

INTERNATIONAL A-LEVEL **BIOLOGY (9610)**

BL05

Unit 5 Synoptic paper

Mark scheme

January 2026

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the typical answer or answers which are expected
- extra information to help the examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit.

The extra information in the 'Comments' column is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme. At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for the same mark are indicated by the use of **OR**. Different terms in the mark scheme are shown by a/; eg allow smooth/free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of errors/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can usually be gained by correct substitution/working and this is shown in the 'Comments' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

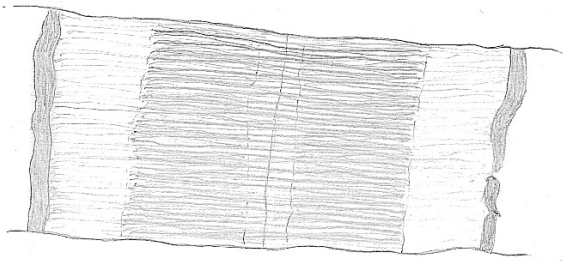
3.7 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking guidance	Mark	Comments
01.1	<p>For 3 marks: answer = 18;;;</p> <p>For 2 marks: <u>Correct Length in Figure 2</u> eg <u>51</u> Same correct length in Figure 1 2.8</p> <p>OR</p> <p>Answer in range but not a whole number – eg 18.2</p> <p>OR</p> <p>Answer in range with incorrect order of magnitude – eg 1.8 / 180</p> <p>OR</p> <p><u>Length in Figure 2</u> and corresponding whole number answer Same length in Figure 1 but measurement(s) not in range</p> <p>For 1 mark:</p> <p><u>Length in Figure 2</u> and corresponding non-integral answer Same length in Figure 1 and measurement(s) not in range</p>	3	<p>Allow a whole number in range 17 to 21</p> <p>Allow Length in Figure 2 = 50 to 53 mm</p> <p>Allow Length in Figure 1 = 2.5 to 3.0 mm</p>

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Question	Marking guidance	Mark	Comments
01.2	1. Drawing large and clear with smooth lines; 2. Correct shape and one whole sarcomere drawn; 3. Correct internal details;	3	1. Not sketchy/broken lines 3. Two Z-lines + A-band + two I-bands + H-zone + M-line eg 

Question	Marking guidance	Mark	Comments
01.3	1. Electrons (in Figure 2) have shorter wavelength than light (in Figure 1); 2. (Electrons/ Figure 2) give(s) higher resolution;	2	1. Ignore magnification 2. Allow description of higher resolution – can distinguish between 2 objects that are closer together

Question	Marking guidance	Mark	Comments
01.4	J;	1	

Question	Marking guidance	Mark	Comments
01.5	1. Thick and thin filaments slide along each other; 2. Thin filaments now fill part J OR Thin filaments now fill H-zone;	2	Ignore references to I-band 1. Allow thin filaments slide inwards 2. Allow there is no longer a region with just thick filaments

Question	Marking guidance	Mark	Comments
01.6	76;	1	

Question	Marking guidance	Mark	Comments
01.7	1. Thin/actin filaments overlap one another; 2. Fewer cross-bridges can form with thick filaments/myosin;	2	

Question	Marking guidance	Mark	Comments
02.1	<p>1. Details of dilution technique;</p> <p>2. Further detail of dilution technique using numbers;</p> <p>3. Peel/remove epidermis from plant;</p> <p>4. Leave pieces of epidermis in each concentration of sucrose for a suitable time (to equilibrate);</p> <p>5. Mount on microscope slide in <u>same</u> concentration of sucrose;</p> <p>6. Count number of plasmolysed cells and number of turgid cells in a specific area</p> <p>OR</p> <p>count number of plasmolysed cells and number of turgid cells in a set total number of cells;</p> <p>7. Calculate the percentage of the total that are plasmolysed;</p> <p>8. Repetitions and calculation of mean percentage for each sucrose concentration;</p>	7 max	<p>2. eg 0.4 mol dm^{-3} by adding 6 parts water to 4 parts 1.0 mol dm^{-3} sucrose solution</p> <p>4. Time = at least 10 min if stated</p> <p>5. Do not allow if buffer/stain solution also added</p> <p>4. and 5. Allow equilibration in solution on slide = 2 marks</p> <p>6. eg in field of vision or for a total ≥ 20 cells</p> <p>8. At least twice more</p>

Question	Marking guidance	Mark	Comments
02.2	<p>1. Line graph;</p> <p>2. Sucrose concentration on x-axis and (mean of) % plasmolysed cells on y-axis;</p> <p>3. Line graph because two continuous variables;</p> <p>4. Draw smooth curve/line of best fit;</p>	3 max	<p>1. Allow scatter graph</p> <p>3. Allow line graph to enable interpolation to find concentration of sucrose having same water potential as the cells</p>

Question	Marking guidance	Mark	Comments
02.3	Idea of cannot tell the difference between a cell with the membrane just touching the cell wall and a turgid cell;	1	

Question	Marking guidance	Mark	Comments
02.4	<p>1. Cells have different water potentials</p> <p>OR</p> <p>different solute concentrations;</p> <p>2. Cells plasmolyse to varying extents in a given solution</p> <p>OR</p> <p>50% plasmolysed gives a typical/representative value</p> <p>OR</p> <p>½ the cells will be below the mean and ½ above the mean;</p>	2	

Question	Marking guidance	Mark	Comments
02.5	Answer ≥ 0.3 and < 0.4 ;	1	

Question	Marking guidance	Mark	Comments
03.1	<p>X = nucleus</p> <p>Y = myelin (sheath)</p> <p>Z = dendrite;;</p>	2	<p>All 3 correct = 2 marks</p> <p>2 correct = 1 mark</p> <p>0 or 1 correct = 0 marks</p> <p>2. Allow Schwann cell</p>

Question	Marking guidance	Mark	Comments
03.2	<p>1. P to Q: (Voltage-gated) Na⁺ channels open and Na⁺ ions (diffuse) in causing increase in membrane potential;</p> <p>2. Q to R: (Na⁺ channels close and) (voltage-gated) K⁺ channels open and K⁺ ions (diffuse) out (causing decrease in membrane potential);</p> <p>3. R to S: (K⁺ channels close and) movement of (3) Na⁺ ions out (for every 2) K⁺ ions in (to restore resting potential) by pump mechanism</p> <p>OR</p> <p>Na⁺ ions out and K⁺ ions in by active transport</p> <p>OR</p> <p>Na⁺ ions out and K⁺ ions in using ATP;</p>	3	<p>1. Allow more positive potential OR less negative potential OR decreased potential difference OR depolarisation</p> <p>2. Allow less positive potential OR more negative potential OR increased potential difference OR repolarisation</p> <p>1. 2 and 3. Must give correct description of membrane potential change at least once for full marks</p>

Question	Marking guidance	Mark	Comments
04.1	<p>1. Parent 1 (can make enzyme A but) cannot make enzyme B so can only produce substance B (white)</p> <p>OR</p> <p>Parent 1 (can make enzyme A but) cannot make enzyme B so cannot produce substance C / purple pigment;</p> <p>2. Parent 2 (can make enzyme B but) cannot make enzyme A so cannot alter substance A (white)</p> <p>OR</p> <p>Parent 2 (can make enzyme B but) cannot make enzyme A so cannot produce substance(s) B (and C / purple pigment);</p>	2	

Question	Marking guidance	Mark	Comments
04.2	<p>1. F₁ plants have genotype AaBb;</p> <p>2. Can make/have active enzyme A and enzyme B (to form substance C) (purple);</p>	2	1. Allow F ₁ plants have A and B

Question	Marking guidance	Mark	Comments																									
04.3	1. Male and female gametes correct: AB + Ab + aB + ab ; 2. Offspring genotypes correctly derived from stated gametes; 3. Offspring phenotypes correct for stated genotypes;	3	2. Must be derived from A/a and B/b in each gamete eg <div><div>Male gametes →</div><div>Female gametes ↓</div><table><tr><td></td><td>AB</td><td>Ab</td><td>aB</td><td>ab</td></tr><tr><td>AB</td><td>AABB^P</td><td>AABb^P</td><td>AaBB^P</td><td>AaBb^P</td></tr><tr><td>Ab</td><td>AABb^P</td><td>AAbb^W</td><td>AaBb^P</td><td>Aabb^W</td></tr><tr><td>aB</td><td>AaBB^P</td><td>AaBb^P</td><td>aaBB^W</td><td>aaBb^W</td></tr><tr><td>ab</td><td>AaBb^P</td><td>Aabb^W</td><td>aaBb^W</td><td>aabb^W</td></tr></table></div>		AB	Ab	aB	ab	AB	AABB ^P	AABb ^P	AaBB ^P	AaBb ^P	Ab	AABb ^P	AAbb ^W	AaBb ^P	Aabb ^W	aB	AaBB ^P	AaBb ^P	aaBB ^W	aaBb ^W	ab	AaBb ^P	Aabb ^W	aaBb ^W	aabb ^W
	AB	Ab	aB	ab																								
AB	AABB ^P	AABb ^P	AaBB ^P	AaBb ^P																								
Ab	AABb ^P	AAbb ^W	AaBb ^P	Aabb ^W																								
aB	AaBB ^P	AaBb ^P	aaBB ^W	aaBb ^W																								
ab	AaBb ^P	Aabb ^W	aaBb ^W	aabb ^W																								

Question	Marking guidance	Mark	Comments
04.4	1. Fertilisation is random; 2. Only see expected/representative/reliable/valid ratios if large numbers OR Allows use of statistical test;	2	2. Allow converse re. small numbers 2. Allow reduces effect of chance variations/anomalies 2. Ignore reference to accurate/precise

Question	Marking guidance	Mark	Comments
<p>04.5</p>	<p>Yes, because:</p> <p>1. With 1 degree of freedom;</p> <p>2. Closest to $\chi^2 = 3.17$ is χ^2 between 2.71 and 3.84</p> <p>OR</p> <p>closest is 3.84</p> <p>OR</p> <p>P is between 0.10 and 0.05/$P \approx 0.05$/$P > 0.05$/$P > 5\%$</p> <p>OR</p> <p>$\chi^2 < \text{critical value of } 3.84$;</p> <p>3. So this <u>difference</u> (from expected result) is due to chance</p> <p>OR</p> <p>So this <u>difference</u> (from expected result) is not significant</p> <p>OR</p> <p>So accept null hypothesis;</p>	<p>3</p>	<p>If incorrect number of degrees of freedom, still allow mp2 and mp3 with appropriate values</p> <p>1. Allow use of appropriate figures to imply 1 degree of freedom – eg 2.71 / 3.84</p> <p>3. Do not allow the ‘results’ are due to chance</p> <p>3. Do not allow the ‘results’ are not significant</p>

Question	Marking guidance	Mark	Comments
05.1	<p>In support:</p> <ol style="list-style-type: none"> Similar ages so comparable OR age is a control variable; Same sex so comparable OR sex is a control variable; Other parameters (/named) similar so comparable; Reference to SDs overlap for all so no significant differences; Standardised type of exercise so comparable; Use of control group so can compare or see effect of exercise; <p>Against:</p> <ol style="list-style-type: none"> Similar ages / all young so do not know effect on other ages; All female so do not know effect on males; Only done once so need repetitions to confirm repeatability/validity; Only 7 in each group so not necessarily representative; Blood cortisol highly variable at start (SD $\pm$ 40 to 70% of mean) so difficult to test validity of changes; Idea of uncertainty of intensity level of exercise so not comparable; Total time of exercise in groups 2 and 3 not the same so not comparable; Only one type of exercise so do not know effects of other types; 	6 max	<p>Must have points in support and points against, together with implications, for full marks</p> <p>Must have at least one correct reference to SD for full marks</p> <p>3. Allow women put into groups randomly so avoid bias</p> <p>9. Allow once so do not know long term effect</p> <p>10. Allow only 7 in a group so cannot be generalised (to whole population) OR allow only 21 in total</p>

Question	Marking guidance	Mark	Comments
05.2	<p>Fitness:</p> <ol style="list-style-type: none"> Group 3 (/continuous) return to resting heart rate (whereas group 2 (/intervals) do not); Difference from Group 2 is <u>significant</u> as SDs do not overlap; <p>Cortisol:</p> <ol style="list-style-type: none"> Group 3 has greater reduction in cortisol than group 2; Group 3 (and group2) cortisol reduced to healthy range (100-200); Group 3 cortisol after is significantly different from start value as SDs do not overlap <p>OR</p> <p>group 2 cortisol is not significantly different from start as SDs do overlap</p> <p>OR</p> <p>group 3 cortisol is significantly less than Group 2 as SDs do not overlap;</p> <p>Obesity:</p> <ol style="list-style-type: none"> Group 3 with lowered cortisol less likely to store fat or less likely to crave fatty/sweet foods so could reduce obesity; (Continuous medium-intensity) exercise may use fat as energy supply <p>OR</p> <p>may use fat in aerobic respiration;</p>	4 max	For full marks must make at least one valid point from each of the 3 aspects and must have at least one correct reference to SD

Question	Marking guidance	Mark	Comments
06.1	<p>1. Use of quadrats/described of specified size – eg 1m²;</p> <p>2. Many random samples;</p> <p>3. Method of achieving randomness – eg random coordinates from a calculator/computer;</p> <p>4. Count the number of plants of each species in each quadrat;</p> <p>5. Identify the species using a key/pictures;</p> <p>6. Calculate the mean number per unit area (eg m²) for each species;</p> <p>7. Measure area of field;</p> <p>8. Multiply each mean (per m²) by the area of the field;</p> <p>9. Substitute in the equation:</p> $d = \frac{N(N - 1)}{\sum n(n - 1)}$	7 max	<p>2. At least 20 samples if a number is specified</p> <p>3. Do not allow throwing quadrats</p> <p>3. Allow random walk with numbers from calculator / computer</p> <p>8. Allow idea of scaling up to area of field</p> <p>9. Allow reciprocal equation</p>

Question	Marking guidance	Mark	Comments
06.2	<p>Biotic factors:</p> <ol style="list-style-type: none"> 1. Herbivores/animals eat plants; 2. Seed dispersal by animals to colonise new areas; 3. Disease caused by pathogens / bacteria / fungi / viruses <p>OR</p> <p>Vectors of pathogens – (eg viruses via aphids);</p> <ol style="list-style-type: none"> 4. Animals that increase reproduction – eg flying insects carry pollen; 5. Competition from other plants for light/water/ions; <p>Abiotic factors:</p> <ol style="list-style-type: none"> 6. Light – used in photosynthesis for photolysis of water <p>OR</p> <p>electron excitation</p> <p>OR</p> <p>making ATP/NADPH;</p> <ol style="list-style-type: none"> 7. Temperature – affects rates of chemical reactions/named eg by increasing kinetic energy or high temperature denaturing enzymes/proteins 8. Water – support/turgor <p>OR</p> <p>for transport</p> <p>OR</p> <p>medium for reactions</p> <p>OR</p> <p>reactant in photolysis/hydrolysis;</p>	6 max	<p>For full marks, must include both biotic factors and abiotic factors</p> <p>6. Allow as a biotic factor – eg shaded by other plants (Once only between abiotic and biotic)</p> <p>8. Allow as a biotic factor – eg competition with other plants (Once only between abiotic and biotic)</p>

<p>9. Ions – eg Mg^{2+} in chlorophyll OR NO_3^- for amino acids/proteins/nucleic acids OR HPO_4^{2-} in DNA/RNA/ATP/phospholipids;</p> <p>10. pH – optimum for enzyme action OR availability of ions;</p> <p>11. Oxygen (in soil) – aerobic respiration to make ATP OR electron acceptor;</p> <p>12. Carbon dioxide – combines with RuBP OR makes GP/TP;</p>	<p>9. Allow as a biotic factor – eg competition with other plants (Once only between abiotic and biotic)</p> <p>9. Do not allow just the name of the element – must specify ions - eg magnesium ions</p> <p>10. Allow extremes of pH denature enzymes/proteins</p> <p>11. Allow as a biotic factor – eg aeration of soil by burrowing animals (Once only between abiotic and biotic)</p> <p>12. Allow carbon dioxide used in Calvin cycle</p>
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Question	Marking guidance	Mark	Comments
06.3	<p>1. Means of transfer (of ancestor) from Africa to Madagascar – eg on rafts of vegetation;</p> <p>2. Isolation of different populations (by sea);</p> <p>3. Habitat variation between populations;</p> <p>4. Genetic variation</p> <p>OR</p> <p>mutation (in each population);</p> <p>5. Better adapted (survive to) reproduce;</p> <p>6. (Survivors) pass on favourable <u>allele(s)</u>;</p> <p>7. Speciation has occurred if African and Madagascan populations cannot interbreed to produce fertile offspring;</p>	5 max	<p>2. Allow reproductive isolation (by sea)</p> <p>3. Allow examples of biotic factors – eg different food/predators OR abiotic factors – eg different climate</p> <p>3. Allow different selection pressures</p> <p>5. Ignore natural selection</p> <p>5. Ignore survival of the fittest</p> <p>6. Allow (survivors) pass on <u>mutations</u></p> <p>6. Ignore pass on characteristics/genes</p>

Question	Marking guidance	Mark	Comments
06	<p><u>Quality of written communication</u></p> <p>These are awarded for correct use of scientific terms and the ability to present a clear, logical account. They are not awarded for spelling, punctuation and grammar.</p> <p><u>2 marks</u> for an answer in which technical terms are used correctly throughout and the accounts are presented clearly and logically.</p> <p><u>1 mark</u> for an answer in which most technical terms are used correctly and most of the accounts are presented clearly and logically.</p> <p><u>0 marks</u> for an answer in which few technical terms are used correctly or the accounts are seldom presented clearly and logically.</p>	2	Award mark for overall performance in 06.1 , 06.2 and 06.3