Chapter 6. Evolution

The Origin of Life and Evidences of Evolution

1 Mark Questions

1.Why are analogous structures a result of convergent evolution?[All India 2014]

Ans.When two species have structures that are similar in function but differ in origin and anatomy are called analogous structures. This is because both move from different areas to a habitat where they adapt themselves accordingly, therefore it is called convergent evolution.

2.Name the type of evolution that, has resulted in the development of structures like wings of butterfly and bird. What are such'structures Called? [Delhi 2014 C]

Ans.Convergent evolution has resulted in the development of structures like wings of butterfly and bird and such structures are called analogous organs.

3.State the significance of the study of fossils in evolution. [Delhi 2012]

Ans.Fossils help us to know the morphological details of the organisms in the past and relate them to the organisms in the present for understanding the process of evolution. We can also trace the time at which the organism existed.

4.State the significance of biochemical similarities among diverse organisms in evolution.[Delhi 2012]

Ans. Similarities in biochemicals such as DNA, helps in deriving the line of evolution. Organisms with more similar DNA sequences are considered close relatives or have evolved from the same ancestor,

5.Write the similarity between the wing of a butterfly and the w*ng of a bat. What do you infer from the above, with reference to evolution?[Delhi 2012]
or
Comment on the similarity between the wings of a cockroach and the wings of a bird. What do you infer from the above, with reference to evolution? [All India 2012]
or
Comment on the similarity between the flippers of dolphin and penguins, with reference to evolution. [Foreign 2012,2009]

Ans.Similarity between the wings of both the organisms is that they perform similar functions. They are thus, analogous organs. With reference to evolution, it can be inferred that these are result of convergent evolution.

6.Name the scientist who disproved spontaneous generation theory.[Delhi 2010]

Ans.Louis Pasteur disproved the spontaneous generation theory.

7.Why are wings of butterfly and wings of bat called analogous?[Delhi 2009]

Ans.They are called analogous because they perform similar functions, but are dissimilar in their development and basic structure.

8.Mention the type of evolution that has brought the similarity as seen in potato tuber and sweet potato.[Delhi 2009]

Ans. Convergent evolution has bought the similarity as seen in potato tuber and sweet potato.

9.Are the thorn of Bougainvillea and tendrils of Cucurbita homologous or analogous? What type of evolution has brought such a similarity in them? [HOTS; Delhi 2009]
or

Are the wing of a bird and the forelimb of a horse homologous or analogous? Name the type of evolution that explains the development of such structures.[Foreign 2009]

Ans.They are homologous. Divergent evolution has brought this similarity in them

10.Name any two vertebrate body parts that are homologous to human forelimbs. [All India 2008]

Ans.Wings of birds and forelimbs of horses are homologous to human forelimb.

11.Name the placental mammals corresponding to the Australian spotted Cuscus and Tasmanian tiger cat, which have evolved as a result of convergent evolution.[All India 2008 C]

Ans.Australian spotted cuscus – Lemur Tasmanian tiger cat – Bob cat.

2 Marks Questions

12.Identify the following pairs as homologous of analogous organs:
(i)Sweet potato and potato.
(ii) Eye of Octopus and eye of mammals.
(iii)Thoms of Bougainvillea and ` tendrils of Cucurbits.
(iv)Forelimbs of bat and whale.[Delhi 2014]

Ans.The given pairs are identified as
(i) Analogous organs.
(ii) Analogous organs.
(iii) Homologous organs.
(iv) Homologous organs.

13.What was proposed by Oparin and Haldane on origin of life? How did SL Miller's experiment support their proposal? [Foreign 2014]

Ans.Oparin and Haldane proposed that life originated on earth sponataneously from non-living matter, i.e. organic molecules. SL Miller conducted an experiment where he created conditions similar to primitive atmosphere, in laboratory such as high temperature, reducing atmosphere consisting of CH_4, NH_3, etc. When he created a electric discharge in the flask containing all of these at 800°C. Organic molecules, e.g. amino acids were formed. This supports the above hypothesis that life could have originated from organic matter.

14.List the two main propositions of Oparin and Haldane. [All India 2013]

Ans. Two main propositions of Oparin and Haldane were

(i) The primitive atmosphere was reducing, i.e.free oxygen was absent.

(ii) There was high temperature, high methane, ammonia and hydrogen gas in the atmosphere.

15.Write the Oparin and Haldane's hypothesis about the origin of life on earth. How does meteorite analysis favour this hypothesis? [All India 2013]

Ans.Oparin-Haldane theory states that origin of life is the result of a long series of physicochemical changes, brought about first by chemical evolution and then by biological evolution.
Analysis of meteorites also revealed the presence of similar compounds as found in the atmosphere, indicating occurrence of similar processes else where in space.

16.Write about the ancestry and evolution of bat, horse and human on the basis of a comparative study of their forelimbs. What are these limbs categorised as? [Delhi 2013c]

Ans.Bat, horse and human (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different function in these animals, they have similar anatomical

structure, i.e. all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs.

17.Divergent evolution leads to homologous stmctures. Explain with the help of an example.[All India 2011 C]

Ans.Divergent evolution is a process where the same structure develops along different directions in different organisms due to adaptations to different needs. Divergent evolution leads to homologous structures, as they all have similar anatomical structure and origin, but perform different functions.
Examples, the thorn of Bougainvillea and tendrils of Cucurbita are homologous organs as both of them are modified stem which perform different functions.

18.Convergent evolution leads to analogous stmctures. Explain with the help of an example. [All India 2011 c]

Ans.Convergent evolution is a process of evolution, where anatomically dissimilar structures in different organisms perform similar functions.
It leads to analogous structures, in different group of organisms as they perform similar function, but are anatomically different,Example, potato (stem modification) and sweet potato (root modification), flippers of penguins and dolphins

19.Mention the contribution of SL Miller's experiments to origin of life.[Delhi 2010]

Ans.SL Miller's experiment provided experimental evidence for chemical evolution. Result of the experiment showed that the first non-cellular forms of life were created about three million years ago. Experiment also demonstrated that non-cellular biomolecule exist in the form of DNA, RNA, polysaccharides and proteins.

20.Why are wings of butterfly and birds said to be analogous organs? Name the type of evolution the analogous organs are a result of. [Foreign 2010]

Ans. Wings of butterfly and birds are analogous structures because they are morphologically different but performs same function.i.e, flying. It occurs due to convergent evolution.

21.What is adaptive radiation? How did Darwin explained this process of evolution? [Delhi 2008 C]

Ans.Adaptive radiation is the process of evolution of different species in a given geographical area starting from a point and radiating to other habitats.Darwin went to Galapagos islands and observed that there were many varieties of finches in the same island. All the varieties evolved on the island itself. Darwin reasoned that after originating from a common ancestral seed eating stock, the finches must have radiated to different geographical areas and undergone adaptive changes in their beaks enabling some to become insectivorous.

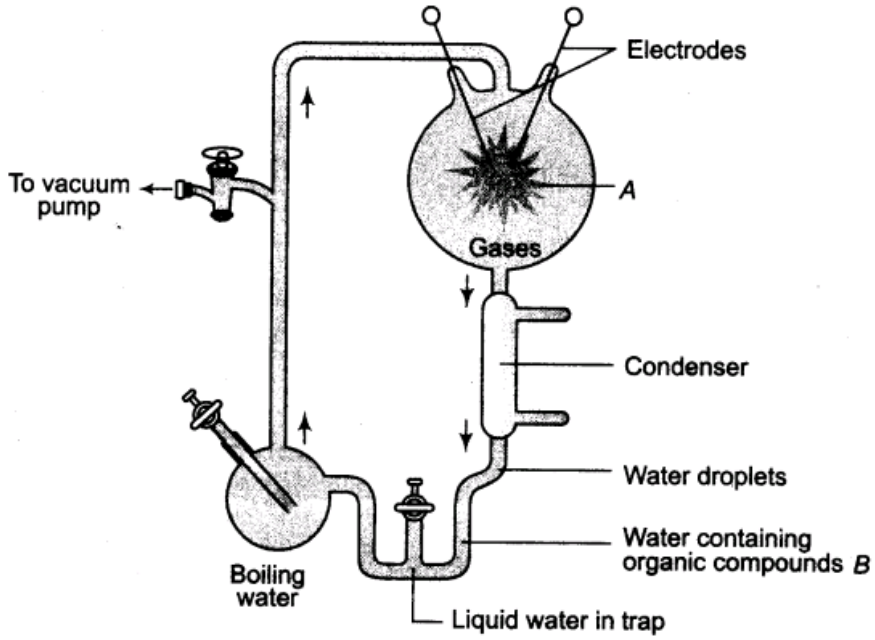
22.(i) Explain adaptive radiation with the help of suitable example.
(ii)Cite an example where more than one adaptive radiations have occurred in an isolated geographical area. Name the type of evolution your example depicts and state why it is so named? [All India 2014]

Ans.(i)The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas or habitat is called adaptive radiation such as alterations in beaks of finches on Galapagos island.

(ii) An example where more than one adaptive radiations have occur in an isolated geographical area is Australian Marsupials, where a number of different marsupials evolved from an ancestral stock but within the isolated Australian island, but adapted to different habitats, e.g. Tasmanian wolf (marsupial) and placental wolf (placental mammals).
The above cited example depicts convergent evolution as these marsupials show development of similar adaptive functional structures in unrelated groups of organisms

3 Marks Questions

23.Given below is a diagrammatic representation of the experimental set-up used by SL Miller for his experiment



(i)Write the names of different gases contained and the conditions set for the reaction in the flask A.
(ii)State the type of organic molecule he collected in the water at B. [Delhi 2013C]
(iii)Write the conclusion he arrived at. [Foreign 2011]

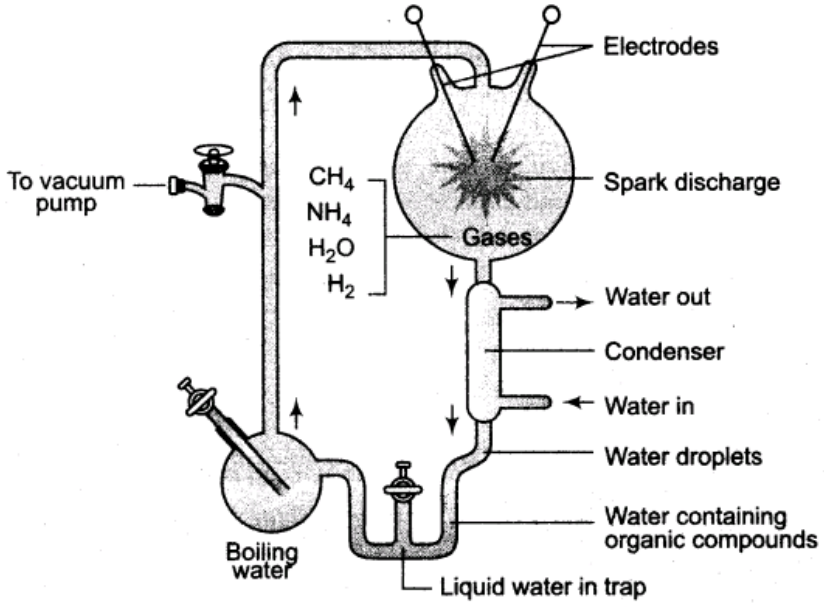
Ans.(i)Gases are methane, ammonia, hydrogen and water vapour. In 'A' flask-electric discharge is created using electrodes.

(ii) The organic molecules collected in water at'B' are amino acids.

(iii) He concluded that life could have come from pre-existing non-living organic molecules and their formation was preceded by chemical evolution.

24.State the theory of biogenesis. How does Miller's experiment support this theory? [Delhi 2012]
or
State the views of Oparin and Haldane on evolution. How does SL Miller's experiment support their views? [Delhi 2011 c]

Ans.The theory of biogenesis was proposed by Oparin and Haldane. It states that 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, i.e. formation of diverse organic molecules from inorganic constituents.



Diagrammatic representation of Miller-Urey experiment

In 1953, Urey and Miller conducted an experiment to prove this theory. They created the conditions of primitive earth-high temperature, volcanic storms, reducing atmosphere containing CH_4, NH_3, etc. at laboratory scale. They then stimulated electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800°C. They observed formation of amino acids. In similar experiments, others observed formation of sugars, nitrogen bases, pigment and fats. These small organic molecules are the building blocks for proteins and other components. Hence, this experiment supported that life has came from pre-existing non-living organic molecules

25.Convergent evolution and divergent evolution are the two concepts explaning organic evolution. Explain each one with the help of an example.[Foreign 2011; Delhi 2010]

Ans. Divergent evolution is a process where the same structure develops along different directions in different organisms due to adaptations to different needs. Divergent evolution leads to homologous structures, as they all have similar anatomical structure and origin, but perform different functions.
Examples, the thorn of Bougainvillea and tendrils of Cucurbita are homologous organs as both of them are modified stem which perform different functions.
Convergent evolution is a process of evolution, where anatomically dissimilar structures in different organisms perform similar functions.
It leads to analogous structures, in different group of organisms as they perform similar function, but are anatomically different,Example, potato (stem modification) and sweet potato (root modification), flippers of penguins and dolphins

26.Explain adaptive radiation and convergent evolution by taking example of some of Australian marsupials and Australian placental mammals. [Foreign 2010]
or
Australian marsupials and placental mammals are suitable examples of adaptive radiation and convergent evolution. Explain giving reasons. [All India 2010 c]
or
(i)What is adaptive radiation?
(ii)Explain with the help of a suitable example, where adaptive radiation has occurred to represent convergent evolution. [Delhi 2009 c]

Ans.The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitat) is called adaptive radiation. Australian marsupials are a good example.
Many Australian marsupials, each different from the other, e.g. kangaroo, sugar glider, etc. evolved from a common ancestral stock, but all within the Australian island continent.
When more than one adaptive radiation occur in an isolated geographical area, it can be called as convergent evolution.
Australian placental mammals also show adaptive radiation in evolving into varieties of such placental mammals, each one of which appear similar to a corresponding marsupial, e.g. placental wolf and Tasmanian wolf, anteater and numbat, etc.

27.Anthropogenic action hasten evolution. Explain with the help of suitable example. [Foreign 2010]

Ans.Human activities' i.e. anthropogenic action are found to enhance evolution.
For example,

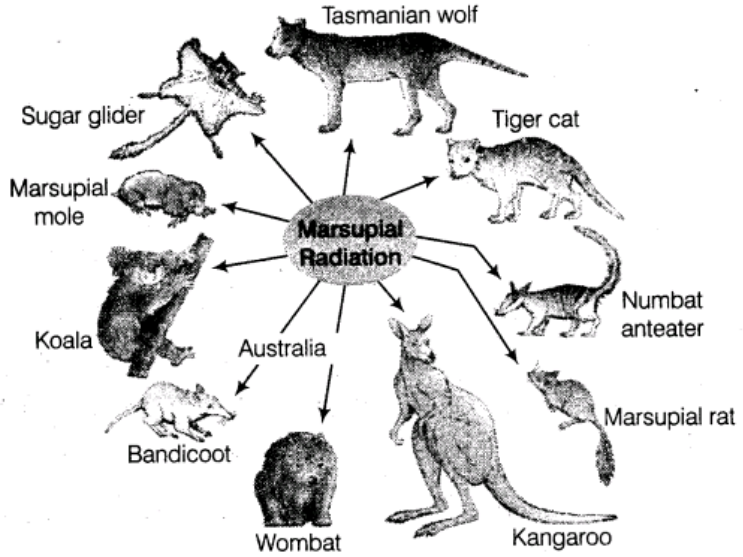
(i) Excessive use of DDT as a fertiliser in crops resulted in evolution of DDT resistant mosquitoes.

(ii) Evolution of antibiotic resistant microbes occur due to overuse of antibiotics.

- When DDT was used first time, many mosquitoes died, but few survived.
- Survived mosquitoes showed resistance to DDT and reproduced in presence of DDT.
- Offspring produced by these mosquitoes were also resistant to DDT.
- Hence, DDT is not affective on mosquito population today

28.(i) Mention the specific geographical region, where these organisms are found.
(ii)Name and explain the phenomenon that has resulted in the evolution of such diverse species in the region.

(iii)Explain giving reasons the existence of placental wolf and Tasmanian wolf sharing the same habitat. [Delhi 2009]



Ans.(i) Australia

(ii) The phenomenon responsible for evolution to such diverse species in the region is the adaptive radiation. It is evolutionary phenomenon in which different species are evolved in a given geographical area starting from a point and literally radiating to other habitats in that area.

(iii) Tasmanian wolf and placental wolf share same habitat since, they exhibit adaptive radiation and evolved into varieties.

29.(i)Write your observations on the variations seen in the Darwin's finches shown below.
(ii) How did Darwin explain the existence of different varieties of finches on Galapagos islands? [All India 2009]
or
Darwin observed a variety of beaks in small black birds inhabiting Galapagos islands. Explain what conclusion did he draw and how? [All India 2009]

Ans.(i)Darwin's finches show variations in beaks due to adaptation to different food habits.

(ii) Darwin's explanation

- All the varieties must have evolved within the same island itself. The original finches were seed-eating. From them, some arose with altered beaks as insectivorous and some as vegetarian finches. .
- This process of evolution of different species in a given geographical area starting from a point and radiating to other habitats is called adaptive radiation.

30.The study of
(i)fossils of dinosaurs.
(ii) forelimbs of cheetah, bat, whale and human.
(iii) thorns of Bougainvillea and tendril of Cucurbita.
Shows that evolution of life forms has indeed taken place on earth. Explain.[Alt India 2008 C]

Ans.(i) **Fossils of dinosaurs** provide palaeontological evidences for evolution. Different aged rock sediments contain fossils of different life forms who probably died during the formation of the particular sediment. Some of them appear similar to modern organisms. They represent extinict organisms (e.g. dinosaurs).

(ii) **Forelimbs of cheetah, bat, whale** and **human** provide evidences from comparative anatomy and morphology. These organisms share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure.

(iii) **Thorns of Bougainvillea** and **tendril of Cucurbita** provide evidences from comparative anatomy and morphology. The thorns of these plants represent homology. They are not anatomically similar structures, though they perform similar functions. Hence, analogous structures are a result of convergent evolution.
These evidences indicate that the evolution of life forms has indeed taken place on earth.

Biological Evolution, Its Mechanism and Evolution of Man

1 Mark Questions

1.What is 'saltation' according to de Vries? [Delhi 2014 c]

Ans.According to de Vries 'saltation' is single step large mutation that means mutation causes species formation

2.State the significance of Coelacanth in evolution. [Delhi 2012]
or
Coelacanth was caught in 1938 in South Africa. Why is it very significant in the evolutionary history of vertebrates? [All India 2010 C]

Ans.The discovery of Coelacanth (lobe fins), first amphibians is significant as they prove that amphibians have evolved from fish-like organisms. Lobe fins were the ancestors of modern day frogs and salamanders.

3.Name the common ancestor of the great apes and man. [All India 2011]

Ans.Dryopithecus is the common ancestor of great apes and man.

4.Mention how is mutation theory of Hugo de Vries different from Darwin's theory of natural selection? [Foreign 2011]

Ans.Hugo de Vries theory It states that evolution occurs due to single step large mutations called saltation, whereas

Darwin's theory states that the speciation occurs gradually through a number of generations, with accumulation of minor variations.

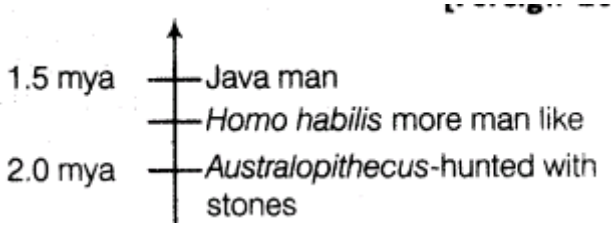
5.What does Hardy-Weinberg equation $p^2 + 2pq + q^2 - 1$, convey?[Foreign 2011]

Ans.It indicates genetic equilibrium which means the allele frequencies in a population are stable and remain constant from generation to generation.

6.When does a species become founders to cause founder effect? [Foreign 2010]

Ans. When the change in the allele frequency is very different in the original drifted population, it becomes founder effect

7.Study the ladder of human evolution given above and answer the following questions.
(i)Where did Australopithecus evolve?
(ii)Write the scientific name of Java man. [Delhi 2010 C]



Ans.(i)Australopithecus evolved in East African grasslands.

(ii) Java man – Homo erectus.

8.According to Hardy-Weinberg's principle, the allele frequency of a population remains constant. How do you interpret the change of frequency of alleles in a population? [All India 2009]

Ans.The change of frequency of alleles will be interpreted as resulting in evolution.

9.What causes speciation according to Hugo de Vries? [All India 2008 C]

Ans. According to Vries, single step large mutation (saltation) caused evolution.

10.Mention the key concepts about the mechanism of biological evolution/speciation according to
(i) de Vries (ii) Darwin. [Delhi 2008 C]

Ans.(i) de Vries He said that mutation caused speciation and hence, called it saltation.

(ii) Darwin Branching descent and natural selection are the two key concepts of Darwin's theory of evolution

2 Marks Questions

11.Explain how natural selection operates in nature by taking an example of white winged and dark winged moths of England [2014 c]

Ans.In England, prior to industrialisation the tree trunks were covered with white lichens, and therefore white moths could survive and got protected from predators due to white colour, whereas black (a dark winged moths) could be easily identified due to dark colour and declined in numbers.

But as industrialisation progressed, the lichens were replaced by soot and dust particles and dark coloured moth were benefitted due to camouflage, while white winged moths could be easily eaten up by the predators being easily identifiable. Thus, only the dark winged moth who were able to fit and survive in conditions reproduced well in nature. This is how natural selection operates in nature.

12.Rearrange the following in increasing order of evolution; Gnetales; Ferns; Zosterophyllum; Ginkgo,[2014 c]

Ans. The increasing order of evolution in plants is as – Zosterophyllum—Ferns—-Ginkgo— Gnetales

13.How is Darwin's concept of evolution different from that of de Vries?[Foreign 2009, 2008]

Ans. Differences between Darwin's concept and de Vries concept:

Darwin's concept	de Vries concept
Variations causes minor heritable changes in characters among the individuals of a species.	Mutations are large differences in the characteristics of organisms, that occur suddenly and causes speciation.
Evolution was gradual.	Evolution occurs in a large single-step mutation.

14.How mutation explained by Hugo de Vries is different from the Darwinian variations? [All India 2009 C]

Ans.Hugo de Vries worked on evening primrose and put forth an idea that large differences arise suddenly in population. He believed that it is mutation which causes evolution and not the minor variations that Darwin talked about. Mutations are random and directionless, while Darwinian variations are small and directional
Evolution was gradual for Darwin, while de Vries believed mutation caused speciation and hence called it saltation (single step large mutation).

15.State Hardy-Weinberg principle of genetic equilibrium. Knowing that genetic drift disturbs this equilibrium mention what does this disturbance in genetic equilibrium lead to?[Foreign 2008]

Ans. Hardy-Weinberg principle states that allele frequencies in a population are stable and remain constant generation after generation.

- Genetic drift refers to the random change in allele frequencies of a population occurring by chance.
- The change in allele frequency may be so different that the population becomes a different species, the original population becomes founders and such an effect, is called founder effect.

16.How does fitness of a population help in evolution? [Delhi 2008 c]

Ans.According to Darwin, fitness ultimately refers to reproductive fitness. Those who best fit in an environment, reproduces well and survive. Hence, they are selected by nature. He called it natural selection and implified it as a mechanism of evolution.

17.Prior to industrialisation, there were for more white-winged moths on trees than melanised moths in England. However, after industrialisation, the distribution pattern of these two kinds of moths reversed. What does the above observation indicate? Explain giving reasons. [All India 2008 C]

Ans. Due to industrialisation in England, the trees became covered with soot and dust particles. As a result, more melanised moths were found because they could camouflage themselves with the blackish environment formed by air pollution.Prior to industrialisation, there were more white-winged moths, because lichens were grown on the tree trunks and the melanic moths were easily detected by the predators. This explains why the distribution of white-winged and melanised moths changed because of industrialisation.

3 Marks Questions

18.Since the origin of life on earth, there were five episodes of mass extinction of species.
(i)How is the 'Sixth Extinction', presently in progress, different from the previous episodes?
(ii)Who is mainly responsible for the 'sixth extinction?
(iii)List any four points that can help to overcome this disaster.[All India 2014 C]

Ans.(i) Sixth extinction is different from previous episodes in following ways:

- It takes place rapidly, i.e. reduction in number of species per unit area per unit time.
- It is accelerated by human activities such as deforestation, industrialisation, etc.

(ii) Human activities that ultimately leads to global warming and disruption of environmental and ecological balance is responsible for sixth extinction.

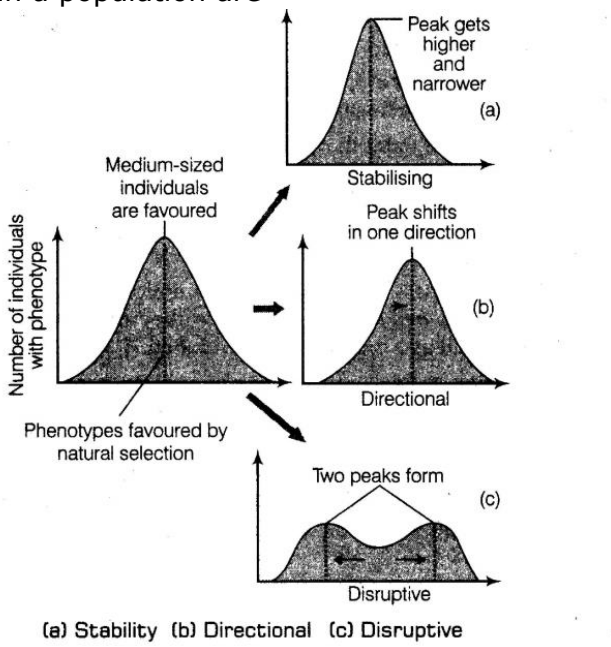
(iii) The four measures that can be implemented to overcome this disaster are

- Afforestation
- Reduction in over-exploitation of natural resources.
- Conservation of species and their natural habitats to minimise their losses.

- Create awareness among people regarding global warming and their consequences

19.Describe the three different ways by which natural selection can affect the frequency of a heritable trait in a population. [Foreign 2014]

Ans.The three different ways by which natural selection can affect the frequency of a heritable trait in a population are



(a) Stability (b) Directional (c) Disruptive

(i)Stabilisation It results in more number of individuals acquiring the mean character value, i.e. variation is much reduced.

(ii) Directional change It results in more individuals acquiring value other than mean character value, i.e. the peak shift towards one direction.

(iii) Disruption In this more individuals acquire peripheral character value at both ends of the distribution curve, i.e. two peaks are formed at periphery

20.Giving three reasons, write how Hardy-Weinberg equilibrium can be affected. [Delhi 2014c]

Ans.Factors which affect Hardy-Weinberg equilibrium are

(i) **Gene migration** Due to migration, new genes or alleles are added to the population and are lost from the old population in turn, changing the frequencies. Migration when happens multiple times, is termed as gene flow.

(ii) **Genetic drift** Changes occurring in frequencies by chance is called genetic drift. Due to changes in allele frequency in new population, some different species are formed. This is called founder effect and the original population is called founder.

(iii) **Mutations** These occur randomly and at very slow rates. They lead to new phenotypes and due to considerable genetic variation, speciation occurs.

(iv)**Recombination** During gametogenesis, crossing over in meiosis leads to new combination of genes.

21.According the Darwinian theory, the rate of appearance of new forms is linked to their life Cycles. Explain. [All India 2014C]

Ans.Darwin's theory states that the fitness of an organism is measured by its reproductive ability. The appearance of new forms is linked to the life span of an organism. The greater the life span, the more it can reproduce and hence, greater new forms would appear. This can be observed in the development of dark-winged moths due to industrial melanism.

22.Explain the increase in the numbers of melanic (dark winged) moths in the urban areas of post-industrialisation period in England. [Delhi 2012]

Ans.This is an example of industrial melanism.

(i) Before industrial revolution in England, there were many white winged/ dull gray moths. Trees were covered with lichens and white coloured moths could survive better due to white colour.

(ii) After industrialisation, more black/melanic moths appeared.

(iii) This may be due to soot covered vegetation which allowed melanic moths to protect themselves by camouflaging.

(iv) It indicated that the organisms which adapt themselves better, survive and reproduce and increase in population.

23.Branching descent and natural selection are the two key concepts of Darwinian theory of evolution. Explain each concept with the help of a suitable example. [All India 2011]24.Explain the three ways in which natural selection operates on different traits in nature.[All India 2011 C]

Ans.Branching Descent

(i) Members of a population vary in characteristics, even though they look superficially similar. Most of these variations are heritable.

(ii) Accumulation of variations over a period of time through a number of generations leads to change in population characteristics.

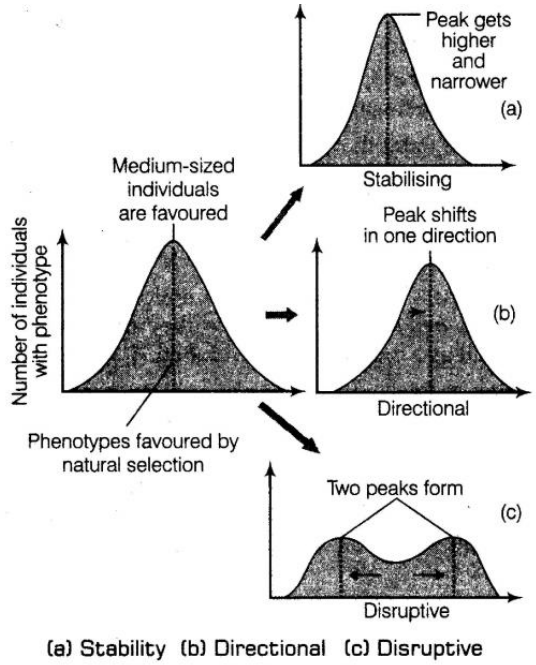
Example: evolution of marsupials of Australia from common ancestor.

Natural selection Nature selects those individuals who are fit in the environment. Fitness according to Darwin is reproductive fitness.
Those who adapt better to the habitat will reproduce' more and progeny consist of more fit individuals, who are selected by nature.

Example : Industrial melanism.

24.Explain the three ways in which natural selection operates on different traits in nature.[All India 2011 C]

Ans. Natural selection is a process in which better dapted individuals are enabled to prod. a a large number of offspring. Natural selection operate in three ways:
The three different ways by which natural selection can affect the frequency of a heritable trait in a population are



(a) Stability (b) Directional (c) Disruptive

(i)Stabilisation It results in more number of individuals acquiring the mean character value, i.e. variation is much reduced.

(ii) Directional change It results in more individuals acquiring value other than mean character value, i.e. the peak shift towards one direction.

(iii) Disruption In this more individuals acquire peripheral character value at both ends of the distribution curve, i.e. two peaks are formed at periphery

25.(i) How does the Hardy Weinberg's expression ($p^2 + 2pq + q^2 = 1$), explain that genetic equilibrium is maintained in a population?
(ii)List any two factors that can disturb the genetic equilibrium. [All India 2010]

Ans.The expression states that the sum total of all the allele frequencies is one. Suppose there are two alleles 'A' and 'a' in a population. Their frequencies are p and q, respectively. The frequency of ` AA'
` AA' individual in a population is $p^2$ . It can be explained that the probability that an allele ` A' with a frequency p appear on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e. p^2. In the same way, the frequency aa is q^2 and for Aa it is 2pq.
$p^2 + 2pq + q^2 = 1$
where, p^2 represents frequency of homozygous dominant genotype,
2pq represents the frequency of the heterozygous genotype and q_2 represents the frequency of homozygous recessive.

(ii) Genetic equilibrium is disturbed by the factors like gene migration, genetic drift, mutation and gene recombination during gamete formation.

26.Discovery of lobefins is considered very significant by evolutionary biologists. Explain. [Delhi 2009 c]

Ans. Lobefins (Coelacanth) were the ancestors of modern day frogs and salamanders. Lobefins are the fish with stout and strong fins, could move on land and go back into water. They lived about 350 mya and become extinct.
In 1938, a fish (Coelacanth) was caught in South Africa. Because no specimen of these are left with us, they evolved into the first amphibians.

27.(i) Rearrange the following in an ascending order of evolutionary tree reptiles, salamanders, lobefin, frogs.
(ii) Name two reproductive characters that make reptiles more successful than amphibians. [Delhi 2009 C]

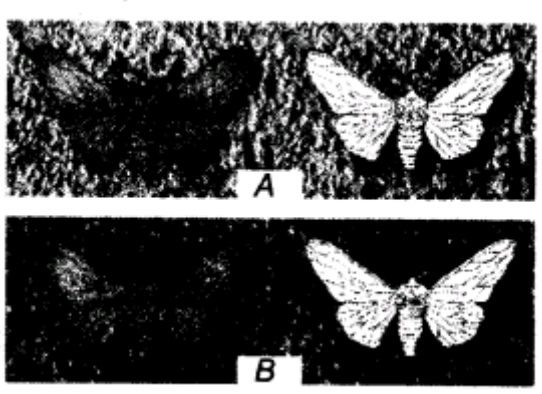
Ans.(i)The ascending order of evolutionary tree is Lobefins -> Frogs -> Salamanders -> Reptiles.

(ii) Features that make reptiles more

successful than amphibians are

- Fertilisation is internal.
- They lay fertilised eggs, covered by a hard calcareous sh&ll in a safe place in the environment.

28.What do these pictures A and B illustrate with reference to evolution? Explain. [Foreign 2009]



Ans. (i)In picture A there is a melanic moth and a white-winged moth on a tree trunk in an unpolluted area.

(ii) In picture B there is a melanic moth and a white-winged moth on a tree trunk in a polluted area. This is an example of industrial melanism.

(i) Before industrial revolution in England, there were many white winged/ dull gray moths. Trees were covered with lichens and white coloured moths could survive better due to white colour.

(ii) After industrialisation, more black/melanic moths appeared.

(iii) This may be due to soot covered vegetation which allowed melanic moths to protect themselves by camouflaging.

(iv) It indicated that the organisms which adapt themselves better, survive and reproduce and increase in population.

29.How did Darwin's theory of natural selection, explain the appearance of new forms of life on earth?
[All India 2008]

Ans.Darwin's theory of Natural Selection

(i) Any population has built in variations for each character which adapt it better to the environment.

(ii)The characteristics which enable some populations to survive better in natural conditions (climate, food, physical factors) would outbreed others (survival of the fittest).

(iii)The population which better fit in an environment will be selected by nature and will survive more (natural selection).

(iv) Adaptability is inherited and fitness is the end result of ability to adapt and get selected by nature.

5 Marks Questions

30.(i) Explain Darwinian theory of evolution with the help of one suitable example. State the two key concept of theory.
(ii) Mention any three characteristics of Neanderthal man that lived in near East and central Asia. [Delhi 2014]

Ans. Darwinian theory of evolution –

(i) Any population has built in variations for each character which adapt it better to the environment.

(ii)The characteristics which enable some populations to survive better in natural conditions (climate, food, physical factors) would outbreed others (survival of the fittest).

(iii)The population which better fit in an environment will be selected by nature and will survive more (natural selection).

(iv) Adaptability is inherited and fitness is the end result of ability to adapt and get selected by nature.

The two key concepts of Darwinian theory are

- Branching descent and
- natural selection

Branching Descent

(i) Members of a population vary in characteristics, even though they look superficially similar. Most of these variations are heritable.

(ii) Accumulation of variations over a period of time through a number of generations leads to change in population characteristics.

Example: evolution of marsupials of Australia from common ancestor.

Natural selection Nature selects those individuals who are fit in the environment. Fitness according to Darwin is reproductive fitness.
Those who adapt better to the habitat will reproduce' more and progeny consist of more fit individuals, who are selected by nature.

Example : Industrial melanism.

(ii) The tree characteristics of Neanderthal man that lived in near East and central Asia are

- Walked upright with bipedal movement.
- Cranial capacity was 1300-1600cc.
- Face slightly prognathous and jaw deep with no chin.

31.(a) Describe Hardy-Weinberg principle.
(b)List any four factors which affect genetic equilibrium.
(c)Describe founder effect.[Foreign 2014]

Ans.(i)According to Hardy Weinberg principle, the allele frequencies in a population are stable and is co'nstant from generation to generation

(ii)The four factors that affect genetic equilibrium are

- Gene migration.
- Genetic drift.
- Mutation and recombination.
- Natural selection.

(iii)Whenever the gene migration occurs multiple times, leading to some changes, that may sometimes result in change in allele frequency (at random or by chance). This different change in ailed leads frequency to a different new sample of population such that they evolve into a different species. Such population are called founders and the effect generated is called founder effect.

32.How does the process of natural selection affect Hardy-Weinberg equilibrium? Explain. List the other four factors that disturb the equilibrium. [All India 2013]

Ans.Natural Selection

(i) It is a process in which heritable variations help survival of an organism, enabling it to reproduce and give rise to large number of offsprings.

(ii)There may be change in the frequency of genes and alleles in the future generations.

(iii)It leads to the formation of new species Hardy Weinberg law states that allelic frequencies in a population are stable and stay constant from generation to generation but natural selection allow only one allele to adapt.

Factors which affect Hardy-Weinberg equilibrium are

(i) **Gene migration** Due to migration, new genes or alleles are added to the population and are lost from the old population in turn, changing the frequencies. Migration when happens multiple times, is termed as gene flow.

(ii) **Genetic drift** Changes occurring in frequencies by chance is called genetic drift. Due to changes in allele frequency in new population, some different species are formed. This is called founder effect and the original population is called founder.

(iii) **Mutations** These occur randomly and at very slow rates. They lead to new phenotypes and due to considerable genetic variation, speciation occurs.

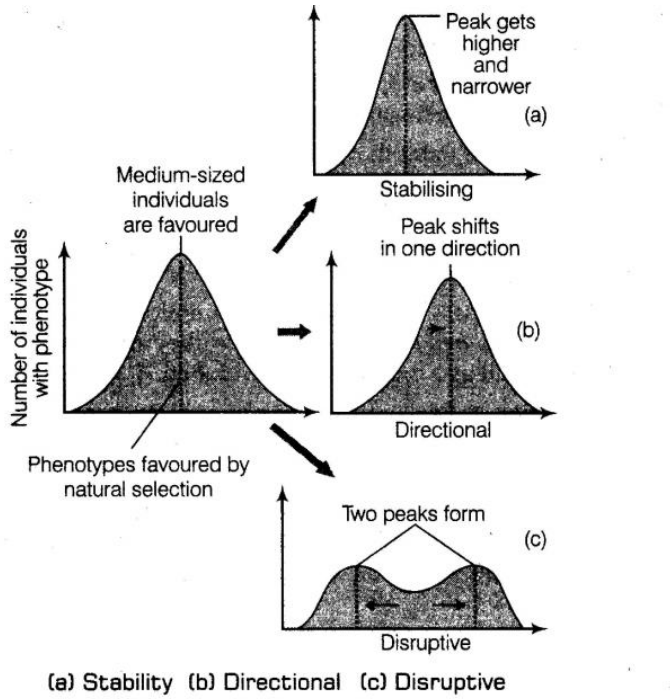
(iv)**Recombination** During gametogenesis, crossing over in meiosis leads to new combination of genes.

33.(i) Explain the process of natural selection that leads to speciation.
(ii) List the three ways in which the process operate in nature. Explain any one of processes. [Foreign 2012]

Ans.(i)Natural Selection

- It is a process in which heritable variations help survival of an organism, enabling it to reproduce and produce large number of offspring.
- Any population has built in variation in characters which adapt it better to the environment.
- The characteristics which enable some populations to survive better in natural conditions (climate, food, physical factors) would outbreed others (survival of fittest).
- The population which better fit in an environment will be selected by nature and will survive more (natural selection).
- Adaptability is inherited and fitness is the end result of ab ‘:ty to adapt and get selected by nature

(ii)Natural selection is a process in which better dapted individuals are enabled to prod. a a large number of offspring. Natural selection operate in three ways:
The three different ways by which natural selection can affect the frequency of a heritable trait in a population are



(a) Stability (b) Directional (c) Disruptive

(i)Stabilisation It results in more number of individuals acquiring the mean character value, i.e. variation is much reduced.

(ii) Directional change It results in more individuals acquiring value other than mean character value, i.e. the peak shift towards one direction.

(iii) Disruption In this more individuals acquire peripheral character value at both ends of the distribution curve, i.e. two peaks are formed at periphery

34.(i) How does Hardy-Weinberg equation explain genetic equilibrium? [Foreign 2012]
(ii) Describe how this equilibrium gets disturbed which may lead to founder effect? [Foreign 2012]

Ans.(i)**Hardy-Weinberg principle** states that the allele frequencies in a population are stable and remain constant from generation to generation, i.e. gene pool is constant or genetic equilibrium or Hardy Weinberg equilibrium is maintained.

It can be explained by following equation $p^2 + 2pq + q^2=1$
Where, p and q are frequencies of different alleles.

(ii) Genetic Drift

- It refers to the changes in allele frequencies that occur only by chance events.
- Sometimes the change in an allele frequency is so different in the new sample of population, that they become a different species.
- Originally drifted population become the founder and such an effect is called founder effect.

35.(i) Name the primates that lived about 15 million years ago. List their characteristic feature.
(ii) (a) Where was the man-like animal found? [Delhi 2011]
(b)Write the order in which Neanderthals, Homo habilis and Homo erectus appeared on the earth. State the brain capacity of each of them.
(c)When did modern man Homo sapiens appear on this planet?[Delhi 2011]

Ans.(i) Dryopithecus and Ramapithecus are the primates that lived about 15 million years ago. Their characteristics are

- They were hairy.
- They walked like gorillas and chimpanzees.

Dryopithecus was more ape-like whjle Ramapithecus was more man-like.

(ii) (a) The man like animal was found in East African grasslands.

(b)Homo habilis, Homo erectus and Neanderthal had brain capacities of 650- 800cc, 900cc and 1400cc respectively.

(c)During ice age between 75000-10000 years ago modern man Homo sapiens appeared on this planet

36.Explain the salient features of Hugo de Vries theory of mutation. How is Darwin's theory of natural selection different from it? Explain. [Delhi 2011]

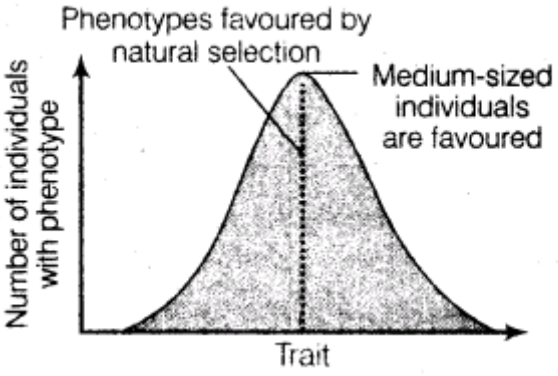
Ans.Hugo de Vries explained that new species arise from pre-existing ones in a single generation by a sudden appearance of marked differences called mutations. He believed that it is mutation which causes evolution.

de Vries theory	Darwin's theory
Evolution resulted from mutation.	Evolution resulted from variations.
Evolution was sudden.	Evolution was gradual.
Mutations are random and directionless.	Variations are small and directional.

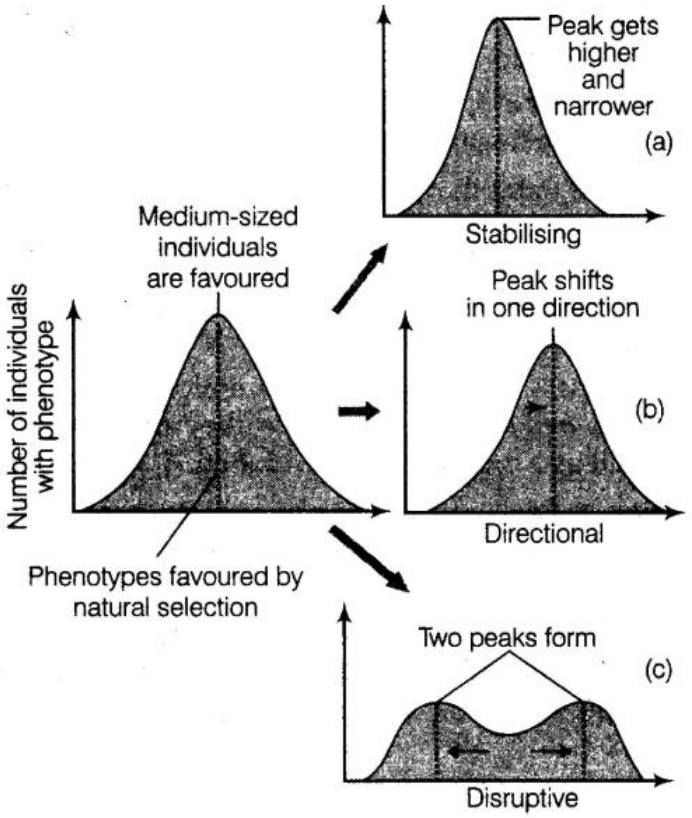
37.(i) Natural selection operated when nature selects for fitness. Explain,
(ii) The rate of appearance of new forms is linked to the life span of an organism. Explain with the help of a suitable example. [Delhi 2010]

Ans.(i)The members of a population vary in characteristics even though they look similar. The population will increase exponentially but the natural resources are limited leading to more competition. The individuals which are fit and adapt themselves are able to survive. They grow reproduce and survive. This is called natural selection by Darwin.
(ii)Darwin's theory states that the fitness of an organism is measured by its reproductive ability. The appearance of new forms is linked to the life span of an organism. The greater the life span, the more it can reproduce and hence, greater new forms would appear. This can be observed in the development of dark-winged moths due to industrial melanism.

38.(i) Write Hardy-Weinberg principle.
(ii) Explain the three different ways the natural selection can affect the frequency of a heritable trait in a population shown in the graph given below. [Delhi 2010]



Ans.(i)According to Hardy-Weinberg principle, the gene pool in a population remains constant. It means, the allele frequencies in a population are stable and constant from generation to generation. This is called genetic equilibrium
(ii)(ii)Natural selection is a process in which better dapted individuals are enabled to prod. a a large number of offspring. Natural selection operate in three ways:
The three different ways by which natural selection can affect the frequency of a heritable trait in a population are



(a) Stability (b) Directional (c) Disruptive

(i)Stabilisation It results in more number of individuals acquiring the mean character value, i.e. variation is much reduced.

(ii) Directional change It results in more individuals acquiring value other than mean character value, i.e. the peak shift towards one direction.

(iii) Disruption In this more individuals acquire peripheral character value at both ends of the distribution curve, i.e. two peaks are formed at periphery

39.(i)Explain taking one example of vertebrates anatomy that evolution of life has occurred on earth.
(ii) 'Nature selects for fittest.' Explain with suitable examples. [All India 2009 C]

Ans.(i)The forelimbs of cheetah, bats and human have a similar anatomical structure. These have bones, humerus, radius, ulna, carpals, metacarpals and phalanges. It indicates divergent

evolution, where the same structure has developed along different directions as adaption to different ` needs.
Such structures are called homologous organs and homology indicates common ancestry.

(ii)The members of a population vary in characteristics even though they look similar. The population will increase exponentially but the natural resources are limited leading to more competition. The individuals which are fit and adapt themselves are able to survive. They grow reproduce and survive. This is called natural selection by Darwin.