# Biology Paper 1

Sample assessment 2026–27

**Time allowed: 2 hours  Total marks: 70**

**Do not open this paper until instructed. Record every answer in the separate answer booklet.**

## Instructions

- Answer all questions.
- Section A multiple-choice questions come first. Record the selected option in the separate answer booklet.
- Write all extended responses in the separate answer booklet and identify each question clearly.
- A scientific, non-programmable, non-graphing calculator may be used.
- No data or formula booklet is provided for this paper.
- Show all working where relevant.
- No AI is permitted.
- The mark allocation is shown beside each question.

**Answer all 20 Section A multiple-choice questions and all five Section B questions.**
**Record all answers in the separate answer booklet, using the printed identifiers A1–A20 and B1(a)–B5(d).**
**Choose one option A–D for each multiple-choice question.**
**A scientific, non-programmable, non-graphing calculator is permitted. No formula or data booklet is supplied.**
**Show relevant working and use units where appropriate. No AI, internet or unauthorised electronic assistance is permitted.**

## Section A · Multiple-choice questions

Answer all 20 multiple-choice questions. 20 marks.

Question A1: Which statement is part of cell theory? 1
A. All cells contain chloroplasts.
B. New cells arise from existing cells.
C. All organisms consist of several cells.
D. Every cell has a membrane-bound nucleus.

Question A2: Which structure occurs in both a typical bacterial cell and a typical animal cell? 1
A. A Golgi apparatus
B. A nuclear envelope
C. A ribosome
D. A chloroplast

Question A3: What is meant by the resolution of a microscope? 1
A. Its ability to distinguish two close points as separate
B. The ratio of image size to actual size
C. The diameter of its eyepiece lens
D. The brightness of its light source

Question A4: Which organelle modifies and packages proteins for secretion? 1
A. The nucleolus
B. A centriole
C. A lysosome
D. The Golgi apparatus

Question A5: Which part of a phospholipid faces the aqueous cytoplasm in a cell-surface membrane? 1
A. Its hydrophobic tails
B. Its hydrophilic head
C. Its peptide bonds
D. Its cholesterol ring

Question A6: Which membrane component can bind an extracellular signalling molecule and initiate a cellular response? 1
A. A receptor protein
B. A cellulose fibre
C. A free ribosome
D. A glycogen granule

Question A7: Which process can move a dissolved substance against its concentration gradient using metabolic energy? 1
A. Simple diffusion
B. Osmosis
C. Active transport
D. Facilitated diffusion

Question A8: In which process does a cell release material when a vesicle fuses with the cell-surface membrane? 1

A. Endocytosis
B. Plasmolysis
C. Mitosis
D. Exocytosis

Question A9: Which description of osmosis is correct? 1

A. Net movement of water from higher to lower water potential through a partially permeable membrane
B. Net movement of solute from lower to higher concentration through any membrane
C. Movement of all molecules towards pure water
D. Movement of water that always requires ATP

Question A10: During which part of the cell cycle is DNA replicated? 1

A. G1 phase
B. S phase
C. Metaphase
D. Cytokinesis

Question A11: Which event occurs during anaphase of mitosis? 1

A. Homologous chromosomes pair.
B. DNA replication begins.
C. Sister chromatids separate.
D. The nuclear envelope first reforms.

Question A12: Which property distinguishes a pluripotent stem cell from a multipotent stem cell? 1

A. It has no chromosomes.
B. It cannot divide.
C. It always forms an entire organism.
D. It can form cell types from all three embryonic germ layers.

Question A13: Which enzyme begins protein digestion in the stomach? 1

A. Amylase
B. Pepsin
C. Lipase
D. Maltase

Question A14: Which feature most directly increases the surface area available for absorption in the small intestine? 1

A. A thick layer of cartilage
B. A single large air space
C. Villi and microvilli
D. A waterproof outer cuticle

Question A15: What causes food to move along the oesophagus by peristalsis? 1

A. Coordinated contraction and relaxation of muscles in its wall
B. Diffusion of food through the wall
C. The beating of cilia inside blood vessels
D. Contraction of the diaphragm alone

Question A16: Which vessel carries oxygenated blood from the lungs to the heart? 1
A. The pulmonary artery
B. The vena cava
C. The hepatic portal vein
D. The pulmonary vein

Question A17: Which structure normally initiates the electrical activity that sets the heart’s rhythm? 1
A. The aortic semilunar valve
B. The sinoatrial node
C. The left ventricular cavity
D. The coronary vein

Question A18: Which change normally promotes oxygen unloading from haemoglobin in an actively respiring tissue? 1
A. A decrease in carbon dioxide concentration
B. An increase in pH alone
C. An increase in carbon dioxide concentration
D. A decrease in temperature alone

Question A19: An image of a cell is 48 mm long. The actual cell is 24 µm long. What is the image magnification? 1
A. ×2
B. ×20
C. ×200
D. ×2,000

Question A20: A person’s heart rate is 75 beats per minute. What is the mean duration of one cardiac cycle? 1
A. 0.80 s
B. 1.25 s
C. 4.50 s
D. 75 s

## Section B · Extended-response questions

Answer all 5 extended-response questions. 50 marks.

### Question B1: Cell structure and microscopy — 10

A pancreatic cell produces a protein that is released from the cell. A micrograph of one of its mitochondria shows an image length of 36 mm. The actual mitochondrial length is 3.0 µm.

(a) Describe the roles of ribosomes, rough endoplasmic reticulum, the Golgi apparatus and secretory vesicles in producing and releasing the protein. [4]

(b) Calculate the magnification of the mitochondrial image. Show your working. [2]

(c) Explain why transmission electron microscopy can reveal internal mitochondrial detail that cannot be resolved with a light microscope. [2]

(d) A learner selects only the five largest mitochondria visible in one micrograph and uses their mean length to represent all mitochondria in the tissue. Identify one limitation of this sampling method and explain a suitable improvement. [2]

### Question B2: Membranes and water movement — 10

Potato pieces of comparable dimensions were immersed for 40 minutes in sucrose solutions. One piece had an initial mass of 2.50 g and a final mass of 2.20 g. Only one piece was used at each concentration.

(a) Describe the arrangement of phospholipids in the cell-surface membrane. [2]

(b) Explain how facilitated diffusion differs from simple diffusion through the phospholipid bilayer. [2]

(c) Calculate the percentage change in mass of the potato piece. Show the sign and your working. [2]

(d) Explain the net mass change using water potential and membrane properties. [2]

(e) Explain why using only one piece per concentration weakens the conclusion, and propose an improvement. [2]

Question B3: Cell division and stem cells 10

A research group is considering cells for replacing damaged tissue. It compares adult tissue stem cells with embryonic stem cells. No treatment outcome is supplied.

(a) Describe four events in mitosis that result in two nuclei with the same chromosome number as the original nucleus. [4]

(b) State two ways in which the products of meiosis differ from the products of mitosis, starting from a diploid cell. [2]

(c) Explain one potential advantage of embryonic stem cells over adult tissue stem cells for producing replacement cell types. [2]

(d) Identify one ethical concern about using embryonic stem cells and explain why it should influence a decision about this research. [2]

Question B4: Digestion and absorption 10

A small-intestine preparation is used to investigate glucose uptake. In one condition, oxygen availability is greatly reduced, limiting ATP production. At the start of a separate uptake measurement, the solution contains 18.0 mg of glucose. After 5.0 minutes it contains 12.0 mg. Assume that uptake by the preparation accounts for this decrease.

(a) Describe how enzymes digest starch and protein into molecules that can be absorbed. [4]

(b) Explain how limiting ATP production can reduce sodium–glucose cotransport from the intestinal lumen into epithelial cells. [4]

(c) Calculate the mean glucose uptake rate in mg per minute for the separate measurement. [2]

Question B5: Circulation and tissue exchange 10

During an activity, a person has a heart rate of 120 beats per minute and a stroke volume of 85 $cm^3$ per beat. Researchers also compare oxygen delivery and exercise performance in a small group of volunteers.

(a) Describe how the atrioventricular and semilunar valves control blood flow during ventricular systole and ventricular diastole. [4]

(b) Calculate cardiac output in $dm^3$ per minute. Show your working. [2]

(c) An actively respiring muscle uses oxygen rapidly. Explain how its capillary exchange surface supports oxygen delivery to its cells. [3]

(d) The volunteers with higher measured oxygen delivery also perform better in an exercise task. State one reason why this association alone does not establish that higher oxygen delivery caused better performance. [1]