EVOLUTION

1. Birbal Sahni was
   a) Palaeobotanist b) Zoologist c) Ornithologist d) Palaeozoologist
2. England in 1850s, *i. e.*, before industrialization set in, it was observed that there were more white-winged moths on trees than dark-winged or melanised moths.
   However, in the collection carried out from the same area, but after industrialization, *i. e.*, in 1920, there were more dark-winged moths in the same area, *i. e.*, the proportion was reversed
   Predict the possible reason for such change
   a) Natural selection b) Artificial selection c) Conditional selection d) Divergent selection
3. In a given population, the ...A... of occurrence of alleles of a gene is supposed to remain ...B... and even remain the same through generations. Hardy-Weinberg principle stated it using ...C... equation
   Choose the correct option for A, B and C to complete the given NCERT statement
   a) A-frequency, B-unstable, C-algebraic b) A-frequency, B-stable, C-algebraic
   c) A-frequency, B-stable, C-simple d) A-frequency, B-stable, C-complex
4. Which of the following provides most evident proof of evolution?
   a) Fossils b) Morphology c) Embryo d) Vestigial organs
5. Which set includes only analogous organs?
   a) Wings of butterfly, housefly and bat
   b) Hindlegs of horse, grasshopper and bat
   c) Wings of butterfly and wingspead of bat and birds
   d) Mandibles of cockroach, mosquito and honey bee
6. Study of fossils is called
   a) Organic evolution b) Herpetology c) Cytology d) Palaeontology
7. Hugo de Vries's experimental organism was
   a) Fruitfly b) China rose plant c) Four O'clock plant d) Evening primrose
8. A biologist is trying to infer how five closely related species of snakes are related to one another. She noticed that some of the snakes have forked tongues and others do not. Which of the following would help her to distinguish their ancestral state?
   a) She looks among snake fossils for evidences that being forked is a characteristic of the ancestor of this group, but determines no such fossils exists
   b) She locates a specimen of a more distantly related snake to see if it has a forked tongue
   c) She looks at a representative mammal species to see if it has a forked tongue
   d) She flips a coin
9. Origin of life occurred in
   a) Precambrian b) Coenozoic c) Palaeozoic d) Mesozoic
10. In which of the following situations would evolution would occur

Migration	Selection Pressure	Variations due to Mutation
I. Absent II. Absent	Low High	Low High

III. High IV. High	Low High	High Low

Select the correct using the codes given below

a) I and II b) I and III c) I and IV d) II, III and IV

11. Theory of natural selection was given by
    a) Lamarck b) Darwin c) Alfred Wallace d) JBS Haldane
12. What's the difference between natural selection and sexual selection?
    a) Sexual selection occurs during sexual inter course b) Natural selection is a type of sexual selection
    c) Sexual selection is a type of natural selection d) Sexual selection occurs within demes
13. What do homologous organs indicates?
    a) Different ancestry b) Common ancestry
    c) Independent development d) Dependent development
14. Proteins found in the blood of man and ape are similar. This is an example of
    a) Cellular homology b) Molecular homology c) Cellular analogy d) Molecular analogy
15. According to the Neo-Darwinian theory, which of the following is responsible for the origin of new species?
    a) Mutations b) Useful variations
    c) Mutation together with natural selection d) Hybridization
16. 'Continuity of germplasm' theory was given by
    a) Hugo de Vries b) Weismann c) Darwin d) Lamarck
17. Select the wrong pair
    a) Oparin – Probiont b) Spallanzani – Approve abiogenesis
    c) Haldane – Hot dilute soup d) Fox – Coacervates
18. Divergent evolution gives rise to
    a) Homologous organ b) Analogous organs c) Both (a) and (b) d) None of these
19. The greatest evolutionary change enabling the land vertebrates to be completely free from the water. Habitat was the development of
    a) Four legs b) Four-chambered heart
    c) Lungs d) Shelled eggs and internal fertilization
20. Which of the following is not an examples of adaptive radiation?
    a) Wombat, marsupial rat, flying phalanges b) Darwin's finches
    c) Different placental mammals in Australia d) Placental wolf and Tasmanian wolf
21. Pasteur and Koch are related to
    a) Discovery of nucleic acids (DNA and RNA) b) Discovery of ultracentrifuge
    c) Germ theory of disease d) Gene splicing
22. Some persons can move their pinnae. This ability is imparted by
    a) Recapitulation b) Atavism c) Over specialization d) Regeneration
23. Darwin judged the fitness of an individual by
    a) Ability to defend itself b) Strategy to obtain food
    c) Number of offsprings d) Dominance over other individuals
24. Why the genetic variation is important from an evolutionary standpoint/
    a) If all organisms were the same, the entire population would be vulnerable to particular pathogens, like viruses
    b) All evolutionary adaptations (*e. g.*, the origin of forelimbs) are the result of the gradual build up of genetic difference between organisms over geological time
    c) Evolution (at the population level) refers to changes in the frequencies of genes in the population overtime
    d) All of the above

25. 'XX' lived 100000-40000 years ago, in Europe, Asia and Africa. 'XX' was short stature, hairy eyebrows, sctreating forehead and large jaws. Identify 'XX'
a) Neanderthal man b) *Homo habilis* c) Cro-magnon man d) *Dryopithecus*
26. Who discarded the theory of spontaneous generation forever?
a) Louis Pasteur b) Franscisco Redi c) Spallanzani d) Aristotle
27. Saltation stands for
a) Single step large mutation b) Single step small mutation
c) Double step small mutation d) Double step large mutation
28. Which of the following statement is true regarding the theory of natural selection?
a) It was the first theory of organic evolutions
b) It do not explain fossils
c) It has been failed to explain the origin of variations
d) It has been successful to explain the origin of variations
29. '*Ontogeny Recapitulates Phylogeny*'is narrated in which of the evidences for organic evolution?
a) Palaeontological evidence b) Physiological evidence
c) Embryological evidence d) Anatomical evidence
30. In the developmental history of mammalian heart, it is observed that it passes through a two-chambered fish-like heart, three-chambered frog-like heart and finally four-chambered stage. To which hypothesis can the above cited statement be approximated?
a) Biogenetic law b) Hardy-Weinberg law
c) Lamarck's principle d) Mendelian principles
31. Which of the following statements is correct?
a) *Homo erectus* is the ancestor of man
b) Cro-magnon man's fossil has been found in Ethiopia
c) *Australopithecus* is the real ancestor of modern man
d) Cromagnon man is the most recent ancestor of *Homo sapiens*
32. 'Hot dilute soup' was given by
a) Oparin b) Haldane c) Urey d) None of these
33. Vestigial organ in human being is
a) Incisor b) Molar c) Premolar d) None of these
34. Darwinian 'natural selection' of evolution was inspired by
a) Thomas Malthus b) Alfred Wallace c) Dr. David Lack d) August Weismann
35. Evolutionary changes does not come about at the level of individual but at the level of
a) Two persons b) Ten persons c) Population d) Small group
36. Which of the following statements are wrong?
I. Thomas Malthus is well known for his book on population
II. The work of Thomas Malthus on population did not influence Darwin
III. There must be a genetic basic for getting selected and to evolve
IV. All the finches on the Galapagos islands are descended from a common ancestor
Choose the correct option
a) Only I b) Only II c) I and III d) IV and III
37. Which of the following animal extinct recently?
a) Draco b) Dinosaur c) Mammoth d) Pteridosperms
38. Evolutionary biology is
a) The study of history of life forms on earth b) Study of pedigrees of life forms on earth
c) Equivalent to demography d) Equivalent to anthropology
39. Maximum cranial capacity is of
a) Neanderthal man b) Cro –magnon man c) Modern man d) Java man
40. In pleistocene epoch, the ancestor of horse is
a) *Eohippus* b) *Mesohippus* c) *Merychippus* d) *Equus*

41. Which group is evolutionary modern?
a) Gymnosperms b) Grasses c) Pteridophytes d) Algae

42. The Mesozoic era is also called as the golden age of the
a) Amphibians b) Reptiles c) Mammals d) birds

43. In human beings, vestigial organs are
a) Wisdom teeth, coccyx, vermiform appendix, nail eyelid
b) Wisdom teeth, coccyx, vermiform appendix, pancreas, elbow joint
c) Wisdom teeth, coccyx, vermiform appendix, nictitating membrane, auricular muscles
d) Coccyx, wisdom teeth, nail, auricular muscles

44. Which one of the following is the most primitive ancestor of man?
a) *Homo habilis* b) *Australopithecus*
c) *Ramapithecus punjabicus* d) *Homo neanderthalensis*

45. First land plants (psilophyte) were originated in
a) Ordovician period b) Cambrian period c) Silurian period d) Cretaceous period

46. Earliest fossil ape prior to the ape man was
a) *Ramapithecus* b) *Dryopithecus* c) *Australopithecus* d) *Homo erectus*

47. Arrange the following events of modern concept of evolution sequentially
I. Genetic variations in population
II. Natural selection
III. Heredity
IV. Isolation
V. Speciation
The correct option is
a) I, II, III, IV, V b) I, III, II, IV, V c) I, IV, III, II, V d) I, IV, II, III, V

48. Human beings belongs to the family-Hominidae which evolved about 24 million years ago. The relative family-Pongidae includes
a) Chimpanzee b) Gorilla c) Orangutan d) All of these

49. The chronological order of human evolution from early to the recent is
a) *Ramapithecus – Australopithecus – Homo habilis – Homo erectus*
b) *Australopithecus – Ramapithecus – Homo habilis – Homo erectus*
c) *Pithecanthropus pekinensis – Homo habilis – Homo erectus*
d) *Australopithecus – Ramapithecus – Pithecant – hropus pekinensis – Homo erectus*

50. The main point of Darwin's theory is
a) Variation b) Natural selection c) Enormous fertility d) mutation

51. Which of the set represents vestigial organs?
a) Vermiform appendix, body hair and patella b) Wisdom teeth, body hair and atlas vertebre
c) Ear muscles, cochlea and coccyx d) Vermiform appendix, ear muscles and coccyx

52. Connecting link between Annelida and Mollusca is
a) *Peripatus* b) *Lepidosiren* c) *Neopilina* d) *Protopterus*

53. Which of the following examples supports Lamarckism?
a) Webbed toes of aquatic bird b) Cave dwellers
c) Flightless bird d) All of these

54. Identify the vestigial organ in the given figure

a) Vermiform appendix
b) Auricular
c) Coccyx (short tail)
d) Plica semilunaris

55. Darwin's finches represents
a) Morphological variation
b) Geographical isolation
c) Climatic variation
d) Reproductive isolation

56. Which of the following evidences does not favour the Lamarckian concept of inheritance of acquired characters?
a) Absence of limbs in snakes
b) Presence of webbed toes in aquatic birds
c) Melanization in peppered moth
d) Lack of pigment in cave-dwelling animals

57. Oparin and Haldane's theory is also called
a) Chemical theory of origin of life
b) Modern theory of origin of life
c) Naturalistic theory
d) All of the above

58. A microsphere is a ...A... collection of organic macromolecules with double layered outer boundary. The term microsphere was given by ...B...
Complete the given statement by choosing correct options for A and B with reference to NCERT textbook
a) A-non-living, B-Sydney Fox
b) A-living, B-Oparin
c) A-non-living, B-Haldane
d) A-living, B-Altman

59. Which is not true of *Archaeopteryx*?
a) Jaws are modified into beak
b) Tail is bony and long
c) Forelimbs are modified into wings
d) Connecting link between birds and amphibians

60. The sequence of origin of life could be
a) Organic materials → inorganic materials → colloidal aggregate → eobiont → cell
b) Inorganic materials → organic materials → colloidal aggregate → eobiont → cell
c) Inorganic materials → organic materials → eobiont → cell → colloidal aggregate
d) Organic materials → inorganic materials → eobiont → cell → colloidal aggregate

61. Australian marsupials are the example of
a) Homologous radiation
b) Analogous radiation
c) Adaptive radiation
d) Convergent radiation

62. Which of the following in birds indicates their reptilian ancestry?
a) Scales on their hindlimbs
b) Four-chambered heart
c) Two special chambers crop and gizzards in their digestive tract
d) Egg with a calcareous shell

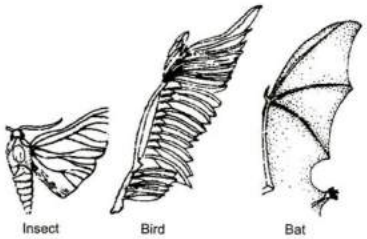
63. Big-Bang theory attempts to explain the origin of
a) Earth
b) Solar-system
c) Universe
d) Contenents

64. Life cannot originate from inorganic materials now because of
a) Low atmospheric temperature
b) High degree of pollution
c) High atmospheric oxygen
d) Absence of raw materials

65. According to one of the most accepted theory, the earth atmosphere before any life had originated consists of H_2O, H_2, NH_2 and
a) CH_4
b) O_2
c) N_2
d) None of these

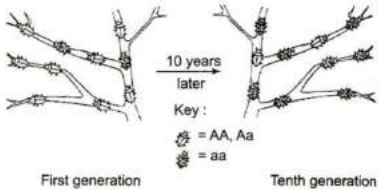
66. The first life on the earth was developed through
a) Chemical evolution
b) Penspermia
c) Biogenesis
d) Abiogenesis

67. Given diagram depicts



a) Analogous organs b) Homologous organs c) Vestigial organs d) Heterologous organs

68. The given diagram illustrates the change that occurred in the frequency of phenotypes in an insect population over 10 generations. A probable explanation for this change would be



a) Over time there was a decrease in the adaptive value of gene a
b) Over time there was an increase in the adaptive value of gene a
c) Over time there was an increase in the population of AA, Aa
d) Over time there was an decrease in the mutation rate of gene a

69. Which compound has very important role in prebiotic evolution?
a) SO_2 b) NO c) CH_4 d) SO_3

70. Origin of life as a result of chemical evolution was properly explained by
I. Fox II. Oparin
III. Wateson IV. Haeckel
V. Mendel VI. Crick
Choose the correct option
a) I and II b) III and IV c) V and VI d) Only II

71. Name given to fossil hominid of Shivalik hills in India is
a) *Ramapithecus* b) *Australopithecus* c) *Pithecanthropus* d) *Pithecanthropus*

72. Which of the following statements are correct?
I. Bird originated 150 million years ago
II. Mammals originated 200 million years ago
III. Multicellular organisms 1 billion years ago
The correct combination is
a) I and II b) II and III c) I and III d) I, II and III

73. Hardy-Weinberg described the frequency of ...A... for an entire ...B... .
Choose the correct option for A and B to complete the given NCERT statement
a) A-genes; B-population
b) A-genotype; B-population
c) A-phenotype; B-population
d) A-alleles; B-population

74. The modern man differs from the apes in
a) Protruding eyes b) Spare body hair
c) Wearing of clothes d) Arms shorter than legs

75. What did Miller obtained from his experiment?
a) Amino acid b) Organic compounds
c) Peptide d) All of these

76. A study of fossils in different sedimentary layers indicates
a) Physiological period in which they existed b) Geological period in which they existed
c) Conditions in which they were living d) All of the above

77. Development of similar adaptive functional structural features in an unrelated group of organism is called
a) Adaptive radiation
b) Adaptive convergence
c) Both (a) and (b)
d) Evolution

78. Organic evolution is also called
a) Chemical evolution
b) Stellar evolution
c) Biological evolution
d) All of these

79. In equation, $p^2 + 2pq + q^2 = 1$
Where,
I. p^2= Homozygous dominant genotype
II. q^2= Heterozygous dominant genotype
III. $2pq$= Heterozygous genotype
Identify which entity (p^2, q^2 and $2pq$) is not described correctly?
a) Only I
b) I and III
c) I and II
d) Only II

80. The present concept of evolution is known as
a) Neo-Darwinism theory of evolution
b) Synthetic theory of evolution
c) Modern concept theory of evolution
d) All of the above

81. Scientist who also came to the similar conclusions around the same time of Charles Darwin was
a) Alfred Wallace
b) Hugo de Vries
c) TH Morgan
d) Oparin and Haldane

82. Giant dinosaurs and reptiles predominated during the Jurassic period. This period was also marked the evolution of higher insects and angiosperms, conifers, cycads, etc. Jurassic period belongs to …….. era
Complete the given statement by choosing an appropriate option
a) Cenozoic
b) Palaeozoic
c) Mesozoic
d) Proterozoic

83. Weismann cut off tails of mice generation after generation but tails neither disappeared nor shortened showing that
a) Lamarck's theory was wrong
b) Darwin's theory was wrong
c) Synthetic theory was wrong
d) Mutational theory was wrong

84. The pioneers in the field of organic evolutions are
a) Darwin, Lamarck, Robert Hooke, Huxely
b) Darwin, Hugo de Vries, Lamarck, Huxley
c) Darwin, Lamarck, Hugo de Vries, Robert Brown
d) Darwin, Lamarck, Hugo de Vries, Purkinje

85. In the animals, the same structures developed along the different directions due to the adaptations to different needs. This is called
a) Convergent evolution
b) Divergent evolution
c) Disruptive evolution
d) Directional evolution

86. Large size of pinnae in animals of warm region in comparison to animal of cold region is due to
a) Dollo's law
b) Gloger's law
c) Cope's law
d) Allen's rule

87. The gases condensed under …A… and formed the galaxies of the present day universe. In the solar system of the milky way galaxy, earth was supposed to have been formed about …B… back. There was no atmosphere …C… on the earth. Water vapour, …D… carbon dioxide and ammonia released from molten mass covered the surface.
Choose the correct option for A, B, C and D to complete the given paragraph with reference to NCERT textbook
a) A-Gravitation, B-4.5 billion years, C-Early, D-Methane
b) A-Acceleration, B-4.5 billion years, C-Early, D-Methane
c) A-Acceleration, B-4.5 billion years, C-Early, D-Ethane
d) A-Gravitation, B-4.5 billion years, C-Early, D-Ethane

88. Which species of human ancestor was named lucy?
a) Heidelberg man
b) Cro-magnon man

c) *Australopithecus africanus* d) *Ramapithecus punjabicus*

89. The Neanderthal man with a brain size ...A... cc lived in near ...B... between ...C... to ...D... years back. The correct choices for *A*, *B*, *C* and *D* are
    a) A-1000, B-East and Central Asia, C-100000, D-40000
    b) A-1400, B-East and Central Asia, C-100000, D-40000
    c) A-1400, B-East and West Asia, C-100000, D-40000
    d) A-1400, B-East and West Asia, C-100000, D-10000
90. What kind of evidence suggested that man is more closely related with chimpanzee than with other hominoid apes?
    a) Evidence from DNA of sex chromosome only
    b) Comparison of chromosome morphology only
    c) Evidence from fossil remains and the fossil mitochondrial DNA alone
    d) Evidence from DNA extracted from sex chromosome, autosomes and mitochondria
91. The first non-cellular form of life could have originated
    a) 3 billion years back b) 2 billion years back c) 4 billion years back d) 1 billion years back
92. The idea that the life originates from pre-existing life is referred as
    a) Biogenesis theory b) Special creation theory
    c) Abiogenesis theory d) Extraterrestrial theory
93. 'Darwin natural selection theory' could not explain
    a) Retention of characters of no use or vestigial organ b) Giraffe has long neck
    c) Giraffe has long legs d) Survival of the fittest
94. First autotrophs on the primitive earth was/were
    a) Aerobic b) anaerobic
    c) Both (a) and (b) d) Photosynthetic protist
95. Evolutionary history of an organism is known as
    a) Genetics and interpretation b) Biogenesis
    c) Recapitulation d) evolution
96. According to the Darwin's theory of evolution, differences between the species occurs due to
    a) The disuse of body structures
    b) The transmission of acquired characteristics
    c) Natural selection
    d) Mutagenic agents
97. A change in the relative abundance of an allele (the allelic frquency) within a population, over a succession of generations is called
    a) Micro-evolution b) Macro-evolution
    c) Co-evolution d) Phylog-enetic evolution
98. Gradual accumulation of adaptation of changing environment leads to the origin of
    a) New species b) A genus c) Old structures d) All of these
99. Which of the following statement is the most appropriate one in an evolutionary sense?
    a) A lion is successful at capturing prey but has no cubs
    b) A lion has many cubs, eight of which live to adulthood
    c) A lion overcomes a disease and lives to have three cubs
    d) A lion has a harem of many lionesses and one cub
100. Microbial experiments show that ...A... advantageous ...B... when selected will result in observation of new phenotypes. Over few generations, this would result in ...C... . Natural selection is a process in which ...D... variations enabling better survival are enabled to reproduce and leave greater number of progeny
    Choose the correct option for A, B, C and D to complete the given NCERT statement
    a) A-post existing, B-mutation, C-speciation, D-heritable
    b) A-post existing, B-mutation, C-speciation, D-unheritable

c) A-pre-existing, B-mutation, C-speciation, D-heritable
d) A-existing, B-mutation, C-speciation, D-heritable

101. The force responsible for fixing in population of neutral characteristics is
a) Genetic drift
b) Mutation
c) Reproduction
d) Genetic recombination

102. Mutation is more common when it is present in
a) Recessive condition
b) Dominant condition
c) Constant in population
d) None of these

103. Choose the correct statements
I. Law of embryonic development was given by Von Baer
II. Recapitulation theory was proposed by Haeckel
III. Haeckel theory states that 'Ontogeny repeats phylogeny'
IV. Haeckel theory and biogenetic law were proposed by the same person
The correct combination is
a) I and II
b) II and III
c) III and I
d) I, II, III and IV

104. 'Every cell of the body contributes gemmules to the germ cells and so shares in the transmission of inherited characters', this theory is known as
a) Theory of inheritance of acquired characters
b) Theory of germplasm
c) Theory of pangenesis
d) Theory of mutation

105. Synthetic theory of evolution was developed by
a) Several biological specialities
b) Darwin
c) Mendel
d) Wallace

106. Natural indicator of industrial pollution is
a) Algae
b) Fungi
c) Lichen
d) Bacteria

107. Lamarckism cannot explain
a) Webbed toes in aquatic birds
b) Weak muscles in the son of a wrestler
c) Long narrow and limbless body of snakes
d) Heterophylly

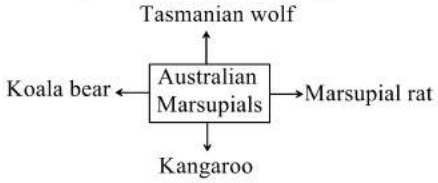
108. Arrange the periods of Palaeozoic era in ascending order in a geological time scale.
a) Cambrian –Ordovician –Silurian –Devonian –Carboniferous -Permian
b) Cambrian – Devonian – Ordovician – Silurian –Carboniferous -Permian
c) Cambrian –Ordovician – Devonian – Silurian –Carboniferous -Permian
d) Silurian – Devonian – Cambrian – Ordovician – Permian - Carboniferous

109. What is common to whale, seal and shark?
a) Seasonal migration
b) Thick subcutaneous fat
c) Convergent evolution
d) Homeothermy

110. Give the name of the first organism who invaded land
a) Plants
b) Consumers
c) Animal
d) Carnivores

111. Hardy-Weinberg principle can be expressed as
a) $p^2 + 3pq + q^2 = 1$
b) $p^2 + 2pq + q^2 \geq 1$
c) $p^2 + 2pq + q^2 \leq 1$
d) $p^2 + 2pq + q^2 = 1$

112. Identify what the given diagram indicates



a) Convergent evolution
b) Divergent evolution
c) Recapitulation
d) Parallel evolution

113. Speciation is the evolutionary process by which
a) A new gene pool is formed
b) Evolutionary paths of the species converge
c) Hybrids species are formed

d) Differences in physical traits appears

114. First human like hominid is known as
a) Neanderthal man b) *Homo habilis* c) *Dryopithecus* d) *Homo erectus*

115. 'Darwin's finches' refers to
a) Fossils of birds collected by Darwin at Galapagos islands
b) A type of birds present on Galapagos islands
c) Migratory birds collected by Darwin at Galapagos islands
d) Fossils of reptiles collected by Darwin at Galapagos islands

116. Age of fossils in the past was generally determined by radio-carbon method and other methods involving radioactive elements found in the rocks. More precise methods, which were used recently and led to the revision of the evolutionary period for different groups of organisms, include
a) Study of carbohydrates/ proteins in fossils b) Study of conditions of fossilization
c) Electron spin resonance (ESR) and fossil DNA d) Study of carbohydrates/proteins in rocks

117. Which of the following is not vestigial in man?
a) Tail vertebrae b) Nails
c) Nictitating membrane d) Vermiform appendix

118. Survival of the fittest is possible due to
a) Over production
b) Favourable variation
c) Environmental change
d) Inheritance of acquired characters

119. Which of the following branch of biology helps in to know the existence of coal?
a) Palaeobotany b) Bacteriol ogy c) Economic botany d) Ecology

120. Which of the following factor is most likely to decrease the genetic diversity in a population?
a) Genetic recombination b) Mutation
c) Genetic drift d) Stabilizing natural selection

121. The first cellular form of life could have originated
a) 2000 million years back b) 11000 million years back
c) 1500 million years back d) 500 million years back

122. Origin of life as a result of chemical evolution has been properly explained by or the most logical biochemical theory of origin of life has been given by
a) Stanley Miller b) Darwin c) A I Oparin d) S Fox

123. The structural similarities between the flippers of whales and the arms of human are used to show that
a) Human species began life in the oceans
b) Human species and whales have a common ancestry
c) Whales are older than the human species
d) Whales evolved from the human species

124. Fossil X is older than fossil Y if
a) X was found deeper in sediment than Y
b) Y was found deeper in sediment than X
c) Y had less vestigial organs
d) Fossil Y had a homologous and analogous organs of X

125. I. Oparin's theory of origin of life is based on ...A...
II. Chemical theory of origin of life was given by ...B...
Choose the correct option for A and B to complete the statements I and II
a) A-biological evolution; B-Oparin b) A-elemental evolution; B-Haldane
c) A-organic evolution; B-Oparin and Haldane d) A-chemical evolution; B-Oparin and Haldane

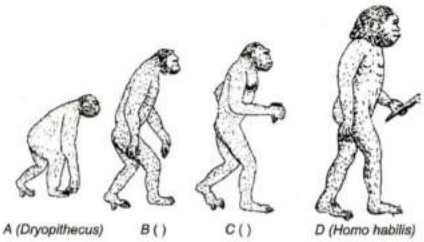
126. The concept of natural selection in evolution was proposed by
a) Charles Robert Darwin b) August Weismann
c) Hugo de Vries d) Jean Baptiste Lamarck

127. Darwin proposed that new species evolve from ancestral forms by the
a) Gradual accumulation of adaptations to changing environment
b) Inheritance of acquried adaptation to the environment
c) Struggle for limited resources
d) Accumulation of mutations

128. Which of the following is not a correct pair?
a) Mesozoic era - Age of mammals
b) Origin of species - Charles Darwin
c) Study of fossil – Palaeontology
d) Mutation theory – Hugo de Vries

129. S L Miller's closed flask contained
a) CH_4
b) H_2
c) NH_3 and H_2O
d) All of these

130. Give the name of *B* and *C*



a) B-*Ramaithecus*; C-*Homo erectus*
b) B-Ramapithecus; C-*Australopithecus*
c) B-*Australopithecus*; C-*Ramapithecus*
d) B-*Australopithecus*; C-*Homo erectus*

131. The primate, which existed 15 million years ago, among these was
a) *Homo habilis*
b) *Australopithecus*
c) *Ramapithecus*
d) *Homo erectus*

132. Which type of growth living organism undergoes?
a) Reversible
b) Apical
c) Accretion
d) Intussusception

133. Directional selection favours
a) One extreme from over the other extreme from over intermediate from of a trait
b) Both extremist form of trait
c) Environmental differences
d) Intermediate form of a trait

134. What was the most significant trend in the evolution of modern man (*Homo sapiens*) from his ancestors?
a) Shortening of jaws
b) Binocular vision
c) Increasing brain capacity
d) Upright posture

135. For a long time it was believed that life came out of decaying and rotting matter like straw mud, etc. This was the theory of
a) Catastrophism
b) Abiogenesis
c) Panspermia
d) Chemogeny

136. In which of the following era first mammal like reptile originated?
a) Permian period
b) Triassic period
c) Jurassic period
d) Tertiary period

137. Darwin judged the fitness of an individual by
a) Ability to defend itself
b) Strategy to obtain food
c) Number of offsprings
d) Dominance over other individuals

138. In the theory of evolution, Lamarck explained
I. internal vital force
II. effect of environment on organisms
III. inheritance of acquired characters
IV. use and disuse of organs
Choose the correct combination
a) I and II
b) II and III
c) I, II and IV
d) I, II, III and IV

139. Evolutionary development of a species can be studied by
a) DNA analysis
b) Finding age by carbon dating
c) Studying fossils of the species
d) All of the above

140. Phenomenon of industrial melanism demonstrates
a) Reproductive isolation
b) Induced mutation
c) Natural selection
d) Geographical isolation

141. Diversity of living organisms is due to
a) Instant changes
b) Polyploidy
c) Long term evolutionary changes
d) Short term evolutionary changes

142. Darwin's book 'Origin of New Species by Natural Selection' was published in
a) 1809
b) 1859
c) 1957
d) 1869

143. What is the difference between genetic drift and changes drift to the natural selection?
a) Genetic drift do not requires the presence of variations
b) Genetic drift rarely involves competition between the members of a species
c) Genetic drift is most effective in very large populations but natural selection operates in a small isolated population
d) There is no difference between genetic drift and natural selection

144. *Homo sapiens* were arose during
a) Ice-age between 25000-10000 years ago
b) Continental drift between 75000-10000 years ago
c) Continental drift between 75000-5000 years ago
d) Ice-age between 50000-10000 years ago

145. Which phenomena confined the pouched mammals of Australia survived because of lack of competition from any other mammals?
a) Continental origination
b) Continental shifting
c) Continental drifting
d) Continental evolution

146. Which of the following animals is not only a living fossil but also considered as connecting link?
a) *Sphenodon*
b) *Limulus*
c) *Neopilina*
d) *Latimeria*

147. Fossils of *Homo erectus* was found in
a) Java in 1891
b) India in 1921
c) Africa in 1927
d) Australia in 1945

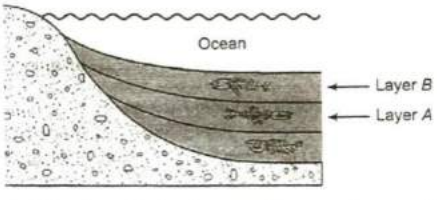
148. Which of the following is a unit of natural selection?
a) Genus
b) Species
c) Individual
d) Population

149. Industrial melanism is an example of
a) Protective resemblance with the surroundings
b) Defensive adaptation of skin against ultraviolet radiations
c) Drug resistance
d) Darkening of skin due to smoke from industries

150. Stanley Miller proposed origin of life by
a) Chemical synthesis
b) Abiogenesis
c) Biogenesis
d) None of these

151. Anthropoids were evolved into
a) Apes, *Proconsul* and monkeys
b) Apes, cro-magnon man and old world monkeys
c) *Proconsul*, new world monkeys and peking man
d) New world monkeys, *Proconsul* and *Homo habilis*

152. The diagram below shows an undisturbed sedimentary strata at the bottom of an ocean. The fossils found in layer *B* resemble the fossils found in layer *A*. This similarity suggests that



a) The fossils in layer *B* were formed before the fossils in layer *A*

b) Modern forms of the life may have evolved from earlier forms of life
c) Vertebrate fossils are only found in sediments
d) The fossils in layer *A* must be more complex than those in layer *B*

153. Hardy –Weinberg equilibrium is known to be affected by gene flow, genetic drift, mutation, genetic recombination and
a) Evolution b) Limiting factors c) Saltation d) Natural selection

154. Struggle for existence and survival of the fittest theories were given by
a) Wallace b) Darwin c) Lamarck d) None of these

155. Theory of continuity of germplasm was given by
a) August Weismann b) Lamarck c) Darwin d) Wallace

156. The process by which different type of finches were evolved in Galapagos islands is
a) Adaptive radiation b) Geographic similarity
c) Geographic dissimilarity d) Unadaptive radiation

157. An evolutionary process, giving rise to new species adapting to new habitat and ways of life is called
a) Adaptive radiation b) Adaptation
c) Convergent evolution d) Microevolution

158. Natural selection is a process in which ...A... variations enables better survival and ability to ...B... and leave ...C... number of progeny
Choose the correct options for A, B and C to complete the given NCERT statement
a) A-heritable, B-reproduce, C-greater b) A-non-heritable, B-reproduce, C-greater
c) A-non-heritable, B-reproduce, C-lesser d) A-heritable, B-reproduce, C-lesser

159. Which of the follows have not left any evidence of organic evolution?
a) *Archaeopteryx* b) Cow c) *Peripatus* d) *Neophilina*

160. Biological concept of species was given by
a) E Mayer b) Darwin c) De Vries d) Mendel

161. Somatic cells of gorilla, chimpanzee and orangutan have
a) 44 chromosomes b) 42 chromosomes c) 46 chromosomes d) 48 chromosomes

162. Natural selection
I. tends to increase its characters that enhances survival and reproduction
II. causes adaptation
III. acts on organism phenotype
IV. mechanism of evolution explained by Darwin
Which of the following statements are correct?
a) I, II, III b) I and II c) II and IV d) I and III

163. Darwinian fitness can be estimated by
a) How long different individual in a population survive
b) Number of offsprings produced by different individual in population
c) Individual have a large size in population
d) Species recover after mass extinction

164. The first life on earth consists of
a) Provirus b) Protovirus c) Virus d) Bacteria

165. Factor affecting the process of speciation are
I. Mutation
II. Recombination
III. Natural selection
IV. Hybridisation
V. Genetic drift
VI. Polyploid
VII. Isolation
Choose the correct combination

a) I, II, V, VII and VI
b) II, VI, IV, III and V
c) III, IV, V, VII and II
d) I, II, III, IV, V, VI and VII

166. Jurassic period of the Mesozoic era is characterized by
a) Gymnosperms are dominant plants and first birds appear
b) Radiation of reptiles and origin of mammals like reptiles
c) Dinosaurs become extinct and angiosperms appear
d) Flowering plants and first dinosaurs appear

167. Blood groups-A and B are found in
a) Monkeys
b) Apes
c) Dogs
d) Cats

168. An organism which is the connecting link between the animals and plants is
a) Bacteria
b) Cyanobacteria
c) *Euglena*
d) *Amoeba*

169. ..... organs shows adaptive radiation.
Complete the given statement with an appropriate option given below
a) Homologous
b) Analogous
c) Progressive organs
d) Similar in structure

170. Identify the phenomenon in which a new set of population is formed the set of existing population due to the excessive change in the allele frequency
a) Founder effect
b) Evolutionary effect
c) Bottle-neck effect
d) None of the above

171. Age of gymnosperm is
a) Cenozoic era
b) Mesozoic era
c) Palaeozoic era
d) Proterozoic era

172. Which of the following example of variation is not important from an evolutionary standpoint?
a) Genetic differences between individual organisms comprising the population
b) Inherited difference between individual organisms comprising the population
c) Both (a) and (b)
d) Difference due to diet, health, age and accident that have no affect on an individual's ability to survive and reproduce

173. Organs which are anatomically different, but performs similar functions are called
a) Analogous organs
b) Homologous organ
c) Vestigial organs
d) Heterologous organs

174. Coacervates are
a) Protobionts having polysaccharide, protein and H_2O
b) Protein aggregate
c) Protein and lipid aggregates
d) None of the above

175. The primates nearest to humans in the evolutionary line is
a) New world monkeys
b) Apes
c) Lemurs
d) Echidna

176. Primitive man was originated during
a) Miocene
b) Holocene
c) Pleistocene
d) Pliocene

177. Survival of the fittest is the basic principle of a competition. Its importance in organic evolution was explained by
a) Lamarck
b) de Vries
c) Darwin
d) Mendel

178. Which of the following is an example of an ancestral homology?
a) Almost all modern reptiles, birds and mammals have forelimbs, a trait they also share with contemporary amphibians
b) The first birds and all their descendant species have feathers, a trait that is unknown in any other group
c) Humans and many insect species have eyes
d) All of the above

179. Swan-necked flask experiment proved
a) Biogenesis
b) Abiogenesis
c) Gene therapy
d) Both (a) and (b)

180. Industrial melanism was highlighted by
a) *Mimosa pudica*
b) *Triticum aestivum*
c) *Biston betularia*
d) Rock python

181. de Vries gave his mutation theory on organic evolution, while working on

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

182. Which of the following statement is correct regarding the evolution of humans?
I. The skull of adult chimpanzee is more like adult human skull than baby chimpanzee skull
II. The skull of baby chimpanzee is more like adult human than adult chimpanzee skull
III. *Dryopithecus* is oldest human like fossil
IV. *Dryopithecus* found in Miocene rock of Africa and Europe
The correct option is
a) I and II b) I and III c) I and IV d) All excepts I

183. Select the correct statement from the given options
a) Darwinism variation are small and directionless
b) Fitness is the end result of the ability to adapt and gets selected by nature
c) All mammals except whales and camels have seven cervical vertebrae
d) Mutations are random and directional

184. Human arm is homologous to
a) Seal flipper b) *Octopus* tentacle c) Bird wing d) Both (a) and (c)

185. Lamarck's theory of evolution is also known as
a) Theory of acquired characters
b) Theory of genetic characters
c) Theory of spontaneous characters
d) Theory of impose characters

186. Which fossil man has been known from Shivalik hills in India?
a) *Ramapithecus* b) *Zinjanthropus* c) *Shivapithecus* d) *Pithecanthropus*

187. The crosspterygian fish '*Latimaria*' is considered as the ancestor of terrestrial tetrapods. During which period these fishes evolved into Amphibians?
a) Devonian b) Silurian c) Ordovian d) Cambrian

188. *Australopithecus* is also called
a) Java ape man b) First ape man c) African ape man d) Both (b) and (c)

189. According to de Vries theory, evolution is
a) Discontinuous b) Jerky
c) Continuous and smooth d) Both (a) and (b)

190. Which is a unit of evolution?
a) Cell b) Individual c) Population d) Species

191. Primates which existed about 15 million years ago were
I. *Dryopithecus*
II. *Homo habilis*
III. *Ramapithecus*
IV. *Australopithecus*
V. *Homo erectus*
VI. Neanderthal man
Choose the correct option
a) I and II b) III and IV c) V and VI d) Only III

192. The Coenozoic era is often designated as
a) Age of fish b) Age of reptiles c) Age of mammals d) Age of amphibians

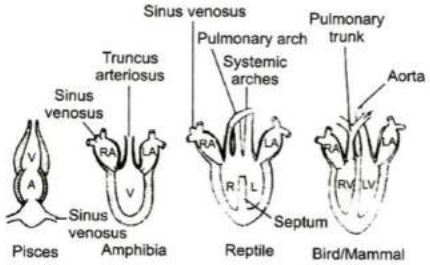
193. When and who wrote the book. *The origin of species*?
a) Mendel in 1809 b) Wallace in 1858 c) Lamarck in 1869 d) Darwin in 1859

194. Spontaneous generation theory was given by
a) F Redi b) L Spallanzani c) Louis Pasteur d) Aristotle

195. What is the relationship between the wing of a bird and the wing of a bat?

a) They are homologous because they represent modified forms of a trait present in a common ancestor (forelimbs)
b) They are analogous because while each carries out the same function (fight), this trait has arisen independently as a result of convergence
c) There is no relation between the wings of bird and wings of bat
d) They both have undergone severe mutation

196. Given diagram depicts



a) Evolutionary evidences from comparative anatomy and physiology
b) Evolutionary evidences from embryology
c) Evolutionary evidences from biochemistry and physiology
d) Evolutionary evidences from cytology

197. *Homo erectus* lived about
a) 2 million years ago
b) 1.5 million years ago
c) 1 million years ago
d) .5 million years ago

198. The concept of chemical evolution is based on
a) Crystallization of chemicals
b) Interaction of water, air and clay under interse heat
c) Effect of solar radiation on chemicals
d) Possible origin of life by combination of chemicals under suitable environment conditions

199. The stage next to *Homo habilis* was
a) *Homo erectus*
b) *Homo sapiens*
c) *Dryopithecus*
d) Neanderthal man

200. What was the name of the sail ship used by Charles Darwin during the sea Voyage?
a) HMS Beagle
b) HSM Beagle
c) HMS Eagle
d) HSM Eagle

201. In which era, life was absent?
a) Archaeozoic
b) Palaeozoic
c) Proterozoic
d) Azoic

202. The first cell like structure was appeared in
a) Air
b) Mountain
c) Ocean
d) Soil

203. Synthesis of amino acids to prove that amino acids were formed in primitive ocean was experimentally proved by
a) Sydney Fox
b) Oparin
c) Haldane
d) Stanley Miller

204. Separate the following into homologous and analogous organs
I. Sweet potato
II. Potato
III. Filippers of penguins and dolphins
IV. Hearts of different vertebrate
V. Forelimbs of whales, bat and cheetah
The correct option is

	Homologous organs	**Analogous organs**
a)	I, II, III	IV, V
b)	IV, V	I, II, III
c)	I, II	III, IV, V
d)	I, II, V	IV, III

205. *Echidna and Ornithorhynchus* are the connecting links between
a) Amphibians and aves
b) Mammals and amphibians
c) Reptiles and mammals
d) Reptiles and amphibians

206. Which one of the following is incorrect about the characteristics of protobionts (coacervates and microspheres) as envisaged in the abiogenic origin of life?
a) They were able to reproduce
b) They could separate combinations of molecules from the surroundings
c) They were partially isolated from the surroundings
d) They could maintain an internal environment

207. Find out wrong statement about *Homo habilis*
I. Also called able or skilful man
II. Also called tool marker
III. Fossil discovered from fast Africa
IV. 500 cc
V. Have teeth likes modern man
VI. Lined 2 million years ago
The correct choice is
a) Only IV b) Only V c) Only II d) Only VI

208. I. Random selection
II. Convergent evolution
III. Genetic drift
IV. Divergent evolution
Choose the correct option for Sewell's effect from above option
a) I and II b) III and IV c) Only III d) Only IV

209. Information molecule to get evolved first on the primitive earth was
a) Protein b) DNA c) RNA d) All of these

210. The first mammals were like ...A... . Their fossils are small sized. Mammals were ...B... and protected their unborn young inside the mother's body
Choose the correct option for A and B to complete the given NCERT statement
a) A-shrews. B-viviparous
b) A-monkeys, B-viviparous
c) A-monkeys, B-oviparious
d) A-shrews, B-oviparious

211. Ontogeny recapitulates phylogeny, this theory is called as
a) Biogenetic law b) Law of embryology
c) Law of acquired characters d) Law of bridges

212. Present concept of evolution is the result of the work by number of scientists
I. T Dobzhansky II. RA Fisher
III. JBS Haldane IV. Charles Darwin
V. Sewall Wright VI. Ernst Mayer
VII. Hugo de Vries VIII. GL Stebbins IX. Lamarck
The scientists who contributed to the present concept of evolution are
a) I, II, III, IV, V, VII, VIII b) I, II, III, V, VII, VIII, IX c) I, II, III, V, VI, VIII, IX d) II, III, IV, V, VI, VII, IX

213. What is the supportive evidence for evolution from comparative embryology?
a) All plant seeds look alike
b) All embryos arises by the union of egg and sperm
c) Different species have different embryos
d) Different species develops along the pattern set by their common ancestor

214. *Homo erectus* had large brain around ...A... cc. *Homo erectus* was probably ...B... . Here A and B refers to
a) A-700 cc, B-carnivorous b) A-700 cc, B-herbivorous
c) A-900 cc, B-omnivorous d) A-800 cc, B-herbivorous

215. Identify the cranial capacity *A*, *B* and *C* of the given primates

Primates	Cranial capacities (in cubic centimetris)
1. Chimpanzee and gorilla	*A*
2. Australopithecus	500 cc
3. *Homo habilis*	*B*
4. Java ape man	800-1000 cc
5. Peking man	*C*

a) A-325-500 cc, B-900 cc, C-800-1000 cc
b) A-325-510 cc, B-700 cc, C-850-1000 cc
c) A-325-510 cc B-700 cc, C-850-1200 cc
d) A-325-510 cc B-700 cc, C-850-1400 cc

216. In plants like *Acacia*, the leaves are compound but their seedlings possess simple leaves. This phenomenon can be explained by
a) Adaptive radiation concept by Darwin
b) Theory of inheritance of acquired characters by Lamarck
c) Recapitulation concept by von Baer
d) Mutation theory by de Vries

217. *Australopithecus* has been given the nick name Lucy by
a) Edward Lewis b) Donald Johanson c) LSB Leaky d) C Fuhlroti

218. Which of the following is not an example of evolutionary change?
a) The dark form of many moth species has increased in areas with increased pollution
b) Penicillin resistant forms of bacteria have arisen, by the introduction of antibiotics
c) The last American eagle dies off, leading to the extinction of the species
d) All of the above

219. Darwin travelled in which of the following ship?
a) H N S Eagle b) D Matrica c) H M S Beagle d) Titanic

220. Flippers of seal are
a) Modified forlimbs b) Modified hindlimbs c) Modified gill d) Modified fins

221. The cranial capacity of Peking man was about
a) 900 cc b) 1660 cc c) 1075 cc d) 1450 cc

222. Resistant varieties evolved in much lesser time because of
a) Natural selection
b) Faster rate of mutation
c) Anthropogenic (human) activities
d) Random selection

223. Which of the following features are true for stabilizing type of natural selection?
a) Selection of averaged individual
b) It reduces variation
c) It is bell-shaped
d) All of the above

224. Homologous organs indicate the
a) Convergent evolution
b) Parallel evolution
c) Common descendent
d) Natural selection

225. Evolutionary convergence is the development of
a) Common set of characters in a groups of different ancestry
b) Dissimilar characters in closely related groups
c) Common set of characters in closely related groups
d) Development of characters by random mating

226. Which of the following is a pair of analogous organs?
a) Contractile vacuole in *Amoeba* and uriniferous tubule in frog
b) Paddle of whale and front legs of horse
c) Mouth parts in insects
d) Forelimbs in lizard and wings in birds

227. First evidence of ceremonial burial of dead body and belief in religion have been found with fossil of
a) Neanderthal b) Cro-magnon c) *Homo erectus* d) *Homo habilis*

228. Which of the given pairs are correct
I. Wings of insects and birds are homologous organ
II. Wings of bats and bird are homologous organ
III. Wings of insect and bats are analogous
IV. Wings of insect and bird are analogous
Choose the correct option
a) I and II b) I and III c) I and IV d) II, III and IV

229. In a random mating population in equilibrium, which of the following brings about a change in gene frequency in non-directional manner?
a) Selection b) Migration c) Mutation d) Random drift

230. The theory of pangenesis was rejected due to the acceptance of
a) Spallanzani theory of biogenesis b) Richter theory of cosmozoic
c) Cuvier theory of catastrophism d) Weismann theory of germplasm

231. There was no life in
a) Cenozoic era b) Mesozoic era c) Palaeozoic era d) Azoic era

232. Why is the advent of reproductive isolation is important from an evolutionary standpoint
a) When the organisms comprising two population of a species can no longer interbreed, the flow of genetic material between them stops
b) It is not important from an evolutionary standpoint. The question is based on a false assumption
c) Reproductive isolation increases the mutational rate
d) Reproductive isolation may slow down reproduction

233. There are two opposing views about origin of Modern man. According to one view, *Homo eretus* in Asia were the ancestors of modern man. A study of variations of DNA however suggested African origin of modern man. What kind of observation on DNA variation could suggest this?
a) Greater variation in African than in Asia b) Variation only in Asia and no variation in Africa
c) Greater variation in Asia than in Africa d) Similar variation in Africa and Asia

234. A population containing a gene 'X' with two alleles 'Aa' is in Hardy-Weinberg equilibrium for gene 'X'. If the gene frequency of allele 'A' is 0.2, allele frequency of 'a' is
a) 0.2 b) 0.42 c) 0.8 d) 1

235. Which of the following are the correct pair of homologous organs?
I. Hands of man and wings of bat
II. Wings of bat and wings of cockroach
III. Wings of bird and wings of butterfly
IV. Fins of fish and forelimbs of horse
V. Forearm of human and forelimbs of horse
The correct combination is visible in option
a) I and II b) I and V c) III and IV d) IV and V

236. Which of the following presumably possesses a cranial capacity larger than modern man?
a) Neanderthal man b) Peking man c) *Australopithecus* d) Cro –magnon man

237. Hardy-Weinberg principle is the
a) Genetic structure of a non-evolving population
b) Genetic structure of an evolving population
c) Phenotypic structure of an evolving population
d) Phenotypic structure of a non-evolving population

238. Which of the following statement is correct?
a) Adaptation due to geographical isolation
b) Evolution of different species from a common ancestor
c) Migration of members of a species to different geographical areas

d) Power of adaptation in an individual to a variety of environments

239. Genetic drift in also known as
a) Hardy effect
b) Weinberg effect
c) Hardy-Weinberg effect
d) Sewall Wright effect

240. Which of the following is the first vascular plant to be represented by an extinct group?
a) Bryophytes
b) Lycopods
c) Conifers
d) Cycads

241. The concept that the species have changed over long period of time is known as
a) Ecology
b) Embryology
c) Spontaneous generation
d) Organic evolution

242. Choose the wrong statements
I. The essence of Darwinian theory about evolution can be seen in the phenomenon of natural selection
II. The rate of appearance of new forms is not linked to the evolution
III. Adaptive ability is a complete evolution
IV. Mutations are random and directionless
The correct option is
a) I and II
b) III and II
c) I and III
d) I and IV

243. Connecting links are organism which shows characters of
a) Its phylum only
b) Two groups (phylums)
c) Its class only
d) Its order only

244. The ratio of methane, ammonia and hydrogen in Stanley Miller's experiment was
a) 3 : 1 : 2
b) 2 : 1 : 2
c) 1 : 2 : 1
d) 5 : 4 : 1

245. Proteinoids are
a) Carbohydrate structure consisting of branched sugars
b) Fatty acid structure consisting of branched fatty molecules
c) Protein structure consisting of branched amino acids
d) Protein structure consisting of unbranched amino acids

246. Evolutionary history of an organism is known as
a) Phylogeny
b) ancestry
c) Palaeontology
d) ontogeny

247. Evolutionary convergence is the development of
a) Common set of characters in closely related groups
b) Common set of characters in the group of different ancestry
c) Random mating
d) Dissimilar characters in the closely related groups

248. Random genetic drift in a population probably results from
a) Constant low mutation rate
b) Large population size
c) Highly genetically variable individuals
d) Interbreeding within this population

249. Organs differ in origin but performing similar function
a) Analogous
b) Homologous
c) Vestigial
d) Atavism

250. *Homo sapiens* were arose in
a) India
b) America
c) England
d) Africa

251. 'PP' is a type of selection that favours both small sized and large-sized individual. 'PP' eliminates most of the members with mean expression, so as to produce two peak in the distribution of the tract that many lead to the development of two different populations. Identify 'PP'
a) Disruptive selection
b) Opposite of stabilizing selection
c) Diversifying sekection
d) All of these

252. Formation of simple and less elaborated forms from the more complex and specialized one is called

a) Progressive evolution
b) Microevolution
c) Macroevolution
d) Retrogressive evolution

253. Natural selection means
a) Better adaptability
b) Elimination of less adapted
c) Better survival
d) All of the above

254. Which of the following statements are correct?
I. Directional selection favours one extreme form over the other extreme and over intermediate forms of a trait
II. Stabilising selection favours the intermediate forms of a trait
III. Disruptive selection favours both the extreme forms of a trait
IV. Fossils are the remnents of hard parts of life forms present in rocks
V. A study of fossils in different sedimentary layers indicates the geological period in which they live
VI. Radio isotopes are often used to determine the age of the fossils
VII. Study of fossils is called Palaeontology
VIII. Most fossils are found in sedimentary rocks
IX. The unit of evolution is population
a) All except I, III and X
b) All except IV, V and II
c) All except VII, V and IX
d) All of the above

255. ...A... is a binomial expression of $(p+q)^2$. When frequency measured, differs from the expected values, the difference indicates the extent of ...B...
Choose the option for A and B to complete the given NCERT statement
a) A$-p^2+2pq+q^2=1$; B-evolutionary change
b) A$-p^2+2pq+q^2+q^2=1$; B-genetic change
c) A$-p^2+2pq+q^2\geq 1$; B-genetic change
d) A$-p^2+2pq+q^2\leq 1$; B-evolutionary change

256. Which one of the following features occurs in the direction of the evolution for human species?
a) Well developed brain
b) Opposable thumb
c) Binocular vision
d) All of these

257. The theory of random genetic drift was proposed by
a) Hardy –Weinberg
b) R A Fischer
c) Sewall Wright
d) Mayr

258. How old is our universe?
a) 10 billion year old
b) 20 billion year old
c) 15 billion year old
d) 5 billion year old

259. Which of the following defines Hardy –Weinberg law?
a) $p^2+2pq+q^2=1$
b) $p^2+2pq+q^2=1$
c) $p^2+2pq+q^2=0$
d) $q^2+p^2+2pq=0$

260. Correct order of evolutionary scale is
a) Palaeozoic → Archeozoic → Cenozoic
b) Archaeozoic → Palaeozoic →Proterozoic
c) Palaeozoic, Mesozoic, Cenozoic
d) Mesozoic → Archaeozoic→Proterozoic

261. The concept of inheritance of acquired character in support of evolution was proposed by
a) Darwin
b) Cuvier
c) Lamarck
d) de Vries

262. *Peripatus* is a connecting link between
a) Ctenophora and Platyhelminthes
b) Mollusca and Echinodermata
c) Annelida and Arthropoda
d) Coelenterata and Porifera

263. Convergent evolution is shown by
a) Homologous organs
b) Analogous organs
c) Vestigial organs
d) All of these

264. Which one of the following are homologous organs?
a) Wing of butterfly, wing of bird, wing of bat
b) Forelimb of frog, wing of bird, forelimb of rabbit, flipper of whale
c) Thoracic leg of cockroach, hindleg of frog, forelimb of rabbit
d) Wing of bird, wing of bat, wing of flying lizard

265. Fossilized faecal material of animals are known as

a) Coprolites b) Compressions c) Moulds d) Casts

266. Identify the phenomenon in which the members of a species do not interbreed with the members of other species or same species
a) Habitat species b) Geographical isolation
c) Temporal isolation d) Reproductive isolation

267. I. Use and disuse of organs
II. Inheritance of acquired characters
III. Branching descent
IV. Natural selection
V. Mutation
VI. Reproductive isolation
The two key concepts of Darwinism from the given options are
a) I and II b) III and IV c) V and VI d) IV and VI

268. Related species which are reproductively isolated but mophologically similar are called
a) Sibling b) Sympatric c) Allopatric d) Morphospecies

269. An important evidence in favour of organic evolution is the occurrence of
a) Homologous and vestigial organs b) Analogous and vestigial organs
c) Homologous organs only d) Homologous and analogous organs

270. Evolution is
a) Sudden change occurring in a population
b) Progeny with modifications
c) Discontinuous process
d) All of the above

271. The result of Miller's experiments were discussed in the book 'The Planets' written by
a) Sayere b) Harold Urey c) Huxley d) Stanley

272. Which of the following experiment suggested that simplest living organisms could not have originated spontaneously from non-living matter?
a) Microbes did not appear in stored meat
b) Larvae could appear in decaying organic matter
c) Microbes appeared from unsterilized organic matter
d) Meat was not spoiled, when heated and kept sealed in a vessel

273. Darwin asserted that ...A... which are heritable and which makes the resources utilization ...B... for few, will enable only those to reproduce and leave ...C... progeny
Choose the correct option for A, B and C to complete the given statement
a) A-variations, B-better, C-more b) A-variations, B-better, C-less
c) A-variations, B-normally, C-less d) A-variations, B-normally, C-more

274. Phenomenon in which the genetic drift gives rise to a new sample of population is called
a) Founder's effect b) Divergent evolution
c) Bottle neck effect d) Stabilizing selection

275. Genetic drift operates to
a) Large isolated population b) Small isolated population
c) Fast reproductive population d) Slow reproductive population

276. *Archaeopteryx* is a connecting link between
a) Reptiles and birds b) Birds and mammals
c) Amphibians and reptiles d) None of the above

277. Which one of the following is not a vestigial structure in *Homo sapiens*?
a) Third molar b) Epiglottis c) Plica semilunaris d) Pyramidalis muscle

278. Which of the following was not explained by the Darwinism?
a) Natural selection b) Struggle for existence
c) Arrival of the fittest d) Origin of species

279. Creation of new taxa is focussed in
a) Macro-evolution
b) Theory of special creation
c) Sympatric speciation
d) Theory of pangenesis

280. Which of the following statement is correct?
a) Stem cells are specialized cells
b) There is no evidence of the existence of gills during embryogenesis of mammals
c) All plants and animals cells are totipotent
d) Ontogeny repeats phylogeny

281. Lung fishes, air breathing animals and corals predominated during the ..... period
Complete the given statement by choosing an appropriate option
a) Mississippian
b) Silurian
c) Devonian
d) Jurassic

282. Development of different functional structures from a common ancestral form is called
a) Differential evolution
b) Adaptive radiation
c) Non-adaptive radiation
d) Regressive evolution

283. Hand of man, wing of bat and flipper of seal represents
a) Vestigial organs
b) Analigous organs
c) Evolutionary organs
d) Homologous organs

284. Who wrote the famous book Origin of Species?
a) Lamarck
b) Darwin
c) de Vries
d) Mendel

285. According to the heterotroph hypothesis, the first life on the earth was able to
a) Synthesis its food from inorganic compounds
b) Feed upon carbohydrates produced by autotrophs
c) Feed upon available nutrients in the environment
d) Carry on photosynthesis instead of respiration

286. Which of the following events is an examples of evolution?
a) Different finch species found of different Galapagos islands
b) Remarkable rise in antibiotic resistant strains of bacteria
c) Changes in guppy populations after the introduction of predators
d) All of the above

287. The theory that evolutionary change is slow and continuous this phenomenon is known as
a) Punctuated equilibrium
b) Geographic isolation
c) Speciation
d) Gradualism

288. Links between organisms that shows branching pattern of evolutionary relationships are shown by
a) Living fossils
b) Comparative embryology
c) Phylogenetic trees
d) Two fossil layers

289. Which of the following is not Darwin's conclusion?
a) Survival of the fittest
b) Struggle for existence
c) Inheritance of acquried characters
d) Origin of species by natural selection

290. Which group of organisms is believed to be evolved first on earth?
a) Arthropods
b) Coelenterates
c) Protozoans
d) Reptiles

291. Artificial synthesis of ATP, porphyrin and nucleotides was detained by
a) Fox
b) Orgeal
c) Miller and Urey
d) Darwin

292. The biochemical analysis of different chlorophyll pigments in plants would be most useful in determining
a) How plants reproduce asexually
b) How plants pass favourable traits to their offspring
c) Why some plants produce haemoglobin
d) Which plants might have a common ancestor

293. Select the wrong statements
I. Swank-neck flask experiment was performed by Louis Pasteur
II. Louis Pasteur is famous for germ theory of disease

III. Louis Pasteur disapproved spontaneous theory forever
IV. Cosmozoic theory of origin of life was proposed by Richter
V. Theory of catastrophism was given by Georges Cuvier
Choose the correct option

a) I, II and IV b) I, III and IV c) III, IV and V d) None of these

294. Percentage of homology in the haemoglobin of man and gorilla is

a) 97% b) 96% c) 99% d) 98%

295. Hybridized sterile ($2n$) plant can be converted into a fertile species by doubling the chromosomes through induced polyploidy. Such plants are called

a) Diploid b) Tetraploids c) Amphidiploids d) Amphitetraploids

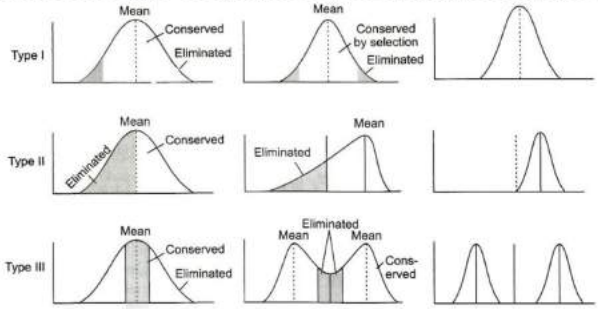
296. Abiogenesis means

a) Origin of eukaryotes b) Origin of life from living organisms
c) Origin of life from non-living organisms d) Origin of prokaryotes

297. Pouched marsupials are found only in

a) New Zealand b) Australia c) Both (a) and (b) d) Canada and Australia

298. Name the type of natural selection depicted in the given diagram (type I, type II and type III)



Type I Type II Type III

a) Disruptive Directional Stabilising b) Directional Disruptive Stabilising
c) Stabilizing Directional Disruptive d) Stabilising Disruptive Directional

299. Evolution is not continuous. It is a Jerky and a discontinuous process. This is the punch line of

a) Natural selection theory of evolution b) Theory of acquired character
c) Mutational theory of evolution d) Synthetic theory of evolution

300. Which of the following statements are correct?

I. Survival of the fittest is based upon the characteristics that are inherited
II. Darwin's variations are small and directional
III. The fitness is the end result of the ability of adults
IV. Genetic drift is operated in small population
V. Genetic drift operates in large population
VI. Genetic drift upset the Hardy-Weinberg equilibrium
Choose the correct option

a) I, II, III and IV b) IV, V, VI and II c) I, II, III, V and VI d) I, II, III, IV and VI

301. If frequency, of 'A' allele is 0.4 than, find out the frequency of 'B' allele and heterozygous genotype in a random mating population at equilibria

a) 0.6 and 0.24 b) 0.6 and 0.96 c) 0.6 and 0.48 d) 0.6 and 0.50

302. Darwin differentiate ...A... species of finches and grouped them into ...B... main types.
Choose the correct option for A and B to complete the given statement

a) A-six; B-thirteen b) A-fifteen; B-six c) A-seven; B-three d) A-fourteen; B-seven

303. When a species gets separated geographically, it evolves separately. Which of the following condition would determine whether they are now different species?

I. They failed to interbreed
II. They failed to give fertile offspring

III. They have different coloured body
IV. They appear morphologically slightly different
Choose the correct combination from given options
a) I and II b) II and III c) III and IV d) I and IV

304. First cell produced on earth is
a) Protobiont b) Protozoa c) Metazoa d) None of these

305. Biochemical similarities indicates the
a) Similarities in carbohydrates of organisms b) Similarities in fat (fatty acid) of organisms
c) Similarities in protein and genes of organisms d) All of the above

306. Who proposed the Big-Bang theory?
a) Father Saurez b) Abbe Lemaitre c) Arno Allen Penzias d) Edwin P Hubble

307. Organic evolution means
a) Cumulative change of living population b) Progressive development of an organ
c) Development of different races d) History of human races

308. Fossil man, who made cave paintings, is
a) Java man b) Neanderthal man c) Cro –magnon man d) Peking man

309. What is meant by the term "Darwin fitness"
a) The ability to survive and reproduce b) High aggressiveness
c) Healthy appearance d) Physical strength

310. Primary source of allelic variation is
a) Due to long periods of evolutionary changes b) Due to abrupt mutations
c) Suddenly on earth d) By seed dispersal

311. All organism shares the same types of proteins and biochemical pathways. This supports the fact that
a) Evolution occurs very fast b) Life began on earth a long time ago
c) All organism have common ancestry d) Evolution is an ongoing process

312. *Ornithorhynchus* is a connecting link between
a) Birds and reptiles b) Reptiles and amphibians
c) Birds and amphibians d) Fishes and amphibians

313. Analogous organs appears as the result of
a) Divergent evolution b) Progressive evolution
c) Retrogressive evolution d) Convergent evolution

314. Who proposed that the first form of life could have come from pre-existing non-living organic molecules?
a) S L Miller b) Oparin and Haldane c) Charles Darwin d) Alfred Wallace

315. Vestigial organ in human being is
a) Canine b) Hindlimb c) Incisor d) Premolar

316. The scientific name of Java man is
a) *Homo habilis* b) *Homo sapiens neanderthalensis*
c) *Homo erectus erectus* d) *Australopithecus boisei*

317. Example of convergent evolution is
a) Darwin finches and marsupial mouse b) Placental wolf and Tasmanian wolf
c) Placental wolf and Darwin finches d) Tasmanian wolf and marsupial mouse

318. Which theory arguments that life on earth came from outer space?
a) Theory of panspermia b) Cosmozoic theory
c) Spore theory d) All of these

319. Which of the following is the most primitive ancestor of man?
a) *Homo habilis* b) *Homo neanderthalensis*
c) *Australopithecus* d) *Ramapithecus punjabicus*

320. Presence of visceral pouches in the embryos of all vertebrates supports the theory of
a) Organic evolution b) Biogenesis c) Metamorphosis d) Recapitulation

321. A population exhibiting Hardy-Weinberg equilibrium possesses 25% recessive traits. Find out the frequency of recessive alleles in the gene pool of the same population
a) 0.5 b) 0.4 c) 0.3 d) None of these

322. Which of the following natural process is likely to fasten organic evolution?
a) Favourable environment b) Overproduction
c) Abundant genotypic variations d) Reproductive isolation

323. *Homo sapiens neanderthalensis* and *Homo sapiens sapiens* (Cro-magnon man), were originated from
a) *Homo erectus* b) *Homo habilis* c) *Ramapithecus* d) *Proconsul*

324. How might an evolutionary biologist why a species of salamander becomes blind after colonizing a cave?
a) It is possible that in the cave there is a source of pollution that increases the mutation rate for a gene that makes salamanders blind. Over time, due to exposure to this chemical, the members of the population lose their sight
b) Members of the ancestral population that colonized the cave differed in their ability to see. If maintaining the ability to see in the cave was a waste of energy, blind salamanders might actually have more offspring than those who could see
c) There is no to explain this in terms of natural selection
d) The members of this salamander species no longer needed to use their eyes. Over time, due to the lack of use, they lost the ability to see

325. Which one amoung the following is an example for homology?
a) Eye of *Octopus* and mammals
b) Tuber of sweet potato and potato
c) Wings of butterfly and birds
d) Thorn and tendrils of *Bougainvillea* and *Cucurbita*

326. Coacervates belong to category of
a) Cyanobacteria
b) Protozoans
c) Molecular aggregates
d) Molecular aggregate surrounded by lipid membrane

327. Which of the following sequences was proposed by Darwin and Wallace for organic evolution?
a) Over-production, constancy of population size, variations, natural selection
b) Variations, natural selection, over-production, constancy of population size
c) Over -production, variations, constancy of population size, natural selection
d) Variations, constancy of population size, over-production, natural selection

328. Fossils are useful in
a) Studying extinct organisms b) Studying history of organism
c) Both (a) and (b) d) None of the above

329. Biological concept of species is mainly based on
a) Reproductive isolation b) Morphological features only
c) Methods of reproduction only d) Morphology and methods of reproduction

330. Which of the following statements stands in favour of abiogenesis?
I. Spontaneous generation
II. Origin of viruses and microbes
III. Origin of life from living organism
IV. Origin of life from non-living organism
The correct combination is
a) I and II b) II and III c) III and IV d) I and IV

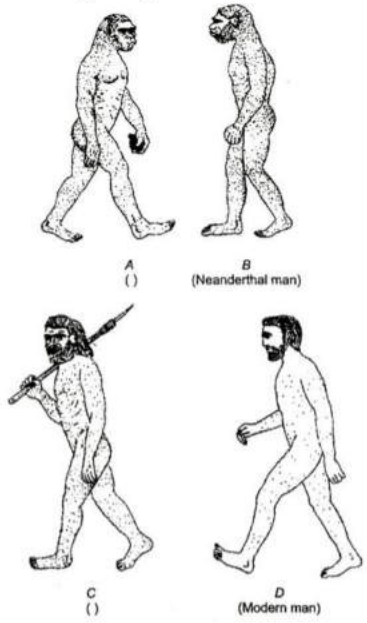
331. The brain capacity of *Homo erectus* was about
a) 650 cc b) 900 cc c) 1200 cc d) 1400 cc

332. Single step large mutation leading to speciation is also called
a) Founder's effect b) Saltation c) Branching descent d) Natural selection

333. According to Oparin, which one of the following was not present in the primitive atmosphere of the earth?
a) Methane b) Oxygen c) Hydrogen d) Water vapour

334. What is the use of Electronic Spin Resonance (ESR) in fossil studies?
a) It helps to study the proteins in sedimentary fossils
b) It helps to revise the evolutionary period for different groups of organisms
c) It helps to study the enzymes present in sedimentary fossils
d) All of the above

335. In the given picture of human evolution, identify the missing stages, *i. e.*, *A* and *C*



a) A-*Homo erectus*; C-Cro-magnon man b) A-*Homo erectus*; C-*Australopithecus*
c) A-Cro-magnon man; C-*Australopithecus* d) A-Cro-magnon man; C-*Homo erectus*

336. Wings of birds and wings of flies perform similar functions so they are examples of
a) Homologous organ b) Analogous organ c) Evolutionary organ d) Paralogous organ

337. Vestigial organs present in an adult individual are examples of ..... Basis of evidence of evolution.
a) morphological b) Palaeontological c) Embryological d) Anatomical

338. Evolution that shift the allele frequency in a study consistent direction is called?
a) Directional evolution
b) Disruptive evolution
c) Molecular evolution
d) All of these

339. Bird with average sized wings survived in the severe strom but the short winged birds died. It shows
a) Stabilizing selection b) Gene flow c) Diversifying selection d) Founder effect

340. Cosmozoic theory was proposed by
a) Helmhontz b) Richter c) Pasteur d) Arrhenius

341. Major radiations of mammals, birds and pollinating insects took place in which epoch?
a) Oligocene b) Ecocene c) Pliocene d) Palaeocene

342. In the early earth, organic acids were produced by the combination of H_2 with
a) Ammonia and methane b) Hydrogen
c) Organic matter d) Sulphates and nitrates

343. Change of frequency of alleles in a population results in evolution. This statement is proposed in
a) Darwin's theory b) Lamarck's theory
c) Hardy –Weinberg principle d) de Vries theory

344. The first enzyme on the primitive earth was/were
a) Proteins b) DNA c) RNA d) Amino acids

345. Ancestor of man, who first stood erect, was
a) *Australopithecus* b) Cromagnon c) Java –ape man d) Peking man

346. Theory of special creation arguments that
I. all living organisms were created as such
II. the diversity was always the same since creation
III. earth is 4000 years old
Choose the right option to complete the given statement
a) I and II b) II and III c) I and III d) I, II and III

347. 'Use and disuse' theory was proposed by
a) Lamarck b) Darwin c) Hugo de Vries d) Malthus

348. What kind of variation contributes to the height of animals?
a) Somatogenic variations b) Discontinuous variations
c) Continuous variations d) Blastogenic variations

349. The most recent and direct prehistoric ancestor is
a) Cro –magnon b) Pre –Neanderthal c) Neanderthal d) None of these

350. Evolution for Darwin was gradual, while de Vries believed that mutations, caused speciation. The belief of de Vries supports the concept of
a) Saltation b) Evolution c) Genetic equilibrium d) Variance

351. Study of origin and development of humans in all their physical, social and cultural relationship is called
a) Zoology b) Anthropology c) Biogeography d) Zoogeography

352. Which of the following best shown the common origin of man and chimpanzee?
a) Chromosome banding b) Binocular vision
c) Cranial capacity d) Dental formula

353. Neo-geographic speciation can be found in
a) Parapatric speciation
b) Peripatric speciation
c) Allopatric speciation
d) Sympatric speciation

354. Which of the following statement are correct about *Homo erectus*
I. Had a large brain around 900cc
II. Appeared about 1.5 million years ago
III. Ate meat/omnivorous
IV. Evolved from *Homo habilis*
Choose the correct option
a) I and II b) II and III c) III and IV d) I, II, III and IV

355. Evolution is
a) Discontinuous process b) Continuous process
c) Both (a) and (b) d) Non-essential process

356. Which of the following is an example of fossils?
a) Pollen grains buried in the bottom of peat bogs b) The petrified cast of clam's burrow
c) The impression, a clam shell made in mud, preserved in mudstone d) All of the above

357. Rapid evolution a number of new taxa in a short span of time due to large scale of environmental change is called
a) Coevolution b) Quantum evolution c) Convergent evolution d) Divergent evolution

358. Which of the following statement describes that natural selection is not analogous to artificial selection
a) Natural selection picks the fits organism, whereas in artificial selection, the breeder decide which organism will breed
b) Natural selection depends upon the presence of variation while artificial selection do not
c) Natural selection occurs within the population but it is not mendatory in case of artificial selection

d) There is a limit of changes that can be brought by natural selection but no such limit exists for artificial selection

359. What happened to NH_3 present in the primary atmosphere during its conversion to the secondary atmosphere?
a) It got oxidized to H_2 and water
b) It was absorbed by photoautotrophs
c) Most of it got oxidized to nitrogen oxides
d) It concentration was decreased due to O_2 formation

360. Select the incorrect statements
I. Natural selection is essential for evolution
II. Natural selection do not include variations
III. Concept of natural selection was given by Hugo de Vries
IV. Mutation is the sudden inheritable change
V. Synthetic theory is also called Neo-Darwinism theory of evolution
The correct combination is a
a) I, II and III b) II, III and IV c) III, IV and V d) II and III

361. Cro –magnon was
a) Frugivorous b) Carnivorous c) Herbivorous d) Omnivorous

362. Urey –Miller's experiment mixture had the following except
a) Methane b) CO_2 c) Hydrogen d) Water vapour

363. Life appeared
a) 500 million years after the formation of earth b) 600 million years after the formation of earth
c) Four billion years back d) Both (a) and (c)

364. Evidence that evolution of life forms has indeed taken place on earth has come from
a) Fossils study (palaeontological evidence)
b) Morphological and comparative anatomical study
c) Biochemical study
d) All of the above

365. Darwin in his 'natural selection theory', did not believed in any role of which one of the following in organic evolution?
a) Struggle for existence b) Discontinuous variations
c) Parasites and predators as natural enemies d) Survival of the fittest

366. The first living beings were
a) Chemoheterotrophs b) Chemoautotrophs
c) Oxygenic photoautotrophs d) Anoxygenic photoautotrophs

367. Offsprings formed by the combination of new characters are called
a) Mutant b) Recombinant c) New variety d) All of these

368. Evolution is the
a) Disturbance in the genetic equilibrium
b) Disturbance in Hardy-Weinberg principle
c) Change in frequency of alleles in population
d) All of the above

369. The most recent era in geological time scale is
a) Mesozoic b) Cenozoic c) Palaeozoic d) Proterozoic

370. Change of lighter coloured variety of peppered moths (*Biston betularia*) to darker variety occurred due to
a) Selection of darker variety for survival in smoke laden industrial environment
b) Deletion of gene
c) Industrial carbon deposited on the wings
d) Translocation of gene

371. Which of the following pairs is correct?
a) Bats wings and insect wings are analogous
b) Seal flippers and bats paw are homologous
c) Insect wings and bird wings are homologous
d) Thorns of *Bougainvillea* and tendrils of pea are analogous

372. Two key concepts of Darwinian theory of evolution are
I. branching descent
II. use and disuse of organs
III. natural selection
IV. somatic variance
The correct combination is
a) I and II b) III and IV c) I and III d) II and IV

373. Origin of different types of beaks occur due to
a) Natural selection b) Interspecific competition
c) Genetic drift d) Interspecific variation

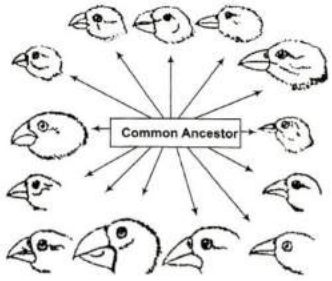
374. The early man whose skeleton is almost indistinguishable from that of modern man is
a) Neanderthal man b) Peking man c) *Homo erectus* d) Cro- magnon man

375. Coacervates were experimentally produced by
a) Urey and Miller b) Jacob and Monod
c) Fischer and Huxley d) Sydney Fox and Oparin

376. Which of the following evolved first on the primitive earth?
a) Viroids b) Coacervates c) Cyanobacteria d) Mycoplasma

377. Given below some major events in the early history of life
I. First heterotrophic prokaryotes
II. First eukaryotes
III. First autotrophic prokaryotes
IV. First animals
Choose the correct sequence of these evolutionary events
a) IV, III, II, I b) I, III, II, IV c) I, II, III, IV d) IV, I, II, III

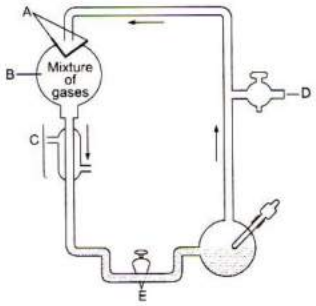
378. Identify what is indicated in the given diagram?



I. Natural selection
II. Adaptive radiation
III. Ecological succession
IV. Different species of finches by mutation
a) I and II b) I and III c) III and IV d) II and IV

379. First dinosaurs and first egg-laying mammals were originated in
a) Jurassic period b) Triassic period c) Permian period d) Cambrian period

380. The diagram represent Miller's experiment. Choose the correct combination of labelling.



A-Electrodes

B – $NH_3 + H_2 + H_2O + CH_4$

a) C- Cold water

D- Vacuum

E- U-trap

A-Electrodes

B – $NH_4 + H_2 + CO_2 + CH_3$

b) C- Hot water

D- Vacuum

E- U-trap

A-Electrodes

B – $NH_3 + H_2O$

c) C- Steam

D- U-trap

E- Vacuum

A-Electrodes

B – $NH_3 + H_2 + H_2O + CH_4$

d) C- Steam

D- Vacuum

E- U-trap

381. *Philosophie Zoologique* was written by

a) Darwin b) Linnaeus c) Lamarck d) Theophrastus

382. Mark the correct statements

I. Fitness of individuals means reproductive fitness

II. Homology in vertebrae brain indicates common ancestry

III. Theory of acquired character was given by de Vries

IV. After industrialization, the white moth did not survive due to predators

The correct option is

a) I, II and III b) I, III and IV c) II, III and IV d) I, II and IV

383. Genetic basis of adaptation was performed by

a) Joshua Lederberg b) Carolus Linnaeus c) Mayer d) De Vries

384. Identify the cranial capacity *A* and *B* of the given primates

Primates	Cranial Capacities (in cubic centimetris)
1. Heidelberg man	1300 cc
2. Neanderthal man	*A*
3. Cro-Magnon man	1650 cc

4. Living Modern man	*B*

a) A-1300-1600 cc, B-1450 cc
b) A-1200-1300 cc, B-1450 cc
c) A-1200-1300 cc, B-1600 cc
d) A-1600 cc, B-1300-1600 cc

385. In which epoch, only modern humans prevails?
a) Pleiostocene b) Holocene c) Pliocene d) Micoene

386. Select the examples which favours the mutational theory of evolution
I. Ancon sheep II. Hornless cattle
III. Cicer gigas IV. Novel oranges
V. Hairless cat VI. Double toed cat
The correct combination is
a) I, II and III b) III, IV and V c) IV, V and VI d) I, II, III, IV, V and VI

387. Although all mammals have some common characters, but they shows conspicuous differences due to
a) Genetic drift b) Convergence c) Divergence d) Normalisation

388. A good example for recapitulation theory is
a) Embryonic membranes of reptiles
b) Tadpole larva of frog
c) Placenta of mammals
d) Canine teeth of frog

389. Which of the following pairs is correct?
a) Wings of kiwi
b) Coccyx in man
c) Pelvic girdle of python
d) Flipper of seal

390. Atavism is
a) Appearance of ancestral traits
b) Loss of existing traits
c) Modification of existing characters
d) Loss of new characters

391. The best description of natural selection is
a) The survival of the fittest
b) The struggle for existence
c) The reproductive success of the members of a population best adapted to the environment
d) A change in the proportion of variation within a population

392. Which one of the following amino acid was not found to be synthesized in Miller's experiment?
a) Glycine b) Aspartic acid c) Glutamic acid d) Alanine

393. The ...A... from the sun broke up water into hydrogen and oxygen and the ...B... escaped. Oxygen combined with ammonia and methane to form ...C... . CO_2 and others. The ozone layer was formed. As it cooled, the water vapour fell as rain, to fill all the depressions and form ...D...
Choose the correct option for A,B,C and D to complete the given paragraph, to NCERT textbook
a) A-IR rays, B-lighter H_2, C-water, D-oceans
b) A-UV rays, B-lighter H_2, C-water, D-oceans
c) A-UV rays, B-heavier H_2, C-water, D-oceans
d) A-UV rays, B-heavier H_2, C-water, D-oceans

394. Evolution occurs when
a) Genetic equilibrium is upset
b) Genetic equilibrium is not upset
c) No migration and genetic recombination
d) No mutation and gene flow

395. *Myrmecobius* and *Myrmecophaga* are closely related and have similar adapatations for the same habitat. This phenomenon is
a) Divergent evolution
b) Homoplasty
c) Convergent evolution
d) Parallel evolution

396. Galapagos islands are located in
a) Indian ocean b) Pacific ocean c) Atlantic ocean d) Arabian ocean

397. Lamarck's concept of inheritance of acquired characters was discarded by
I. Mendel's laws of inheritance
II. Theory of natural selection

III. Mutational theory
IV. Theory of continuity of germplasm
Choose the correct combination of the given options to complete the given statement
a) I and II b) II and III c) I and IV d) III and IV

398. The finches of Galapagos islands provide an evidence in favour of
a) Special creation
b) Evolution due to mutation
c) Retrogressive evolution
d) Biogeographical evolution

399. ...A... of Russia and ...B.... of England proposed that the first form of life could have come from ...C... non-living organic molecule
Choose the right option for A, B and C to compete the given NCERT statement
a) A-Oparin, B-Haldane, C-Post-existing
b) A-Haldane, B-Oparin, C-Post-existing
c) A-Oparin, B-Haldane, C-Pre-existing
d) A-Haldane, B-Oparin, C-Pre-existing

400. Phrase 'Survival of the Fittest' was used by
a) Hugo de Vries
b) Charles Darwin
c) Herbert Spencer
d) Jean Baptiste Lamarck

401. The cranial capacity of modern man is
a) 430-650 cc^3 b) 600-100 cc^3 c) 900-1100 cc^3 d) 1200-1600 cc^3

402. Primary source of allelic variation is
a) Independent assortment
b) Recombination
c) Mutation
d) Polyploidy

403. Which of the following molecules falls under the category of eobionts?
I. Coacervates II. Microspheres
a) Only I b) Only II c) I and II d) None of these

404. A baby has been born with a small tail. It is the case of exihibiting
a) Retrogressive evolution
b) Mutation
c) Atavism
d) metamorphosis

405. Prodigality of reproduction in Darwinism refers to
a) Every organism produces numerous offspring
b) Successful organism produce numerous offsprings
c) Only a few individuals are able to reproduce
d) Only a few individuals are able to survive

406. Which of the following is an evidence for Darwin's theory of common descent?
a) There are patterns in the fossil record that suggest that other species have diverged from a single ancestor species
b) There are biogeographic patterns in the distribution of species, for instance, distinct bird species on an island tends to resemble one another, suggesting a common ancestor
c) There are common stages in the early embryological development of organisms, representing several distinct vertebrate groups
d) All of the above

407. Which one of the following describes correctly the homologous structures?
a) Organs that have no function now but had an important in ancestors
b) Organs appearing only in embroynic stage and disappearing later in the adult
c) Organs with anatomical similarities but performing different functions
d) Organs with anatomical dissimilarities but performing same functions

408. Scientific name of Solo man is
a) *Homo soloensis* b) Neanderthal c) *Ramapithecus* d) *Homo erectus*

409. Genetic equilibrium refers to phenomenon that
a) The traits remains constant in a population
b) The total genes remains constant in a population
c) The total genes keeps on varying in a population

d) Traits keeps on varying in a population

410. Arrange the following events in a sequential order to describe the phenomenon of speciation
I. Over production rapid multiplication
II. Limited food and space
III. Struggle for existence
IV. Speciation
V. Inheritance of useful variation
VI. Natural selection/survival of the fittest
VII. Appearance of variation
The correct sequence is
a) I, II, III, V, VI, VII, IV b) I, IV, II, III, VI, VII, V c) I, II, IV, VI, III, VII, V d) I, II, III, VII, VI, V, IV

411. The sequence of events in geographic speciation is most likely to be
a) Genetic divergence → geographic barrier → reproductive isolation
b) Geographic barrier → genetic divergence → reproductive isolation
c) Reproductive isolation → genetic divergence → geographic barrier
d) geographic barrier → reproductive isolation → Genetic divergence

412. What was the Lamarck's explanation for long necked giraffes?
a) Stretching of necks over many generation b) Short neck suddenly changed into long one
c) Natural selection d) Mutation

413. The highest cranial capacity is/was present in
a) Java man b) Peking man c) Handy man d) Modern man

414. Miller and Urey performed an experiment to prove the origin of life. They took gases NH_3 and H_2 along with
a) N_2 and H_2O b) H_2O and CH_4 c) CH_4 and N_2 d) CO_2 and NH_3

415. Identify the correct sequence of stages in evolution of modern man/ *Homo sapiens*.
a) Australopithecus, Neanderthal man, Cromagnon man, Homo erectus and Modern man
b) Australopithecus, Homo erectus, Neanderthal man,Cromagnon man and Modern man
c) Homo erectus, Neanderthal man,Australopithecus, Cromagnon man and Modern man
d) Homo erectus, Australopithecus, Neanderthal man, Cromagnon man and Modern man

416. Which of the following is the most primitive ancestor of man?
a) *Homo neanderthalensi* b) *Homo habilis*
c) *Ramapithecus* d) *Australopithecus*

417. Trilobites were evolved during which of the following periods?
a) Silurian b) Cambrian c) Ordovician d) Precambrian

418. Darwin's finches provide an excellent evidence in favour of organic evolution. These are related to which of the following evidences?
a) Embryology b) Palaeontology (or fossils)
c) Anatomy d) Biogeography (or geographic distribution)

419. Analogous structures are
a) Anatomically different but performing similar functions
b) Anatomically similar but performing different functions
c) Anatomically similar and functioning similarly
d) Anatomically differentfunctioning differently

420. Mendel described the frequency of ...A... for offsprings of a single ...B...

Choose the correct options for A and B to complete the given NCERT statement

a) A-genome; B-mated pair
b) A-chromosome; B-mated pair
c) A-gene; B-mated pair
d) A-genotype; B-mated pair

421. All organisms shares the same genetic code. This commonality is an evidence that
a) The evolution is occurring now
b) The convergent evolution has occurred
c) The evolution occurs gradually
d) All the organisms are descended from a common ancestor

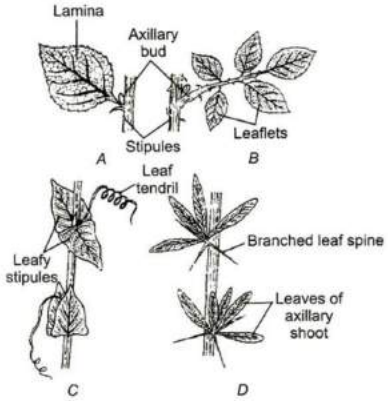
422. Homology refer to
I. Divergent evolution
II. Common descent
III. Convergent evolution
Choose the correct option
a) I and III
b) II and III
c) Only III
d) I and II

423. Comparative anatomy and morphology shows ...A... and ...B... among organisms of today and those that existed years ago. Such similarities can be interpreted to understand whether ...C... ancestors were shared or not
Choose the correct option for A, B and C the complete the given NCERT statement
a) A-similarities, B-differences, C-common
b) A-similarities, B-differences, C-different
c) A-complexities, B-differences, C-different
d) A-complexities, B-differences, C-common

424. *Homo erectus* evolved about 1.7 million years ago. They used fire and tools and also used animal hides as clothing. The fossil of *Homo erectus* were named as
a) Neanderthal man
b) Cro-magnon man
c) Java ape man
d) *Proconsul*

425. Thorns of *Bougainvillea* and tendrils of *Cucurbita* are examples of
a) Analogous organs
b) Homologous organs
c) Vestigial organs
d) Retrogressive evolution

426. Diagram given below indicates



a) Analogous organs
b) Homologous organs
c) Convergent evolution
d) All of these

427. First mammal occurred in which era/period?
a) Permian –Palaeozoic
b) Triassic –Mesozoic
c) Tertiary –Coenozoic
d) None of these

428. Theory of spontaneous generation or abiogenesis was first disproved by
a) A R Wallace
b) Francisco Redi
c) Louis Pasteur
d) A I Oparin

429. Primitive man was originated during
a) Miocene
b) Holocene
c) Pleistocene
d) Pliocene

430. Modern synthetic theory is based on
a) Mutation
b) Population
c) Isolation
d) All of these

431. Which of the following situation would most likely result in the highest rate of natural selection?
a) Reproduction by asexual method
b) Low mutation is an stable environment
c) Little competition
d) Reproduction by sexual method

432. Which one is the largest ape among the given four genera of apes?
a) *Hyalobates* (the gibbon)
b) *Simia* (orangutan)
c) *Pan* (chimpanzee)
d) *Gorilla* (the gorilla)

433. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed as
a) Divergent evolution
b) Micro-evolution
c) Co- evolution
d) Convergent evolution

434. Which one of the following phenomenon supports Darwin's concept of natural selection in organic evolution?
a) Development of transgenic animals
b) Production of 'Dolly' the sheep by cloning
c) Prevalence of pesticide resistance insects
d) None of the above

435. Who first conducted experiment on evolution to prove biochemical origin of life?
a) Miller and Urey
b) Darwin
c) Lamarck
d) Weismann

436. In Africa, there is a species of bird called the yellow-throated long claw. It looks exactly like the meadowlark found in North America, but they are not closely related. This is an example of
a) Uniformitarianism
b) Artificial selection
c) Gradualism
d) Convergent evolution

437. Theory of pangenesis was given by
a) Darwin
b) Lamarck
c) Hugo de Vries
d) Oparin

438. Krebs' cycle, glycolysis, lipogenesis, enzymes, all of these indicates
a) Biochemical evidence of evolution
b) Morphological evidence of evolution
c) Anatomical evidence of evolution
d) Biogeographical evidence of evolution

439. *Peripatus* is a connecting link between
a) Annelids and molluscs
b) Reptiles and mammals
c) Annelids and arthropods
d) Annelids and reptile

440. In Hardy-Weinberg law the homozygous dominant alleles, homozygous recessive alleles and heterozygous alleles are represented by

	I	II	III
a)	p^2	q^2	3pq
b)	p^2	q^2	2pq
c)	a^2	p^2	2pq
d)	q^2	2pq	p^2

441. During the course of human evolution which part of the brain has shown maximum increase in size?
a) Midbrain
b) Forebrain
c) Hindbrain
d) All of these

442. Miller synthesized simple amino acids from one of the following mixtures in his experiment
a) CH_4, NH_3, H_2 and water vapour
b) H_2, O_2, N_2 and water vapour
c) H_2, O_2, C_2 and water vapour
d) CH_4, NH_3, C_2 and water vapour

443. From one population to other, the new mutation spreads by
I. Bottle neck effect II. Budding
III. Immigrants IV. Sexual reproduction
V. Binary fission VI. Asexual reproduction
Choose the correct combination
a) I and II
b) III and IV
c) IV and VI
d) I and VI

444. Factor affecting the Hardy-Weinberg principles are
I. gene flow
II. genetic drift
III. mutation
IV. genetic recombination
V. natural selection
The correct combination is

a) I and II b) II, III and IV c) III, IV and V d) I, II, III, IV and V

445. First theory of evolution was given by
a) Charles Darwin b) Hugo de Vries c) Lamarck d) Wallace

446. The idea of natural selection as the fundamental process of evolutionary changes was reached
a) By Alfred Russell Wallace in 1901
b) Independently by Charles Darwin and Alfred Russell Wallace in 1859
c) Independently by Charles Darwin and Alfred Russell Wallace in 1900
d) By Charles Darwin in 1866

447. Mutation results in
a) Change in gene frequency b) Stabilization of allele frequency
c) Change in phenotypic frequency d) Stabilisation of selection pressure

448. Plants of the Galapagos islands show resemblance most closely to the plants of
a) Asia b) Australia c) North America d) South America

449. According to abiogenesis, life originated from
a) Non-living b) Pre-existing life
c) Chemicals d) Extra-terrestrial matter

450. Formation of more complex and specialized organisms from the simple and less elaborated forms is called
a) Retrogressive evolution b) Progressive evolution
c) Microevolution d) Macroevolution

451. Anthropogenic actions that leads to evolution is the use of
a) Herbicides b) Pesticides c) Antibiotics d) All of these

452. Which one is linked to evolution?
a) Extinction b) Competition c) Variation d) Reproduction

453. First seed plant appeared during which period?
a) Silurian b) Devonian c) Carboniferous d) Cretaceous

454. Organic compounds first evolved in earth required for origin of life were
a) Urea and amino acids b) Proteins and nucleic acids
c) Proteins and amino acids d) Urea and nucleic acids

455. The study of the homologous structures in mature organisms provides the evidence for the evolutionary relationships among certain groups of organisms. Which field of the study includes this evidence of evolution?
a) Comparative cytology b) Biochemistry
c) Geology d) Comparative anatomy

456. Which of the following statements are incorrect?
I. Microbial experiment shows that when the pre-existing advantagoeus mutations are selected they will result in the observation of new phenotypes. Over few generations, this would results in speciation
II. Neanderthal fossils represents a human relative.
III. In 1938, a fish caught in South Africa happened to be a coelacanth (lobe fins) which was thought to be extinct. These animals evolved into the first living amphibian on both land and water
IV. Lichens can be used as water pollution indicators
V. Alfred Wallace, a naturalist, who worked in Malay Archepalago (present Indonesia) had also came to the similar conclusion on natural selection as reached by Darwinism
The correct option is
a) I and II b) Only II c) V and IV d) Only IV

457. Which of the following was formed in S Miller's experiment?
a) Amino acids b) Nucleic acids c) UV radiations d) Microspheres

458. Which of the following is not a concept of Lamarck?
a) Environmental pressure causes variation
b) Rate and survival of organism is different due to variation
c) Inheritance of acquried characters

d) If an organ is used constantly it will continuously increase its size

459. Which of the following features are connected with the modern theory of evolution?
I. Genetic and chromosomal mutation
II. Genetic recombination and natural selection
III. Reproductive isolation
The correct combination is
a) I and II b) II and III c) I and III d) I, II and III

460. Which era is called the age of angiosperms?
a) Cenozoic era b) Mesozoic era c) Proterozoic era d) Palaeozoic era

461. *Dryopithecus* is also called as
a) *Parapithecus* b) Proconsul c) *Oreopithecus* d) *Pithecanthropus*

462. Darwin's finches are a good example of
a) Industrial melanism b) Connecting link
c) Adaptive radiation d) Convergent evolution

463. The animal called ..... evolved into the first amphibians that lived on both land and water.
Complete the given statement by choosing an appropriate option
a) Invertebrate b) Coelacanth c) Amphioxus d) All of these

464. True statements regarding the genetic drift are
I. It mostly occurs in smaller population
II. Certain alleles can be lost forever because of genetic drift
III. Founder effects and bottle neck effects are caused by genetic drift
IV. Mutations are primarly responsible for genetic drift
The correct combination showing true statement is
a) Only I b) III and IV c) II and IV d) All except IV

465. Which of the following is an atavistic character?
I. Body hairs
II. Enlarged canines
III. Presence of six fingers
IV. Presence of tail in some babies
The correct combination is
a) I and IV b) I and II c) I and III d) I, II and IV

466. 'Population tends to increase geometrically, while food supply increases arithmatically'. This concept was put forward by
a) TR Malthus b) Struart Mill c) Charles Darwin d) Adam Smith

467. Which of the following phenomenon is difficult to explain in terms of natural selection?
a) Male peacocks evolve tail and feathers that makes them more vulnerable to predators
b) Male deer evolve antlers which do not help them to defend against predators
c) A bird issues a warning cry that puts it at greater risk of being noticed by a predator
d) All of the above

468. In Hardy-Weinberg principle expression of allele frequency is represented by
a) $(q+p)(q-p)$ b) $p^2+2pq+q^2=1$ c) $(p+q)^2=1$ d) Both (b) and (c)

469. Experimental evidence of chemical evolution was given by
a) Miller b) Haldane c) Oparin d) All of the above

470. Sum total of all the allelic frequency is
a) 2 b) 1.5 c) 1 d) 0.5

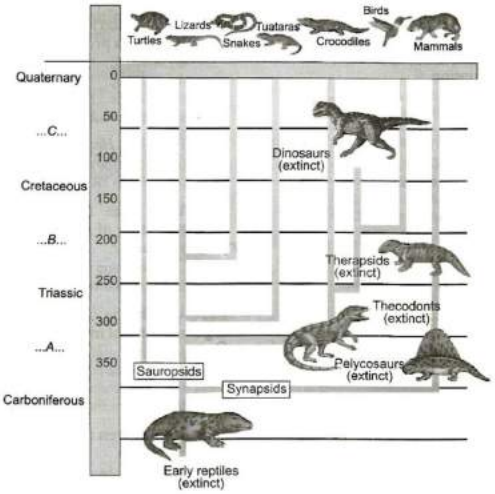
471. Fossil of Cro-magnon man was found in
a) Southern France b) Northern France c) Northern Germany d) South Africa

472. In which era Protozoa, sponge and algae were originated?
a) Cenozoic era b) Azoic era c) Proterozoic era d) Mesozoic era

473. Which one of the following aspect of evolution is shown by Darwin finches?

a) Biogeographic evidence
b) Industrial melanism
c) Biochemical evidence
d) Embryological evidence

474. Identify the geographical periods (A, B, C) in the given diagram



a) A-Tertiary, B-Jurassic, C-Permian
b) A-Tertiary, B-Permian, C-Jurassic
c) A-Permian, B-Jurassic, C-Tertiary
d) A-Jurassic, B-Tertiary, C-Permian

475. Fitness according to Darwin refers to
a) Reproductive fitness b) Physiological fitness c) Spiritual fitness d) None of the above

476. The concept of adaptive radiation was developed by
a) Oparin b) Haldane c) HF Osborn d) Darwin

477. Eye of *Octopus* and mammals appears quite similar. They are
a) Homologous organs b) Analogous organs c) Vestigial organs d) None of these

478. Which of the following is the vestigial organ in human beings?
a) Nictitating membrane
b) Spleen
c) Femur
d) Tibia

479. How *Australopithecus* skull differs from the skull of modern man?
a) On the bases of skull's age
b) On the bases of shape and size of skull
c) On the bases of length of skull
d) All of the above

480. How might an evolutionary biologist explains why a species of birds has evolved a larger beak size?
a) Large beak size occurred as a result of mutation in each member of the population
b) The ancestors of this bird species encountered a tree with larger than the average sized seeds. They needed to develop larger beaks in order to eat the larger seeds and over time, they adapted to meet this need
c) Some members of the ancestral population had larger beaks than others. If larger beak size was advantageous, they would be more likely to survive and reproduce. As such, large beaked birds increased in frequency relative to small beaked birds
d) There is no way to explain such phenomenon in evolutionary terms

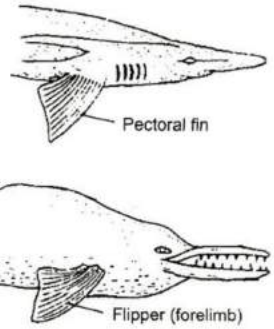
481. Which was absent in the atmosphere at the time of origin of life?
a) NH_3 b) H_2 c) O_2 d) CH_2

482. Atavism is found in
a) Animals b) Plants c) Both (a) and (b) d) None of these

483. Which of the following are the wrong statements
I. Organs which are different in basic structure and origin but performs similar functions are called analogous organ
II. Organs with different to basic structure and origin but perform similar functions are called homologous organs

III. Homologous organs lead to convergent evolution
IV. Analogous organ leads to divergent evolution
The correct combination is
a) I, III and IV b) I, IV and III c) I and II d) II, III and IV

484. Diagram given below indicates



a) Homologous organs b) Analogous organs
c) Atavism d) Divergent evolution

485. Two nucleotide sequences found in two different species are exactly the same. This suggests that these species
a) Are evolving into the same species b) Contains identical DNA
c) May have similar evolutionary histories d) Have the same number of mutations

486. The variation in the natural selection is on, it is due to the random mutations. What does this imply about the natural selection?
a) Natural selection is a random process b) Natural selection is nevertheless a directed process. The likelihood one variant will be favoured in a given environment over another is predictable, even if the origin is not
c) Natural selection is a hypothetical process d) None of the above

487. Which of the following statements regarding the evolution of plants and animals is/are correct?
I. Amphibians evolved into reptiles
II. Fish with stout and strong fins could move on land and go back to water. This was about 350 million years ago
III. Giants ferns fell to form wall deposits slowly
IV. About 65 million years ago dinosaurs died out
V. *Archeopteryx* is the connection link between birds and reptiles
The correct combination is
a) I and II b) III and IV c) V and I d) I, II, III, IV and V

488. Which of the following statements correctly defines the phenomenon of genetic drift?
I. Random change in gene allele frequency
II. Occur by chance
III. It is directional
IV. Causes elimination of certain alleles
V. Causes fixation of alleles
The correct combination is
a) I, II and III b) III, IV and V c) I, III and V d) I, II, IV and V

489. Hugo de Vries based on his work on ...A... brought forth the idea of ...B..., large difference arising suddenly in a population. He believed that it is mutation which causes evolution and not the ...C... that Darwin talked about. Mutations are random and ...D..., while Darwinian variations are small and ...E...
Choose the correct option for A, B, C, D and E to complete the given statement
a) A-evening primorse, B-mutations, C-minor variation, D-direction less, E-directional
b) A-evening primorse, B-mutations, C-minor variation, D-directional, E-non-directional

c) A-four O' clock plant, B-mutations, C-minor variation, D-directional, E-non-directional
d) A-four O' clock plant, B-mutations, C-minor variation, D-direction less, E-directional

490. Tendrils in plants are an example of
a) Convergent evolution b) Radiation c) Divergent evolution d) Co-evolution

491. *Australopithecus africanus* is also known as
a) First ape man b) Modern man c) Erect man d) Cro-magnon man

492. The natural selection that acts against change in the form and keeps the population constant through the time is
a) Directional b) Disruptive c) Not acting d) Stabilizing

493. 'A brief reduction in size of a population, due to natural calamities, usually leads to random genetic drift'. For this statement, identify the correct example from the following.
a) Human population of Pitcaim island b) Polydactylic dwarfs in Amish population
c) Long –necked giraffe d) Industrial melanism

494. Prehistoric cave art developed about ...A... years ago. Agriculture came around ...B... years back and human settlements started. Choose an appropriate option for A and B to complete the given NCERT statement
a) A-18000; B-2000 b) A-18000; B-10000 c) A-10000; B-5000 d) A-15000; B-5000

495. Amoug the human ancestors, the brain size was more than 1000 cc in
a) *Homo neanderthalensis* b) *Homo erectus*
c) *Ramapithecus* d) *Homo habilis*

496. In the origin of life, microspheres are most primitive protobiont, which have a membrane of
a) Lipids and proteins b) Lipids c) Carbohydrates d) fats

497. Neo- Darwinism is
a) Natural selection theory b) Modern mutation theory
c) Modern synthesis theory d) Population theory

498. The abiogenesis occurred about how many billion years ago?
a) 1.2 billion b) 1.5 billion c) 2.5 billion d) 3.5 billion

499. *Australopithecus* existed in
a) Pliocene b) Miocene c) Pleistocene d) Both (a) and (b)

500. Which of the following statement is correct about *Australopithecus*
a) They lived in East African grassland
b) They hunted with stone weapons
c) They were transititional stage between ape and humans
d) All of the above

501. The diagram below represents a section of undisturbed layers of sedimentary rock in New York State and shows the location of fossils of several closely related species.
According to currently accepted evolutionary theory, which is the most probable assumption about species *A*, *B* and *C*?

Species	*A*
Species	*B* and *A*
Species	*B*
Species	*C*

→ Surface of ground

a) Species *B* is more abundant than species *C* b) Species *C* existed before species *B*
c) Species *A* and *B* are genetically identical d) Species *B* descended from species *A*

502. Which of the following factor would affect the future population?
a) Mutation in sperm or egg b) Exercise daily
c) Mutation in somatic cell d) Mutation in somatic cells

503. Which of the following variations are temporary and have nothing to do with the last or next generation?
a) Hereditary variations b) Discontinuous variations
c) Environmental variations d) None of the above

504. Evolution convergence is characterized by
a) Development of dissimilar characteristics in closely related groups
b) Replacement of common characteristics in different groups
c) Development of a common set of characteristics in groups of different ancestry
d) Development of characteristics by random mating

505. Mutation introduces new genes into a species and brings about the changes in
a) Phenotypes b) Genotypes c) Both (a) and (b) d) None of these

506. The concept that the species have changed over a long period of time is know as
a) Ecosystem b) Spontaneous generation
c) Organic evolution d) Genetic recombination

507. Fossils are the remains of
a) Hard part of life forms found in rocks b) Light part of life forms found in rocks
c) Protein and bones of life forms found in rocks d) Fat and protein of life forms found in rocks

508. Which of the following is not a living fossil?
a) King crab b) *Sphenodon* c) *Archaeopteryx* d) *Peripatus*

509. *Homo habilis* originated in
a) Oligocene b) Miocene c) Pleistocene d) Holocene

510. In recent years, DNA sequences (nucleotide sequences) of *mt*DNA and Y-chromosomes were considered for the study of human evolution, because
a) Their structure is known in greater detail
b) They can be studied from the samples of fossil remains
c) They are small and therefore, easy to study
d) They are uniparental in origin and do not take part in recombination

511. Earth originated approximately
a) 4500 million years ago b) 3600 million years ago
c) Between 1600-2600 million years ago d) 2.5 million years ago

512. Gene flow takes flow by
a) Intrabreeding between one population to another
b) Intrabreeding between one population only
c) Intrabreeding between one population to another
d) Intrabreeding between one population only

513. The diversity in the type of finches and adaptation to different feeding habits on the Galapagos islands, as observed by Darwin, provides an evidence of
a) Origin of species by natural selection b) Intraspecific variation
c) Intraspecific competition d) Interspecific competition

514. Which of the following is/are the most significant trend in the evolution of humans?
I. Shortning of eye
II. Bionocular vision
III. Tool making
IV. Increased cranial capacity
a) I and II b) Only IV c) III and IV d) Only I

515. Choose the homologous organs from the given options
I. Vertebrate hearts
II. Vertebrate brains
III. Thorn and tendrils of *Bougainvillea* and *Cucurbita*
IV. Vertebrate limbs
The correct combination is
a) I and II b) II and III c) III and IV d) I, II and III

516. Evolution is
a) Development of DNA from nucleotides. b) Development of organism through time.

c) Development of a cell from chemicals. d) cloning

517. Hardy –Weinberg principle explains
a) Genetic equilibrium b) Non-random mating
c) Evolutionary force d) All of these

518. Which of the following fossil man is named as handy man?
a) *Ramapithecus* b) *Australopithecus* c) *Homo erectus* d) *Homo habilis*

519. Which of the following is an example of vestigial structure?
a) Your tail bone b) Nipples on male mammals
c) Sixth fingers found in some human d) Human knee cap

520. Connecting link between ape and man is
a) Cromagnon man b) *Australopithecus* c) Neanderthal man d) Lemur

521. The theory of use and disuse of organ was proposed by
a) Darwin b) Lamarck c) de Vries d) Hooker

522. The difference between *Homo sapiens* and the *Homo erectus* was
a) *Homo sapiens* originated in Africa, while *Homo erectus* originated in Asia
b) *Homo erectus* were much smaller in size than *Homo sapiens*
c) *Homo erectus* stayed in Africa, while *Homo sapiens* did not
d) The size of the brain of *Homo erectus* was smaller than that of *Homo sapiens*

523. Which of the following is an extinct animal?
a) *Protopterus* b) *Equus* c) *Archaeopteryx* d) *Columba*

524. The classical example of adaptive radiation in development of new species is
a) Darwin's finches b) Marsupials of Australia
c) Giant turtle d) All of these

525. Mutational theory of evolution was given by
a) Charles Darwin b) Robert Brown c) Oparin d) Hugo de Vries

526. All the existing life forms share ...A... and share ...B... ancestors. The geological history of earth closely correlates with ...C... history of earth.
Choose the right option for A, B and C to complete the given statement with reference to NCERT text book
a) A-dissimilarities, B-dissimilar, C-zoological b) A-dissimilarities, B-dissimilar, C-botanical
c) A-dissimilarities, B-dissimilar, C-biological d) A-similarities, B-common, C-biological

527. Natural selection can lead to ...A... in which more individuals acquire mean character value, ...B.... more in which individuals acquire value other than the mean character value and ...C... in which more individuals acquire peripheral character value at both ends of the distribution curve
Choose the correct options for A, B and C to complete the given statement with reference to NCERT text book
a) A-directional changes, B-stabilising, C-disruption
b) A-stabilisation, B-directional changes, C-disruption
c) A-stabilisation, B-disruption, C-directional changes
d) A-disruption, B-directional changes, C-stabilising

528. Malay Archipalago stands for
a) A group of islands visited by Wallace
b) Research paper on evolution written by Wallace
c) Research paper on ecology written by Wallace
d) A group of organism studied by Wallace

529. First life on the earth originated from non-living matters has been explained by
a) Theory of biogenesis b) Theory of abiogenesis
c) Theory of special creation d) Theory of extraterrestrial origin

530. The age of fossils or dating of fossils can be best estimated by
a) Radioactive carbon (C^{14}) dating method b) Radioactive nitrogen method
c) Radioactive clock method d) None of the above

531. Wings of insects and birds are
a) Analogous b) Homologous c) Vestigial d) Atavism

532. Dinosaurs were abundant during
a) Jurassic period b) Pleistocene period c) Devonian period d) None of these

533. Half-life of ^{14}C is ...A... material used in determining the age of fossil is ...B... . Here A and B refers to
a) A-5568 years; B-radioactive carbon b) A-10,000 years; B-carbon
c) A-1000 years; B-sulphur d) A-2000 years; B-iodine

534. How did George Cuvier accounts for the extinctions in nature
a) Extinctions never occur there are unexplored parts of the globe where the organisms that appears to have gone extinct may still live
b) Extinctions occur when the slow adaptations of the organisms overtime to their environment are not quick enough to help them respond to changing conditions
c) Extinctions occur at random, they do not reflect God's will
d) Extinctions occur due to the catastrophic events

535. Genetic equilibrium means
a) Gene pool remains constant b) Phenotypes remains constant
c) Migration of a species into new area d) Immigration of species

536. According to fossils discovered upto present time origin and evolution of man was started from which country?
a) France b) Java c) Africa d) China

537. What is the basis of Hugo de Vries theory of mutation?
a) Do not rule out natural selection theory b) Opposes natural selection theory
c) Supports Lamarck theory d) Opposes germplasm theory

538. Variations in a progeny takes place due to
a) Mutation b) Recombination by gametogenesis
c) Gene flow or genetic drift d) All of the above

539. Which of the following sets contain only homologous organs?
a) Whale's flipper, horse's forelimb, Human hand b) Wings of butterfly, crow and insect
c) Horse's forelimb, insect wing, human hand d) Vermiform appendix, body hair and patella

540. 'XX' is a type of selection process in evolution 'XX' promotes the population changes in one particular direction 'XX' favours small or large sized individuals, mean size of population changes in 'XX'. Identify 'XX'
a) Stabilizing selection
b) Directional selection
c) Disruptive selection
d) None of these

541. Darwin proposed the theory of
a) Inheritance of acquired characters b) Natural selection
c) Recapitulation d) Continuity of germplasm

542. A population is in Hardy-Weinberg equilibrium for a gene with only two alleles. If the gene frequency of an allele'A' is 0.7, genotype frequency of 'a' is
a) 0.21 b) 0.42 c) 0.36 d) 0.7

543. The theory of random genetic drift was proposed by
a) Sewall Wright b) Hardy-Weinberg c) R A Fisher d) Mayer

544. Vestigial organ in human being is
a) Common embryonic origin but perform different functions
b) Different embryonic origin but perform different functions
c) Common embryonic origin but perform similar functions
d) Different embryonic origin but perform similar functions

545. Genus *Homo erectus* includes three fossil (s) namely
I. Java ape man

II. Neanderthal man
III. Cro-magnon man
IV. Peking man
V. Heidelberg man
The correct options is
a) I, II and III b) II, III and IV c) I, IV and V d) III, IV and V

546. Inheritance of acquired characters comes under
a) Lamarckism b) Darwinism c) Neo- Lamarckism d) Neo -Darwinism

547. Which one of the following factor do not allows Hardy-Weinberg principle to operate?
a) Inbreeding b) Mutation c) No selection d) No migration

548. Which of the following statements is correct?
a) Organs which are different in basic structure and origin but have similar functions are called analogous organs
b) Organs which are different in basis structure and origin but have dissimilar functions are called analogous organs
c) Organs which are similar in basis structure and origin but have different functions are called analogous organs
d) None of the above

549. Stings of honey bee and the stings of scorpion are
I. analogous organs
II. heterologous organs
III. homologous organs
IV. vestigial organs
The correct combination is
a) III and IV b) II and III c) I and II d) I and III

550. Theoretically population size grows ...A..., if everybody reproduced maximally and the fact that the population size in reality is ...B..., means that there had been competition for resources
Choose the correct option for A and B to complete the given statement with reference to NCERT text book
a) A-geographically; B-unlimited b) A-exponentially; B-unlimited
c) A-exponentially; B-limited d) A-geographically; B-limited

551. Darwinism explains all the following except
a) Within each species, there are variations
b) Organisms tend to produce more number of offspring that can survive.
c) Offspring with better traits that overcome competition are best suited for the environment
d) Variations are inherited from parents to offspring through genes

EVOLUTION

: ANSWER KEY :

1)	a	2)	a	3)	b	4)	a	157)	a	158)	a	159)	b	160)	a
5)	c	6)	d	7)	d	8)	b	161)	d	162)	a	163)	b	164)	b
9)	a	10)	d	11)	b	12)	c	165)	d	166)	a	167)	b	168)	c
13)	b	14)	b	15)	c	16)	b	169)	a	170)	a	171)	b	172)	d
17)	b	18)	a	19)	d	20)	d	173)	a	174)	a	175)	b	176)	c
21)	c	22)	b	23)	d	24)	d	177)	c	178)	a	179)	a	180)	c
25)	a	26)	a	27)	a	28)	c	181)	c	182)	d	183)	b	184)	d
29)	c	30)	a	31)	d	32)	b	185)	a	186)	c	187)	a	188)	c
33)	b	34)	a	35)	c	36)	b	189)	d	190)	c	191)	d	192)	c
37)	c	38)	a	39)	b	40)	d	193)	d	194)	d	195)	c	196)	a
41)	b	42)	b	43)	c	44)	c	197)	b	198)	d	199)	a	200)	a
45)	a	46)	b	47)	c	48)	b	201)	d	202)	c	203)	d	204)	b
49)	a	50)	b	51)	d	52)	c	205)	c	206)	d	207)	a	208)	c
53)	d	54)	c	55)	b	56)	c	209)	c	210)	a	211)	a	212)	c
57)	d	58)	a	59)	d	60)	b	213)	d	214)	c	215)	b	216)	b
61)	c	62)	d	63)	c	64)	c	217)	b	218)	c	219)	c	220)	a
65)	a	66)	a	67)	a	68)	b	221)	c	222)	c	223)	d	224)	c
69)	c	70)	d	71)	a	72)	d	225)	a	226)	a	227)	a	228)	d
73)	d	74)	d	75)	d	76)	b	229)	c	230)	d	231)	d	232)	a
77)	c	78)	c	79)	d	80)	d	233)	c	234)	c	235)	b	236)	d
81)	a	82)	c	83)	a	84)	b	237)	a	238)	d	239)	d	240)	b
85)	b	86)	d	87)	a	88)	c	241)	d	242)	b	243)	b	244)	b
89)	b	90)	d	91)	a	92)	a	245)	c	246)	a	247)	b	248)	c
93)	a	94)	b	95)	d	96)	c	249)	a	250)	a	251)	c	252)	d
97)	a	98)	a	99)	b	100)	c	253)	d	254)	b	255)	a	256)	d
101)	a	102)	b	103)	d	104)	b	257)	c	258)	b	259)	a	260)	c
105)	a	106)	c	107)	b	108)	a	261)	c	262)	c	263)	b	264)	b
109)	c	110)	a	111)	d	112)	b	265)	b	266)	d	267)	b	268)	a
113)	a	114)	b	115)	b	116)	c	269)	a	270)	b	271)	b	272)	d
117)	b	118)	b	119)	a	120)	d	273)	a	274)	a	275)	b	276)	a
121)	a	122)	c	123)	b	124)	a	277)	b	278)	c	279)	a	280)	d
125)	d	126)	a	127)	a	128)	a	281)	b	282)	b	283)	d	284)	b
129)	d	130)	b	131)	c	132)	d	285)	c	286)	d	287)	d	288)	c
133)	a	134)	c	135)	b	136)	a	289)	c	290)	c	291)	a	292)	d
137)	c	138)	d	139)	d	140)	c	293)	d	294)	c	295)	b	296)	c
141)	c	142)	b	143)	b	144)	a	297)	b	298)	c	299)	c	300)	d
145)	c	146)	c	147)	a	148)	d	301)	c	302)	b	303)	a	304)	a
149)	a	150)	a	151)	a	152)	b	305)	c	306)	b	307)	a	308)	c
153)	d	154)	b	155)	a	156)	a	309)	a	310)	a	311)	c	312)	b

313)	d	314)	b	315)	a	316)	c	437)	a	438)	a	439)	c	440)	b
317)	b	318)	d	319)	d	320)	a	441)	b	442)	a	443)	b	444)	d
321)	a	322)	a	323)	a	324)	b	445)	c	446)	b	447)	a	448)	d
325)	d	326)	d	327)	c	328)	c	449)	a	450)	b	451)	d	452)	c
329)	a	330)	d	331)	b	332)	b	453)	b	454)	b	455)	d	456)	d
333)	b	334)	a	335)	a	336)	b	457)	a	458)	b	459)	d	460)	a
337)	b	338)	a	339)	a	340)	b	461)	b	462)	c	463)	b	464)	d
341)	d	342)	a	343)	c	344)	c	465)	d	466)	a	467)	a	468)	d
345)	a	346)	d	347)	a	348)	a	469)	a	470)	c	471)	a	472)	c
349)	a	350)	a	351)	b	352)	a	473)	a	474)	c	475)	a	476)	c
353)	c	354)	d	355)	b	356)	d	477)	b	478)	a	479)	d	480)	c
357)	b	358)	a	359)	a	360)	d	481)	c	482)	c	483)	d	484)	b
361)	d	362)	b	363)	d	364)	d	485)	c	486)	b	487)	d	488)	d
365)	b	366)	a	367)	b	368)	d	489)	a	490)	c	491)	a	492)	d
369)	b	370)	d	371)	a	372)	c	493)	b	494)	b	495)	a	496)	a
373)	a	374)	d	375)	d	376)	b	497)	c	498)	d	499)	d	500)	d
377)	b	378)	a	379)	b	380)	a	501)	b	502)	a	503)	c	504)	c
381)	c	382)	d	383)	a	384)	a	505)	c	506)	c	507)	a	508)	c
385)	b	386)	d	387)	c	388)	b	509)	c	510)	d	511)	a	512)	c
389)	d	390)	a	391)	c	392)	c	513)	a	514)	b	515)	d	516)	b
393)	b	394)	a	395)	d	396)	b	517)	a	518)	d	519)	b	520)	b
397)	c	398)	d	399)	c	400)	c	521)	b	522)	d	523)	c	524)	d
401)	c	402)	b	403)	d	404)	c	525)	d	526)	d	527)	b	528)	a
405)	b	406)	d	407)	c	408)	a	529)	b	530)	a	531)	a	532)	a
409)	b	410)	d	411)	b	412)	a	533)	a	534)	d	535)	a	536)	c
413)	d	414)	b	415)	b	416)	c	537)	a	538)	d	539)	a	540)	b
417)	b	418)	b	419)	a	420)	d	541)	b	542)	b	543)	a	544)	d
421)	d	422)	d	423)	a	424)	c	545)	c	546)	a	547)	b	548)	a
425)	b	426)	b	427)	b	428)	b	549)	c	550)	c	551)	d		
429)	c	430)	d	431)	d	432)	a								
433)	d	434)	c	435)	a	436)	d								

EVOLUTION

: HINTS AND SOLUTIONS :

1 **(a)**
Birbal Sahni (14 November, 1891 and 10 April 1949) was an Indian palaeobotanist who studied the fossils of Indian sub-continents. He was also a geologist who took an interest in Archaeology. He founded the Birbal Sahni Institute of Palaeobotany in Lucknow, India. His greatest contributions lies in the study of botany of the plants of India.
Apart from writing numerous influential papers on these topics, he also served as the President of the National Academy of Sciences, India and as the Honorary President of the International Botanical Congress, Stockholm. He died on 10 April, 1949

2 **(a)**
The evolution of the peppered moths over the last two hundred years has been studied in detail. Originally, the vast majority of peppered moths had light colouration, which effectively camouflaged them against the light-coloured trees and lichens which they rested upon. However, because of widespread pollution during the Industrial Revolution in England, many of the lichens died out, and the trees that peppered moths rested on become blackened by the soot, causing most of the light-coloured moths or typical, to die off from predation. At the same time, the dark-coloured or melanic moths flourished because of their ability to hide on the darkened trees

3 **(b)**
A-Frequency, B-Stable, C-Algebraic

4 **(a)**
Fossils provide the direct evidences of organic evolution. Fossils may be entire organisms buried in sediment or snow, small part of ancient organisms or impression, extinct organisms, ancient leaf or stem.

5 **(c)**
The organs, which have similar function but different in their structure and origin are called analogous organ, *e.g.*, wings of butterfly and wingspead of bat and birds.

6 **(d)**
Palaeontology– Study of fossils

Cytology– Study of cell structure and function

Herpetology–Study of reptiles and amphibians

7 **(d)**
Experiment Conducted by Hugo de Vries
He conducted his experiment on *oenothera lamarckiana* (everning primorse) and found several different types of plants when plant was self pollinated and its seeds were allowed to grow, majority of F_1 plants were similar to the parents but few were different. Hugo de Vries suggested from his experiments that new types of inherited characters may appear suddenly without any previous indication of their presence in the race

8 **(b)**
Forked tongue snakes may represents the origin of new variety of snake from the non-forked tongue snakes. If biologist is trying to find that how closely these two species are related to each other than, he/she has to locate a specimen of more distantly related snake to see it, wheater, it has a forked tongue or not

9 **(a)**
The first living form is named as protocell or eobiont or protobiont, which evolved into prokaryotic cell. These were originated about 3900-3500 million years ago, during precambrian era.

10 **(d)**

Lack of migration, low selection pressure and very less mutation leads to the stabilization of a species in which the evolution occurs very slowly

11 **(b)**

Darwin.

Based on observation made during a sea voyage in a sail ship called HMS Beagle round the world. Charles Darwin conclude that the existing living forms share similarities to varying degrees not only among themselves but also with the life forms that existed millions of years ago

The fitness, according to Darwin, refers ultimately and only to reproductive fitness. Hence, those who are better fit in an environment, leave more progeny than other. These, therefore will survive more and, hence are selected by nature. He called it natural selectional and implied it as a mechanism of evolutions

12 **(c)**

Sexual selection is the type of natural selection in which the organism is selected due to high reproductive values

13 **(b)**

Common ancestry.

Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution

Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position.

Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. Usually, it is a result of diffusion of the same species to different and isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection

Primarily diffusion is the basis of molecular division which can be seen in some higher-level characters of the structure and function that are readily observable in organisms. For example, the vertebrate limb is one example of divergent evolution. The limb in many different species has a common origin, but has diverged somewhat in overall structure and function

14 **(b)**

Homology is also seen amongst the molecules. This is called molecular. For example, the proteins found in the blood of man and ape are similar. The phylogeny of an organism can be traced by using the base sequence in nucleic acids and the amino acid sequence of the proteins in related organisms

15 **(c)**

According to Neo—Darwinian theory, the processes thst bring changes at the genetic level and are responsible for the origin of new species are **mutations, recombinations, gene, migration** (gene exchange), **genetic drift** and **natural selection**. These agents cause changes in alleles, genes, genotypic frequencies of a population and thus bring out evolution through origin of new species.

16 **(b)**

Theory of continuity of germplasm was proposed by **August Weismann**. He suggested that the changes occurring in germplasm are inherited by offsprings, whereas changes in somatoplasm are not transmitted to next generation.

17 **(b)**

Spallanzani disapproved the theory of abiogenesis (spontaneous generation)

Spallanzani's Experiment He experimented that animal and vegetable broths boiled for the several hours and soon after sealed, were never infested with microorganisms. From this experiment the concluded that, high temperature had killed all living organisms in the broths and without them life did not appear. When the broths were left exposed to air, it was soon invaded by microorganisms

18 **(a)**

Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution

Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position

19 **(d)**
Shelled eggs and internal fertilization these are the two great changes occurred in the organism, which made them free from their water life. These two changes are seen in reptiles, birds and amphibians. But the organism, which are still completely dependent on the water do not have these the characters

20 **(d)**
In evolutionary biology, adaptive radiation is a process in which the organisms diversify rapidly into a multitude of new forms, particularly when a change in the environment makes the new resources available and opens the environmental niches. Starting with a recent single ancestor, this process results in the speciation and phenotypic adaptation of an array of species exhibiting morphological and physiological traits with which they can exploit a range of divergent environments

21 **(c)**
Pasteur proposed the germ theory of disease and **Robert Koch** find the definite proof for **germ theory of disease**. Robert Koch also got **Nobel Prize** for creation of microbiology.

22 **(b)**
Atavism.
Atavism It is the reappearance of certain ancestral characters, which had either disappeared or were reduced. Some examples of atavism in human beings are the power of moving pinna in some persons, developed canine teeth, exceptionally long dense hairs, short tail in some babies (coccyx) and presence of additional mammae in some individuals

23 **(d)**
Darwin began to realise that under the intense competition of members in a population, any variation which favoured survival in a particualr environment would increase that individual's ability to reproduce and leave fertile offspring. Less favourable variations would be at a disadvantage and organisms possessing them would therefore, have their chances of successful reproduction decreased. The survival of the fittest is a result of selection and proliferation of only those organisms which were most suitably adapted to the environment.

24 **(d)**
Any condition which brings changes in the genetic frequency are important from an evolutionary point of view

25 **(a)**
Neanderthal human were most numerous from about 100000 years ago. They become extinct 10000 years ago Neanderthals were legendary cave dwellers. They have been portreted as having heavy brows ridges and hamped back. Their fossils were heavy found in Europe and West Asia

26 **(a)**
Theory of spontaneous generation was disapproved by many scientist. *Noted scientist were*
(i) Francisco Redi (1626-1697)
(ii) Lazzaro Spallanzani (1729-1799)
(iii) Louis Pasteur (1822-1895)
Louis Pasteur's swan neck experiment finally disapproved abiogenesis and powered biogenesis (life originated from pre existing one)

27 **(a)**
Single step large mutation.
Hugo de Vries believed that mutation causes evolution and not the minor heritable variations, which was mentioned by Darwin
Mutation are random and directionless, while Darwin's variations are small and directional
Term 'saltation' is also called single step large mutation, which leads to new specks

28 **(c)**
Darwin's theory of natural selection based on the following observation
(i) Limited natural resources
(ii) Stable population size except seasonal fluctuation
(iii) Varying characteristics of the members of a population
(iv) Most variation are inherited
(v) Varying characteristics enable some population or individuals to survive better in natural condition (survival of the fittest)
(vi) Those population which better fit (reproductive fit) in an environment will be selected by the nature and will surive more (natural selection)

Examples
Industrial melanism
Chemical resistance
But this theory does not explains the origin of new variation, because Darwin was unaware about the genetics

29 **(c)**
Ernst Haeckel (1866) proposed recapitulation theory or biogenetic law which states that 'ontogeny' (development of the embryo) is recapitulation of phylogeny (the ancestral sequence). It is narrated in the **embryological evidences** for organic evolution, *e.g.*, homology in early embryonic development of all multicellular organisms, resemblance among vertebrate embryos, etc.

30 **(a)**
Biogenetic law was propounded by **Ernst Haeckel** in 1860. According to it, during the development of an animal heart, it passes through ancestral adult stages.

31 **(d)**
Cromagnon man was the most recent ancestor of today's man. It was discovered by **MacGregor** in 1868 from Cromagnon rocks of France. It was about 180 cm in height with a large skull, broad face, rounded forehead, narrow nose and prominent chin. The cranial capacity was about 1680 cc. They were omnivorous. They expressed themselves through sculpture and painting.

32 **(b)**
J B S Haldane (1920) used the term **prebiotic soup** or **hot dilute soup of organic substances** for oceanic water containing mixture of simple organic compounds.

33 **(b)**
Wisdom teeth are third **molars** of our dentition. Being useless, these are poorly developed and vestigial.

34 **(a)**
Darwinian natural selection was inspired from **Thomas Malthus** in 1798. TR Malthus, a British economist, put forward a theory of human population growth
(i) He stated that population grows geometrically when unchecked, whereas the means of its subsistence like food grows only arithmetically
(ii) Naturally, after sometime an imbalance would occur in the population and the environment
(iii) When the imbalance reaches a certain value, some factors like hunger, epidemics, floods, earthquakes, war, etc., 'crashes'. This is called catastrophic control of population. These factors were called positive checks by Malthus

35 **(c)**
Evolutionary changes come about at the level of **population** as single individual cannot change their combination of genes.

36 **(b)**
Charles Robert Darwin returned to England in October 1836 from his 5-year expedition. In 1838 he came across with a book An Essay on Principle of Population written by Thomas Robert Malthus (1766-1834). Darwin was much influenced by Malthus theory of human population growth

37 **(c)**
A mammoth is any species of the extinct genus *mammuthus*. They are commonly equipped with long, curved tusks and, in northern species, a covering of long hair is present. They lived from the Pliocene epoch (from around 5 million years ago) into the Holocene at about 4,500 years ago in Europe, Asia and America as far south as Mexico. They were members of the family Elephantidae which contains, along with mammoths, the two genera of modern elephants and their ancestors

38 **(a)**
Evolutionary biology is the study of history of life forms on earth
Evolution The word 'evolution' (Latin-*evolvere*) means to unfold or unroll. In broad sense evolution simply means an orderly change from one condition to another. Evolution is a continuous process in which decent with modification are produced

39 **(b)**
Cro –magnon man (*Homo sapiens fossilis*) had a highest cranial capacity, *i.e.*, 1680 cc.

Modern man (*Homo sapiens sapiens*) had cranial capacity 1400-1450 cc.

40 **(d)**
The genus of horse, *i.e.*,*Equus* arose in North America during the Pleistocene epoch and migrated into Eurasis and Africa where it gave

rise to zebras and asses as well as the modern horse.

41 **(b)**
Angiosperms (*e.g.*,**grasses**) are considered evolutionary modern than algae, bryophytes, pteridophytes and gymnosperms. Angiosperms are characterized by the presence of ovary, double fertilization and triploid endosperm.

42 **(b)**
The **Mesozoic era** is called the **golden age of reptiles** because 'dinosaurs' were dominant on the earth in this era.

43 **(c)**
Human body has been described to possess about 90 vestigial organ. *Some of them are*
(i) Nictitating (plica semilunar's) membrane
(ii) Auricular muscles
(iii) Segmental muscle of abdomen
(iv) Panniculus cornices
(v) Vermiform appendix
(vi) Caudal vertebrae
(vii) Third molar
(viii) Hairs on body
(ix) Nipples in male

44 **(c)**
The sequence of human evolution is

Ramapithecus → *Australopithecus*
→ *Homo habilis* → *Homo erectus*
→ *Homoerectus pekinensis*
→ *Homo sapiens neanderthalensis*
→ *homo sapiens fossilis*
→ *Homo sapiens sapiens*.

45 **(a)**
Ordovician period

46 **(b)**
Earliest fossil ape prior to ape man was *Dryopithecus*.

47 **(c)**
I, II, III, IV and V.
Modern Concept of Evolution Modern concept of evolution is the synthesis of Darwin's and Hugo de Vries theory also called synthetic theory of evolution. *Modern concept of evolution includes the following steps*
(i) Genetic variations in population
(ii) Isolation
(iii) Heredity
(iv) Natural selection
(v) Speciation (origin of new species)
The modern theory is a result of number of scientist namely T Dobzhonsky, RA Fisher, JBS Haldane, Sewall Wright Ernst Mayer, GL Stebbins Stebbins in his book 'Progress of organic evolution' discussed the synthesis theory of evolution

48 **(b)**
The Hominidae (also known as great apes) form a taxonomic family of primates, including four genera
(i) Chimpanzees
(ii) Gorillas (*Gorilla*)
(iii) Humans (*Homo*)
(iv) Orangutans (*Pongo*)

49 **(a)**
The correct chronological order of human evolution from early to recent is

Ramapithecus → *Australopithecus* →
(First hominid) (First ape man)
Homo habilis → *Homo erectus*
(Tool maker handy man) (Erect man)

50 **(b)**
Main point of Darwin's theory is Natural Selection.

51 **(d)**
Vestigial structures are those structures, which were functionally active in ancestral organisms but now become non-functional, *e.g.*, vermiform appendix, ear muscles and coccyx.

52 **(c)**
Connecting link is one, which exihibits characteristics of more than one groups. *Neopilina*is a connecting link between phylum-Annelida and Mollusca.

53 **(d)**
Examples is support of Lamarckism
(i) Evolution of giraffe
(ii) Webbed toes of aquatic birds
(iii) Disappearance of limbs in snakes
(iv) Flat fishes
(v) Flightless birds
(vi) Retractile claws of carnivorous animal

(vii) Cave dwellers
(viii) Emergent of hydrophytes

54 **(c)**
Coccyx.
Atavism It is the reappearance of certain ancestral characters, which had either disappeared or were reduced. Some examples of atavism in human beings are the power of moving pinna in some persons, developed canine teeth, exceptionally long dense hairs, short tail in some babies (coccyx) and presence of additional mammae in some individuals

55 **(b)**
There are thirteen types of finches described by **Darwin**. They are **geographical isolated** and found in Galapagos islands of South Pacific.

56 **(c)**
Industrial melanism in peppered moth *Biston betularia* demonstrate the natural selection, which was put forword by **Charles Darwin**, not by Lamarck.

57 **(d)**
All of the above.
Important theories to explain the origin of life on earth are
(i) **Theory of Special Creation** The greatest supporter of this theory was father Suarez. According to this theory life was created by supernatural powers. According to Bible the world was created in six days. The earth is 4000 yrs old. All the diversity was existed since creation
(ii) **Theory of Panspermia** This theory is also called the cosmozoic theory. Early Greek thinkers thought units of life called spores were transferred to the different plants including earth from the other planets
(iii) **Theory of Spontaneous Generation** This theory also is called a biogenesis or autogenesis. This theory states that the life originated from non-living by itself or spontaneous manner
Dismissial of Spontaneous Generation Theory
Louis Pasteur by carefully experimentation demonstrated that, life comes only from pre-existing life. He showed that in pre-sterilised flasks life did not come from killed yeast, while in another flask open to air, new living organisms arose from 'killed yeast'. Spontaneous generation theory was dismissed once and for all. However, this did not answer how the first life came on the earth.
(iv) **Theory of Chemical Evolution** This theory is also called modern theory of evolution or neuralistic theory of evolution
Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (*e. g.*, RNA, protein, etc.) and that formation of life was preceded by chemical evolution, *i.e.*, formation of diverse organic molecules from inorganic constituents

58 **(a)**
A-Non-living, B-Sydney Fox

59 **(d)**
*Archaeopteryx*is the connecting link between birds and reptiles. It shows that birds have evolved from reptilian ancestors. As per Huxley, 'Birds are the glorified reptiles'.

60 **(b)**
Sequence of origin of life
Free atom
↓
Origin of molecules and simple inorganic molecule
↓
Origin of early organic compounds
↓
Origin of simple organic compounds
↓
Origin of complex organic compounds
↓
Origin of coacervates like droplets
↓
Eobionts
↓
Prokaryotes
↓
Eukaryotes

61 **(c)**
Examples of adaptive radiation are
(i) **Darwin's Finches of Galapagos Island** They had common ancestors but different types of modified beaks according to their food habits.
Darwin differentiated thirteen species of the finches according to their food habits
(ii) **Australian Marsupials** Darwin explained that adaption radiation gave rise to the varieties of marsupials (pouched mammals) in Australia by

the same process of adaptive radiation as found in the finches of Galapagos Islands.

(iii) **Placental mammals** in Australia exhibit adaptive radiation in evolving into varieties of placental mammals each of which appears to be similar to corresponding marsupials

62 **(d)**

Nearly a century ago, **T H Huxley** called birds 'glorified reptiles' thereby meaning that birds have evolved from some **reptilian ancestor**. Both the birds and reptiles lay the same type of eggs, which are deposited outside water. Eggs are large and telolecithal. The ovum is surrounded by albumen, an egg membrane and a thick hard **calcareous shell,**which are all secreted by special gland located in the walls of oviduct.

63 **(c)**

Origin of universe.

Origin of Universe There are several theories regarding the origin of universe but most accepted is Big-Bang theory.

Big-Bang Theory This theory was proposed by **Abbe Lemaitre** in 1931. According to the Big-Bang theory about 15 billion years ago, cosmic matter was in a condensed form. Explosion took place which broke the condensed matter and scattered its fragments into space at an enormous velocity making a Big-Bang sound and thus the theory came to be known as the Big-Bang theory

64 **(c)**

Life cannot originate from inorganic materials now because of **high atmospheric oxygen**. Oxygen is potentially very dangerous to living things, because it reacts with organic molecules, destroying these molecules and releasing their stored energy.

65 **(a)**

Most accepted theory for origin of life is Oparin theory of chemical evolution. According to this hypothesis, primitive atmosphere chiefly consisting of methane, ammonia, water vapour, hydrogen gas. So,primitive atmosphere was reducing in nature.

66 **(a)**

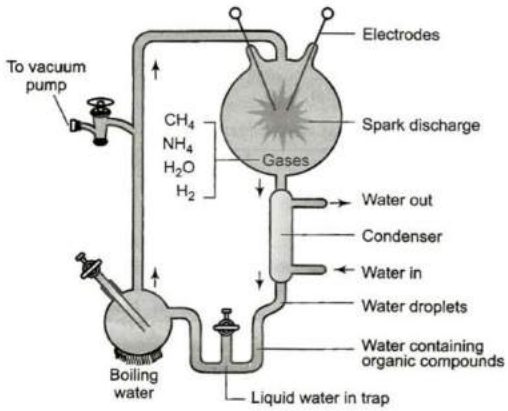
Chemical theory of origin of life is the most accepted theory.

Stanley Miller in 1953, who was than a graduate student of Harold Urey (1893-1981) at the university of Chicago, demonstrated it clearly that ultra-violet radiation or electric discharges can produce complex organic compounds from mixture of CH_4, NH_3, H_2O and H_2. The ratio of methane, ammonia and hydrogen in Miller's experiment was 2 : 1 : 2

Experimental Evidences of Chemical Evolution

Experi ik mentally chemical theory of evolution performed by SL Miller and HC Uray in 1953.

He created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800 C. He observed formation of amino acids. In similar experiments other the observed, formation of sugar, nitrogen bases, pigments and fats



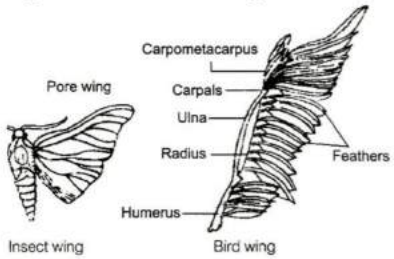
Diagrammatic representation of Miller's experiment

The first non-cellular forms of life could have originated-3 billion years back. The first cellular form of life did not possibly originated till about 2 billion years ago because the conditions were non-biogenic at that time. This version of biogenesis, *i.e.*, the first form of life arose slowly through evolutionary forces from non-living molecule was accepted by majority

67 **(a)**

Analogous organs.

Analogous Organs The organs which have similar functions but are different in their details and origin are called analogous organs. The analogous organs shows convergent evolution



68 **(b)**

Population genetics shows us that certain traits of a species becomes more abundant if they benefit the species. In this case, plant must have camouflage the insects, for having spots therefore, the gene 'a' responsible for the spotting increased over the time in the population

69 **(c)**
J B S Haldane (1920) used the term 'prebiotic soup' or 'hot dilute soup of organic substances' for oceanic water containing mixture of simple organic compounds. **Methane**(CH_4) was probably the first organic compound and hydrogen cyanide was formed later.

70 **(d)**
Oparin and Haldane explained the chemical evolution of life

71 **(a)**
*Ramapithecus*was first manlike primate. The first fossil of *Ramapithecus* was (discovered fragment of upper jaw) from Shivalik hills of India.

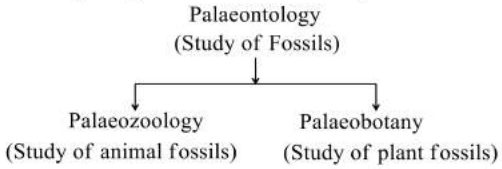
72 **(d)**
The basic timeline of 4.6 billion year old Earth, with approximate dates
(i) 3.6 billion years of simple cells (prokaryotes)
(ii) 3.4 billion years of cyanobacteria performing photosynthesis
(iii) 2 billion years of complex cells (eukaryotes)
(iv) 1 billion years of multicellular life
(v) 600 billion years of simple animals
(vi) 570 million years of arthropods (ancestors of insects, arachnids and crustaceans)
(vii) 550 million years of complex animals
(viii) 500 million years of fish and proto-amphibians
(ix) 475 million years of land plants
(x) 400 million years of insects and seeds
(xi) 360 million years of amphibians
(xii) 300 million years of reptiles
(xiii) 200 million years of mammals
(xiv) 150 million years of birds
(xv) 130 million years of flowers
(xvi) 66 million years since, the dinosaurs died out
(xvii) 20 million years since, the appearance of the Hominoidae (great apes)
(xviii) 2.5 million years since, the appearance of the family Hominoidae (great apes)
(xix) 20 million years since, the appearance of the genus *Homo* (human predecessors)
(xx) 20,000 years since, the appearance of anatomically modern humans
(xxi) 25,000 years since, the disappearance of neanderthal traits from the fossil record
(xxii) 13,000 years since, the disappearance of *Homo floresiensis* from the fossil record

73 **(d)**
A-Alleles; B-Population. *NCERT*

74 **(d)**
The modern man differs from the apes in arms, which are shorter than legs.

75 **(d)**
Miller circulated four gases methane, ammonia, hydrogen and water vapour in an air tight apparatus and passed electrical discharges from electrode at 800°C. After week, he found a large number of simple organic compounds including amino acid such as alanine glycine, aspartic acid. Other substances such as urea, hydrogen cyanide, lactic acid and acetic acid were also present

76 **(b)**
Geological period in which they existed.



Palaeontological evidences (Evidences from fossil records)
Study of fossils is called Palaeontology
Leonardo de Vinci (1452-1519) an italian painter and invertor is called the Father of Palaeontology
Fossils are the remains of hard parts of life-forms found in rocks. Rocks forms sediments and a cross-section of earth's crust indicates the arrangement of sediments one over the other during the long history of earth
A variety of fossils ranging from the modern organisms to extint organisms can be observed and depicted by evolution
By studing the different sedimentary layers, the geological time period in which the organisms existed can be predicted

77 **(c)**
Adaptive radiation or adaptive convergence both forms are used interchangeably for the divergent evolution

78 **(c)**
The word evolution (*L. evolvere*) means to unfold or unroll or to reveal the hidden potentialities. In

its broadest sense, evolution simply means an orderly change from one condition to another. For example, when the planets and the stars change in between their birth and death, it is called stellar evolution. When the matters, elements change in time, it is called inorganic evolution and when the changes are in the organisms (living things) over the course of generations, it called biological or organic evolution

79 **(d)**

Only II. It must be homozygous recessive genotypes.

Hardy-Weinberg Principle

It was proposed by GH Hardy an English mathematician and W Weinberg a German physician independently in 1908

(i) It describes a theoretical situation in which a population is undergoing no evolutionary change. This is called genetic or Hardy-Weinberg equilibrium

(ii) It can be expressed as $p^2 + 2pq + q^2 = 1$ or $(p + q)^2 = 1$

(iii) Evolution occurs when the genetic equilibrium is up set (evolution is a departure from Hardy-Weinberg equilibrium principle)

The sum of total of Allelic frequency $(p + q) is = 1$

$p^2 + 2pq + q^2$ or $(p + q)^2$

Where, p^2 = % homozygous dominant individuals

p = frequency of dominant allele

q^2 = % homozygous recessive individuals

q = frequency of recessive allele

$2pq$ = % heterozygous individuals

Realize that $(p + q)^2 = 1$ (three are only 2 alleles)

$p^2 + 2pq + q^2 = 1$ (these are the only genotypes)

Example An investigator has determined by the inspection that 16% of a human population has a recessive trait. Using this information, we can calculate all the genotypes and allele frequencies for the population, provided the conditions for Hardy-Weinberg equilibrium are met

Given $q^2 = 16\% = 0.16$ are homozygous recessive individuals

Therefore,

$q = \sqrt{0.16} = 0.4$ = frequency of recessive allele

$p = 1.0 - 0.4 = 0.6$ = frequency of dominant allele

$p^2 = 0.6 \times 0.6 = 0.36$ or 36% are homozygous dominant individuals

$2pq = 2 \times 0.6 \times 0.4 = 0.48 = 48\%$ are heterozygous individuals

Or $= 1.00 - 0.52$

$= 0.48$

Thus, 84% (36+48) have the dominant phenotype

80 **(d)**

The present concept of evolution is a modified form of the Darwin's theory of natural selection and often called Neo-Darwinism

According to it, only genetic variations (mutations) are inherited and not all variations as the held by Darwin

Thus, modern concept of evolution is synthesis of Darwin's and Hugo de Vries theories. This is also called synthesis theory of evolution

81 **(a)**

Alfred Wallace (1823-1913) was a naturalist from Britain. He wrote an essay tittle 'On the Tendencies of varieties to Depart Indefinitely from the original type'. Thinking of both Darwin and Wallace in respect of organic evolution was similar

82 **(c)**

Mesozoic

83 **(a)**

Theory of continuity of germplasm was give by **August Weismann** (1834-1914).

Theory of continuity of germplasm by **August Weismann** (1834-1914). A German biologist, was the main opposer of the inheritance of acquired characters. He put forward the theory of continuity of germplasm. According to Weismann, the characters influencing the germ cells are only inherited. There is a continuity of germplasm (protoplasm of germ cells) but the somatoplams (protoplasm of somatic cells) is not transmitted to the next generation. Hence, it do not carry characters to the next generation. Weismann cut off the tails of rats for as many as 22 generations and allowed them to breed, but tailless rats were never born

84 **(b)**

Pioneers of organic evolution were Charles Darwin, Hugo de Vries, Lamarck and Huxley

85 **(b)**

Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. Usually, it is a result of diffusion of the same species to different and

isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection
Primarily diffusion is the basis of molecular division which can be seen in some higher-level characters of the structure and function that are readily observable in organisms. For example, the vertebrate limb is one example of divergent evolution. The limb in many different species has a common origin, but has diverged somewhat in overall structure and function

86 **(d)**
According to **Allen's rule**, the animals of colder areas have shorter extremities (*i.e.*, tail, ears, head) as compared to animals of warmer areas. According to **Gloger's law**, the birds and mammals of warm humid regions tend to be darker in colour than inhabiting the cold or dry region of their geographical range.

87 **(a)**
A-Gravitation, B-4.5 billion years, C-Early, D-Methane

88 **(c)**
In 1981 Donald Johanson found a 3.2 million years old skeleton of a female human ancestor. He nick named it Lucy. Lucy's scientific name is *Australopithecus africanus*

89 **(b)**
A-1400, B-East and Central Asia, C-100000, D-40000

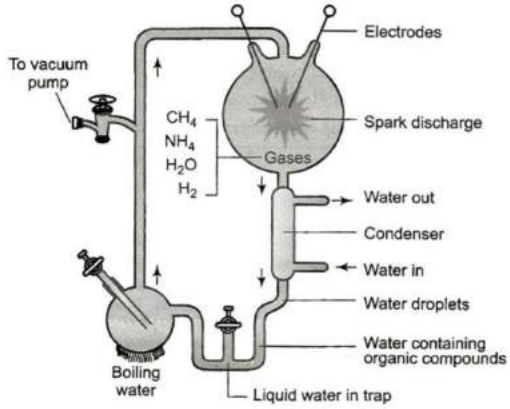
90 **(d)**
Chimpanzee is more closely related to man than other hominoids. It is evidenced by chromosome banding pattern, DNA extracted from sex chromosomes, autosomes and mitochondria. Molecular clock based on mitochondrial DNA are used to date recent events because this DNA mutates 5-10 times faster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

1.DNA matching shows human similarity with chimpanzee.

2.There is little differences in banding pattern in chromosomes 3 and 6 in human and chimpanzee.

3.Serum test indicates maximum homology between human and chimpanzee.

91 **(a)**
3 billion years back.
Experimental Evidences of Chemical Evolution
Experi ik mentally chemical theory of evolution performed by SL Miller and HC Uray in 1953.
He created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800 C. He observed formation of amino acids. In similar experiments other the observed, formation of sugar, nitrogen bases, pigments and fats



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92 **(a)**
Biogenesis is the origin of life from pre-existing life, *ie,omnis vivum ex ovo, vivo*. Thistheory was approved by an Italian Physician **Francisco Redi** (in 1668), **Spallanzani**and **Louis Pasteur**.

93 **(a)**
Objection/criticism of the natural selection theory
(i) Inheritance of small variation
(ii) Vestigial fittest
(iii) Over specialization of some organs
(iv) Arrival of fittest
(v) Degeneration of organs
(vi) Discontinuous variation

94 **(b)**
Autotrophs are of two types
(i) **Chemoautotrophs** The organisms performing chemosynthesis are called chemoautotrophs. They were anaerobic. Chemoautotrophs has the

ability to synthesis organic molecules from inorganic raw materials. Such mode of nutrition is present even now in some bacteria, *e. g.*, sulphur bacteria, iron bacteria, nitrifying bacteria
(ii) **Photoautotrophs** The photosynthesis organisms, the photoautotrophs, contains the pigment chlorophyll, which is formed by the combination of simple chemicals. They prepared organic food by using solar energy captured with the help of chlorophyll. They lacks the biochemical pathways to produce oxygen. They are still anaerobic and utilize hydrogen from the sources other than water

95 **(d)**
Descent with modification is the main theme of evolution.

96 **(c)**
Natural selection means that the nature determines what traits are favourable and need to get passed on to offspring

97 **(a)**
Microevolution involves changes in allelic frequency within a gene pool. The macroevolution involves large scale changes among groups of species.

98 **(a)**
Gradual accumulation of the adaptations of changing environment leads to the origin of species. It was the central idea of 'Theory of Natural Selection' given by Charles Darwin

99 **(b)**
A lion who has many cubs and eight of which live to adulthood is most appropriate in evolutionary sense because the eight surviving cubs have much better survival value than the others in the given conditions

100 **(c)**
A-Pre-existing, B-Mutation, C-Speication, D-Heritable

101 **(a)**
Genetic drift is an evolutionary force operating in small populations. It is responsible for fixing in population of neutral characteristics.

102 **(b)**
Mutation is more common when it is present in **dominant condition**. The reason is that the dominant mutant gene can express in both homozygous and heterozygous conditions.

103 **(d)**
Von Bear's law The development of an organism proceeds from the general to the special forms and the embryos belonging to various classes closely resemble one another in their earlier stages but diverge more and more as development proceeds. He formulated Baer's laws of embryology
(i) General characteristics of the group to which an embryo belongs, develops before the special characteristics
(ii) General structural relations are likewise formed before the most specific relations appear
(iii) The form of any given embryo does not converge upon other definite forms but, on the contrary, separates itself from them
(iv) Fundamentally, the embryo of a higher animal form never resembles the adult of another animal form

104 **(b)**
Charles Darwin (1809-1882) tried to suggest the physical basis of heredity by pangenesis theory and suggested that every cell of the body contributes gemmules to the germ cells and so shares in the transmission of inherited characters.

105 **(a)**
The synthetic theory of evolution is the result of the work of a number of scientist namely T Dobzhansky, RA Fisher, JBS Haldane, Sewall Wright, Ernst Mayer.
Homology is also seen amongst the molecules. This is called molecular. For example, the proteins found in the blood of man and ape are similar. The phylogeny of an organism can be traced by using the base sequence in nucleic acids and the amino acid sequence of the proteins in related organisms

106 **(c)**
Lichen are very sensitive to the air pollution specially to the sulphur dioxide. Lichen are the symbiotic association of algae and fungi. Generally, lichens are not found in the industrial areas

107 **(b)**
Lamarckian theory is also known as theory of inheritance of acquried characters or theory of use and disuse of organs. This theory can not

explain the reason of weak muscles in the son of a wrestler.

108 **(a)**
The correct order of the poriods of Palaeozoic era in ancending order in a geological time scale is—

Cambrian –Ordovician –Silurian –Devonian – Carboniferous -Permian

109 **(c)**
Distantly related animals (as whale, seal and shark) inhabiting similar habitats often develop similar morphological features that make them look similar. This is termed as **adaptive convergence** or **convergent evolution**. Dogfish (pisces) and whale (mammals) have acquried aquatic character though distantly related.

110 **(a)**
Plants were the first who invaded land. They prominanted modern era

111 **(d)**
$p^2 + 2pq + q^2 = 1$
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112 **(b)**
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113 **(a)**
Speciation is an evolutionary process by which new biological species arises.
There are five types of speciation : allopatric, peripatric, parapatric, and sympatric and artificial
(i) **Allopatric Speciation** It occurs when a species separates into two separate groups which are isolated from one another. A physical barrier, such as a mountain range or a waterway, makes it impossible to breed with one another. Each species develops differently, based on the demands of their unique habitat or the genetic characteristics of the group that are passed on to offspring
(ii) **Peripatric Speciation** When small groups of individuals break off from the larger groups and

forms new species, this is called peripatric speciation. As in allopatric speciation, physical barriers make it impossible for numbers of groups to interbreed with one another, the main difference between allopatic speciation and peripatric speciation is that in peripatric speciation, one group is much smaller than the other

(iii) **Parapatric Speciation** A species is spread over a large geographic area. Although it is possible for any member of the species to mate with another member, individuals only mate with those in their own geographic region

(iv) **Sympatric Speciation** Some scientists don't believes that this form exists. Sympatric speciation occurs when there are no physical barriers preventing any member of a species from mating with another and all members are in close proximity to one another.

A new species, perhaps based on a different food source of characteristics, seems to develop. The theory is that some individuals becomes dependent on certain aspects of an environment-such as shelter or food sources, while others do not

(v) **Artificial Speciation** Is the creation of new species by people. This is achieved through lab experiments, where scientists mostly research insects like fruit files, and in animal husbandry. Animal husbandry is the care and breeding of livestock (animals). Many agricultural products, such as dairy, meat and wool, depends on animal husbandry

114 **(b)**

Homo habilis; (*homo* = human; *habilis* = able) 2-1.5 mya. Brain of *Homo habilis* was one half the size of a modern human. They were more sophisticated with rudimentary speech

115 **(b)**

Darwin's finches refers to a type of birds present on Galapagos islands.

116 **(c)**

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

117 **(b)**

Vestigial organs are incompletely developed, *i.e.*, rudimentary and generally non-functional organs, *e.g.,* tail vertebrae, nictitating membrane and vermiform appendix are vestigial organs of man.

Nails are not vestigial organs because these are the functional structure.

118 **(b)**

The organisms which are provided with the favourable variations would survive because they are fittest to face their surrounding while unfit organism are destroyed

119 **(a)**

Palaeobotany is the branch of Palaeontolgoy in which we study the fossils of plants. Coal was formed by large pteridophyte in prehistoric time

120 **(d)**

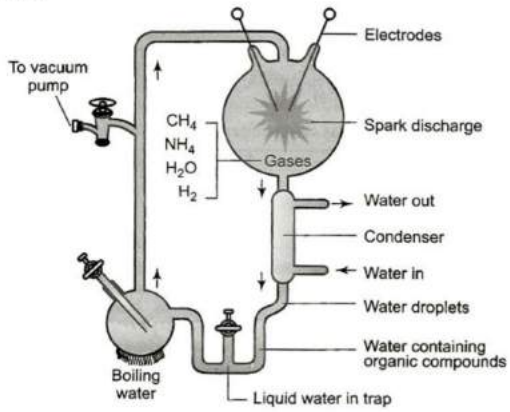
Stabilizing natural selection is a condition in which the conditions of natural selection become static. Due to static conditions, there is no origin of variation. That's way, the genetic diversity decreases in the stabilizing natural selection

121 **(a)**

20000 million years.

Experimental Evidences of Chemical Evolution

Experi ik mentally chemical theory of evolution performed by SL Miller and HC Uray in 1953. He created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800 C. He observed formation of amino acids. In similar experiments other the observed, formation of sugar, nitrogen bases, pigments and fats



Diagrammatic representation of Miller's experiment

The first non-cellular forms of life could have originated-3 billion years back. The first cellular form of life did not possibly originated till about 2 billion years ago because the conditions were non-biogenic at that time. This version of

biogenesis, *i.e.*, the first form of life arose slowly through evolutionary forces from non-living molecule was accepted by majority

122 **(c)**
Modern theory of origin of life was proposed by **A I Oparin** and**J B S Haldane** As per this theory origin of life is the result of long series of physico-chemical changes which brought about first by chemical evolutions and then by biological evolution.

123 **(b)**
Comparing structural similarities is called comparative anatomy. The more similar two different species body structures are, the closer they evolutionary linked and the more recently they shared a common ancestor

124 **(a)**
If the fossil *X* is order than fossil *Y* than in the sedimentary rock or sedimentation fossil *X* will be found deeper than the fossil *Y*. In sedimentation the layers are deposited one above the other as the time proceeds

125 **(d)**
A-Chemical evolution; B-Oparin and Haldane

126 **(a)**
As a result of struggle for existence, variability and inheritance the successive generations tend to become better adopted to their environment. These adaptations are preserved and accumulated in the individual of the species. **Darwin** summarised them under the heading **'Origin of Species by Natural Selection'**.

127 **(a)**
According to Darwin, speciation is the result of gradual accumulation of adaptations to changing environment.

128 **(a)**
Mesozoic era is known as the **age of reptiles**. Coenozoic era known as age of mammals.

129 **(d)**
The first experimentalsupport to Oparin-Haldane's theory of origin of life came from Urey and Stanley Miller's experiment in 1953. He built an apparatus of glass tubes and flasks in the laboratory. He created an atmosphere containing **hydrogen** (H_2), **ammonia**(NH_3), **methane**(CH_4) and **water** in one large flask and allowed condensed liquids to accumulate in another small flask. The ratio of methane, ammonia and hydrogen in large flask was 2 : 1 : 2.

130 **(b)**
B-*Ramapithecus*; C-*Australopithecus*

131 **(c)**
*Ramapithecus*survived about 14-15 million years ago during late Miocene to Pliocene. **Edward Lewis** (1932) obtained fossil of *Ramapithecus* from Pliocene rocks of Shivalik hills of India. *Ramapithecus*became extinct about 1-8 million years ago.

132 **(d)**
In physiology, intussusception is the reception of foreign matter by living organisms and its conversion into food by ingestion, digestion and assimilation of food, including the whole process of nutrition and growth. It is the mode of interstitial growth characteristic of organic life. In botany, intussusception theory proposed by Nageli, the growth of cell walls by the intercalation of new solid particles between those already in existence. The intussusception theory is opposed to the theory of growth by apposition, which; supports that the new particles are deposited in layers on the inner side of the cell wall

133 **(a)**
Directional selection favours one extreme value for a particular trait in a distribution of these value.

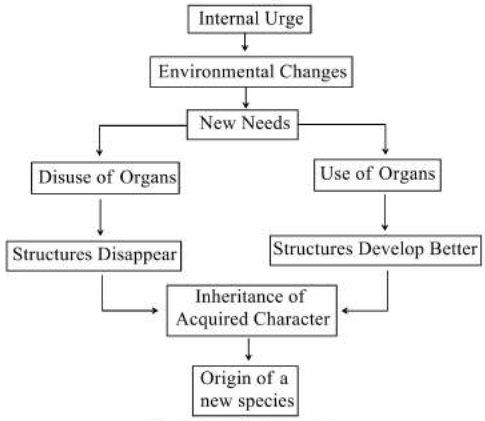
134 **(c)**
The first human-like being was the hominid called *Homo habilis*. The brain capacities were between 650-800cc. They probably did not eat meat. Fossils discovered in Java in 1891 revealed the next stage, *i.e., Homo erectus*. *Homo erectus* had a large brain and probably are meat ester. The Neanderthal man with a brain size of 1400 cc lived in near east and central Asia between 1,00,00-40,000 year back. They used animal skin to protect their body and burried their dead. *Homo sapiens* arose in Africa and moved across continents and developed into distinct races. During ice age between 75,000-10,000 years back modern *Homo sapiens* arose.

135 **(b)**
Theory of spontaneous generation (Abiogenesis or Autogenesis).
This theory states that life originated from non-living things in a spontaneous manner. This concept was held by early Greek philosophers like Thales, Anaximander, Xanophanes, Empedocles, Plato, Aristole, etc.

136 **(a)**
Permian period

137 **(c)**
Darwin realised that under the intense competition of members in a population, any variation which favoured survival in a particular environment would increase the individual's ability to reproduce and leave fertile offsprings. While less favourable variations decrease the chance of successful reproduction. Hence, Darwin judged the fitness of an individual by reproducing ability and the **number of offsprings**.

138 **(d)**
I, II, III and IV.
Lamarck's theory (theory of acquired characters).
Lakarckism includes the four main factors
(i) **Internal Vital Force** All the living things and their component parts are continually increased due to the internal vital force
(ii) **Effect of Environment and New Needs**
Environment influences all the type of organisms. Any changes in environment brings about changes in organisms. It gives rise to the new needs of organisms
(iii) **Use and Disuse of Organs** If an organ is constantly used it would be better developed whereas disuse of organ results in its degeneration
(iv) **Inheritance of Acquired Characters** Whatever an individual acquires (to possess) characters in its life time due to internal vital forces effect of environment, new needs and use and disuse of organs, they are inherited (transmitted) to the next generations. After several generations, the variations are accumulated upto such extent that they give rise to new species
Objection in Lamarck Theory
(i) Boring of pinna (external ear) and nose of women is never inherited to the next generations
(ii) The wrestler's powerful muscles are not transmitted to the offspring
(iii) European ladies wear tight waist garments in order to keep their waist slender but their off spring at the time of birth have normal waists
(iv) Chinese women used to wear irons shoes in order to have small feet, but their children at the time of birth have always normal feet



Basic idea of Lamarckism

139 **(d)**
DNA analysis, finding age by carbon dating, studing fossils of species, these all are the methods through which evolutionary development of a species can be studied

140 **(c)**
Phenomenon of industrial melanism demonstrates **natural selection**, *e.g.*, occurrence of dark (melanic) form of insects in regions with high industrial pollution.

141 **(c)**
Diversity of living organism occurs due to the long term evolutionary changes which accumulated gradually in the organisms

142 **(b)**
Darwin's book **Origin of New Species by Natural Selection** was published in **1859**.

143 **(b)**
Natural selection leads to the competition between the members of same species or different species but in genetic drift there is very little competition between the members of the same species

144 **(a)**
Homo sapiens sapiens (the man of today) appeared about 25000 years ago and started spreading all over the world about 10,000 years ago. Morphologically, the transition is marked merely by slight raising of skull cap, thining of skull bones and cranial capacity (1300-1600 CC) and formation of four flexor in vertebral column

145 **(c)**
Continental drift pouched mammals of Australian survived because of lack of competition from other mammals or animals

146 **(c)**
*Neopilina*is a living fossil and also considered as connecting link between Annelida and Mollusca.

147 **(a)**
Fossils of *Homo erectus* (Java ape man) were obained from Java and the similar fossils were found in the cave near Peking China in the 1891. They were named *Homo erectus pekinensis*

148 **(d)**
Natural selection is the differential success in reproduction and it leads to the adaptation of organisms to their environment. Thus, natural selection occurs through an interaction between the environment and the population

149 **(a)**
Industrial melanism is an example of directional selection, changing, environment leading to change in the phenotypic/genotypic constitution of a population.

150 **(a)**
Stanley Miller proposed that the life has originated in the sea due to reactions taken place between the organic compounds.

151 **(a)**
Anthropoid are like a human being or an ape
Examples for Anthropoid
Gorillas, chimpanzees and gibbons are all anthropoid apes, having long arms, no tails and highly developed brains.
Monkeys, apes and humans, proconsul, are all anthropoids

152 **(b)**
These fossils demonstrates gradualism, the theory on the time frame of evolution that states that the species gradually changes over time. Since, the fossils are found in the different layers of sedimentary rocks, the older layer contains species that evolved into new species with some changes into the new layer of rock

153 **(d)**
The Hardy –Weinberg law states that the gene and genotypic frequencies in a Mendelian population remain constant generation after generation if there is no selection, mutation, migration or random drift.

154 **(b)**
Darwin gave both theories—struggle for existence and survival of the fittest.

155 **(a)**
Theory of continuity of germplasm was give by **August Weismann** (1834-1914).
Theory of continuity of germplasm by **August Weismann** (1834-1914). A German biologist, was the main opposer of the inheritance of acquired characters. He put forward the theory of continuity of germplasm. According to Weismann, the characters influencing the germ cells are only inherited. There is a continuity of germplasm (protoplasm of germ cells) but the somatoplams (protoplasm of somatic cells) is not transmitted to the next generation. Hence, it do not carry characters to the next generation. Weismann cut off the tails of rats for as many as 22 generations and allowed them to breed, but tailless rats were never born

156 **(a)**
Adaptive radiation.
Examples of adaptive radiation are
(i) **Darwin's Finches of Galapagos Island** They had common ancestors but different types of modified beaks according to their food habits.
Darwin differentiated thirteen species of the finches according to their food habits
(ii) **Australian Marsupials** Darwin explained that adaption radiation gave rise to the varieties of marsupials (pouched mammals) in Australia by the same process of adaptive radiation as found in the finches of Galapagos Islands.
(iii) **Placental mammals** in Australia exhibit adaptive radiation in evolving into varieties of placental mammals each of which appears to be similar to corresponding marsupials

157 **(a)**
When a group of organisms shares a homologous structure, which is specialized to perform a varity of different functions, it shows **adaptive radiation**, which represents evolution of new forms in several directions from the common ancestral type (divergence).

158 **(a)**
A-Inheritable, B-Reproduce, C-Greater

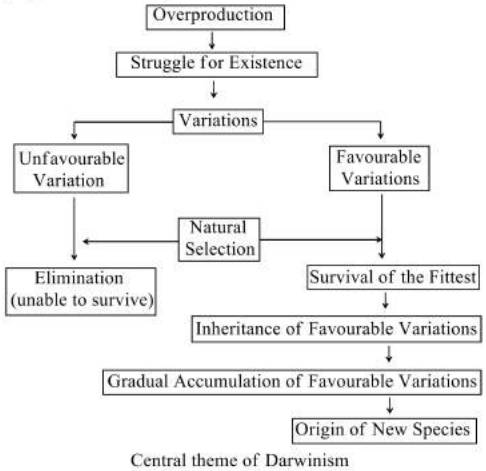
159 **(b)**
Among these, **cow** does not left any evidence of organic evolution.

160 **(a)**
Biological concept of species was given by Ernst Mayer. Alternative ways of defining a species

Biological Aspect	Definitions
Breeding	A group of organisms capable of interbreeding and producing fertile offspring
Genetic	A group of organisms showing close similarity in genetic karyotype
Ecological	A group of organisms sharing the same ecological niche; no two species can share the same ecological niche
Evolutionary	A group of organisms sharing a unique collection of structural and functional characteristics

161 **(d)**
Somatic cell of gorilla, chimpanzee and orangutan have 48 chromosome (24 pairs) while humans have 46 chromosome (23 pairs)

162 **(a)**
Natural selection
(i) Tend to increase the characters that enhance survival and reproduction
(ii) Cause adaptation



Central theme of Darwinism

163 **(b)**
Darwinian fitness can be estimated by the number of offspring produced by different individual in a population. The organisms which have favourable variation in accordance with environment have more offspring than the other which don't variations in accordance with environment

164 **(b)**
Protoviruses are considered as the first life on earth.

165 **(d)**
All new species develop from the pre-existing species. The phenomenon of the development of a new species from the pre-existing ones is called speciation. A species is a collection of demes. The deme is a group of population with a common gene pool. Mutation, recombination, natural selection, hybridization, genetic drift polyploidy, isolation, all of these factors affects the phenomenon of speciation

166 **(a)**
Jurassic period is the second geological period of Mesozoic era. In this period, the **gymnosperms** were dominant and the plants included ferns, cycads, *Ginkgo*, rushes and conifers, among animals, important invertebrates included anamniotes, corals, brachiopods, bivalves and echinoids. Reptiles dominated the vertebrates and the **first flying reptiles**, the pterosaurs appeared. The **first primitive bird**,*Archaeopteryx* also made its appearance.

167 **(b)**
Evidences for common ancestory of great apes and man are as follows
Evidence from Blood Protein It has been proved by the blood protein tests that man is most closely related to great apes (Chimpanzee and Gorilla) and next closest, in order are the old world monkeys the new world monkeys and tarsiers
Evidence from Blood Group In humans four blood groups A, B, AB and O occurs. The blood groups A and B are found in apes but not in monkeys. This indicates that human beings are more closely related to apes than to monkeys
Evidence from Haemoglobin There is 99% homology in haemoglobin of man and gorilla. This suggests that the two are closely related

168 **(c)**
Euglena is a member of protist kingdom. It has both the animals and plant characteristics. That's

way, it is considered as the connecting link between animals and plants

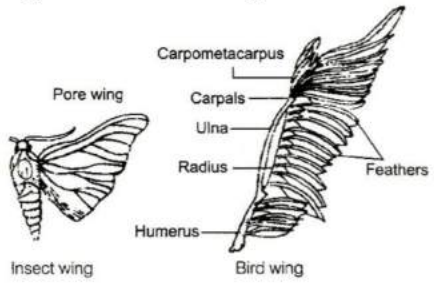
169 **(a)**
Homologous organ.
Concept of adaptive radiation in evolution was developed by **HF Osborn** in 1902. Adaptive radiation is also called divergent evolution. Homologous organ shows the adaptive radiation

170 **(a)**
Founder Effect Sometime the change in allele frequency is so different in the new sample of population that they become a different species. The original drifted population becomes founders and the effect is called founder effect. Generally, this effects operates when a population drifted to the new geographical area permanently

171 **(b)**
Mesozoic era

172 **(d)**
Difference in diet, health age and accident do not affect organism's hereditary material. Therefore, it is not important in evolutionary point of view

173 **(a)**
Analogous Organs The organs which have similar functions but are different in their details and origin are called analogous organs. The analogous organs shows convergent evolution



174 **(a)**
Oparin and **Sydney Fox** held that large organic molecules, synthesized abiotically on primitive earth, formed large colloidal aggregates due to intermolecular attraction. These colloidal particles were called coacervates, which are protobionts having polysaccharide, protein and water.

175 **(b)**
Humans blood group are as A, AB, B, O. Blood groups A and B are also found in apes, but not in monkeys. This indicates that human beings are more closely related to apes than to monkeys

176 **(c)**
Australopithecus (first ape-man) lived from 4 to 1.5 million years ago in cave during **Pleistocene** period. It was erect posture, omnivorous and have cranial capacity of 500-700 cc.

177 **(c)**
Darwin gave theory to explain organic evolution. The main postulates, which formed the basis of Darwin's theory were-over production, limited resources, struggle for existence, variations, survival of the fittest (natural selection) and formation of new species.

178 **(a)**
Almost all modern reptiles, birds and mammals, have forelimbs means, they all have same basic plan of the structure but they perform different functions. This phenomenon is called ancestral homology

179 **(a)**
Pasteur performed a swan-necked flasked experiment for proving biogenesis, according to biogenesis, all the living oranisms have originated from other living organisms. This experiment disproved the concept of spontaneous generation completely.

180 **(c)**
Industrial melanism is a term used to describe the evolutionary process, in which darker individuals come to predominate over lighter individuals. Since, the industrial revolution as a result of natural selection. Until 1848, almost every individual of peppered moth (*Biston betularia*) captured in Great Britain had light-coloured wings with black specklings. In 1848, a black form of moth was recorded in Manchester and by 1895, 98 of the peppered moth population in Manchester was black. This black melanic form arose by a recurring random mutation.

181 **(c)**
deVries gave his mutation theory on organic evolution, while working on *Oenothera lamarckiana* (4'O clock plant).

182 **(d)**
The skull of baby chimpanzee is more like adult human skull than the adult chimpanzee skull. *Dryopithecus* is the most oldest human like fossil. It is considered as the common ancestor of both human and ape.

Dryopithecus was found in miocene rock of Africa and Europe

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

184 **(d)**
Both (a) and (c).
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position

185 **(a)**
Lamarck's theory (theory of acquired characters).
Lakarckism includes the four main factors
(i) **Internal Vital Force** All the living things and their component parts are continually increased due to the internal vital force
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(iv) Chinese women used to wear irons shoes in order to have small feet, but their children at the time of birth have always normal feet

186 **(c)**
Fossil of *Shivapithecus* reported from Shivalik hills (India) from the rocks of Miocene epoch (about 20-25 million years ago).

187 **(a)**
Devonian

188 **(c)**
Australopithecus (first ape man)
Australopithecus africanus appeared about 5 million years ago and is also called African ape man. He was about 1.5 meters high and had human as well as ape characters. *Australopithecus africanus* had also gave rise to man like apes called *Australopithecus robustus* and *Australopithecus boisei* along a separate line end that ends blindly

189 **(d)**
Hugo de Vries pioneered the theory of mutation to explain the mechanism of evolution. According to him evolution is discontinuous and jerky process. Frequency of a mutated gene in population is expected to increase if that gen is selected by nature.

190 **(c)**
Population is the unit of evolution. The individuals of a population form a unique set of genotype or gene pool and local environmental factors act as selective agents to alter the gene pool in ways that adapt the organisms to the local conditions. Thus, each population of a species follows its own course of evolution.

191 **(d)**
The fossils *Dryopithecus africanus* was discovered from Miocene rock of Africa and Europe. It lived about 20-25 million years ago. *Dryopithecus* gave rise to the *Ramapithecus* which was on the direct line of human evolution. They appeared about 14-15 million years ago

192 **(c)**

Coenozoic is regarded as **age of mammals**. In this era, varity of mammals like whale, bat and man appeared for first time.

193 **(d)**
In 1859, Darwin published his observations and conclusion under the name 'origin of species'. Darwin's book became very popular and it had changed people's thinking about organic evolution

194 **(d)**
Spontaneous generation theory was given by **Aristotle**. According to this theory, life originated not only from living but also from non-living forms, spontaneously.

195 **(c)**
Both (a) and (b).
Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. Usually, it is a result of diffusion of the same species to different and isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection
Primarily diffusion is the basis of molecular division which can be seen in some higher-level characters of the structure and function that are readily observable in organisms. For example, the vertebrate limb is one example of divergent evolution. The limb in many different species has a common origin, but has diverged somewhat in overall structure and function

196 **(a)**
In the given diagram, the evolution of heart is in dictated from the two chambered heart of fishes to the most evolved four-chambered heart of mammals. It is an example of evolution from comparative anatomy and morphology

197 **(b)**
1.5 million years ago

198 **(d)**
The concept of **chemical evolution** is based on possible origin of life by combination of chemical under suitable environmental conditions.

199 **(a)**
Character of *Homo erectus* (1.6 million to 200 000 years ago)
Upright human protruding jaw, no chin, thick brow ridges and a long skull
(i) teeth smaller than in *habilis*
(ii) much larger brain than habilis (1000 mm)
(iii) may have had advanced speech controlled fire
(iv) made more sophisticated tools then predecessors
(v) left Africa and spread throughout Asia and Europe

200 **(a)**
Based on observation made during a sea voyage in a sail ship called HMS Beagle round the world. Charles Darwin conclude that the existing living forms share similarities to varying degrees not only among themselves but also with the life forms that existed millions of years ago

201 **(d)**
The period of approximately 0.6 billion years that existed between the formation of the gaseous clouds (about 4.6 billion years ago) and the formation of earth's crust is called Azoic era during which no life existed.

202 **(c)**
First life originated in water (sea)

203 **(d)**
The Synthesis of amino acid from methane, ammonia, hydrogen and water vapour in UV-radiation or electric discharge was experimentally proved by **Stanley Miller.**

204 **(b)**

Homologous organs	Analogous organs
Similar in anatomy	Dissimilar in anatomy
Doing dissimilar functions	Doing similar functions
Develop in related animals	Develop in unrelated animals
Inherited from a common ancestor	Not inherited from common ancestor
Similar developmental pattern	Developmental pattern is not similar
Similar structure and origin	Dissimilar in structure and origin

205 **(c)**
Echidna (spiny anteater)and Ornithorhynchus (platypus) are the connecting links between **reptiles** and **mammals**.

206 **(d)**
Homeostasis is keeping the internal enviroment of the body constant. It is necessary for normal life processes.

207 **(a)**
Homo habilis is also called handy or tool maker man. Mary Leaky and LBS Leaky discovered the fossils of *Homo habilis* from Pleistocene rocks of Olduvai Gorge in East Africa. His cranial capacity was 680-720 cc. Their teeth were like that of modern humans

208 **(c)**
Genetic drift is also known as the Sewall Wright effect (named after its discovers)

209 **(c)**
In the first living body, basic organic molecule formed was RNA that served as the genetic material.
Enzymatic activities of RNA molecules are constantly being discovered, but no enzymatic activity has ever been attributed to DNA. Further, ribose is much more readily synthesized than deoxyribose under stimulated prebiotic conditions. A selective advantageous RNA molecule would be one that directs the synthesis of protein that accelerates the replication of particular RNA (*i.e.*, RNA polymerase)

210 **(a)**
A-Shrews. B-Viviparous

211 **(a)**
Ontogeny repeats phylogeny comes under **biogenetic law**.

212 **(c)**
Modern Concept of Evolution Modern concept of evolution is the synthesis of Darwin's and Hugo de Vries theory also called synthetic theory of evolution. *Modern concept of evolution includes the following steps*
(i) Genetic variations in population
(ii) Isolation
(iii) Heredity
(iv) Natural selection
(v) Speciation (origin of new species)
The modern theory is a result of number of scientist namely T Dobzhonsky, RA Fisher, JBS Haldane, Sewall Wright Ernst Mayer, GL Stebbins Stebbins in his book 'Progress of organic evolution' discussed the synthesis theory of evolution

213 **(d)**
Different species developed along the pattern, set by their common ancestors gives rise to homologous organs

214 **(c)**
A-900cc, B-Omnivorous

215 **(b)**
Cranial Capacities of Apes and Man

Primates	Cranial capacities (in cubic centimetris)
Chimpanzee and gorilla	325-510 cc
Australopithecus	500 cc
Homo habilis	700 cc
Java Ape man	800-1000 cc
Peking man	850-1100 cc
Heidelberg man	1300 cc
Neanderthal man	1300-1600 cc
Cro-Magnon man	1650 cc
Living Modern man	Average about 1450 cc

216 **(b)**
Embryological Evidences in Plants Plants like *Acacia*, the leaves are compound but their seedling have simple leaves. This suggest their evolutionary relationship (biogenetic law), Haeckel's biogenetic law states that ontogeny repeats phylogeny. Ontogeny is the life history of an organism, while phylogeny is the evolutionary history of the race of that organism. In other words an organism repeats its ancestral history during its development

217 **(b)**

Name	Discovered the Fossil
Edward Lewis	*Ramapithecus*
Donald Johanson	*Australopithecus* (Lucy)
LSB Leaky	*Homo habilis*
C Fuhlrott	Neanderthal man

218 **(c)**
Daying or extinction of an individual or species is not an example of evolutionary change. Rather, it is the way through which the valuable genes are removed out of the gene pool

219 **(c)**
Darwin travelled in **HMS Beagle** ship.

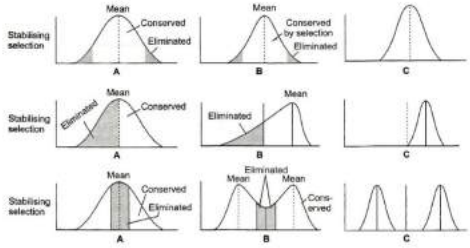
220 **(a)**
Flippers of the seal are the modified from of forelimbs. These are the examples of homologous organ

221 **(c)**

The cranial capacity of Peking man was about **1075 cc.**

222 **(c)**
Although evolutionary changes within most species is thought to occur slowly, recent studies have identified the cases where evolutionary change has apparently occurred over a few generations. Anthropogenically altered environments appears particularly open to the rapid evolutionary changes over comparatively short time scales. Here, we consider a Pacific salmon population that may have experienced life-history evolution, in response to habitat alteration, within a few generations

223 **(d)**
All of these.
Selection process in natural selection are



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224 **(c)**
Homologous organis are those organs which have the same basic structure but different functions. These show common descendent and divergent evolution while analogous organs show convergent evolution.

225 **(a)**
Evolutionary convergence is the development of the common set of characters in a groups of different ancestry.
Convergent evolution describes the acquisition of the same biological trait in an unrelated lineages. The wings are the classic example of convergent evolution in action. Flying insects, birds and bats have all evolved the capacity of flight independently. They have 'convergent' on this useful trait.
The ancestors of both bats and birds were terrestrial quadrupeds, and each of them had independently evolved powered flight via adaptations are superficially 'wing-shaped', they are substantially dissimilar in construction.
The bat wing is a membrane stretched across four extremely elongated fingers, while the airfoil of the bird wing is made of feathers, which are strongly attached to the forearm the ulna and the highly fused bones of the wrist and hand the carpometacarpus, with only tiny remnants of two fingers remaining, each anchoring a single feather. Both bats and birds have retained the thumb for specialized functions. So, while the wings of bats and birds are functionally convergent, they are not anatomically convergent

226 **(a)**
Contraclile vacuole in *Amoeba* and uriniferous tubule in frog are analogous organs. Analogous organs have different origin and structure but have same function. Similarly, on the basis of same function is called analogy. Both **contractile vacuoles** and **uriniferous tubules** are cocerned with osmoregulation.

227 **(a)**
Neanderthals were the first human beings who believed in the immortality of soul and practised ceremonial burial.

228 **(d)**
Wings of insects and birds are analogous organs because they performs the same function but have different origins

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

230 **(d)**
Darwin's theory of inheritance was referred to **pangenesis theory**. **Weismann** (1900) suggested that reproductive cells have the germplasm and they pass traits to the next generation. As the traits of somatoplasm do not transmit to next generation, they are not found in the offsprings. This is the basis of present day **chromosomal theory of inheritance**.

231 **(d)**
Azoic means no life. It was the era which prevailed during the origin of earth. At that time there was no hostile condition for the survival of any living organisms

232 **(a)**
Reproductive isolation states the condition when two populations of a species can no longer interbred. As a result the flow of genetic material stops between them. This leads to the origin of new species

233 **(c)**
DNA variation suggest that there was a greater variation in Asia than in Africa.

234 **(c)**
Allele/gene frequency of 'A' = 0.2
For allelic frequency $A + a = 1$
So, allelic frequency of 'a' = 1 – 0.2 = 0.8

235 **(b)**
Hands of man and wings of bat, forearm of humans and forelimbs of horses are the examples of homology because they have same or common origin but have different functions

236 **(d)**
Cromagnon man is closest ancestor of modern man. The cranial capacity was highest (1680cc). It lived in **France** and **Spain**. It made paintings inside cave and ornaments of ivory. The feeding habit was omnivore. He had aesthetic sense.

237 **(a)**
HW Principle is the genetic structure of allelic frequency of non-evolving population under stable conditions

238 **(d)**
Adaptive radiation is the development of different functional structures from a common ancestral form.

239 **(d)**
Sewall Wright Effect.
Stability of the population and species over the number of generations is met under the following conditions
(i) **No Mutation** Sudden appearance of variations are called mutations. There should not be either gene or chromosomal mutation. Mutation causes changes in gene frequency
(ii) **No Gene flow** (Gene Migration) Within the gene pool of a given breeding population there is a continuous interchange of alleles between organisms. Gene flow refers to the movement of alleles from one population to another as a result of interbreeding between the members of two population. There must not be gene flow between the population
(iii) **No Genetic Drift** Genetic drift is also known as 'Sewall Wright Effect' (named after its discoverer). It is random in gene (allele) frequency. It occurs only by chance. It is non directional. Genetic drift can cause elimination of certain alleles or fixation of the other alleles in the population. Genetic drift refers to a change in the population of alleles in the gene pool. So genetic drift must not occur
(iv) **No Genetic Recombination** The alleles of the parental linkage groups separates and new associations of alleles are formed in the gamate cells, this process is known as genetic recombination. Thus, crossing over during meiosis is a major source of genetic variation within population.
Offspring formed from these gametes showing 'new' combination of the characteristics are called recombinants. There is no genetic recombination
(v) **No Natural Selection Pressure** There must be no natural selection pressure with respect to the alleles in question.
According to Hardy-Weinberg Principle, gene frequencies will remain constant if all above five conditions are met

240 **(b)**
The lycophytes separated from the rest of the early land plants, evolved adequate reproductive, supportive, and transport systems.
Three groups of extinct vascular plants were prevalent in Devonian times; the rhyniophytes, zosterophylls, and trimerophytes. The oldest known vascular plant is *Cooksonia*, a 6.5 centimeter- tall plant with dichotomously branched (forking into two) leafless stems with sporangia at their tips. Only bits and pieces have so far been recovered and no rhizomes or below ground parts have been found. It is a rhyniophyte and its relatives were extinct by mid-Devonian time

241 **(d)**
Organic means living. Evolution means change through time. Ecology is the study of organisms in their environment. Embryology is the study of developing organisms. Spontaneous generation is the theory that living things can arise from the non-living materials

242 **(b)**
Evolution is always considered as the appearance of new character, permanently. The genes of the new characters should also be transmitted to the offspring otherwise the changes are lost. Adaptive ability can't be consider as evolution because this ability may be temporary due to environmental changes

243 **(b)**
Connecting Links The organisms having the structures of two different groups are called connecting links. These explain the path of evolution.
Connecting Links Organisms are those which show characters of two different groups. They show the possible path for evolution
Some Important Connecting Links

Link	Between the Groups
Xenoturbella	Protozoa and Metazoa
Virus	Living and non-living
Trochophore larva	Annelida and Mollusca
Tornaria larva	Echinodermata and Chordata
Sphenodon (living fossil lizard)	Amphibia and Reptilia
Seymouria	Amphibian and Reptiles
Rickettsia	Virus and Bacteria
Protopterus (Lung fishes)	Bony fishes and Amphibia
Proterospongia	Protozoa and Porifera
Peripatus (walking worm)	Annelida and Arthropoda
Ornithorhynchus (duck billed platypus)	Reptiles and Mammals
Neopilina	Annelida and Mollusca
Myxomycetes	Protista and Fungi
Latimeria	Pisces and Amphibia
Hornworts	Protista and Bryophytes
Gnetum	Gymnosperms and Angiosperms
Euglena	Animals and plants
Echidna (spiny and easter)	Reptiles and mammals
Cycas	Pteridophytes and gymnosperms
Ctenophora	Coelenterates and Platyheliminthes
Club moss	Bryophytes and Pteridophytes
Chimera (rabbit fish/ratfish)	Cartilaginous and bony fishes
Balanoglossus	Chordates and non-chordates
Archaeopteryx	Reptiles and birds
Actinomycetes	Bacteria and fungi

244 **(b)**
Stanley Miller and **Harold Urey** synthesized amino acid by passing an electric discharge in a mixture of
ammonia
(NH_3), hydrogen (H_2), water vapours (H_2O)and m
The ratio of CH_4, $NH_3$and H_2 in large flask was **2 : 1 : 2.**

245 **(c)**
Proteinoids are proteins like structures consisting of branched chain of amino acids. Protenoids are formed by the dehydration synthesis of amino acids at a temperature of 180°C

246 **(a)**
Phylogeny (Gr. *phylon*=tribe or race; *geneia*=origin) is the origin and diversification of any taxon or the evolutionary history of its origin and diversification. It is usually represented as a

diagrammatic phylogenetic tree (that traces putative evolutionary relationships), *i.e*,dendrogram.

247 **(b)**

Common set of characters in group of different ancestory.

Convergent evolution describes the acquisition of the same biological trait in an unrelated lineages. The wings are the classic example of convergent evolution in action. Flying insects, birds and bats have all evolved the capacity of flight independently. They have 'convergent' on this useful trait.

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248 **(c)**

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

249 **(a)**

The organs, which perform same function but develop in totally different groups and are totally different in their basic structure and developmental origin are called **analogous organs**.

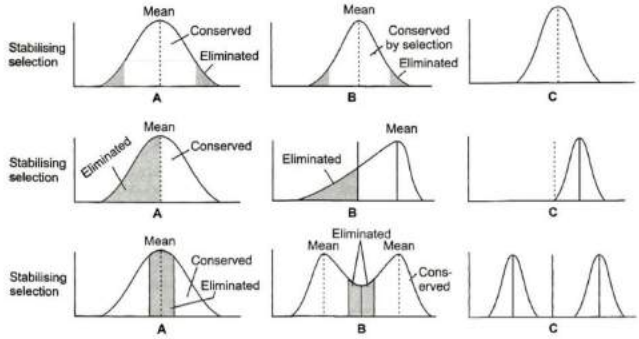
250 **(a)**

Homo sapiens arose in Africa and moved across continents and developed into deistinct races. During ice-age between 7,000-10,000 years ago, modern *Homo sapiens* arose. Pre-historic cave art developed about 18,000 years ago. Agriculture came around 10,000 years back and human settlements started

251 **(c)**

Both (a) and (b).

Selection process in natural selection are



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252 **(d)**

Regressive evolution is a phenomenon by which a species loses its features through evolution. It is especially evident in many cave-dwelling species, the majority of which actually descended from species that originally lived above ground.

Some of these organisms happened to have traits that were beneficial in a cave environment, prompting part of the population to move underground. Over time some features, like eyes or skin pigmentation, for example, became unnecessary and eventually disappeared

253 **(d)**
Natural selection provided better adaptability to the organisms. It wipes out unfit or less adaptive organisms and thus, helpful for better survival.

254 **(b)**
All except IV, V and II.
Hugo de Vries believed that mutation causes evolution and not the minor heritable variations, which was mentioned by Darwin
Mutation are random and directionless, while Darwin's variations are small and directional
Term 'saltation' is also called single step large mutation, which leads to new specks

255 **(a)**
$A - p^2 + 2pq + q^2 = 1$; B = Evolutionary charge

256 **(d)**
Well developed brain, opposite thumb and binocular vision. All of these features are the direction of evolution in human species

257 **(c)**
The **theory of genetic drift** was proposed by geneticist**Sewall Wright** in 1930. It is also called Sewall Wright effect or scattering of variability. It refers to the 'random fluctutation' in the gene frequencies in a small population generation after generation purely by chance.

258 **(b)**
The universe is vast relatively speaking the earth. Itself is almost only a speck. The universe is very old almost 20 billion years old. Huge dusters of galaxies comprises the universe

259 **(a)**
Hardy Weinberg equilibrium describes that under certain conditions of stability allelic frequencies remain constant from generation to generation in sexually reproducing organisms. The Hardy – Weinberg law uses the binomial expression $p^2 + 2pq + q^2 = 1$to calculate genotype and allele frequencies of a population.

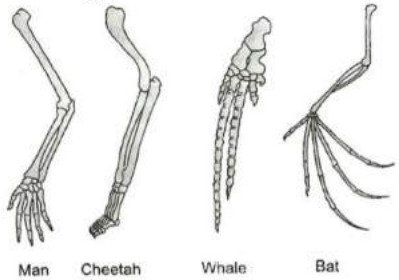
Cenozoic era (recent)

261 **(c)**
The concept of inheritance of acquried character in support of evolution was proposed by **Lamarck**. New traits are acquired by organism during their lifetime, and are passed on to the next generation.

262 **(c)**
Peripatus is a connecting link between**Annelida** and **Arthropoda**. Like annelids, it has continuous muscle layers in the body wall, unjointed legs like parapodia, nephridia for excretion and simple gut. Main arthropod characters are claws on the legs, haemocoel,tracheae for respiration, dorsal heart with ostia, etc.

263 **(b)**
Convergent evolution or adaptive convergence or parallel evolution is shown by analogous organs, whereas divergent evolution or evolutionary divergence or adaptive radiation are shown by homologous organs.

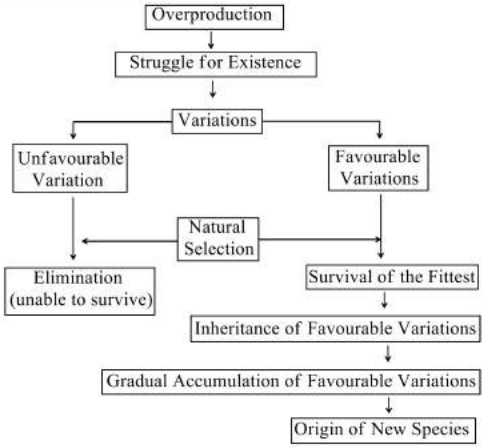
264 **(b)**
Forelimb of frog, wings of bird, forelimb or rabbit, flipper of whale.
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position
Vertebrates hearts, vertebrate brains and vertebrate limbs have the same basic plan of organization during development. But in adult condition they are modified. This indicate their homology



265 **(b)**
Coprolite is a scientific name for the fossilized excrement, faeces or droppings of ancient animals. It was coined by **Dr. William Buckand**(1829).

266 **(d)**
When the members of a species do not interbreed with the members of other species or same species due to differential modification is called reproductive isolation. The criterion of the reproductive isolation can not be used in asexual organisms

267 **(b)**
Branching desent and natural selection are the two main concepts of Darwin.
Mendel's laws of inheritance and Weismann's theory of continuity of germplasm (1892) discarded Lamarck's concept of inheritance of acquired characters



Central theme of Darwinism

268 **(a)**
Related species which are reproductively isolated but mophologically similar are called sibling species.

Allopatric species are species having exclusive areas of geographical distribution.

Sympatric species are species having overlapping areas of geographical distribution.

269 **(a)**
Presence of **homologous** and **vestigial organs** are important evidences in favour of organic evolution. They show divergent evolution.

270 **(b)**
Progeny with modifications.
Evolutionary biology is the study of history of life forms on earth
Evolution The word 'evolution' (Latin-*evolvere*) means to unfold or unroll. In broad sense evolution simply means an orderly change from one condition to another. Evolution is a continuous process in which decent with modification are produced

271 **(b)**
Harold Clayton Urey, (April 29, 1893-January 5, 1981) was an American Physical Chemist, whose pioneering work on isotopes earned him the **Nobel Prize** in chemistry in 1934 and later led him to theories of planetary evolution.

272 **(d)**
"Meat was not spoiled, when heated, and kept sealed in a vessel". This experiment suggested that simplest living organisms could not have originated spontaneously from non-living matter.

273 **(a)**
A-Variations, B-Better, C-More

274 **(a)**
Founder effect is the loss of genetic variations that occurs when a new population is established containing a very small number of individuals called founders. Sometimes they forms a new species. The population in a new settlement may have different genotype frequencies from that of parent population

275 **(b)**
Genetic Drift The process of change in the genetic composition of a population due to chance or random events rather than by natural selection, resulting in changes in allele frequencies overtime. The effect of genetic drift in large populations is usually negligible whereas in small populations, it predominates

276 **(a)**
*Archaeopteryx*possesses both reptilian (toothed jaws, non-pneumatic bones, keel –less sternum, free caudal vertebra) and avian characters (forelimb forming wings, feathers, beak, fused skull bones).

277 **(b)**
Epiglottis is not a vestigial organ in man.
Epiglottis is the structure that prevents the entry

of food into respiratory tract during swallowing in man.

278 **(c)**
Origin of new species by the struggle for existence and survival of the fittest due to natural selection was the main theme of Darwinism. **Arrival of the fittest** (*i.e.*, production of individuals already adapted to environment) was not explained by the Darwinism.

279 **(a)**
Development of large changes like formation of new species and genera (or taxa) due to mutation comes in **macroevolution**. In this, large changes in chromosomes take place.

280 **(d)**
Recapitulation theory or biogenetic law states that ontogeny (development of embryo) is recapitulation of phylogeny (ancestral history).

281 **(b)**
Silurian

282 **(b)**
The evolutionary process, which produces new species, diverged from a single ancestral form adapted to new invaded habitats and to modes of life necessary there, is known as adaptive radiation

283 **(d)**
Homologous organs are those organs, which have similar origin and basic structure but are adapted differently to perform different functions.

284 **(b)**
Drawin's work was published with R Wallace's paper in the "Proceeding's of Linnean Society' in 1859, latter on Darwin published his famous book "Origin of Species".

285 **(c)**
After the aggregates became so large, some organisms developed the ability to ingest smaller organic molecules. This is heterotrophic nutrition. As the seas became filled, some developed the ability to change the light energy into usable energy called glucose. This is autotrophic nutrition and according to the heterotroph hypothesis, autotrophic nutrition came after heterotrophic nutrition

286 **(d)**
Following are the example of evolution
(i) Different finch species found in different Galapagos islands
(ii) The rise of antibiotic resistant strain of bacteria
(iii) Guppy populations after the introduction of predator shows evolution

287 **(d)**
Gradualism means that the species evolved gradually. Punctuated equilibrium means that the species remained stable for long period of time and then, due to large environment changes they changed rapidly in. Both theories are supported by the fossil records

288 **(c)**
A phylogenetic tree or evolutionary tree is a branching diagram of 'tree' showing the inferred evolutionary relationships among various biological species or other entities based upon similarities and differences in their physical and/or genetic characteristics. The taxa joined together in the tree are implied to have descended from a common ancestor

289 **(c)**
Inheritance of acquried characters means organs used most extensively would enlarge and become more efficient and such changed charascteristics (acquired traits) would be transmitted to the offsprings. This idea was the central theme of Lamarckism, while rest are related to Darwinism.

290 **(c)**
Protozoa is a group of animal-like unicellular protists. From unicellular organisms, multicellular organisms arises. Coelenterata group to which *Hydra* and jellyfish belongs, would be more advanced than protozoans but more primitive than arthropoda, to which the grasshoppers belong. Reptiles are more advanced than the arthropods

291 **(a)**
SW Fox of the university of Miami had demonstrated that if a nearly dry mixture of amino acids was heated, polypeptide molecules were synthesized. Similarly, simple sugars could form polysaccharides and fatty acids could combine to produce fats. Amino acids could form proteins. Thus, the small simple organic molecules combined to form large complex organic molecules, *e. g.*, fatty acids and glycerol

united to form fats, sugars, nitrogenous bases, and phosphates combined into nucleotides which polymerized into nucleic acids in the ancient oceans

292 **(d)**
Comparative biochemistry is the field of biology that deals with comparing similarities among different species DNA and protiens produced from the DNA. The more similar two different species DNA is, the closer the evolutionary link, and the more recent the two species shared a common ancestor

293 **(d)**
Theories of origin of life and their creators or supporter
(i) **Theory of Special Creation** The greatest supporter of this theory was father Suarez
(ii) **Theory of Spontaneus Creation** This concept was held by early Greek philosophers like Thales, Plato, Aristotle
(iii) **Cosmozoic Theory of Theory of Panspermia** This theory was proposed by Richter (1865)
(iv) **Theory of Eternity of Life** This theory was proposed by Preyer in 1880
(v) **Theory of Catatrophism** This theory given by Georges Cuvier (1769-1832)
(vi) **Modern Theory** Oparin (1938) and Haldane (1929) gave similar views regarding the origin of life called chemical or naturalistic theory

294 **(c)**
99%.
Evidences for common ancestory of great apes and man are as follows
Evidence from Blood Protein It has been proved by the blood protein tests that man is most closely related to great apes (Chimpanzee and Gorilla) and next closest, in order are the old world monkeys the new world monkeys and tarsiers
Evidence from Blood Group In humans four blood groups A, B, AB and O occurs. The blood groups A and B are found in apes but not in monkeys. This indicates that human beings are more closely related to apes than to monkeys
Evidence from Haemoglobin There is 99% homology in haemoglobin of man and gorilla. This suggests that the two are closely related

295 **(b)**
Polyploidy cells and organisms are those containing more than two paired (homologous) sets of chromosomes. Most eukaryotic species are diploid meaning they have two sets of chromosomes, one set inherited from each parent. However, polyploidy is found in some organisms and is especially common in plants. Polyploidy occurs in some animals, such as goldfish, salmon, and salamanders, but is especially common among ferns and flowering plants including both wild and cultivated species. Wheat, for example, after millennia of hyrbidisation and modification by humans, has strains that are diploid (two sets of chromosomes), tetraploid (four sets of chromosomes) with the common name of durum or macaroni wheat, and hexaploid (six sets of chromosomes) with the common name of bread wheat

296 **(c)**
Important theories to explain the origin of life on earth are
(i) **Theory of Special Creation** The greatest supporter of this theory was father Suarez. According to this theory life was created by supernatural powers. According to Bible the world was created in six days. The earth is 4000 yrs old. All the diversity was existed since creation
(ii) **Theory of Panspermia** This theory is also called the cosmozoic theory. Early Greek thinkers thought units of life called spores were transferred to the different plants including earth from the other planets
(iii) **Theory of Spontaneous Generation** This theory also is called a biogenesis or autogenesis. This theory states that the life originated from non-living by itself or spontaneous manner
Dismissial of Spontaneous Generation Theory Louis Pasteur by carefully experimentation demonstrated that, life comes only from pre-existing life. He showed that in pre-sterilised flasks life did not come from killed yeast, while in another flask open to air, new living organisms arose from 'killed yeast'. Spontaneous generation theory was dismissed once and for all. However, this did not answer how the first life came on the earth.
(iv) **Theory of Chemical Evolution** This theory is also called modern theory of evolution or neuralistic theory of evolution
Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (*e. g.*, RNA, protein, etc.)

and that formation of life was preceded by chemical evolution, *i.e.*, formation of diverse organic molecules from inorganic constituents

297 **(b)**

Australia.

Examples of adaptive radiation are

(i) **Darwin's Finches of Galapagos Island** They had common ancestors but different types of modified beaks according to their food habits.

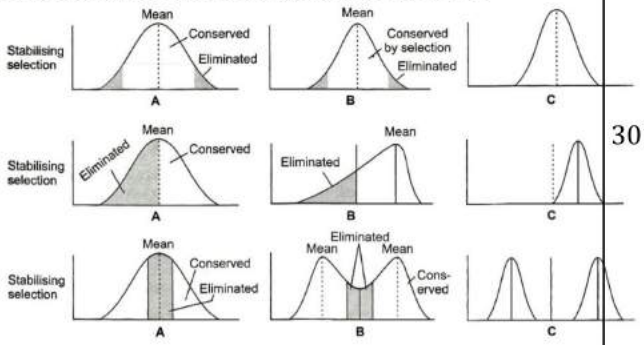
Darwin differentiated thirteen species of the finches according to their food habits

(ii) **Australian Marsupials** Darwin explained that adaption radiation gave rise to the varieties of marsupials (pouched mammals) in Australia by the same process of adaptive radiation as found in the finches of Galapagos Islands.

(iii) **Placental mammals** in Australia exhibit adaptive radiation in evolving into varieties of placental mammals each of which appears to be similar to corresponding marsupials

298 **(c)**

Selection process in natural selection are



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299 **(c)**

Hugo de Vries (1901) put forward the theory of evolution, called mutation theory.

The theory states that evolution is a jerky process where new varieties and species are formed by mutations (discontinuous variations) that functions as the raw materials of evolution

300 **(d)**

Genetic drift (Sewall Wright Effect) is the random change in the frequency of alleles in a population over successive generation due to the sampling error in gametes. Each new generation differs from its parental generation with regards to allele frequency simply because of random variation in the distribution of gametes.

Overtime, this may lead to certain alleles becoming fixed and other being lost altogether. This process is more rapid in the small population. In large population it is very slow. Genetic drift causes the change in gene frequency

301 **(c)**

HW Principle $= p + q = 1$

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

Here, $p = A$ and q is $= B$

Allele frequency of $B = 1\text{-}0.4 = 0.6$

Allele frequency of heterozygous is $= 2 \times 0.6 \times 0.4$

$= 0.48$

302 **(b)**

Darwin's finches (also known as the Galapagos finches) were a group of about fifteen species of passerine birds. They are often are classified as the sub-family-Geospizinae. It is still not clear which bird family they belong to, but they are not related to the true finches. They were first collected by Charles Darwin on the Galapagos islands during second voyage of the Beagle

303 **(a)**

Interbreeding members of a same population are called species.

If the members of same population can't interbreed, than they are considered as different species

304 **(a)**

Protobionts are aggregated forms of different types of molecules, formed abiotically in the primitive sea. These are considered first cells produced on the earth because they have an internal environment that differs from their surroundings and also exhibit some signs of life, such as metabolism and excitability.

305 **(c)**

Biochemical Similarities between Groups
The different types of biochemical reactions occur in every living organism. These reactions are same in all the living organisms. *Some of the chemicals and their reactions are*
(i) **Enzymes** The amylase in all the living organisms digests the carbohydrates. The trypsin in all the living organisms digests the proteins.
(ii) **Hormones** In frog, the metamorphosing hormone is thyroxin. If human thyroxin is injected into thyroid free tadpole larva, if undergoes metamorphosis. This indicates that the function of thyroxin is same in all animals.
(iii) **Haemoglobin** It carries oxygen and carbon dioxide in all animals. Haemoglobin carries oxygen in the form of oxyhaemoglobin. In all birds the oxyhaemoglobin is identical. This indicates that the birds have close relationship among themselves

306 **(b)**

Origin of Universe There are several theories regarding the origin of universe but most accepted is Big-Bang theory.
Big-Bang Theory This theory was proposed by **Abbe Lemaitre** in 1931. According to the Big-Bang theory about 15 billion years ago, cosmic matter was in a condensed form. Explosion took place which broke the condensed matter and scattered its fragments into space at an enormous velocity making a Big-Bang sound and thus the theory came to be known as the Big-Bang theory

307 **(a)**

Organic Evolution Organic evolution is a process of cumulative change of the living populations and in the descendant populations of organisms. In other words, it is **descent with modification**

308 **(c)**

Cro –magnon was omnivorous, wore skin clothes and made paintings on the cave walls.

309 **(a)**

Darwin proposed the theory of Natural Selection. The organisms with favourable variations would survive because they are fittest to face their surroundings while unfits are destroyed originally, it was an idea of Herbert Spencer who used the term survival of the fittest while Darwin named it as Natural Selection.

310 **(a)**

Diversification in plants life appeared **due to long periods of evolutionary changes**. The evolutionary changes sequence is

Bryophyte (thalloid, no vascular tissue)→ Pteridophytes

(differentiation in vascular tissue begins) →Gymnosperms

(no fruit formation) →Angiosperms (fruit present).

311 **(c)**

All organisms have common ancestry.
Biochemical Evidences The similarities is proteins and genes performing a common given function among the diverse organisms gives the clue to common ancestry. Several metabolic processes possesses the same enzyme in different organisms.
e. g., Krebs' cycle, glycolysis, nucleotide synthesis, etc.

312 **(b)**

Ornithorhynchus anatinus. Duck-billed platypus is one of the three species of monotremes. These species are unique among mammals in that they retain their ancestral characteristic of egg laying. They have a cloaca through which eggs are laid and both liquid and solid waste is eliminated. Duck-billed platypus is stream-lined and elongated, they have fur ranging from medium brown to dark brown on the dorsal side and brown to silver-gray on the ventral side

313 **(d)**

Convergent evolution describes the acquisition of the same biological trait in an unrelated lineages. The wings are the classic example of convergent evolution in action. Flying insects, birds and bats have all evolved the capacity of flight independently. They have 'convergent' on this useful trait.

The ancestors of both bats and birds were terrestrial quadrupeds, and each of them had independently evolved powered flight via adaptations are superficially 'wing-shaped', they are substantially dissimilar in construction.
The bat wing is a membrane stretched across four extremely elongated fingers, while the airfoil of the bird wing is made of feathers, which are strongly attached to the forearm the ulna and the highly fused bones of the wrist and hand the carpometacarpus, with only tiny remnants of two fingers remaining, each anchoring a single feather. Both bats and birds have retained the thumb for specialized functions. So, while the wings of bats and birds are functionally convergent, they are not anatomically convergent

314 **(b)**
Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules (*e.g.,* RNA, protein, etc.) and that formation of life was preceeded by chemical evolution.

315 **(a)**
Vestigial organs are non-functional or imperfectly developed organs that were functional in ancestral species and may still be functional in related species, *e.g.*, vermiform appendix, nictitating membrane, etc.

In man, wisdom tooth (3rd molar) and **canines** (tearing) are also the vestigial sturctures.

316 **(c)**
Java man named *Pithecanthropus erectus* (ape man that can walk erect) by **Eugene Dubois** and *Homo erectus erectus* by **Mayer** (1950).

317 **(b)**
In convergent evolution two or more different group of organisms develops similar characters due to the same environmental forces Tasmanian wolf and placental wolf are the examples of convergent evolution

318 **(d)**
Theory of panspermia (cosmozoic) was proposed by, Richter (1865). According to this theory, 'protoplasm' reached the earth in the form of spores of germs or other simple particles from some unknown parts of the universe with the cosmic dust, and subsequently evolved into various forms of life

319 **(d)**
*Ramapithecus punjabicus*is known only by few teeth and some fragments of jaw. It is considered to be the earliest man-like primate and oldest of man's ancestors. Its fossils have been discovered from the Shivalik hills in India and date back to 14-15 million years ago in **Miocene**.

320 **(a)**
The theory of recapitulation is often known as ontogeny recapitulates phylogeny. It was an idea of Etienne Serres in 1824-26. In 1886 Ernst Haeckel proposed that the embryonic development of an individual organism (its ontogeny) followed the same path as the evolutionary history of its species (its phylogeny). It is also called the biogenetic law or embryological parallelism. It was a theory (idea) that tied evolution (the change organisms over time) with embryology (the way organisms develop before they are born).
The theory basically stated that before they were born, organisms passed through the developmental stages that look like adult animals of other species, in roughly the same order that these other species split off during evolution

321 **(a)**
Presence of recessive traits = 25%
$(q_1^2) = 25\%$
$q_1 = 0.5$
Total allelic frequency $(p + q) = 1$
$p + 0.5 = 1$
Allelic frequency $p = 0.5$

322 **(a)**
As per modern synthetic theory of evolution, there are five basic factors involved in the process of organic evolution:

1.Gene mutation

2.Changes in chromosome structure and number

3.Genetic recombinations

4.Natural selection

5.Reproductive isolation

The first three factors are responsible for providing genetic variability and the last two are

responsible for giving direction to the evolutionary processes.

323 **(a)**
Homo erectus (erect man) appeared about 1.7 million years ago in middle Pleiostocene. *Homo erectus* was evolved from *Homo habilis*. He was about 1.5-1.8 metres tall. He was the progenater of two main sub-species Neanderthal and Cro-magnon man

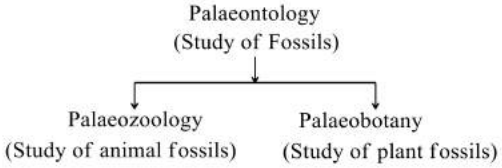
324 **(b)**
Nature select an organism which have an advantage to the particular given environment. Members of the ancestral salamander population that colonized the cave differed in their abilities. In caves, the eyes are of no use. So in that condition blind salamander were selected over the salamanders having eyes

325 **(d)**
Homology indicates common ancestry. It is based on divergent evolution, In plants, the thorns and tendrils of *Bougainvillea* and *Cucurbita*, respectivelyrepresent homology.

326 **(d)**
It is suggested that the large organic molecules formed abiotically in the primitive earth came together spontaneously and due to intermolecular attractions formed large colloidal aggregates called **coacervates**. An envelose of water molecules formed around each such aggregate due to hydrophilic nature of some of these compounds.

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

328 **(c)**
Both (a) and (b).



Palaeontological evidences (Evidences from fossil records)
Study of fossils is called Palaeontology
Leonardo de Vinci (1452-1519) an italian painter and invertor is called the Father of Palaeontology
Fossils are the remains of hard parts of life-forms found in rocks. Rocks forms sediments and a cross-section of earth's crust indicates the arrangement of sediments one over the other during the long history of earth
A variety of fossils ranging from the modern organisms to extint organisms can be observed and depicted by evolution
By studing the different sedimentary layers, the geological time period in which the organisms existed can be predicted

329 **(a)**
A species can be defined as 'a group of closely related organisms', which are capable of inbreeding to produce fertile offsprings. Thus, biological concepts of species is mainly based on **reproductive isolation**, which preserve the integrity of the species by checking hybridization.

330 **(d)**
Spontaneous generation and origin of life from non-living organism are the most common alternative ways to describe the process of abiogenesis

331 **(b)**
Homo erectus had a large brain having cranial capacity 900cc.

332 **(b)**
Saltation is the occurrence of a major mutation in a single generation, bringing about singnificant change.

333 **(b)**
According to **Oparin**, the atmosphere of primitive earth was reducing because H atoms were most numerous and most reactive. Large quantities of $H_2, N_2, H_2O, CO_2, CH_4$ and NH_3 were present but free oxygen was not present in significant amount.

334 **(a)**
Electron Spin Resonance (ESR) **Dating** Many materials found in archeological sites are able to trap electronic charges as a result of bombardment by radioactive radiation from the surrounding sediment.

The presence of these trapped charges can be detected by Electron Spin Resonance (ESR) spectroscopy.

The intensity of the ESR signal is a measure of the accumulated dose and thus of the age. Tooth enamel is ubiquitous at archeological sites and is well suited for ESR dating, with a precision of about 10-20%.

This method has now been used to date many sites critical to the biological and cultural evolution on modern man

335 **(a)**

A-*Homo erectus*; B-Cro-magnon man

336 **(b)**

Organs which perform similar functions but having different origin and structure are called **analogous organs**. Wings of birds and wings of insects are analogous organs. Such organs are not antomically similar through they perform similar functions. Hence, analogous structures are result of convergent evolution. Other examples of analogy are the eye of the *Octopus* and mammals, the flippers of penguins and dolphins, sweet potato and potato, etc.

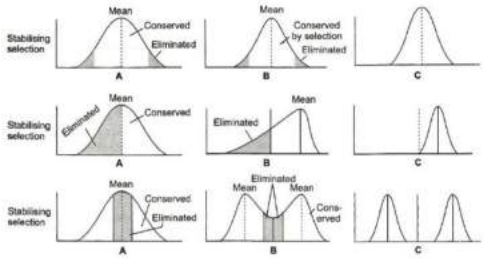
337 **(b)**

Vestigial organs present in an adult individual are examples of palaeontologicalbasis of evidence of evolution.

338 **(a)**

Directional.

Selection process in natural selection are



(i) **Stabilizing Selection** (Balancing selections)

This type of selection favours average sized individuals, while eliminates small sized individuals. It reduces variation and hence, do not promote evolutionary changes. It maintains the mean value from generation to generation. If we draw a graphical curve of population, it is bell-shaped

(ii) **Directional Selection** (Progressive Selection)

In this selection, the population changes towards one particular direction. It means this type of selection favours small or large-sized individuals and more individuals of that type will be present in new generation. The mean size of the population changes

(iii) **Disruptive Selection** (Diversifying selection)

This type of selection favours both small-sized and large-sized individuals. It eliminates most of the members with mean expression, so as to produce two peaks in the distribution of the trait that may lead to the development of two different populations. This kind of selection is opposite of stabilizing selection and is rare nature but is very important in bringing about evolutionary changes

339 **(a)**

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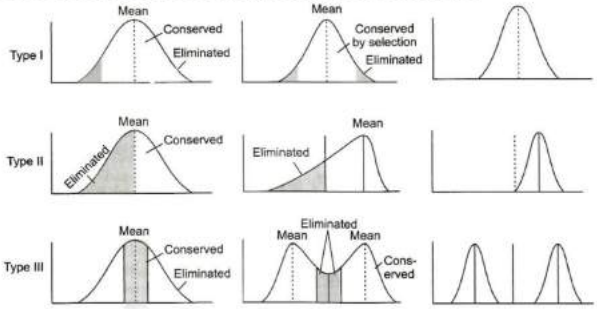

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340 **(b)**

Cosmozoic theory or hypothesis of Panspermia was developed by **Richter** (1865) and then supported by Thomson, Helmhontz, Van Tieghem and others. According to this hypothesis, life comes from other space in the form of spores of simple organisms.

341 **(d)**
Major radiations of mammals, birds and pollinating insects took place in **Palaeocene** epoch.

342 **(a)**
Stanley Miller and **Harold Urey** built an apparatus of glass tube and flasks in laboratory. He created early earth atmosphere containing hydrogen, methane, ammonia and water vapours and produced simple organic acids such as urea, hydrogen cyanide, sugars, purines, pyrimidines and amino acids.

343 **(c)**
Hardy –Weinberg principle illustrates that change of frequency of alleles in a population results in evolution.

344 **(c)**
RNAs most probably could have catalyzed the formation of lipid like molecules that could have in turn formed plasma membrane and proteins. The proteins might have taken over most enzymatic heredity molecule then, DNA evolved from RNA template. Once cells were evolved, DNA probably replaced RNA in most organisms

345 **(a)**
*Australopithecus*are considered as connecting link between ape and man. They were the ancestors of man, who first stood erect. Their cranial capacity was 300-500 cc.

346 **(d)**
All of above.
mportant theories to explain the origin of life on earth are
(i) **Theory of Special Creation** The greatest supporter of this theory was father Suarez. According to this theory life was created by supernatural powers. According to Bible the world was created in six days. The earth is 4000 yrs old. All the diversity was existed since creation
(ii) **Theory of Panspermia** This theory is also called the cosmozoic theory. Early Greek thinkers thought units of life called spores were transferred to the different plants including earth from the other planets
(iii) **Theory of Spontaneous Generation** This theory also is called a biogenesis or autogenesis. This theory states that the life originated from non-living by itself or spontaneous manner
Dismissial of Spontaneous Generation Theory
Louis Pasteur by carefully experimentation demonstrated that, life comes only from pre-existing life. He showed that in pre-sterilised flasks life did not come from killed yeast, while in another flask open to air, new living organisms arose from 'killed yeast'. Spontaneous generation theory was dismissed once and for all. However, this did not answer how the first life came on the earth.
(iv) **Theory of Chemical Evolution** This theory is also called modern theory of evolution or neuralistic theory of evolution
Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (*e. g.*, RNA, protein, etc.) and that formation of life was preceded by chemical evolution, *i.e.*, formation of diverse organic molecules from inorganic constituents

347 **(a)**
Lamarck's theory of evolution was published in *Philosophie Zoologique* in the year 1809. It is popularly known as 'the inheritance of acquried characters in organisms'. According to this, if an organ is used continuously and constantly, it will tend to become highly developed, whereas disuse results in its degeneration.

348 **(a)**
Continuous Variations Continuous variations are minute variations, which occurs in graded series. They fluctuate an either side of the average condition and differ only slightly from one another

349 **(a)**
Cro –magnon man (*Homo sapiens fossilis)*is the most recent and direct prehistoric ancestor of present man. It arose about 3,40,000 years ago.

350 **(a)**
Hugo de Vries believed that mutation causes evolution and not the minor heritable variations, which was mentioned by Darwin

Mutation are random and directionless, while Darwin's variations are small and directional Term 'saltation' is also called single step large mutation, which leads to new specks

351 **(b)**

Anthropology (from the Greek 'human' or 'person') consists of the study of humanity. This discipline is a holistic study, concerned with all humans, at all times, in all humanity's dimensions. Anthropology is traditionally distinguished from other disciplines by its emphasis on cultural relatively, in-depth examination of context and cross-cultural comparisons

352 **(a)**

Chromosomes of man and ape have been studied with special staining techniques and has been established that chromosome of man and apes(especially chimpanzee) have similar **banding** pattern. The comparison in actual sequence of amino acids in the polypeptide chains of haemoglobin of man, chimpanzee and monkey shows that there is absolutely no differences. The molecular structure of cytochrome-*c*, insulin and serum albumin in man and apes exhibits minimum differences.

353 **(c)**

Allopatric speciation.

Speciation is an evolutionary process by which new biological species arises.

There are five types of speciation : allopatric, peripatric, parapatric, and sympatric and artificial

(i) **Allopatric Speciation** It occurs when a species separates into two separate groups which are isolated from one another. A physical barrier, such as a mountain range or a waterway, makes it impossible to breed with one another. Each species develops differently, based on the demands of their unique habitat or the genetic characteristics of the group that are passed on to offspring

(ii) **Peripatric Speciation** When small groups of individuals break off from the larger groups and forms new species, this is called peripatric speciation. As in allopatric speciation, physical barriers make it impossible for numbers of groups to interbreed with one another, the main difference between allopatic speciation and peripatric speciation is that in peripatric speciation, one group is much smaller than the other

(iii) **Parapatric Speciation** A species is spread over a large geographic area. Although it is possible for any member of the species to mate with another member, individuals only mate with those in their own geographic region

(iv) **Sympatric Speciation** Some scientists don't believes that this form exists. Sympatric speciation occurs when there are no physical barriers preventing any member of a species from mating with another and all members are in close proximity to one another.

A new species, perhaps based on a different food source of characteristics, seems to develop. The theory is that some individuals becomes dependent on certain aspects of an environment-such as shelter or food sources, while others do not

(v) **Artificial Speciation** Is the creation of new species by people. This is achieved through lab experiments, where scientists mostly research insects like fruit files, and in animal husbandry. Animal husbandry is the care and breeding of livestock (animals). Many agricultural products, such as dairy, meat and wool, depends on animal husbandry

354 **(d)**

Features of Homo erectus are as follows

(i) They appeared about 1.7-1.5 million years ago

(ii) They evolved from *Homo habilis*. He was about 1.5-1.8 m long

(iii) The cranial capacity was 800-1300 cc cranium was domed to accommodate large brain

355 **(b)**

Evolution is a continuous process of change. Changes can be very rapid in small organisms, such as bacteria, but in most living things, it takes thousands of years. Human evolution from an ape like ancestor took millions of years and gave rise to several different species, not just our own

356 **(d)**

There are five different types of fossila

Terms	Definitions
Moid (imprint) fossils	When a leaf, feather, bone or even a body of an organism leaves an imprint on sediment, which hardens and becomes rock
Cast fossils	

Fossil fuels	When minerals fill in the hollows of an animal track, a mollusc shell or another part of an organism Fuels formed by the remains of dead plants and animals
Actual Remains	The body of an organism, with all the parts intact. Usually preserved in ice, amber or tar
Petrified wood	When minerals replace wood or stone to create either petrified wood or a mineralized fossil

357 **(b)**
Quantum Evolution Development of land plants, wingless insects and scorpions occured due to quantum evolution

358 **(a)**
Artificial Selection It is the man-made selection in which the selection is made on the commercial or beneficial level of mankind but in natural selection the selection is made due to the compatibility of an organism with its environment

359 **(a)**
Oxygen releasing photosynthesis organisms on the primitive earth similar to the existing blue-green algae (cyanobacteria). They used water to get hydrogen and released oxygen. Addition of oxygen to the atmosphere started oxidizing methane and ammonia, hence they began to disappear

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$

360 **(d)**
Theory of Natural selection This theory was given by Charles Darwin. This theory states that the variations which are favourable to environment inheritable are the major cause of evolution

361 **(d)**
Cro –magnon was the direct ancestor of the living modern man. It was **omnivorous** with 1680 cc cranial capacity.

362 **(b)**
In 1953, **Stanley Miller** and **Harold Urey**synthesized amino acids by passing an electric discharge in a mixture of methane (CH_4), ammonia (NH_3), hydrogen(H_2)and water v

Carbon dioxide(CO_2)was not present in the Urey-Miller experiment mixture.

363 **(d)**
Life appeared 500 million years after the formation of earth, *i.e.*, almost 4 million years from the present day

364 **(d)**
There are many evidence of evolution these evidence of evolution mainly came from
(i) Evidences from the fossil (Palaeontological studies)
(ii) Morphological study
(iii) Anatomical study
(iv) Biochemical study
(v) Phylogenetic tree

365 **(b)**
Natural selection theory of Darwin did not belive in any role of**discontinuous variations**. **Darwin** called these variations as 'sports', while **Hugo de Vries** used the term mutation to these variations. These variations are sudden heritable changes, which can occur in any stage of development.

366 **(a)**
The first living beings were chemoheterotrophs.

367 **(b)**
Recombinants are formed when two individual of different traits of the same species interbreed. Resulting progeny contains the characters from both the presents and known as hybrid or recombinant

368 **(d)**
Constant gene frequencies over several generations indicates that the evolution is not taking place. Changing gene frequencies would indicate that the evolution is in progress. In other would evolution occurs when the genetic equilibrium is upset. Evolution is the departure from Hardy-Weinberg equilibrium principle

369 **(b)**
Cenozoic era

370 **(d)**
Change of light coloured variety of the peppered moths to the darker variety is an excellent example which supports the theory of natural selection by Charles Darwin

371 **(a)**
Analogous organs are similar in function but anatomically different and unrelated, *e.g.*, the wings of bats and the wings of insects.

373 **(a)**
The possibility of the new characters is always present in the organisms. But, it is the condition of nature, which gives the chance of that character to come forward. Therefore any new character is favoured because of natural selection

374 **(d)**
Cro-magnon man (*Homo sapiens*) is the closest ancestor of modern man. The cranial capacity was highest 1650 cc. He lived in France and Spain and made painting inside cave. He was omnivore with aesthetic sense.

375 **(d)**
Coacervates were experimentally produced by **Sydney Fox**and **Oparin**. Sydney Fox called them 'microsphere' and Oparin as 'coacervates'.

376 **(b)**
Origin of Coacervates The large organic molecules, which were synthesized abiotically on the primitive earth later come together, and due to intermolecular attraction, they formed large colloidal aggregates. Such water bound aggregrates have been named microspheres by Sydney Fox. Later these colloidal bodies were named coacervates by Oparin

377 **(b)**
Sequence of main steps during evolution
(i) Free atoms
(ii) Formation of simple organic molecules
(iii) Formation of complex organic molecules
(iv) Formation of eobionts
(v) Formation of prokaryotes (various mode of nutrition)
(vi) Formation of autotropic prokaryotes
(vii) Formation of eukaryotes
(viii) Formation of animals

378 **(a)**
Natural selection is the only mechanism which consistently causes adaptive radiation. Adaptive evolution relative fitness, struggle for existence and survival for the fittest are often coined to describe the process of natural selection

379 **(b)**
Triassic period

380 **(a)**
The correct combination of labelling are-

A-Electrodes

B – $NH_3 + H_2 + H_2O + CH_4$

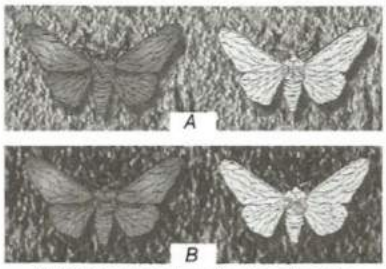
C- Cold water

D- Vacuum

E- U-trap

381 **(c)**
The book **Philosophie Zoologique**was written by **Lamarck** in 1809.

382 **(d)**
Theory of acquired character was given by Lamarck also called Lamarckism. Mutational theory of evolution was given by Hugo de Vries which states that sudden inheritable change is the cause of evolution.
Industrial melanism was highlighted by *Biston betularia*. It is an excellent example of natural selection during post industralisation period, the tree trunks become dark due to industrial smoke and sorts. Under these conditions the white winged moth did not survive due to predators (dark-winged or melanised moth). Before industrialization set in, thick growth of almost white-coloured lichen covered the trees.
In that background, the white winged moth survived but the dark-coloured moth were picked out by the predators. Hence, moths that were able to camouflage themselves, *i.e.*, hide in the background, survived. This understanding was supported by the fact that in areas, where industrialization did not occur, *e. g.*, in rural areas, the count of melanic moths was low. Remembers that no variant was completely wiped out



White moth and dark-winged moth (melanised) on a tree trunk (*A*) in unpolluted area (*B*) in polluted area

383 **(a)**

Genetic bases of adaptation was proved by Joshua Lederberg by performing the famous. Lederberg replica plating experiment

384 **(a)**
A-1300-1600 cc, and 1450 cc.
Theory of germplasm was given by Weismann. If human shared ancestry with other primates such as premian, monerys, etc. then ramnents of that common ancestry should be present in our genes

385 **(b)**
In the quaternary period there were two epochs
(i) **Holocene** It includes only moderns humans
(ii) **Pleistocene** It includes ice age and various human species

386 **(d)**
Examples of Mutational Theories
(i) **Ancon Sheep** It is a short legged variety appeared suddenly in Massachusetts in 1791
(ii) **Horn Less Cattle** They developed from the horned cattle in 1889
(iii) **Single Mutation** It can give to many varieties even in the species of plants, *e. g.*, apple cicergigas, noval orange
(iv) **Hairless Cat** double toed cat are also the examples of mutation theory of evolution because they are originated in a single step not continuously like natural selection

387 **(c)**
Divergence.
Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. Usually, it is a result of diffusion of the same species to different and isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection
Primarily diffusion is the basis of molecular division which can be seen in some higher-level characters of the structure and function that are readily observable in organisms. For example, the vertebrate limb is one example of divergent evolution. The limb in many different species has a common origin, but has diverged somewhat in overall structure and function
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position

388 **(b)**
Tadpole larva of frog is a good example of **recapitulation theory**. They repeats their ancestor embryonic stages.

389 **(d)**
All those are vestigial organs, which are now functionless but **flipper of seal** is a functional organ and helps to swim. Hence, flipper of seal is not a vestigial organ.

390 **(a)**
Atavisms
Example living whales with legs, newborn babies with tails. Anatomical atavisms are closely related conceptually to vestigial structures.
An atavism is the reappearance of a lost character specific to a remote evolutionary ancestor and not observed in the parents or recent ancestors of the organism displaying the atavistic character.
Atavisms have several essential features (i) presence in adult stages of life, (ii) absence in parents or recent ancestors and (iii) extremely rare in a population. For developmental reasons, the occasional occurrence of atavisms is expected under common descent if structures of functions are gradually lost between ancestor and descendant lineages

391 **(c)**
Natural selection is shown by the reproductive success of the members of a population best adapted to the environment.

392 **(c)**
Miller and **Urey** were the two scientists who recreated the conditions of primitive earth in laboratory and abiotically synthesized amino acids and bases. They synthesized glycine, aspartic acid and alanine in abundant quantities, while glutamic acid is not synthesized in their experiment.

393 **(b)**
A-UV rays,

B-Higher H_2,
C-Water and
D-Oceans

394 **(a)**
Evolution occurs when the genetic equilibrium gets upset or disturb. Mutation, gene flow, genetic drift, genetic recombination and natural selection are some factors which upset the genetic equilibrium and contributes significantly to evolution

395 **(d)**
The organism of different classes can acquire similar characteristics independently and separately to avail the similar environment. This is known as **parallel evolution**.

396 **(b)**
Galapagos islands consists of 14 main islands and numerous smaller islands which lies on the equator about 960 km of the west coast of south America in pacific ocean. These islands are vollcanic in origin and are called **A living laboratory of evolution**

397 **(c)**
Mendel's laws of inheritance and Weismann's theory of continuity of germplasm (1892) discarded Lamarck's concept of inheritance of acquired characters

398 **(d)**
Darwin's finches of Galapagos islands has common ancestors, later on whose beaks modified according to their feed habit. These provide evidence of biogeographical evolution.

399 **(c)**
A-Oparin, Haldane, Pre-existing
Important theories to explain the origin of life on earth are
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Dismissial of Spontaneous Generation Theory
Louis Pasteur by carefully experimentation demonstrated that, life comes only from pre-existing life. He showed that in pre-sterilised flasks life did not come from killed yeast, while in another flask open to air, new living organisms arose from 'killed yeast'. Spontaneous generation theory was dismissed once and for all. However, this did not answer how the first life came on the earth.
(iv) **Theory of Chemical Evolution** This theory is also called modern theory of evolution or neuralistic theory of evolution
Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (*e. g.*, RNA, protein, etc.) and that formation of life was preceded by chemical evolution, *i.e.*, formation of diverse organic molecules from inorganic constituents

400 **(c)**
Herbert Spencer (1820-1903) used the words 'survival of the fittest' for natural selection. According to it, in the struggle for existence, only those individuals survive, which possess the most useful variations. This has been called **natural selection** by **Darwin**.

401 **(c)**
Australopithecus – 300 – 500 cc

Java ape man -900 cc

Peking man -1075 cc

Modern man -1360 cc

402 **(b)**
Recombination is the primary source of allelic variation. The alleles of parental linkage groups separate and new association of alleles are formed in the gamete cells through recombination.

403 **(d)**
Eobionts are of two types
(i) Coacervates (ii) Microsphere.

Eobionts are also called protocell or protobionts. There are two types of eiobionts (a) coacervates and (b) microsphere

(i) **Coacervates** Lack membrane, no one claims coacervates are alive, but they do exhibit some life like characters. They able to grow and divide

(ii) **Microsphere** A microsphere is a non-living collection of organic molecule with double layered outer boundary. The term given by Sydney Fox (1958-1964)

404 **(c)**

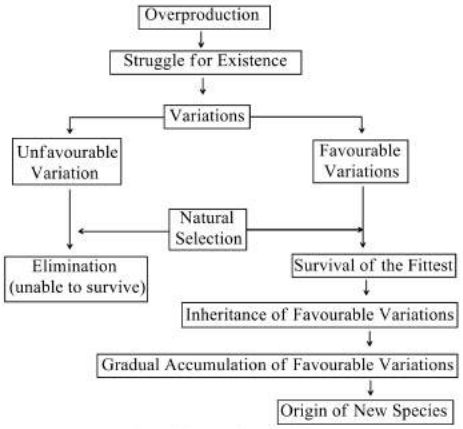
The phenomenon of sudden reappearance of some ancestral features is called **atavism**. Appearance of ancestral characters in the new born such as large canines, thick body hairs, monstral face, short temporary tails, gill slits, additional pairs of nipples, etc, are example of atavism.

405 **(b)**

According to Darwinism, population of each species tends to increase in a geometric ratio from a single pair due to reproductive prodigality in organisms.

406 **(d)**

All of the above.



Central theme of Darwinism

Darwin's theory of natural selection states that the species tend to overproduce due to limiting resources. This sets up competition or struggle for existence. Those most fit in that environment are likely to survive, passing those favourable genes on to the offspring. In time, a new species evolves from the accumulation of favourable genes. Punctuated equilibrium is a theory that was formulated after Darwin's theory and it states that the species remains relatively stable for long period of time and then, due to some natural catastrophe, change rapidly in a short period of time

Darwin's evidence for evolution: Biogeographic distributions

(i) Environment cannot account for either similarity for dissimilarity, since similar environments can harbor entirely different species groups

(ii) Affinity (similarity) of groups on the same continent (or sea) is closer than between continents (or sea)

(iii) Geographical barriers usually divide these different groups, and there is a correlation between degree of difference and rate of migration of ability to disperse across the barriers

407 **(c)**

The term **homologous** was introduced by **Richard Owen** (1834). Homologous organs are those organs, which are similar in origin and basic structure but are adapted differently to perform different functions, *e.g.*, forelimb of human and wings of bat.

408 **(a)**

Solo man (*Homo soloensis*). Its fossils were found on the banks of the Solo river in 1954. That's way it was named *Homo soloensis*

409 **(b)**

Hardy-Weinberg Principle

It was proposed by GH Hardy an English mathematician and W Weinberg a German physician independently in 1908

(i) It describes a theoretical situation in which a population is undergoing no evolutionary change. This is called genetic or Hardy-Weinberg equilibrium

(ii) It can be expressed as $p^2 + 2pq + q^2 =$ 1 or $(p + q)^2 = 1$

(iii) Evolution occurs when the genetic equilibrium is up set (evolution is a departure from Hardy-Weinberg equilibrium principle)

The sum of total of Allelic frequency $(p + q)is = 1$

$p^2 + 2pq + q^2$ or $(p + q)^2$

Where, p^2 = % homozygous dominant individuals

p = frequency of dominant allele

q^2 = % homozygous recessive individuals

q = frequency of recessive allele

$2pq$ = % heterozygous individuals

Realize that $(p + q)^2 = 1$ (three are only 2 alleles)

$p^2 + 2pq + q^2 = 1$ (these are the only genotypes)

Example An investigator has determined by the inspection that 16% of a human population has a recessive trait. Using this information, we can calculate all the genotypes and allele frequencies for the population, provided the conditions for Hardy-Weinberg equilibrium are met

Given $q^2 = 16\% = 0.16$ are homozygous recessive individuals

Therefore,

$q = \sqrt{0.16} = 0.4$ = frequency of recessive allele

$p = 1.0 - 0.4 = 0.6$ = frequency of dominant allele

$p^2 = 0.6 \times 0.6 = 0.36$ or 36% are homozygous dominant individuals

$2pq = 2 \times 0.6 \times 0.4 = 0.48 = 48\%$ are heterozygous individuals

Or $= 1.00 - 0.52$

$= 0.48$

Thus, 84% (36+48) have the dominant phenotype

410 **(d)**

I, II, III, VII, VI, V followed IV

411 **(b)**

Geographic speciation (allopatric speciation)

Geographic barrier

↓

Genetic divergence

↓

Reproductive isolation

Speciation is an evolutionary process by which new biological species arises

There are five types of speciation : allopatric, peripatric, parapatric, and sympatric and artificial

(i) **Allopatric Speciation** It occurs when a species separates into two separate groups which are isolated from one another. A physical barrier, such as a mountain range or a waterway, makes it impossible to breed with one another. Each species develops differently, based on the demands of their unique habitat or the genetic characteristics of the group that are passed on to offspring

(ii) **Peripatric Speciation** When small groups of individuals break off from the larger groups and forms new species, this is called peripatric speciation. As in allopatric speciation, physical barriers make it impossible for numbers of groups to interbreed with one another, the main difference between allopatic speciation and peripatric speciation is that in peripatric speciation, one group is much smaller than the other

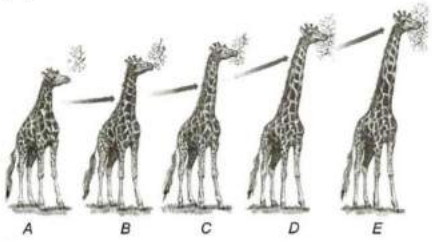
(iii) **Parapatric Speciation** A species is spread over a large geographic area. Although it is possible for any member of the species to mate with another member, individuals only mate with those in their own geographic region

(iv) **Sympatric Speciation** Some scientists don't believes that this form exists. Sympatric speciation occurs when there are no physical barriers preventing any member of a species from mating with another and all members are in close proximity to one another.

A new species, perhaps based on a different food source of characteristics, seems to develop. The theory is that some individuals becomes dependent on certain aspects of an environment-such as shelter or food sources, while others do not

(v) **Artificial Speciation** Is the creation of new species by people. This is achieved through lab experiments, where scientists mostly research insects like fruit files, and in animal husbandry. Animal husbandry is the care and breeding of livestock (animals). Many agricultural products, such as dairy, meat and wool, depends on animal husbandry

412 **(a)**



A-Ancestors of giraffe with short neck were incapable of reaching the leaves of trees

B-Neck of giraffe lengthen a little by making efforts to each the leaves

C-Offspring with longer neck were produced

D-Further, the neck of offsprings length in when the lower branches were consuming

E-Very long neck of giraffe was developed after the number of generations

Lamarck explanation for long necked giraffes The ancestors of giraffe were bearing small neck and fore limbs were like horses. But as they were living in places with no surface vegetation, they had to stretch their neck and forelimb to take

their food, which resulted in the slight elongations of these parts. Whatever they acquired in one generation was transmitted to next generation with the result that race of long necked and long forelimbed animal was developed

413 **(d)**
The cranial capacity of Java man (*Homo erectus erectus*) was 900 cc. The cranial capacity of Peking man (*Homo erectus pekinesis*) was 1075 cc. The cranial capacity of Handy man (*Homo habilis*) was 700 cc and the cranial capacity of **Modern man**(*Homo sapiens sapiens*) is **1360 cc**.

414 **(b)**
Miller and Urey took NH_3, H_2, H_2O and CH_4in his experiment.

415 **(b)**
The correct sequence of stages in evolution of modern man/*Homo sapiens*is *Australopithecus*, *Homo erectus*,Neanderthal man, Cro-magnon and **Modern man.**

416 **(c)**
In the given options, *Ramapithecus* is the most primitive ancestor of man **Edward Lewis**(1932) obtained fossil of *Ramapithecus* from Pliocene rocks of Shivalik hills of India.

*Ramapithecus*survived about 14–15 million years ago during late Miocene to Pliocene. *Ramapithecus*became extinct about 7–8 million years back.

417 **(b)**
The origin of trilobites is considered about 505-510 millions of years ago during **Cambrian** period. They became extinct in Permian period.

418 **(b)**
Biogeography is the study of the geographical distribution of life forms on earth. **Darwin** under took a voyage on the ship HMS Beagle. The ship travelled the Southern Hemisphere where life is most abundant and varied. Along the way, Darwin found different forms of life very different from those in England.

419 **(a)**
The organs which are anatomically different but perform similar functions are called analogous organs. For example insect and bird's wings are different in basic structure and origin because insect wing is formed from integument while the bird wing is a modified forelimb but functionally both are adapted to flight. The organs which have same basic structure but different functions are called homologous organs.

420 **(d)**
A-Genotype; B-Mated pair. *NCERT*

421 **(d)**
There are 64 genetic codes. Three codons are non-sense codon (terminator). These genetic codes are universal, *i.e.*, a codon specifies the same amino acid from virus to a tree or human beings. This indicates that all the organisms are descended from a common ancestor

422 **(d)**
Divergent evolution and common ancestor.
Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. Usually, it is a result of diffusion of the same species to different and isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection
Primarily diffusion is the basis of molecular division which can be seen in some higher-level characters of the structure and function that are readily observable in organisms. For example, the vertebrate limb is one example of divergent evolution. The limb in many different species has a common origin, but has diverged somewhat in overall structure and function
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position

423 **(a)**
A-Similarities, B-Differences, C-Common

424 **(c)**

Homo erectus (erect man) *includes three fossils*
(i) Java ape man
(ii) Pecking man
(iii) Heidelberg man

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

*Cucurbita*into tendrils for climbing.

426 **(b)**
Homologous organs.
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position

427 **(b)**
The **Triassic** period of **Mesozoic** era, the primitive amphibians became extinct some of the reptilian group returned to sea-life and some invaded air. Another important event which took place late in Triassic period was the first appearance of mammals, which retained egg laying habit.

428 **(b)**
According to abiogenesis or theory of spontaneous generation, life originated from non-living matter.**Francisco Redi** (1668) gave the theory of biogenesis (life comes only from pre-existing life) and first disproved the theory of abiogenesis by covering and uncovering boiled rotten meat.

429 **(c)**
Primitive man was originated during **Pleistocene** epoch.

430 **(d)**
Key factors of modern synthetic theory are
(i) Genetic variation in population
(ii) Isolation
(iii) Heredity
(iv) Natural selection
(v) Speciation (origin of new species)

431 **(d)**
Reproduction by sexual methods brings the change in progeny. In sexually genes reproduced organisms, the independent assortment of genes and genetic recombination takes place. Due to these events, the progeny have high rate of natural selection than the asexually reproduced organisms

432 **(a)**
Genera of apes are as follows
(i) **Hyalobates** (the gibbon) It is smallest and most primitive of the apes
(ii) **Simia** (the orangutan) It build nests on trees
(iii) **Pan** (the chimpanzee) Most intelligent among apes. It can make tools, etc.
(iv) **Gorilla** (the gorilla) It is the largest ape and very dangerous

433 **(d)**
In **convergent evolution**, lineages show similar morphology under the influence of similar environmental factors.

434 **(c)**
According to Natural Selection theory as a result of struggle for existance only those organisms could survive which have favourable variations to adapt environmental conditions and result in survival of the fittest.

435 **(a)**
Miller and **Urey** conducted first experiment on evolution to prove biochemical origin of life.

436 **(d)**
Convergent evolution.
Convergent evolution describes the acquisition of the same biological trait in an unrelated lineages. The wings are the classic example of convergent evolution in action. Flying insects, birds and bats have all evolved the capacity of flight independently. They have 'convergent' on this useful trait.
The ancestors of both bats and birds were terrestrial quadrupeds, and each of them had independently evolved powered flight via adaptations are superficially 'wing-shaped', they are substantially dissimilar in construction.

The bat wing is a membrane stretched across four extremely elongated fingers, while the airfoil of the bird wing is made of feathers, which are strongly attached to the forearm the ulna and the highly fused bones of the wrist and hand the carpometacarpus, with only tiny remnants of two fingers remaining, each anchoring a single feather. Both bats and birds have retained the thumb for specialized functions. So, while the wings of bats and birds are functionally convergent, they are not anatomically convergent

437 **(a)**

Darwin proposed the **theory of pangenesis** to explain the inheritance of characteristics from parents to offsprings. According to this theory every somatic cells produces gemmules and the actual germ cells are the sites of collection of gemmules coming from different somatic cells.

438 **(a)**

Biochemical Evidences The similarities is proteins and genes performing a common given function among the diverse organisms gives the clue to common ancestry. Several metabolic processes possesses the same enzyme in different organisms.

e. g., Krebs' cycle, glycolysis, nucleotide synthesis, etc.

439 **(c)**

Connecting Links Organisms are those which show characters of two different groups. They show the possible path for evolution

Some Important Connecting Links

Link	Between the Groups
Xenoturbella	Protozoa and Metazoa
Virus	Living and non-living
Trochophore larva	Annelida and Mollusca
Tornaria larva	Echinodermata and Chordata
Sphenodon (living fossil lizard)	Amphibia and Reptilia
Seymouria	Amphibian and Reptiles
Rickettsia	Virus and Bacteria
Protopterus (Lung fishes)	Bony fishes and Amphibia
Proterospongia	Protozoa and Porifera
Peripatus (walking worm)	Annelida and Arthropoda
Ornithorhynchus (duck billed platypus)	Reptiles and Mammals
Neopilina	Annelida and Mollusca
Myxomycetes	Protista and Fungi
Latimeria	Pisces and Amphibia
Hornworts	Protista and Bryophytes
Gnetum	Gymnosperms and Angiosperms
Euglena	Animals and plants
Echidna (spiny and easter)	Reptiles and mammals
Cycas	Pteridophytes and gymnosperms
Ctenophora	Coelenterates and Platyheliminthes
Club moss	Bryophytes and Pteridophytes
Chimera (rabbit fish/ratfish)	Cartilaginous and bony fishes
Balanoglossus	Chordates and non-chordates
Archaeopteryx	Reptiles and birds
Actinomycetes	Bacteria and fungi

440 **(b)**

In Hardy-Weinberg law

I. Homozygous dominant alleles $= p^2$

II. Homozygous recessive alleles $= q^2$

III. Heterozygous alleles $= 2pq$

$(p + q)^2 = p^2 + q^2 + 2pq$

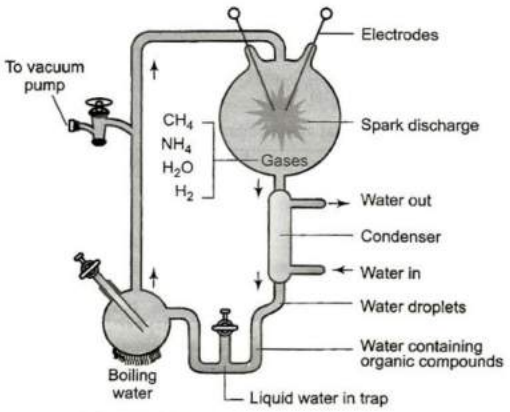
441 **(b)**

Forebrain

442 **(a)**

Experimental Evidences of Chemical Evolution

Experi ik mentally chemical theory of evolution performed by SL Miller and HC Uray in 1953. He created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800 C. He observed formation of amino acids. In similar experiments other the observed, formation of sugar, nitrogen bases, pigments and fats



Diagrammatic representation of Miller's experiment

The first non-cellular forms of life could have originated-3 billion years back. The first cellular form of life did not possibly originated till about 2 billion years ago because the conditions were non-biogenic at that time. This version of biogenesis, *i.e.*, the first form of life arose slowly through evolutionary forces from non-living molecule was accepted by majority

443 **(b)**

Binary fission and budding are the types of asexual reproduction in which the genetic material remains the same from parents to progeny.

Bottle-Neck Effect Bottle-neck effect is a sharp reduction in the size of a population due to environmental stochastic events (such as earthquakes, floods, fires, or droughts) or human activities. Such events are able to reduce the variations in the gene pool of a population drastically

444 **(d)**

Stability of the population and species over the number of generations is met under the following conditions

(i) **No Mutation** Sudden appearance of variations are called mutations. There should not be either gene or chromosomal mutation. Mutation causes changes in gene frequency

(ii) **No Gene flow** (Gene Migration) Within the gene pool of a given breeding population there is a continuous interchange of alleles between organisms. Gene flow refers to the movement of alleles from one population to another as a result of interbreeding between the members of two population. There must not be gene flow between the population

(iii) **No Genetic Drift** Genetic drift is also known as 'Sewall Wright Effect' (named after its discoverer). It is random in gene (allele) frequency. It occurs only by chance. It is non directional. Genetic drift can cause elimination of certain alleles or fixation of the other alleles in the population. Genetic drift refers to a change in the population of alleles in the gene pool. So genetic drift must not occur

(iv) **No Genetic Recombination** The alleles of the parental linkage groups separates and new associations of alleles are formed in the gamate cells, this process is known as genetic recombination. Thus, crossing over during meiosis is a major source of genetic variation within population.

Offspring formed from these gametes showing 'new' combination of the characteristics are called recombinants. There is no genetic recombination

(v) **No Natural Selection Pressure** There must be no natural selection pressure with respect to the alleles in question.

According to Hardy-Weinberg Principle, gene frequencies will remain constant if all above five conditions are met

445 **(c)**

Lamarckism is the first theory of evolution, which was proposed by **Jean Baptiste de Lamarck** (1744-1829), a French biologist. Although the outline of the theory was brought into notice in 1801, but his famous book *Philosophie Zoologique* was published in 1809, in which he discussed his theory in detail. Lamarck coined the terms **invertebrates** and **Annelida**. The term **Biology** was given by Lamarck and Treviranus (1802)

446 **(b)**

In 1831, **Charles Darwin** accepted an unpaid post of naturalist on the surveyship HMS Beagle, which spends the five years at the sea charting the east coast of South America and gave theory of natural selection. **Alfred Russell Wallace** had travelled widely in South America, Malaya and the Eastern Indian archipelago and come to the same conclusions as Darwin regarding natural selection.

In 1858, Wallace wrote an essay, outline his theory and sent it to Darwin. This stimulated and encouraged Darwin and in July 1858, Darwin and Wallace presented papers on their ideas at a meeting of the Linnean Society in London. Over a

year later, in 1859, Darwin published—'On the origin of species by means of natural selection'.

447 **(a)**
Change in gene frequency.
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448 **(d)**
Darwinfound that fossils of Galapagos islands are more or less similar to living species of **South America.**

449 **(a)**
Theory of abiogenesis or autobiogenesis or theory of spontaneous generation was supported by**Anaximander, Aristotle, Thales, Xenophanes, Plato** and **Von Helmont**, etc. As per this theory, life originated from non-living (life-less) materials automatically.

450 **(b)**
Evolution is commonly defined as any process of growth or development from one stage to another. Progressive means favouring or advocating progress, change, improvement and movement towards better conditions. Biological evolution refers more specifically to the changes in the gene pool of a population from generation to generation by the processes such as mutation, natural selection, and genetic drift

451 **(d)**
Excess use of herbicides, pesticides, etc., has only resulted in the selection of resistant varieties in a much lesser time scale. This is also true for microbes against, which we employ antibiotics or drugs. Hence, resistant organisms/cells are appearing in a time scale of month or years and not centuries. These are the examples of evolution by anthropogenic action. This also tells us that evolution is not a directed process in the sense of determinism. It is a stochastic process based on the chance events in nature and chance mutation in that organisms

452 **(c)**
It is difficult to find out any of the two individuals alike. Even the progeny of the same parents are not exactly alike in all respects. These differences are known as **variations**. Without variations changes could not occur and there will be no possibility of evolution to occur certain variations, which once appeared in the parent generation, continue to appear in the progeny generation after generation.

453 **(b)**
First seed plant appeared during **Devonian** period.

454 **(b)**
In the process of evolution smaller and simpler organic compounds gradually started combining among themselves to from complex organic compounds. The amino acids combines to form polypeptide and proteins while the purine and

pyrimidines combine to form nucleotides and ultimately nucleic acids.

455 **(d)**
Comparative cytology is the field of study involving observation of similarities in different organisms cells. Biochemistry compares DNA and proteins

456 **(d)**
Lichens are the indicator of air pollution not of water

457 **(a)**
In 1953, **Stanley Miller** synthesized organic compounds under conditions resembling the primitive atmosphere of the earth, a mixture of water vapour, methane, hydrogen and ammonia was circulated through a closed apparatus by steam from boiling water and subjected to an electric spark discharge (7000V) between tungston electrodes. This apparatus was permitted to run for a week. The result was several **amino acids**.

458 **(b)**
Rate and survival of organism is different due to variation is not a concept of Lamarckism.

459 **(d)**
Synthetic or modern theory includes
(i) gene mutation
(ii) changes in chromosomal structure and number
(iii) genetic recombination
(iv) natural selection
(v) reproductive isolation

460 **(a)**
Cenozoic era

461 **(b)**
Proconsul (*Dryopithecus*) was a fossil ape, which is believed to be ancestor of todays hominoids, apes and humans. It is more near to ape than to man.

462 **(c)**
Darwin's finches are good example of **adaptive radiation**.It is an evolutionary process starting from a point in a geographical area, giving rise to new species depending upon habitat. Main Darwin's finch was in South America, some flew to Galapagos islands and same variations got selected and gave rise to new species.

463 **(b)**
Coelacanth

464 **(d)**
Migration rather than mutation is primary responsible for genetic drift

465 **(d)**
Atavism It is the reappearance of certain ancestral characters, which had either disappeared or were reduced. Some examples of atavism in human beings are the power of moving pinna in some persons, developed canine teeth, exceptionally long dense hairs, short tail in some babies (coccyx) and presence of additional mammae in some individuals

466 **(a)**
Population tends to increase geometrically while food supply increases arithmetically. This concept was put forward by TR Malthus

467 **(a)**
Male peacocks evolve tail and feathers, a male deer evolve antlers and bird issues a warning cry even if could be noticed by predator. These all phenomenon are difficult to explain in terms of natural selection because these all characters are the disadvantages for the survival of an organism

468 **(d)**
Frequency of a particular allele is calculated as follows
$p^2 + q^2 + 2pq = 1$
$(p + q)^2 = 1$
It depends on the condition that which formular suits the particular situation

469 **(a)**
Stanley Miller in 1953, who was than a graduate student of Harold Urey (1893-1981) at the university of Chicago, demonstrated it clearly that ultra-violet radiation or electric discharges can produce complex organic compounds from mixture of CH_4, NH_3, H_2O and H_2. The ratio of methane, ammonia and hydrogen in Miller's experiment was 2 : 1 : 2

470 **(c)**
Hardy-Weinberg Principle
It was proposed by GH Hardy an English mathematician and W Weinberg a German physician independently in 1908
(i) It describes a theoretical situation in which a population is undergoing no evolutionary change. This is called genetic or Hardy-Weinberg equilibrium

(ii) It can be expressed as $p^2 + 2pq + q^2 = 1$ or $(p + q)^2 = 1$
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The sum of total of Allelic frequency $(p + q) is = 1$
$p^2 + 2pq + q^2$ or $(p + q)^2$
Where, p^2 = % homozygous dominant individuals
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Realize that $(p + q)^2 = 1$ (three are only 2 alleles)
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Example An investigator has determined by the inspection that 16% of a human population has a recessive trait. Using this information, we can calculate all the genotypes and allele frequencies for the population, provided the conditions for Hardy-Weinberg equilibrium are met
Given $q^2 = 16\% = 0.16$ are homozygous recessive individuals
Therefore,
$q = \sqrt{0.16} = 0.4$ = frequency of recessive allele
$p = 1.0 - 0.4 = 0.6$ = frequency of dominant allele
$p^2 = 0.6 \times 0.6 = 0.36$ or 36% are homozygous dominant individuals
$2pq = 2 \times 0.6 \times 0.4 = 0.48 = 48\%$ are heterozygous individuals
Or = 1.00 − 0.52
= 0.48
Thus, 84% (36+48) have the dominant phenotype

471 **(a)**
Cro-magnon (*Homo sapiens fossils*) is the direct ancestor of modern man. Its fossil remains were found in 1864 from rock shelter caves in **Southern France**. More fossils were later found from caves of North-West Italy, Poland, Czechoslovakia and France.

472 **(c)**
Proterozoic era

473 **(a)**
Darwin's evidence for evolution: Biogeographic distributions
(i) Environment cannot account for either similarity for dissimilarity, since similar environments can harbor entirely different species groups
(ii) Affinity (similarity) of groups on the same continent (or sea) is closer than between continents (or sea)
(iii) Geographical barriers usually divide these different groups, and there is a correlation between degree of difference and rate of migration of ability to disperse across the barriers

475 **(a)**
The fitness, according to Darwin, refers ultimately and only to reproductive fitness. Hence, those who are better fit in an environment, leave more progeny than other. These, therefore will survive more and, hence are selected by nature. He called it natural selectional and implied it as a mechanism of evolutions

476 **(c)**
Concept of adaptive radiation in evolution was developed by **HF Osborn** in 1902. Adaptive radiation is also called divergent evolution. Homologous organ shows the adaptive radiation

477 **(b)**
Eyes of the *Octopus* and mammals are quite similar. They also performs the same function, *i.e.*, seeing. But their embryological development are different and the organs, which have different origin and same functions are called analogous organs

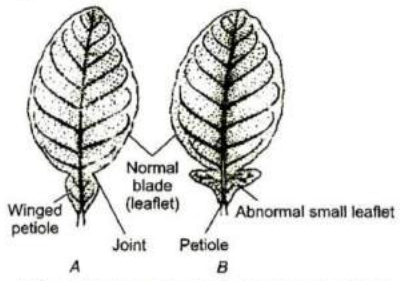
478 **(a)**
Vestigial organs are non-functionl organs in an organism, These are non-functional in related animals and were functional in the ancestors. There are 90 vestigial organs in human body and mainly include coccyx, **nictitating** membrane (3rd eyelid), caecum, vermiform appendix, canines, wisdom teeth, body hair, etc.

479 **(d)**
Australopithecus skull differs from the skull of modern man as follows
(i) On the basis of age
(ii) Basis of shape and size of skull
(iii) On the basis of length of skull

480 **(c)**
Some members of birds had large beak. As there was natural selection, the large beaked bird increased their frequency due to their advantages over other. That's why their number is more than the other small beaked bird

481 **(c)**
Primitive atmosphere of earth was reducing containing methane, ammonia, hydrogen and water vapour. There was no free oxygen.

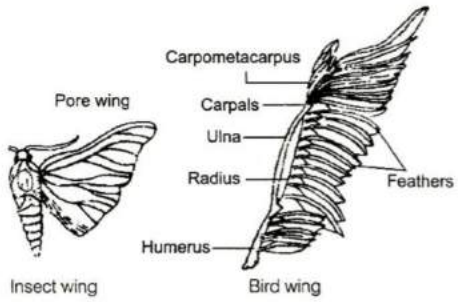
482 **(c)**
Atavism is also observed in plants. In citrus leaf the lamina is separated from the wing petiole by means of joint or constriction. Sometimes the winged part of the petiole is enlarged to produce two lateral leaf the trifolic etc. It shows that the citrus leaf was once trifoeiate compound but during evolution, the two leaf gets have degenerated



Atavism (*A*) normal citrus leaf showing joint winged petiole, (*B*) an abnormal leaf with two additional leaflets

Atavism (*A*) normal citrus leaf showing joint winged petiole, (*B*) an abnormal leaf with two additional leaflets

483 **(d)**
II, III and IV.
Homologous Organs The organs which have the same fundamental structure but are different in functions are called homologous orangs. These organs follows the same basic plan of organization during development. But in adult condition, these organs are modified to perform different function as an adaptation to the different environment. Homologous organs are the resultant of divergent evolution
Implants homologous organs may be a those of *Bougainvillea* or a tendril of *Cucurbita*, both arising in the axillary position
Analogous Organs The organs which have similar functions but are different in their details and origin are called analogous organs. The analogous organs shows convergent evolution



484 **(b)**
Pectoral fins of sharks and flippers of dolphins are analogous organs. Pectoral fins of sharks are not pentadactyle. The flippers of dolphins are pentadactyle.
Thus basic structure of pectoral fins of sharks and flippers of dolphins are different but both are useful in swimming and perform the same function

485 **(c)**
Comparative biochemistry shows that the more similar the DNA of two species is, the more closely related they are, and the more recently they get evolved separately

486 **(b)**
The variations of the natural selection are quite common. It is due to the random mutations. Except this, the natural selection is nevertheless is a directed process.
The one liklihood one variant will be favoured in a given environment over another is predictable but their origin is uncertain and unpredictable

487 **(d)**
All statements are correct.
The basic timeline of 4.6 billion year old Earth, with approximate dates
(i) 3.6 billion years of simple cells (prokaryotes)
(ii) 3.4 billion years of cyanobacteria performing photosynthesis
(iii) 2 billion years of complex cells (eukaryotes)
(iv) 1 billion years of multicellular life
(v) 600 billion years of simple animals
(vi) 570 million years of arthropods (ancestors of insects, arachnids and crustaceans)
(vii) 550 million years of complex animals
(viii) 500 million years of fish and proto-amphibians
(ix) 475 million years of land plants
(x) 400 million years of insects and seeds
(xi) 360 million years of amphibians
(xii) 300 million years of reptiles
(xiii) 200 million years of mammals

(xiv) 150 million years of birds
(xv) 130 million years of flowers
(xvi) 66 million years since, the dinosaurs died out
(xvii) 20 million years since, the appearance of the Hominoidae (great apes)
(xviii) 2.5 million years since, the appearance of the family Hominoidae (great apes)
(xix) 20 million years since, the appearance of the genus *Homo* (human predecessors)
(xx) 20,000 years since, the appearance of anatomically modern humans
(xxi) 25,000 years since, the disappearance of neanderthal traits from the fossil record
(xxii) 13,000 years since, the disappearance of *Homo floresiensis* from the fossil record

488 **(d)**
I, II, IV and V **Genetic Drift** is the random change in the allele frequency caused by sampling error across generation in a finite population. The consequences of genetic drift are not predicted that's why it is called non-directional.
Allele/gene frequency of 'A' = 0.2
For allelic frequency $A + a = 1$
So, allelic frequency of 'a' = 1 – 0.2 = 0.8

489 **(a)**
A-Evening primrose, B-Mutations, C-Minor variation, D-Directionless, E-Directional

490 **(c)**
Leaves modified as thorns (*Bougainvillea*), tendril (*Cucurbita*) are homologous structure. The homologous organs show **divergent evolution**.

Analogous organs show convergent evolution. Coevolution involves evolutionary changes in one or more species in response to changes in other species of the same community.

491 **(a)**
Australopithecus (first ape man). Raymond Dart (1924) discovered *Australopithecus africanus* from Pliocene rocks

492 **(d)**
Stabilizing selection acts in the absence of large scale environment change, therefore, it keeps a population genetically constant.

493 **(b)**
The variations that occur by chance in a small population are collectively called random genetic drift. It is of two types, *i.e.*, founder effect and bottleneck effect. Bottle necks are natural calamities like earth quake, floods, tsunamis, etc, *e.g.*, polydactylic dwarf individuals are more in old order Amish population of Lankaster in USA.

494 **(b)**
A-18,000; B-10,0000

495 **(a)**
The cranial capacity of *Homo neanderthalensis* was about 1450 cc. roughly equal to that of Modern man.

496 **(a)**
The covering membrane can be of the lipid bilayer if the mixture contains lipids and corresponding to cell membrane. **Sydney Fox** (1950) heated a dry mixture of amino acids to130° – 180°C. It formed proteins or polypeptides. The latter were cooled in water. It produced protenoid microspheres of 1 – 2μmdiameter.

497 **(c)**
Neo- Darwinism has emerged out as the **modern synthetic theory** of evolution. It was designated by **Huxley** (1942).

Neo- Darwinism is refinement of original theory of natural selection to remove objections. According to this both mutations and natural selection are responsible for evolution.

498 **(d)**
Abiogenesis (Gr. *abios*=without life; *genesis*=origin) is the process of spontaneous generation of living organisms from non-living substances. Fossils of certain prokaryotic cells have been found from the rock about **3.6 billion** years old. It is, therefore, believed that life must have appeared at least about 3.7 billion years ago.

499 **(d)**
*Australopithecus*existed in both **Pliocene** and **Miocene.**

500 **(d)**
Australopithecus is also called the first ape man
Some of its characteristics are as follows
(i) They were about 1.5 m high and had human as well as ape characters
(ii) They possessed was bipedal locomotion, omnivorous diet and had erected posture

(iii) Their brain capacity was about 500 cc similar to that of ape
(iv) They lived in caves. There was the lumber occur in their back
(v) They hunted with simple weapons like stones. They lived in East African region about 3.2 mya

501 **(b)**
Species A is the most recent species because it is located on the top. As time goes on, debris falls on the ground covering these organisms, turning them into fossils. Further we go down, older all the fossils

502 **(a)**
Mutation in sperm or egg affects the future population because egg or sperm are the germ cells and any change in germ cells leads to the change in offspring produced by them (egg or over)

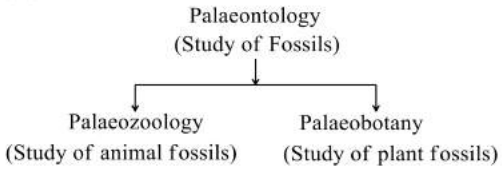
503 **(c)**
Variations are of two types, *i.e.*, hereditary variations and environmental variations.
Environmental variations are those variations, which are merely due to environment. These variations are temporary and have nothing to do with the next generation.

504 **(c)**
Convergent evolution is the phenomenon of development of similar adaptive functional structures in unrelated groups of organisms, *e.g.*, wings of birds, bat and insects.

505 **(c)**
Mutation is the sudden inheritable change in the heredity material. Mutations bring change in the genotype as well as is the phenotype of an organism

506 **(c)**
Organic evolution (biology) is the sequence of events involved in the evolutionary development of a species or taxonomic group of organisms.
Organic evolution includes the two major processes
Anagenesis, the alteration of the genetic properties of a single lineage over time and **Cladogenesis**, or branching, whereby a single lineage splits into two or more distinct lineages.
Emergent Evolution The appearance of entirely new properties at certain critical stages in the course of evolution
Macro Evolution It occurs on a large scale extending over geologic era and results in the formation of new taxonomic groups
Micro Evolution It results from small specific genetic changes that may to the formation of new sub-species
Biological Process (organic process) is a process occurring in living organisms
Speciation It is the evolution of a biological species

507 **(a)**



Palaeontological evidences (Evidences from fossil records)
Study of fossils is called Palaeontology
Leonardo de Vinci (1452-1519) an italian painter and invertor is called the Father of Palaeontology
Fossils are the remains of hard parts of life-forms found in rocks. Rocks forms sediments and a cross-section of earth's crust indicates the arrangement of sediments one over the other during the long history of earth
A variety of fossils ranging from the modern organisms to extint organisms can be observed and depicted by evolution
By studing the different sedimentary layers, the geological time period in which the organisms existed can be predicted

508 **(c)**
Living fossils are those plants and animals which have become extinct excepting one or two representatives, *e.g.*,
Sphenodon, *Ginkgo*, *Equisetum*.

509 **(c)**
The fossil of *Homo habilis* (able or skillful man, the tool maker, handy man) was discovered by **Louis S B Leakey** and his wife **Mary Leakey** from **Pleistocene** rocks of Olduvai Gorge in East Africa.

510 **(d)**
Wilson and **Sarich** choose mitochondrial DNA (*mt*DNA) for the study of maternal line inheritance, while Y-chromosomes were considered for the study of human evolution particularly male domain. It is possible because

thay are uniparental in origin and do not take part in recombination.

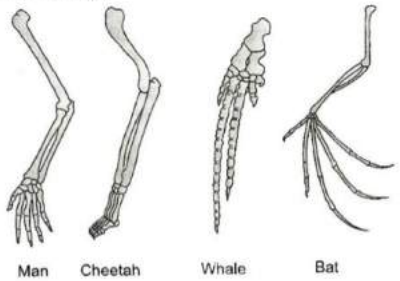
511 **(a)**
Origin of earth is about 4.5 billion (4500 million years) ago. At the initial stage, earth was just a molten mass at an excessively high temperature.

512 **(c)**
Gene flow takes place and when one population interbred with other population and gives rise to new individual. It also refers to the changes in the alleles of a population's gene pool. It upsets the HW principle

513 **(a)**
Natural selection The organisms which are provided with favourable variations would survive because they are fittest for their surroundings while, the unfit organisms are destroyed. The diversity in the finches adapted to different feeding habitat in Galapagos island indicates the natural selection of favourable variations of different habitats for finches

514 **(b)**
Increased cranial capacity is the most significant trand in the evolution of humans. Rest of the characters are more or less common in the other ancestors of humans

515 **(d)**
Vertebrates hearts, vertebrate brains and vertebrate limbs have the same basic plan of organization during development. But in adult condition they are modified. This indicate their homology



516 **(b)**
Evolution is the event of changes through which an organism is descended from ancestor through time.

517 **(a)**
According to Hardy –Weinberg law of equilibrium, the relative frequencies of various kinds of genes in a large and randomly mating, sexual panmictic population tend to remain constant from generation to generation in the absence of mutation, selection and gene flow.

518 **(d)**
Homo habilis (Able or skill full man, the tool maker or handy man) was Discovered by LSB Leakey and his wife Mary Leakey (1960) from Pleistocene Rocks of olduvai gorge in east Africa. He lived in Africa about 2 million years ago

519 **(b)**
Vestigial structures are often called vestigial organs, although many of them are not actually organs. Such vestigial structures typically are degenerated atrophied or rudimentary and tend to be much more variable than homologous non-vestigial parts. Although structures commonly regarded 'vestigial' may have lost some or all of the functional roles that they had played in ancestral organisms, such structures may retain lesser functions or may have become adapted to the new roles in an extant population

520 **(b)**
*Australopithecus*is considered as the connecting link between ape and man. It was ancestor of man, who first stood erect. Its cranial capacity was 300-500 cc.

521 **(b)**
The **theory of use and disuse of organ** was proposed by **Jean Baptiste de Lamarck** (1744-1829).

522 **(d)**
Homo Sapiens Sapiens The first skeletal remains of *Homo sapiens sapiens* were found in Europe and were named cro-magnon. In the *Homo sapiens* there is final reduction of the jaws, the appearance of the jaws, the appearance of modern man's chin and of the rounded skull. Mean cranial capacity was about 1350 cc modern man is very closely related to cro-magnon.
Homo erectus The cranial capacity of *Homo erectus* which includes Java man and peking man varied from about 775 to nearly 1300 cc. The tool tradition is associated with the *Homo erectus* way of life. The stone tools were largely made of quartz. Bone tools and wooden tools like wooden speaks have also been discovered. There is an evidence of big game hunting which indicates that

there must have been collective hunting. The *Homo erectus* seem to be cave-dwellers

523 **(c)**
Archaeopteryx (*Archlae* – primitive; *pteryx* – wing). It was found in the rocks of Jurassic period. It was discovered by Andreas Wagnar in 1861. It displays both the characters of reptiles and birds

524 **(d)**
The development of different functional structures from a common ancestral from is called **adaptive radiation** or divergent adaptations, *eg*,

1.Darwin's finches of the Galapagos islands

2.Australian marsupials

3.Limbs of mammals.

525 **(d)**
Mutation Theory of Evolution
Mutation theory was given by Hugo de Vries in 1901.
According to this theory
(i) Mutations or discontinuous variations are the raw materials of evolution
(ii) Mutations appears all of a sudden. They become operational immediately
(iii) Unlike Darwin's continuous variations or fluctuations, mutations do not revolve around the mean or normal character of the species
(iv) The same type of mutations can appear in a number of individuals of a species
(v) All mutations are inheritable
(vi) Useful mutations are selected by nature. Lethal mutations are eliminated. However, useless and less harmful ones can persist in the progeny
(vii) Accumulation of the variations produce new species. Sometimes a new species is produced from a single mutations
(ix) Evolution is a jerky and discontinuous process

526 **(d)**
A-Similarities, B-Common, C-Biological

527 **(b)**
A-Stabilisation, B-Directional changes, C-Disruptive

528 **(a)**
Malay Archipalago is an island group in southeast Asia between Australia and the Asian mainland and it separates the Indian and Pacific oceans. It includes Indonesia, the Philippines, and the Malaysia.
The Malay Archipalago is a book by the British naturalist Alfred Russel Wallace that chronicles his scientific exploration, during the eight-year period 1854 to 1862, of the southern portion of the Malay Archipelago including Malaysia, Singapore, the islands of Indonesia. Dutch East Indies, and the island of New Guinea

529 **(b)**
Oparin and Haldane proposed that the first form of life originated from pre-existing non-living organic molecules like RNA and protein and that formation of life was proceded by chemical evolution.

530 **(a)**
Radioactive carbon (C^{14}) dating method is used to study the age of fossils or dating of fossils.

531 **(a)**
Wings of insects and birds are different in basic structure and origin because insect wing is formed from integument, while the bird wing is modified forelimb but are **analogous** organs because both are flat structures and are adapted for flight.

532 **(a)**
Dinosaurs are the terrible lizards, which lived on this earth 200 million years ago long before the first man appeared on this earth. They were dominant during Jurassic period of Mesozoic era.

533 **(a)**
^{14}C used as a substrate for determining the age of fossils. The process involved is termed do carbon dating

534 **(d)**
Theory of catastrophism was given by Georges Cuvier (1769-1832). He is the father of modern Palaeontology. According to this theory, cataclysms or catastrophic evolution occurs upon earth from time to time which completely destroys all the organisms. New organisms then suddenly arises from the inorganic matter

535 **(a)**
Gene pool remain constant.
Hardy-Weinberg Principle

It was proposed by GH Hardy an English mathematician and W Weinberg a German physician independently in 1908

(i) It describes a theoretical situation in which a population is undergoing no evolutionary change. This is called genetic or Hardy-Weinberg equilibrium

(ii) It can be expressed as $p^2 + 2pq + q^2 = 1$ or $(p + q)^2 = 1$

(iii) Evolution occurs when the genetic equilibrium is up set (evolution is a departure from Hardy-Weinberg equilibrium principle)

The sum of total of Allelic frequency $(p + q) is = 1$

$p^2 + 2pq + q^2$ or $(p + q)^2$

Where, p^2 = % homozygous dominant individuals

p = frequency of dominant allele

q^2 = % homozygous recessive individuals

q = frequency of recessive allele

$2pq$ = % heterozygous individuals

Realize that $(p + q)^2 = 1$ (three are only 2 alleles)

$p^2 + 2pq + q^2 = 1$ (these are the only genotypes)

Example An investigator has determined by the inspection that 16% of a human population has a recessive trait. Using this information, we can calculate all the genotypes and allele frequencies for the population, provided the conditions for Hardy-Weinberg equilibrium are met

Given $q^2 = 16\% = 0.16$ are homozygous recessive individuals

Therefore,

$q = \sqrt{0.16} = 0.4$ = frequency of recessive allele

$p = 1.0 - 0.4 = 0.6$ = frequency of dominant allele

$p^2 = 0.6 \times 0.6 = 0.36$ or 36% are homozygous dominant individuals

$2pq = 2 \times 0.6 \times 0.4 = 0.48 = 48\%$ are heterozygous individuals

Or $= 1.00 - 0.52$

$= 0.48$

Thus, 84% (36+48) have the dominant phenotype

536 **(c)**

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

537 **(a)**

The mutational theory believes in the natural selection or survival of the fittest. But in contrast to the natural selection of Darwinism, mutational theory believes that the evolution is a jerkey process

538 **(d)**

Variations in progeny takes place only when there is a change in their genetic material. Mutation, recombination by gametogenesis, gene flow or genetic drift, these all are the ways to bring the change in the genetic material of progeny

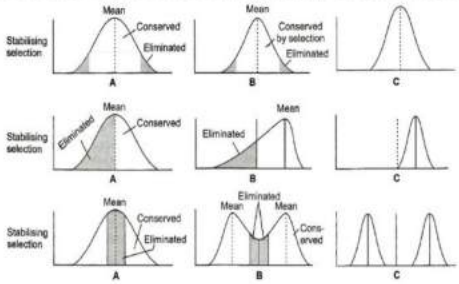
539 **(a)**

Organs that have developed from the same embryonic cell and thus have similar internal organization are called homologous **organs.** These organs may or may not have similar functions, *e.g.*, whale's flipper, forelimb of horse, human hand.

540 **(b)**

Directional selection.

Selection process in natural selection are



(i) **Stabilizing Selection** (Balancing selections) This type of selection favours average sized individuals, while eliminates small sized individuals. It reduces variation and hence, do not promote evolutionary changes. It maintains the mean value from generation to generation. If we draw a graphical curve of population, it is bell-shaped

(ii) **Directional Selection** (Progressive Selection) In this selection, the population changes towards one particular direction. It means this type of selection favours small or large-sized individuals and more individuals of that type will be present in new generation. The mean size of the population changes

(iii) **Disruptive Selection** (Diversifying selection) This type of selection favours both small-sized and large-sized individuals. It eliminates most of the members with mean expression, so as to produce two peaks in the distribution of the trait that may lead to the development of two different

populations. This kind of selection is opposite of stabilizing selection and is rare nature but is very important in bringing about evolutionary changes

541 **(b)**

Darwin proposed the **theory of natural selection**. According to which, the organisms that are provided with favourable variations would survive because thay are fittest to face their surroundings, while the organisms, which are unfit for surrounding variations would likely to become extinct & destroyed.

542 **(b)**

According to Hardy-Weinberg law, at equilibrium, genetic and allelic frequencies remain constant from one generation to next generation. It can be mathematically expressed as

For allelic frequency

$A+a=1$

For genetic frequency

$A^2 + a^2 + 2Aa = 1$

So, allelic frequency of $A=0.7$

So, allelic frequency of $a=1-0.7=0.3$

Therefore, the genetic frequency of Aa is

$$=2(Aa)$$

$$= 2(0.7 \times 0.3)$$

$$= 2 \times 0.21 = 0.42$$

So, frequency of $Aa=0.42$.

543 **(a)**

Sewall Green Wright was an American geneticist known for his influential work on evolutionary theory. The theory of random genetic drift was proposed by him. Genetic drift or allelic drift is the change in the frequency of a gene variant (allele) in a population due to random sampling. The effect of genetic drift is larger in small populations, and smaller in large populations.

544 **(d)**

The **analogous organs** have almost similar appearance and perform the same function but these are totally different in their basic structure, development and origin.

545 **(c)**

Homo erectus includes three fossils

(i) **Java Ape Man** Body 1.65 to 1.75 m tall, weight 70 kg cranial capacity 800 to 1000 cc

(ii) **Peking Man** About 1.55 to 1.60 m tall. Peking man was slightly shorter and weaker. They have the cranial capacity which range from 850 to 1100 cc

(iii) **Heidelberg Man** He used the tool and fire. Cranial capacity is believed to be about 1300 cc. It is regarded as intermediate between *Pithecanthropines* and neandertales

546 **(a)**

Inheritance of acquired characters comes under Lamarckism because it is postualated by **Lamarck**.

547 **(b)**

Mutation brings the change in gene frequency hence, it fluctuates the allelic frequency of Hardy-Weinberg principle

548 **(a)**

Analogous organs are different in origin and basic structure but have similar functions, *eg*, the human eye and the eye of *Octopus*.

549 **(c)**

Analogous organs (Convergent evolution).

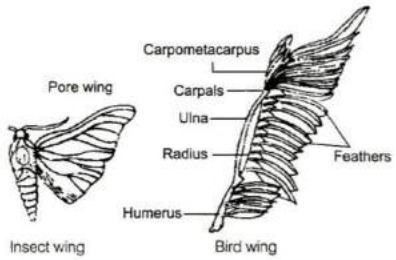
Convergent evolution describes the acquisition of the same biological trait in an unrelated lineages. The wings are the classic example of convergent evolution in action. Flying insects, birds and bats have all evolved the capacity of flight independently. They have 'convergent' on this useful trait.

The ancestors of both bats and birds were terrestrial quadrupeds, and each of them had independently evolved powered flight via adaptations are superficially 'wing-shaped', they are substantially dissimilar in construction.

The bat wing is a membrane stretched across four extremely elongated fingers, while the airfoil of the bird wing is made of feathers, which are strongly attached to the forearm the ulna and the highly fused bones of the wrist and hand the carpometacarpus, with only tiny remnants of two fingers remaining, each anchoring a single feather. Both bats and birds have retained the thumb for specialized functions. So, while the wings of bats

and birds are functionally convergent, they are not anatomically convergent
Analogous organs.

Analogous Organs The organs which have similar functions but are different in their details and origin are called analogous organs. The analogous organs shows convergent evolution



550 **(c)**
A-Exponentially; B-Limited

551 **(d)**
Variation was the one of the main postulates of Darwinism. Darwin recognised two types of variations—continuous and discontinuous variations, but he could not explain the inheritance of variations.