Biofuel Production:

Biofuels are reliable fuels for the future, produced by conversion of biomass through contemporary biological processes. They are renewable sources of energy which provide a cost-effective way to meet transportation fuel needs.
Written as per the latest syllabus prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune.

STD. X

Science and Technology

Part - 2

Salient Features

- Written as per the new textbook.
- Exhaustive coverage of entire syllabus.
- Memory maps provided for revision at a glance.
- Chapter-wise assessment with every chapter for knowledge testing.
- Model Question Paper in accordance with the latest paper pattern.
- Activity / project explanation videos included wherever required.

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PREFACE

While designing the book, our main intention was to create a book that would act as a single point of reference for students. We wanted this book to provide students, the much needed answers for their textual questions as well as build up their knowledge quotient in the process.

Science and Technology: Std. X Part - 2 has been prepared as per the new syllabus and paper pattern which is more child-centric and focuses on active learning along-with making the process of education more enjoyable and interesting.

We have infused the book with a liberal sprinkling of suitable examples and additional questions wherever required. A series of ‘Intext Questions’ along with questions titled under ‘Use your brain power’, ‘Can you tell’ and various similar titles pave the way for a robust concept building.

Every chapter begins with covering all the textual content in the format of Objectives, Question Answers, Give Reasons, Diagram-based questions, Paragraph based questions and a host of other Objective and Subjective type of questions. To enhance audio-visual learning, videos explaining activities / projects are included wherever required.

Wherever possible questions are allotted with marks in accordance with new marking scheme. The question without marks can be modified as per the new marking scheme and asked in examination. Memory maps have been included in each chapter to provide a quick revision of the important topics of that chapter. The chapter eventually ends with a Chapter wise Assessment that stands as a testimony to the fact that the child has understood the chapter thoroughly.

Model question paper, designed as per the latest paper pattern, is a unique tool to enable self-assessment for the students.

With absolute trust in our work, we hope, our holistic efforts towards making this book an ideal knowledge hub for students pays off.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we’ve nearly missed something or want to applaud us for our triumphs, we’d love to hear from you.

Please write to us at: mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

From,
Publisher
Edition : First

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There will be separate question papers for Part 1 and Part 2 of 40 marks each.

Duration of each paper will be 2 hours.

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[Reference: महाराष्ट्र राज्य राष्ट्रीय पत्रिका निर्मिती व अभ्यासक्रम संशोधन मंडळ, पुणे निर्मित मूल्यमापन आराख्या]

[P.S. Scan this Q.R. Code to get a better understanding of the New Syllabus as well as Paper Pattern.]
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*Note: Textual exercise questions are represented by * mark.*
1. Complete the following statements.

i. Francois Jacob and Jacques Monod proposed a model for the process of _______ synthesis.

ii. Information about protein synthesis is stored in the_______.

iii. mRNA is formed in the nucleus and transferred to the cytoplasm for translation.

iv. _______ was awarded the Nobel Prize in 1968, for his contribution in the discovery of the triplet codons for 20 amino acids.

v. tRNA has anticodon with complementary sequence to the codon on mRNA.

vi. Coccyx in man is an example of vestigial organ.

vii. Carbon dating method is based upon the radioactive decay of naturally occurring C-14.

viii. Fossils of invertebrates indicate they originated in the Paleozoic era.

ix. Based on his observations of plants and animals, Darwin suggested that only the fittest organisms survive.

x. Lamarck proposed that activities of an organism are responsible for their evolution.

*2. Complete the statements by choosing the correct options from bracket.

i. The causality behind the sudden changes was understood due to _______ principle of Hugo de Vries.

ii. The proof for the fact that protein synthesis occurs through _______ was given by George Beadle and Edward Tatum.

iii. Transfer of information from molecule of DNA to mRNA is called as _______ process.

iv. Evolution means _______.

v. Vestigial organ _______ present in human body is proof of evolution.

Answers:

i. The causality behind the sudden changes was understood due to mutation principle of Hugo de Vries.

ii. The proof for the fact that protein synthesis occurs through gene was given by George Beadle and Edward Tatum.

iii. Transfer of information from molecule of DNA to mRNA is called as transcription process.

iv. Evolution means gradual development.

v. Vestigial organ appendix present in human body is proof of evolution.
3. Fill in the blanks by selecting the correct word from the bracket and complete the given paragraph. [3 Marks]
(two, Ramapithecus, modern sciences, seven, Neanderthal man, lemurs, agriculture, orangutans)
The last dinosaurs disappeared approximately ________ crore years ago. Monkey-like animals are said to have evolved from some ancestors who were similar to modern ________. The first human-like animals with erect posture evolved about ________ crore years ago. The first record of this human-like ape is ________ from East Africa. ________ can be considered as the first member of the class – wise-man. About 10 thousand years ago, wise-man started to practice ________.

Answer:
The last dinosaurs disappeared approximately seven crore years ago. Monkey-like animals are said to have evolved from some ancestors who were similar to modern lemurs. The first human-like animals with erect posture evolved about two crore years ago. The first record of this human-like ape is Ramapithecus from East Africa. Neanderthal man can be considered as the first member of the class – wise-man. About 10 thousand years ago, wise-man started to practice agriculture.


Choose the correct alternative [1 Mark each]

1. Which of the following nitrogenous base is NOT present in DNA?
   (A) Thymine (B) Uracil (C) Adenine (D) Guanine
2. Adenine can pair with which of the following nitrogenous bases?
   (A) Cytosine (B) Uracil (C) Thymine (D) Both (B) and (C)
3. RNA does not contain
   (A) deoxyribose (B) phosphate (C) adenine (D) uracil
4. Which of the following types of RNA carries information from genes to the ribosome?
   (A) mRNA (B) tRNA (C) rRNA (D) All of the above
5. The origin of the universe is explained by
   (A) Darwin’s theory (B) Big-bang theory (C) Speciation (D) Lamarckism
6. Which of the following is/are unicellular organism(s)?
   (A) Amoeba (B) Chlorella (C) Paramoecium (D) All of the above
7. The appendix is useful in ruminants for digestion of which of the following compounds?
   (A) Fats (B) Cellulose (C) Proteins (D) Glycogen
8. Which of the following is the connecting link between annelida and arthropoda?
   (A) Peripatus (B) Lungfish (C) Duck-billed platypus (D) Petromyzon
9. Connecting links suggest that amphibians have evolved from
   (A) mammals (B) reptiles (C) fishes (D) aves
10. Theory of inheritance of acquired characters is also known as
    (A) Lamarckism (B) natural selection (C) speciation (D) translocation
11. Modern man differs from Australopithecus in which of the following aspects?
    (A) Presence of tail (B) Use of hands for eating food (C) Increased brain size (D) All of the above

Answers:
1. (B) 2. (D) 3. (A)
4. (A) 5. (B) 6. (D)
7. (B) 8. (A) 9. (C)
10. (A) 11. (C)

Name the following [1 Mark each]

1. The transfer of biological characters from one generation to another via genes.
2. Pioneer of modern genetics.
3. Sudden changes that occur in genes.
4. Genetic disorder that is caused by mutation.
5. First living material formed in ocean.

Answers:
1. Heredity
2. Gregor Johann Mendel
3. Mutations
4. Sickle cell anemia, etc.
5. Protoplasm
6. Origin of species
Chapter 1: Heredity and Evolution

**Right or Wrong. If wrong, write the correct sentence**

1. Appendix is a fully functional organ in ruminants.
2. The age of fossils is determined by carbon dating technique.
3. Reptiles and amphibians have evolved from mammals.
4. Darwin’s theory of natural selection explained evolution with respect to useful and useless modifications.
5. According to Lamarck, the characters which are acquired by the organism during the lifetime are passed on to the next generation.
6. Geographical isolation leads to speciation.

**Answers:**
1. Right.
2. Right.
3. Wrong. Mammals have evolved from reptiles and amphibians evolved from fishes.
5. Right.
6. Right.

**Odd one out**

2. Aves, Reptiles, Amphibians, Pisces.

**Answers:**
1. Intestine
   Intestine is a fully functional organ in humans, whereas coccyx, wisdom teeth and appendix are vestigial organs.
2. Aves
   Aves belong to the Cenozoic era, whereas, reptiles, amphibians and pisces belong to the Paleozoic era.
3. Aegytopithecus walked using four limbs whereas, Cro-Magnon man, Australopithecus and Neanderthal man had erect posture.

**Match the following**

1. **Column I**
   - Walter and Sutton
   - Avery, McCarty and MacLeod
   - Cro-Magnon man
   - Lungfish

   **Column II**
   - Proved that except viruses all living organisms have DNA as genetic material
   - Proposed the central dogma
   - Observed paired chromosomes in cells of grasshopper
   - Discovered triplet codon

   **Column I**
   - Fossils
   - Flipper of whale and forelimb of bat

   **Column II**
   - Paleontological evidence
   - Morphological evidence
   - Anatomical evidence

   **Column I**
   - Cenozoic era
   - Mesozoic era

   **Column II**
   - Amphibians
   - Aves
   - Reptiles
   - Pisces

   **Column I**
   - Connecting link between pisces and amphibians
   - Connecting link between reptiles and mammals

   **Column II**
   - Lungfish
   - Duck-billed platypus
   - Peripatus
   - Snail

   **Answers:**
   1. (i – c), (ii – a)
   2. (i – a), (ii – c)
   3. (i – b), (ii – c)
   4. (i – a), (ii – b)

**Answer the following**

*1. Define heredity. Explain the mechanism of hereditary changes.

**Ans:**
   i. Heredity is defined as the transfer of biological characters from one generation to another via genes.
   ii. The mechanism of hereditary changes is as follows:
      a. Diversity or hereditary changes occur due to genetic variation.
      b. In sexually reproducing organism, fusion of gametes from male and female parents occurs, the offspring always has
recombined genes of both the parents. These offsprings thus show some characters of either of the parents.

   c. Also, sometimes sudden changes known as mutations occur in the genes. A change in the position of even a single nucleotide, can cause either a minor effect or a considerable alteration in the characters of an individual.

   d. If these changes (mutation) occur in DNA of germ line cells then, these changes would be inherited to the next generation.

2. How are the hereditary changes responsible for evolution? [5 Marks]

   Ans: i. Evolution is the gradual change occurring in living organisms over a long duration.

   ii. Certain heritable sudden changes may occur in the genes of an individual resulting in genetic variations.

   iii. These genetic variations are responsible for the formation of new species from the earlier ones.

   iv. According to Darwin’s theory, organisms with favourable or beneficial variations survive in competition and are selected by nature whereas the others with non-favourable variations are eliminated.

   v. This leads to formation of new species due to specific changes in specific characters accumulated through several generations in sustained and selected organisms.

3. What is mutation? [1 Mark]

   Ans: Mutation is any sudden change that occurs in nucleotide sequence of a gene, causing either a minor or considerable change in the characters of an individual.

4. How are genes carried? [1 Mark]

   Ans: Genes are carried via chromosomes.

5. Enlist the uses of the science of heredity. [2 Marks]

   Ans: The uses of the science of heredity are as follows:

   i. Diagnosis of diseases.

   ii. Treatment and prevention of heredity disorders.

   iii. Production of hybrid varieties of animals and plants.

   iv. Industrial processes in which microbes are used.

6. How do genes control the structure and functioning of the body? [1 Mark]

   Ans: Genes carry genetic information that is responsible for the development of the body structure and functioning of various organ systems of the body.

7. What is the central dogma? [1 Mark]

   Ans: Central dogma is the process of synthesis of proteins by DNA, through RNA.

8. Write a note on ‘transcription’. [2 Marks]

   Ans: i. Transcription is the process of synthesis of mRNA from DNA. It takes place in the presence of RNA polymerase.

   ii. During transcription, mRNA is produced as per the sequence of nucleotides present on the DNA.

   iii. This mRNA sequence is always complementary to the DNA strand that is used for its synthesis.

   iv. The thymine in DNA molecule is replaced by uracil in RNA, during the process of transcription.

9. What is the triplet codon? [1 Mark]

   Ans: Three nucleotides which code for each amino acid is known as triplet codon.

10. Explain the process of formation of complex proteins. [3 Marks]

   Ans: Translation is the process of synthesis of proteins after transcription of DNA to RNA. The formation of complex proteins occurs in the following manner:

   i. mRNA formed in the nucleus during transcription moves in the cytoplasm, carrying the coded message by DNA.

   ii. Each mRNA contains codes for amino acids in the form of triplet codons.

   iii. As per the message on mRNA, amino acids are supplied by tRNA, which has an anticodon (complementary sequence) to the codon on mRNA.

   iv. The amino acids supplied by tRNA are bound together by peptide bonds with the help of rRNA.

   v. The process continues as the ribosome moves along the entire length of the mRNA by a distance of one triplet codon, also known as translocation.

   vi. Many chains of amino acids (peptides) come together to form complex proteins.
11. **What is translocation?** [1 Mark]

Ans: Translocation is the movement of ribosome from one end of the mRNA to the other end by the distance of one triplet codon during translation.

*12. Write a short note on evolution. [2 Marks]*

Ans:

i. Evolution is defined as the gradual change occurring in living organisms over a long duration.

ii. It is a slow-going process through which development of organisms is achieved.

iii. Evolution is thus the formation of new species due to changes in specific characters of living organisms.

iv. Changes in these specific characters get accumulated over several generations of living organisms in response to natural selection.

13. **Explain the process of formation of complex compounds.** [5 Marks]

Ans:

i. Around 3.5 billion years ago, it is speculated that life was non-existent on earth.

ii. In the beginning, only simple elements may have been present in the oceans.

iii. Simple organic and inorganic compounds may have been formed by these simple elements.

iv. These simple compounds may have eventually resulted in the formation of complex compounds like proteins and nucleic acids.

v. The process of formation of complex compounds may have occurred over a long period of several years.

*14. Explain with suitable examples importance of anatomical evidences in evolution.*

Ans:

i. Anatomical evidences are the similarities in the structures of bones and bony joints of animals that provide proof of evolution.

ii. The hand of human, foreleg of ox, flipper of whale and forelimbs of bat appear different superficially or morphologically.

iii. Also, the function of these structures is different in different animals.

iv. However, there is a similarity in the structure of bones and bony joints in the organs of these animals.

v. These similarities indicate that the animals evolved from a common ancestor.

*15. Define vestigial organs. Write names of some vestigial organs in human body and write the names of those animals in whom same organs are functional.*

Ans:

i. Vestigial organs are degenerated or underdeveloped useless organs of organisms.

ii. Some vestigial organs in humans that are functional in other animals are as follows:

   a. Appendix: It is fully functional in ruminants for digestion of cellulose.

   b. Muscle of the ear pinna: It is useful in monkeys and other animals like rabbits, cows, horses, etc. for movement of ear pinna.

   c. Tail-bone (coccyx): It is useful in other mammals for balance.

   d. Body hairs: They are useful in other mammals for insulation against the cold.

   e. Nictitating membrane (third eyelid): It is useful in animals like frog, pigeon, etc., for the purpose of protection of eye.

   f. Wisdom tooth: They are present in mammals with large jaws for chewing raw food.

*16. Define fossil. Explain importance of fossils as proof of evolution.*

Ans:

i. Fossils are remnants and impressions of organisms that remain preserved underground.

ii. Carbon consumption of animals and plants stops after death and only the decaying processes of C-14 takes place continuously.

iii. The ratio of C-14 to C-12 changes constantly as C-12 is non-radioactive in dead plants and animals with time.

iv. The time passed since the death of a plant or animal can be calculated by carbon dating i.e. by measuring the radioactivity of C-14 and ratio of C-14 to C-12 present in the remains of the dead organism.

v. Thus, study of fossils is an important aspect of evolution since, it can be used in paleontology and anthropology for determining the age of fossils and deducing information about their ancestors.

*17. Write a short note on connecting link.* [2 Marks]

Ans:

i. Connecting links are some plants or animals that show morphological characters by which they can be related to two different groups of organisms.
ii. *Peripatus* is the connecting link between two different groups *annelida* and *arthropoda*. It shows annelid-like characters such as segmented body, thin cuticle and parapodia-like organs. It also shows arthropod-like characters such as tracheal respiration and open circulatory system.

iii. The duck-billed platypus is a connecting link between mammals and reptiles. It shows similarity with mammals due to the presence of mammary glands and hairs. It lays eggs like reptiles.

iv. Lungfishes are connecting links between fishes and amphibians. The lungfish performs respiration with lungs even though it is a fish.

18. **Write a short note on embryology.** *(2 Marks)*

**Ans:**

i. Embryology is a branch of biology that deals with the study of different stages of development of embryo.

ii. As the developing embryo grows, in the first few weeks, there is increase in complexity from differentiation of the cells into specialized tissues to form specific organs.

iii. Embryology enables us to comparatively study the developmental stages of various animals.

iv. Embryos of different vertebrates appear similar during the initial stages and these similarities decrease gradually as the embryo develops.

19. **Embryological evidences provide proof of evolution. Explain.** *(3 Marks)*

**Ans:**

i. Embryological evidences arise from comparative study of embryological developmental stages of various vertebrates.

ii. Embryos of different vertebrates appear similar during the initial stages of development and these similarities gradually decrease as the embryo develops.

iii. Embryology can be used as evidence of evolution as similarities in initial stages of development indicate common origin of the animals.

20. **Explain the theory of evolution and mention the proof supporting it.**

**Ans:**

i. According to the theory of evolution, the first living material (protoplasm) was formed in the ocean.

ii. Unicellular organisms formed in the course of time.

iii. Larger and more complex organisms were formed due to the slow and gradual changes that occurred in unicellular organisms.

iv. Through evolution, plants and animals progressively developed from their ancestors that had different structural and functional organization.

v. The proof supporting the theory of evolution are as follows:

a. **Morphological evidence:** It is based on the similarity of size, shape or structure of organs among a group of organisms proving that they evolved from the same ancestor.

b. **Anatomical evidence:** It is based on the similarities in the structure of bones and bony joints in the organs of animals.

c. **Vestigial organs:** It is based on the theory that some useless organs are degenerated or underdeveloped due to non-functionality through several years.

d. **Paleontological evidence:** It is based on the study of remnants and impressions of organisms that remain preserved underground as fossils.

* Connecting links: It is related to some plants or animals that show morphological characters by which they can be related to two different groups of organisms.

f. **Embryological evidence:** It arises from comparative study of embryological developmental stages of various vertebrates.

21. **Write a short note on Darwin’s theory of natural selection.** *(2 Marks)*

**Ans:**

i. Darwin’s theory of natural selection is based on the concept of survival of the fittest.

ii. The organisms can reproduce prolifically.

iii. Under limited resources, organisms compete with each other in a life-threatening manner for their survival.

iv. According to this theory, only those organisms survive which show modifications for winning the competition. This gives rise to new species with their specific set of characters.

22. **Enlist the objections raised against Darwin’s theory of natural selection?**

**Ans:** Some of the main objections raised against Darwin’s theory of natural selection are as follows:

i. Natural selection is not the only factor responsible for evolution.

ii. In his theory, Darwin did not explain the inheritance useful and useless modifications.

iii. No explanation regarding slow and abrupt changes was provided in this theory.
23. Write a short note on Lamarckism.

Answer:

i. Lamarckism is the theory of inheritance of acquired characters from one generation to another, given by Jean-Baptiste Lamarck.

ii. It states that the morphological changes occurring in living organisms are responsible for evolution.

iii. Morphological changes may occur gradually, either due to specific activities or laziness of a particular organism.

iv. For e.g. Browsing on leaves of tall plants caused the neck of the giraffe to become long; frequent hammering movements caused the shoulders of ironsmith to become strong; inactivity caused weakening of the wings of birds like emu; legs of swans and ducks have become useful for swimming due to living in water; due to burrowing habits, snakes have lost their legs; etc.

24. Why was Lamarck’s theory disproved?

[1 Mark]

Answer: Lamarck’s theory of inheritance of acquired traits was disproved because, modifications brought about in an individual are not always transferred to the next generation.

25. What is meant by ancestry of acquired characters?

[1 Mark]

Answer: The ability of living organisms to transfer the characters which they have acquired, to the next generation is called ancestry of acquired characters.

26. What is speciation?

[1 Mark]

Answer: Speciation is the formation of new species of plants and animals as an effect of evolution.

27. Write evolutionary history of modern man.

Answer: Human evolution began approximately 7 crore years ago.

The sequence of evolutionary history of modern man is as follows:

i. The last dinosaurs existed 7 crore years ago.

ii. Monkey-like animals are said to be evolved from ancestors that were similar to modern lemurs around the same time.

iii. Ape-like animals (Aegyptopithecus) evolved around 4 crore years ago, by the disappearance of tail, enlargement of brain and improvement in the functioning of hands.

iv. In Africa, these ape-like animals evolved into gorillas and chimpanzees around 2.5 crore years ago (Dryopithecus).

v. Human-like animals who used their hands for eating and other work evolved around 2 crore years ago.

vi. These animals lived on land, as the forests declined due to dry environments.

vii. Their lumbar bones developed enabling them to stand in an erect posture in grasslands, thus leaving their hands free for use.

viii. The first record of this human-like ape in East Africa, was Ramapithecus (around 1 crore years ago).

ix. Around 40 lakh years ago, these apes grew larger in size and became more intelligent (Australopithecus).

x. Around 20 lakh years ago human-like animals shared morphological similarities with the members of genus Homo, and thus skilled human developed.

xi. Around 15 lakh years ago human walking with an erect posture evolved and may have existed in China, Indonesia and the Asian subcontinent.

xii. Neanderthal man evolved around 15 lakh years ago.

xiii. For around 1 lakh years from then, man evolved by developing his brain (improving their cranial capacity) and also discovered fire during this period.

xiv. The brain of 50,000 year old man evolved in such a way that it could be considered as member of class–wise man (Homo sapiens).

xv. Cro-Magnon man evolved around 50,000 years ago after which evolution became more faster.

xvi. 10,000 years ago present day modern started practising agriculture, rearing cattle and establishing cities. Also, cultural development took place around this time period.


Give reasons [2 Marks each]

1. Morphological evidences suggest that dog, sheep and wolf have a common origin.

Answer: The animals like dog, sheep and wolf resemble each other in various morphological features.
ii. They possess similarities in structure of mouth, position of eyes, structure of nostrils and ear pinnae and thickly distributed hairs on body. Hence, morphological evidences provide proof that dog, sheep and wolf share a common origin.

2. Forelimb of bat and flipper of whale have different functions but indicate common ancestry.
Ans: i. Forelimb of bat and flipper of whale appear different superficially and also have different functions.
ii. They however, are similar in structure of bones and bony joints in organs and hence indicate a common ancestry.

3. The vestigial organ appendix is still existent in human beings.
Ans: i. Sudden development of new tissues or organs is not possible for the purpose of living in changing environment.
ii. The existing organs of an organism undergo gradual changes and may become useless or harmful under certain conditions.
iii. Such structures begin to degenerate, as per the principle of natural selection.
iv. These organs take thousands of years to disappear. Hence they may appear in different phases of disappearance in different animals.

Hence, even though appendix is a vestigial organ, it is still existent in human beings.

4. Read the following statements and justify same in your own words with the help of suitable examples.
   i. Study of fossils is an important aspect of study of evolution.
   Ans: Refer Answer the following: Q.16.

   ii. There are evidences of fetal science among chordates.
   Ans: Evidence of fetal science deals with the study of embryology as a proof of evolution.
   Refer Answer the following: Q.19.

   iii. Geographical and reproductive isolation of organisms gradually leads to speciation.
   Ans: a. Speciation is the formation of new species of plants and animals as an effect of evolution.
b. Each species grows in specific geographical conditions and hence have a specific habitat, type of food, reproductive ability and period.
c. Geographical isolation occurs when a population is separated into two or more groups by geographical barriers such as rivers, etc., thus exposing the organisms to different geographical conditions, leading to speciation.
d. Reproductive isolation is brought about by genetic variation of organisms, which gradually results in speciation.

   Therefore, geographical and reproductive isolation of organisms gradually leads to speciation.

   iv. Human evolution began approximately 7 crore years ago.
   Ans: a. The last dinosaurs appeared approximately 7 crore years ago, during which monkey-like animals were said to have evolved from ancestors similar to modern lemurs.
b. The tails of these monkey-like animals in Africa were speculated to have disappeared around 4 crore years ago, along with enlargement of brain and that improved hands, that resulted in evolution of ape-like animals.
c. Gorillas and chimpanzees evolved 2.5 crore years ago, from which apes that used their hands for eating food and other work evolved around 2 crore years ago.
d. The lumbar bones of these apes developed in such a way that they started to stand in an erect posture and their hands became free for use, giving rise to the first human-like animals.

Thus, it is justified that human evolution began approximately 7 crore years ago.


Distinguish between [2 Marks]

1. Lamarckism and Natural selection

<table>
<thead>
<tr>
<th>Lamarckism</th>
<th>Natural selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. All acquired characters are transferred to the next generation.</td>
<td>Only useful modifications/variations are transferred to next generation.</td>
</tr>
<tr>
<td>ii. It is not based on survival of the fittest.</td>
<td>It is based on survival of the fittest.</td>
</tr>
<tr>
<td>iii. It occurs due to morphological changes.</td>
<td>It occurs due to modifications.</td>
</tr>
<tr>
<td>iv. It occurs due to continued activity or laziness of an organism.</td>
<td>It occurs due to life-threatening competition.</td>
</tr>
</tbody>
</table>
1. **Complete the following diagram.**

   **Evidences of Evolution**
   - Morphological
   - Vestigial organs
   - Paleontological
   - Similarities in bones structure

   **Questions based on diagram**
   1. Observe the diagram and answer the questions given below it. **[3 Marks]**

   i. **Identify the cellular process depicted in the diagram.**
   
   **Ans:** The cellular process depicted in the diagram is transcription.

   ii. **Which enzyme is required for this process?**
   
   **Ans:** The enzyme required for this process is RNA polymerase.

   iii. **In which part of the cell does this process occur?**
   
   **Ans:** This process occurs in the nucleus of a cell.

2. **Observe the given diagram and answer the questions given below it.** **[3 Marks]**

   i. **Identify the molecule labelled as ‘X’ in the given diagram.**
   
   **Ans:** The molecule labelled as ‘X’ is tRNA.

   ii. **What would be the sequence on the anticodon, if the corresponding codon sequence on the mRNA is GAU?**
   
   **Ans:** The sequence on the anticodon would be CUA.

   iii. **During the process of translation, the amino acids are bound by which bond?**
   
   **Ans:** During translation, the amino acids are bound by peptide bonds.

3. **Observe the following diagrams and explain the anatomical evidences with the help of the given diagram.** **[3 Marks]**

   **Refer Answer the following:** Q.14.

   **Human hand, Foreleg of Ox, Forelimb of Bat, Flipper of Whale**

   **Ans:** The given diagrams depict anatomical similarities between human hand, foreleg of ox, forelimb of bat and flipper of whale.
4. Carefully observe the given diagram and answer the following questions. [3 Marks]

- Identify the part labelled as ‘X’.
  Ans: The part labelled as ‘X’ is appendix.

- What type of organ is shown in the given diagram?
  Ans: The type of organ shown in the given diagram is a vestigial organ.

- Mention any other two examples of such organs in humans.
  Ans: Other examples of vestigial organs in humans are wisdom tooth, coccyx, body hairs, muscle of ear pinna, etc. [Any two examples]

5. Explain the given diagram.

Ans: i. The given diagram represents the structure of ground level and fossils i.e., the remnants and impressions of organisms that remain preserved underground.

   ii. Fossils of invertebrates, pisces, amphibians and some reptiles are found in the lowermost levels of ground indicating that they evolved around the paleozoic era.

   iii. Fossils of reptiles were also found in the middle layers of the ground indicating that these fossils date back to the mesozoic era.

   iv. The top-most layer on the ground has fossils of aves and mammals indicating that they evolved in the cenozoic era.

   v. The presence of fossils of animals in different layers of soil indicate that progressive development took place in animals.

6. Observe the following pictures and identify the organisms. Explain how each of them provides proof of evolution.

(i) (ii) (iii)

Ans: i. The first picture is that of a duck-billed platypus. It lays eggs like reptiles and has hairs and mammary glands like mammals and thus, it is the connecting link between reptiles and mammals.

   ii. The second picture is that of lungfish. Though it is a fish, it breathes air through its lungs. It is the connecting link between amphibians and fishes.

   iii. The third picture is that of Peripatus. It is considered as the connecting link between phylum Annelida and phylum Arthropoda. Peripatus has segmented body, thin cuticle and parapodia-like appendages like annelids and shows tracheal respiration and open circulatory system like arthropods.

Questions based on paragraph [5 Marks]

1. Information about protein synthesis is stored in the DNA. Proteins are synthesized by DNA through RNA. This is also known as the central dogma of life. The nucleotide sequences of the mRNA produced are complementary to the DNA strand that is used as the template for synthesis. This process of synthesis of RNA from DNA is known as ‘transcription’. The code for each amino acid consists of three nucleotides (triplet codon) that are present on the mRNA. The tRNA has an anticodon sequence complementary to the codon on the mRNA. During translation, the code on mRNA is read and respective amino acids brought by tRNA are joined together by peptide bonds.
Based on the given paragraph, answer the following questions:

i. If 3'-AACGT-5' is a sequence on the template DNA strand, what would be the nucleotide sequence on the corresponding mRNA synthesized from it?

ii. What is the difference in nitrogenous bases of DNA and RNA?

iii. Which enzyme would be required for the synthesis of RNA from DNA during transcription?

iv. How many amino acids can the following mRNA sequence code for?

   5'-UUCAGCCGUGCACAUU-3'

v. What is the function of mRNA in translation?

   Ans: i. The corresponding mRNA synthesized from the given template DNA strand would be 5'-UUGCA-3'.

   ii. In DNA, thymine is present whereas in RNA, uracil is present instead of thymine.

   iii. RNA polymerase is required for the synthesis of RNA from DNA during transcription.

   iv. The code for each amino acid consists of three nucleotides (triplet codon). The given mRNA sequence can code for five amino acids as it is made up of five triplet codons.

   v. mRNA carries information for protein synthesis from DNA (present in the nucleus) to ribosome (present in the cell cytoplasm).

Apply your Knowledge

1. Can you recall? (Textbook page no. 1)

   i. Which component of the cellular nucleus of living organisms carries hereditary characters?

      Ans: The DNA carries the hereditary characters.

   ii. What do we call the process of transfer of physical and mental characters from parents to the progeny?

      Ans: The process of transfer of physical and mental characters from parents to the progeny is called heredity.

   iii. Which are the components of the DNA molecule?

      Ans: The components of the DNA molecule are deoxyribose sugar, nitrogenous bases and phosphoric acid.

2. Can you tell? (Textbook page no. 1)

   i. Sketch and explain the structure of DNA and various types of RNA.

      Ans: a. Structure of DNA

      1. In 1953, Watson and Crick proposed a model of the DNA molecule.

      DNA (Watson and Crick’s Model)

b. RNA

1. Structure of RNA:

   - The nucleotide is the smallest unit of the chain of the RNA molecule.
• RNA nucleotide is made up of a ribose sugar, phosphate molecule and any one of the four types of nitrogenous bases adenine, guanine, cytosine and uracil.
• Large number of nucleotides are bonded together to form the macromolecule of RNA.

2. Depending upon the function, RNA are classified into three types:

Types of RNA
• Ribosomal RNA (rRNA): It is the component of cellular organelle, ribosome. Ribosomes perform the function of protein synthesis.
• Messenger RNA (mRNA): It carries the information for protein synthesis from genes (i.e. DNA segment in the nucleus of cell) to the ribosome (in cytoplasm of cell).
• Transfer RNA (tRNA): It carries amino acid up to the ribosome according to the message on the mRNA.

[Note: Students are expected to refer the accompanying QR code for better understanding.]

ii. Explain the meaning of genetic disorders and give names of some disorders.
Ans: a. Diseases or disorders occurring due to abnormalities in chromosomes and mutations in genes are called genetic disorders.
   b. Cleft lip, albinism, sickle cell anaemia, haemophilia, Down’s syndrome, Turner’s syndrome and Klinefelter’s syndrome are some examples of genetic disorders.

3. Can you recall? (Textbook page no. 3)
   i. What is the function of the appendix of our digestive system?
   Ans: The appendix present in our digestive system is a vestigial organ. It does not perform any function in human beings. However, in ruminating animals it is used for digestion of cellulose.

   ii. Are our wisdom teeth really useful for chewing the food?
   Ans: No, we do not use our wisdom teeth for chewing the food, because it is a vestigial structure in human body.

   iii. Why did the huge animals like dinosaur become extinct?
   Ans: Huge animals like dinosaurs became extinct due to geological events like collision of comets or asteroids with earth, volcanic eruptions, etc.

   iv. Why are many species of animals and birds getting extinct?
   Ans: Many species of plants and animals are getting extinct due to following reasons:
   a. Over exploitation of resources
   b. Loss of habitat due to deforestation
   c. Lack of food
   d. Pollution
   e. Poaching / Hunting
   f. Climate change
   g. Human activities like construction of expressways, dams, etc.

4. Internet is my friend. (Textbook page no. 3)
Collect the information from internet about Big-bang theory related with formation of stars and planets and present it in your class.
Ans: i. It is presumed that, about 15,000 million years ago, the universe came into existence with a single titanic explosion called as ‘Big Bang’.
   ii. Due to this, all the matter and tremendous energy came into existence.
   iii. The fragments of the fire ball expanded and cooled to give rise to many celestial bodies.
   iv. The majority of atoms produced by the Big Bang were hydrogen, along with helium and traces of lithium. Giant clouds of these primordial elements later merged through gravity, till they became denser and hotter. In due course of time this resulted in formation of stars and planets.

5. Try this. (Textbook page no. 4)
Observe the images given on page no. 4 of your textbook and note the similarities between given animal images and plant images.
Ans: i. Various similarities in the morphological structures can be observed in the images of the given animals and plants respectively.
ii. The animals have similarity in structure of mouth, position of eyes, structure of nostrils and ear pinnae, presence of thickly distributed hairs all over their body, etc.

iii. The plants show similarities in leaf shape, leaf venation, seeds enclosed in fruits, etc.

6. Can you tell? (Textbook page no. 4)

i. Which are the different organs in body of organisms?
Ans: a. Different types of organs present in the body of animals are heart, kidneys, liver, pancreas, mouth, stomach, etc.

b. Similarly, different types of organs present in plants are root, stem, leaves, flower, fruit, etc.

ii. Is each of the organs useful to organism?
Ans: Yes, majority of the organs present in plants and animals are fully functional and useful. However, certain organs present in these organisms do not perform any function and are known as vestigial organs.

7. Use of ICT. (Textbook page no. 4)

Collect the information of geological dating and present it in the classroom.
Ans: i. Geological dating is the chemical analysis of a geological specimen in order to estimate its age.

ii. In this method, the amount of radioactive decay (half-life of radioactive isotope) is measured in order to determine the age of materials like fossils, etc., in which traces of these radioactive impurities were selectively incorporated when they were formed.

[Students are expected to collect more information on geological dating.]

8. Observe and discuss. (Textbook page no. 5)

Observe the pictures given on page no. 5 of your textbook.
Ans: i. The given pictures are of fossils of reptiles and fish.

ii. Fossils are the dead remains of plants and animals which existed in the past.

iii. Sometimes impression of animals and plants are formed on mud which gets converted into fossils at a later stage.

iv. At other times, plants and animals get covered in layers of sediment, bury deep by increasing layers of soil and the tissues and muscles gets decayed, while the hard part (bones) remains in the soil in the form of fossils.

9. Use of ICT. (Textbook page no. 5)

Find how the vestigial organs in certain animals are functional in others. Present the information in your class and send it to others.
Ans: i. Vestigial organs in humans:

a. Nictitating membrane (Third eyelid): In animals like frog, pigeon, etc. It is used for the protection of eye. However, it is vestigial in man due to change in habitat and physiology of eye.

b. Caecum and vermiform appendix: In herbivores, it is used to digest cellulose. However, it is vestigial in man because, cellulose of plant food is simplified during the process of cooking, thus there is no need to digest cellulose.

c. Auricular muscles (Muscles of ear pinna): These are functional in animals like rabbit, cow, horse, elephant, etc. Animals use these muscles to move their pinna in the direction of source of sound. However in man, it is vestigial and thus immovable.

ii. Vestigial organs in other animals:

Wings in ostrich and kiwi: Ostrich and kiwi are flightless birds hence their wings are vestigial.

iii. Vestigial organs in plants:

Scale like leaves of Indian pipe plant have lost its chlorophyll and become heterotrophic. Thus, such leaves which were otherwise used to prepare food in plants by photosynthesis, have become vestigial.

10. Observe and discuss. (Textbook page no. 6)

Observe the pictures given on page no. 6 of your textbook and discuss the characters observed.
Ans: Refer Questions based on diagram: Q 6.

11. Observe and discuss. (Textbook page no. 7)

Carefully observe the stages of embryonic development of some animals shown in fig. 1.10 (Textbook page no. 7).

Ans: i. The given pictures indicate that the embryos of fish, salamander, tortoise, chicken, pig, cow, rabbit and man in their early stages of development showed extreme similarities, though these similarities decrease gradually during the later stages of development.

ii. This indicates a common ancestry or origin of the animals.
12. Internet is my friend. *(Textbook page no. 8)*
Collect the pictures and information of various species of monkeys from internet.
[Students are expected to collect pictures and information of various species of monkeys on their own by using internet.]

*13. Project:
  i. Make a presentation on human evolution using various computer softwares and arrange a group discussion over it in the classroom.
  [Students are expected perform this activity on their own.]
  
ii. Read the book – ‘Pruthvivar Manus Uparach’ written by Late. Dr. Sureshchandra Nadkarni and note your opinion on evolution.
  [Students are expected perform this activity on their own.]

---

**Central Dogma:**

DNA \(\rightarrow\) RNA \(\rightarrow\) Proteins

**Process of protein synthesis:**

DNA \(\rightarrow\) mRNA \(\rightarrow\) Chains of amino acids (Peptides) \(\rightarrow\) Complex proteins

**Evolution:**

3.5 billion years ago life non-existent on earth

Simple elements present in the oceans

Simple organic and inorganic compounds formed from simple elements

Complex compounds like proteins and nucleic acids formed

First primitive type of cells (unicellular) formed

Reaction with surrounding chemicals

Increase in number of cells

Natural selection

Good growing cells were selected

Slow and gradual changes

Larger and complex organisms formed

Progressive development of plants and animals
Chapter 1: Heredity and Evolution

Evidence of Evolution

- **Morphological evidence**: Similarity in morphological characters like mouth structure, position of eyes, etc.

- **Anatomical evidence**: Similarity in bone structure and bony joints in organs

- **Vestigial organs**: Degenerated/underdeveloped useless organs e.g. Appendix, coccyx, wisdom tooth, etc.

- **Paleontological evidence**: Age of fossils estimated by carbon-dating technique

  - **Connecting links**
    - Annelids
    - Peripatus
    - Arthropods
    - Fishes
    - Lungfish
    - Amphibians
    - Reptiles
    - Duck-billed Platypus
    - Mammals

- **Embryological evidence**: Similarity in embryonic developmental stages of development

---

**Darwin’s theory of natural selection:**

1. Organisms reproduce prolifically
2. Life-threatening competition
3. Modifications (Survival of the fittest)
4. Beneficial modifications selected
5. Organism survives competition
6. Reproduce
   - Accumulation of characters over generations
7. New species formed
8. Non-beneficial modifications eliminated
9. Organisms perish

Lamarckism / Theory of inheritance of acquired characters:

Organisms

Specific Activities

- (Morphological change)
  Development of organs

Laziness/No use of organ

- (Morphological change)
  Degeneration of organs

Acquired characters transferred to next generation

Theories of evolution

Natural selection
(Charles Robert Darwin)

- Survival of the fittest

Lamarckism
(Jean-Baptiste Lamarck)

- Inheritance of acquired characters

Speciation

- Reproductive isolation
- Geographical isolation

Caused due to

Human evolution:

<table>
<thead>
<tr>
<th>Period</th>
<th>Event</th>
<th>Evolution of Man</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 crore years ago</td>
<td>Last dinosaurs disappeared. Monkey-like animals (similar to modern lemurs) evolved.</td>
<td></td>
</tr>
<tr>
<td>4 crore years ago</td>
<td>Ape-like animals evolved by disappearance of tail, enlargement of brain, improved hand function.</td>
<td>Aegyptopithecus</td>
</tr>
<tr>
<td>2.5 crore years ago</td>
<td>In South and North East Asia, ape like animals evolved into gibbon and orangutan.</td>
<td>Dryopithecus</td>
</tr>
<tr>
<td>2 crore years ago</td>
<td>In Africa, ape-like animals evolved into gorillas and chimpanzees.</td>
<td>Ramapithecus</td>
</tr>
<tr>
<td>40 lakh years ago</td>
<td>Ape grew in size, became more intelligent.</td>
<td>Australopithecus</td>
</tr>
<tr>
<td>20 lakh years ago</td>
<td>Morphology similar to genus ‘Homo’.</td>
<td>Skilled human</td>
</tr>
<tr>
<td>15 lakh years ago</td>
<td>Human walking with erect posture was evolved. It may have existed in China, Indonesia and Asian subcontinent.</td>
<td>Neanderthal man</td>
</tr>
<tr>
<td>For 1 lakh years thereafter</td>
<td>Evolution in developing brain. Discovery of fire.</td>
<td></td>
</tr>
<tr>
<td>50,000 years ago</td>
<td>Brains evolved. Class-wise man. <em>Homo sapiens</em></td>
<td>Cro-magnon man</td>
</tr>
<tr>
<td>10,000 years ago</td>
<td>Wise man practiced agriculture, cattle-rearing and established cities. Cultural development took place.</td>
<td>Wise man</td>
</tr>
<tr>
<td>5,000 years ago</td>
<td>Art of writing invented</td>
<td></td>
</tr>
<tr>
<td>400 years ago</td>
<td>Modern sciences emerged</td>
<td></td>
</tr>
<tr>
<td>200 years ago</td>
<td>Industrial society established</td>
<td></td>
</tr>
</tbody>
</table>
Q.1. (A) **Answer the following.**

i. Complete the analogy.
Similarity in structure of mouth : Morphological evidence :: Similarity in structure of bones :

ii. State right or wrong. If wrong, write the correct sentence.
Strengthening of the shoulders of an ironsmith due to repeated hammering movements is an example of natural selection.

iii. Find the odd man out.
Lamarckism, Translation, Natural selection, Speciation

iv. Match the columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Transcription</td>
<td>1. Process of protein synthesis from mRNA</td>
</tr>
<tr>
<td>b. Translocation</td>
<td>2. Movement of mRNA from nucleus to the cytoplasm</td>
</tr>
<tr>
<td></td>
<td>3. Movement of ribosome on the mRNA by a distance of one codon</td>
</tr>
<tr>
<td></td>
<td>4. Process of RNA synthesis from DNA</td>
</tr>
</tbody>
</table>

v. Name the following.
Method used to determine the age of human fossils and manuscripts.

(B) **Choose the correct alternative.**

i. Which among the following is the most primitive ancestor of man?
   (A) Dryopithecus  (B) Aegyptopithecus  (C) Australopithecus  (D) Cro-magnon man

ii. Which of the following fossil man had cranial capacity nearly equal to that of modern man?
   (A) Neanderthal man  (B) Australopithecus  (C) Ramapithecus  (D) Dryopithecus

iii. Monkey-like animals are characterized
   (A) as members of genus Homo  (B) by large brain-size  (C) by erect posture  (D) by presence of tail

Q.2. **Answer the following (any three):**

i. Write a note on the evolution of Ramapithecus from monkey-like animals.

ii. Define speciation. Give examples of any two factors causing speciation.

iii. Give four examples of vestigial organs in humans.

iv. Give reasons why *Peripatus* is considered the connecting link between annelids and arthropods.

Q.3. **Answer the following (any two):**

i. Explain Lamarck’s theory of evolution with examples.

ii. Observe the given diagram and explain the cellular process depicted in it.

iii. Explain any three evidences of evolution in detail.
Q.4. Answer the following (any one):
   i. Explain in detail how fossils provide evidence of evolution.
   ii. Explain in detail the process of formation of complex compounds on earth.

**Answers:**

Q.1. (A)
   i. Anatomical evidence
      Similarity in structure of mouth provides morphological evidence of evolution, whereas, similarity in structure of bones provides anatomical evidence of evolution.
   ii. Wrong
      Strengthening of the shoulders of an iron smith due to repeated hammering movements is an example of Lamarckism.
   iii. Translation
      Lamarckism, natural selection and speciation are the theories of evolution, whereas, translation is the process of protein synthesis from mRNA.
   iv. (a – 4), (b – 3)
   v. Carbon dating

(B)
   i. (B) ii. (A) iii. (D)

Q.2.
   i. a. Monkey-like animals evolved from ancestors that were similar to modern lemurs around 7 crore years ago.
   b. Ape-like animals (Aegyptopithecus) evolved around 4 crore years ago, by the disappearance of tail, enlargement of brain and improvement in the functioning of hands.
   c. In Africa, these ape-like animals evolved into gorilla and chimpanzees, around 2.5 crore years ago (Dryopithecus).
   d. Human-like animals evolved around 2 crore years ago, who used their hands for eating and other work. Their lumbar bones developed enabling them to stand in erect posture in grasslands and the first record of these human-like apes in East Africa, was Ramapithecus (around 1 crore years ago).
   ii. Speciation is the process of formation of new species of plants and animals as an effect of evolution. Two factors that result in speciation are geographical isolation and reproductive isolation.
   iii. The examples of vestigial organs in humans are coccyx, appendix, wisdom tooth and muscle of ear pinna.
   iv. *Peripatus* is considered as the connecting link between annelids and arthropods because:
      a. It shares similar characters to both annelids and arthropods.
      b. It has annelid features like segmented body, thin cuticle and parapodia-like organs as well as of tracheal respiration and open circulatory system like arthropods.

Q.3.
   i. Refer Answer the following: Q. 23
   ii. Refer Answer the following: Q. 10
   iii. Refer Answer the following: Q. 20 (v - Any three points)

Q.4.
   i. Refer Answer the following: Q. 16
   ii. Refer Answer the following: Q. 13
**Available Subjects:**
- English Kumarbharati
- हिंदी लोकभारती
- हिंदी लोकवाणी
- मराठी अक्षरभारती
- आमोद: (सम्पूर्ण संस्कृतम्)
- आनन्द: (संयुक्त संस्कृतम्)
- Mathematics - I
- Mathematics - II
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