Biology Paper 2 Mark Scheme

Sample assessment 2026–27

Time allowed: 2 hours Total marks: 70

STAFF ONLY

Credit valid equivalent scientific responses where they meet the approved set-specific marking criteria. Reconcile every maximum mark to the candidate paper and answer booklet.

Section A · Multiple-choice questions

Award 1 mark for each correct answer.

Question	Correct answer
A1	C · Sodium ions entering through voltage-gated channels Opening voltage-gated sodium channels permits sodium influx.
A2	A · It permits saltatory conduction between nodes. Action potentials are regenerated at nodes of Ranvier.
A3	D · Rods Rods support vision at low light levels.
A4	B · The lens becomes more convex. Accommodation for near vision increases lens refractive power.
A5	B · Troponin Calcium binding to troponin moves the troponin–tropomyosin complex.
A6	D · The Z-lines move closer together. Filaments slide past each other without shortening.
A7	A · Plasma cells Plasma cells differentiate from activated B lymphocytes.
A8	C · Engulfment of particles into a cell in a vesicle A phagocyte takes particles into an intracellular compartment.
A9	D · Alveolar pressure falls below atmospheric pressure. Expansion of the thorax lowers pressure within the lungs.
A10	B · A thin epithelial lining A thin barrier shortens the gas diffusion pathway.
A11	C · The cytoplasm Glycolysis occurs in the cytoplasm.
A12	A · Oxaloacetate Oxaloacetate is regenerated during the cycle.
A13	A · Oxygen Oxygen accepts electrons and combines with protons to form water.
A14	C · The thylakoid membranes Photosystems and associated electron carriers occur in thylakoid membranes.

Question	Correct answer
A15	B · Ribulose bisphosphate Carbon dioxide is fixed to ribulose bisphosphate in a reaction catalysed by rubisco.
A16	D · RNA polymerase RNA polymerase links complementary RNA nucleotides during transcription.
A17	C · It carries an amino acid and has an anticodon complementary to an mRNA codon. The anticodon helps position the appropriate amino acid.
A18	D · Somatic gene therapy targets body cells and is not intended to be inherited. Somatic treatment does not target the germline.
A19	B · 0.80 12 / 15 = 0.80; the ratio has no units.
A20	A · 1/4 The probabilities of aa and bb are each 1/2; their product is 1/4.

Section B · Extended-response marking map

Question B1 · 10 marks

(a) 3 marks
1 mark: Depolarisation opens voltage-gated calcium channels.
1 mark: Calcium ions enter the presynaptic terminal.
1 mark: Calcium entry triggers vesicle fusion with the membrane and neurotransmitter release by exocytosis.
Mapping: LO13; AO1 3

(b) 3 marks
1 mark: A myosin head binds to an exposed site on actin.
1 mark: The head changes angle in a power stroke, pulling actin.
1 mark: ATP binding detaches myosin from actin, or ATP hydrolysis re-energises/repositions the head for another cycle.
Mapping: LO15; AO1 3

(c) 2 marks
1 mark: Acetylcholine cannot activate its receptors to depolarise the muscle membrane sufficiently/initiate a muscle action potential.
1 mark: The normal signal for calcium release inside the muscle is absent, so actin sites are not exposed and cross-bridge cycling is not activated.
Mapping: LO13, LO15; AO2 2

(d) 2 marks
1 mark: The lens spreads/diverges incoming light rays before they enter the eye.
1 mark: This moves the focus farther back onto the retina.
Mapping: LO14; AO2 2

Alternative valid responses / allocation: (b) Credit any three distinct accurate events; ATP binding and hydrolysis may be credited as separate events if their roles are correctly distinguished.

Question B2 · 10 marks

(a) 2 marks
1 mark: Mucus traps particles and microorganisms.
1 mark: Cilia move mucus towards the throat, where it can be swallowed/removed.
Mapping: LO10; AO1 2

(b) 4 marks
1 mark: The antigen binds to a B lymphocyte with a complementary receptor.
1 mark: The selected B lymphocyte is activated, with appropriate helper-cell signals.
1 mark: It divides by mitosis to form a clone.
1 mark: Some cloned cells differentiate into plasma cells that secrete specific antibodies.
Mapping: LO16; AO1 4

(c) 2 marks
1 mark: Memory cells specific to that antigen remain after the first exposure.
1 mark: They respond rapidly and produce more antibody-secreting cells on re-exposure.
Mapping: LO16; AO2 2

(d) 2 marks
1 mark: The response is specific to the antigen tested and does not establish protection against unrelated pathogens.
1 mark: Antibody concentration alone does not measure complete clinical protection; effectiveness also depends on factors such as antibody function, pathogen variation or other immune responses.
Mapping: LO16; AO3 2

Alternative valid responses / allocation: (b) Credit an equivalent accurate account of clonal selection and expansion.
(d) One mark per distinct reason. Credit other relevant limits; do not require a particular disease example.

Question B3 · 10 marks

(a) 4 marks
1 mark: Reduced coenzymes donate electrons to the electron transport chain.
1 mark: Energy released during electron transfer drives proton pumping from the matrix into the intermembrane space.
1 mark: This establishes an electrochemical proton gradient across the inner membrane.
1 mark: Proton flow back through ATP synthase drives phosphorylation of ADP to ATP.
Mapping: LO25; AO1 4

(b) 2 marks
1 mark: Proton leakage dissipates/reduces the gradient.
1 mark: Less energy is available from proton flow through ATP synthase, reducing ATP synthesis even if electron transfer continues.
Mapping: LO25; AO2 2

(c) 2 marks
1 mark: Rates are 4.0 and 6.0 nmol min^{-1}, or uses the equivalent volume/amount ratio for the same interval.
1 mark: Percentage increase = 100 × (6.0 − 4.0) / 4.0 = 50%.
Mapping: LO25; AO2 2

(d) 2 marks
1 mark: Identifies an appropriate variable such as temperature, substrate concentration, oxygen availability or mitochondrial integrity.
1 mark: Explains how this variable could independently affect respiration/ATP production, so controlling it helps attribute differences to the test substance.
Mapping: LO24, LO25; AO3 2

Alternative valid responses / allocation: (c) Correct 50% earns both marks; a correct method followed by arithmetic error earns one.
(d) A matched variable and reason are required. Equal mitochondrial mass is already specified but may be credited if its effect on the measured rate is explained.

Question B4 · 10 marks

(a) 4 marks
1 mark: Light excites electrons in chlorophyll/photosystems.
1 mark: Water is split to supply replacement electrons and protons.
1 mark: Oxygen is released from the splitting of water.
1 mark: Electrons and protons are used to reduce NADP to reduced NADP.
Mapping: LO26; AO1 4

(b) 2 marks
1 mark: At 100/200 units the rates are the same, consistent with light limiting the response rather than carbon dioxide in this range.
1 mark: At 400/800 units higher carbon dioxide gives a higher rate, consistent with carbon dioxide limiting the lower-carbon-dioxide treatment.
Mapping: LO26; AO2 2

(c) 2 marks
1 mark: Lower carbon dioxide: 5.0 − 5.0 = 0.0 μmol min^{-1}.
1 mark: Higher carbon dioxide: 9.0 − 7.0 = 2.0 μmol min^{-1}.
Mapping: LO26; AO2 2

(d) 2 marks
1 mark: Respiration consumes some oxygen while photosynthesis produces oxygen, so net output is reduced by respiration.
1 mark: Measure respiration/oxygen consumption independently, for example in darkness with an explicit assumption about its applicability in the light.
Mapping: LO26; AO3 2

Alternative valid responses / allocation: (b) Both marks require reference to the supplied pattern; do not demand that a single factor is the only possible limit.
(c) One mark per correct result with units.
(d) Credit an appropriate alternative method; dark respiration is an estimate, not proof that respiration has the same rate in light.

Question B5 · 10 marks

(a) 4 marks
1 mark: Heating separates the two DNA strands.
1 mark: Cooling allows primers to bind to complementary target sequences.
1 mark: A thermostable DNA polymerase extends from the primers.
1 mark: Complementary free nucleotides are joined to synthesise new DNA strands.
Mapping: LO29; AO1 4

(b) 4 marks
1 mark: Correct complementary RNA bases AUG CCU GAA.
1 mark: Correct orientation 5′–AUG CCU GAA–3′.
1 mark: Methionine is the first amino acid.
1 mark: Proline followed by glutamate completes the correct sequence.
Mapping: LO22; AO2 4

(c) 1 mark
1 mark: 1/4, 0.25 or 25%.
Mapping: LO27; AO2 1

(d) 1 mark
1 mark: It enables the person to decide whether to permit a use with privacy/personal or familial implications, rather than assuming permission for a different purpose.
Mapping: LO30; AO3 1

Alternative valid responses / allocation: (a) Credit the correct sequence and scientific roles. Exact temperatures are not required.
(b) Award the orientation mark only with a correctly oriented sequence; accept unambiguous standard amino-acid abbreviations. Do not require a stop codon outside the supplied segment.
(d) Credit a relevant explanation of autonomy or privacy; the bare phrase “it is ethical” is insufficient.

Marking principles

Award one mark for the single correct MCQ option; otherwise award zero. No negative marking. If an answer is clearly replaced, mark the final unambiguous choice.

For Section B, use the stated point allocations and specific calculation rules. Credit equivalent scientifically correct responses; do not double-credit a repeated point.

Where a later calculation uses an earlier incorrect value correctly, credit the independent subsequent method unless this makes the task trivial. Do not award the final accuracy mark for an incorrect result.

Do not penalise spelling unless meaning is unclear or a different scientific term is given. Assess scientific content rather than agreement with a preferred ethical position.

All raw marks, marker identities, moderation decisions and release approvals must be recorded through the controlled pack processes.

Section A item map (1 mark each): A1–A2 LO13/AO1; A3–A4 LO14/AO1; A5–A6 LO15/AO1; A7–A8 LO16/AO1; A9–A10 LO10/AO1; A11–A12 LO24/AO1; A13 LO25/AO1; A14–A15 LO26/AO1; A16–A17 LO22/AO1; A18 LO30/AO1; A19 LO25/AO2 (respiratory-quotient calculation); A20 LO28/AO2 (dihybrid test-cross probability). Section A totals: AO1 18, AO2 2. Section B item mappings total AO1 24, AO2 19, AO3 7. Paper mapping: AO1 42, AO2 21, AO3 7; total 70.