

SECTION A: THEORY (90 Marks)

Question 1: Introduction to Biology & Careers (10 Marks)

a) Two main branches of Biology (2 marks)

- i. Botany – study of plants
- ii. Zoology – study of animals

Other options:

- Microbiology – study of microorganisms
- Genetics – study of heredity and genes
- Ecology – study of interactions with environment

b) TWO applications of Biology in everyday life (2 marks each)

- i. Medicine – understanding diseases and developing treatments
- ii. Agriculture – improving crop and livestock productivity
- iii. Environmental conservation – preserving biodiversity
- iv. Food production – processing and safety of food

Other options:

- Biotechnology – genetic engineering and cloning
- Forensics – solving crimes using biological evidence

c) Match each field of Biology with a suitable career (4 marks)

Field of Biology	Career
Botany	Plant scientist / Agricultural officer / Botanist
Microbiology	Laboratory technician / Microbiologist / Pathologist
Genetics	Geneticist / Research scientist
Ecology	Environmentalist / Conservation officer

d) TWO factors that should positively influence career choice in Biology (2 marks)

- i. Personal interest and passion for the subject
- ii. Availability of career opportunities in the field

Other options:

- Academic strengths in science subjects
- Guidance and mentorship from professionals
- Desire to contribute to society / environment

Question 2: Biodiversity & Specimen Collection (15 Marks)

a) Apparatus used to collect small animal specimens (2 marks)

- S: Sweep net / Insect net
- T: Pitfall trap / Jar / Container

b) TWO other apparatus used to collect small animals (2 marks)

- i. Beating tray / beating sheet

ii. Hand lens / magnifying glass

Other options:

- Aspirator / pooter
- Forceps / tweezers

c) THREE steps for preparing a plant specimen for a herbarium (3 marks)

- Collect the plant carefully, including roots, stems, leaves, flowers
- Press the plant between sheets of newspaper / blotting paper to flatten
- Dry the specimen and mount it on herbarium sheets with labels

d) THREE reasons why specimen collection and preservation are important (3 marks)

- For reference and study in future research
 - To identify and classify species
 - To study biodiversity and monitor environmental changes
- other options:

- To teach students in biology lessons
- To maintain genetic records of species

Question 3: Microscope & Cell Structure (20 Marks)

a) Use of microscope parts (4 marks)

Part of Microscope	Use
Eyepiece lens	Magnifies the specimen / view image
Objective lens	Further magnifies specimen at different powers
Diaphragm	Controls the amount of light passing through
Coarse adjustment knob	Brings specimen into general focus

b) THREE differences between light and electron microscope (6 marks)

Light Microscope	Electron Microscope
Uses light to view specimen	Uses electrons to view specimen
Lower magnification (up to 1000x)	Higher magnification (up to 1,000,000x)
Can view living specimens	Can only view dead specimens

c) Cell organelles labeled A, B, C, D (4 marks)

A: Mitochondrion

B: Golgi bodies

C: Nucleus

D: Endoplasmic Reticulum

d) Function of organelles (2 marks)

Cell Organelle	Function
Cytoplasm	Site of chemical reactions / supports organelles
Smooth endoplasmic reticulum	Synthesizes lipids / transports materials

Question 4: Cell Specialization & Adaptation (18 Marks)

a) FOUR differences between plant and animal cells (4 marks)

Plant cell	Animal cell
Has cell wall	No cell wall
Has chloroplasts	No chloroplasts
Large central vacuole	Small or no vacuole
Fixed rectangular shape	Irregular / rounded shape

b) Specialized cells for functions (6 marks)

Function	Specialized Cell
Transports oxygen in the body	Red blood cell / erythrocyte
Absorbs water and mineral salts from soil	Root hair cell
Transmits electrical impulses in the body	Nerve cell / neuron
Carries out photosynthesis efficiently	Palisade mesophyll cell
Controls opening and closing of stomata	Guard cell
Enables movement by contraction	Muscle cell / skeletal muscle fiber

c) Adaptations

- i) Root hair cell: Long projection increases surface area; thin cell wall for easy absorption
- ii) Red blood cell: Biconcave shape for increased surface area; lacks nucleus for more space to carry oxygen

Question 5: Chemicals of Life & Enzymes (9 Marks)

a) TWO classes of chemicals of life found in cells (2 marks)

i. Carbohydrates

ii. Proteins

Other options:

- Lipids / fats
- Nucleic acids (DNA, RNA)

b) Test for food substances (3 marks)

i) Starch: Add iodine solution – turns blue-black if starch present

ii) Proteins: Biuret test – purple/lilac color indicates protein

iii) Lipids: Sudan III stain / grease spot test – red-stained oil layer or translucent spot

c) TWO factors that affect enzyme activity (2 marks)

- i. Temperature
- ii. pH

Other options:

- Substrate concentration
- Presence of inhibitors

Question 6: Enzymes & Importance of Water (8 Marks)

a) Define enzyme (2 marks)

- Enzyme is a biological catalyst that speeds up chemical reactions in living organisms without being used up

b) TWO roles of enzymes in living cells (2 marks)

- i. Break down large molecules into smaller molecules (catabolic reactions)
- ii. Help build complex molecules from simpler ones (anabolic reactions)

c) TWO importance of water in cells (2 marks)

- i. Solvent for biochemical reactions
- ii. Helps in transport of substances within cells

Question 7: Digestive & Cellular Enzymes (6 Marks)

Function of Enzyme	Name of Enzyme
Breaks down hydrogen peroxide into water and oxygen	Catalase
Breaks down starch into maltose	Amylase
Breaks down proteins into amino acids	Protease / Pepsin
Breaks down fats into glycerol and fatty acids	Lipase
Breaks down lactose into glucose and galactose	Lactase
Breaks down RNA into nucleotides	Ribonuclease / RNase

Question 8: Catalase Enzyme Experiment (11 Marks)

a) Gas produced in test tube A (1 mark)

- Oxygen (O_2)

b) Enzyme present in liver tissue (1 mark)

- Catalase

c) Explain why bubbles observed in A but not B (2 marks)

- Fresh liver contains active catalase which breaks down H_2O_2 to water and oxygen, producing bubbles.
- Boiled liver has denatured enzyme, so no reaction occurs and no bubbles are formed.

d) TWO conclusions (2 marks)

- i. Catalase enzyme breaks down hydrogen peroxide
- ii. Heat denatures enzymes and stops their activity

e) TWO precautions (2 marks)

- i. Use equal amounts of liver in each test tube
- ii. Ensure hydrogen peroxide concentration is the same

Question 9: Photosynthesis (13 Marks)

a) TWO structural features of chloroplast related to its function (2 marks)

- i. Thylakoid membranes – contain chlorophyll for light absorption
- ii. Stroma – site of dark reactions / enzyme reactions

b) Part of chloroplast where light stage occurs (1 mark)

- Thylakoid / grana

c) How dark stage depends on light stage (2 marks)

- Dark stage (Calvin cycle) requires ATP and NADPH produced in the light stage

d) TWO importance of photosynthesis in nature (2 marks)

- i. Produces oxygen for respiration
- ii. Produces food (glucose) for all organisms

e) Differentiate light and dark stage (2 marks)

Light stage	Dark stage
Requires light energy	Does not require light
Occurs in thylakoids / grana	Occurs in stroma
Produces ATP and NADPH	Uses ATP and NADPH to produce glucose

f) TWO factors affecting rate of photosynthesis (2 marks)

- i. Light intensity
- ii. Carbon dioxide concentration

other options:

- Temperature
- Water availability

g) Word equation for photosynthesis (2 marks)

Carbon dioxide + Water → Glucose + Oxygen

