

Section 1 — Multiple Choice (20 marks)

Choose the best answer for each question.

Question 1

1 mark

Which of the following best distinguishes eukaryotic cells from prokaryotic cells?

- A) Eukaryotic cells contain ribosomes; prokaryotic cells do not
- B) Eukaryotic cells have DNA; prokaryotic cells do not
- C) Eukaryotic cells contain membrane-bound organelles; prokaryotic cells do not
- D) Eukaryotic cells can divide; prokaryotic cells cannot

Question 2

1 mark

Which organelle is responsible for lipid synthesis and the detoxification of harmful substances within a cell?

- A) Rough endoplasmic reticulum
- B) Smooth endoplasmic reticulum
- C) Golgi apparatus
- D) Lysosome

Question 3

1 mark

As a cell increases in size, its volume increases faster than its surface area. Identify the consequence of this for the cell.

- A) The rate of diffusion into the cell increases
- B) The surface area-to-volume ratio increases, improving exchange
- C) The surface area-to-volume ratio decreases, making exchange less efficient
- D) The cell's metabolic demand decreases

Question 4

1 mark

During which stage of mitosis do chromosomes line up along the equator of the cell?

- A) Prophase
- B) Metaphase
- C) Anaphase
- D) Telophase

Question 5**1 mark**

Monomers of glucose join together, releasing a water molecule at each junction, to form a glycosidic bond. This process is called:

- A) Hydrolysis
- B) Condensation (dehydration) synthesis
- C) Phosphorylation
- D) Denaturation

Question 6**1 mark**

Identify the process by which a polymer is broken down into its constituent monomers through the addition of water.

- A) Condensation synthesis
- B) Hydrolysis
- C) Dehydration synthesis
- D) Polymerisation

Question 7**1 mark**

Villi in the small intestine increase the efficiency of nutrient absorption mainly by:

- A) Secreting digestive enzymes directly into the blood
- B) Increasing the surface area available for diffusion and reducing diffusion distance
- C) Producing mucus to protect the intestinal wall
- D) Storing nutrients until they are needed

Question 8**1 mark**

Identify the nephron structure responsible for the selective reabsorption of most useful substances (e.g. glucose, amino acids, much of the water) from the filtrate.

- A) Glomerulus
- B) Bowman's capsule
- C) Proximal tubule
- D) Collecting duct

Question 9**1 mark**

A non-competitive inhibitor reduces enzyme activity by:

- A) Binding to the active site and blocking the substrate
- B) Binding to a site other than the active site and changing the enzyme's shape
- C) Increasing the rate of substrate binding
- D) Permanently denaturing the enzyme at any temperature

Question 10**1 mark**

Which statement correctly distinguishes catabolism from anabolism?

- A) Catabolism builds larger molecules and requires energy; anabolism breaks molecules down and releases energy
- B) Catabolism breaks molecules down and releases energy; anabolism builds larger molecules and requires energy
- C) Catabolism and anabolism both release energy
- D) Catabolism and anabolism both require energy input

Question 11**1 mark**

ATP is described as the "universal energy currency" of the cell mainly because it:

- A) Is a large, stable molecule that stores energy indefinitely
- B) Is a small molecule that can be readily hydrolysed to transfer usable energy between reactions
- C) Cannot be broken down once synthesised
- D) Is only produced during anaerobic respiration

Question 12**1 mark**

Most of the ATP generated during aerobic respiration is produced at the:

- A) Cytoplasm, during glycolysis
- B) Mitochondrial matrix, during the Krebs cycle
- C) Inner mitochondrial membrane, during the electron transport chain
- D) Outer mitochondrial membrane

Question 13**1 mark**

Compared with aerobic respiration, anaerobic respiration produces:

- A) The same amount of ATP per glucose molecule
- B) Far more ATP per glucose molecule
- C) Far less ATP per glucose molecule
- D) No ATP at all

Question 14**1 mark**

The partial pressure of oxygen in the alveoli is higher than in the pulmonary capillary blood. Identify the direction oxygen will move.

- A) From blood into alveoli
- B) From alveoli into blood
- C) No net movement will occur
- D) Oxygen will move by active transport against the gradient

Question 15**1 mark**

The Calvin cycle uses ATP and NADPH produced by the light-dependent reactions to:

- A) Split water and release oxygen
- B) Fix carbon dioxide and produce carbohydrate
- C) Produce ATP for the light-dependent reactions
- D) Break down glucose to release energy

Question 16**1 mark**

Xylem tissue is adapted for its function because it:

- A) Consists of living sieve tube cells with companion cells
- B) Consists of dead, lignified vessels that provide strength and a continuous pathway for water
- C) Actively pumps water using ATP
- D) Transports sucrose from source to sink

Question 17**1 mark**

Which environmental condition would most increase the rate of transpiration from a leaf?

- A) High humidity
- B) Low light intensity
- C) Increased wind speed
- D) Low temperature

Question 18**1 mark**

In the stimulus-response model of homeostasis, the structure that compares information against a set point and coordinates a response is the:

- A) Receptor
- B) Control centre
- C) Effector
- D) Stimulus

Question 19**1 mark**

Photoreceptors in the retina primarily detect:

- A) Chemical concentration
- B) Light
- C) Pressure
- D) Temperature

Question 20**1 mark**

The nodes of Ranvier along a myelinated axon function to:

- A) Produce neurotransmitters
- B) Allow the action potential to jump between nodes, speeding up transmission
- C) Insulate the axon completely, preventing any impulse
- D) Store neurotransmitter vesicles

Section 2 — Short Response (20 marks)

Question 21

4 marks

Describe the sequence of events that occurs during the transmission of an action potential along a neuron, starting from the resting potential.

Question 22

3 marks

Explain how a nerve impulse is transmitted across a synapse from a presynaptic neuron to a postsynaptic neuron.

Question 23**4 marks**

The table below shows part of the feedback pathway the body uses to respond to dehydration (a decrease in blood water content). Complete the table by filling in the blanks.

Stimulus	Receptor	Control centre	Effector	Response
Decrease in blood water content (increased blood solute concentration)				

Question 24**3 marks**

Compare hibernation and aestivation as behavioural thermoregulatory strategies, including when each is used and their effect on metabolism.

Question 25**4 marks**

Describe the three lines of defence in vertebrates, providing one example of each.

Question 26**2 marks**

Distinguish between active and passive immunity, using an example of each.
