9th Class Biology Question-Answer Notes

Complete Chapter-Wise Solved MCQs, Short Questions and Long Questions

For students of BISE Bahawalpur Board - Class 9 Biology (2026-27 session)

All 11 chapters of the current Punjab Biology book, covered chapter by chapter: 165 practice MCQs with answer keys, 88 solved short questions, and 33 solved long questions, all written in simple, clear language for exam preparation and daily revision.

Please read this note: The Biology book and syllabus are the same across all Punjab boards, so these notes serve every Punjab board student. They are framed here for Bahawalpur Board students. All questions in this book are **original practice questions** written for study and revision. They are **not** official board paper questions, and no question here is claimed to appear in any board paper. For paper pattern, marks distribution and exam dates, always follow the official BISE Bahawalpur announcements and your teacher's guidance. Students should also check chapter titles against their own issued book.

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How this book is organised: every chapter begins with a short introduction, then 15 MCQs, then 8 solved short questions, then 3 solved long questions, and ends with an answer key table for its MCQs. Work through one chapter at a time. First read the introduction, then try the short questions with the answers covered, then attempt the MCQs without looking at the key.

Chapter 1 - The Science of Biology

What biology is, its branches, the levels of organization of life, and the scientific method.

MCQs - Chapter 1

1. The word biology comes from Greek words meaning:

A) life and study B) living and plants C) animals and plants D) nature and life

2. The study of animals is called:

A) Botany B) Zoology C) Microbiology D) Anatomy

3. The study of the internal structures of organisms is:

A) Morphology B) Physiology C) Anatomy D) Ecology

4. Which branch studies the functions of living things and their parts?

A) Anatomy B) Physiology C) Morphology D) Histology

5. Which is the correct order from smallest to largest?

A) cell, tissue, organ, organ system B) tissue, cell, organ, organism C) organ, tissue, cell, organism D) cell, organ, tissue, system

6. A group of organisms of the same kind living in one area is a:

A) community B) population C) ecosystem D) biosphere

7. A community together with its non-living environment forms a:

A) population B) biosphere C) ecosystem D) habitat

MCQs - Chapter 1 (continued)

8. A testable possible explanation for an observation is called a:

A) law B) theory C) hypothesis D) observation

9. A well-tested explanation supported by a large body of evidence is a:

A) hypothesis B) theory C) guess D) observation

10. The malarial parasite is called:

A) Anopheles B) Plasmodium C) Amoeba D) Paramecium

11. Malaria is spread to people by the female:

A) housefly B) Anopheles mosquito C) honeybee D) butterfly

12. The study of tissues is called:

A) Cytology B) Histology C) Genetics D) Morphology

13. The study of genes and inheritance is called:

A) Ecology B) Genetics C) Biotechnology D) Physiology

14. Biophysics is the application of:

A) chemistry to life B) physics to living things C) mathematics to life D) medicine to plants

15. The part of the Earth where life exists is called the:

A) atmosphere B) hydrosphere C) biosphere D) lithosphere

Short Questions with Answers - Chapter 1

Q1. Define biology and name its three major divisions.

Biology is the scientific study of life and living things. Its three major divisions are zoology (the study of animals), botany (the study of plants) and microbiology (the study of microorganisms).

Q2. What is the difference between morphology and anatomy?

Morphology is the study of the form and external structure of organisms, while anatomy is the study of their internal structures. Morphology looks at outward shape; anatomy looks inside the body.

Q3. Arrange these in order from smallest to largest: organ system, cell, organism, tissue, organ.

Cell, tissue, organ, organ system, organism. Cells group into tissues, tissues into organs, organs into organ systems, and all organ systems together make an organism.

Q4. What is a population? How is it different from a community?

A population is a group of organisms of the same kind living in one area. A community is made of the populations of different kinds of organisms living together in one area.

Q5. What is a hypothesis? Give one example.

A hypothesis is a testable possible explanation for an observation. Example: "Mosquitoes spread malaria" was a hypothesis that scientists tested by experiments before accepting it.

Q6. How is a theory different from a law?

A theory is a well-tested explanation supported by much evidence, while a law is a statement describing a regular pattern observed in nature. A theory explains why something happens; a law states what happens.

Q7. Why is the study of malaria a good example of the scientific method?

Because it followed every step: a problem was recognised, observations linked malaria with mosquitoes, a hypothesis was proposed, experiments tested it, and the conclusion - that the female Anopheles mosquito carries Plasmodium - was confirmed by further work.

Q8. Name two careers linked to biology and what each involves.

Medicine: doctors and nurses use biology to understand the human body, diagnose disease and treat patients. Agriculture: agricultural scientists use biology to improve crops, protect plants from pests and increase food production.

Long Questions with Answers - Chapter 1

Q1. Describe the levels of biological organization from atom to biosphere.

Life is organised in a series of levels, each built from the level below it. Atoms join to form molecules, and molecules assemble into organelles, the working parts inside cells. Cells are the basic units of life: every living thing is made of one or more cells. Similar cells working together form a tissue, such as muscle tissue. Different tissues combine to form an organ, such as the heart or a leaf. Organs working together form an organ system, such as the digestive system or the shoot system of a plant. All the organ systems together make an organism, a complete living thing. Beyond the individual, organisms of the same kind in one area form a population, and populations of different kinds living together form a community. A community together with its non-living surroundings - air, water, soil and light - forms an ecosystem. Finally, all the ecosystems of the Earth together make the biosphere, the part of the planet where life exists. Understanding these levels helps a student see how small structures build up into whole living systems and how living things relate to their environment.

Q2. Explain the steps of the scientific method, using the example of malaria.

The scientific method is the organised way scientists study a problem. First, a problem is recognised: in some areas, many people suffered from malaria. Second, observations are made: the disease was common where mosquitoes were common, and people protected from mosquitoes often stayed healthy. Third, a hypothesis is proposed, a testable possible explanation - in this case, that mosquitoes spread malaria. Fourth, experiments test the hypothesis: mosquitoes that had bitten malaria patients were allowed to bite healthy people, who then fell ill, while people kept away from mosquitoes stayed healthy. Fifth, a conclusion is drawn from the results: the female Anopheles mosquito carries the malarial parasite, Plasmodium, from one person to another. Further work by other scientists confirmed the conclusion, and it became accepted knowledge. This is why controlling mosquitoes controls malaria. The malaria example shows that science does not accept an idea just because it sounds reasonable; an idea must be tested by observation and experiment before it is trusted.

Long Questions with Answers - Chapter 1 (continued)

Q3. Describe the main branches of biology and explain how biology is linked with other sciences.

Biology is divided into three major divisions: zoology for animals, botany for plants and microbiology for microorganisms. It is further divided into branches that study one aspect of life. Morphology studies form and structure, anatomy studies internal structure, physiology studies functions, cytology studies cells, histology studies tissues, genetics studies inheritance, ecology studies relations between organisms and their environment, and biotechnology applies living things for human benefit. Biology does not stand alone; it is linked with other sciences. Biophysics applies the principles of physics to living things, for example in understanding how the eye focuses light or how blood flows. Biochemistry studies the chemical substances and reactions of life, such as how food is broken down in the body. Biomathematics uses mathematics to study populations, growth and disease patterns, and biogeography studies where organisms live and why. These links matter because living things follow physical and chemical laws, and because biology offers careers in medicine, agriculture, teaching, research, fisheries, forestry and biotechnology. A student who sees these connections understands biology as part of science as a whole, not as an isolated subject.

Answer Key - Chapter 1 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	A	B	C	B	A	B	C	C	B	B	B	B	B	B	C

Chapter 2 - Biodiversity

The variety of life on Earth, how organisms are named and classified, and why biodiversity must be protected.

MCQs - Chapter 2

1. Biodiversity means:

A) variety of genes only B) variety of life at gene, species and ecosystem levels C) number of animals only D) variety of plants only

2. The branch of biology that names and classifies organisms is:

A) Ecology B) Taxonomy C) Genetics D) Morphology

3. Binomial nomenclature was introduced by:

A) Whittaker B) Linnaeus C) Darwin D) Aristotle

4. In binomial nomenclature, the genus name is written:

A) in small letters, second B) with a capital letter, first C) in small letters, first D) with a capital letter, second

5. Scientific names are written in italics in print and ____ when handwritten:

A) in bold B) underlined C) in capitals D) in brackets

6. The scientific name of the human is:

A) Homo sapiens B) Sapiens homo C) Homo Sapiens D) homo Sapiens

7. Which kingdom contains bacteria?

A) Protista B) Monera C) Fungi D) Plantae

MCQs - Chapter 2 (continued)

8. Amoeba belongs to the kingdom:

A) Monera B) Protista C) Fungi D) Animalia

9. Mushrooms belong to the kingdom:

A) Plantae B) Protista C) Fungi D) Monera

10. Which of these is NOT a kingdom in the five-kingdom system?

A) Monera B) Protista C) Virus D) Fungi

11. Viruses are not placed in any kingdom because:

A) they are too small B) they are not made of cells C) they cause disease D) they are plants

12. A species that no longer exists anywhere on Earth is called:

A) endangered B) extinct C) rare D) protected

13. A species at serious risk of becoming extinct is called:

A) extinct B) endangered C) common D) fossil

14. Which of these causes loss of biodiversity?

A) conservation B) habitat destruction C) national parks D) wildlife sanctuaries

15. Conservation means:

A) hunting animals B) protection and careful management of species and habitats C) cutting forests D) introducing new species

Short Questions with Answers - Chapter 2

Q1. Define biodiversity and name its three levels.

Biodiversity is the variety of life on Earth. Its three levels are genetic diversity (variety of genes within a species), species diversity (variety of species) and ecosystem diversity (variety of ecosystems).

Q2. State the rules of binomial nomenclature.

Each species gets two names: the genus name first, written with a capital letter, and the species name second, written in small letters. The full name is written in italics in print and underlined in handwriting.

Q3. Why do scientists use scientific names instead of common names?

Common names differ from place to place and language to language, so one organism may have many local names. A scientific name is one name understood worldwide, which avoids confusion in scientific work.

Q4. Name the five kingdoms and give one example of each.

Monera (bacteria), Protista (Amoeba), Fungi (mushroom), Plantae (rose plant) and Animalia (human).

Q5. Why are viruses not placed in any kingdom?

Viruses are not made of cells, so they do not fit the cell-based kingdom system. They are particles of genetic material in a protein coat that can only reproduce inside a living host cell.

Q6. What is the difference between an extinct and an endangered species?

An extinct species no longer exists anywhere on Earth. An endangered species still exists but is at serious risk of becoming extinct.

Q7. Give two causes of biodiversity loss.

Habitat destruction, when forests and wetlands are cleared, and hunting, when animals are killed faster than they can reproduce. Pollution and the introduction of new species into an area also harm biodiversity.

Q8. Give two methods of conservation.

National parks, where habitats are protected by law, and wildlife sanctuaries, where animals are kept safe from hunting. Laws against hunting and breeding programmes for rare species also help.

Long Questions with Answers - Chapter 2

Q1. Explain binomial nomenclature and why scientists use it, with an example.

Common names cause confusion because they differ from place to place and language to language: one organism may have many local names, and one local name may be used for different organisms. Binomial nomenclature solves this by giving every species one scientific name understood all over the world. The name has two parts: the genus, which is a group of closely related species, and the species itself. The genus name is written first with a capital letter, and the species name second in small letters. For example, the scientific name of the human is Homo sapiens, where Homo is the genus and sapiens is the species. The name is written in italics in print and underlined in handwriting. The system was introduced by the Swedish scientist Carolus Linnaeus and is used by biologists everywhere, so a scientist in any country knows exactly which organism is meant. Without such a system, research, medicine and conservation work would be full of mistakes caused by wrong identification.

Q2. Compare the five kingdoms on the basis of cell type, cell number and mode of nutrition.

The five-kingdom system, proposed by Robert Whittaker, divides living things by cell type, cell number and nutrition. Monera are single-celled organisms without a true nucleus; bacteria are the main example, and they make their own food or absorb it from their surroundings. Protista are mostly single-celled organisms with a true nucleus; some, like certain algae, photosynthesise, while others, like Amoeba, take in food. Fungi are mostly multicellular organisms with a true nucleus that absorb food from dead or living matter; mushrooms and moulds are examples. Plantae are multicellular organisms with a true nucleus that make their own food by photosynthesis, such as a rose plant. Animalia are multicellular organisms with a true nucleus that take in food by eating other organisms, such as humans. This comparison shows a clear pattern: from Monera to Animalia, organisms become more complex in cell structure and organisation, and nutrition changes from absorption and photosynthesis to eating other organisms.

Long Questions with Answers - Chapter 2 (continued)

Q3. Explain the threats to biodiversity and how conservation protects it.

Biodiversity is threatened in several ways. Habitat destruction is the greatest threat: when forests are cut, wetlands drained or grasslands ploughed, the organisms living there lose their homes and food. Hunting kills animals faster than they can reproduce, and pollution poisons air, water and soil. Introducing a new species into an area can also harm native species, because the newcomer may eat them or compete for food and space. When these pressures continue, species become endangered, and if nothing changes, they become extinct and are lost forever. Conservation means protecting species and their habitats to prevent this loss. National parks and wildlife sanctuaries protect whole habitats by law, so animals and plants can live and breed safely. Laws against hunting protect threatened animals, and breeding programmes help rare species recover. Conservation also matters for people: biodiversity gives food, medicines, timber and clean air and water, and a healthy variety of life keeps ecosystems stable. Protecting biodiversity is therefore not only about saving animals and plants, but also about protecting human life itself.

Answer Key - Chapter 2 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	B	A	B	B	C	C	B	B	B	B	B

Chapter 3 - The Cell

The basic unit of life, cell theory, prokaryotic and eukaryotic cells, and the jobs of the organelles.

MCQs - Chapter 3

1. Who first observed cells in cork in 1665?

A) Schwann B) Hooke C) Virchow D) Schleiden

2. Cell theory states that all cells arise from:

A) air B) pre-existing cells C) soil D) water

3. Which cell type has no true nucleus?

A) Eukaryotic B) Prokaryotic C) Plant cell D) Animal cell

4. Bacteria are:

A) eukaryotic B) prokaryotic C) viruses D) fungi

5. The cell membrane controls the:

A) release of energy B) passage of materials in and out of the cell C) making of proteins D) photosynthesis

6. The powerhouse of the cell is the:

A) nucleus B) ribosome C) mitochondrion D) Golgi apparatus

7. Proteins are made in the:

A) lysosomes B) ribosomes C) vacuoles D) mitochondria

MCQs - Chapter 3 (continued)

8. Which organelle packs and sends out proteins?

A) Golgi apparatus B) Endoplasmic reticulum C) Lysosome D) Nucleus

9. Which organelle digests worn-out cell parts?

A) Ribosome B) Lysosome C) Mitochondrion D) Vacuole

10. Rough endoplasmic reticulum differs from smooth endoplasmic reticulum because it has:

A) ribosomes B) DNA C) chlorophyll D) vacuoles

11. Which structures are found in plant cells but not in animal cells?

A) mitochondria and nucleus B) cell wall, chloroplasts and a large central vacuole C) ribosomes and Golgi apparatus D) cell membrane and cytoplasm

12. Chloroplasts are the site of:

A) respiration B) photosynthesis C) protein synthesis D) digestion

13. The nucleus controls the cell and holds the:

A) ATP B) genetic material C) water D) pigments

14. The jelly-like fluid in which the organelles sit is the:

A) cell sap B) cytoplasm C) plasma D) vacuole fluid

15. Schleiden and Schwann proposed that:

A) cells come from air B) plants and animals are made of cells C) cells have no nucleus D) bacteria are animals

Short Questions with Answers - Chapter 3

Q1. State the three points of cell theory.

All living things are made of one or more cells; the cell is the basic unit of life; and all cells arise from pre-existing cells.

Q2. What is the difference between a prokaryotic and a eukaryotic cell?

A prokaryotic cell has no true nucleus and no membrane-bound organelles, and its genetic material lies free in the cytoplasm. A eukaryotic cell has a true nucleus and membrane-bound organelles.

Q3. Why is the mitochondrion called the powerhouse of the cell?

Because it releases energy from food during respiration. The energy released is stored as ATP, which powers all the work of the cell.

Q4. Name three structures found in plant cells but not in animal cells, and give one function of each.

Cell wall: gives support and protection. Chloroplasts: carry out photosynthesis. Large central vacuole: stores sap and keeps the cell firm.

Q5. What is the function of the cell membrane?

The cell membrane is the boundary of the cell. It controls what enters and leaves the cell, letting useful substances in and keeping harmful substances out.

Q6. What is the difference between rough and smooth endoplasmic reticulum?

Rough endoplasmic reticulum has ribosomes on its surface and helps make and transport proteins. Smooth endoplasmic reticulum has no ribosomes and helps make lipids and transport materials.

Q7. What does the Golgi apparatus do?

The Golgi apparatus modifies, packs and sends out proteins made in the cell. It prepares them for use inside the cell or for export outside it.

Q8. What is the function of lysosomes?

Lysosomes digest unwanted material and worn-out organelles. They act as the cleaning system of the cell, breaking down waste so it can be removed or reused.

Long Questions with Answers - Chapter 3

Q1. Compare plant and animal cells.

Plant and animal cells share many structures because both are eukaryotic cells. Both have a cell membrane, cytoplasm, nucleus, mitochondria, ribosomes, endoplasmic reticulum and Golgi apparatus, and both carry out the basic activities of life. The differences come from the different ways plants and animals live. Plant cells have a rigid cell wall outside the membrane, which gives the cell a fixed shape and protects it. They also have chloroplasts, which trap sunlight for photosynthesis, because plants make their own food. Plant cells have a large central vacuole that stores cell sap and keeps the cell firm. Animal cells lack a cell wall and chloroplasts, because animals take in food instead of making it, and they have only small vacuoles or none at all. Because of the wall, plant cells are usually regular in shape, while animal cells vary in shape. These differences show how cell structure matches the way of life of the organism.

Q2. Describe the functions of the main organelles of a eukaryotic cell.

Each organelle in a eukaryotic cell has a particular job, and together they keep the cell alive. The nucleus controls all cell activities and holds the genetic material that guides the cell. The cell membrane forms the boundary of the cell and controls what enters and leaves. The cytoplasm is the jelly-like fluid in which the organelles sit and where many chemical reactions take place. Mitochondria release energy from food during respiration and are called the powerhouse of the cell. Ribosomes build proteins by joining amino acids. The endoplasmic reticulum transports materials within the cell: the rough type, covered with ribosomes, handles proteins, while the smooth type handles lipids. The Golgi apparatus modifies, packs and sends out proteins. Lysosomes digest unwanted material and worn-out organelles. In plant cells there are extra organelles: chloroplasts trap sunlight for photosynthesis, the cell wall gives support, and the large central vacuole stores water and substances. When all organelles work together, the cell grows, repairs itself and carries out its functions properly.

Long Questions with Answers - Chapter 3 (continued)

Q3. Explain cell theory and how it developed over time.

Cell theory is the idea that all living things are made of cells, that the cell is the basic unit of life, and that all cells arise from pre-existing cells. It developed step by step as microscopes improved. In 1665, Robert Hooke looked at thin slices of cork under a microscope and saw small box-like compartments, which he called cells, although he was really seeing the walls of dead plant cells. Later, the botanist Schleiden studied plants and the zoologist Schwann studied animals, and both concluded that plants and animals are made of cells. This was a major step, because it showed that the same basic unit builds all living things. Later, Virchow added the third point: new cells come only from existing cells, so cells do not appear from nothing. Together, these ideas became cell theory, one of the most important ideas in biology. It explains growth, repair and reproduction: an organism grows because its cells divide, and every new cell has a parent cell. Cell theory also guides medicine, because disease is often understood as a problem in cells.

Answer Key - Chapter 3 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	B	C	B	A	B	A	B	B	B	B	B

Chapter 4 - Cell Cycle

How a cell grows, copies its DNA and divides - mitosis, meiosis and why cell division matters.

MCQs - Chapter 4

1. DNA is copied during which stage of interphase?

A) G1 B) S C) G2 D) M

2. During the G1 stage, the cell:

A) copies its DNA B) grows and makes proteins C) divides D) stops all activity

3. Chromosomes line up in the middle of the cell during:

A) prophase B) metaphase C) anaphase D) telophase

4. Sister chromatids are pulled apart to opposite ends during:

A) metaphase B) anaphase C) telophase D) prophase

5. Nuclear membranes form again around each set of chromosomes during:

A) prophase B) metaphase C) anaphase D) telophase

6. Division of the cytoplasm after nuclear division is called:

A) mitosis B) meiosis C) cytokinesis D) karyokinesis

7. Mitosis produces:

A) four different cells B) two genetically identical cells C) one cell D) eight cells

MCQs - Chapter 4 (continued)

8. Meiosis produces:

A) two identical cells B) four haploid cells C) two haploid cells D) four identical cells

9. Crossing over takes place during:

A) mitosis B) meiosis I C) cytokinesis D) interphase

10. Crossing over creates:

A) identical cells B) new combinations of genes C) extra chromosomes D) cell walls

11. Gametes (sex cells) are produced by:

A) mitosis B) meiosis C) cytokinesis D) budding

12. Homologous chromosomes are:

A) identical copies of one chromosome B) a pair, one from each parent, carrying genes for the same traits C) two nuclei in one cell D) sister chromatids

13. Mitosis is important for:

A) making gametes B) growth and repair C) fertilisation D) seed dispersal

14. Uncontrolled cell division may form a:

A) tissue B) tumour C) organ D) gamete

15. The long growing and copying stage of the cell cycle is:

A) mitotic phase B) interphase C) cytokinesis D) telophase

Short Questions with Answers - Chapter 4

Q1. What are the two main parts of the cell cycle?

Interphase, the long stage when the cell grows and copies its DNA, and the mitotic phase, the shorter stage when the cell divides.

Q2. What happens during the S stage of interphase?

The DNA is copied, so that each daughter cell will receive a complete set of genetic material after division.

Q3. Name the four stages of mitosis in order.

Prophase, metaphase, anaphase and telophase.

Q4. What is cytokinesis?

Cytokinesis is the division of the cytoplasm after the nucleus has divided. It gives two separate daughter cells, each with its own nucleus.

Q5. What is crossing over, and why is it important?

Crossing over is the exchange of pieces between homologous chromosomes during meiosis I. It creates new combinations of genes, which produces variation among offspring.

Q6. What is the difference between a haploid cell and a diploid cell?

A haploid cell has a single set of chromosomes, as in gametes. A diploid cell has two sets of chromosomes, one set from each parent, as in most body cells.

Q7. Why does meiosis produce variation but mitosis does not?

Meiosis includes crossing over and the separation of homologous chromosomes, which shuffle genes into new combinations. Mitosis copies the cell exactly, so the daughter cells are genetically identical to the parent.

Q8. Give two uses of mitosis in the body.

Growth: a multicellular organism grows because its cells divide by mitosis. Repair: worn-out or damaged cells are replaced by new identical cells produced by mitosis.

Long Questions with Answers - Chapter 4

Q1. Describe the stages of mitosis and explain its importance.

Mitosis is the division of the nucleus that produces two daughter cells genetically identical to the parent cell. It has four stages. In prophase, the chromosomes shorten and become visible, and the nuclear membrane begins to disappear. In metaphase, the chromosomes line up across the middle of the cell. In anaphase, the sister chromatids separate and move to opposite ends of the cell. In telophase, nuclear membranes form around each set of chromosomes. After the nucleus has divided, cytokinesis divides the cytoplasm, giving two daughter cells. Mitosis is important because it produces identical cells for growth, for replacing worn-out cells and for repairing damaged tissues. A young organism grows because its cells keep dividing, and a cut heals because new cells replace the damaged ones. Because mitosis copies the genetic material exactly, every new cell carries the same instructions as the parent cell, which keeps the body working in an organised way. Without mitosis, growth and repair would be impossible.

Q2. Compare mitosis and meiosis.

Mitosis and meiosis are both forms of cell division, but they differ in purpose, number of divisions and results. Mitosis has one division and produces two daughter cells that are genetically identical to the parent cell and have the full chromosome number. It takes place in body cells and is used for growth, repair and replacement of worn-out cells. Meiosis has two divisions, meiosis I and meiosis II, and produces four daughter cells that are genetically different from the parent and have half the chromosome number. It takes place in reproductive organs and produces gametes for sexual reproduction. Crossing over happens during meiosis I but not in mitosis, and homologous chromosomes separate in meiosis I, which shuffles genes into new combinations. This is why meiosis creates variation among offspring, while mitosis keeps the genetic material unchanged. The halving of chromosomes in meiosis is also essential: when two gametes join at fertilisation, the full chromosome number is restored in the offspring.

Long Questions with Answers - Chapter 4 (continued)

Q3. Describe interphase and explain why DNA must be copied before division.

Interphase is the longest part of the cell cycle. Although the cell is not dividing during interphase, it is very active: it grows, carries out its normal functions and prepares to divide. Interphase has three stages. In G1, the cell grows and makes proteins and new organelles. In the S stage, the DNA is copied, so that each chromosome now consists of two identical sister chromatids. In G2, the cell grows more and prepares the structures needed for division. Copying the DNA before division is essential because each daughter cell must receive a complete set of genetic instructions. If a cell divided without copying its DNA, each daughter cell would get only half the instructions and could not work properly. Copying also allows errors to be checked, because the cell has time to repair damage before dividing. Mistakes in controlling the cell cycle can be dangerous: if a cell divides without proper control, growth becomes uncontrolled and may form a tumour. Interphase therefore protects the organism by making sure division happens only when the cell is ready and its genetic material is complete.

Answer Key - Chapter 4 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	D	C	B	B	B	B	B	B	B	B	B

Chapter 5 - Tissues, Organs, and Organ Systems

How similar cells form tissues, tissues form organs, and organs work together as systems in plants and animals.

MCQs - Chapter 5

1. A group of similar cells working together for a particular function is a:

A) organ B) tissue C) system D) organism

2. Which plant tissue carries water and dissolved minerals upward?

A) Phloem B) Xylem C) Parenchyma D) Collenchyma

3. Food made in leaves is carried to other parts by the:

A) xylem B) phloem C) sclerenchyma D) cambium

4. Apical meristems are found at:

A) leaf bases B) root and shoot tips C) stem sides D) flower centres

5. Lateral meristems make stems and roots grow:

A) longer B) thicker C) greener D) faster

6. Parenchyma cells are:

A) thick-walled and dead B) thin-walled, used for storage and photosynthesis C) water carriers D) food carriers

7. Sclerenchyma tissue gives the plant:

A) colour B) strength and support C) movement D) food

MCQs - Chapter 5 (continued)

8. Collenchyma mainly supports:

A) old woody parts B) young growing parts C) roots only D) flowers only

9. Blood is an example of which animal tissue?

A) Epithelial B) Muscular C) Connective D) Nervous

10. Cardiac muscle is found in the:

A) stomach B) heart C) skin D) bones

11. Skeletal muscles are:

A) involuntary B) under conscious control C) found in the heart D) smooth

12. Messages in the body are carried by:

A) epithelial tissue B) nervous tissue C) connective tissue D) muscular tissue

13. A neuron is a:

A) muscle cell B) nerve cell C) blood cell D) plant cell

14. In a flowering plant, the root system:

A) makes food B) anchors the plant and absorbs water C) reproduces D) makes flowers

15. The shoot system of a plant includes the:

A) roots only B) stem, leaves and flowers C) root hairs D) xylem only

Short Questions with Answers - Chapter 5

Q1. Define tissue, organ and organ system, giving one example of each.

A tissue is a group of similar cells working together for a function, for example muscular tissue. An organ is a structure made of different tissues working together, for example the heart. An organ system is a group of organs working together for a major function, for example the circulatory system.

Q2. What is the difference between meristematic and permanent tissue?

Meristematic tissue is made of young, dividing cells found at growing regions. Permanent tissue is made of cells that have stopped dividing and have taken on a fixed function, such as storage or support.

Q3. What are the functions of xylem and phloem?

Xylem carries water and dissolved minerals from the roots upward to stems and leaves. Phloem carries food made in the leaves to all other parts of the plant.

Q4. Name the four types of animal tissue and give one example of each.

Epithelial tissue (skin), connective tissue (blood or bone), muscular tissue (skeletal muscle) and nervous tissue (neurons of the brain).

Q5. What is the difference between parenchyma and sclerenchyma?

Parenchyma is made of soft, thin-walled living cells used for storage and photosynthesis. Sclerenchyma is made of thick-walled cells that give strength and support, and these cells are often dead at maturity.

Q6. Where are apical, lateral and intercalary meristems found?

Apical meristems are at root and shoot tips. Lateral meristems are at the sides of stems and roots. Intercalary meristems occur at the base of leaves and internodes, especially in grasses.

Q7. Name three human organ systems and one function of each.

Digestive system: breaks down food. Circulatory system: transports substances around the body. Respiratory system: carries out gas exchange, taking in oxygen and giving out carbon dioxide.

Q8. What is the difference between skeletal, smooth and cardiac muscle?

Skeletal muscle is attached to bones and is under conscious control. Smooth muscle is found in internal organs such as the stomach and works without conscious control. Cardiac muscle is found only in the heart and contracts rhythmically without tiring.

Long Questions with Answers - Chapter 5

Q1. Describe the types of plant tissue and their functions.

Plant tissues are of two main kinds: meristematic and permanent. Meristematic tissues are made of young, dividing cells found at growing regions. Apical meristems at root and shoot tips make the plant grow longer. Lateral meristems at the sides of stems and roots make them grow thicker. Intercalary meristems at the base of leaves and internodes, common in grasses, allow growth from the base. Permanent tissues are made of cells that have stopped dividing. Simple permanent tissues are parenchyma, collenchyma and sclerenchyma. Parenchyma is made of soft, thin-walled cells used for storage and photosynthesis. Collenchyma has cells with thickened corners and supports young growing parts while still allowing growth. Sclerenchyma has thick-walled cells that give strength to older parts such as seed coats and woody stems. Complex permanent tissues are xylem and phloem. Xylem carries water and dissolved minerals upward from roots, while phloem carries food from leaves to the rest of the plant. Together, these tissues let a plant grow, support itself, feed itself and transport substances.

Q2. Describe the four types of animal tissue.

Animal bodies are built from four types of tissue. Epithelial tissue covers surfaces and lines organs and cavities. It protects the body, as in the skin, and lines organs such as the stomach and intestines, where it can also absorb substances. Connective tissue joins and supports other tissues. It includes blood, which transports substances; bone, which supports the body; cartilage, which cushions joints; and tendons, which join muscles to bones. Muscular tissue contracts to produce movement. Skeletal muscle moves the bones and is under conscious control. Smooth muscle is found in the walls of internal organs such as the stomach and intestines and works without conscious control. Cardiac muscle is found only in the heart; it contracts rhythmically all through life without tiring. Nervous tissue carries messages around the body. It is made of nerve cells called neurons, which carry impulses, supported by other cells that protect and nourish them. Each tissue type has a structure that matches its job, and organs are built by combining these tissues in different proportions.

Long Questions with Answers - Chapter 5 (continued)

Q3. Explain how cells, tissues, organs and organ systems are related, with plant and animal examples.

Living things are organised in levels, and each level is built from the one below it. Similar cells working together form a tissue. For example, muscle cells form muscular tissue in animals, and thin-walled cells form parenchyma in plants. Different tissues working together form an organ. The heart is an organ made of muscular tissue that pumps, connective tissue that supports it, nervous tissue that controls its beating, and epithelial tissue that covers its surfaces. A leaf is a plant organ made of tissues for photosynthesis, transport and protection. Organs working together form an organ system. The heart, blood vessels and blood form the circulatory system, which transports oxygen, food and wastes around the body. In a flowering plant, the root system anchors the plant and absorbs water, while the shoot system, made of stem, leaves and flowers, makes food and reproduces. The two systems together make the whole plant body. This organisation is efficient: instead of every cell doing every job, cells specialise, and groups of specialised cells cooperate. That cooperation is what allows large, complex organisms to live and work properly.

Answer Key - Chapter 5 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	B	B	B	B	C	B	B	B	B	B	B

Chapter 6 - Biomolecules

The carbon-based molecules of life: carbohydrates, proteins, lipids, nucleic acids and water.

MCQs - Chapter 6

1. Which of these is a monosaccharide?

A) Sucrose B) Starch C) Glucose D) Cellulose

2. Table sugar (sucrose) is a:

A) monosaccharide B) disaccharide C) polysaccharide D) protein

3. Starch is the energy store of:

A) animals B) plants C) bacteria only D) fungi only

4. Glycogen is the energy store of:

A) plants B) animals C) algae D) viruses

5. Cellulose forms the:

A) animal cell membrane B) plant cell wall C) muscle fibre D) blood cell

6. Proteins are made of:

A) fatty acids B) nucleotides C) amino acids D) sugars

7. Amino acids are joined together by:

A) hydrogen bonds B) peptide bonds C) ionic bonds D) glycosidic bonds

MCQs - Chapter 6 (continued)

8. Haemoglobin is a protein that carries:

A) food B) oxygen C) hormones D) water

9. Antibodies are proteins that:

A) store energy B) defend the body C) build cell walls D) carry oxygen

10. Compared with carbohydrates, fats store per gram:

A) less energy B) more energy C) equal energy D) no energy

11. Phospholipids form the:

A) cell wall B) cell membrane C) bone D) hair

12. DNA is a nucleic acid that is:

A) single-stranded B) double-stranded C) triple-stranded D) not a nucleic acid

13. RNA is usually:

A) double-stranded B) single-stranded C) absent from cells D) made of amino acids

14. A nucleotide is made of:

A) a sugar, a phosphate group and a nitrogenous base B) amino acids C) fatty acids and glycerol D) glucose units

15. Water helps control body temperature because it:

A) boils quickly B) heats and cools slowly C) is acidic D) has no heat capacity

Short Questions with Answers - Chapter 6

Q1. Name the four main classes of biomolecules.

Carbohydrates, proteins, lipids and nucleic acids.

Q2. What is the difference between starch, glycogen and cellulose?

Starch stores energy in plants, glycogen stores energy in animals, and cellulose forms plant cell walls and provides fibre in the diet. All three are polysaccharides made of glucose units.

Q3. Why is the shape of a protein important?

A protein's shape decides its job. A wrongly shaped protein cannot bind its target or carry out its function, just as a wrongly shaped key cannot open a lock.

Q4. What are nucleotides made of?

Each nucleotide is made of a sugar, a phosphate group and a nitrogenous base. Nucleotides join to form DNA and RNA.

Q5. Give two functions of lipids.

Lipids store energy, and they store more energy per gram than carbohydrates. They also insulate the body, protect organs, and form cell membranes as phospholipids.

Q6. What is the difference between DNA and RNA?

DNA is double-stranded and stores the hereditary instructions for making proteins. RNA is usually single-stranded and helps turn those instructions into proteins.

Q7. Why is carbon central to biomolecules?

Each carbon atom can form four bonds, so carbon atoms can join into long chains and rings of many shapes. This allows the huge variety of molecules that living things need.

Q8. Why is water essential for life?

Water is the medium in which most life reactions happen. It dissolves substances, carries materials around the body, and helps control temperature because it heats and cools slowly.

Long Questions with Answers - Chapter 6

Q1. Describe carbohydrates and their roles, from monosaccharides to polysaccharides.

Carbohydrates are made of carbon, hydrogen and oxygen and are the main quick source of energy for living things. The simplest carbohydrates are monosaccharides, single sugar units such as glucose and fructose. Glucose is the main fuel of cells: it is broken down in respiration to release energy. Two monosaccharides joined together make a disaccharide, such as sucrose, the sugar used in tea and cooking, and lactose, the sugar in milk. Many monosaccharides joined together make a polysaccharide. Starch is the energy store of plants: plants make glucose in photosynthesis and store the extra as starch. Glycogen is the energy store of animals, kept mainly in the liver and muscles, and released as glucose when the body needs energy. Cellulose is also a polysaccharide of glucose units, but it is used for structure rather than energy: it builds plant cell walls and provides fibre in the human diet, which helps digestion. So carbohydrates give quick energy as sugars, stored energy as starch and glycogen, and structural strength as cellulose.

Q2. Compare the functions of proteins, lipids and nucleic acids.

Proteins, lipids and nucleic acids each cover different needs of the cell. Proteins are built from amino acids joined by peptide bonds into chains that fold into particular shapes, and their shape decides their job. Structural proteins build parts of the body, such as collagen in skin and keratin in hair. Transport proteins carry substances, such as haemoglobin carrying oxygen in blood. Defensive proteins such as antibodies protect the body from disease, and enzymes are proteins that speed up reactions. Lipids, including fats and oils made of fatty acids and glycerol, store the most energy per gram, insulate the body against cold, and protect organs. Phospholipids, with a water-loving head and water-fearing tails, form cell membranes. Steroids such as cholesterol and some hormones are also lipids. Nucleic acids store and pass on hereditary information. DNA holds the instructions for the whole organism, and RNA helps turn those instructions into proteins. Together, these three classes cover structure, energy, control and inheritance: proteins do most of the work, lipids store energy and build membranes, and nucleic acids hold the instructions.

Long Questions with Answers - Chapter 6 (continued)

Q3. Explain why proteins are called the working molecules of the cell, with examples.

Proteins are often called the working molecules of the cell because they carry out most of the jobs that keep a cell and a body alive. They are built from amino acids joined by peptide bonds into long chains that fold into particular shapes, and each shape suits one job. Structural proteins build the body: collagen gives strength to skin, tendons and bones, and keratin forms hair and nails. Transport proteins move substances: haemoglobin in red blood cells carries oxygen from the lungs to the tissues. Defensive proteins protect the body: antibodies recognise and attack germs that enter the body. Enzymes are proteins that speed up chemical reactions, without which the reactions of life would be far too slow. Some proteins act as signals, such as many hormones, carrying messages between parts of the body. Because proteins do building, carrying, defending, signalling and speeding up reactions, almost every activity of a cell depends on them. When a protein loses its shape, it loses its function, which is why conditions that denature proteins, such as strong heat, can seriously damage living things.

Answer Key - Chapter 6 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	C	B	B	B	B	C	B	B	B	B	B	B	B	A	B

Chapter 7 - Enzymes

Biological catalysts: how enzymes work, why they are specific, and what affects their speed.

MCQs - Chapter 7

1. Most enzymes are made of:

A) carbohydrate B) protein C) lipid D) nucleic acid

2. The part of an enzyme where the substrate fits is the:

A) active site B) cofactor C) product D) inhibitor

3. The substance an enzyme acts on is called the:

A) product B) substrate C) inhibitor D) coenzyme

4. An enzyme denatured by heat has lost its:

A) substrate B) shape C) cofactor D) products

5. In the lock-and-key model, the substrate fits the active site:

A) after the enzyme changes shape B) exactly, without any change C) only at high temperature D) only with a cofactor

6. In the induced-fit model, the active site:

A) never changes B) changes shape slightly to grip the substrate better C) breaks apart D) releases the enzyme

7. As substrate concentration rises, the reaction rate first rises and then:

A) falls to zero B) levels off C) doubles each time D) stops at once

MCQs - Chapter 7 (continued)

8. Raising the enzyme concentration increases the rate as long as:

A) temperature is zero B) substrate is available C) pH is zero D) no products form

9. A non-protein helper such as a metal ion is called a:

A) coenzyme B) cofactor C) inhibitor D) substrate

10. An organic helper such as a vitamin is called a:

A) cofactor B) coenzyme C) inhibitor D) product

11. An inhibitor is a substance that:

A) speeds up enzymes B) slows down or stops enzymes C) builds enzymes D) replaces substrates

12. Enzymes are not used up in reactions because they are:

A) products of the reaction B) released unchanged after the reaction C) dissolved by the substrate D) substrates themselves

13. Each enzyme usually works on:

A) all substrates B) one substrate or a few similar ones C) only water D) only proteins

14. Enzymes in biological washing powders help to:

A) colour clothes B) break down stains C) soften water D) add scent

15. Beyond the optimum temperature, enzyme activity:

A) keeps rising B) falls sharply C) stays the same D) doubles

Short Questions with Answers - Chapter 7

Q1. What is an enzyme, and why is it called a biological catalyst?

An enzyme is a substance, usually a protein, that speeds up a chemical reaction in a living thing without being used up in the reaction. That is exactly what a catalyst does, so enzymes are called biological catalysts.

Q2. What is the active site?

The active site is the specially shaped region of an enzyme where the substrate fits and the reaction takes place. Its shape decides which substrate the enzyme can work on.

Q3. What is an enzyme-substrate complex?

It is the temporary joining of an enzyme and its substrate during a reaction. While joined, the reaction takes place more easily; then the products are released and the enzyme is free to work again.

Q4. What happens to an enzyme at very high temperature?

Its shape breaks down, which is called denaturation. The substrate no longer fits the active site, so the enzyme stops working.

Q5. What is the difference between the lock-and-key and induced-fit models?

In the lock-and-key model, the substrate fits the active site exactly without any change, like a key in a lock. In the induced-fit model, the active site changes shape slightly to grip the substrate better, like a glove moulding to a hand.

Q6. What is the difference between a cofactor and a coenzyme?

A cofactor is a non-protein helper needed by some enzymes, such as a metal ion. A coenzyme is an organic helper, such as many vitamins, that also helps the enzyme work.

Q7. What is an inhibitor? How can it slow an enzyme?

An inhibitor is a substance that slows down or stops an enzyme. It may block the active site so the substrate cannot enter, or it may bind elsewhere on the enzyme and change the enzyme's shape.

Q8. Give two everyday or industrial uses of enzymes.

Biological washing powders use enzymes to break down stains in clothes. In food making, enzymes are used in baking and cheese making, and in medicine, enzyme tests help diagnose disease.

Long Questions with Answers - Chapter 7

Q1. Explain how an enzyme works, using the enzyme-substrate complex.

An enzyme works by giving a reaction an easier path. The substrate, the substance the enzyme acts on, fits into the enzyme's active site, a specially shaped region on the enzyme surface. The enzyme and substrate join briefly to form a temporary enzyme-substrate complex. While they are joined, the reaction takes place more easily than it would on its own: bonds in the substrate may be broken, or new bonds may be formed. The products of the reaction are then released, and the enzyme itself is unchanged, so it is free to act on another substrate molecule. Because the enzyme is not used up, one enzyme molecule can catalyse many reactions, one after another. The fit is specific: only a substrate with the right shape can enter the active site, which is why each enzyme works on only one substrate or a small group of similar substrates. This specificity is important in the cell, because it means each reaction is controlled by its own enzyme, and the cell can switch reactions on or off by controlling its enzymes.

Q2. Describe how temperature, pH, substrate concentration and enzyme concentration affect enzyme activity.

Four factors strongly affect how fast an enzyme works. Temperature: as temperature rises, molecules move faster, so the enzyme and substrate meet more often and the reaction speeds up. But every enzyme has an optimum temperature at which it works fastest; beyond it, the heat breaks down the enzyme's shape, the enzyme denatures, and activity falls sharply. pH: each enzyme works best at its own optimum pH, and moving far from it denatures the enzyme and lowers activity, which is why enzymes in the stomach and in the blood work at different pH values. Substrate concentration: adding more substrate increases the rate, because more active sites are filled, but only until all active sites are busy; after that, the rate levels off and cannot rise further. Enzyme concentration: adding more enzyme increases the rate, because more active sites are available, as long as there is enough substrate to fill them. Understanding these factors explains why the body keeps its temperature and pH steady: enzymes only work well within narrow conditions.

Long Questions with Answers - Chapter 7 (continued)

Q3. Explain enzyme specificity and the two models of enzyme action, and why specificity matters in the cell.

Enzyme specificity means that each enzyme usually works on only one substrate or a small group of similar substrates. This happens because the active site has a particular shape that only a matching substrate can fit. Two models explain the fit. In the lock-and-key model, the substrate fits the active site exactly, like a key fitting a lock, with no change in either shape. In the induced-fit model, the active site is flexible: when the substrate arrives, the active site changes shape slightly to grip it better, like a glove moulding to a hand. The induced-fit model explains why some enzymes can work on a few similar substrates and why binding can change the enzyme's activity. Specificity matters because a cell carries out thousands of reactions at once. If enzymes were not specific, they would act on the wrong substances and the cell's chemistry would fall into disorder. Instead, each reaction has its own enzyme, so the cell can control each reaction separately, speeding one up and slowing another down as needed. Medicines also use specificity: many drugs work by fitting into the active site of one particular enzyme and blocking it.

Answer Key - Chapter 7 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	A	B	B	B	B	B	B	B	B	B	B	B	B	B

Chapter 8 - Bioenergetics

How living things obtain, store and use energy: ATP, photosynthesis and cellular respiration.

MCQs - Chapter 8

1. The energy currency of the cell is:

A) DNA B) ATP C) Glucose D) NADPH

2. When ATP releases energy for cell work, it becomes:

A) ADP B) AMP C) DNA D) RNA

3. The oxygen released in photosynthesis comes from the splitting of:

A) carbon dioxide B) glucose C) water D) chlorophyll

4. Photosynthesis takes place in the:

A) mitochondria B) chloroplasts C) nucleus D) ribosomes

5. The green pigment that traps light energy for photosynthesis is:

A) haemoglobin B) chlorophyll C) melanin D) carotene

6. The light-dependent reactions of photosynthesis happen in the:

A) stroma B) thylakoids (grana) C) nucleus D) cytoplasm

7. The Calvin cycle takes place in the:

A) grana B) stroma C) thylakoid membrane D) mitochondrion

MCQs - Chapter 8 (continued)

8. In the Calvin cycle, the gas that is fixed into glucose is:

A) oxygen B) carbon dioxide C) nitrogen D) hydrogen

9. Which of these is NOT a limiting factor of photosynthesis?

A) light intensity B) carbon dioxide concentration C) temperature D) soil colour

10. Aerobic respiration is respiration that uses:

A) no oxygen B) oxygen C) sunlight D) chlorophyll

11. Glycolysis, the first stage of respiration, takes place in the:

A) mitochondrion B) cytoplasm C) chloroplast D) nucleus

12. Most of the ATP in aerobic respiration is made by the:

A) cytoplasm B) electron transport chain in the mitochondria C) chloroplast D) nucleus

13. Anaerobic respiration in yeast produces:

A) lactic acid only B) ethanol and carbon dioxide C) oxygen D) glucose

14. Anaerobic respiration in hard-working muscle cells produces:

A) ethanol B) lactic acid C) oxygen D) carbon dioxide only

15. Fermentation by yeast is used in:

A) baking and brewing B) photosynthesis C) digestion D) breathing

Short Questions with Answers - Chapter 8

Q1. What is ATP, and why is it called the energy currency of the cell?

ATP is adenosine triphosphate. It stores energy in its phosphate bonds and releases it when a phosphate is removed, so cells use it to pay for energy-requiring work, like money in trade.

Q2. Write the word equation for photosynthesis.

Carbon dioxide + water, in the presence of sunlight and chlorophyll, gives glucose + oxygen.

Q3. Where do the two stages of photosynthesis take place?

The light-dependent reactions take place in the thylakoids (grana) of the chloroplast, and the light-independent reactions (Calvin cycle) take place in the stroma.

Q4. What are the products of the light-dependent reactions?

Oxygen, released when water is split, and the energy carriers ATP and NADPH, which are used in the Calvin cycle to build glucose.

Q5. What is the difference between aerobic and anaerobic respiration?

Aerobic respiration uses oxygen and releases much energy plus carbon dioxide and water. Anaerobic respiration works without oxygen and releases little energy plus ethanol (in yeast) or lactic acid (in muscle).

Q6. What is fermentation? Give one example.

Fermentation is the anaerobic breakdown of glucose. For example, yeast breaks down glucose into ethanol and carbon dioxide, which is used in baking and brewing.

Q7. Name three limiting factors of photosynthesis and explain what "limiting" means.

Light intensity, carbon dioxide concentration and temperature. A limiting factor is the factor in shortest supply: raising it increases the rate, but only until another factor becomes limiting instead.

Q8. Why does lactic acid build up in muscles during hard exercise?

During hard exercise, the muscles need energy faster than oxygen can be supplied, so they respire anaerobically. This produces lactic acid, which causes tiredness and cramps until oxygen supply catches up.

Long Questions with Answers - Chapter 8

Q1. Describe the two stages of photosynthesis.

Photosynthesis is the process by which plants use sunlight to make glucose from carbon dioxide and water, and it has two stages. In the light-dependent reactions, which happen in the thylakoids (grana) of the chloroplast, chlorophyll traps light energy. The energy splits water into hydrogen and oxygen. Oxygen is released into the air, and the energy is stored in the carriers ATP and NADPH. In the light-independent reactions, known as the Calvin cycle, which happen in the stroma and do not need light directly, carbon dioxide is fixed and combined with hydrogen from NADPH, using energy from ATP, to build glucose. So light energy is first captured and stored in the light-dependent reactions, and then used in the Calvin cycle to make food. The glucose made may be used at once for energy, stored as starch, or used to build other substances the plant needs. The rate of photosynthesis is limited by light intensity, carbon dioxide concentration and temperature: raising any one increases the rate only until another factor becomes limiting.

Q2. Describe aerobic respiration and compare it with anaerobic respiration.

Aerobic respiration releases energy from food using oxygen, and it happens in three stages. First, glycolysis takes place in the cytoplasm, where glucose is split into pyruvate with a small gain of ATP. Pyruvate then enters the mitochondria, where the Krebs cycle releases carbon dioxide and prepares energy carriers. Finally, the electron transport chain in the mitochondria uses oxygen and makes most of the ATP. The overall result is glucose + oxygen giving carbon dioxide + water + energy. Anaerobic respiration happens without oxygen and stops after glycolysis, so it gives far less ATP. In yeast, pyruvate becomes ethanol and carbon dioxide, a process called fermentation, used in baking and brewing. In hard-working muscle cells, pyruvate becomes lactic acid, which causes tiredness and cramps. Aerobic respiration is therefore far more efficient, which is why organisms prefer it whenever oxygen is available, and only use anaerobic respiration when oxygen is short or absent.

Long Questions with Answers - Chapter 8 (continued)

Q3. Explain how energy flows from sunlight to cell work in a plant.

Energy enters the living world as sunlight. In a leaf, chlorophyll in the chloroplasts traps light energy during the light-dependent reactions of photosynthesis, splitting water and storing the energy as ATP and NADPH. The Calvin cycle then uses that stored energy to fix carbon dioxide into glucose. Glucose is a store of chemical energy: the energy of sunlight is now held in the bonds of the sugar molecule. The plant may store glucose as starch or use it at once. When the plant cell needs energy for work, such as growth, transport or repair, it breaks down glucose in cellular respiration. Aerobic respiration releases the stored energy step by step and rebuilds ATP, the energy currency of the cell. ATP then pays for cell work: when it loses a phosphate, energy is released exactly where it is needed, and ATP becomes ADP, which is rebuilt again using energy from food. In this way, energy flows from sunlight into glucose, from glucose into ATP, and from ATP into the work of the cell, linking photosynthesis and respiration into one continuous energy system.

Answer Key - Chapter 8 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	A	C	B	B	B	B	B	D	B	B	B	B	B	A

Chapter 9 - Plant Physiology

How plants take in water and minerals, move substances, feed themselves, and respond to their surroundings.

MCQs - Chapter 9

1. Water enters root hairs mainly by:

A) active transport only B) osmosis C) translocation D) photosynthesis

2. Osmosis is the movement of:

A) food through phloem B) water across a partially permeable membrane from higher to lower water concentration C) minerals upward D) gases through stomata

3. Transpiration is fastest in:

A) cold, still, humid air B) warm, windy, dry air C) dim light D) night time

4. Transpiration pull draws water:

A) down the phloem B) up the xylem C) into the soil D) out of the roots

5. Stomata are opened and closed by the:

A) xylem cells B) guard cells C) root hairs D) phloem cells

6. Food is translocated through the:

A) xylem B) phloem C) cambium D) epidermis

7. In translocation, the source is usually a:

A) root B) leaf C) flower D) seed

MCQs - Chapter 9 (continued)

8. Unlike xylem flow, phloem flow can go:

A) only upward B) up or down, depending on where food is needed C) only downward D) sideways only

9. Nitrogen is needed by plants for making:

A) stomata only B) proteins and chlorophyll C) fruit colour only D) root hairs only

10. Phosphorus is important for:

A) energy transfer and root growth B) leaf colour only C) flower scent D) seed coats only

11. Shoots bending towards light is called:

A) geotropism B) phototropism C) thigmotropism D) chemotropism

12. Roots growing downward in response to gravity is an example of:

A) phototropism B) geotropism C) thigmotropism D) hydrotropism

13. Auxins promote:

A) dormancy B) cell elongation and bending towards light C) fruit ripening D) closing of stomata

14. Which plant hormone promotes fruit ripening?

A) Auxin B) Gibberellin C) Ethene D) Cytokinin

15. Abscisic acid:

A) promotes germination B) promotes dormancy and closes stomata in dry conditions C) lengthens stems D) drives cell division

Short Questions with Answers - Chapter 9

Q1. How does water enter a plant root?

Through root hairs by osmosis: water moves from the soil, where its concentration is higher, into the root cells. Dissolved minerals enter by diffusion and active transport.

Q2. What is transpiration pull?

It is the upward pull on water in the xylem caused by water evaporating from leaves. As water is lost, more water is drawn up behind it, much like sucking through a straw.

Q3. What is translocation? Name the source and the sink.

Translocation is the movement of food through the phloem from source to sink. The source is usually a leaf, where food is made, and the sink is a growing part, a root or a storing organ, where food is used or stored.

Q4. How do guard cells open and close the stomata?

When guard cells take in water, they swell and bend, opening the pore between them. When they lose water, they shrink and the pore closes. This controls gas exchange and water loss.

Q5. Name two macronutrients and give one function of each.

Nitrogen: needed for proteins and chlorophyll. Potassium: needed for the working of stomata and for resistance to disease.

Q6. What is the difference between phototropism and geotropism?

Phototropism is growth in response to light: shoots bend towards light. Geotropism is growth in response to gravity: roots grow downward and shoots grow upward.

Q7. Name two plant hormones, other than auxins, and give one function of each.

Gibberellins promote stem growth and seed germination. Cytokinins promote cell division.

Q8. Why is transpiration slower on a humid, still day?

Transpiration depends on water vapour leaving the leaf. On a humid day, the air already holds much water vapour, so less water evaporates; still air also lets vapour collect around the leaf, slowing further loss.

Long Questions with Answers - Chapter 9

Q1. Explain how water moves from the soil to the leaf, and how transpiration helps.

Water begins its journey in the soil. It enters the plant through root hairs by osmosis, moving from the soil, where its concentration is higher, into the root cells. Dissolved minerals enter with it by diffusion and active transport. The water then passes through the root tissues into the xylem, the tissue that carries water upward through the stem to the leaves. In the leaves, water evaporates through the stomata, the tiny pores on the leaf surface. This loss is called transpiration, and it creates a pull, called transpiration pull, which draws more water up the xylem, much like sucking through a straw. The process also brings dissolved minerals up with the water and cools the leaf as water evaporates. Guard cells control the stomata: they swell to open the pore for photosynthesis when water is plentiful, and shrink to close it and save water when conditions are dry. Transpiration is faster in bright light, warm temperature, wind and low humidity, and slower in dim light, cold, still and humid air. Without transpiration pull, a tall plant could not lift water from its roots to its highest leaves.

Q2. Describe tropisms and the role of plant hormones in them.

Tropisms are growth movements of a plant towards or away from a stimulus. In phototropism, a shoot bends towards light. This happens because the plant hormone auxin moves to the shaded side of the shoot, where it promotes faster cell elongation, so the shaded side grows longer and the shoot bends towards the light. In geotropism, roots grow downward and shoots grow upward in response to gravity, again guided by the distribution of auxin. Other hormones control other kinds of growth. Gibberellins promote stem growth and wake dormant seeds into germination. Cytokinins promote cell division in growing regions. Abscisic acid promotes dormancy in buds and seeds and closes the stomata when water is short, helping the plant survive drought. Ethene promotes the ripening of fruit. Together, these chemical messengers let the plant adjust its growth to its surroundings: bending towards light to photosynthesise better, growing roots down towards water, and pausing growth when conditions are harsh. Tropisms show that plants, although they cannot move from place to place, actively respond to their environment.

Long Questions with Answers - Chapter 9 (continued)

Q3. Explain translocation: how food moves from source to sink, and why phloem flow differs from xylem flow.

Translocation is the movement of food, mainly sugars made in photosynthesis, through the phloem from a source to a sink. The source is usually a leaf, where food is made, although a storage organ can also act as a source when it releases stored food. The sink is any part that uses or stores food: a growing shoot tip, a developing fruit, or a root. Unlike xylem flow, which carries water and minerals mainly upward from roots to leaves, phloem flow can go up or down, depending on where food is needed at the time. In spring, for example, food stored in roots may move upward to feed new leaves; in summer, food made in leaves may move downward to roots for storage. This two-way ability is possible because phloem transport is driven by the needs of sources and sinks, not by a single pull from above. Translocation matters because leaves make food but every living part of the plant needs it: roots need energy to grow and absorb minerals, flowers need energy to reproduce, and fruits need food to develop seeds. Without translocation, only the leaves could use the food they make, and the rest of the plant would starve.

Answer Key - Chapter 9 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	B	B	B	B	B	A	B	B	B	C	B

Chapter 10 - Reproduction in Plants

How plants produce new plants: asexual reproduction, flowers, pollination, fertilisation, seeds and germination.

MCQs - Chapter 10

1. Potato reproduces vegetatively by its:

A) bulbs B) runners C) tubers D) seeds

2. Strawberry spreads naturally by its:

A) tubers B) runners C) bulbs D) rhizomes

3. Onion is an example of a:

A) tuber B) bulb C) runner D) rhizome

4. Ginger spreads underground by its:

A) bulbs B) rhizomes C) cuttings D) seeds

5. Pollen is produced in the:

A) ovary B) stigma C) anther D) style

6. The female part of a flower that receives pollen is the:

A) anther B) stigma C) filament D) sepal

7. Pollination is the transfer of pollen from:

A) ovary to stigma B) anther to stigma C) style to ovary D) petal to sepal

MCQs - Chapter 10 (continued)

8. In cross-pollination, pollen goes to:

A) the same flower B) another plant of the same species C) a different species D) the ovary directly

9. Double fertilisation is special to:

A) mosses B) ferns C) flowering plants D) algae

10. After fertilisation, the ovule becomes a:

A) fruit B) seed C) flower D) pollen grain

11. After fertilisation, the ovary becomes a:

A) seed B) fruit C) embryo D) testa

12. The endosperm formed in double fertilisation:

A) becomes the flower B) feeds the embryo C) protects the seed coat D) makes pollen

13. Which of these is needed for germination?

A) Light only B) Water, oxygen and suitable temperature C) Soil only D) Fertiliser only

14. Grafting joins:

A) two roots B) a shoot of one plant onto the rootstock of another plant C) two seeds D) two leaves

15. Tissue culture grows:

A) one plant from a seed B) many plants from a few cells in a laboratory C) plants from pollen only D) plants without water

Short Questions with Answers - Chapter 10

Q1. What is the difference between asexual and sexual reproduction in plants?

Asexual reproduction uses one parent and no gametes, giving offspring genetically identical to the parent. Sexual reproduction uses male and female gametes, giving offspring that differ from the parents.

Q2. Give two natural methods of vegetative propagation with examples.

Runners, such as strawberry stems that root at nodes. Tubers, such as potato, where each eye can grow into a new plant.

Q3. What is pollination, and how do self-pollination and cross-pollination differ?

Pollination is the transfer of pollen from anther to stigma. In self-pollination, the pollen comes from the same plant; in cross-pollination, it comes from another plant of the same species.

Q4. Name the four main parts of a typical flower and give one function of each.

Sepals protect the flower bud. Petals attract insects for pollination. Stamens are the male parts: the anther makes pollen. Carpels are the female parts: the stigma receives pollen, and the ovary contains ovules.

Q5. What is double fertilisation?

In flowering plants, one male gamete fuses with the egg to form the zygote, and a second male gamete fuses with other nuclei to form the endosperm, which feeds the embryo. These two fusions together are called double fertilisation.

Q6. What three things does a seed need to germinate?

Water, oxygen and a suitable temperature. The seed absorbs water, the embryo grows, and the young root and shoot emerge.

Q7. What is the difference between a seed and a fruit?

A seed is a fertilised ovule containing an embryo, stored food and a protective coat (testa). A fruit is the ripened ovary that surrounds and protects the seeds and helps in their dispersal.

Q8. Give two agents of seed dispersal and explain how each helps.

Wind carries light seeds far from the parent plant. Animals eat fruits and drop or pass the seeds elsewhere, or carry seeds stuck to their bodies. Dispersal stops new plants crowding the parent and competing for light, water and nutrients.

Long Questions with Answers - Chapter 10

Q1. Describe sexual reproduction in a flowering plant, from pollination to seed formation.

Sexual reproduction in a flowering plant begins with pollination, the transfer of pollen from the anther to the stigma. Pollen may be carried by wind, water, insects or other animals. In self-pollination, pollen goes to a flower of the same plant; in cross-pollination, it goes to another plant of the same species. After pollination, a pollen tube grows down the style, carrying two male gametes to the ovule. Then double fertilisation takes place: one male gamete fuses with the egg cell to form the zygote, which grows into the embryo, and the second male gamete fuses with other nuclei to form the endosperm, a tissue that stores food for the embryo. The ovule develops into a seed, containing the embryo, stored food and a protective coat called the testa, while the ovary develops into a fruit. The seed is then dispersed by wind, water, animals or explosion, so that new plants do not crowd the parent. When the seed finds water, oxygen and a suitable temperature, it germinates: the embryo grows, and the young root and shoot emerge to form a new plant.

Q2. Compare natural and artificial vegetative propagation, and explain why farmers use artificial methods.

Vegetative propagation is asexual reproduction using plant parts, and it can be natural or artificial. Natural vegetative propagation happens on its own: runners, such as strawberry stems, root at nodes; bulbs, such as onion, store food and sprout; tubers, such as potato, grow new plants from their eyes; and rhizomes, such as ginger, spread underground. Artificial vegetative propagation is done by people. Cuttings are stem pieces planted to root. Layering roots a stem while it is still attached to the parent. Grafting joins a good fruiting shoot onto the strong rootstock of another plant. Tissue culture grows many small plants from a few cells in a laboratory. Farmers prefer artificial methods for several reasons. They are fast and produce many plants at once. They give plants identical to a good parent, so fruit quality stays the same from plant to plant. Grafting lets a farmer combine the best shoot with the best roots, for example a tasty fruit variety on roots that resist disease. Artificial methods therefore give farmers control over quality, quantity and timing that natural methods cannot match.

Long Questions with Answers - Chapter 10 (continued)

Q3. Explain seed dispersal and germination: why dispersal matters and what a seed needs to grow.

After a seed is formed, it must reach a place where it can grow, and this is done by dispersal: the spreading of seeds away from the parent plant. Seeds are dispersed by wind, which carries light seeds far away; by water, which floats seeds to new places; by animals, which eat fruits and drop or pass seeds elsewhere or carry seeds stuck to their bodies; and by explosion, in which some fruits burst open and throw seeds out. Dispersal matters because if all seeds fell under the parent plant, the young plants would crowd together and compete for light, water and nutrients, and most would die. Spreading out gives each seedling a better chance and lets the species reach new areas. Once a seed lands in a suitable place, it needs three things to germinate: water, oxygen and a suitable temperature. The seed absorbs water, which wakes the embryo from dormancy and activates its enzymes. Oxygen is needed for respiration, which releases energy for growth. A suitable temperature allows the enzymes to work properly. The embryo then grows: the young root emerges first to anchor the seedling and absorb water, followed by the young shoot, which grows upward towards light and begins photosynthesis.

Answer Key - Chapter 10 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	C	B	B	B	C	B	B	B	C	B	B	B	B	B	B

Chapter 11 - Biostatistics

Using statistics in biology: types of data, samples, averages, range and graphs.

MCQs - Chapter 11

1. Data describing flower colour is:

A) quantitative B) qualitative C) continuous D) discrete

2. Plant height measured in centimetres is an example of:

A) qualitative data B) quantitative data C) neither type D) categorical data

3. The number of petals on a flower is an example of:

A) continuous data B) discrete data C) qualitative data D) grouped data

4. Height in centimetres is an example of:

A) discrete data B) continuous data C) qualitative data D) a sample

5. The whole group being studied is called the:

A) sample B) population C) mode D) range

6. A smaller part of a population chosen for study is called a:

A) population B) sample C) frequency D) mean

7. A good sample must:

A) include only the largest plants B) fairly represent the population C) include only one type D) be chosen by height

MCQs - Chapter 11 (continued)

8. The middle value of ordered data is the:

A) mean B) mode C) median D) range

9. The value that occurs most often in a set of data is the:

A) mean B) median C) mode D) range

10. For the values 3, 5, 5, 7, the mode is:

A) 3 B) 5 C) 7 D) 4

11. For the values 2, 4, 4, 6, 9, the mean is:

A) 4 B) 5 C) 6 D) 25

12. For the values 4, 6, 6, 8, 11, the range is:

A) 5 B) 6 C) 7 D) 11

13. A histogram is best for showing:

A) comparing categories B) grouped continuous data C) change over time D) single values

14. A line graph is best for showing:

A) separate categories B) change over time C) grouped data D) averages

15. A bar chart is best for:

A) change over time B) comparing separate categories C) grouped continuous data D) averages

Short Questions with Answers - Chapter 11

Q1. What is biostatistics?

Biostatistics is the use of statistics in biology: collecting, organising, presenting and interpreting numerical data from living things, so that fair conclusions can be drawn.

Q2. What is the difference between qualitative and quantitative data? Give one example of each.

Qualitative data describes qualities, such as flower colour. Quantitative data is numerical, such as plant height measured in centimetres.

Q3. What is the difference between a population and a sample?

A population is the whole group being studied, while a sample is a smaller part of it chosen to represent the whole group. A good sample must fairly represent the population.

Q4. Find the mean of 2, 4, 4, 6 and 9.

Mean = (2 + 4 + 4 + 6 + 9) / 5 = 25 / 5 = 5.

Q5. Find the median of 3, 7, 5, 9 and 5.

First arrange in order: 3, 5, 5, 7, 9. The middle value is 5, so the median is 5.

Q6. What is a frequency table?

A frequency table organises raw data by showing how often each value occurs. It makes a set of measurements easy to read and to summarise.

Q7. What is the range? Find the range of 5, 9, 12 and 15.

The range is the highest value minus the lowest value, and it shows how spread out the data is. Range = 15 - 5 = 10.

Q8. Why must a graph have a title and labelled axes?

Because the title tells the reader what the graph shows, and the axis labels tell what is measured and in what units. Without them, the reader cannot understand the graph correctly.

Long Questions with Answers - Chapter 11

Q1. Find the mean, median, mode and range of: 4, 6, 6, 8, 11. Explain each step.

The numbers used here are practice numbers for this exercise. Mean: add all the values (4 + 6 + 6 + 8 + 11 = 35) and divide by how many values there are (5), giving 35 / 5 = 7. Median: arrange the values in order (4, 6, 6, 8, 11) and take the middle value, which is 6. If there were an even number of values, the median would be the average of the two middle values. Mode: the value that occurs most often, which is 6, because it occurs twice while every other value occurs once. Range: the highest value minus the lowest value, 11 - 4 = 7, which shows how spread out the data is. Together, these four measures describe the data well: the data is centred near 6 to 7 and spread over 7 units. The mean gives the overall average, the median gives the middle point, the mode gives the most common value, and the range shows the spread. A student should always show the steps, not just the final answers, because the working earns credit and makes mistakes easy to find.

Q2. When would you use a bar chart, a histogram and a line graph? Give a biology example of each.

Each type of graph suits a different kind of data. A bar chart compares separate categories, with gaps between the bars: for example, the number of flowers of each colour in a garden, where each colour is a separate category. A histogram shows grouped continuous data with touching bars: for example, the heights of seedlings grouped in ranges such as 0-5 cm, 5-10 cm and 10-15 cm, where the bars touch because height is continuous and the ranges join together. A line graph shows change over time, joining points with a line: for example, the height of one plant measured each week for six weeks, where the line shows the pattern of growth. Choosing the right graph matters because the wrong graph can mislead the reader: categories must not be shown as continuous, and change over time is clearest as a line. Every graph must have a title and labelled axes, including units, so that the reader can understand it without extra explanation. Honest graphs never stretch or cut axes to exaggerate a difference.

Long Questions with Answers - Chapter 11 (continued)

Q3. A student wants to compare the growth of seedlings kept in light with seedlings kept in darkness. Plan a fair small investigation using biostatistics.

A fair investigation begins with a clear question and a fair sample. The population is all the seedlings of one kind available to the student, and the sample should fairly represent them: for example, twenty similar, healthy seedlings of the same kind, divided into two groups of ten, one kept in light and one in darkness, with the same water, soil and temperature for both groups. The student should decide what data to collect: seedling height in centimetres is quantitative continuous data, while the number of leaves is quantitative discrete data. Measurements should be taken at the same time each day, using the same method, and recorded in a table. After a fixed period, the raw data should be organised into frequency tables, one for each group. Then the mean, median, mode and range should be found for each group, so the groups can be compared fairly instead of judging from one or two seedlings. A bar chart can compare the mean heights of the two groups, and a line graph can show growth over time. Finally, the student should write a conclusion in careful words: if the light group grew taller on average, the results support the idea that light helps growth, but one small investigation cannot prove a general rule. Repeating the investigation and keeping conditions fair makes the conclusion stronger.

Answer Key - Chapter 11 MCQs

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	B	B	B	B	B	B	B	C	C	B	B	C	B	B	B

1. **One chapter at a time:** Read the chapter introduction first and say the main ideas in your own words before moving to the questions.
2. **Short questions first:** Cover the answers and try all 8 short questions yourself. Read the answer only after you have attempted it, and note the questions you missed.
3. **Long questions second:** Study the 3 long answers of the chapter. Learn their structure: definition first, then explanation, then key points and one example.
4. **MCQs last, without the key:** Attempt all 15 MCQs of the chapter before checking the answer key table. Mark wrong answers and re-read those topics.
5. **Definitions every day:** Keep a small list of definitions from each chapter (cell, tissue, enzyme, ATP, transpiration, pollination, mean, median) and revise five of them daily.
6. **Diagrams from your book:** Practise drawing and labelling the diagrams from your textbook (cell, flower, stages of mitosis) from memory, then compare with the book.
7. **Worked numbers:** Redo the Chapter 11 calculations yourself (mean, median, mode, range) with new practice numbers until the steps feel easy.
8. **Weak chapters twice:** In the last week before exams, revise your two weakest chapters a second time and re-attempt their MCQs.
9. **Write, do not just read:** Write at least one long answer per day in full, with headings, in the time you would have in an exam.
10. **Check against your book:** If any chapter title or topic in these notes differs from your issued book, follow your book and your teacher's guidance.
11. **Rest and sleep:** Short daily revision beats one long night of cramming. Revise a little every day and sleep well before exam day.