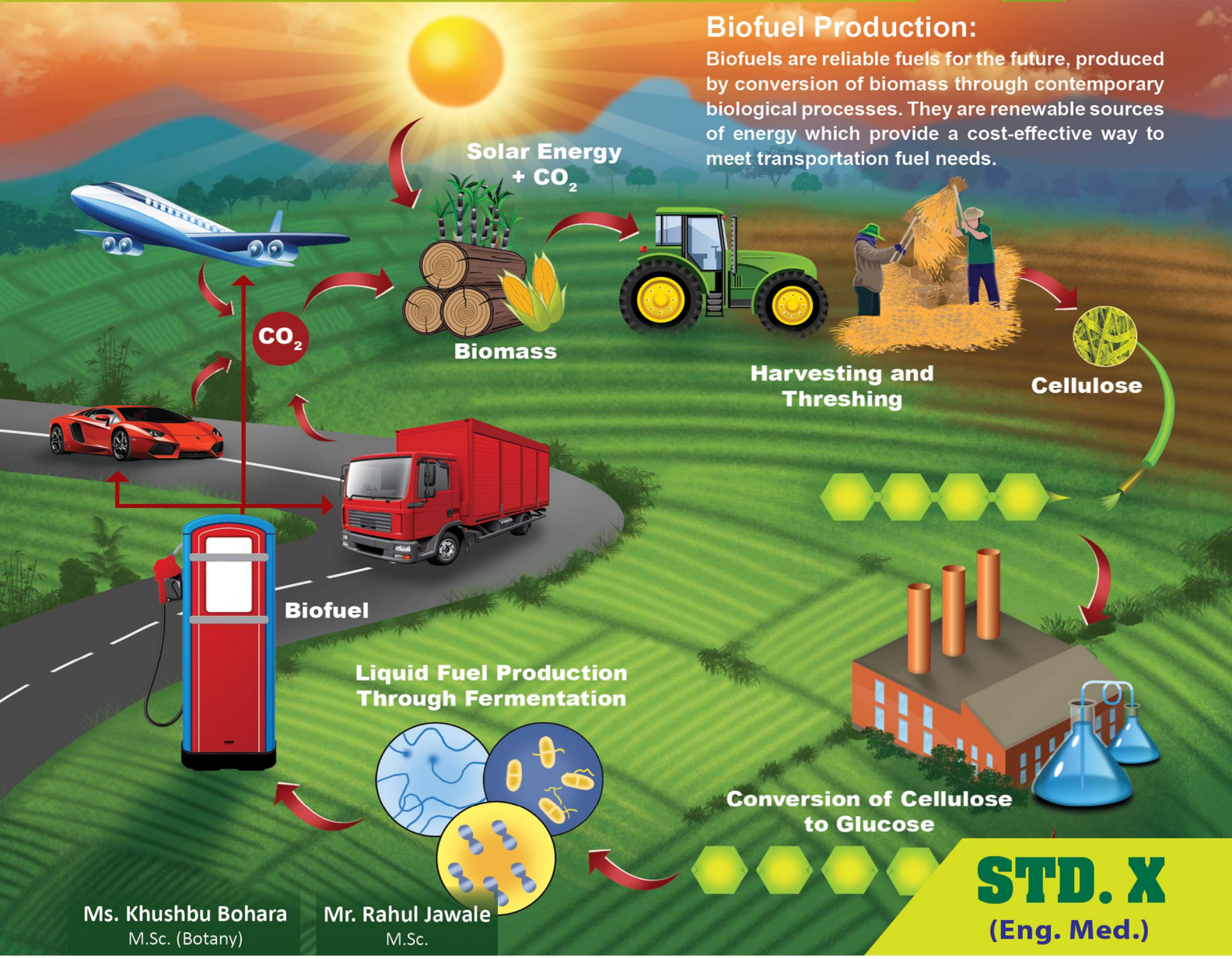
SAMPLE CONTENT

PERFECT

SCIENCE AND TECHNOLOGY (PART - 2)

BASED ON TEXTBOOK AND BOARD PAPER PATTERN



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STD. X
(Eng. Med.)

With your Buddy GG

Target Publications® Pvt. Ltd.

Based on the **Latest Board Paper Pattern** prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04

PERFECT
Science and Technology (Part – 2)

STD. X

Salient Features

- Written as per Latest Board Paper Pattern.
- Exhaustive coverage of entire syllabus.
- Memory maps provided for revision at a glance.
- 'Reading between the lines' provided for concept elaboration.
- Chapter-wise assessment with every chapter for knowledge testing.
- Model Activity Sheet in accordance with the Latest Board Paper Pattern.
- Includes solved questions from Board Activity Sheets of March and July 2019, March and December 2020, March 2022
- Activity demonstration/concept explanation videos included wherever required.

This book comprises of **QR Codes** at strategic touch points. You can simply scan this Code through your Smartphone camera and get a plethora of subject knowledge at your disposal. The QR Codes included herein would take you to videos that shall provide you a better understanding of 'Activities', 'Experiments', 'Projects' and 'Try This' section of the book. We hope students would maximize the use of this book with the aid of these videos.

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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.

'Perfect Notes Science & Technology Part – 2, Std. X' has been prepared as per the Latest Board Paper Pattern.

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 aid the students in their exam preparation. For the students to grasp a better understanding of the concept lying behind the answer, 'Reading between the lines' (not a part of the answer) has been provided wherever necessary. Questions that entail students to apply higher order thinking skills are marked *[HOTS]*. To enhance audio-visual learning, videos showing demonstration of activities / concept explanation are included wherever required. To keep students updated, solved questions from Board Activity Sheets of March 2019, July 2019, March 2020, December 2020 and March 2022 are included.

Wherever possible, questions are allotted with marks in accordance with the new marking scheme. Questions can be modified as per the new marking scheme and asked in the 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 Activity Sheet, designed as per the latest paper pattern, is a unique tool to enable self-assessment for the students.

We have provided **QR Code** for students to access the 'Solution' given for the Model Activity sheet'.

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.

- Publisher

Edition: Fifth

GG - Gyan Guru

We present to you our very own mascot-'GG'. GG is a student-buddy who pops up throughout the book and draws your attention to important bits of knowledge also termed as 'Gyan Guru'. This 'Gyan Guru' section helps you understand a concept distinctly with a corresponding example, which you can relate to easily. This is our initiative that helps to link learning with life, thereby educating the students much more practically. We're hopeful that you will love this initiative.

KEY FEATURES

Reading between The lines

'Reading between the lines' (not a part of the answer) helps students to grasp a better understanding of the concept lying behind the answer.

Latest Board Questions

Includes questions from Board Activity Sheets of March 2020, December 2020 and March 2022.

New Question Types

Optimum coverage of new type of questions i.e., diagram based questions, paragraph based questions.

Memory Maps

Memory Maps summarize the key points in the chapter and provide chapter overview succinctly.

QR Codes

QR code provides:

i. Access to a video/PDF in order to boost understanding of a concept or activity
ii. 'Solution' of Model Activity Sheet
iii. Solutions to Chapter assessment of each chapter

Gyan Guru

Gyan Guru section helps to understand a concept distinctly with corresponding example, which you can relate to easily.

Weightage of Marks

Wherever possible, questions are allotted with marks in accordance with new marking scheme.

Apply your Knowledge

The section 'Apply your Knowledge' covers different types of questions like "can you recall", "Internet my friend", etc. for better concept-building.

Chapter Assessment

Chapter Assessment helps students to evaluate understanding of the chapter.

Activity Sheets

Model Activity Sheet is provided for the students to know about the types of questions that are asked in the Board Examinations.

PAPER PATTERN

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

Question No.	Type of Questions	Total Marks
1.	(A) 5 Questions of 1 mark each (MCQs)	05
	(B) 5 Questions of 1 mark each (Objectives)	05
2.	(A) 3 Questions of 2 marks each (Solve any 2)	04
	(B) 5 Questions of 2 marks each (Solve any 3)	06
3.	8 Questions of 3 marks each (Solve any 5)	15
4.	2 Questions of 5 marks each (solve any 1)	05

Distribution of marks according to question type and aims

Sr. No.	Question type	Marks	Marks with option	% Marks
1.	Objective	10	10	25
2.	Very short answer	10	16	25
3.	Short answer	15	24	37.5
4.	Long answer	5	10	12.5
	Total	**40**	**60**	**100**

Sr. No.	Aims	Marks	Marks with option	% Marks
1.	Knowledge	10	10	25
2.	Understanding	10	15	25
3.	Application	16	24	40
4.	Skill	4	6	10
	Total	**40**	**60**	**100**

[Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04]

CONTENTS

*Note: Textual exercise questions are represented by * mark.*

Modified textual questions are represented by ♣ mark.

Exam Pointers

Students are expected to write the answers in their Examination as illustrated below.

Multiple Choice Questions: Write only the correct option while answering the MCQ.

1. Which of the following nitrogenous base is NOT present in DNA?

(A) Thymine (B) Uracil

(C) Adenine (D) Guanine

Ans: (B)

Find out the correlation – Determine the correlation between two components and re-write it.

2. *Herdmania* : Urochordata :: *Amphioxus* : _____

Ans: *Herdmania* : Urochordata :: *Amphioxus* : Cephalochordata

Reading between the lines

The explanation provided under 'Reading between the lines' is not expected to be a part of the answer. Its sole purpose is to provide a sound understanding of the concept behind the answer.

1. What will happen if number of consumers in environment goes on increasing gradually?

Ans: i. If the number of consumers in the environment goes on increasing gradually, there would be a decline in the number of the prey they feed on.

ii. A decline in the number of prey, would eventually result in a decline in the number of consumers due to scarcity of food.

Hence, increase in the number of consumers in the environment would cause an imbalance in the ecosystem.

Answer

Reading between the lines

Considering there is a gradual increase in the number of herbivores;

- *The number of producers will be comparatively less to fulfill the food requirements of large number of primary consumers (herbivores).*
- *As a result, many of the primary consumers (herbivores) will die due to the lack of availability of food.*
- *Eventually, secondary consumers (carnivores) depending upon these primary consumers will also die due to lack of food, thereby disrupting the entire food chain.*

Not a part of the answer

Practicing model papers is the best way to self-assess your preparation for the exam Scan the adjacent QR Code to know more about our **"SSC 54 Question Papers & Activity Sheets With Solutions."**

Going through the entire book in the last minute seems to be a daunting task?
Go for our **"Important Question Bank (IQB)"** books for quickly revising important questions
Scan the adjacent QR Code to know more.

Once you solve 1000+ MCQs in a subject, you are going to become a pro in it.
Go for our **"Science and Technology MCQs (Part - 1 & 2)"** & become a pro in the subject.
Scan the adjacent QR code to know more.

Scan the adjacent QR Code to know more about our **"Board Questions with Solutions"** book for Std. X and Learn about the types of questions that are asked in the X Board Examination.

1 Heredity and Evolution

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. Transfer of information from molecule of DNA to mRNA is called as _____ process. **[Mar 2020]**
   (A) transcription (B) translation
   (C) translocation (D) mutation

5. 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
6. The origin of the universe is explained by
   (A) Darwin's theory (B) Big-bang theory
   (C) Speciation (D) Lamarckism
7. Which of the following is/are unicellular organism(s)?
   (A) *Amoeba* (B) *Chlorella*
   (C) *Paramoecium* (D) All of the above

♣8. Vestigial organ _____ present in human body is proof of evolution.
   (A) intestine (B) appendix
   (C) liver (D) eye lens

9. The appendix is useful in ruminants for digestion of which of the following compounds?
   (A) Fats (B) Cellulose
   (C) Proteins (D) Glycogen
10. _____ is a connecting link between Annelida and Arthropoda. **[Mar 2019]**
   (A) Duck-billed platypus
   (B) *Peripatus*
   (C) Lungfish
   (D) Whale
11. Connecting links suggest that amphibians have evolved from
   (A) mammals (B) reptiles
   (C) fishes (D) aves
12. Theory of inheritance of acquired characters is also known as
   (A) Lamarckism (B) natural selection
   (C) speciation (D) translocation
13. 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.	(A)	6.	(B)
7.	(D)	8.	(B)	9.	(B)
10.	(B)	11.	(C)	12.	(A)
13.	(C)				

Complete the paragraph *[3 Marks]*

1. **Fill in the blanks by selecting the correct word from the bracket and complete the given paragraph.**
   (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**.

Name the following *[1 Mark each]*

1. Genetic disorder that is caused by mutation.
2. First living material formed in ocean.
3. Remnants and impressions of organisms that remain preserved underground.
4. Method used in palaeontology and anthropology for determining the age of fossils by measuring C-14 radioactivity.
5. Plants and animals that show some morphological characters by which they are related to two different groups.
6. Book published by Darwin explaining evolution through natural selection.
7. I am connecting link between Reptilia and mammals. What is my name? **[Mar 2020]**

Answers:

1. Sickle cell anaemia, etc.
2. Protoplasm
3. Fossils
4. Carbon dating
5. Connecting links
6. Origin of species
7. Duck-billed platypus

True or False. If false, write the correct sentence *[1 Mark each]*

1. Francois Jacob and Jacques Monod proposed a model for the process of protein synthesis.
2. The causality behind the sudden changes was understood due to mutation principle of Hugo de Vries.
3. The proof for the fact that protein synthesis occurs through gene was given by George Beadle and Edward Tatum.
4. Information about protein synthesis is stored in the tRNA.
5. Proteins are synthesised by DNA through RNA.
6. During transcription, the sequence of nucleotides in mRNA is complementary to the DNA strand used for synthesis.
7. tRNA has anticodon with complementary sequence to the codon on mRNA.
8. mRNA is formed in the nucleus and transferred to the cytoplasm for translation.
9. Gradual development of plants and animals from ancestors having different structural and functional organization is called evolution.
10. Under changing environment sudden development of new tissues and organs occurs in living organisms.
11. Fossils of invertebrates indicate they originated in the Cenozoic era.
12. Appendix is a fully functional organ in ruminants.
13. Reptiles and amphibians have evolved from mammals.
14. Darwin's theory of natural selection explained evolution with respect to useful and useless modifications.
15. Based on his observations of plants and animals, Darwin suggested that only the fittest organisms survive.
16. According to Lamarck, the characters which are acquired by the organism during the life time are passed on to the next generation.
17. Long neck of giraffe is an example of Lamarckism.
18. Genetic variation is responsible for formation of new species from earlier ones.
19. Geographical isolation leads to speciation.

Answers:

1. True.
2. True.
3. True
4. False.
   Information about protein synthesis is stored in the DNA.
5. True.
6. True.
7. True.
8. True.
9. True.
10. False.
    Under changing environment gradual changes occur in existing tissues and organs in living organisms.
11. False.
    Fossils of invertebrates indicate they originated in the Paleozoic era.
12. True.
13. False.
    Mammals have evolved from reptiles and amphibians have evolved from fishes.
14. False.
    Darwin's theory of natural selection did not explain useful and useless modifications.
15. True.
16. True.
17. True.
18. True.
19. True.

Odd one out *[1 Mark each]*

1. Foreleg of ox, Ear pinnae of sheep, Patagium of bat, Flipper of whale
2. Coccyx, Intestine, Wisdom teeth, Appendix
3. Cro-Magnon man, Aegytopithecus, Australopithecus, Neanderthal man

Answers:

1. Ear pinnae of sheep
   Foreleg of ox, patagium of bat and flipper of whale are similar in structure, indicating common ancestry (anatomical evidence). Ear pinnae of sheep is not similar to these structures.

2. Intestine
Intestine is a fully functional organ in humans, whereas coccyx, wisdom teeth and appendix are vestigial organs.
3. Aegytopithecus walked using four limbs, whereas Cro-Magnon man, Australopithecus and Neanderthal man had erect posture.

Complete the analogy *[1 Mark each]*

1. DNA: Thymine :: RNA: _____
2. RNA synthesis: _____ :: Protein synthesis: Translation
3. _____: Sudden changes in genes :: Evolution : Gradual changes in specific characters
4. Morphological evidence: Similarity in position of eyes :: _____ : Similarity in structure of bones
5. *Peripatus* : Connecting link :: Wisdom tooth : _____
6. Survival of fittest : _____ :: Ancestry of acquired characters : Lamarck
7. First human like animal : _____ :: First wise man : Neanderthal man

Answers:

1. Uracil
Thymine present in DNA is replaced by uracil in RNA.
2. Transcription
Protein synthesis occurs by the process of translation, whereas RNA synthesis occurs by transcription.
3. Mutation
Gradual changes in specific characters results in evolution, whereas sudden changes in genes results in mutation.
4. Anatomical evidence
Similarity in position of eyes in different organisms is morphological evidence, whereas similarity in structure of bones is anatomical evidence.
5. Vestigial organ
Peripatus is an example of connecting link, whereas wisdom tooth is an example of vestigial structure.
6. Darwin
The concept of ancestry of acquired characters was proposed by Lamarck, whereas concept of the survival of the fittest was proposed by Darwin.
7. Ramapithecus
The first example of wise man can be considered as Neanderthal man, whereas the first record of human-like animal is Ramapithecus.

Match the following

1.

	Column I		Column II
i.	Walter and Sutton	a.	Proved that except viruses all living organisms have DNA as genetic material
ii.	Avery, McCarty and MacLeod	b.	Proposed the central dogma
		c.	Observed paired chromosomes in cells of grasshopper
		d.	Discovered triplet codon

2.

	Column I		Column II
i.	Fossils	a.	Paleontological evidence
ii.	Flipper of whale and forelimb of bat	b.	Morphological evidence
		c.	Anatomical evidence

3.

	Column I		Column II		Column III
i.	Cenozoic era	a.	Amphibians	p.	Birds
ii.	Mesozoic era	b.	Aves	q.	Frogs
		c.	Reptiles	r.	Starfish
		d.	Pisces	s.	Snakes

4.

	Column I		Column II
i.	Connecting link between pisces and amphibians	a.	Lungfish
ii.	Connecting link between reptiles and mammals	b.	Duck-billed platypus
		c.	*Peripatus*
		d.	Snail

Answers:

1. (i – c), (ii – a)
2. (i – a), (ii – c)
3. (i – b – p), (ii – c – s)
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 organisms, 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.

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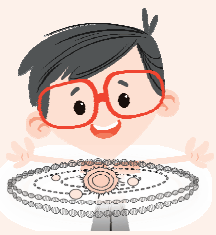
- ✓ *Length of DNA molecule in a single mammalian cell is about 2 meters which fits into a space just 6 microns across.*
- ✓ *The human body contains approximately 30 trillion cells, so if you stretch the DNA in all the cells out, end to end, it would stretch over 744 million miles, about twice the diameter of the Solar System.*



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 the 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 do you mean by central dogma? **[Mar 2019]** ***[1 Mark]***

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

8. What is transcription? **[Mar 2019]** ***[1 Mark]***

Ans: Transcription is the process of RNA synthesis.

OR

Transcription is the process of synthesis of mRNA from DNA.

9. 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.

10. What is meant by triplet codon? **[Mar 2019]** ***[1 Mark]***

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

11. What is translation? ***[1 Mark]***

Ans: Translation is the process by which tRNA having anticodon to the codon on the mRNA, supplies amino acids, as per the message on mRNA.

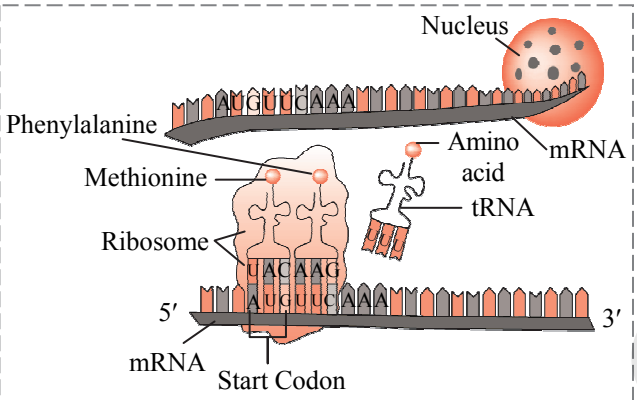
***12. Explain the process of formation of complex proteins.**

Ans:
i. Information about protein synthesis is stored in the DNA. mRNA is synthesised from this DNA by the process of **transcription**. The process of synthesis of proteins from DNA through RNA is called the **central dogma**.
ii. **Translation** occurs in the following manner:
a. mRNA formed in the nucleus during transcription moves in the cytoplasm, carrying the coded message by DNA.
b. Each mRNA contains codes for amino acids in the form of triplet codons.

c. As per the message on mRNA, amino acids are supplied by the tRNA, which has an anticodon (complementary sequence) to the codon on mRNA.
d. The amino acids supplied by tRNA are bound together by peptide bonds with the help of rRNA.
iii. 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**.

In this way, many such chains of amino acids (peptides) come together to form complex proteins.

***[Note:** Students can refer the given diagram for better understanding of formation of proteins from mRNA.]*



Translation

13. 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.

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

Ans:

i. Evolution is defined as the gradual changes 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.

15. Explain the process of formation of complex compounds from simple elements. ***[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.

***16. 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 proofs supporting the theory of evolution include morphological evidence, anatomical evidence, vestigial organs, paleontological evidence, connecting links and embryological evidence.

17. What is morphological evidence of evolution? ***[1 Mark]***

Ans: Morphological evidence 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.

18. Define anatomical evidence. ***[1 Mark]***

Ans: Anatomical evidence is the evidence of evolution based on the similarities in the anatomical structure of bones and bony joints in the organs of animals.

***19. Explain with suitable examples importance of anatomical evidences in evolution.**
[July 2019, Mar 2020] ***[3 Marks]***

Ans:

i. Anatomical evidences are the similarities in structures and anatomy between different organisms.
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 thus providing proof of evolution.

Reading between the lines

Comparative anatomy is the study of similarities and differences in the anatomy (body structures or organs) of different species.
It includes;

- *Homologous organs:*
  These organs perform different functions but have similar anatomical structures and indicate common ancestry.
  e.g.: Forelimb of whale, bats, humans, etc.
- *Analogous organs:*
  These organs have similar function but appear structurally dissimilar.
  e.g.: Eye of octopus and eye of mammals, etc.
- *Vestigial organs:*
  These structures are non-functional in certain organisms, while they are functional in others, indicating common ancestry. e.g.: Appendix, etc.

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Archaeopteryx lived around 150 million years ago and is considered as the connecting link between birds and reptiles because it had characters of both classes i.e. birds and reptiles.

20. What are vestigial organs? *[1 Mark]*

Ans: Vestigial organs are useless organs that are degenerated or underdeveloped due to non-functionality through several years.

21. *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.

OR

i. Define vestigial organs.
ii. Write name of any *two* vestigial organs in human body.
iii. Explain how one human vestigial organ is functional in another animal.

[Dec 2020] *[3 Marks]*

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. Other vestigial organs include the tail-bone (coccyx), body hairs, nictitating membrane (third eyelid), wisdom tooth, etc.

Reading between the lines

Function of some vestigial organs in other animals is as follows:

- *Tail-bone (coccyx): It is useful in other mammals for balance.*
- *Body hairs: They are useful in other mammals for insulation against the cold.*
- *Nictitating membrane (third eyelid): It is useful in animals like frog, pigeon, etc., for the purpose of protection of eye.*
- *Wisdom tooth: They are present in mammals with large jaws for chewing raw food.*

22. Define vestigial organs. Write any two names of vestigial organs in human body.

[July 2019] *[2 Marks]*

Ans: *Refer Answer the following: Q.21*

23. What is paleontological evidence of evolution based on? *[1 Mark]*

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

***24. 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 with time as C-12 is non-radioactive in dead plants and animals.
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. The oldest fossils are buried deep in the Earth's crust, while the younger ones occupy the upper surfaces. Hence, fossils of invertebrates are found buried deep as they are very old and belong to the Palaeozoic era. The fossils of Pisces, Amphibians and Reptiles were obtained in the consecutive layers. The Mesozoic era was dominated by reptiles, while the Cenozoic era showed presence of mammals and birds.
vi. Thus, study of fossils is an important aspect of evolution since it can be used in paleontology and anthropology for determining age of the fossils and deducing information about their ancestors.

25. What are connecting links? *[1 Mark]*

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

***26. 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.

***27. Write a short note on embryology.** *[2 Marks]*

Ans:

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

ii. It enables us to comparatively study the developmental stages of various animals.

iii. Embryos of different vertebrates appear similar during the initial stages indicating common origin of these animals.

iv. Similarities decrease gradually as the embryos develop due to an increase in complexity from differentiation of the cells into specialized tissues to form specific organs.

28. 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.

29. How is embryological evidence of evolution studied? *[1 Mark]*

Ans: Embryological evidence arises from comparative study of embryological developmental stages of various vertebrates.

***30. Write a short note on Darwin's theory of natural selection.**

OR

Explain Darwin's theory of natural selection.

[Dec 2020] *[2 Marks]*

Ans:

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

ii. 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. The selected organisms then give rise to new species with their specific set of characters.

31. Write the objections raised against Darwin's theory of natural selection?

[Mar 2022] *[3 Marks]*

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 of useful and useless modifications.

iii. No explanation regarding slow and abrupt changes was provided in this theory.

***32. Write a short note on Lamarckism.**

Ans:

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. This concept was based on the principle of **use and disuse of organs**.

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 cause 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.

33. Why was Lamarck's theory disproved? *[1 Mark]*

Ans: 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.

34. What is meant by ancestry of acquired characters? *[1 Mark]*

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

35. Define evolution. *[1 Mark]*

Ans: Evolution is the formation of new species due to changes in specific characters over several generations of living organisms as a response to natural selection.

36. What is speciation? *[1 Mark]*

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

37. What is species? *[1 Mark]*

Ans: Species is a group of organisms that can produce fertile individuals through natural reproduction.

***38. Write evolutionary history of modern man.**

Ans: Human evolution began approximately 7 crore years ago.

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

i. The last dinosaurs disappeared 7 crore years ago.
ii. Monkey-like animals are said to have 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 1.5 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 man started practising agriculture, rearing cattle and establishing cities. Also, cultural development took place around this time period.

Give reasons

1. Morphological evidences suggest that dog, sheep and wolf have a common origin. *[2 Marks]*

Ans:

i. 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. *[2 Marks]*

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. *[2 Marks]*

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. Human evolution began approximately 7 crore years ago. ***[2 Marks]***

Ans:

a. The last dinosaurs disappeared 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.

ii. Geographical and reproductive isolation of organisms gradually leads to speciation. ***[2 Marks]***

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.

iii. Study of fossils is an important aspect of study of evolution.

Ans: *Refer Answer the following: Q.24*

iv. 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.28

Distinguish between *[2 Marks]*

1. Transcription and Translation

Ans:

	Transcription	Translation
i.	Transcription is the process of synthesis of mRNA from DNA.	Translation is the process by which tRNA having anticodon to the codon on the mRNA, supplies amino acids, as per the message on mRNA.
ii.	It occurs in the nucleus.	It occurs in the cytoplasm.
iii.	It is the process of RNA synthesis.	It is the process of protein synthesis.
iv.	RNA polymerase catalyses this process.	The ribosome catalyses this process.

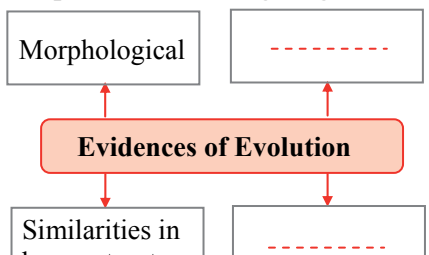
2. Lamarckism and Natural selection

Ans:

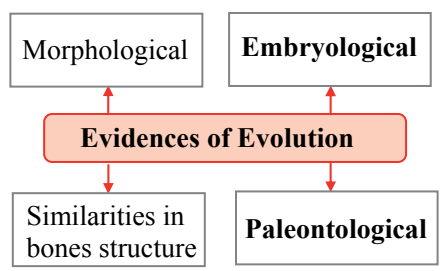
	Lamarckism	Natural selection
i.	All acquired characters are transferred to the next generation.	Only useful modifications/ variations are transferred to next generation.
ii.	It is not based on survival of the fittest.	It is based on survival of the fittest.
iii.	It occurs due to morphological changes.	It occurs due to modifications.
iv.	It occurs due to continued activity or laziness of an organism.	It occurs due to life-threatening competition.

Complete the given chart/table

***1. Complete the following diagram.**

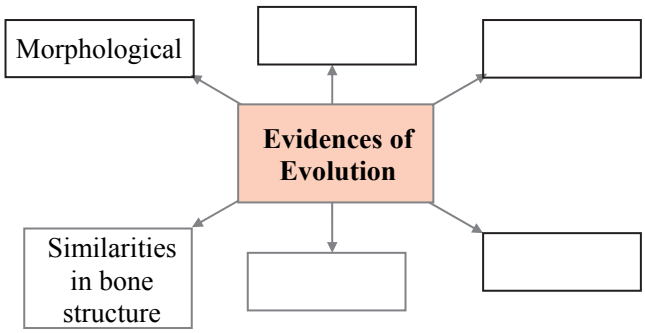


Ans:

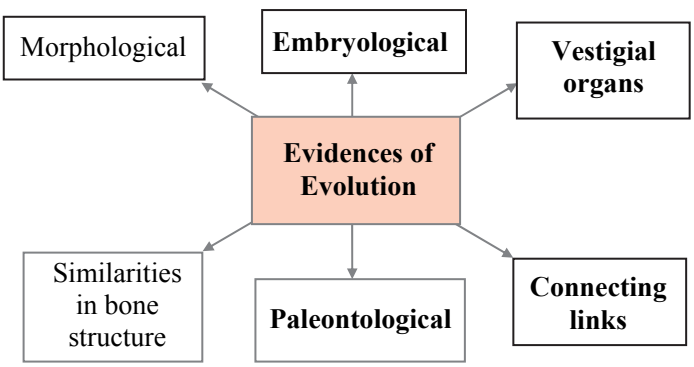


Vestigial organs and connecting links are the other evidences of evolution.

2. Complete the following diagram. **[Mar 2022]** ***[2 Marks]***

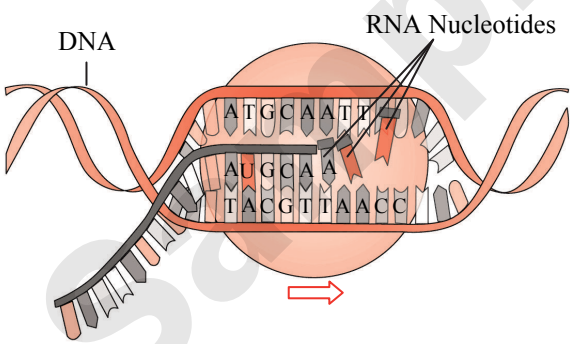


Ans:



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.

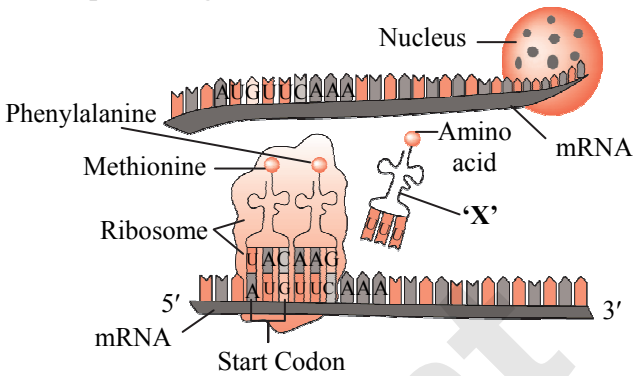
ii. Which enzyme is required for this process?

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.

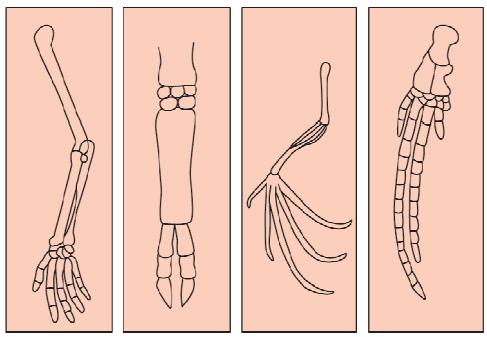
ii. What would be the sequence on the anticodon, if the corresponding codon sequence on the mRNA is GAU?

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.

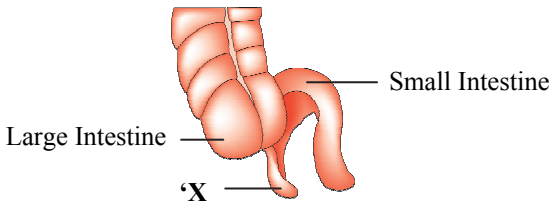
3. Observe the following diagrams and explain the anatomical evidences with the help of the given diagram.



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.
Refer Answer the following: Q.19.

4. Carefully observe the given diagram and answer the following questions. ***[3 Marks]***



i. Identify the part labelled as 'X'.

Ans: The part labelled as 'X' is appendix.

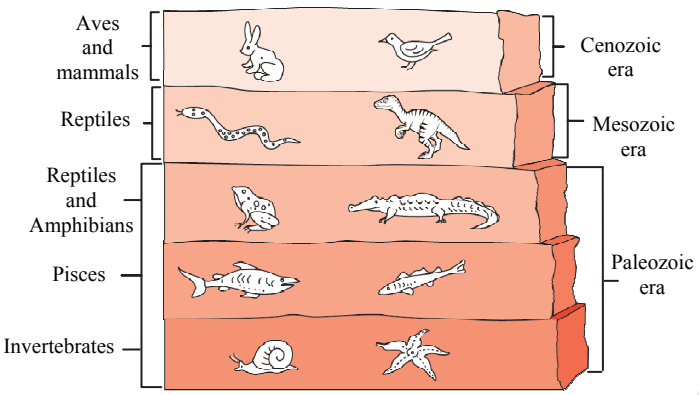
ii. What type of organ is shown in the given diagram?

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

iii. 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.

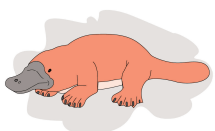
ii. Fossils of invertebrates, pisces, amphibians and some reptiles are found in the lowermost levels of ground indicating that they evolved around the paleozoic era.

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.

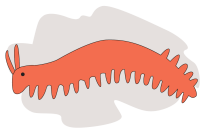
v. The presence of fossils of animals in different layers of soil indicate that progressive development took place in animals.

6. Observe and discuss. ***(Textbook page no. 6)***
Observe the following pictures and discuss the characters observed.



Duck billed platypus

Lungfish



Peripatus

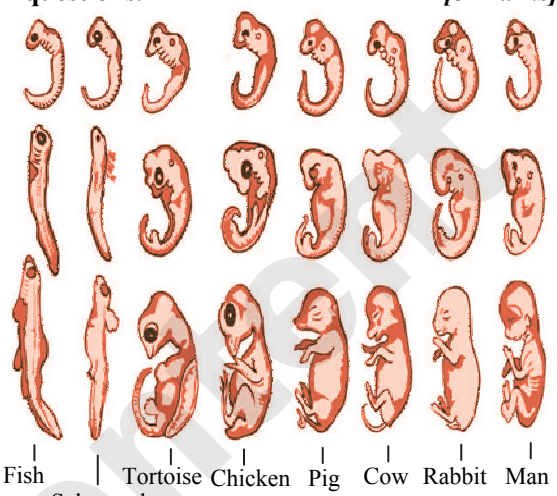
Ans:

i. Duck billed platypus: *Refer Answer the following : Q. 26 (iii)*

ii. Lungfish: *Refer Answer the following : Q. 26 (iv)*

iii. *Peripatus*: *Refer Answer the following : Q. 26 (ii)*

7. Observe the given figure and answer the questions. ***[3 Marks]***



i. Identify the evidence of evolution shown in the given diagram.

Ans: Embryological evidence of evolution is shown in the given diagram.

ii. How is this evidence used as a proof of evolution?

Ans: Embryological evidence is used as proof of evolution as a similarity in initial stages of development (embryos) amongst different animals indicates a common origin (ancestor) of these organisms.

iii. Mention any two other evidence of evolution.

Ans: Morphological evidence, anatomical evidence, vestigial organs, paleontological evidence, connecting links. *[Any two examples]*

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 of the template DNA strand, what would be the nucleotide sequence of 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′- UUCAGCCGUGUCAUU-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.

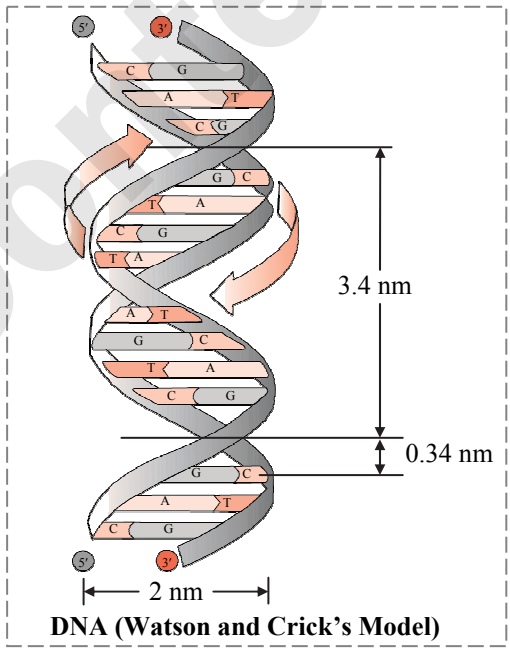
2. Can you tell? *(Textbook page no. 1)*

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.
2. According to this model, the two threads (strands) of nucleotides coil around each other to form a double helix.
3. This double helical structure appears like a flexible ladder.
4. Each strand is made up molecules known as nucleotides.
5. A molecule of a nitrogenous base and phosphoric acid are joined to a molecule of sugar to form nucleotide.
6. There are four types of nitrogenous bases in the form of adenine and guanine (purines), thymine and cytosine (pyrimidines). Thus, four types of nucleotides are formed.
7. The nitrogenous bases from the two strands are joined by hydrogen bonds to form base pairs (rungs of ladder). Two threads form a long chain of alternately joined molecules of sugar and phosphoric acid (rails of the ladder).
8. The adenine always pairs with thymine and guanine always pairs with cytosine in a DNA molecule.



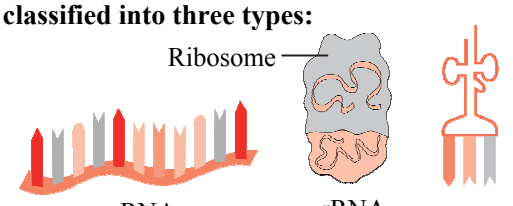
DNA (Watson and Crick's Model)

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 Q. R. code in *Quill – The Padhai App* 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. Genetic disorders may occur due to increase or decrease in chromosome number and deletion or translocation of any part of chromosomes.

c. Some examples of genetic disorders are as follows:

1. Polygenic disorders like diabetes, blood pressure, heart disorder, cleft lip, cleft palate, spina bifida, asthma, obesity, etc.
2. Monogenic disorders like Tay Sach's galactosemia, albinism, sickle-cell anemia, haemophilia, night blindness, phenylketonuria, cystic fibrosis, etc.
3. Chromosomal disorders like Down's syndrome, etc.

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 are speculated to have become 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 animals and birds 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 impressions of animals and plants are formed on mud which get 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. 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.

11. 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.]

***12. 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.

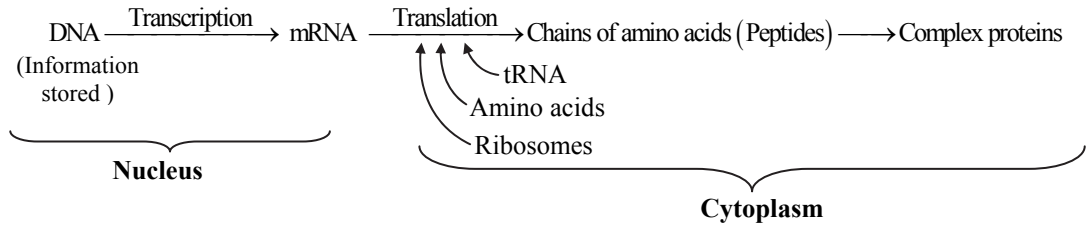
[Students are expected perform this activity on their own.]

Memory Maps

➢ **Central Dogma:**

$$DNA \xrightarrow{\text{Transcription}} RNA \xrightarrow{\text{Translation}} Proteins$$

➢ **Process of protein synthesis:**



➢ **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

↓ Mixture of organic and inorganic compounds

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

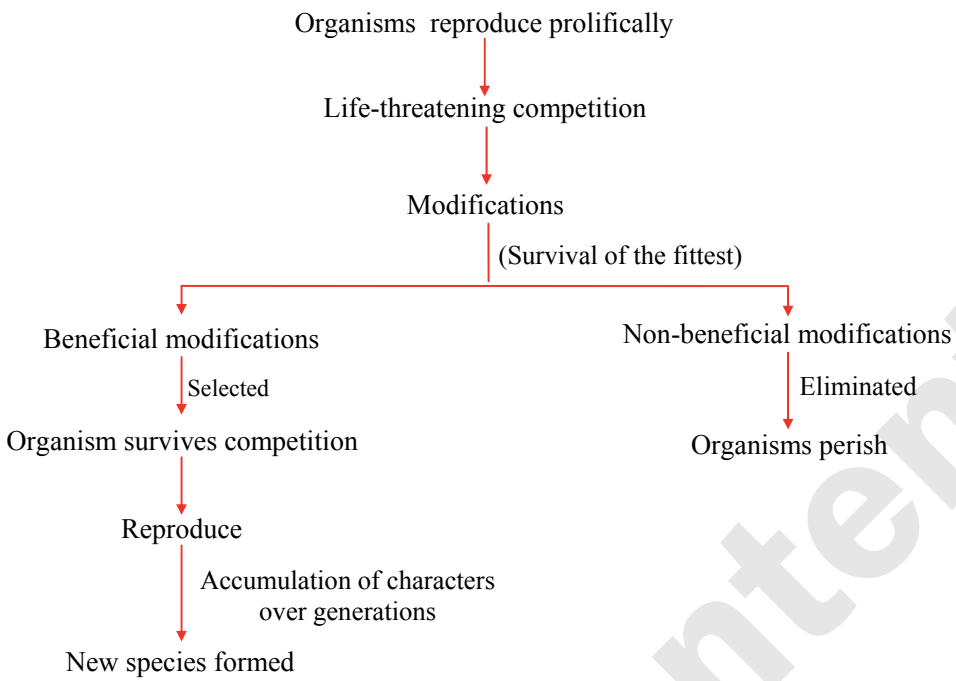
↓

Progressive development of plants and animals

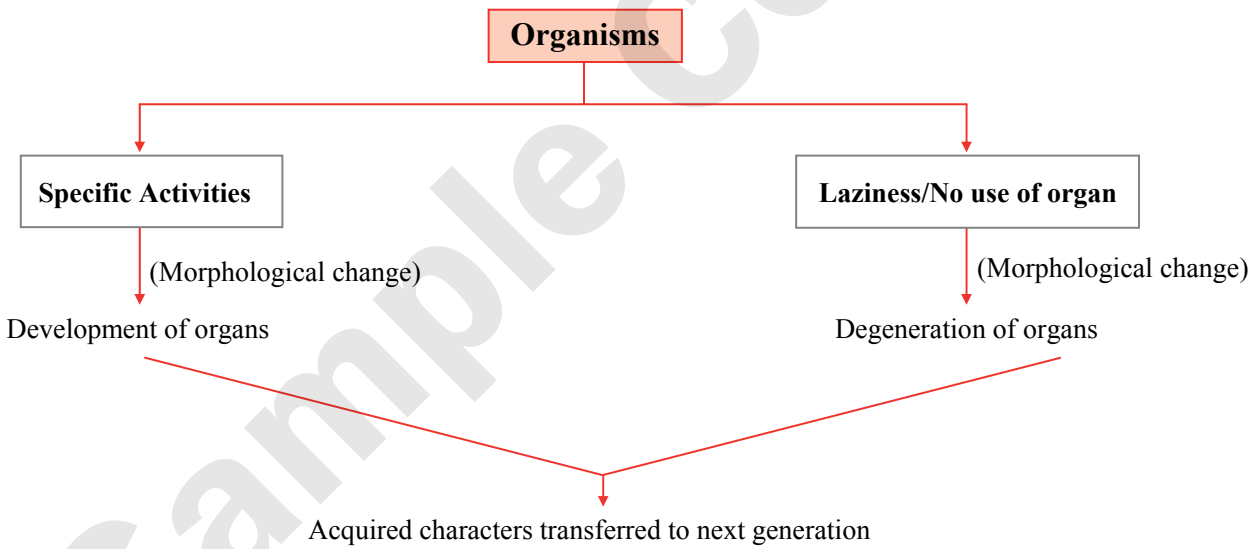
Evidence of Evolution

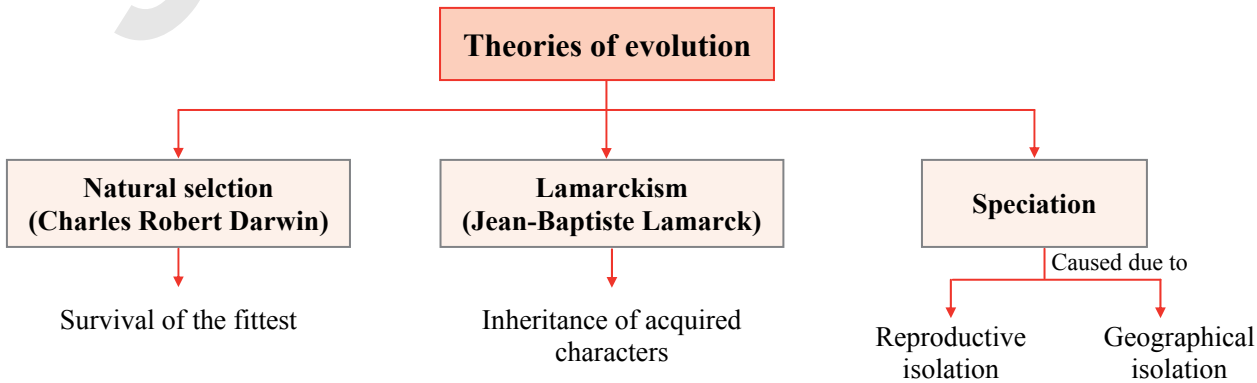
- **Morphological evidence** → Similarity in morphological characters like mouth structure, position of eyes, etc.
- **Anatomical evidence** → Similarity in structure and anatomy
- **Vestigial organs** → Degenerated/ underdeveloped useless organs e.g. Appendix, coccyx, wisdom tooth, etc.
- **Paleontological 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

➢ **Darwin's theory of natural selection:**



➢ **Lamarckism / Theory of inheritance of acquired characters:**





➢ **Human evolution:**

Period	Event	Evolution of Man
7 crore years ago	Last dinosaurs disappeared. Monkey-like animals (similar to modern lemurs) evolved.	-
4 crore years ago	Ape-like animals evolved by disappearance of tail, enlargement of brain, improved hand function.	Aegyptopithecus
	In South and North East Asia, ape like animals evolved into gibbon and orangutan.	
2.5 crore years ago	In Africa, ape-like animals evolved into gorillas and chimpanzees.	Dryopithecus
2 crore years ago	Human-like animals, lived on land as forests declined, lumbar bones developed, erect posture, hand used for eating food and other work	Ramapithecus
40 lakh years ago	Ape grew in size, became more intelligent.	Australopithecus
20 lakh years ago	Morphology similar to genus '*Homo*'.	Skilled human
15 lakh years ago	Human walking with erect posture evolved. It may have existed in China, Indonesia and Asian subcontinent.	
For 1 lakh years thereafter	Evolution in developing brain. Discovery of fire.	-
50,000 years ago	Brains evolved. Class–wise man. (*Homo sapiens*)	Cro-magnon man
10,000 years ago	Wise man practiced agriculture, cattle-rearing and established cities. Cultural development took place.	Wise man
5,000 years ago	Art of writing invented	-
400 years ago	Modern sciences emerged	-
200 years ago	Industrial society established	-

➢ **Information about scientists**

Scientist	Contribution	Year
Gregor Johann Mendel	Pioneer of Modern Genetics	1886
Dr. Har Gobind Khorana	Indian scientist to get Nobel Prize for his contribution in the discovery of the triplet codons for 20 amino acids	
Walter and Sutton	Observed the paired chromosomes in grasshopper	1902
Ostwald Avery, Mclyn McCarthy, Collin Macleod	All living organisms have DNA as genetic material (Except viruses)	1944
Francois Jacob and Jack Monad	Model for protein synthesis	1961

Chapter Assessment

[Total Marks: 25]

Q.1. (A) Choose the correct alternative. **[4]**

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

iv. Duck billed platypus is the connecting link between Mammals and _____.
(A) Reptiles (B) Aves
(C) Pisces (D) Amphibia

Q.1. (B) Answer the following. **[4]**

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

ii. State true or false. If false, 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.

	Column I		Column II
a.	Transcription	1.	Process of protein synthesis from mRNA
b.	Translocation	2.	Movement of mRNA from nucleus to the cytoplasm
		3.	Movement of ribosome on the mRNA by a distance of one codon
		4.	Process of RNA synthesis from DNA

Q.2. (A) Give scientific reasons. (Any one) **[2]**

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

ii. Forelimb of bat and flipper of whale have different functions but indicate common ancestry.

Q.2. (B) Answer the following. (Any two) **[4]**

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

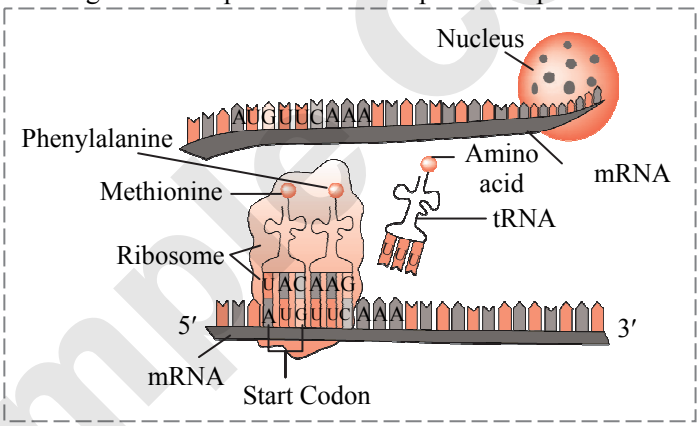
ii. Define speciation. Give examples of any two factors causing speciation.

iii. Give four examples of vestigial organs in humans.

Q.3. Answer the following (Any two): **[6]**

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): **[5]**

i. Explain in detail how fossils provide evidence of evolution.

ii. Explain in detail the process of formation of complex compounds on earth.

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