

## **BIOLOGY GRADE 10**

### **MID TERM 2 2026**

### **MARKING SCHEME**

#### **SECTION A (40 MARKS)**

1. (a) Structure of a mitochondrion and adaptation to function (5 marks)

- Double membrane – outer membrane smooth, inner membrane folded into cristae (1 mark)
- Cristae – increase surface area for attachment of enzymes and electron transport chains (1 mark)
- Matrix – contains DNA, ribosomes, and enzymes for Krebs cycle (1 mark)
- Intermembrane space – for proton gradient during oxidative phosphorylation (1 mark)
- Adaptations: large SA for respiration enzymes; compartmentalization for efficient ATP production (1 mark)

1. (b) Diagram of mitochondrion (3 marks)

- Correct shape (bean/oval) – (1 mark)
- Cristae labelled – (1 mark)
- Matrix labelled – (1 mark)

(Also accept: outer membrane, inner membrane, intermembrane space)

2. (a) i) Light compensation point (2 marks)

- Light intensity at which rate of photosynthesis equals rate of respiration (1 mark)
- Net gas exchange = zero (1 mark)

(From table: between 0 and  $2 \times 1000$  lux, approx  $0.5-1.0 \times 1000$  lux)

2. (a) ii) Percentage increase ( $4 \rightarrow 8 \times 1000$  lux) (2 marks)

- Rate at 4 = 4.0, Rate at 8 = 4.8
- Increase =  $4.8 - 4.0 = 0.8$  (1 mark)
- % increase =  $(0.8 / 4.0) \times 100 = 20\%$  (1 mark)

2. (b) Water loss process (1 mark)

- Transpiration (1 mark)

3. (a) Anaerobic respiration in plants (4 marks)

- Occurs in absence of oxygen (1 mark)
- Glucose  $\rightarrow$  ethanol +  $\text{CO}_2$  + ATP (1 mark)
- Takes place in cytoplasm (1 mark)
- Example: root cells during waterlogging (1 mark)

3. (b) Two differences aerobic vs anaerobic (2 marks)

- O<sub>2</sub> required vs not required (1 mark)
- More ATP (36–38) vs less ATP (2) – (1 mark)

(Also accept: end products CO<sub>2</sub>+H<sub>2</sub>O vs ethanol +CO<sub>2</sub>; occurs in mitochondria vs cytoplasm)

4. (a) Transverse section of dicot leaf – diagram (5 marks)

- Upper epidermis, lower epidermis (1 mark)
- Palisade mesophyll (1 mark)
- Spongy mesophyll (1 mark)
- Vascular bundle (xylem/phloem) (1 mark)
- Stoma/guard cells (1 mark)

(Labels must be correct for marks)

4. (b) Palisade mesophyll location (3 marks)

- Near upper surface to capture more sunlight (1 mark)
- Cells contain many chloroplasts (1 mark)
- Maximizes photosynthesis rate (1 mark)

5. (a) Definition of osmosis (1 mark)

- Net movement of water molecules from high water potential to low water potential across a partially permeable membrane (1 mark)

5. (b) Cell in hypertonic solution (4 marks)

- Water moves out of cell by osmosis (1 mark)
- Cell shrinks/crenates (animal) or plasmolysis (plant) – (1 mark)
- Explanation: higher solute concentration outside than inside (1 mark)
- Water potential lower outside (1 mark)

**SECTION B (40 MARKS)**

6. (a) Diagram of human heart (6 marks)

- Right atrium, right ventricle (1 mark)
- Left atrium, left ventricle (1 mark)
- Pulmonary artery, pulmonary vein (1 mark)
- Aorta, vena cava (1 mark)
- Septum (1 mark)
- Valves (tricuspid/bicuspid/semilunar) – (1 mark)

6. (b) Pathway of blood through heart (4 marks)

- Deoxygenated blood → vena cava → right atrium → tricuspid valve → right ventricle → pulmonary valve → pulmonary artery (to lungs) – (2 marks)
- Oxygenated blood from lungs → pulmonary vein → left atrium → bicuspid valve → left ventricle → aortic valve → aorta (to body) – (2 marks)

7. (a) Curve for enzyme activity vs temperature (3 marks)

- Correct shape: increases to optimum, then decreases sharply – (1 mark)
- Optimum labelled (~37–40°C for catalase) – (1 mark)
- X-axis (temp), Y-axis (activity) labelled – (1 mark)

7. (b) Increase up to optimum temperature (2 marks)

- Increased kinetic energy (1 mark)
- More frequent successful collisions between enzyme and substrate (1 mark)

7. (c) Above 60°C (2 marks)

- Enzyme denatures (1 mark)
- Active site shape changes permanently → substrate cannot bind (1 mark)

7. (d) Part responsible for substrate binding (1 mark)

- Active site (1 mark)

8. (a) Definitions (3 marks)

- i) Reflex: rapid, automatic, involuntary response to stimulus (1 mark)
- ii) Synapse: gap between two neurons where neurotransmitters transmit signal (1 mark)
- iii) Hormone: chemical messenger transported in blood to target organ (1 mark)

8. (b) Reflex arc diagram (4 marks)

- Sensory receptor → sensory neuron → relay neuron (spine) → motor neuron → effector (1 mark)
- Correct labels for each (3 marks)

8. (c) Reflex actions faster than conscious responses (3 marks)

- Shorter pathway (no brain involvement) (1 mark)
- Fewer synapses (1 mark)
- No conscious decision-making time (1 mark)

9. (a) Menstrual cycle & hormones (6 marks)

- Days 1–5: menstruation – (1 mark)
- Days 6–14: follicle develops, oestrogen rises → repair endometrium (1 mark)
- Day 14: ovulation (LH surge) – (1 mark)
- Days 15–28: corpus luteum secretes progesterone → maintain endometrium (1 mark)
- Hormones: FSH, LH, oestrogen, progesterone (2 marks)

9. (b) Two contraception methods (4 marks)

- Method 1: e.g., condom – prevents sperm meeting egg (barrier) – (2 marks)
  - Method 2: e.g., pill – hormonal inhibition of ovulation – (2 marks)
- (Other acceptables: IUD, implant, sterilization, natural rhythm)

10. (a) Carrying capacity (2 marks)

- Maximum population size an environment can sustain indefinitely (1 mark)
- Without degrading the environment (1 mark)

10. (b) Bacterial doubling (2 marks)

- Initial = 100, after 1h = 200, 2h = 400, 3h = 800, 4h = 1600 (1 mark)

· Working:  $100 \times 2^4 = 100 \times 16 = 1600$  (1 mark)

10. (c) Four biotic factors limiting population (2 marks)

· Competition, predation, disease, parasitism ( $\frac{1}{2}$  mark each)

10. (d) Food chain vs food web (2 marks)

· Food chain: single pathway of energy transfer (1 mark)

· Food web: interconnected multiple food chains (1 mark)

11. (a) Mutation (1 mark)

· Sudden, heritable change in DNA sequence (1 mark)

11. (b) Two environmental mutagens (1 mark)

· Radiation (UV, X-rays), chemicals (cigarette tar, pesticides) – ( $\frac{1}{2}$  each)

11. (c) Natural selection leading to evolution (4 marks)

· Variation exists in population (1 mark)

· Overproduction leads to struggle for existence (1 mark)

- Individuals with advantageous traits survive and reproduce (1 mark)
- Over generations, favourable alleles increase in frequency (1 mark)

11. (d) Two pieces of evidence for evolution (2 marks)

- Fossil record (1 mark)
- Comparative anatomy (homologous structures) – (1 mark)

(Also accept: DNA evidence, embryology, biogeography)

