

Markscheme

May 2025

Biology

Higher level

Paper 1B

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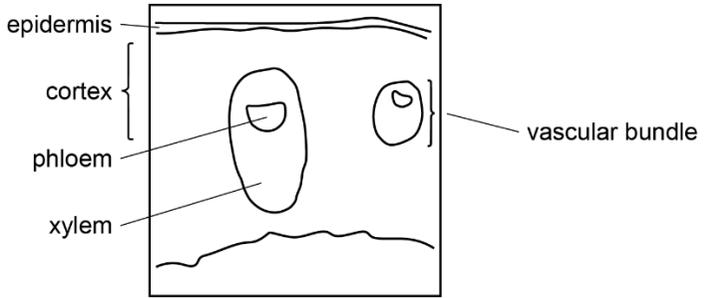
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Subject Details: Biology HL Paper 1B Markscheme

Candidates are required to answer **all** questions in Paper 1B. 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	<p>a. vascular bundle; b. xylem OR phloem; c. epidermis; d. cortex;</p> 	<p><i>Award one mark for properly labelled tissue and drawn in correct proportion/ shape.</i></p> <p><i>Note that a plan diagram is needed. Do not accept diagrams with cells indicated.</i></p>	3 max
1.	b i	0.45 mm / 0.045cm / 450µm;	<p><i>Units required for the mark.</i></p> <p><i>Accept answers in the ranges of 0.42-0.47 mm / 0.042-0.047cm / 420-470µm.</i></p>	1
1.	b ii	<p>count number of (eyepiece graticule) divisions within the stem thickness AND multiply by number of micrometers / actual length represented by one graticule division</p> <p>OR</p> <p>calculate the actual length of each graticule division AND multiply by the number of divisions (taken up by the thickness of the stem);</p>		1

Question		Answers	Notes	Total
1.	c	(presence of sharp) spines/thorns / other physical structures OR (production of) toxins / toxic chemicals / secondary compounds (in seeds and leaves) / stings;		1
1.	d	a. (thick) waxy cuticle to avoid water loss by evaporation/transpiration; b. small leaves / spines to reduce surface area for evaporation/transpiration; c. sunken stomata / hairs to keep moisture near the surface and reduce transpiration rate; d. rolled leaves keep moisture near the surface and reduce transpiration rate; e. succulent leaves with water storage tissue; f. some (CAM) plants open stomata only at night when temperature is cooler to decrease water loss;	<i>Adaptation + explanation needed for a mark.</i>	2 max

Question			Answers	Notes	Total
2.	a	i	DNA, as it is a double helix / base pairs can be seen OR DNA, as it is wrapped around the core region;		1
2.	a	ii	a. (core is) made of <u>proteins/polypeptides</u> OR the secondary structure / alpha helices of the proteins can be seen; b. there are <u>8 histone</u> molecules OR there are <u>4 types</u> of <u>histone</u> molecules;	<i>b. Accept <u>histone octamer</u> for 8 <u>histones</u>.</i>	2 max
2.	b		no (super)coiling/condensation / organization of DNA OR there is little DNA / only a single loop of DNA / have naked DNA / no histone proteins;		1 max
2.	c		a. cladistics classifies/groups organisms/species based on evolutionary relationships; b. evidence comes from <u>DNA base sequences</u> ; c. compare/analyse (base) sequences of the same gene between different species; d. the more similarities in (base) sequences the more closely related species are; e. all organisms with a common ancestry are placed in a clade; f. (gradual) accumulation of mutations/differences (in base sequences) used as basis for when clades diverged (from common ancestor);	<i>mp d. Accept reverse argument</i>	4 max

Question			Answers	Notes	Total
3.	a	i	statin/inhibitor concentration OR type of statin;		1
3.	a	ii	pH / temperature / concentration of substrate/enzyme / volume of substrate/enzyme / size of containers / time;		1 max
3.	b		<p><u>Similarities [max 2]</u></p> <p>a. (overall) with both statins, activity of HMG-CoA reductase/enzyme decreases as concentrations (of statins) increase;</p> <p>b. both statins cause the most reduction/decrease in activity / inhibition (of HMG-CoA reductase/enzyme) when concentrations increase from <u>0 to 80 μM</u>;</p> <p>c. the activity of HMG-CoA reductase/ the enzyme is the same between 0-40 μM/at 260 μM of statins</p> <p><u>Differences [max 2]</u></p> <p>d. between 80 and 160 μM, activity (of HMG-CoA reductase/enzyme) decreases more with S1 than with S2;</p> <p>e. as concentrations of statins increase from 160 to 320 μM, the activity (of HMG-CoA reductase/enzyme) increases with S1 but continues decreasing with S2;</p> <p>f. the greatest inhibitory effect/ reduction in enzyme activity occurs at a concentration of 160 μM with S1, but at 320 μM with S2;</p>	<p><i>Both similarities and differences needed for 3 marks</i></p> <p><i>c. Allow values between 0-50 μM / 250-270 μM.</i></p> <p><i>d. Vice versa.</i></p>	3 max

Question		Answers	Notes	Total																
3.	c	a. volume/concentration of product present divided by time taken for its appearance OR volume/concentration of substrate used divided by time taken for its disappearance; b. reciprocal of time taken (1/time taken) for either product to appear or substrate to disappear;	Must have an indication of time. Accept correct formula.	1 max																
3.	d	<table border="1" style="margin-left: 40px;"> <thead> <tr> <th></th> <th>Competitive</th> <th>Non-competitive</th> <th></th> </tr> </thead> <tbody> <tr> <td>a.</td> <td>binds to <u>active</u> site</td> <td>binds to <u>allosteric</u> site</td> <td>;</td> </tr> <tr> <td>b.</td> <td>blocks the active site</td> <td>changes the shape of the enzyme/active site</td> <td>;</td> </tr> <tr> <td>c.</td> <td>affected by substrate concentration</td> <td>not affected by substrate concentration</td> <td>;</td> </tr> </tbody> </table>		Competitive	Non-competitive		a.	binds to <u>active</u> site	binds to <u>allosteric</u> site	;	b.	blocks the active site	changes the shape of the enzyme/active site	;	c.	affected by substrate concentration	not affected by substrate concentration	;	Answer should include both distinguishing statements to gain 1 mark.	1 max
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3.	e	<table border="1"> <thead> <tr> <th><i>a. name of process</i></th> <th><i>b. description</i></th> </tr> </thead> <tbody> <tr> <td>(blood) clotting;</td> <td>thrombin converts fibrinogen to fibrin (blocks/prevents entrance of pathogens);</td> </tr> <tr> <td>phagocytosis;</td> <td>(hydrolytic) enzymes (present in lysosomes) digest/ break down pathogens/ bacteria;</td> </tr> <tr> <td>secretion of mucus;</td> <td>enzymes in mucus kill/destroy pathogens;</td> </tr> <tr> <td>B-lymphocytes/ plasma B-cells;</td> <td>use enzymes to produce antibodies (once activated);</td> </tr> </tbody> </table>	<i>a. name of process</i>	<i>b. description</i>	(blood) clotting;	thrombin converts fibrinogen to fibrin (blocks/prevents entrance of pathogens);	phagocytosis;	(hydrolytic) enzymes (present in lysosomes) digest/ break down pathogens/ bacteria;	secretion of mucus;	enzymes in mucus kill/destroy pathogens;	B-lymphocytes/ plasma B-cells;	use enzymes to produce antibodies (once activated);	<p><i>Process and description must match for 2 marks</i></p>	<p>2 max</p>
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Question			Answers	Notes	Total																		
4.	a	i	157;	<i>Accept range between 156 and 158</i>	1																		
4.	a	ii	168;	<i>Accept range between 167 and 169</i>	1																		
4.	a	iii	a. they are outliers; b. (both values) are more than 1.5 times the interquartile range/IQR above the third/ upper quartile/maximum height;		1 max																		
4.	b		a. (data suggests) wide range of heights / not only a few distinct forms / show <u>continuous</u> variation; b. (it is correct) as (continuous variation) is due to several genes controlling height OR (it is partially correct) as (continuous variation) also influenced by environmental factors/ differences in diet;		2																		
4.	c		<p><u>Similarity:</u></p> <p>a. both result in a change in allele frequency (within a population) OR both do not favour / select against the mean/intermediate (phenotype) OR both occur in response to environmental changes/pressures OR both can result in new species;</p> <p><u>Difference:</u></p> <table border="1" style="display: inline-table; vertical-align: top;"> <tr> <td>b.</td> <td>directional favours</td> <td>disruptive favours</td> </tr> <tr> <td></td> <td>one side of mean</td> <td>both sides of mean</td> </tr> <tr> <td></td> <td>OR</td> <td></td> </tr> <tr> <td></td> <td>one extreme</td> <td>both extremes</td> </tr> <tr> <td></td> <td>OR</td> <td></td> </tr> <tr> <td></td> <td>one phenotype</td> <td>two phenotypes</td> </tr> </table>	b.	directional favours	disruptive favours		one side of mean	both sides of mean		OR			one extreme	both extremes		OR			one phenotype	two phenotypes	<p><i>a. Do not accept natural selection as it is in the question.</i></p> <p><i>b. Answer should include both distinguishing statements to gain the mark.</i></p>	2
b.	directional favours	disruptive favours																					
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Question		Answers	Notes	Total
4.	d	<p>a. <i>correct equation given:</i> $p^2 + 2pq + q^2 = 1$ where p and q denote allele frequencies;</p> <p>b. applies when (only) one dominant and one recessive allele of a gene exist;</p> <p>c. can be used to predict allele/genotype frequencies in populations;</p> <p>d. predictions are valid as long as allele frequencies remain constant/are not changed / natural selection/evolution does not occur;</p> <p>e. assumes (mating) population is large / mating is random / no genetic drift</p> <p>OR</p> <p>assumes there are no mutations / no emigration/immigration/migration takes place;</p>		3 max
