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Class	9th	Chapter	01
Subject	Biology	Board	Punjab

CHAPTER 1: THE SCIENCE OF BIOLOGY

TEXTBOOK EXERCISE SOLUTION

A. Select the Correct Answers for the Following Questions

1. Which branch of Biology focuses on the study of the structure and function of cells?

Answer: (a) Cytology

2. The study of the processes of heredity and variation in living organisms is known as:

Answer: (b) Genetics

3. Insulin made through bacteria is an example of the technique of:

Answer: (b) Biotechnology

4. Heart pumps blood, stomach digests food, and kidneys excrete wastes. The statement comes from:

Answer: (a) Physiology

5. Which branch of Biology involves the study of the classification of organisms?

Answer: (a) Taxonomy

6. Which step comes between making a hypothesis and doing experiments?

Answer: (a) Making deductions

7. Which of the following is NOT a characteristic of the scientific method?

Answer: (c) Hypothesis will always be correct

8. Choose the correct sequence of steps of the scientific method.

Answer: (a) Observations → Hypothesis → Deduction → Experiments

9. People who slept near a smoky fire had less chance of suffering from malaria. Why?

Answer: (c) Mosquitoes cannot tolerate smoke and are repelled.

10. Experiments are very important in the scientific method because a researcher:

Answer: (b) Disproves many hypotheses and gets some hypotheses proved.

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B. Write Short Answers

1. Define the following branches of Biology.

Genetics: The branch of Biology that deals with the study of genes, heredity, and variations in inherited traits in living organisms.

Anatomy: The branch of Biology that deals with the study of the internal structures and organ systems of living organisms, often through dissection.

Palaeontology: The branch of Biology that deals with the study of fossils, which are the preserved remains or traces of ancient organisms.

Marine Biology: The branch of Biology that focuses on the study of life and organisms found in seas, oceans, and marine ecosystems.

Pathology: The branch of Biology and medicine that deals with the study of diseases, including their causes, development, mechanisms, and effects on living organisms.

2. Which branch of Biology involves the study of the development of organisms from fertilization to birth or hatching?

Answer: Embryology deals with the study of the development of an embryo from fertilization to birth or hatching.

3. How is the profession of medicine and surgery different from animal husbandry?

Answer:

- **Medicine and Surgery:** These fields focus on human health. Medicine deals with the diagnosis and treatment of diseases, while surgery involves repairing, replacing, or removing damaged tissues or organs.
- **Animal Husbandry:** This field focuses on the care, breeding, management, and production of domesticated animals, such as cattle, sheep, and poultry, for human benefit.

4. Differentiate between Morphology and Physiology.

Answer:

- **Morphology:** The study of the external form, shape, and structure of living organisms.
- **Physiology:** The study of the functions and biological processes of various parts and organ systems of living organisms.

5. What is Computational Biology?

Answer: Computational Biology is an interdisciplinary branch of Biology that uses computer algorithms, mathematical models, and statistical techniques to analyze and interpret complex biological data, such as genomic sequences and protein structures.

6. What is the role of observation and experimentation in the scientific method?

Answer:

- **Observation:** It helps scientists gather information about natural phenomena using their senses and scientific instruments. These observations lead to the formulation of scientific questions and hypotheses.

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- **Experimentation:** It tests a proposed hypothesis under controlled conditions and produces empirical data that scientists use to draw logical conclusions.

C. Descriptive Questions

1. Link the study of Biology with that of Physics, Chemistry, Statistics, Geography, Economics, and Computer Science.

Answer:

- **Biophysics:** Studies biological phenomena using the principles and laws of Physics. Examples include the mechanics of limb movement and the passage of light through the eyes.
- **Biochemistry:** Studies the chemical reactions, molecules, and metabolic pathways occurring in living organisms. Examples include photosynthesis and respiration.
- **Biometry / Biostatistics:** Applies statistical and mathematical techniques to collect, analyze, and interpret biological data obtained from experiments.
- **Biogeography:** Studies the geographical distribution of plant and animal species across different regions of the Earth.
- **Bioeconomics:** Examines biological resources and production from an economic perspective. For example, it can be used to calculate the cost-benefit ratio of wheat production.
- **Bioinformatics / Computer Science:** Uses computational tools, databases, and software to store, organize, and analyze genetic and other biological data.

2. Explain how the study of Biology can lead to different professional studies.

Answer: The study of Biology provides opportunities to pursue various professional fields, including the following:

- **Medicine and Surgery:** Diagnosis and treatment of human diseases and the performance of surgical operations.
- **Fisheries:** Management and breeding of aquatic organisms to improve fish production.
- **Agriculture:** Improvement of crop production, soil management, and pest control.
- **Animal Husbandry:** Care, selective breeding, and welfare of livestock.
- **Horticulture:** Commercial cultivation of ornamental plants, fruits, and gardens.
- **Farming:** Management of livestock, poultry, and dairy farms using modern techniques.
- **Forestry:** Conservation and sustainable management of natural forests.
- **Biotechnology:** Use of living organisms, cells, or biological processes to produce useful products, such as insulin and vaccines.

3. Science is a collaborative field in which scientists work together to share knowledge. Prove this statement by giving examples.

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Answer: Science is a collaborative field because scientists from different disciplines and countries often work together to solve complex problems. Examples include:

- **Human Genome Project:** Geneticists, computer scientists, and bioinformaticians from several countries collaborated to determine the sequence of human DNA.
- **Malaria Research:** Physicians, entomologists, and other scientists worked together to investigate the life cycle of *Plasmodium* and the role of mosquitoes in transmitting malaria.
- **Vaccine Development:** Virologists, molecular biologists, immunologists, and epidemiologists collaborate to study viruses and develop vaccines during disease outbreaks.

These examples show that scientific progress depends on sharing knowledge, conducting research together, and combining expertise from different fields.

4. How is a hypothesis converted into a theory, law, and principle?

Answer:

- **Hypothesis:** A tentative, testable explanation for an observed scientific problem.
- **Theory:** A well-supported explanation that is developed through repeated testing and supported by a large body of scientific evidence. An example is the Cell Theory.
- **Law:** A statement that describes a consistent pattern or relationship observed in nature. An example is Mendel's Laws of Inheritance.

A hypothesis does not automatically become a theory and then a law. Theories and laws serve different purposes: theories explain scientific phenomena, while laws describe observed patterns or relationships.

5. What are the basic steps a scientist adopts to solve a scientific problem?

Answer: The basic steps of the scientific method are as follows:

1. **Identification of the Scientific Problem:** Recognizing a natural phenomenon or question that requires investigation.
2. **Observations:** Gathering information using the senses and scientific measuring instruments.
3. **Formulation of a Hypothesis:** Proposing a logical and testable explanation for the observations.
4. **Deductions:** Drawing logical predictions from the hypothesis, often in the form of "If... then..." statements.
5. **Experimentation:** Conducting experiments to test the predictions under controlled conditions.
6. **Summarization of Results:** Organizing and analyzing experimental data using tables, graphs, and statistical methods where appropriate.
7. **Conclusion and Reporting:** Using the results to evaluate the hypothesis and communicating the findings through reports or scientific publications.

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6. Describe the work of different scientists in discovering the cause of malaria.

Answer:

- **Laveran (1880):** Charles Louis Alphonse Laveran, a French physician, examined the blood of a malaria patient under a microscope and observed parasites responsible for the disease. These were later identified as *Plasmodium*.
- **King (1883):** Patrick Manson King recorded observations suggesting a relationship between mosquitoes and malaria. Observations about mosquito exposure and smoky fires contributed to investigations into mosquito behaviour and malaria transmission.
- **Grassi (1898):** Giovanni Battista Grassi, an Italian zoologist, helped demonstrate that female *Anopheles* mosquitoes transmit human malaria parasites.

The work of these scientists contributed to establishing the role of mosquitoes in the transmission of malaria.

7. Write a descriptive note on the experiments performed by Ross.

Answer:

Ronald Ross (1897): Ronald Ross was a British Army physician working in India who conducted important experiments to investigate the transmission of malaria by mosquitoes.

Procedure: Ross allowed mosquitoes of the genus *Culex* to feed on sparrows suffering from avian malaria. He later dissected the mosquitoes and examined their internal tissues under a microscope.

Observations: Ross observed stages of the malaria parasite developing inside the mosquitoes, supporting the idea that mosquitoes play an important role in malaria transmission.

Infection: His experiments with infected mosquitoes and healthy sparrows provided evidence that mosquitoes could transmit avian malaria from infected birds to healthy birds.

Conclusion: Ross demonstrated the role of mosquitoes in transmitting avian malaria. His research was a major contribution to the understanding of malaria transmission, and he received the Nobel Prize in Physiology or Medicine in 1902 for his work on malaria.

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