

chapter-24	555	Evolution
chapter-24		Evolution
Q1 what is evolution. Discuss the concept of evolution.		
Answer: Evolution:		
<u>Meaning :-</u> Evolution mean unfolding or a variety of changes that occur over time, or - uncoiling.		
<u>Definition :-</u> Gradual change in characters of a population over the course of generation through a long period of time is called Evolution.		
<u>Explanation :- <concept of Evolution></u>		
The origin of life on earth and the concept of evolution has been most attracting and complicating problem for the biologist. Various concept have been forward to explain the origin of life and the concept of evolution. like the theory of special creation, spontaneous evolution theory, cosmozoic theory, Biochemical (organic) evolution theory, etc. i.e -		
<u>Concept-1: Scala Naturae :- <Ladder of Nature></u>		
<u>Aristotle :-</u> This concept was proposed by Aristotle (384-322BC)		
<u>Main points :-</u>		
1: - According to this concept all living organisms (that he encountered) are fit into in orderly scheme, later called the scala naturae or ladder of nature.		
2: - This ladder is placed over non-living matter.		
3: - Each rung of the ladder represents a particular group of organisms.		
4: - Scala naturae was considered to be permanent and		

chapter-24	556	Evolution
never change. each organism has its own permanent place in the ladder of nature represented by rung which is ordained by God during their creation at the past. <u>Classification of organisms :-</u> Like climbing a ladder is - starting from lower organisms like - Fungi, mosses, mollusks, and insects. Then these small organisms are followed by complex organisms like plants and animals and finally the most complex human on the top rung of the ladder. <u>Concept-2: Creationism :</u> <u>Theory of special creation :-</u> creationism is also called theory of special creation. according to this concept God create all living thing and the whole universe by its own supreme natural power. This concept explain that the whole universe was created in 6-days. <u>European naturalists :-</u> After discovery of lands of - Africa, asia and america, the european naturalists found that the diversity among organisms is much greater than expectations of humans. There were some exotic species which had similarities but they also had some variations. These variations in species lead some naturalists that species may not remain unchanged and could undergo changes. - perhaps these species having some similarities had common ancestors. This argument was supported by the discovery - of fossils. i.e. -		

chapter-24	557	Evolution
<u>Fossil discovery</u> :- Fossil record of organisms showed that fossils found in lowest and oldest rock layers were different from modern species, However fossils found in upper and younger rock layers were not much different from modern species. It shows that there were ladder of nature - stretching back in time.		
<u>concept-3: catastrophism</u> :- (تباہ کنیت)		
<u>George cuvier</u> :- Catastrophism concept was 1st proposed by George cuvier (1769-1832). According to him, a vast supply of species was created in the begining. But - successive catastrophs destroyed many species into fossils. The flora (plants) and fauna (animals) of the modern world are the species that remained protected from the catastrophs and therefore survived. (ETEA-2014)		
<u>Louis Agassiz</u> - (1807-1873) :- Louis Agassiz proposed that there was new creation after each catastrophe. Thus the modern species result from the most recent - creation. It means after catastrophe, the specie remained had undergone dramatic changes and changed into modern spp.		
<u>concept-4: uniformitarism</u> : (ETEA-2014)		
<u>Hutton and Lyell</u> :- This concept was proposed by j-Hutton (1726-1797) and Charles-Lyell (1797-1875).		
<u>Main points</u> :- 1: - uniformitarism means that ratio of catastrophism is uniform.		

- 2: They wrote that catastrophes in the form of flood, wind, earthquake, volcanoes, creating series of layers on earth when occur repeatedly which means that the frequency of catastrophism is same every time.
- 3: These layers of rocks are evidence of ordinary natural - processing occurring repeatedly over a long period of time, which proves that earth is primitive.
- 4: According to Hutton and Lyell, the earth was eternal (etis) i.e - no vestiges of a beginning, no prospect (ukel) of an end. But this non-convincing and evolution will occur continuously.

Concept-5: Lamarckism:

Lamarck :- This concept or theory was proposed by a biologist - Lamarck (1744-1829).

Main points :- 1:- This concept believed on the inheritance of acquired characters

- 2: He also proposed principles of use and disuse of organs.
- 3: Lamarck posposed that organism an innate drive or struggle for perfection. During this struggle they acquire certain characters and then pass these characters to their offsprings which cause a dramatic change in a species i.e → Evolution.

Concept-6: Darwinism: (ETEA-2020)

Charles Darwin :- This concept was proposed by C. Darwin 2: (1809-1882)

Main points :- 1:- According to Darwin, evolution is a slow process and new species arise slowly and gradually due

chapter-24	559	Evolution
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to the accumulation of useful-variations and natural selection

2: This concept believed on natural-selection, that nature - select the best and reject the unfit organism.

3:- This also believed on struggle for survival in the environment

Q2 Discuss the evolution of eukaryotes from prokaryotes:

Answer: Evolution of Eukaryotes from prokaryotes:

Introduction :- The first cells were most likely very simple prokaryotic forms. The prokaryotes might have arisen more than 3.5-billion years ago. Fossils records indicate that eukaryotes evolved from prokaryotes somewhere between 1.5 to 2 billion years ago.

Hypothesis :- There are two main hypothesis proposed for the evolution of eukaryotes from prokaryotes. i.e.-

1: Endosymbiosis Hypothesis :- (ETEA-2020)

Lynn Margulis :- This idea was first given by Lynn Margulis and is known as endosymbiotic hypothesis in which two - separate mutually beneficial invasions of a prokaryote cell - produced the modern day mitochondria and chloroplast as - eukaryotic-organelles.

Explanation :- (ETEA-2007)

1: Ancestral mitochondria :- According to endosymbiotic-hypothesis, ancestral mitochondria were small heterotrophs which capable of using oxygen to perform cellular-respiration

chapter-24	560	Evolution
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and thereby create useful energy. Then they became part of a large cell either by direct invasion as an internal - parasite or as an indigestible food source and become mitochondria.

2: Ancestral chloroplast :- A second invasion brought the ancestral chloroplast, which are thought to be a small, - photosynthetic cyanobacteria

Modern concept :- modern - concept support the evidence for endosymbiosis which shows that both the mitochondria and chloroplasts have their own - genes, circular-DNA, RNA, and reproduced by binary fission without the host life cycle. Therefore they appear to be more similar like - prokaryotes than eukaryotes.

2: Membrane infolding Hypothesis :-

Introduction :- Another hypothesis regarding the evolution of eukaryotic cell is called membrane infolding hypothesis. According to this hypothesis the prokaryotic cell membrane are large and invaginated which help in the formation of several double membrane entities or organelles in a cell, or - It is also suggested that continued membrane infolding

The diagram illustrates the endosymbiotic theory. It is organized into three horizontal sections representing different taxonomic groups: MONERA, PROTISTA, and PLANTS ANIMALS. In the MONERA section, 'Aerobic bacteria' and a 'Prokaryote host (mycoplasma)' are shown. An arrow points from these to the PROTISTA section, where 'Mitochondria containing Amoeboid' and 'Ancestral flagellates (protozoa, fungi)' are depicted. Another arrow points from the PROTISTA section to the PLANTS ANIMALS section, where 'Plants' and 'Animals' are shown. A separate arrow points from 'Blue green algae' in the PROTISTA section to 'Plants' in the PLANTS ANIMALS section. A third arrow points from 'Spermactes' in the PROTISTA section to 'Animals' in the PLANTS ANIMALS section.

Chapter-24	561	Evolution
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created the endomembrane of mitochondria and chloroplast.

Explanation :- Due to invasions of the host prokaryotic cell were successful because the host membrane surrounded from both invading prokaryotic cell (i.e. mitochondria, chloroplast) and then they easily transport to host cell and cell-membrane can not dissolved. as a result second membrane is created around the protomitochondria and protochloroplast.

Modern concept :- According to modern concept the inner-membrane of both mitochondria and chloroplast contain the similar structure like prokaryotes than eukaryotes, whereas the outer membrane remains eukaryotic characteristics. similarly due to continued infolded of membrane the endo-membrane system are created.

conclusion :- Due to above changes and similarity, it is said the first eukaryotic cell is possible develop from prokaryotic-cell.

Q3 Describe the mechanism of evolution as proposed by Lamarck or Discuss Lamarckism.

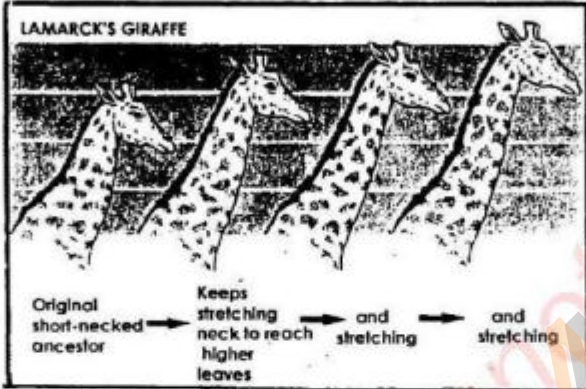
chapter-24	562	Evolution
<u>Answer: Lamarckism :</u>		
<u>Lamarck (1744-1829) :-</u> The first theory about organic evolution was proposed by French Jean Baptiste Lamarck who was first a soldier then Botanist and finally a - professor of zoology in paris.		
<u>Book :-</u> His famous book - philosophic zoologique, in which theory of inheritance of acquired characters or lamarckism was published in the year 1809.		
<u>Lamarckism theory :-</u> He was of the view that acquired characters developed by organisms during lifetime are - transferred to their offsprings.		
<u>Acquired characters :-</u> modification in structure or function acquired by an organism during its life, caused by - environmental factors is called acquired characters.		
<u>Explanation of Lamarckism theory :-</u> i.e. -		
<u>1: Use and Disuse of organs :-</u> Lamarck argued that every organism is adjusted to its environment. whenever the - environment changes the organism acquires new needs. In order to satisfy these needs some of the organs are put to greater use and other to lesser use or no use. consequently, the organs which are used the most become larger and - stronger while the others are reduced in size and weak.		
<u>Example : 1: Giraffe Limbs and neck: (use of certain organs)</u>		
The ancestors of giraffe were grazers and feed upon		

Chapter-24	563	Evolution
surface grass, However, climate changes and no further grass were available on ground. in order to fulfill their needs they have started to feed upon small shrubs and then trees to reach these shrubs and trees they were compelled to stretch their necks and limbs. as a result of this elongation of neck and forelimbs has taken place. according to him all these useful characters are heritable.		
ii: <u>Snake limbs:-</u> (<u>Disuse of certain organs</u>) - According to Lamarck ancestors of snake were having limbs just like other reptiles, However their limbs started to disappear. The main reason behind this was the appearance of certain mammals (e.g. weasels) which were their predators. In order to protect themselves they started to crawl and conceal in which limbs create lot of hurdles. now they have started to live in burrows in order to conceal, this result in reduction and loss of limbs.		
2: <u>Inheritance of acquired characters:-</u> According to Lamarck the characters which are acquired through use or disuse are inherited. This process continues until after many generations the organism is so changed that it become a new species. It means that the environment can directly change the species.		
<u>Objection on Lamarckism :-</u> However, we now know that the acquired characters cannot be inherited because these do not affect the DNA of reproductive or germ cells according to the		

chapter 24 564 Evolution

- principle of - genetics -

LAMARCK'S GIRAFFE



Original short-necked ancestor → Keeps stretching neck to reach higher leaves → and stretching → and stretching

Q4 Explain Darwins theory of evolution by natural selection

-OR- The darwin-wallac theory of evolution.

Answer: Darwinism :-

Life span :- Charles Darwin was an English naturalist. He was born in Feb; 19, 1809 in England. He died in 19-April 1882.

Father of Evolution :- Charles Darwin was pioneer of - evolution known as father of evolution on the basis of his Theory of natural-selection.

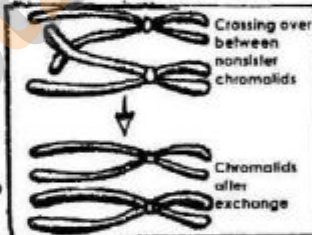
Darwin voyage :- After graduation from Cambridge, Darwin was appointed as a naturalist by professor - Henslow on the ship Beagle, which had to make a 5-year cruise round the world, preparing navigation-charts for British navy. Darwin made a voyage around the South American coast and the - Island of the Pacific from 1831 to 1836. During his voyage Darwin observed diverse forms of species of animals and plants. These animals were adapted to their environment. e.g. -

Chapter-24	565	Evolution
1: The Flora (plants) and Fauna (animals) of South America were apparently different from that of Europe. 2: He was surprised to see the diversity of giant Tortoises and Finches (birds). He observed that Tortoises of one island were totally different from another island. 3: The common birds of the Galapagos islands were the Finches that were remarkably different from the Finches of the mainland in respect of beaks shape, size and feeding on different diets. ← (ETEA-2018) <u>Receptions of Darwin :-</u> After his return to England in 1836, Darwin perceived as below - 1: The origin of new Species and adaptations are closely related & processed. 2: A new Species would arise from an ancestral form by the gradual accumulation of adaptations to different environments following geographical isolation. 3: After many generations the two populations would become so different to be designated as separate species. This would have happened to the Galapago - Finches. <u>Book :-</u> In 1859, Darwin publish his information in the form of book the name of this book was - origin of species. <u>Darwin - Wallace theory of evolution :</u> <u>Introduction :-</u> The long delayed publication of Darwin's on the origin of Species by means of natural selection in 1859 was catalyzed by Alfred Wallace who independently arrived		

chapter-24	566	Evolution
at the theory of natural-selection, working in the east india		
<u>Explanation :-</u> The salient features of Darwin-Wallace theory are.		
<u>1: over production :</u>		
<u>Reproduction :-</u> The population size of all organisms rapidly increase by reproduction. In other word, all the organisms produce offsprings in far greater number than can possibly survive.		
<u>Environmental resources :-</u> Since environmental resources (e.g- Food, space, water, etc) are generally limited so - limited of offspring survive due to competition on these resources.		
<u>2: Struggle for existence :-</u> Over-production naturally leads to a severe competition among the individuals of a population for necessities of life which was called by Darwin as the Struggle for existence. The struggle of existence aims at self-preservation and self-perpetuation ($\langle \frac{1}{2} \rangle$).		
<u>competition for resources :-</u> Such competition may involve struggle for - food, space, mates and other necessities of life or against adverse climatic-conditions of environment.		
<u>Types of struggle for existence :-</u> Struggle may be -		
<u>i: Intra specific struggle :-</u> This struggle is between the - same kind of species or closely related forms.		
<u>ii: Inter specific struggle :-</u> This struggle is between the - different kinds of species, living together.		
<u>iii: Extra specific struggle :-</u> This is the struggle against the severe climatic conditions such as, - light, temp; space, water.		

chapter-24	567	Evolution
<u>3: Variation :-</u> individuals have great variation of form, size, colour, habit and physiology among themselves. Even identical twins are not identical in genes, different gene may be mutated in them. according to Darwin variation is heritable and form the raw material for evolution. - variations may be harmful, neutral or useful. <u>Types of Variation :-</u> variations are two types i.e - i: <u>Harmful variation :-</u> Those variations in organisms which give them damage and keep them in disadvantage are called Harmful variation. It decreases the population or species. ii: <u>Useful variations :-</u> Those variations which provide advantage to the possessor over other and therefore increase the chance of survive. <u>4: Natural selection :-</u> < <u>Survival of fittest</u> > <u>Struggle for survive :-</u> In this competition the individual with more useful variations are better adapted to their environment and hence remain alive in the struggle for existence. In other word, nature selects such organisms for survival and future reproduction and weeds out the others. <u>Survival of fittest :-</u> Darwin called it - natural selection while Herbert spencer used the term - Survival of fittest. Thus the fittest are automatically selected and the unfit are eliminated by nature. <u>5: Speciation : origin of species :-</u> <u>Transmission of useful variation :-</u> The natural selection helps a species to adapt to its changing environment. The operation		

Chapter-24	568	Evolution
of natural selection generation after generation leads to accumulation of more and more favourable variations in the succeeding generations. <u>New Species formation</u>:- The accumulation of variations - through large number of generation leads to evolution of new species. The process of evolution is also called "Descend with modification through times."		
Q5 Explain Neo-darwinism and the Modern synthesis concept.		
<u>Answer</u> : Neo-darwinism and the modern synthesis:		
<u>Introduction</u> :- Those scientists who follow Darwin - theory are called Neo-darwinism. Due to some objection on Darwin theory, These scientists modified Darwin theory in the light of population genetics. They collectively proposed a theory called Modern synthetic theory. These scientists are - Mayer, Simpson and cheverikov.		
<u>Modern synthesis concept</u>:- Neo-darwinism is also called synthesis because it includes discoveries and ideas from many different fields of biology including - paleontology, Taxonomy, Biogeography, Ecology, Ethology, and the population genetics.		
<u>Causes or factors of evolution</u>:- i.e.-		
<u>1: Gene and chromosomal mutation</u>:-		
<u>Mutation</u>:- Any change in the gene or DNA or chromosome which changes the phenotypic-expression of gene is called mutation. mutations are very rare and most mutations are harmful.		

Chapter-24	569	Evolution
<u>Variation</u> :- Both gene and chromosomal mutation can bring about variations. These variations can lead to evolution or changes in offspring characters.		
2: <u>Genetic recombination</u> :-		
<u>Reshuffling of genes</u> :- Reshuffling of genes occurs in sexual reproduction is called genetic-recombination. meiosis causes random assortment of genes during synapsis and rearrangement of paternal and maternal chromosomes in both sperm and egg. These gametes unite to form zygote which have changed gene combination and form individual which is different from parents.		
<u>Crossing over</u> :- Moreover crossing over of genes during meiosis also leads to the appearance of new genetic combination in organism. This new genetic combination of old genes produce new character-new genetic variability and thus evolution.		 Crossing over between non-sister chromatids Chromatids after exchange
3: <u>Natural selection</u> :- Natural selection uses both variation and mutation as raw-materials for better survival of a spp.		
<u>physical and biotic factors</u> :- Natural selection includes - physical (abiotic) and biotic - factors to determine how and in which direction an organism is going to change. It enables the organism to fit in its changed environment.		
4: <u>Genetic Drift</u> :-		

Chapter-24	570	Evolution
<u>Definition</u>:- change in gene frequency of a small population purely by chance is known as genetic drift. <u>Mutation in new environment</u>:- when a species moves from its original home into a new area, the individuals are not fully suited to the new environment. They are thus exposed to mutations with their gene-pool markedly different from the parent-population, which makes it best suited in new environment. as a result new species formation occur. Therefore genetic-drift determines evolution. <u>5: Reproduction Isolation</u>:- It is one of the most important factors of evolution. It does not allow the interbreeding - among the individuals of different species. It has been observed that closely allied species are intersterile because of differences in their copulatory organs. <u>Formation of new Species</u>:- Reproduction isolation helps in splitting of the species and helps in the formation of new - species. Thus it leads to evolution. Q6 Describe the different evidences of evolution. <u>Answer: Evidences of evolution</u>:- Evolutionary biologist - proposed the following evidences in favour of evolution - which clearly explain that how the new species evolved by descent with modification from a common ancestor. i.e -		

Chapter-24	571	Evolution
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1: Evidence from comparative anatomy:- The study of internal structure is called anatomy. among the class vertebrata, the internal structure of pentadactyl-limb was explain as a anatomical evidence. for evolution.

The following two terms will clear the evidence.

1: Homology : (ETEA, 08, 11, 14)

Definition :- Those organs which have same structures but perform different functions are called Homologous organs and this phenomenon is called Homology

Example :- Human hand, Bat's wings, Horse legs and Dolphin flippers are having same number of bones, muscles, nerves, and blood vessels arranged in the same pattern with similar mode of developments but they perform different functions i.e-

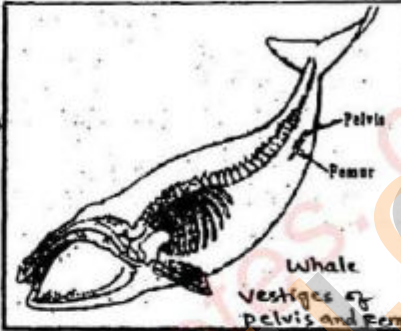
- 1: Human arms are used for grasping.
- 2: Bat's wings are used for flying.
- 3: Horse legs are used for running.
- 4: Dolphin flipper are used for swimming.

Conclusion :- This evidence of homology show that all the above animals have evolved from a common ancestor and therefore favour divergent evolution.

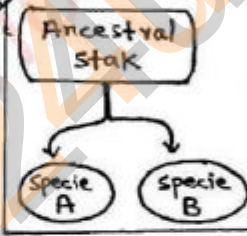
ii: Analogy :- (ETEA-2020)

Chapter-24	572	Evolution
<u>Definition :-</u> Those organs which have different structures but perform same function are called analogous organ and this phenomenon is called analogy. <u>Example :-</u> Bat wings, Bird wings, butterfly wing - all are totally different from each other in anatomy but all these perform same function i.e - Flying. <u>Conclusion :-</u> Analogous organs support convergent evolution because all the above organisms have brought similar changes in their bodies according to the need of new environment. <u>2: Fossil Evidence :</u> <u>Fossil :-</u> A fossil is the hard remains of a prehistoric - animal or plant that are found inside a rock. <u>Paleontology :-</u> The study of fossils is called paleontology. <u>Explanation :-</u> Fossil record shows that there is a gradual change from ancient organism through intermediate stages to modern organism which is a strong evidence for evolution. Fossils are present in rocks in various layers. The fossils from the uppermost rock layers are most like current forms while the fossils from the deeper layers are the ancestors of modern forms. <u>Example :- 1- Horse :-</u> Fossil record of horse shows that - initially horse was of the size of a dog but evolved into the present day form through many intermediate stages. <u>2:-</u> Giraffes, mollusks and elephants also show such -		

chapter-24	573	Evolution
Series of evolution. 3: <u>Archaeopteryx</u> :- Fossil of Archaeopteryx (fossil bird) was discovered from rocks of East - Germany. This bird possess both avian and reptilian characters. This show that birds are evolved from reptiles. 3: <u>Evidence from Vestigial organs</u> :- <u>Vestigial organs</u> :- Some species have certain homologous structures which are highly reduced and functionless. These are the oldest homologous structures and are called vestigial organs. <u>Convincing evidence of evolution</u> :- presence of vestigial organs is the most convincing evidence of evolution. The presence of such organs can be explained only on the basis that they are the vestiges (remnants) of the organs which were well developed and functional in the ancestors and are now on their way to disappear in future generation, because environmental change made the organ unnecessary for survival and the organ gradually become non-functional and reduced in size. (ETEA-2005) <u>Example : i - in Human</u> :- Some of the example of vestigial organs in human beings are - Nictitating membranes of eyes, Appendix, Coccyx (Tail bone), Mammary glands of male, muscles of ear and nose, Wisdom tooth, pointed canine, Third molar, Hair on chest region, segmental-muscles on abdomen, etc. <u>ii: In whale</u> :- whale has vestiges of hind limbs and pelvic -		

chapter-24	574	Evolution
girdle buried in the flesh, where its tail begins.		
iii: <u>In Snakes</u> :- Snakes (e.g python) has tiny bony structures beneath the skin which are the remains of ancestral hind limb.		
4: <u>Evidence from biochemistry</u>:		
This is the most convincing evidence for evolution from a common ancestry. All living organism exhibit similarity in biochemistry. This also proves that evolution has take place.		
For example: i:- <u>protoplasm</u> :- The protoplasm of all living organisms has roughly the same composition and proposties.		
ii:- <u>DNA and RNA</u> :- The DNA and RNA show remarkable similarity in structure and functions in all organisms.		
iii:- <u>protein synthesis</u> :- The process of protein-synthesis is essentially identical in all living organisms.		
iv:- <u>ATP</u> :- The occurance of ATP as the same mechanisms for trapping and transforming energy in all organisms.		
5: <u>Evidences from molecular biology</u> :- — Exercise Question		
Almost all living organisms use the same basic biochemical molecules including— DNA, ATP and protein.		
For example:- i:- <u>Amino-acid</u> :- almost all living organism utilize the same 20-amino-acids in their proteins.		
ii:- <u>DNA and RNA</u> :- DNA and RNA are the mechanisms for		

Chapter-24	575	Evolution
inheritance and gene activity in all organism are same.		
iii:- <u>Genetic code</u>:- The structure of the genetic code <Triplet codon> is almost identical in all living organisms.		
iv:- <u>Cytochrome-c and a</u>:- cytochrome-c and a are respiratory proteins used in the electron transport system of all aerobic-organisms.		
<u>Conclusion</u>:- This uniformity in biochemical-organization underlies the diversity of living things and points to evolutionary-relationships.		
<u>6: Evidences from Embryology</u>:-		
<u>Karl von Baer</u>:- According to an embryologist named Karl - Von Baer, even the great adult vertebrates differ from one another yet their embryos resemble one another and provide an evidence of evolution.		
<u>For example</u>:- 1:- all multicellular animals begin their life from unicellular zygote.		
2: The zygote forms - morulla, blastula, and gastrula by cell Division. These stages of formation of morulla, blastula and gastrula are similar in all metazoan including man.		
<u>Von Baer theory of Recapitulation</u>:- This theory states that every organism during its development repeats ancestral character.		
<u>Haeckel biogenetic law</u>:- This law states that ontogeny - repeats phylogeny. Here ontogeny is the developmental stages and phylogeny is the evolutionary history of an organism. In - other words, Haeckel biogenetic law say that in during -		

chapter-24	576	Evolution
development, each individual tends to climb to its own family tree. <u>Example :-</u> According to Haeckel, Zygote is supposed to be unicellular ancestor and gastrula is a diploblastic ancestor.		
Q7 Explain Divergent and convergent Evolution.		
<u>Answer:</u> Divergent and convergent evolution :		
<u>1: Divergent evolution :-</u> (adaptive radiation)		
<u>Definition :-</u> The type of evolution in which two species evolve from same common ancestry due to diversity in environment is called Divergent evolution or adaptive radiation.		
<u>Explanation :-</u> This type of evolution occurs when two or more related species become more and more dissimilar due to different environment. Divergent evolution involves - splitting of ancestral-groups into several new groups. But such divergent or new species leaving clues to their history of ancestry in the fine structure of their adaptations.		
<u>Example :-</u> examples of divergent evolution are given below -		
<u>i: Homology :-</u> The term homology means similarity due to same development pathway. Homology insists that all the structures have common embryonic origin. so Homologous organs are the example of divergent evolution.		
<u>ii: Red fox and kit fox :-</u>		
<u>1:</u> Red fox and kit fox have undergone divergent evolution.		

Chapter-24	577	Evolution
2: Both are foxes with common ancestors but red fox lived in farmlands while Kit-fox lived in deserts and plains. 3: Red fox that lived in farmlands and forests adopted characters according to its own environment and its body colour is - changed such that it can help it to hide in plants both from prey and predators. 4: on the other hand, Kit fox lived on plains and deserts and acquired such body colour (e.g-sandy) which helps it to conceal from predators, further more kit-fox has larger ears than red fox which help it to get rid of extra heat in desert. 2: <u>convergent evolution</u> : < <u>parallel evolution</u> > <u>Definition</u> :- The phenomenon of acquiring similar set of - characteristics in response to similar environment by individuals of two or more totally unrelated species is called convergent.Ev. <u>Explanation</u> :- This type of evolution occurs when organism share same environment for a long period of time, as a result the - unrelated species become more and more similar due to same environment or habitat. <u>Example</u> :- Some examples of convergent evolution are below. i: <u>Analogy</u> :- Those structures which have same function but different structural design and developmental pathways are called analogous organs and the phenomenon is called analogy all analogous organs are example of convergent evolution.		

Chapter-24	578	Evolution
ii :- <u>Cactus and Euphorbia</u> :- cactus grow in American - desert where as Euphorbia grows in African desert. As their environment is same (i.e.-desert) therefore both evolve in same pattern like both has fleshy stem and spines. iii :- <u>Wings</u> :- The wings of insects, birds, pterosaur and bats have the same function (i.e.- flight) but different - structural design and developmental pathways.		
QB Discuss Hardy-Weinberg principle as an evidence of Evolution.		
Answer: <u>Hard-Weinberg theorem</u> :		
<u>Introduction</u> :- In 1908, two Famous Scientist - Goldfsey.H. Hardy an english mathematician and W.Weinberg a German physcian express mathematical relationship about the state of a population genotype with respect to evolution in the form of $p+q=1$ equation. This equation represent the frequency of all alleles for a particular gene in a population of diploid organism in which only two alleles (e.g Aa) exist. i.e- 'p'- mean frequency of dominant allele and 'q'- mean the - frequency of recessive allele.		
<u>Statment</u> :- Gene Frequency will be remains constant from one generation to next generation in a large interbreeding population in which mating is random, No- selection, No-migration occur.		
<u>Conditions</u> :- In the absence of following condition gene - frequency will remains constant from generation to generation		

chapter-24	579	Evolution
in a large randomly breeding population. 1: mutation. 2: Natural selection. 3: large population. 4: random mating. 5: no emigration or immigration. 6: All members of the population breed. 7: everyone produces the same number of offspring. ∴ at constant gene frequency (gene pool) no evolution will occur in a population. <u>Explanation: - (mathematical form)</u> 1: IF 'p' is the frequency of dominant allele (A) and 'q' is the frequency of recessive allele (a). This can be expressed in a mathematical form as— $(p + q)^2 = 1 \text{ or } 100\%.$ $p^2 + 2pq + q^2 = 1$ 2: In this equation p^2 is the predicted frequency of homozygous dominant (AA) people in a population, $2pq$ is the predicted frequency of heterozygous (Aa) people and q^2 is the predicted frequency of homozygous recessive (aa) people. So—equation will be— $(A + a)^2 = A^2 + 2Aa + a^2 = 1 \text{ or } 100\%.$ 3: This shows population at equilibrium, but population is not 100% in equilibrium because violation of one or more of the above mentioned conditions do occur. in such case the frequency of population will change. such a population then enters a state of evolutionary change.		

chapter-24	580	Evolution
<u>phenotypic observation</u> :- From phenotypic observation we can identify only those people who are homozygous recessive (q^2) because they will show the character controlled by that allele but we cannot differentiate between p^2 and $2pq$ - people because both of them will have same - phenotypes (i.e. - dominant trait). This can be find by - Hardy - weinberg theorem.		
Q9 write a short note of Genetic Drift		
<u>Answer</u> : Genetic drift : (ETEA-2009,2013)		
<u>Definition</u> :- change in gene frequency of a small population purely by chance is called genetic drift. —OR— “An accidental change in gene frequency is called Genetic drift.		
<u>Occurance</u> :- Genetic drift is very prominent in small - population. genetic drift is due to emigration or immigration or epidemic, etc. This change in allele - frequency is the cause of evolution i.e. - certain alleles increase or decrease in frequency in a population.		
<u>Explanation</u> :- Genetic drift is concerned with changes in gene frequencies of small populations by chance. It occurs when the population size is limited and therefore by chance certain alleles increase or decrease in frequency. The gene frequency will continue to fluctuate untill a new mutant is either lost or fixed. genetic drift is random and rarely produces adaptation to the environment.		

chapter-24	581	Evolution
<u>Charles Darwin</u> :- According to Charles Darwin some species adapt itself in a changing environment and other loss its life due to adjustment with such new environment. so due to natural selection some species modified with surrounding which lead new species formation and the other which loss decrease the gene pool of a population. so this changes or decrease of gene frequency in a population is called genetic drift. <u>Example</u> :- migration is the movement of population groups or individuals into or out of population. In genetic terms - migration enables gene flow from one population into another which cause genetic variation that can also change gene-frequencies and result in evolution.		
Q10 Define and explain the mechanism of speciation.		
<u>Answer: Speciation:</u>		
<u>Definition</u> :- The formation of new species by evolutionary process is known as speciation.		
<u>Mechanism of Speciation</u> :- 1 :- Speciation start when a parental population is divided into two or more than two daughter-populations.		
2: Second step is the type of mating system like random or no-random in some animals. as a result population one is reproductive isolated from second population.		
<u>Conditions which help in speciation</u> :- some conditions are—		

Chapter-24	582	Evolution
1: Polyploid, which mean change in chromosomes set. 2: Dispersal, which mean distribution. 3: Variance, which mean difference. 4: Genetic drift, which mean change in gene frequency. 5: Natural selection, which mean environmental selection. <u>Types of Speciation :-</u> There are 3-types of speciation. <u>1: Sympatric Speciation :-</u> <u>Definition :-</u> The type of speciation which occurs due to change in chromosome number (set) is called Sympatric Speciation. <u>causes :-</u> Sympatric Speciation occurs due to polyploidy. <u>occurrence :-</u> Sympatric speciation is very rare in nature. It is occurs more in plants than in animals. It is so much easier for plants to self-fertilize than it is for animals. <u>Explanation :-</u> In this type of speciation individual always share some geographical area and habitat, however due to mutation and chromosomal aberation, one type of population will retain more than normal chromosome pair like Tetraploid ($4n$) which then cannot mate with diploid ($2n$) individual so main population is divided into two daughter population with new species each. <u>2: Allopatric Speciation :-</u> <u>Definition :-</u> The type of speciation which occurs due to geographical isolation is called allopatric speciation. <u>Causes :-</u> It is occurs due to geographical distribution.		

chapter-24	583	Evolution
<u>occurrence</u> :- Allopatric or geographic isolation is very common		
<u>Explanation</u> :- There are certain physical barriers like - rocks, Rivers, forests, volcanic, etc. which separate some individuals of population from other members. Both of them are now in different environments where they are exposed to mutation and natural selection. Both will undergo different changes and will adapt different characters thus they will be isolated from each other overtime and will form new species. The other cause may be founder effect.		
<u>Founder effect</u> :- when the population is small and suddenly over grows, they can undergo a prominent mutation.		
<u>3: parapatric speciation</u> :		
<u>Definition</u> :- The type of speciation which occurs due to habitats differences within same geographical area is called p. spec;		
<u>causes</u> :- It occurs due to habitat-difference in an area.		
<u>occurrence</u> :- parapatric speciation is extremely rare.		
<u>Explanation with example</u> :- plants that live on boundaries between very distinct climates may flower at different times in response to their different environment making - them unable to interbreed. if reproductive cycle starts in one plant and the other has not start yet. However, when the - second start its own reproductive cycle the reproductive cycle in first plant end. They can only interbreed if times is not delayed between them.		

Q 11 What is the Facts about Creation of living organisms.

Answer: Facts about Creation of living organisms

Charles Darwin concept:

The theory of evolution as proposed by Charles Darwin in the 19th century, is one of the most unbelievable and irrational claims in history. The theory puts forth the irrational claim that all living organisms, plants, animals and human beings are the result of blind, unconscious, accidental events.

Objection on Darwin concept:

If human efforts cannot produce any living thing by using the whole pool of human knowledge, how can life be brought into being with the aid of unconscious atoms and chance events?

Discoveries of 20th and 21st centuries:

Scientific discoveries, especially in the 20th and 21st centuries, have shown that the flawless design of the universe is clearly the work of supreme intelligence, The Allah, with His supreme intelligence, limitless knowledge and eternal power created the universe.

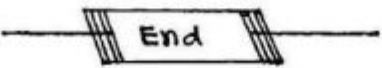
Fact about the creation:

The fact about the creation is that there is a mighty force in the universe that has created all different types of living things once by special creation and in them have put the ability to reproduce their next generations. This mighty force is Allah the Almighty Who is the Creator and Who sustains life on earth.

Evolution of eukaryotes:

The hypothesis that two prokaryotes cells invaded another prokaryote cell resulting in the evolution of a eukaryote cell is as baseless as some ones claim that two raksh as invaded a third one and in this way a motor car was evolved. The above hypothesis suggests that one of the invading prokaryote cell was changed into mitochondria and another invading prokaryote cell was modified into chloroplast.

Who is that Creator? Therefore, there should be a Creator of the universe and an Owner of the balance visibly everywhere from our body to

chapter-24	585	Evolution
the farthest corners of the vast universe. Who is that Creator? That Almighty Creator is one. He is Allah. He brought into existence everything and Whose existence is without any beginning or end. <u>Reference with Quranic Ayah's:</u> Some of the Quranic Ayah's in this regard are quoted below. 1. "Allah is creator of all things, and He is the Wakil (Trustee, guardian, disposer of affairs) over all things." (Sura Zumar : Ayah 62) 2. "He created man from sounding clay like the clay of pottery." (Sura Rahman : Ayah 14) 3. "It says about the origin of life that "We made from water, every living thing. Will they not then believe?" (Sura Anbiyah 21 : Ayah 30) 4. " We have spread out of the earth and set upon it immovable mountains. We have caused to grow in it from every ordained things " . (Sura Hajar 15 : Ayah 19). 5. " Glory be to Him who created pairs of all the things which the earth grows and of their own kind and that of which they have no knowledge". (Sura Yasin 36 : Ayah 36) 6. " He is the Creator of the heavens and the earth. (Sura Ana'm 6 : Ayah10) 7: " And Allah created every animal from water. Some creep up on their bellies, others walk on two legs, and others on four. Allah Creates What He pleases (wills). He has power over all things. (Sura Nur 24, Ayah 45) 		

Exercise

Exercise MCQs

A. Multiple Choice Questions (MCQs).

1. The random loss of alleles in a population is called
 - (a) Mutation
 - (b) Selection
 - (c) Gene flow
 - (d) Genetic drift
2. Human appendix, coccyx and nictitating membrane of the eye are:
 - (a) vestigial organs
 - (b) homologous organs
 - (c) analogous organs
 - (d) embryonic organ
3. The existing species are the modified descendants of pre-existing ones according to:
 - (a) Theory of special creation
 - (b) theory of organic evolution
 - (c) uniformitarianism
 - (d) theory of catastrophe
4. Using the Hardy-Weinberg Principle, which expression represents the frequency of the homozygous recessive genotype?
 - (a) P^2
 - (b) $2pq$
 - (c) q^2
 - (d) q
5. Which one of the following would cause the Hardy-Weinberg principle to be inaccurate?
 - (a) The size of the population is very large.
 - (b) Individuals mate with one another at random.
 - (c) Natural selection is present.
 - (d) There is no source of new copies of alleles from outside the population.
6. Similarity in characteristics resulting from common ancestry is known as:
 - (a) Analogy
 - (b) Homology
 - (c) Evolutionary relationship
 - (d) Phylogeny
7. The parts of the body use extensively to cope with the environment become larger and stronger, while those that are not used deteriorate was argued by:
 - (a) Charles Darwin
 - (b) Alfred Wallace
 - (c) Carolus Linnaeus
 - (d) Lamarck
8. The process of evolution of different species in a given area starting from a point and spreading to other geographical areas is known as
 - a. Adaptive radiation
 - b. Migration
 - c. Divergent evolution
 - d. Natural selection

Chapter-24	587	Evolution															
9. The idea of Natural selection as the fundamental process of evolutionary changes was reached a. Independently by Charles Darwin and Alfred Russel Wallace in 1900. b. By Charles Darwin in 1866. c. By Alfred Russel Wallace in 1901. d. Independently by Charles Darwin and Alfred Russel Wallace in 1859.																	
10. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed: a. Microevolution b. Divergent evolution c. Convergent evolution d. Co-evolution																	
11. Which of the following organic compounds first evolved and later were required for origin of life on Earth? a. Proteins and Amino acids b. Proteins and Nucleic acids c. Urea and Amino acids d. Urea and Nucleic acids																	
12. Which of the following statement is correct for analogous structures? a. Anatomically similar and functioning similarly b. Anatomically similar but performing different functions c. Anatomically different but performing similar functions d. Anatomically different and functioning differently																	
13. Which one of the following pairs represents analogous features? (a) Elephant tusks & Human incisors (b) Insects wings & bat wings (c) Mammal fore limb & bird wing (d) Reptilian heart & mammalian heart																	
14. Which of the following ideas was not part of Charles Darwin's theory of evolution by natural selection? (a) Organisms produce more offspring than the environment can support. (b) Variation between individuals arises by gene mutation. (c) Only those individuals that are best adapted to the env; survive and reproduce. (d) Individuals compete for space and resources.																	
Answer:(key) <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>1-d</td> <td>2-a</td> <td>3-b</td> <td>4-c</td> <td>5-d</td> </tr> <tr> <td>6-b</td> <td>7-d</td> <td>8-a</td> <td>9-d</td> <td>10-c</td> </tr> <tr> <td>11-b</td> <td>12-c</td> <td>13-b</td> <td>14-b</td> <td></td> </tr> </tbody> </table>			1-d	2-a	3-b	4-c	5-d	6-b	7-d	8-a	9-d	10-c	11-b	12-c	13-b	14-b	
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6-b	7-d	8-a	9-d	10-c													
11-b	12-c	13-b	14-b														

Short Questions

Q1: - For each pair of terms, explain how the meaning of the terms differ-

a: - Acquired trait and inherited trait.

Answer: Acquired Trait vs inherited trait:

The characteristic features which are inherited from the previous generation is called inherited Trait while the Trait or characteristics which develop in response to the environment and cannot be inherited is called - acquired trait.

b: - Homologous structure and analogous structure.

Answer:- See Question No-6 (write it from first evidence - i.e. - Homology and analogy - only definition).

c: - Divergent evolution and convergent evolution.

Answer:- See Question No-7 (write only definition).

d: - Artificial selection and natural selection.

Answer: Artificial selection and natural selection:

Artificial selection is the selective breeding of domesticated plants and animals to produce offsprings with characters desirable to humans, while in natural selection, nature selects the individuals with favourable variations for better survival in an environment.

Q2: - Differentiate b/w special creation and evolution.

Chapter-24	589	Evolution
<u>Answer: 1: Special creation :-</u> Creationists believe that God created the universe. The world was created in six ordinary days. animals and plants were created pretty much in the form we find them today. most fossils - formed rapidly as a result of a worldwide flood.		
<u>2: Evolution :-</u> Evolutionists believe that the universe - formed from a 'big-bang' billions years ago. life formed from non-life. from the first simple life-form every other living thing on earth has evolved. Evolutionists do not - believe there was a worldwide flood; they believe that fossils formed slowly from local events.		
Q3: - why flora and Fauna of Australia is different from - the other world.		
<u>Answer :- Flora and Fauna of Australia :-</u>		
<u>Introduction :-</u> The flora and fauna of australia is - different from the other world due to biogeography and isolated environment.		
<u>Explanation : 1:-</u> During mesozoic era when primitive Flora and Fauna first arose there was a land connection thus mammals migrated, when connection broke the Fauna thus different from other world.		
2: Beside this climate wise. this region is partially Tropical and partially Temperate (i-e- warm and dry) and are densely covered by rain forest which cause evolution (change).		

chapters-24	590	Evolution
Q4:-	Describe three causes of genetic variation in a population.	
Answers:-	<u>Genetic Variation:</u>	
	<u>Definition:-</u> Genetic variation can be defined as the genetic makeup of organisms within a population change.	
	<u>Three causes of genetic variation:</u>	
1: DNA mutation :-	mutation lead to genetic variation by altering genes and alleles in a population. They may impact an individual gene or entire chromosome. Although mutations change an organisms genotype, they may not necessarily change an organism's phenotype.	
2: Gene flow:-	It is also called gene migration, gene flow introduces new genes into a population as organisms migrate into a new environment. new gene combinations are made possible by the availability of new alleles in the gene pool. Gene frequencies may also be altered by the emigration of organisms out of a population.	
3: Sexual Reproduction :-	Sexual reproduction promotes genetic variation by producing different gene — combination. Genetic variation occurs as alleles in gametes are separated and randomly united upon — fertilization.	
Q5:-	What is meant by the term human gene pool.	
Answers :	<u>Human gene pool:</u>	
	<u>Definition:-</u> A gene pool is the collection of different —	

chapter-24	591	Evolution
genes within an interbreeding population. <u>Explanation :-</u> The concept of a gene pool usually refers to the sum of all the alleles at all the loci within the gene of a population of a single species. It includes both genes that are expressed, and those that are not. A large gene pool has extensive genetic diversity and is better able to withstand the challenges posed by environmental stresses. <u>Example :-</u> Every human being on Earth is able to - interbreed with one another as a single species. The human gene pool is therefore made up of every allele variant of the approximated 19000 - 20000 human genes within our DNA. Q6: - How is phenotype frequency computed? <u>Answer :- phenotype frequency calculation :-</u> To compare different phenotype frequencies, the relative phenotype frequency for each phenotype can be calculated by - counting the number of times a particular phenotype - appears in a population and dividing it by the total - number of individuals in the population. Q7: - What are the conditions that a population must meet in order to have genetic equilibrium. <u>Answer: Conditions for genetic equilibrium :-</u> The Hardy-weinberg law states that under the stability of following conditions both phenotypic and allelic frequencies - remain constant from generation to generation in sexually		

Chapter-24	592	Evolution
reproducing population, a condition known as Hardy - weinberg equilibrium. 1: infinite large population size. 2: All members of population should breed. 3: no mutation. 4: No migration (neither emigration nor immigration). 5: no natural selection. 6: Random mating. 7: Every one produces same number of offsprings.		
Long Questions		
Q1:	— Explain why creationism is regarded as contradictory to the theory of evolution. <u>Answer:</u> see Question No-1. (write only concept-2: creationism)	
Q2:	— What types of evidence of evolution come from paleontology, comparative anatomy, and molecular biology? Discuss in detail. <u>Answer:</u> see Question No-6. (write only part-1, 2, 5 in Q-6)	
Q3:	— Differentiate between convergent and divergent evolution by giving appropriate examples of the homologous and analogous structures. <u>Answer:</u> see Question No-7.	
Q4:	— Give an outline of Lamarck theory of inheritance. What drawbacks have been identified in Lamarckism. <u>Answer:</u> see Question No-3.	
Q5:	— Explain the theory of natural selection as proposed by Darwin. <u>Answer:</u> see Question No-4.	
Q6:	— Discuss Hardy-Weinberg principle as an evidence of evolution. <u>Answer:</u> see Question No-8.	
Q7:	— Define and explain the mechanism of speciation. <u>Answer:</u> see Question No-10.	

Chapter-24	593	ETEA-MCQs																		
Previous Entry Test MCQ's of Biology Chapter No -24: (Evolution)																				
2005 ETEA																				
1. In the human body all the given organs are vestigial except: (a) Appendix (b) Leg muscles (c) Coccyx (d) Nictitating membrane																				
2006 ETEA																				
2. The total of the all allele in a population is called: (a) Genetic drift (b) Genotype (c) Gene pool (d) Gene mutation																				
2008 ETEA																				
3. Wings of a bird and fore limbs of a man are: (a) Homologous (b) Analogous (c) Acquired (d) Vestigial																				
4. The modern horse is called: (a) Equus (b) Eohippus (c) Mesohippus (d) Mercyhippus																				
2009 ETEA																				
5. Changes in gene frequencies in small population by chance is called: (a) Gene pool (b) Genetic drift (c) Gene mutation (d) Gene flow																				
2011 ETEA																				
6. An Inherited characteristic that increases an organism ability to survive and reproduce in its specific environment is called: (a) Radiation (b) Adaptation (c) Vestigial organ (d) Speciation																				
7. A bird's wings are homologous to: (a) Fishes tail fin (b) Dog's front legs (c) Mosquito's wings (d) Alligator's claws																				
2013 ETEA																				
8. Changes in gene frequencies in small population by chance is called: (a) Gene pool (b) Genetic drift (c) Gene mutation (d) Gene flow																				
2014 ETEA																				
9. The theory of uniformitarians was proposed by a) Hutton and Lyell b) Lamarck c) George Cuvier d) Darwin																				
10. Human arm is homologous with: a) Seal flipper b) Octopus tentacle c) Bird wing d) Both A and C																				
11. The theory of new creation was proposed by---- a) George Cuvier b) James Hutton c) Louis Agassiz d) Wallace																				
2007 ETEA																				
12. What event is thought to have contributed to the evolution of eukaryotes? (a) Global warming (b) Glaciation (c) Volcanic activity (d) Oxygenation of the atmosphere																				
2018 ETEA																				
13. Darwin's finches are found in: (a) New Zealand (b) New Guinea (c) Galapagos island (d) Australia																				
2020 ETEA																				
14. ____ occurs because natural selection gives some alleles a better chance of survival than others a. Fitness b. Evolution c. Crossing over d. Artificial selection																				
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