Standard X

NEW SYLLABUS

PRAGATI

SCIENCE AND TECHNOLOGY

Part-II

Workbook Guide

As per the New Revised Syllabus of Maharashtra State Board of Secondary and Higher Secondary Education

PRAGATI

SCIENCE AND TECHNOLOGY

PART – II

STANDARD X

SALIENT FEATURES

- Written strictly as per the New Revised Syllabus and upgraded Question Paper Pattern effective from the academic year commencing from June 2018 onwards.
- Perfect presentation from the exam point of view.
- A brief summary of each chapter is given at the start of every chapter.
- Appropriate diagrams are included whenever necessary.

–: By :–
Prof. Kulkarni

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PREFACE

It gives great pleasure in presenting '***Pragati Science and Technology Part - II*** ' to the students of ***Standard X*** in view of the New Revised Syllabus and Upgraded Evaluation Plan of Maharashtra State Board of Secondary and Higher Secondary Education, effective from the academic year 2018-19.

While writing this book, I have kept in mind the general level of understanding of the students and my every sincere effort is to make this book error-free and to increase the utility of the book. The answers to the questions are so framed that it will boost-up the interest and confidence of the users in the subject. I am sure, it will definitely enhance the performance of the students in the Board Examination.

This book is really speaking, a joint effort. I wish to tak e this opportunity to acknowledge my deep gratitude to the publisher especially ***Shri. Dineshbhai Furia and Shri. Jigneshbhai Furia*** and the members of their team for the deep interest and quick response given by them to my efforts without which this the book would not have taken up the shape.

This preface would be incomplete without the mention of active encouragement given by all my family members for their strong moral support.

I am indebted to all my students and colleagues whose love, faith and affection is a real driving force behind this book. I am eagerly waiting for the response of the students and teachers. The difficulties and the constructive suggestions of the users for the improvement and utility of this book are most welcome.

June 2018

– Prof. Kulkarni

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SCHEME OF EVALUATION

Std. X : Science and Technology I & II

The structure of the activity sheet for Science and Technology part I and II for 40 marks each is expected to be as follows. A time period of 2 hours will be available to solve the 40 marks activity sheet. There will be separate activity sheet for Part 1 and Part 2 of Science and Technology. These papers will be given on two different days rather than on a single day.

The markwise division of questions should be as follows :

Q. 1 A. 5 questions of 1 mark each ..... total marks 5

B. 5 questions of 1 mark each ..... total marks 5

(Q. 1 should be a multiple choice type of question. It should be based on practical work and the understanding of the projects and of application).

Q. 2. Answer 5 out of 7 questions of 2 marks each ..... total marks 10

Q. 3. Answer 5 out of 7 questions of 3 marks each ..... total marks 15

Q. 4. Answer 1 out of 2 questions of 5 marks each ..... total marks 05

Question 2 to 4 should mainly include open ended, thought provoking questions.

The type of questions in the workbooks for languages should be taken into account while preparing the workbook of Science and Technology. While compiling the workbook it is necessary to include different types of questions based on the division of marks given above. These questions should be based on activities and skill. The possible question-wise details are given below.

The question setter, at his/her level is expected to add to the types of questions and bring diversity while conforming to the format of the workbook.

Question 1 subdivision A ***5 marks***

A total of 5 questions of 1 mark each. Questions in this subdivision should not be of same type. Questions of any 5 types out of those given below as sample, can be chosen.

A . Fill in the blanks : If is compulsory to write the whole statement after filling in the appropriate word in the blank.

B. Find the odd out : This type of question should include 4 to 5 components so that the student can choose the odd one out after some rational thinking. The question can have figures depending on the availability of space. If components are given in the form of a picture, the student can think about the concepts involved.

C. Find out the correlation : The question should be to determine the correlation between two components and write it in one sentence.

D. Find out the difference between two components : Find the difference and write it in one sentence.

E. Make pairs : Usually in such questions 4 to 5 words are given in two groups. We should consider how this 1 mark question can be made differently. Four alternatives may be given 2 components. The alternatives should have similarities so that students will have to think logically to reach the correct answer.

F. Right or wrong ? Write if the given statement is correct or wrong.

G. Give name / molecular formula : This type of question can be used in chemistry.

A part from these, we can have questions asking what a particular figure or picture indicates, to fill in the blank in a flow chart etc.

Questions 1 subdivision B. ***5 marks***

- 3 multiple choice questions of 1 mark each based on practical work.
- 2 multiple choice questions of 1 mark each based on projects.

It is necessary that the multiple choice questions on practical work and projects should be based on observation, conjecture and conclusion.

Note : One must ensure that fill in the blanks question does not appear in both subdivisions.

Question 2 : 5 out of 7 sub-questions to be answered (each 2 marks) ***10 marks***

This question can include 7 out of the following questions.

A. Solve numerical problems : Numerical problems different from, but based on those given in the lessons in the book should be asked.

B. Write notes : Write a note based on a concept understood from a figure or picture.

C. Write chemical reactions along with their equations : The question can name a chemical reaction, give an incomplete chemical reaction or give an unbalanced reaction so that the student can identify the chemical reaction and make it clear.

D. Complete the flowchart : In this type of question, an incomplete flow chart should be given. But 4 to 5 blank spaces should be included.

E. Clarify the difference : In this type of question a minimum of 4 differences should be pointed out between two components. These four points should be independent.

F. Write Properties / Characteristics / Advantages / Effects : A minimum of statements are expected in this.

G. Give scientific reasons : It is necessary to clarify the scientific reason behind an event or an activity.

H. Give examples : It is necessary to give 4 different examples based on some component / concept / process and clarify it. The student should be free to give examples from day to day life.

Question 3 : Solve 5 out of 7 sub-questions (3 marks each) ***15 marks***

These sub-questions may include any 7 out of the sub-questions given below.

A. Give explanation using the given statements : Ask to find out the concept based on at least 6 given statements.

B. Suggest remedies / measures : This should have questions about problems / effects related to daily life.

C. Explanation of diagrams : Give an unlabelled diagram and ask the students to label and explain it.

D. Complete the table / chart : Complete the incomplete table and given information based on that.

E. Explain with the help of examples : Ask to give an example of a process e.g. a chemical reaction.

F. Solve numerical problems : Give numerical problems based on the lessons. The difficulty level should be high.

G. Complete the diagram : Complete the diagram like an electric circuit, food chain etc and give explanation.

H. Answer questions based on figures.

I. Write answers with explanations.

J. Write laws, theory and explain.

K. Complete the paragraph : It is necessary to have a minimum of 6 blank spaces in the paragraph and 7 to 8 options.

Question 4 : Solve one out of two sub-questions (5 marks each) 5 marks

Any two of the following sub-questions can be included in this question.

A. Draw a figure and give explanation : An accurate labeled diagram of the concept should be drawn and explain.

B. A new diagram to be drawn correcting the given inaccurate one and explanation should be given.

C. Classify with detailed explanation.

D. Read the given paragraph and answer questions based on it. (A minimum of 5 questions should be asked and these should be based on the psychological capability of students).

E. Complete the given incomplete table / chart and give explanation (It is necessary to have 3-4 columns in the table / chart).

F. Answer the questions in detail. For example, an activity for proving a law or properties, an experiment to verify a statement etc. should be asked in such questions. This should include a diagram.

G. Make a concept diagram based on some components and give explanation.

Distribution of marks according to question type and aims

Distribution of marks according to a question type					***Distribution of marks according to aims***				
Sr. No.	***Question type***	***Marks***	***Marks with option***	***% marks***	***Sr. No.***	***Aims***	***Marks***	***Marks with option***	***% Marks***
1.	Objective	10	10	25.0	1	Knowledge	10	10	25
2.	Very short answer	10	14	25	2	Understanding	10	25	25
3.	Short answer	15	21	37.5	3.	Application	16	25	40
4.	Long answer	5	10	12.5	4	Skill	4	5	10
	Total	***40***	***55***	***100***		***Total***	***40***	***55***	***100***

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CONTENTS

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Chapter 1

Heredity and Evolution

INTRODUCTION

- Transmission of traits, physical or mental, from parent to offspring is called **heredity**.
- Process of RNA synthesis is called as **transcription**.
- As per the message on mRNA, amino acids are supplied by the tRNA. For this purpose, tRNA has anticodon having complementary sequence to the codon on mRNA. This is called as **translation**.
- The amino acids brought in by tRNA are bonded together by peptide bonds with the help of rRNA. During this process, the ribosome keeps on moving from one end of mRNA to other end by the distance of one triplet codon. This is called as **translocation.**
- Evolution is the gradual change occurring in living organisms over a long duration.
- **Evidences of evolution are** : (i) Morphological evidences, (ii) Anatomical evidences, (iii) Vestigial organs, (iv) Paleontological evidences, (iv) Connecting links, (v) Embryological evidences.

Darwin's Theory of Natural Selection :

- "The process of selection of characteristics that contribute to the fitness for survival was called natural selection by Darwin".
- Useful factors appear only in some individuals in the next generation of the species the adapted individuals may also be very different from the original species. This process is described as a natural selection.
- This theory did not explain how an individual plant or animal acquired factors that made it better adapted to its surrounding.
- Jean-Baptiste Lamark proposed that morphological changes occurring in living organisms are responsible for evolution and the reason behind those morphological changes is activities or laziness of that organism.

INTEXT QUESTIONS

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

- DNA carries the hereditary characters.

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

- The process of transfer of physical and mental characters from parents to the progency is called heredity.

Which are the components of the DNA molecule ?

- The components of the DNA molecule are deoxyribose sugar, nitrogeneous bases and phosphoric acid.

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

- ***Structure and type of RNA :***

  According to function, there are three types of RNA.

(a) Ribosomal RNA (rRNA) : The molecule of RNA which is a component of the ribosome organelle is called a ribosomal RNA. Ribosomes perform the function of protein synthesis.

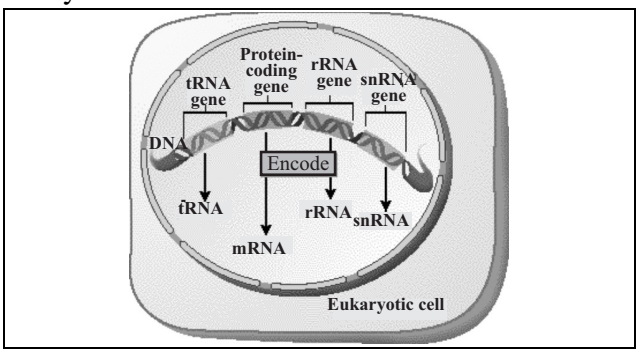


Fig. 1.1

(b) Messenger RNA (mRNA) : The RNA molecule that carries the information of protein synethesis from genes i.e. DNA chain in the cell nucleus to ribosomes in the cytoplasm which produce the proteins, is called messenger RNA.

(c) Transfer RNA (tRNA) : The RNA molecule which, according to the message of the mRNA carries the amino acid up to the ribosomes is called transfer RNA.

- ***Structure and type of DNA :*** Segments of the DNA molecule are called genes. Due to variety in the sequence of nucleotides, different kinds of genes are formed.

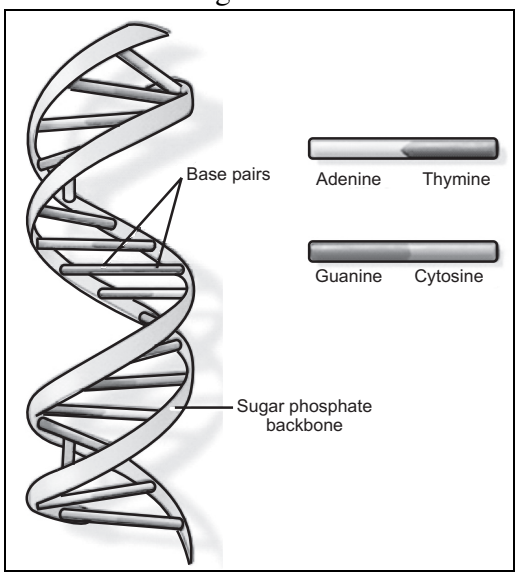


Fig. 1.2 : Structure of DNA

- These genes are arranged in a line. Genes control the structure and function of the cells and of the body. Also, they transmit the hereditary characteristics from parents to offspring. Hence, they are said to be the functional units of heredity. That is why, many similarities are seen between parents and their offspring. Information about protein synthesis is stored in the genes.

Explain the meaning of genetic disorders and give names of some disorders.

- Genetic disorders means the diseaseS or disorders occurring due to abnormalities in chromosomes and mutations in genes.
- **Examples of genetic disorders :** Haemophilia, Cleft lip, sickle cell anaemia, albinism, Turner's syndrome, Down's syndrome, kline felter's syndrome, etc.

What is the function of the appendix of our digestive system ?

- The appendix acts as a storehouse for good bacteria, "rebooting" the digestive system after diarrheal illnesses. It is believed to have been a part of digestive system in our primitive ancestor.

Are our wisdom teeth really useful for chewing the food ?

- Wisdom teeth are a remnant of a past (~100 million years ago) where a third set of molars was required to offset the wear and tear of our ancestors' teeth. Their diet consisted primarily of roots, leaves, nuts and tough meats, which are very coarse foods requiring a lot of chewing. Also their jaws were much larger, they were still running around on all fours and teeth were extremely important in grabbing, tearing, even dismembering prey. Wisdom teeth were sort of a backup set of molars that would appear sometime after they were 17 (life expectancy was barely above 30) to ensure that they did not starve to death because they could not chew their food anymore.

➺ *Why did the huge animals like dinosaur become extinct ?*

- The reasons for the huge animals like dinosaur became extinct are as follows:
- A big meteorite crashed into Earth, changing the climatic conditions so dramatically that dinosaurs could not survive.
- Ash and gas spewing from volcanoes suffocated many of the dinosaurs.
- Diseases wiped out entire populations of dinosaurs.
- Food chain imbalances lead to the starvation of the dinosaurs.

➺ *Why are many species of animals and birds getting extinct ?*

- Animal extinctions may be caused by natural occurrences such as climatic heating or cooling or changes in sea levels. In more modern times, however, human activity has been to blame. Habitat destruction as farming land expands and forests are cut-down is the main cause of modern extinctions along with pollution, the introduction of alien species, and over fishing or hunting. Increasingly, however, climatic change is thought to be driving extinctions.

➺ *Which are the different organs in body of organisms ?*

In body of organisms there are following organs :

- Skeletal system : Bones
- Digestive system : Liver, pancreas, intestines
- Respiratory system : Lungs, larynx, diaphragm.
- Circulatory System : Heart, veins, arteries.

➺ *Is each of the organs useful to organism?*

- Most of the organs are useful to organism. However, few organs may be present now, but they lost their use in the process of evolution. E.g. In human beings, appendix, coccyx, body hair, etc. are not useful now.

TEXT BOOK EXERCISE

1. Complete the following diagram:

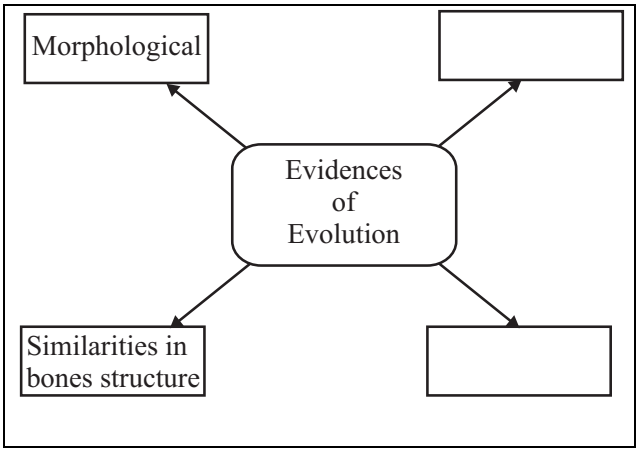


Fig. 1.3

Ans. :

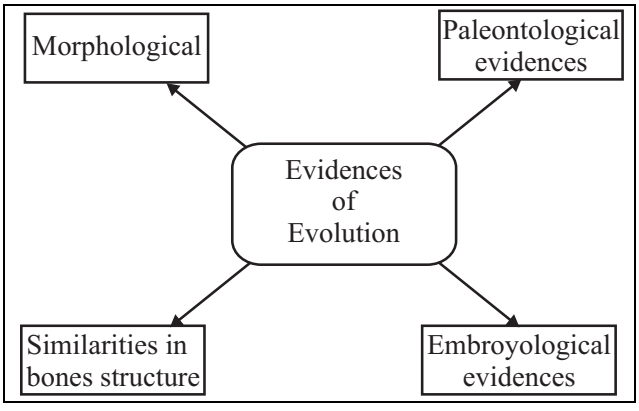


Fig. 1.4

2. Read the following statements and justify same in your own words with the help of suitable examples.

(a) Human evolution began approximately 7 crores years ago.

Ans. : It is true that human evolution began 7 - 10 million years ago. Theories like the 'The Origin of Species' by Charles Darwin suggested that humans emerged from the apes who lived in the African regions which was confirmed by the study of the 3-4 million old Australopithecus fossils. Genetic studies and studies of the fossil evidences by methods like radio-dating, etc. has confirmed these theories.

Studies by paleo-anthropologists on different types of fossils from different regions have led to the theory of evolution of man from apes which have been recorded in the evidence books.

(b) Geographical and reproductive isolation of organisms gradually leads to speciation.

Ans. : A single population (a) is fragmented by a barrier, (b) geographical isolation leads to genetic divergence, (c) when the barrier is removed, the two populations come back into contact with each other, and there is selection for increased reproductive isolation, (d) if reproductive isolation is effective, it leads to accumulation of variations leading to speciation.

(c) Study of fossil is an important aspect of study of evolution.

Ans. : Fossils are used importantly in the study of the Laws of Fossil Succession, according to which

(i) Fossils represent the remains of once-living organisms.

(ii) Most fossils are the remains of extinct organisms; that is, they belong to species that are no longer living anywhere on Earth.

(iii) The kinds of fossils found in rocks of different ages differ because life on Earth has changed through time.

Darwin's theory of evolution accounts for all of the diversity of life, both living and fossils.

According to Darwin, the evolution of life is caused by four processes: variation, over-reproduction, competition, and survival of those best adapted to the environment in which they live.

(d) There is evidence of fatal science among chordates.

Ans. : The evidence of fatal science among chordates is that;

(i) The chordates and the hemichordates had a common ancestor earlier 500 mya.

(ii) There was also an extreme conservation of the phylotypic compartment map which could act as an evidence that development constrains future avenues.
This is because after the compartments have been established (the postphylotypic stage) whereby each compartment shows large flexibility.

(iii) The structure of the fatal science among chordates mitigated the pleiotrophy problem/conflating effects of those mutants whose actions could be beneficial.

3. Complete the following statements by choosing correct options from bracket.

(Gene, Mutation, Translocation, Transcription, Gradual development, Appendix)

(a) The causality behind the sudden changes was understood due to …….. principle of Hugo de Vries.

(b) The proof for the fact that protein synthesis occurs through …….. was given by George Beadle and Edward Tatum.

(c) Transfer of information from molecule of DNA to mRNA is called as …… process.

(d) Evolution means …….

(e) Vestigial organ …….. present in human body is proof of evolution.

Ans. : (a) Mutation, (b) Transcription (c)Translocation, (d) Gradual Development, (e) Appendix

4. Write short notes based upon information known to you:

(1) Lamarckism.

Ans. : Lamarckism (or Lamarckian inheritance) is the hypothesis that an organism can pass on characteristics that it has acquired during its lifetime.

It is also known as the inheritance of acquired characteristics or soft inheritance. The classic example used to explain the concept of use and disuse is the elongated neck of the giraffe.

According to Lamarck's theory, a given giraffe could, over a lifetime of straining to reach high branches, develop an elongated neck.

Another example Lamarck used was the toes of water birds.

(2) Darwin's theory of natural selection.

Ans. : Evolution is the sequence of gradual changes which takes place in the primitive organism over a millions of year and new species are produced.

This theory gives information about variation, inheritance, high rate of population growth, differential survival and reproduction.

Explanation:

(a) Variation : Within a population, some traits can be expressed in various ways and make individuals to look and behave differently.

It can be hair color, body size, eyes color, reaction while facing a danger.

(b) Inheritance : Heritable traits are transmitted to the next generation.

(c) High rate of population growth : At each generation, the population produces more offspring than what the local environment can support. It leads to substantial mortality.

(d) Differential survival and reproduction: Individuals with the best combination of traits to survive in the actual environment will produce more offsprings for the next generation.

(e) More details : Individuals with the best combination of traits will have a survival and reproductive advantage. As a matter of fact, their traits are more likely to be transmitted to the next generation. This process will change the frequency of traits within the population.

This process is called natural selection.

(3) Embryology.

Ans. : Embryology is the branch of biology that studies the prenatal development of gametes (sex cells), fertilization, and development of embryos and fetuses.

Additionally, embryology encompasses the study of congenital disorders that occur before birth, known as teratology.

(4) Evolution.

Ans. : Evolution is the change in the heritable characteristics of biological populations over successive generations. Evolutionary processes give rise to biodiversity at every level of biological organisation, including the levels of species, individual organisms, and molecules.

(5) Connecting Link.

Ans. : The living animals which possess the characteristics of two different groups of animals are known as connecting links.

For example, Lung fish. Lung fish possesses the characters of both the fishes and amphibians. It resembles the fishes in having paired fins, gills and scales over body. On the other hand, it also have the ability to respire through lungs which is the characteristic property of amphibians.

Thus lung fish acts as a connecting link between fish and amphibians. This suggests that in the past, amphibious organisms have developed from fishes.

5. Define heredity. Explain the mechanism of hereditary changes.

Ans. : Heredity is the passing of traits from parent to offspring. Molecules of DNA carry information that codes for various proteins.

These proteins interact with the environment, causing observable patterns of life. The complex mechanisms that replicate and reproduce DNA and the organisms it creates can be recombined and mutated during the process, leading to new and various forms of life.

All organisms, from the simplest bacteria to the largest eukaryotes, use DNA as the main form of heredity.

Heredity is the phenomenon of passing traits from parent to offspring. It is also called as mechanism of inheritance.

Inheritance involves the transfer of characters from one generation to another generation. Basic features of inheritance are elucidated.

- The traits could be hidden in many generations but can reappear in any generation unchanged.
- Traits which remain together may get separated in the next generation.
- One form of a particular character is exhibited frequently than the other form of the same character.

The traits that an organism possess are present because of their DNA. Their DNA has the information to express those traits/characteristics.

The offspring of that organism will inherit a few traits from it's father and few from it's mother. This is because a fusion of gametes take place in reproduction. And each gamete has 23 chromosomes containing information about the DNA in the parent. When the process of fusion takes place, 2 DNA fuse to form a new DNA having some traits from it's mother and some from it's father.

e.g. Brown eyes from mother and nose design of father. The process when the offspring inherits the traits from both its parents is called HEREDITY.

6. 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.: A vestigial structure is an anatomical feature that no longer seems to have a purpose in the current form of an organism of the given species.

Often, these vestigial structures were organs that performed some important function in the organism at one point in the past. Vestigial organs are organs of the body which are smaller and simpler than those in related species. They have lost, or almost lost their original function.

But one type of snake – the boas – have vestigial rear legs and pelvis. The human vermiform appendix, the tail bone, body hair, and the semilunar fold in the corner of the eye are another example.

OR

Degenerated or Underdeveloped organs which is not useful to human, but it is useful to other organisms, is called as vestigial organs.

Example : Charles Darwin was familiar with the concept of vestigial structures, though the term for them did not yet exist.

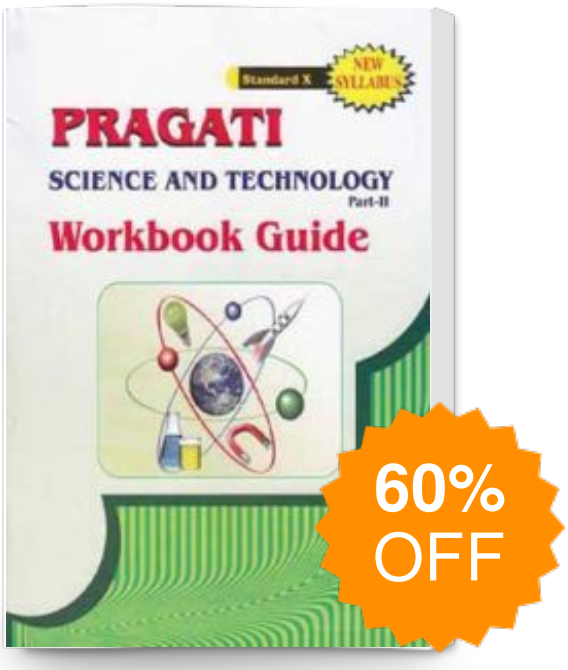
He listed a number of them in The Descent of Man, including the muscles of the ear, wisdom teeth, the appendix, the tail bone, body hair, and the semilunar fold in the corner of the eye.

7. Answer the following questions.

(a) How are the hereditary changes responsible for evolution?

Ans. : Heredity is the process of passing of traits from one generation to the next generation. Now, this process would not lead to any interesting results (and in turn, the astonishing variety of life on earth), if this process was 100% accurate or faithful. So, even though traits are transferred from parents to their off-springs, the traits are usually marginally altered. This gives rise to off-

Science And Technology Part – II



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