

Section 1 — Multiple Choice (20 marks)

Choose the best answer for each question.

Question 1

1 mark

In the fluid mosaic model of the cell membrane, cholesterol molecules function to:

- A) Transport ions across the membrane
- B) Stabilise the membrane and help regulate its fluidity
- C) Act as receptors for hormone binding only
- D) Form the primary structural bilayer

Question 2

1 mark

Which of the following correctly compares facilitated diffusion and active transport?

- A) Both move substances against their concentration gradient and require ATP
- B) Facilitated diffusion moves substances down their gradient using proteins without ATP; active transport moves substances against their gradient using ATP
- C) Facilitated diffusion requires ATP; active transport does not
- D) Both move substances down their concentration gradient without using proteins

Question 3

1 mark

Stem cells give rise to specialised cells through a two-step process. Identify the correct order.

- A) Differentiation, then mitosis
- B) Mitosis, then differentiation
- C) Meiosis, then mitosis
- D) Differentiation only, without division

Question 4

1 mark

During which stage of mitosis do sister chromatids separate and move to opposite poles of the cell?

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

Question 5

1 mark

Chemical digestion of lipids by lipase produces:

- A) Amino acids
- B) Monosaccharides
- C) Fatty acids and glycerol
- D) Nucleotides

Question 6**1 mark**

Protease enzymes in the digestive system function to break down:

- A) Starch into glucose
- B) Proteins into amino acids
- C) Lipids into fatty acids and glycerol
- D) Cellulose into glucose

Question 7**1 mark**

A closed circulatory system, in which blood remains within vessels, provides an advantage over an open system because it:

- A) Uses less energy overall
- B) Allows more controlled and efficient delivery and removal of substances to and from tissues
- C) Eliminates the need for a pump
- D) Prevents any exchange of substances with tissues

Question 8**1 mark**

The collecting duct of the nephron is primarily responsible for:

- A) Filtering plasma from the blood
- B) Establishing the concentration gradient in the medulla
- C) The final, hormonally regulated reabsorption of water before urine leaves the kidney
- D) Secreting glucose into the filtrate

Question 9**1 mark**

An enzyme's rate of reaction increases with temperature up to an optimum, then declines sharply. Identify the reason for the decline beyond the optimum.

- A) Substrate concentration becomes limiting
- B) The enzyme becomes more stable at higher temperatures
- C) Excess heat disrupts the bonds maintaining the enzyme's tertiary structure, altering the active site (denaturation)
- D) The products of the reaction inhibit the enzyme

Question 10**1 mark**

ATP allows energy released from catabolic reactions to be used in anabolic reactions because:

- A) ATP is broken down in catabolic reactions and built up in anabolic reactions only
- B) The hydrolysis of ATP releases usable energy that can drive energy-requiring anabolic reactions
- C) ATP cannot be involved in catabolic reactions
- D) ATP is only produced by anabolic reactions

Question 11**1 mark**

The net products of glycolysis (per glucose molecule) include:

- A) 2 pyruvate, a net gain of 2 ATP, and 2 reduced NAD (NADH)
- B) 6 CO₂ and 6 H₂O
- C) 2 acetyl-CoA and 4 CO₂
- D) 32-34 ATP and 6 H₂O

Question 12**1 mark**

The overall equation for aerobic respiration predicts approximately how much ATP is produced per glucose molecule?

- A) 2 ATP
- B) 4 ATP
- C) 36-38 ATP
- D) 100 ATP

Question 13**1 mark**

Alveoli are adapted for efficient gas exchange because they have:

- A) A thick wall and low surface area
- B) A large surface area, thin walls, and a dense capillary network maintaining steep concentration gradients
- C) A small surface area but very thick walls to prevent gas loss
- D) No blood supply, relying only on diffusion through air

Question 14**1 mark**

As blood passes through capillaries in respiring muscle tissue, identify the correct direction of movement of oxygen and carbon dioxide.

- A) Oxygen moves from blood to muscle; carbon dioxide moves from muscle to blood
- B) Oxygen moves from muscle to blood; carbon dioxide moves from blood to muscle
- C) Both oxygen and carbon dioxide move from blood to muscle
- D) Both oxygen and carbon dioxide move from muscle to blood

Question 15**1 mark**

Identify the correct reactants and products of photosynthesis.

- A) Glucose and oxygen react to form carbon dioxide, water and light energy
- B) Carbon dioxide and water react, using light energy, to form glucose and oxygen
- C) Carbon dioxide and oxygen react to form glucose and water
- D) Glucose and water react to form carbon dioxide and oxygen

Question 16**1 mark**

Phloem tissue is adapted for its function because it:

- A) Consists of dead, lignified vessels providing mechanical strength
- B) Consists of living sieve tube elements and companion cells that support active loading of sucrose
- C) Transports water and minerals from roots to leaves only
- D) Has no cell membrane, allowing free diffusion of all substances

Question 17**1 mark**

During drought conditions, the plant hormone abscisic acid (ABA) helps conserve water by:

- A) Promoting stomatal opening to increase gas exchange
- B) Promoting stomatal closure, reducing water loss through transpiration
- C) Increasing the rate of transpiration
- D) Stimulating additional stomata to form on the leaf surface

Question 18**1 mark**

A hormone released into the bloodstream will only affect cells that:

- A) Are located near the endocrine gland that released it
- B) Display specific receptors complementary to that hormone
- C) Have a nucleus
- D) Are part of the nervous system

Question 19**1 mark**

Brown adipose tissue helps some endotherms maintain body temperature in cold conditions by:

- A) Insulating the body with a layer of fat that reduces heat loss
- B) Generating heat directly through a specialised form of thermogenesis
- C) Increasing evaporative heat loss
- D) Storing energy without producing heat

Question 20**1 mark**

A disease that is transmitted to humans via the bite of an infected mosquito is best described as being spread by:

- A) Direct contact
- B) A contaminated water source
- C) A disease-specific vector
- D) Contaminated food

Section 2 — Short Response (20 marks)

Question 21

4 marks

Compare the structure and function of xylem and phloem tissue in plants.

Question 22

3 marks

An experiment measured the rate of transpiration from a plant at different light intensities.

Light intensity (units)	0	20	40	60	80	100
Transpiration rate (relative units)	2	10	22	34	44	46

Describe the trend shown in the data and explain the biological reason for this trend.

Question 23**4 marks**

Explain the difference between competitive and non-competitive enzyme inhibition, including how increasing substrate concentration affects each type.

Question 24**3 marks**

Describe two innate defence mechanisms used by plants to prevent pathogen infection.

Question 25**4 marks**

The table below shows information collected from five people during a disease outbreak linked to a community event.

Person	Water source	Attended shared BBQ	Onset
1	Well A	Yes	Day 2
2	Town supply	Yes	Day 5 (mild symptoms)
3	Well A	No	Day 2
4	Well A	Yes	Day 3
5	Town supply	No	No illness

Analyse the data to infer the most likely mode of transmission for this outbreak. Justify your answer using the data.

Question 26**2 marks**

Explain what a zone of inhibition indicates in an antimicrobial testing experiment, and how it can be used to compare the effectiveness of different antimicrobial agents.
