$ and water vapour at 600°C
- (d) $\text{CH}_4, \text{H}_2, \text{NH}_3$ and water vapour at 800°C

Ans. (d)

The correct option is (d) because in 1953, SL Miller, created electric discharge in a closed flask containing $\text{CH}_4, \text{H}_2, \text{NH}_3$ and water vapours at 800°C .

03 Variations caused by mutation, as proposed by Hugo de Vries are

[NEET (National) 2019]

- (a) random and directionless
- (b) small and directional
- (c) small and directionless
- (d) random and directional

Ans. (a)

Hugo de Vries proposed that the variations caused by mutation are random and

directionless. These are the sudden, heritable changes in the genetic material and these variations constitute the raw material for evolution. He also proposed that mutations play a key role in speciation and used the term saltation for single step large mutations.

04 According to Hugo de Vries, the mechanism of evolution is

[NEET 2018]

- (a) phenotypic variations
- (b) saltation
- (c) multiple step mutations
- (d) minor mutations

Ans. (b)

According to Hugo de Vries, the mechanism of evolution is saltation. Hugo de Vries (1901) proposed mutation theory of evolution and stated that evolution is a jerky process in which new species are evolved due to discontinuous sudden variations or saltation. These are the single step large mutations occurring in population.

05 Following are the two statements regarding the origin of life

[NEET 2016, Phase I]

- I. The earliest organisms that appeared on the earth were non-green and presumably anaerobes.
- II. The first autotrophic organisms were the chemoautotrophs that never released oxygen.

Of the above statements which one of the following options is correct?

- (a) II is correct but I is false
- (b) Both I and II are correct
- (c) Both I and II are false
- (d) I is correct but II is false

Ans. (b)

The earliest organisms that appeared on earth were anaerobic chemoautotrophs. Chemoautotrophs were the first autotrophic organisms. They were unable to perform photolysis of water and never released oxygen, e.g. sulphur bacteria.

06 Which of the following is the correct sequence of events in the origin of life? [NEET 2016, Phase II]

- I. Formation of protobionts.
- II. Synthesis of organic monomers.
- III. Synthesis of organic polymers.
- IV. Formation of DNA-based genetic systems.

- (a) I, II, III, IV
- (b) I, III, II, IV
- (c) II, III, I, IV
- (d) II, III, IV, I

Ans. (c)

The sequential manner of events of origin of life is as follows

II. Synthesis of organic monomers.

↓

III. Synthesis of organic polymers.

↓

I. Formation of protobionts.

↓

IV. Formation of DNA-based genetic systems.

Thus, option (c) is correct.

07 Which one of the following is incorrect about the characteristics of protobionts (coacervates and microspheres) as envisaged in the abiogenic origin of life? [CBSE AIPMT 2008]

- (a) They were able to reproduce
- (b) They could separate combinations of molecules from the surroundings

- (c) They were partially isolated from the surroundings
 (d) They could maintain an internal environment

Ans. (d)

Homeostasis is keeping the internal environment of the body constant. It is necessary for normal life processes. Microspheres are molecular aggregates of proteinoids. Oparin and Sydney Fox held that large organic molecules synthesised abiotically on primitive earth formed large colloidal aggregates due to the intermolecular attraction.

These colloidal particles were called coacervates. Oparin called giant nucleoproteinoid molecules as protobionts. These reproduce either by budding or binary fission but do not exhibit homeostasis.

08 Which one of the following pair of items correctly belongs to the category of organs mentioned against it? [CBSE AIPMT 2008]

- | | |
|--|---------------------|
| (a) Thorn of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i> | – Analogous organs |
| (b) Nictitating membrane and blind spot in human eye | – Vestigial organs |
| (c) Nephridia of earthworm and Malpighian tubules of cockroach | – Excretory organs |
| (d) Wings of honey bee and wings of crow | – Homologous organs |

Ans. (c)

In annelids like *Nereis*, earthworm, leech, etc., the tubular coiled structures called nephridia are excretory organs. In phylum-Arthropoda, insects centipedes, millipedes and arachnides possess Malpighian tubules as their principal excretory organ. Analogous organs have almost similar appearance and perform the same function but develop in totally different groups and are totally different in their basic structure and developmental origin, e.g. wings of butterfly, birds, bats.

The homologous organs have common origin, perform different type of functions and have different appearance, e.g. thorns of *Bougainvillea* and tendrils of *Cucurbita*.

Vestigial organs are useless remnants, which might have been large and functional in the ancestors, e.g. nictitating membrane, vermiform appendix, etc.

09 The concept of chemical evolution is based on [CBSE AIPMT 2007]

- (a) crystallisation of chemicals
 (b) interaction of water, air and clay under intense heat
 (c) effect of solar radiation on chemicals
 (d) possible origin of life by combination of chemicals under suitable environmental conditions

Ans. (d)

The concept of chemical evolution is based on possible origin of life by combination of chemicals under suitable environmental conditions.

10 Evolutionary history of an organism is known as [CBSE AIPMT 2006]

- (a) ancestry
 (b) palaeontology
 (c) ontogeny
 (d) phylogeny

Ans. (d)

Phylogeny (Gr. *Phylon* – tribe or race; *geneia* = origin) is the origin and diversification of any taxon or the evolutionary history of its origin and diversification. It is usually represented as a diagrammatic phylogenetic tree (that traces putative evolutionary relationships), i.e., dendrogram. Palaeontology is the study of fossils. Ontogeny is the whole course of an individual's development and life history.

11 Which one of the following amino acid was not found to be synthesised in Miller's experiment?

- (a) Aspartic acid (b) Glutamic acid
 (c) Alanine (d) Glycine

Ans. (b)

Miller and Urey were the two scientists who recreated the conditions of primitive earth in laboratory and abiotically synthesised amino acids and bases. They synthesised glycine, aspartic acid and alanine in abundant quantities while, glutamic acid could not be synthesised in their experiment.

12 Which one of the following experiments suggests that simplest living organisms could not have originated spontaneously from non-living matter? [CBSE AIPMT 2005]

- (a) Larvae could appear in decaying organic matter
 (b) Microbes did not appear in stored meat

- (c) Microbes appeared from unsterilised organic matter
 (d) Meat was not spoiled, when heated and kept sealed in a vessel

Ans. (d)

Pasteur performed experiments in which he took sterilised (by boiling) yeast and sugar solution in a long necked flask, then he bent the neck of the flask like a neck of swan. After one month he observed that no life appeared in flask solution because the curved flask neck acts as a filter. He later on broke down the neck and observed the solution. He found that many microorganisms were originated in solution.

13 According to Oparin, which one of the following was not present in the primitive atmosphere of the earth? [CBSE AIPMT 2004]

- (a) Methane (b) Oxygen
 (c) Hydrogen (d) Water vapour

Ans. (b)

According to Oparin the atmosphere of primitive earth was reducing because H atoms were most numerous and most reactive. Large quantities of H_2 , N_2 , water vapour, CO_2 , CH_4 and NH_3 were present, but free oxygen was not present in significant amount.

14 Identify the correct sequence in which the following substances have appeared during the course of evolution of life on earth [CBSE AIPMT 1996]

- (a) glucose, amino acids, nucleic acids, proteins
 (b) ammonia, amino acids, proteins, nucleic acids
 (c) water, amino acids, nucleic acids, enzymes
 (d) amino acids, ammonia, phosphates, nucleic acids

Ans. (b)

Primitive atmosphere was reducing type (without free oxygen). Hydrogen atoms combined with oxygen forming water and with nitrogen, forming ammonia. Water and ammonia were probably the first compound molecules on primitive earth. The primitive atmosphere contained gases like CO_2 , CO , N , H_2 , etc. and methane (CH_4) was the first organic compound formed in primitive atmosphere.

In the primitive atmosphere, electric discharge, ATP and solar energy provided the source of energy for polymerization reactions of organic

synthesis which lead to the synthesis of amino acids, that joined to form polypeptides and proteins. Simple sugar units combined to form polysaccharides; fatty acids and glycerol to form fats; sugars, nitrogenous bases and phosphates combined into nucleotides which polymerised into nucleic acids in the ancient oceans.

15 The first organisms were
[CBSE AIPMT 1992]

- (a) chemoautotrophs
- (b) chemoheterotrophs
- (c) autotrophs
- (d) eukaryotes

Ans. (b)

The first cells were almost certainly heterotrophs, obtaining energy and nutrients from organic molecules in their environment. The prokaryotes evolved before the eukaryotes, the earliest prokaryotes must have been chemoheterotrophs.

16 Which was absent in the atmosphere at the time of origin of life?
[CBSE AIPMT 1991]

- (a) NH₃
- (b) H₂
- (c) O₂
- (d) CH₄

Ans. (c)

The atmosphere of earth at the time of origin of life was without free oxygen atoms. The primitive atmosphere chiefly consisted of methane, ammonia, water vapour, hydrogen gas, nitrogen gas, and some carbon monoxide.

Hydrogen atoms were most numerous and most reactive in primitive atmosphere. They combined with all available oxygen atoms and formed water.

17 'Origin of species' was written by
[CBSE AIPMT 1989]

- (a) Oparin
- (b) Weismann
- (c) Lamarck
- (d) Darwin

Ans. (d)

Darwin and Wallace published a joint paper titled 'Origin of species' in 1858. Later in 1859, Darwin published his detailed theory in his book titled 'Origin of species by means of Natural selection'.

According to Darwin, variations are progressive factors for evolution.

18 Evolution is
[CBSE AIPMT 1989]

- (a) progressive development of a race
- (b) history and development of race along with variations
- (c) history of race
- (d) development of race

Ans. (b)

Evolution is defined as history and development of race with variations. The term 'evolution' in Biology means gradual changes. It is an excellent working hypothesis to approach the problems of diversity of organisms.

19 First life on earth was
[CBSE AIPMT 2001]

- (a) cyanobacteria
- (b) chemoheterotrophs
- (c) autotrophs
- (d) photoautotrophs

Ans. (b)

First living beings were formed in the environment of sea having abundant organic molecules. They absorbed the organic materials for the sake of nutrition and hence, were chemoheterotrophs.

TOPIC 2

Evidences of Evolution

20 Match the List-I with List-II.

List-I	List-II
A. Adaptive radiation	1. Selection of resistant radiation varieties due to excessive use of herbicides and pesticides
B. Convergent evolution	2. Bones of forelimbs in man and whale
C. Divergent evolution	3. Wings of butterfly and bird
D. Evolution by anthropogenic action	4. Darwin Finches

Choose the correct answer from the options given below.

[NEET 2021]

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

Ans. (a)

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

Adaptive radiation is a change that occur in organism by adapting according to the environment, e.g. Darwin finches.

Convergent evolution is a process where distant species develop similar structures, e.g. wings of butterfly and birds.

Divergent evolution is a process by which an inbreeding species diverges into two descendant species, e.g. bones of forelimbs in man and whales.

Evolution by anthropogenic action means evolution occurring due to human activities, e.g. selection of resistant varieties due to excessive use of herbicides and pesticides.

21 Embryological support for evolution was proposed by
[NEET (Oct.) 2020]

- (a) Ernst Haeckel
- (b) Karl Ernst von Baer
- (c) Charles Darwin
- (d) Alfred Wallace

Ans. (a)

Embryological support for evolution was proposed by Ernst Haeckel. He proposed biogenetic law in year 1864. According to this law 'structure of ancient origin develops earlier than structure of newer origin. In other words, it states "Ontogeny repeats phylogeny", i.e. development of structures in an organism follow the same sequence as they evolved in his ancestors.

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 (Oct.) 2020]

- (a) saltation
- (b) co-evolution
- (c) natural selection
- (d) adaptive radiation

Ans. (d)

The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.

23 Embryological support for evolution was disapproved by
[NEET (Sep.) 2020]

- (a) Alfred Wallace
- (b) Charles Darwin
- (c) Oparin
- (d) Karl Ernst von Baer

Ans. (d)

Embryological support for evolution was disapproved by Karl Ernst von Baer. He observed the pattern of embryonic development in different species.

- 24** 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 (Sep.) 2020]

- I. Darwin's Finches of Galapagos islands.
 - II. Herbicide resistant weeds.
 - III. Drug resistant eukaryotes.
 - IV. Man-created breeds of domesticated animals like dogs.
- (a) I and III (b) II, III and IV
(c) Only IV (d) Only I

Ans. (b)

The correct option is (b) because 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 examples of natural selection, adaptive radiation and founder's effect.

- 25** Flippers of penguins and dolphins are examples of [NEET (Sep.) 2020]

- (a) convergent evolution
(b) industrial melanism
(c) natural selection
(d) adaptive radiation

Ans. (a)

Flippers of penguins and dolphins are examples of convergent evolution. They have similar function (helps in swimming) but different origin so, they are also called analogous organs. Penguin and dolphins are not closely related to each other but evolved similar traits (flippers) which represent convergent evolution. Hence analogous organs are a result of convergent evolution.

- 26** In Australia, marsupials and placental mammals have evolved to share many similar characteristics. This type of evolution may be referred to as [NEET (Odisha) 2019]

- (a) adaptive radiation
(b) divergent evolution
(c) cyclical evolution
(d) convergent evolution

Ans. (d)

In Australia, marsupials and placental mammals have evolved to share many similar characteristics. This type of evolution is referred to as convergent evolution.

Convergent evolution is the independent evolution of similar features in species of different lineages. For example, a number of marsupials, each different from the other evolved from an ancestral stock, but all within the Australian island continent. Also, marsupials in Australia resemble placental mammals in the rest of the world, they evolved in isolation after Australia separated from other continents.

- 27** In a species, the weight of newborn ranges from 2 to 5 kg. 97% of the newborn with an average weight between 3 to 3.3 kg 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 (National) 2021]

- (a) Stabilising selection
(b) Disruptive selection
(c) Cyclical selection
(d) Directional selection

Ans. (a)

The given data represents stabilising selection. It eliminates individuals from both ends of a phenotypic distribution and hence maintains the same distribution average. In the given situation, most of the newborn of average weight 3-3.3 kg survive. Babies having more or less weight had low survival rate. Disruptive selection favours both extremes of continuous variation. Directional selection favours one extreme of continuous variation. Cyclical selection is regarded as a source of polymorphism.

- 28** Among the following sets of examples for divergent evolution, select the incorrect option. :

[NEET 2018]

- (a) Brain of bat, man and cheetah
(b) Heart of bat, man and cheetah
(c) Forelimbs of man, bat and cheetah
(d) Eye of *Octopus*, bat and man

Ans. (d)

Divergent evolution results in homologous structures. These organs have the same fundamental structure

but are different in functions. Structural homology is seen in brain, heart and forelimbs of man, bat and cheetah. Eyes of *Octopus*, bat and man are examples of analogous organs which show **convergent evolution**. Therefore, option (d) is incorrect.

- 29** The similarity of bone structure in the forelimbs of many vertebrates is an example of [NEET 2018]

- (a) convergent evolution
(b) analogy
(c) homology
(d) adaptive radiation

Ans. (c)

The similarity of bone structure in the forelimbs of many vertebrates is an example of **homology**. The homologous organs have the same fundamental structure but are adapted to perform different functions, e.g. forelimbs of man, cheetah, whale and bat.

Analogous organs show **convergent evolution**. These organs have similar functions but are different in their structural details and origin. Development of different functional structures from a common ancestral form is called **adaptive radiation**.

- 30** Analogous structures are a result of [NEET 2016, Phase I]

- (a) convergent evolution
(b) shared ancestry
(c) stabilising selection
(d) divergent evolution

Ans. (a)

Analogous structures are a result of convergent evolution. When organisms with completely different organisation, living in the same habitat come to possess superficial resemblance, this is known as convergent evolution.

- 31** Which of the following structures is homologous to the wing of a bird? [NEET 2016, Phase I]

- (a) Wing of a moth
(b) Hind limb of rabbit
(c) Flipper of whale
(d) Dorsal fin of a shark

Ans. (c)

Wings of bird and flipper of whale are modified fore limbs of the two organisms so have same origin wings help in flying and flippers help in swimming, but this perform the different functions.

32 The wings of a bird and the wings of an insect are [CBSE AIPMT 2015]

- (a) homologous structures and represent divergent evolution
- (b) analogous structures and represent convergent evolution
- (c) phylogenetic structures and represent divergent evolution
- (d) homologous structures and represent convergent evolution

Ans. (b)

The wings of a bird and the wings of an insect are analogous structures and represent convergent evolution.

Analogous organs have the same function and are superficially alike only. However their fundamental structures are quite different in morphology, anatomy and embryonic origin. Analogy is an example of convergent evolution.

33 Forelimbs of cat, lizard used in walking forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of [CBSE AIPMT 2014]

- (a) analogous organs
- (b) adaptive radiation
- (c) homologous organs
- (d) convergent evolution

Ans. (c)

Homologous organs are those organs which have a common fundamental anatomical plan and similar embryonic origin but perform varied functions. Forelimbs of cat, lizard used in walking, forelimbs of whale used in swimming and forelimbs of bats used in flying are the example for homologous organs. All are the examples of modified forelimbs, with the same type of bones. They have become different due to the adaptations to different habitat.

34 Which one of the following are analogous structures? [CBSE AIPMT 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

Ans. (a)

Analogous organs are the structures of different species having similar or corresponding functions but different structure. They do not belong to the same evolutionary origin.

Wings of bat are skin folds stretched mainly between elongated fingers but the wing of birds are feathers covering all along the arm. They look similar because they have a common use for flying, but their origin is not common.

35 The eyes of *Octopus* and eyes of cat show different patterns of structure, yet they perform similar function. This is an example of [NEET 2013]

- (a) homologous organs that have evolved due to convergent evolution
- (b) homologous organs that have evolved due to divergent evolution
- (c) analogous organs that have evolved due to convergent evolution
- (d) analogous organs that have evolved due to divergent evolution

Ans. (c)

The analogous organs are not anatomically similar structures though they perform similar functions. Hence, analogous structures are a result of convergent evolution, i.e. different structures evolving for the same function and hence, having similarity.

Therefore, the eyes of *Octopus* and eyes of cat are examples of analogous organs, though they are different in structure but similar in function. Homologous organs develop along different directions due to the adaptations to various needs. This is divergent evolution and the structures are homologous.

36 The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called [NEET 2013]

- (a) natural selection
- (b) convergent evolution
- (c) non-random evolution
- (d) adaptive radiation

Ans. (b)

Convergent evolution occurs in unrelated group of organisms. It is the development of similar functional structures but in unrelated groups. The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography is called adaptive radiation. Natural selection is the basis of evolution.

37 Evolution of different species in a given area starting from a point and spreading to other geographical areas is known as [CBSE AIPMT 2012]

- (a) adaptive radiation
- (b) natural selection
- (c) migration
- (d) divergent evolution

Ans. (a)

The diversification of an ancestral group into two or more species in different habitats is called divergent evolution. When this involves large number of species to occupy different niches, this is called adaptive radiation. Adaptive radiation is the process of evolution of different species in a given geographical area starting from a species of animals or plants and literally radiating to other areas of geography (habitats). Darwin's finches represent one of best examples of this phenomenon.

38 Which one of the following options gives one correct example each of convergent evolution and divergent evolution? [CBSE AIPMT 2012]

Convergent evolution	Divergent evolution
(a) Eyes of <i>Octopus</i> and mammals	Bones of forelimbs of vertebrates
(b) Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Wings of butterflies and birds
(c) Bones of forelimbs of vertebrates	Wings of butterfly and birds
(d) Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Eyes of <i>Octopus</i> and mammals

Ans. (a)

Convergent evolution involves the independent development of similar structures in organisms that are not directly related. It is represented by analogous organs, e.g. eyes of *Octopus* and mammals, wings of insects and birds. In divergent evolution, same basic organ becomes adapted by specialisation to perform different functions.

It is represented by homologous organs, e.g. Bones of forelimbs of vertebrates (like seal's flipper, bat's wing, cat's paw horse's front leg and human hand), thorns of *Bougainvillea* and tendrils of *Cucurbita*.

39 *Peripatus* is a connecting link between [CBSE AIPMT 2009]

- (a) Ctenophora and Platyhelminthes
- (b) Mollusca and Echinodermata
- (c) Annelida and Arthropoda
- (d) Coelenterata and Porifera

Ans. (c)

Peripatus is connecting link between Annelida and Arthropoda. It is a living fossil that has similarities to both arthropods (such as absence of external segmentation, unjoined legs, the presence of cuticle, etc) and annelides (internal segmentation, eyes and segmentally arranged nephridia etc.).

40 Darwin's finches are an excellent example of [CBSE AIPMT 2010, 08]

- (a) adaptive radiation
- (b) seasonal migration
- (c) brood parasitism
- (d) connecting links

Ans. (a)

Adaptive radiation represents evolution of new forms in several directions from the common ancestral type. In 1831, Darwin got an opportunity to travel by HMS Beagle for a voyage of world exploration. Beagle sailed to the Galapagos Islands, here Darwin found a living laboratory of evolution.

The common birds of Galapagos Islands, the finches were markedly different from the finches of main land. The closely related species of finches had beaks of different shapes and sizes and adapted for feeding on completely different diet showing adaptive radiation.

The transitional fossil forms which show characteristic of two different groups of living animals are called connecting links, e.g. *Archaeopteryx*, *Seymouria*, etc.

41 Thorn of *Bougainvillea* and tendril of *Cucurbita* are examples of [CBSE AIPMT 2008]

- (a) analogous organs
- (b) homologous organs
- (c) vestigial organs
- (d) retrogressive evolution

Ans. (b)

Thorns of *Bougainvillea* and tendrils of *Cucurbita* are homologous organs. These are modified branches and are axillary in position. It means axillary branches in *Bougainvillea* are modified into thorns for protection from burrowing animals and in *Cucurbita* they are modified into tendrils for climbing.

The analogous organs have almost similar appearance and perform the same function but these develop in totally different groups and are totally different in their basic structure and developmental origin. The phyllode of *Ruscus* or cladode of *Asparagus* are analogous to leaves of other plants.

The vestigial or rudimentary organs are useless remnants of structures or organs, which might have been large and functional in ancestors, e.g. cutin covered stomata on the stem of cacti plants.

42 Which one of the following statements is correct? [CBSE AIPMT 2007]

- (a) Stem cells are specialised cells
- (b) There is no evidence of the existence of gills during embryogenesis of mammals
- (c) All plant and animal cells are totipotent
- (d) Ontogeny repeats phylogeny

Ans. (d)

Recapitulation theory or Biogenetic law states that **ontogeny** (development of embryo) is recapitulation of phylogeny (ancestral sequence).

43 What is common to whale, seal and shark? [CBSE AIPMT 2007]

- (a) Seasonal migration
- (b) Thick subcutaneous fat
- (c) Convergent evolution
- (d) Homeothermy

Ans. (c)

Distantly related animals (as whale, seal and shark) inhabiting similar habitats often develop similar morphological features that make them look similar. This is termed adaptive convergence of convergent evolution.

44 When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed [CBSE AIPMT 2007]

- (a) divergent evolution
- (b) micro-evolution
- (c) co-evolution
- (d) convergent evolution

Ans. (d)

In convergent evolution lineages show similar morphology under the influence of similar environmental factors.

45 The finches of Galapagos islands provide an evidence in favour of [CBSE AIPMT 2007]

- (a) special creation
- (b) evolution due to mutation
- (c) retrogressive evolution
- (d) biogeographical evolution

Ans. (d)

Darwin's finches of Galapagos islands had common ancestors later on whose beaks modified according to their feeding habits. These provide evidence of geographical distribution.

46 An important evidence in favour of organic evolution is the occurrence of [CBSE AIPMT 2006]

- (a) analogous and vestigial organs
- (b) homologous organs only
- (c) homologous and analogous organs
- (d) homologous and vestigial organs

Ans. (d)

An important evidence in favour of **organic evolution** is the occurrence of homologous and vestigial organs.

Homologous organs are those which have the common origin and are built on the same fundamental pattern but they perform different functions and have different appearances, e.g. whale's flipper, bat's wings, cat's paws, horse's front legs, bird's wings, ox's front legs and human hands.

Vestigial organs in animals are those having no function now, in them, but had important functions in their ancestors.

Analogous organs are quite different in fundamental structure and embryonic origin but perform the same function. The study of analogous organs illustrates the occurrence of **convergent evolution**.

47 Which of the following is the relatively most accurate method for dating of fossils? [CBSE AIPMT 2005]

- (a) Radio-carbon method
- (b) Potassium-argon method
- (c) Electron-spin resonance method
- (d) Uranium-lead method

Ans. (c)

Electron spin resonance method is the most accurate method for dating of fossils. It measures number of charges occupying deep traps in crystal band gap.

48 Using imprints from a plate with complete medium and carrying bacterial colonies, you can select streptomycin resistant mutants and prove that such mutations do not originate as adaptation. These imprints need to be used

[CBSE AIPMT 2005]

- (a) on plates with and without streptomycin
- (b) on plates with minimal medium
- (c) only on plates with streptomycin
- (d) only on plates without streptomycin

Ans. (c)

Plates having streptomycin allow to propagate only those bacteria which are resistant to the antibiotic. While those plates in which streptomycin is absent, both resistant and non-resistant bacteria can grow normally.

49 Presence of gills in the tadpole of frog indicates that

[CBSE AIPMT 2004]

- (a) fishes were amphibian in the past
- (b) fishes evolved from frog-like ancestors
- (c) frogs will have gills in future
- (d) frogs evolved from gilled ancestors

Ans. (d)

According to **biogenetic law** of Ernst Haeckel (1866) **ontogeny repeats phylogeny**. Ontogeny is the life history of an organism while, phylogeny is the evolutionary history of the race of that organism. In other words we can say an organism repeats its ancestral history during its development.

Hence, resemblance of amphibian to fish is seen in most systems of the body as both are cold blooded, both respire by gills (as tadpole of frog), both usually lay eggs in water leading to the conclusion that amphibians have originated from fishes.

50 What kind of evidence suggested that man is more closely related with chimpanzee than with other hominoid apes? [CBSE AIPMT 2004]

- (a) Evidence from DNA from sex chromosomes only
- (b) Comparison of chromosomes morphology only
- (c) Evidence from fossil remains and the fossil mitochondrial DNA alone
- (d) Evidence from DNA extracted from sex chromosomes, autosomes and mitochondria

Ans. (d)

Chimpanzee is more closely related to man than other hominoids. It is evidenced by chromosome banding pattern, DNA extracted from sex chromosomes, autosomes and mitochondria. Molecular clock based on mitochondrial DNA are used to date recent events because this DNA mutates 5-10 times faster than nuclear DNA. Some similarities between human and chimpanzee are

- (a) DNA matching shows human similarity with chimpanzee.
- (b) There is little difference in banding pattern in chromosomes 3 and 6 in human and chimpanzee.
- (c) Serum test indicates maximum homology between human and chimpanzee.

51 Age of fossils in the past was generally determined by radio-carbon method and other methods involving radioactive elements found in the rocks. More precise methods, which were used recently and led to the revision of the evolutionary periods for different groups of organisms, include [CBSE AIPMT 2004]

- (a) study of carbohydrates/proteins in fossils
- (b) study of the conditions of fossilisation
- (c) Electron Spin Resonance (ESR) and fossil DNA
- (d) study of carbohydrates/proteins in rocks

Ans. (c)

Electron Spin Resonance (ESR) measures number of charges occupying deep traps in crystal band gap. The basic principle of ESR is same as those for luminescence, i.e. electrons become trapped and stored as a result of ionising radiations e.g. dating of tooth enamel.

52 Convergent evolution is illustrated by [CBSE AIPMT 2003]

- (a) dogfish and whale
- (b) rat and dog
- (c) bacterium and protozoan
- (d) starfish and cuttle fish

Ans. (a)

Convergent evolution is the acquisition of same or similar characters by distantly related lines of descent. Dogfish (pisces) and whale (mammals) have acquired aquatic characters though distantly related.

53 Which one of the following describes correctly the homologous structures?

[CBSE AIPMT 2003]

- (a) Organs appearing only in embryonic stage and disappearing later in the adult
- (b) Organs with anatomical similarities, but performing different functions
- (c) Organs with anatomical dissimilarities, but performing same functions
- (d) Organs that have no function now, but had an important function in ancestors

Ans. (b)

Homologous structures are similar in origin but similar or dissimilar in function, such as pectoral fins of fish and forelimbs of horse are similar in structure but different in functions.

54 Which of the following pair is homologous organ?

[CBSE AIPMT 2002]

- (a) Wings of birds and locust
- (b) Wings of birds (sparrow) and pectoral fins of fish
- (c) Wings of bat and butterfly
- (d) Legs of frog and cockroach

Ans. (b)

Homologous organs are the organs which have the same origin and similar basic structure but may differ in external appearance and function, wings of birds and pectoral fins of fish are examples of the same. Analogous organs are those organs which are anatomically different but functionally same.

55 According to fossils discovered up to present time origin and evolution of man was started from

[CBSE AIPMT 2002]

- (a) France
- (b) Java
- (c) Africa
- (d) China

Ans. (c)

The first Hominid (ancestor from whom humans evolved) arose at a time when a change in weather led to the reduction in the size of the African forests favouring bipedalism.

56 Sequence of which of the following is used to know the phylogeny?

[CBSE AIPMT 2002]

- (a) mRNA
- (b) rRNA
- (c) tRNA
- (d) DNA

Ans. (b)

The genes for rRNAs tend to be highly conserved and are, therefore, often employed for phylogenetic studies.

57 Reason of diversity in living being is

- (a) mutation [CBSE AIPMT 2001]
(b) gradual change
(c) long term evolutionary change
(d) short term evolutionary change

Ans. (c)

Though mutation provides the source of variation, the diversity in living beings is due to the natural selection of variations and consequent evolutionary change over a long period of time.

58 Similarities in organisms with different genotype indicates

[CBSE AIPMT 2001]

- (a) micro-evolution
(b) macro-evolution
(c) convergent evolution
(d) divergent evolution

Ans. (c)

Increase in resemblance over time of different evolutionary lineages (in one or more phenotypic characters) thereby increasing their phenetic similarities is called convergence or convergent evolution.

59 Half-life period of C^{14} is about

[CBSE AIPMT 2001]

- (a) 500 yr (b) 5730 yr
(c) 50 yr (d) 5×10^4 yr

Ans. (b)

C^{14} takes about 5730 year for half the material to decay.

60 Darwin's finches provide an excellent evidence in favour of evolution. This evidence comes from the field of

[CBSE AIPMT 2000]

- (a) Biogeography (b) Anatomy
(c) Embryology (d) Palaeontology

Ans. (a)

Biogeography is the study of the geographical distribution of life forms on earth. Darwin undertook a voyage on the ship HMS Beagle. The ship traversed the Southern hemisphere where life is most abundant and varied.

Along the way, Darwin found different forms of life very different from those in England. As he sailed southward along

the South America, he found that similar species replaced each other. He thought that related species could have been modified according to the environment.

His views got confirmed on Galapagos islands (small group of Volcanic islands of the Western coasts of South America). Darwin found different modified forms of finches which seemed to have descended from mainland finches as a result of the natural selection.

61 Which one of the following pair has homologous organs?

[CBSE AIPMT 1999]

- (a) Pectoral fins of a fish and forelimbs of a horse
(b) Wings of a bat and wings of cockroach
(c) Air sac of fish and lungs of frog
(d) Wings of a bird and wings of a butterfly

Ans. (a)

Homologous organs are those organs which are originally and anatomically similar but functionally different.

The forelimbs of vertebrates are built on same pentadactyl plan, though they may have different functions, e.g. in birds these are modified for flying.

62 The age of the fossil of *Dryopithecus* on the geological time scale is

[CBSE AIPMT 1998]

- (a) 5×10^6 yr back
(b) 25×10^6 yr back
(c) 50×10^6 yr back
(d) 75×10^6 yr back

Ans. (b)

Dryopithecus lived about 20-25 million years ago. *Dryopithecus* had the combined characters of great apes, old world monkeys and man. The main structural characteristics of *Dryopithecus* are broad jaws, large canines, semi-erect walking, 5 cusped molars and absence of brow ridges.

63 Which one of the following is a living fossil?

[CBSE AIPMT 1997]

- (a) *Pinus longifolia* (b) *Dalbergia sissoo*
(c) *Mirabilis jalapa* (d) *Ginkgo biloba*

Ans. (d)

Ginkgo biloba is believed to be the oldest living seed plant. Its fossils have been found in rocks as old as Triassic. It still survives with little change over this long period of time while other members of its group have become extinct.

64 The homologous organs are those that show similarity in

[CBSE AIPMT 1995]

- (a) size
(b) origin
(c) function
(d) appearance

Ans. (b)

Homologous structures are those which have the same embryonic origin and basic structure, though they may or may not perform the same function.

65 Homologous organs are

[CBSE AIPMT 1994]

- (a) wings of insects and bat
(b) gills of fish and lungs of rabbit
(c) pectoral fins of fish and fore limbs of horse
(d) wings of grasshopper and crow

Ans. (c)

Homologous structures are similar in origin but similar or dissimilar in function, as pectoral fins of fish and forelimbs of horse are similar in structure but different in function.

66 Evolutionary convergence is development of

[CBSE AIPMT 1993, 96]

- (a) common set of characters in group of different ancestry
(b) dissimilar characters in closely related groups
(c) common set of characters in closely related groups
(d) random mating

Ans. (a)

Convergent evolution or adaptive convergence refers to the development of similar adaptive functional structures in unrelated groups of organisms, e.g. wings of insect, bird and bat; Australian marsupials and placental mammals.

67 Study of fossils is

[CBSE AIPMT 1991]

- (a) palaeontology
(b) herpetology
(c) saurology
(d) organic evolution

Ans. (a)

Palaeontology is the study of fossils (remains or impressions of ancient forms) and their distribution in rocks of various ages. Study of animal fossils is known as palaeozoology and study of plant fossils is known as palaeobotany.

68 Humming birds and hawk illustrate
[CBSE AIPMT 1988]

- (a) convergent evolution
- (b) homology
- (c) adaptive radiation
- (d) parallel evolution

Ans. (c)

Adaptive radiation or divergent evolution refers to the formation of different structures from a common ancestral form, e.g. wings of humming birds and hawk, fore limbs of horse, bat and human beings.

TOPIC 3 Theories of Evolution

69 Genetic drift operates in
[NEET 2016, Phase II]

- (a) small isolated population
- (b) large isolated population
- (c) non-reproductive population
- (d) slow reproductive population

Ans. (a)

The genetic drift is a drastic change in allele frequency when population size is very small. Its effects are more marked in a small isolated population.

70 Industrial melanism is an example of
[CBSE AIPMT 2015]

- (a) Neo Darwinism
- (b) Natural selection
- (c) Mutation
- (d) Neo Lamarckism

Ans. (b)

Within a period of years in industrial or polluted areas, the dark species has almost replaced the light species. This is called industrial melanism because of its association with the sooty atmosphere of industry. It is an example of natural selection.

71 Variation in gene frequencies within populations can occur by chance rather than by natural selection. This is referred to as
[NEET 2013]

- (a) genetic flow
- (b) genetic drift
- (c) random mating
- (d) genetic load

Ans. (b)

Genetic drift is a random change in allele frequencies over the generations. It is brought by chance alone. Gene flow or gene migration is the physical

movement of alleles into and out of a population.

72 In the case of peppered moth (*Biston betularia*), the black-coloured form became dominant over the light-coloured form in England during industrial revolution. This is an example of
[CBSE AIPMT 2009]

- (a) natural selection whereby the darker forms were selected
- (b) appearance of the darker coloured individuals due to very poor sunlight
- (c) protective mimicry
- (d) inheritance of darker colour character acquired due to the darker environment

Ans. (a)

The given case is an example of natural selection. As a result of struggle for existence only those organisms could survive, which have favourable variations to adapt to the environmental conditions. With so many variations in population of species the struggle for existence results in survival of the fittest.

The survival of the fittest is the result of selection and proliferation of only those organisms, which were most suitably adapted to the environment and most successful in mating, i.e. natural selection.

73 Which one of following scientists name is correctly matched with the theory put forth by him?
[CBSE AIPMT 2008]

- (a) Weismann–Theory of continuity of germplasm
- (b) Pasteur–Inheritance of acquired characters
- (c) De vries–Natural selection
- (d) Mendel–Theory of pangenesis

Ans. (a)

The correct theory is the Weismann Theory of continuity of germplasm. Rest of the theories were proposed by

Scientist Theory

Pasteur–Germ theory of disease

Charles Darwin–Theory of natural selection

Lamarck–Inheritance of acquired characters

Hugo de Vries–Mutation theory

Mendel–Laws of inheritance

Darwin–Theory of pangenesis

74 Select the correct statement from the following given options.

[CBSE AIPMT 2007]

- (a) Darwinian variations are small and directionless
- (b) Fitness is the end result of the ability to adapt and gets selected by nature
- (c) All mammals except whales and camels have seven cervical vertebrae
- (d) Mutations are random and directional

Ans. (b)

Fitness (survival of the fittest) is a result of selection and proliferation of only those organisms which were most suitably adapted to the environment and get selected by nature.

75 De Vries gave his mutation theory on organic evolution while working on
[CBSE AIPMT 2005]

- (a) *Pisum sativum*
- (b) *Drosophila melanogaster*
- (c) *Oenothera lamarckiana*
- (d) *Althea rosea*

Ans. (c)

Hugo de Vries (1848–1935) proposed mutation theory for the formation of new species. He came to conclude this theory while working on *Oenothera lamarckiana* evening primrose.

According to him, new species are not formed by continuous variations but by sudden appearance of variations which he assigned as mutations. He stated that these mutations are heritable and persist in successive generations.

76 Which one of the following phenomena supports Darwin's concept of natural selection in organic evolution?
[CBSE AIPMT 2005]

- (a) Development of transgenic animals
- (b) Production of 'Dolly', the sheep by cloning
- (c) Prevalence of pesticide resistant insects
- (d) Development of organs from 'stem cells' for organ transplantation

Ans. (c)

According to Darwin's concept of natural selection the organisms which are provided with favourable variations would survive because, they are the fittest to face their surrounding, while the organisms which are unfit for surrounding variations are destroyed. Prevalence of pesticide resistant insects is due to the adaptability of these insects for the changes in environment (due to use of pesticides).

77 Darwin in his 'Natural Selection Theory' did not believe in any role of which one of the following in organic evolution?

[CBSE AIPMT 2003]

- (a) Discontinuous variations
- (b) Parasites and predators as natural enemies
- (c) Survival of the fittest
- (d) Struggle for existence

Ans. (a)

Natural theory of Darwin did not believe in any role of discontinuous variations. Darwin called the variations as 'sports'. While, Hugo de Vries used the term mutation to these variations. These variations are sudden heritable changes which can occur in any stage of development.

78 In a random mating population in equilibrium, which of the following brings about a change in gene frequency in a non-directional manner?

[CBSE AIPMT 2003]

- (a) Migration
- (b) Mutation
- (c) Random drift
- (d) Selection

Ans. (b)

Given certain conditions, the allele frequencies remain constant from generation to generation. Under these conditions, a population would be in equilibrium and there will be no evolutionary change. However, many evolutionary changes usually occur following the appearance of new alleles and source of this is mutation.

79 Random genetic drift in a population probably results from

[CBSE AIPMT 2003]

- (a) large population size
- (b) highly genetically variable individuals
- (c) interbreeding within this population
- (d) constant low mutation rate

Ans. (b)

Genetic drift or Sewall Wright effect is statically significant change in population gene frequencies resulting by chance and not from natural selection, emigration or immigration. In simple words, random loss of alleles is known as genetic drift.

80 Which one of the following sequences was proposed by Darwin and Wallace for organic evolution?

[CBSE AIPMT 2003]

- (a) Variations, natural selection, overproduction, constancy of population size
- (b) Overproduction, variations, constancy of population size, natural selection
- (c) Variations, constancy of population size, overproduction, natural selection
- (d) Overproduction, constancy of population size, variations, natural selection

Ans. (b)

Though living organisms tend to multiply geometrically, the number of individuals of a species tend to remain constant over a long period of time. Out of heterogenous population (due to the variation) best adapted individuals are selected by nature.

81 Genetic drift operates in

[CBSE AIPMT 2002]

- (a) small isolated population
- (b) large isolated population
- (c) fast reproductive population
- (d) slow reproductive population

Ans. (a)

Genetic drift refers to changes in allele frequencies of a gene pool due to chance. Though it operates both in large and small populations, it is expected to be significant only in small populations, where alleles may become extinct or get fixed by chance alone.

82 Reason of diversity in living being is

[CBSE AIPMT 2001]

- (a) mutation
- (b) gradual change
- (c) long term evolutionary change
- (d) short term evolutionary change

Ans. (c)

Though mutation provides the source of variation, the diversity in living beings is due to the natural selection of variations and consequent evolutionary change over a long periods of time.

83 Darwin's theory of pangenesis shows similarity with theory of inheritance of acquired characters then what will be correct according to it?

[CBSE AIPMT 2001]

- (a) Useful organs become strong and developed while useless organs become extinct. These organs help in struggle for survival

- (b) Size of organs increase with ageing
- (c) Development of organs is due to will power
- (d) There should be some physical basis of inheritance

Ans. (d)

According to both the views, something is passed from parent to offspring which causes development of specific characters, i.e. all that has been acquired by the organism during its life time is preserved by generation and transmitted to offsprings in form of pangenes is or gemmules.

84 The presence of gill slits, in the embryos of all vertebrates, supports the theory of

[CBSE AIPMT 1995]

- (a) biogenesis
- (b) recapitulation
- (c) metamorphosis
- (d) organic evolution

Ans. (a)

'The theory of recapitulation' or 'Biogenetic law', propounded by Haeckel states that an individual organism in its development (ontogeny) tends to repeat the stages passed through by its ancestors (phylogeny). During the life history of frog, tadpole larva resembles fishes, the ancestors of Amphibia. The presence of gill clefts in vertebrate embryo provides a strong evidence in support of organic evolution.

85 Which one does not favour Lamarckian concept of inheritance of acquired characters?

[CBSE AIPMT 1994]

- (a) Lack of pigment in cave dwellers
- (b) Absence of limbs in snakes
- (c) Presence of webbed toes in aquatic birds
- (d) Melanization of peppered moth in industrial areas

Ans. (d)

Lamarck believed in direct influence of environment on the individual. Lamarckian postulate of use and disuse of organs is supported by rudimentary eyes of cave dwellers, webbed feet of swimming bird, elongated limbless body of snake, vestigial organs of living animals, etc. *Biston betularia* (peppered moth) shows industrial melanism and demonstrates natural selection.

86 Frequency of a character increases when it is [CBSE AIPMT 1994]

- (a) recessive (b) dominant
(c) inheritable (d) adaptable

Ans. (d)

According to Darwin, the variations are continuous and those which are helpful in the adaptations of an organism towards its surrounding would be passed on to the next generation. In the offsprings, these modifications become more pronounced if they are exposed to similar stress of the environment as faced by their parents.

87 Theory of natural selection dwells on [CBSE AIPMT 1993]

- (a) role of environment in evolution
(b) natural selection acting on favourable variations
(c) changes in gene complex resulting in heritable variations
(d) None of the above

Ans. (b)

According to Darwin's theory of natural selection, in the struggle for existence, only those individuals survive which possess the most useful variations. Useful variations present in the surviving individuals are passed on to the next generation. Next generation repeats the process of development of variations and natural selection.

88 Weismann cut off tails of mice generation after generation but tails neither disappeared nor shortened showing that [CBSE AIPMT 1993]

- (a) Darwin was correct
(b) tail is an essential organ
(c) mutation theory is wrong
(d) Lamarckism was wrong in inheritance of acquired characters

Ans. (d)

Lamarckian theory of inheritance of acquired characters was discarded by Weismann, while experimenting on mice. He cut the tails of mice for 80 generations but no single mouse was born without tail. Weismann formulated his famous 'Theory of continuity of germplasm', according to which only those characters, whatever be their origin and nature, that could affect germplasm are heritable and others are not.

89 Basic principles of embryonic development were pronounced by [CBSE AIPMT 1990]

- (a) Von Baer (b) Weismann
(c) Haeckel (d) Morgan

Ans. (a)

The basic laws or principles of embryonic development were given by von Baer in 1828. According to his theory during embryonic development generalised features brain, spinal cord etc. appeared earlier than special features like hair. Haeckel (1866) propounded 'The theory of recapitulation or Biogenetic law'.

90 'Continuity of germplasm' theory was given by [CBSE AIPMT 1989]

- (a) De Vries (b) Weismann
(c) Darwin (d) Lamarck

Ans. (b)

August Weismann, a German scientist formulated his famous 'Theory of continuity of germplasm' in 1886, on experimenting with mice. His theory states that inheritance in multicellular organisms takes place by means of germ cells i.e. egg and sperm cells only.

91 Theory of inheritance of acquired characters was given by [CBSE AIPMT 1989]

- (a) Wallace (b) Lamarck
(c) Darwin (d) De Vries

Ans. (b)

Jean Baptiste de Lamarck (1744-1829) was the greatest of French naturalists, who for the first time suggested a complete theory of evolution. Lamarckian theory is also known as 'Theory of inheritance of acquired characters' or 'Theory of use and disuse of organs'.

TOPIC 4 Speciation and Isolation

92 The factor that leads to Founder effect in a population is [NEET 2021]

- (a) natural selection
(b) genetic recombination
(c) mutation
(d) genetic drift

Ans. (d)

The factor that leads to Founder effect in a population is genetic drift. It is the change in the frequency of an existing gene variant (allele) in a population due to random sampling of organisms. Genetic drift can cause big losses of genetic variation for small population. The Founder effect is when a few individuals in a population colonize a new location that is separated from the old population. This also greatly reduces the population size, as well as reduces the genetic variability of the population.

Other options can be explained as Natural selection is the process through which populations of living organisms adapt and change.

Genetic recombination, in genetics, primary mechanism through which variation is introduced into populations. Mutation is sudden heritable change.

93 A population of a species invades a new area. Which of the following conditions will lead to adaptive radiation? [NEET (Odisha) 2019]

- (a) Area with large number of habitats having very low food supply
(b) Area with a single type of vacant habitat
(c) Area with many types of vacant habitats
(d) Area with many habitats occupied by a large number of species

Ans. (c)

Option (c) is correct.

The adaptive radiation occurs when a population of a species invades a new area. It is because it provides organisms of a population a new habitat with plenty of niche spaces. Darwin's finches represent one of the best examples of this phenomenon.

94 Which of the following represents order of 'Horse'? [NEET 2017]

- (a) Equidae
(b) Perissodactyla
(c) Caballus
(d) Ferus

Ans. (b)

Order being the higher taxon of classification exhibit the few similar characters of families. The order of horse is perissodactyla.

Concept Enhancer The order perissodactyla includes odd toed mammals. For example, *Equus asinus* (donkey), *Rhinoceros indicus* (the great one horned rhinoceros).

95 In Hardy-Weinberg equation, the frequency of heterozygous individual is represented by [NEET 2016, Phase II]

- (a) p^2 (b) $2pq$
(c) pq (d) q^2

Ans. (b)

Hardy-Weinberg principle states that the allele frequencies in a population are stable and remain constant from generation to generation. This can be expressed by the equation :

$$p^2 + 2pq + q^2 = 1$$

or $(p + q)^2 = 1$

where, p^2 represents frequency of homozygous dominant genotype, $2pq$ represents the frequency of heterozygous genotype and q^2 represents the frequency of homozygous recessive genotype. Hence, option (b) is correct.

96 The tendency of population to remain in genetic equilibrium may be disturbed by [NEET 2013]

- (a) random mating
(b) lack of migration
(c) lack of mutations
(d) lack of random mating

Ans. (d)

According to Hardy-Weinberg principle, allele frequencies in a population are stable and is constant from generation to generation only if the following conditions are met

- (i) There is no mutation, no gene flow and all mating is random.
(ii) All genotypes reproduce equally well (i.e., no natural selection). But all these conditions are rarely met in nature.

97 According to Darwin, the organic evolution is due to [NEET 2013]

- (a) intraspecific competition
(b) interspecific competition
(c) competition within closely related species
(d) reduced feeding efficiency in one species due to the presence of interfering species

Ans. (b)

Darwin stated that the organic evolution is due to the interspecific competition. It is the competition between members of different species. Intraspecific competition occurs amongst members of the same species for obtaining optimum amounts of their food, shelter, mate, water, light, etc.

Closely related species if compete cannot cause evolution. Reduced feeding efficiency in one species due to the presence of interfering species is due to the struggle for existence.

98 Adaptive radiation refers to [CBSE AIPMT 2007]

- (a) adaptations due to geographical isolation
(b) evolution of different species from a common ancestor
(c) migration of members of a species to different geographical areas
(d) power of adaptation in an individual to a variety of environments

Ans. (b)

Adaptive radiation is the development of different functional structures from a common ancestral form.

99 Industrial melanism as observed in peppered moth proves that [CBSE AIPMT 2007]

- (a) the true black melanic forms arise by a recurring random mutation
(b) the melanic form of the moth has no selective advantage over lighter form in industrial area
(c) the lighter form moth has no selective advantage either in polluted industrial area or non-polluted area
(d) melanism is a pollution generated feature

Ans. (a)

Industrial melanism is a term used to describe the evolutionary process in which darker individuals come to predominate over lighter individuals since the industrial revolution as a result of natural selection. In 1848 a black form of the moth was recorded in Manchester and by 1895, 98% of the peppered moth population in Manchester was black. This black 'melanic' form arose by a recurring random mutation, but its phenotypic appearance had a strong selective advantage in industrial areas.

100 One of the important consequences of geographical isolation is [CBSE AIPMT 2007]

- (a) no change in the isolated fauna
(b) preventing speciation
(c) speciation through reproductive isolation
(d) random creation of new species

Ans. (c)

Speciation is the formation of new species and the development of species diversity occurs when gene flow within the common pool is interrupted by an isolating mechanism. The isolation can occur through geographical separation of population, known as **allopatric speciation**.

101 Which one of the following is not a living fossil? [CBSE AIPMT 2006]

- (a) King crab (b) *Sphenodon*
(c) *Archaeopteryx* (d) *Peripatus*

Ans. (c)

Archaeopteryx lithographica is not a living fossil. It is a fossil bird that lived in Jurassic period about 180 million years ago. Its fossil displays the characters of both reptiles (e.g. long tail, bones non pneumatic, claw, presence of weak sternum, free caudal vertebra, etc) and birds (e.g. presence of feathers, modified jaws, etc).

102 Jurassic period of the Mesozoic era is characterised by [CBSE AIPMT 2006]

- (a) radiation of reptiles and origin of mammal-like reptiles
(b) dinosaurs become extinct and angiosperms appear
(c) flowering plants and first dinosaurs appear
(d) gymnosperms are dominant plants and first birds appear

Ans. (d)

Jurassic period is the second geological period of Mesozoic era. In this period, the **gymnosperms** were dominant and the plants included ferns, cycads, *Ginkgo*, bushes and conifers. Among animals, important invertebrates included ammonites, corals, brachiopods, bivalves and echinoids. Reptiles dominated the vertebrates and the **first flying reptiles** the pterosaurs appeared.

The **first primitive bird**, *Archaeopteryx*, also made its appearance.

103 Industrial melanism is an example of [CBSE AIPMT 2003]

- (a) defensive adaptation of skin against ultraviolet radiations
- (b) drug resistance
- (c) darkening of skin due to smoke from industries
- (d) protective resemblance with the surroundings

Ans. (c)

Industrial melanism is an example of directional selection. Changing environment leading to changes in the phenotypic/genotypic constitution of a population.

104 In which condition the gene ratio remains constant for any species? [CBSE AIPMT 2002]

- (a) Sexual selection
- (b) Random mating
- (c) Mutation
- (d) Gene flow

Ans. (b)

According to Hardy-Weinberg theorem, the mixing of alleles at meiosis and their subsequent recombination will not alter the frequencies of alleles in the future generations provided the mating within the population is random.

105 In which era reptiles were dominant? [CBSE AIPMT 2002]

- (a) Coenozoic era
- (b) Mesozoic era
- (c) Palaeozoic era
- (d) Archaeozoic era

Ans. (b)

Mesozoic era began about 24.8 crore year ago and lasted for about 18.3 crore year. It is also known as the 'Age of reptiles'.

Main events in of this era are as follows:

- (i) Gymnosperms dominate landscape, first dinosaurs and mammals.
- (ii) Gymnosperms continue as dominant plants, dinosaurs dominant, first birds.
- (iii) Flowering plants (angiosperms) appear, dinosaurs and many groups of organisms become extinct at end of period.

106 Occurrence of endemic species in South-America and Australia is due to [CBSE AIPMT 2001]

- (a) these species have been extinct from other regions
- (b) continental separation
- (c) there is no terrestrial route to these places
- (d) retrogressive evolution

Ans. (b)

Seas separating the continents form barriers to free intercontinental movement causing evolution of organisms independently in these continents leading to endemism. Endemic species are those species which are found in a restricted area of the world.

107 Genetic drift operates only in [CBSE AIPMT 1998]

- (a) smaller populations
- (b) larger populations
- (c) Mendelian populations
- (d) island populations

Ans. (a)

Genetic drift may be of significance in small populations only, where alleles may easily get extinct by chance alone.

108 In general, in the developmental history of a mammalian heart, it is observed that it passes through a two-chambered fish-like heart, three-chambered frog-like heart and finally to four-chambered stage. To which hypothesis can this above cited statement be approximated? [CBSE AIPMT 1998]

- (a) Hardy-Weinberg law
- (b) Lamarck's principle
- (c) Biogenetic law
- (d) Mendelian

Ans. (c)

Biogenetic law was propounded by Ernst Haeckel in 1866. According to this, during its development an animal passes through ancestral adult stages.

109 'Golden age of dinosaurs'/Age of reptiles was [CBSE AIPMT 1994]

- (a) Mesozoic
- (b) Coenozoic
- (c) Palaeozoic
- (d) Psychozoic

Ans. (a)

Mesozoic era is the age of reptiles. During this era, the dinosaurs achieved an enormous size and were most abundant, Mesozoic era is also known as golden age of dinosaurs.

110 The earliest fossil form in the phylogeny of horse is [CBSE AIPMT 1994]

- (a) *Merychippus*
- (b) *Mesohippus*
- (c) *Eohippus*
- (d) *Equus* principles

Ans. (c)

Hoofed animals like-horse originated in Eocene epoch in North America. First horse-like animals from which the modern horse *Equus* evolved was *Hyracotherium* (old) name *Eohippus*. The fossil record is most complete in horse.

111 Two geographical regions separated by high mountains are [CBSE AIPMT 1994]

- (a) Oriental and Australian
- (b) Palaeartic and Oriental
- (c) Nearctic and Palaeartic
- (d) Neotropical and Ethiopian

Ans. (b)

Dr. PL Scalater (1858) proposed first time the division of the world into six realms or biogeographic regions according to the distribution of birds. In 1876 AR Wallace, adopted it for all the animals, these regions include i.e. Palaeartic, Ethiopian, Oriental, Australian, Nearctic and Neotropical. Palaeartic and Oriental realms are separated by high mountain ranges, i.e. Himalayas.

112 Genetic drift is change of [CBSE AIPMT 1993]

- (a) gene frequency in same generation
- (b) appearance of recessive genes
- (c) gene frequency from one generation to next
- (d) None of the above

Ans. (c)

Genetic drift is defined as any random change, either directed or undirected in gene frequency in a population.

113 Correct order is [CBSE AIPMT 1991]

- (a) Palaeozoic → Archaeozoic → Coenozoic
- (b) Archaeozoic → Palaeozoic → Proterozoic
- (c) Palaeozoic → Mesozoic → Coenozoic
- (d) Mesozoic → Archaeozoic → Proterozoic

Ans. (c)

Era is a division of geological time that includes one or more periods. It follows the order-Palaeozoic, Mesozoic and

Coenozoic. Palaeozoic and Mesozoic eras are sub-divided into periods but Coenozoic is divided into periods and epochs. Mesozoic era is the Age of reptiles, and Coenozoic era is called as 'Age of mammals and birds'.

114 Parallelism is [CBSE AIPMT 1990]

- (a) adaptive divergence
- (b) adaptive divergence of widely separated species
- (c) adaptive convergence of widely different species
- (d) adaptive convergence of closely related groups

Ans. (d)

When convergent evolution is found in closely related species, it is called 'Parallel evolution' (or parallelism), e.g. development of running habit in deer [2 toed] and horse (1 toed) with two vestigial splint bones.

TOPIC 5 Human Evolution

115 A hominid fossil discovered in Java in 1891, now extinct having cranial capacity of about 900 cc was [NEET (Oct.) 2020]

- (a) *Homo erectus*
- (b) Neanderthal man
- (c) *Homo sapiens*
- (d) *Australopithecus*

Ans. (a)

A Hominid fossil discovered in Java in 1891 now extinct having cranial capacity of about 900 cc was *Homo erectus*. It probably ate meat.

116 Which of the following statements is correct about the origin and evolution of men? [NEET (Odisha) 2019]

- (a) Agriculture came around 50,000 years back
- (b) The *Dryopithecus* and *Ramapithecus* primates existing 15 million years ago, walked like men
- (c) *Homo habilis* probably ate meat
- (d) Neanderthal men lived in Asia between 1,00,000 and 40,000 years back

Ans. (d)

Statement (d) is correct about the origin and evolution of men.

Neanderthal men lived in Asia between 1,00,000 and 40,000 years back. Other statements are corrected as follows

Agriculture came around 10,000 years back

About 15 mya, primates called *Dryopithecus* and *Ramapithecus* were existing. They were hairy and walked like gorillas and chimpanzees.

Homo habilis probably did not eat meat while *Homo erectus* probably ate meat.

117 Match the hominids with their correct brain size [NEET (National) 2019]

- | | |
|---------------------------------|------------------|
| A. <i>Homo habilis</i> | (i) 900 cc |
| B. <i>Homo neanderthalensis</i> | (ii) 1350 cc |
| C. <i>Homo erectus</i> | (iii) 650-800 cc |
| D. <i>Homo sapiens</i> | (iv) 1400 cc |

Select the correct option.

- | | | | | |
|-----|-------|-------|------|------|
| | A | B | C | D |
| (a) | (iii) | (ii) | (i) | (iv) |
| (b) | (iii) | (iv) | (i) | (ii) |
| (c) | (iv) | (iii) | (i) | (ii) |
| (d) | (iii) | (i) | (iv) | (ii) |

Ans. (b)

(A)-(iii)(B)-(iv), (C)-(i)(D)-(ii)

The brain capacity of *Homo habilis* or the tool maker was 650-800 cc. *Homo neanderthalensis*, who existed in the late Pleistocene period had the brain size of about 1400 cc. *Homo erectus* were the first to walk upright and stand erect. Their brain size was about 900 cc. *Homo sapiens* or the living modern man has the brain size of about 1350 cc, which is lesser than their immediate ancestors, Cro-Magnon man.

118 The chronological order of human evolution from early to the recent is

- (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*

Ans. (b)

The fossils of *Ramapithecus* was discovered by Edward Levis from Pliocene rocks of Shivalik hills in India. They were present in Pliocene era nearly 14-15 million years ago (mya).

Australopithecus was first ape man found in African Pliocene era rocks present 5 mya.

Homo habilis were believed to be present in East Africa 2 mya in Pliocene era.

Homo erectus appeared nearly 1.5 mya with cranial capacity of 800-1300 cc.

Thus, the correct sequence is *Ramapithecus* → *Australopithecus* → *Homo habilis* → *Homo erectus*

119 What was the most significant trend in the evolution of modern man (*Homo sapiens*) from his ancestors? [CBSE AIPMT 2012, 11]

- (a) Shortening of jaws
- (b) Binocular vision
- (c) Increasing brain capacity
- (d) Upright posture

Ans. (c)

The most significant trend in the evolution of modern man is the increased brain capacity from the ancestors. The first human being was the hominid, called *Homo habilis*. The brain capacities were between 650-800 cc. They probably did not eat meat. Fossils discovered in Java in 1891 revealed the next stage, i.e. *Homo erectus*. *Homo erectus* had a large brain and probably ate meat.

The Neanderthal man with a brain size of 1400 cc lived in near east and central Asia between 1,00,00-40,000 year back. They used hides to protect their body and buried their dead. *Homo sapiens* arose in Africa and moved across continents and developed into distinct races. During ice age between 75,000-10,000 years back modern *Homo sapiens* arose.

120 The extinct human who lived 100000 to 40000 years ago, in Europe, Asia and parts of Africa, with short stature, heavy eye brows, retreating fore heads, large jaws with heavy teeth, stocky bodies, a lumbering gait and stooped posture was [CBSE AIPMT 2012]

- (a) *Homo habilis*
- (b) Neanderthal human
- (c) Cro-magnon humans
- (d) *Ramapithecus*

Ans. (b)

Neanderthal man with a brain size of 1400cc lived in near East and Central Asia, Europe and North Africa between 100000 to 40000 years back. It had slightly prognathous face, sloping forehead, eye brow ridges, smaller or no chin, large receding jaws, thick-boned skull and high domed head. They used hides to protect their body and buried their dead.

121 Among the human ancestors the brain size was more than 1000 cc in [CBSE AIPMT 2007]

- (a) *Homo neanderthalensis*
- (b) *Homo erectus*
- (c) *Ramapithecus*
- (d) *Homo habilis*

Ans. (a)

The cranial capacity of *Homo neanderthalensis* was about 1450 cc, roughly to that of modern man.

122 There are two opposing views about origin of modern man. According to one view *Homo erectus* in Asia were the ancestors of modern man. A study of variation of DNA however, suggested African origin of modern man. What kind of observation on DNA variation could suggest this? [CBSE AIPMT 2005]

- (a) Greater variation in Asia than in Africa
- (b) Greater variation in Africa than in Asia
- (c) Similar variation in Africa and Asia
- (d) Variation only in Asia and no variation in Africa

Ans. (a)

There are two models about origin of modern man (*Homo sapiens sapiens*), i.e.

- (a) **Multiregional model** According to this view, modern humans evolved in many parts of the world from regional descendants of *Homo erectus* who dispersed from Africa between 1 and 2 million years ago.
- (b) **Monogenesis model** According to this view only African descendants of *Homo erectus* gave rise to modern humans.

In late 1980s Rebecca Cann and other geneticists supported this view on the basis of DNA of living humans. They compared the mitochondrial DNA (mtDNA) of a multiethnic sample of more than 100 people representing four

continents. The greater the difference between the mtDNAs of two peoples, the longer ago that mtDNAs diverged from a common source.

By using bioinformatics, they concluded that the divergence of mtDNA of Africans from common source began just 200000 year ago, much too late to represent the dispersal of *Homo erectus*. Thus, there are greater variation in Asia than in Africa.

123 In recent years, DNA sequences (nucleotide sequence) of mtDNA and Y-chromosomes were considered for the study of human evolution, because [CBSE AIPMT 2003]

- (a) they can be studied from the samples of fossil remains
- (b) they are small and, therefore, easy to study
- (c) they are uniparental in origin and do not take part in recombination
- (d) their structure is known in greater detail

Ans. (c)

Wilson and Sarich choose mitochondrial DNA (mtDNA) for the study of maternal line inheritance. While, Y-chromosomes were considered for the study of human evolution particularly male domain. It is possible because they are uniparental in origin and do not take part in recombination.

124 Which of the following is correct order of evolutionary history of man? [CBSE AIPMT 2001]

- (a) Peking man, *Homo sapiens*, Neanderthal, Cro-magnon
- (b) Peking man, Neanderthal, *Homo sapiens*, Cro-magnon
- (c) Peking man, Heidelberg man, Neanderthal, Cro-magnon
- (d) Peking man, Neanderthal, *Homo sapiens*, Heidelberg man

Ans. (c)

Peking man → Heidelberg man → Neanderthal man → Cro-magnon man is the correct order/sequence of evolution man.

125 Which of following is closest relative of man? [CBSE AIPMT 2001]

- (a) Chimpanzee
- (b) Gorilla
- (c) Orangutan
- (d) Gibbon

Ans. (a)

Banding patterns of human chromosome number 3 and 6 are remarkably similar to that of chimpanzee indicating common origin for both.

126 *Homo sapiens* evolved during [CBSE AIPMT 2000]

- (a) Pleistocene
- (b) Oligocene
- (c) Pliocene
- (d) Miocene

Ans. (a)

The family-Hominidae includes humans of today. These are the most intelligent of the hominoids. They are distinguished from the other families of hominoids in that they are **bipedal**, i.e. they walk upright on two legs. Hominids appeared during Pliocene but modern human (*Homo sapiens*) are believed to have arisen about 1,50,000 year back during Pleistocene.

127 Which one of the following features is closely related with the evolution of humans? [CBSE AIPMT 2000]

- (a) Loss of tail
- (b) Shortening of jaws
- (c) Binocular vision
- (d) Flat nails

Ans. (b)

Evolution of modern man is accompanied by the reduction in length of jaw bones and teeth lines becoming semi-circular instead of U-shaped.

128 Which of the following primate is the closest relative of humans? [CBSE AIPMT 2000]

- (a) Rhesus monkey
- (b) Orangutan
- (c) Gorilla
- (d) Gibbon

Ans. (c)

Chimpanzees and gorillas are our closest relatives of humans among the living primates.

129 Which is not a vestigial part in humans? [CBSE AIPMT 2000]

- (a) Segmental muscles of abdomen
- (b) Finger nails
- (c) Third molar
- (d) Coccyx

Ans. (b)

Finger nails are not a vestigial part in humans. Structures or organs which are present in an organism in a diminished size but no longer useful are called **vestigial organ**.

About 90 vestigial organs have been reported from human body. These include coccyx (tail bone), third molar (wisdom tooth) and segmental muscles of abdomen.

130 Which one of the following statements is correct?
[CBSE AIPMT 1998]

- (a) Cro-magnon man's fossil has been found in Ethiopia
- (b) *Homo erectus* is the ancestor of man
- (c) Neanderthal man is the direct ancestor of *Homo sapiens*
- (d) *Australopithecus* is the real ancestor of modern man

Ans. (b)

Homo erectus (0.25-1.7 million years, middle Pleistocene man) is known as erect man, who walked erect over legs. *Homo sapiens* (late Pleistocene man, 5 lakh year) is parent species to which modern man belongs. It evolved from *Homo erectus* in Africa. *Homo sapiens sapiens* is the modern man, evolved about 25000 year back but spread to various parts of the world about 10000-11000 year ago.

131 Common origin of man and chimpanzee is best shown by
[CBSE AIPMT 1997]

- (a) banding pattern in chromosomes number 3 and 6
- (b) cranial capacity
- (c) binocular vision
- (d) dental formula

Ans. (a)

A comparative study of the banding of chromosomes of man and the great apes has shown that the total amount of DNA in human diploid cells and that of apes is more or less similar. The banding pattern of human chromosome numbers 3 and 6 are compared with those of particular autosomes in the chimpanzee, which shows a common origin. More over, blood protein test also proves that man

is most closely related to great apes (chimpanzee and gorilla).

132 Which one of the following statements about fossil human species is correct?
[CBSE AIPMT 1997]

- (a) Fossils of *Homo neanderthalensis* have been found recently in South America
- (b) Neanderthal man and Cro-magnon man did exist for sometime together
- (c) *Australopithecus* fossils have been found in Australia
- (d) *Homo erectus* was preceded by *Homo habilis*

Ans. (d)

Homo erectus was a large hominid. It had a length of about 150 to 170 cm (5 to 5.5 feet) with a low but distinct forehead strong browridge and a brain capacity of about 1000 cc. *Homo erectus* was social and living in tribes of 20 to 50 people and thus had a successful and complex culture. It became widespread throughout the tropical and temperate old world.

133 Which one of the following sets includes only the vestigial structures in man?
[CBSE AIPMT 1996]

- (a) Body hair olecranon process, coccyx, patella
- (b) Wisdom teeth, mammary glands, coccyx, patella
- (c) Coccyx, nictitating membrane, vermiform appendix, ear muscles
- (d) Coccyx, body hair, ear ossicles, vermiform appendix

Ans. (c)

Vestigial organs are non-functional, degenerate and rudimentary organs that correspond to fully developed and functional organs of related organisms, e.g. nictitating membranes, muscles of

ear pinna and third molar (wisdom tooth), mammary gland in males, coccyx (caudal vertebrae), vermiform appendix etc.

134 Which one of the following is regarded as the direct ancestor of modern man?
[CBSE AIPMT 1996]

- (a) *Homo erectus*
- (b) *Ramapithecus*
- (c) *Homo habilis*
- (d) Cro-magnon man

Ans. (d)

Homo sapiens sapiens is the modern man evolved about 25000 years ago. The direct ancestor of the living man was the Cro-magnon (*Homo sapiens fossilis*), discovered in 1868 from Cro-magnon rocks of France by 'Mac Gregor' from Holocene epoch. Cro-magnon was emerged about 34000 years ago. It is believed that Cro-magnon man was somewhat more intelligent and cultured than the man of today.

135 Which one is irrelevant to evolution of man?
[CBSE AIPMT 1994]

- (a) Perfection of hand for tool making
- (b) Change of diet from hard nuts/roots to soft food
- (c) Increased ability to communicate or develop community behaviour
- (d) Loss of tail

Ans. (d)

Evolution simply means an orderly change from one condition to another. It is often called descent with modification. Tail provides an evidence of atavism or reversion, i.e. reappearance of certain ancestral characters which had disappeared or were reduced. Tail is absent in man, but occasionally early embryo of man possesses an external tail (vestigial tail vertebrae). In adults the tail is represented by a string of caudal vertebrae, which constitute the coccyx (tail bone).