

Markscheme

May 2026

Biology

Higher level

Paper 1B

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Subject Details: Biology HL Paper 1b Markscheme

Candidates are required to answer **all** questions. Maximum total = **35 marks**.

1. A markscheme often has more marking points than the total allows. This is intentional.
2. Each marking point has a separate line and the end is shown by means of a semicolon (;).
3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.
4. An alternative answer is indicated by “**OR**”. Either answer can be accepted.
5. An alternative markscheme is indicated under heading **ALTERNATIVE 1** etc. Either alternative can be accepted.
6. Words in brackets () in the markscheme are not necessary to gain the mark.
7. Words that are underlined are essential for the mark.
8. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
9. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect).
10. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
11. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking indicate this by adding **ECF** (error carried forward) on the script.
12. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

Question			Answers	Notes	Total
1.	a	i	a. plant cells have chloroplasts/chlorophyll, whereas fungal cells do not; b. plant cells have amyloplasts/plastids, whereas fungal cells do not; c. plant cells have starch granules, whereas fungal cells have glycogen granules OR plant cells have starch granules, whereas fungal cells do not have starch granules; d. plant cell wall is made of <u>cellulose</u>, whereas fungal cell wall is made of <u>chitin</u>; e. plant cells are not aseptate but fungal cells may be;	<i>Both plant and fungal cells need to be in each statement, or implied with only ...</i> <i>Mp a. Do not accept 'plants can photosynthesise'.</i> <i>Mp c. Allow vice versa.</i> <i>Mp d. Must name both substances.</i> <i>Do not accept difference in vacuoles.</i>	2 max
1.	a	ii	a. plant chromosome is linear/not circular, whereas a bacterial chromosome/DNA is <u>circular</u>/a <u>loop</u>; b. plant chromosome contains histones/nucleosomes (associated with DNA), whereas a bacterial chromosome/DNA is naked/without histones; c. plant chromosome contains introns, whereas a bacterial chromosome/DNA (usually) does not;	<i>Both plant and bacterial chromosomes/DNA need to be in each statement, or implied with only ...</i> <i>Mp b. Do not accept 'naked DNA' vs not 'naked DNA' or 'condensed' implying histones.</i>	2 max

Question			Answers	Notes	Total
1.	b	i	(so) chromosomes/DNA/chromatin can be seen;	<i>Do not accept: (so) cells/nucleus/mitosis/genetic material can be seen.</i>	1
1.	b	ii	a. $\text{mitotic index} = \frac{\text{number of cells in mitosis;}}{\text{total number of cells}}$ b. use of repeated/random sampling OR repeat (counts) in different areas / fields of view OR multiple trials;	<i>Mp a. Accept a description of the equation Accept naming of all mitotic phases/PMAT.</i> <i>Mp b. 'repeat counts' on its own is too vague.</i>	

Question			Answers	Notes	Total
1.	c		a. lower mitotic index indicates reduced tumour growth; b. C60 (alone) has no effect (on reducing tumour growth); c. Dox has a large effect (on tumour growth) OR Dox has a greater effect than C60/control; d. C60+Dox/combination of drugs, reduced (tumour growth) the most/was the most effective/was more effective than either drug alone; e. error bars/SDs overlap, so suggests there is no significant difference between the control and C60 OR error bars/SDs don't overlap, so suggests there is a significant difference between two named groups (e.g. control and Dox only);	<i>Mp a. It needs to be clearly stated, often by using words such as 'as', 'because', 'thus', etc. 'And' is not sufficient to award the mark.</i> <i>Allow vice versa. Do not accept 'no' tumour growth.</i> <i>Mp b. Do not accept 'small/little effect'.</i> <i>Mp c. Do not accept greatest/most. Accept very effective.</i> <i>Mp e. Accept description of the groups e.g. A and C / Control and Dox.</i>	3 max

Question			Answers	Notes	Total
2.	a		a. (total) <u>surface area</u> is a control variable OR <u>surface area</u> (of discs) needs to be the same; b. (as size/surface area) affects (rate of) diffusion/leakage;	<i>Mp a. 'No confounding variable' is too vague.</i> <i>Do not accept reference to number of cells, or surface area to volume ratio.</i> <i>Mp b. Do not accept 'permeability'.</i> <i>Do not award the mark if absorption rather than leakage/diffusion is mentioned.</i>	2
2.	b		use a thermometer/temperature probe at intervals/throughout/to take readings;	<i>Do not accept 'Use a thermometer to monitor' or 'measure' only.</i> <i>Accept measuring temperature constantly (equal throughout), but not 'temperature remains constant' as this is in the stem.</i>	1
2.	c		a. increases reliability (of the mean) OR reduces the effect of random error/outliers; b. allows anomalies/outliers to be identified; c. allows a mean/average to be calculated; d. allows error bars to be drawn (using range);	<i>Do not credit references to increasing accuracy or preventing/removing anomalies from occurring.</i> <i>Mp c. Do not award a mark for statistical tests as there aren't sufficient repeats for such tests.</i>	1 max

Question			Answers	Notes	Total
2.	d		a. as temperature increases (up to 70 °C) membrane permeability increases; b. <u>phospholipids</u> move more/apart (with increased temperature); c. (membrane) <u>proteins</u> denature (above a threshold temperature); d. at 70 °C, all changes to the membrane have already taken place, so no further change OR at 70 °C, all changes to the membrane have already taken place, so absorbance plateaus;	<i>Do not accept cholesterol as these are plant cells.</i> <i>Mp a. Accept (pigment) molecules passing through the membrane instead of permeability. Do not accept 'leaking out' alone.</i> <i>Mp b. accept <u>phospholipid bilayer</u> becomes unstable.</i> <i>Do not accept phospholipid/membrane fluidity.</i> <i>Mp c. accept change to (3D) structure/shape but not damaged (too vague).</i>	3 max
2.	e		a. less subjective / more objective / does not rely on human judgement / different people judge colour intensity differently; b. can determine colour intensities between these values / may have colour intensities between (continuous) values OR generates more precise measurements;	<i>Accept converse arguments for the disadvantages of using a colour scale.</i> <i>Mp b. Do not accept accurate/specific/exact/reliable/wider range instead of precise.</i> <i>Accept 'more significant figures'.</i>	2

Question			Answers	Notes	Total
3.	a		a. respiration/seeds use/absorb/take in <u>oxygen</u> ; b. there is a decrease of volume/pressure (in the tube, as the amount of gas decreases);	<i>Mp b. Ignore carbon dioxide.</i>	2 max
3.	b		returns the coloured liquid back to the right/start/zero OR resets the apparatus / <i>OWTTE</i> OR oxygen/air/volume is replenished;	<i>Do not accept recalibrate.</i>	1 max
3.	c		0.85;	<i>Do not accept answers more or less than 2 decimal places.</i> $(3.14 \times (0.5)^2 \times 26) / 24 = 0.85$	1
3.	d		(shows that) only the seeds/respiration are responsible for causing the results;	<i>OWTTE</i> <i>Accept reverse argument</i> <i>'to show that respiration does not occur when no seeds are present'</i> <i>Do not allow 'for comparison' alone</i> <i>Allow examples of results, e.g. movement of the coloured liquid, change in pressure/volume/use of oxygen.</i>	1

Question			Answers	Notes	Total
3.	e		a. H^+/protons are moved/pumped/taken up/accumulated (across a membrane) OR H^+/proton gradient is formed; b. (pumped from matrix) into the intermembrane space; c. (then) H^+/protons diffuse/flow from intermembrane space to matrix OR (then) H^+/protons diffuse/flow down/along the concentration gradient; d. using ATP synthase; e. ADP + P combine (to produce ATP) OR phosphorylation of <u>ADP</u>; f. using energy from the H^+/proton gradient / OWTTE;	<i>Mp a. Reject 'H^+/protons diffuse/flow'.</i>	4 max

Question			Answers	Notes	Total
4.	a	i	a. <i>D.sechellia</i> and <i>D.simulans</i> ; b. (as) shortest distance from a node/branch point OR (as) share a more recent common ancestor OR (as) split/diverged more recently;	<i>Mp b. 'They share a common ancestor'/'same clade' is too vague.</i>	2
4.	a	ii	same amino acid can be coded for by different codons/triplets/base sequences OR the genetic code is degenerate;	<i>Do not accept universal instead of degenerate.</i> <i>Allow genetic code is redundant.</i>	1
4.	b	i	575;	575 in all boxes	1

Question			Answers	Notes	Total
4.	b	ii	a. chi-squared/1002.65 is greater than <u>7.82/11.34</u> OR chi-squared/1002.65 is greater than the critical value at 3 degrees of freedom; b. (so) reject null hypothesis/H₀; c. there is a <u>significant</u> difference between observed and expected numbers; d. probability that differences are due to chance is <0.05/5%/0.01/1% OR p<0.05/5%/0.01/1% OR p is inside the critical/significant region; e. (so) the genes do not assort independently OR (so) the genes are not on different chromosomes OR (so) the genes are on the same chromosome / linked;	<i>Do not award mp c if the null hypothesis has been accepted [CON].</i> <i>Mp e. Do not accept phenotypes are on different chromosomes.</i>	3 max