

Markscheme

May 2025

Biology

Standard level

Paper 2

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Subject Details: Biology SL Paper 2 Markscheme

Candidates are required to answer **all** questions in Section A and **one** out of **two** questions in Section B. Maximum total = **50 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.

Section B

Extended response questions - quality of construction

- ◆ Extended response questions for SLP2 carry a mark total of **[16]**. Of these marks, **[15]** are awarded for content and **[1]** for the quality of the answer.
- ◆ **[1]** for quality is to be awarded when:
 - ◆ the candidate's answers are clear enough to be understood without re-reading.
 - ◆ the candidate has answered the question succinctly with little or no repetition or irrelevant material.
- ◆ It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.
- ◆ Candidates that score very highly on the content marks need not necessarily automatically gain **[1]** for quality (and *vice versa*).

Section A

Question		Answers	Notes	Total
1.	a	20(%)	accept 19 - 22%	1
1.	b	<p>a. germination starts between 6-8 days; b. reaches between 90-95% germination;</p> <p>Key: Incubation time with hydrogen cyanide</p> <ul style="list-style-type: none"> □ 0 hours (control) ◇ 1 hour ▲ 3 hours ○ 6 hours ■ 18 hours △ 24 hours ● 48 hours 		2
		<p>Used with permission of Oxford University Press - Journals, from <i>Journal of Experimental Botany</i>, Society for Experimental Biology (Great Britain), Federation of European Societies of Plant Physiology, Vol. 59, Issue 8, 2008. Permission conveyed through Copyright Clearance Center, Inc.</p>		

Question		Answers	Notes	Total
1.	c	<p><i>Similarities:</i></p> <p>a. both showed an increase in germination OR at 3 days the seeds incubated for 18 hours have the same percentage germination as the control OR both seeds incubated for 18 hours, and the control seeds did not germinate during the first 2 days;</p> <p><i>Differences:</i></p> <p>b. a higher percentage of seeds germinated when incubated 18 hours than the control seeds OR percentage of germinated seeds incubated for 18 hours shows a steeper increase than the control seeds (between 3 and 5 days) OR seeds incubated for 18 hours level off but percentage of germinated seeds in control continues to increase gradually;</p>		2

Question		Answers	Notes	Total
1.	d	longer (more than 6) hours incubation (with cyanide) causes a delay in days to begin germination OR there is a lag in germination rate at the beginning of each cyanide line (with 6 or more hours) that is not present in the control line / <i>OWTTE</i> ;		1

Question		Answers	Notes	Total
1.	e	a. from the graph, 6 hours produced the fastest germination; b. no incubation times between 6 and 18/3 and 6 hours were tested (so cannot say what the optimum incubation time is) OR the hypothesis is not supported because seeds incubated with different hours eventually reach 100%/close to 100% germination;		2
1.	f	0.5 nl h ⁻¹ g ⁻¹ ;	Units required Accept answers between 0.4 and 0.5	1
1.	g	135;	Accept answers from 131 and 137.	1
1.	h	Similarity a. both D and ND (seed embryos) produced more ethylene with incubation in cyanide; Difference b. ND (seed embryos) produced more total ethylene than D OR D (seed embryos) show a bigger proportional increase than ND seeds OR D has a bigger spread of data;		2

Question		Answers	Notes	Total
2	a	mutation OR sexual reproduction/meiosis/random fertilization/crossing over/independent assortment;		1
2.	b	a. change in environment may cause which characteristics are advantageous/disadvantageous OR selection pressures change; b. natural selection favours organisms that are best adapted to survive in the (changed) environment OR organisms that possess the favourable genes/are best adapted to the environment will survive to / reproduce/pass their traits on; c. an example of a trait and how it may become more advantageous/disadvantageous for a specific change in environment;	<i>Accept vice versa</i>	2 max
2.	c	a. keystone species have a disproportionate/significant/high/large effect on the structure of an ecosystem / <i>OWTTE</i> ; b. loss of biodiversity/diversity of species will occur; c. change of population size/numbers of other species may occur; d. change/disruption in food webs/chains would occur; e. example of loss and its effect;		2 max

Question		Answers	Notes	Total
3.	a	the neuron is insulated since it shows Schwann cells/myelin sheath can be seen;		1
3.	b	a. DNA/chromosomes; b. ribosomes; c. plasma/cell membrane/phospholipid bilayer; d. cytoplasm/cytosol;		2 max
3.	c	a. action potential/nerve impulse reaches the end of the presynaptic neuron; b. impulse/action potential/depolarization of the (presynaptic) membrane causes calcium (ions)/Ca ²⁺ uptake/diffusion into the neuron; c. (calcium ions) cause vesicles to move to the (presynaptic) membrane; d. vesicles contain neurotransmitter; e. neurotransmitter released into the synaptic gap/cleft by exocytosis/when vesicle fuses with membrane;		3 max

Question		Answers	Notes	Total
4.	a	hydrolysis/catabolic reaction;		1
4.	b	a. branching of capillaries gives a large total surface area for exchange OR capillaries are numerous so every cell is close enough to allow rapid exchange of material/monosaccharides OR capillaries beds are dense increasing surface area for exchange; b. thin/one cell thick <u>walls</u> facilitate diffusion/exchange of materials/monosaccharides; c. fenestrations/larger openings/pores between capillary cells (for more rapid movement) for exchange of material/monosaccharides;		2 max
4.	c	a. movement of material/fructose from an area of high concentration to low/with the concentration gradient; b. does not require (ATP) energy/is passive; c. requires channel/integral proteins; d. channel proteins make membrane selectively permeable;	<i>c. Do not accepts carrier protein, pumps or any protein that requires ATP to function</i>	2 max

Question		Answers	Notes	Total
5.	a	nucleotide(s);		1
5.	b	a. DNA is double stranded, and RNA is single stranded; b. DNA contains the sugar deoxyribose and RNA contains ribose; c. DNA contains thymine and RNA contains uracil; d. DNA is a long molecule and RNA is much shorter;	<i>Both contrasting statements about the point being considered need be given to obtain one mark</i>	2 max
5.	c	a. phenotype is the appearance of a genotype; b. a genotype may be homozygous/TT, tt or heterozygous/Tt / <i>OWTTE</i> ; c. dominant alleles mask/hide the presence of the recessive allele OR dominant alleles show their effects / are expressed with the presence of one single dominant allele (in a genotype) / Tt and TT both show dominant trait/phenotype; d. genotype tt / homozygous recessive shows recessive trait/phenotype OR absence of a dominant allele shows recessive trait/phenotype; e. if the recessive allele is sex linked, only one allele is present in males and will be expressed;	<i>Answers may be shown in an annotated Punnett Grid</i>	3 max

Section B

Clarity of communication: [1]

The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

Question		Answers	Notes	Total
6.	a	<p>a. cohesion is caused by the polarity of water OR water molecules have a negative and positive end;</p> <p>b. water molecules are attracted to each other OR water molecules are linked by hydrogen bonds;</p> <p>c. (cohesion) enables water to move along stems/xylem OR enables a continuous column of water in transpiration/transpiration pull;</p> <p>d. surface tension provides a habitat for some organisms OR some insects can walk on water surface because of surface tension/other verified example OR cohesion is related to buoyancy allowing organisms (like ringed seal) to float;</p> <p>e. helps animals regulate body temperature (through evaporative cooling);</p> <p>f. (cohesion causes high specific heat) so maintains a stable temperature in aquatic environments OR water is liquid at a wide range of temperatures supporting many aquatic habitats;</p>		4 max
6.	b	<p>a. transpiration is the evaporation of water from the stomata/openings of the plant leaf;</p> <p>b. increase in humidity will decrease water loss/transpiration;</p> <p>c. increase in temperature will increase water loss/transpiration;</p> <p>d. increase in wind/ air movement will increase water loss/transpiration;</p> <p>e. increase in light intensity will increase water loss/transpiration;</p> <p>f. lack of water in soil causes stomates to close/transpiration to decrease;</p>	<i>Accept vice versa for these statements</i>	4 max

Question		Answers	Notes	Total
6.	c	<p>a. osmosis is <u>water</u> moving through a partially/semi permeable membrane/cell membrane/aquaporins;</p> <p>b. osmosis is a form of simple diffusion OR water travels down the (water) concentration gradient OR osmosis is passive;</p> <p>c. the solute concentration determines the direction of net movement of water;</p> <p>d. plant cells in hypotonic solutions will take in water;</p> <p>e. they will swell/are turgid/develop turgor pressure (in hypotonic solutions);</p> <p>f. cell wall prevents the plant cells from bursting due to water pressure (in hypotonic solutions);</p> <p>g. plant cells in hypertonic solutions will lose water;</p> <p>h. they will shrink/get smaller/flaccid (in hypertonic solutions);</p> <p>i. the cell membrane will pull away from the cell wall/plasmolysis (in hypertonic solutions);</p> <p>j. isotonic solutions are the same concentration as inside the plant cells/cytoplasm/cell sap;</p> <p>k. plant cells will have no net change (in isotonic solutions)/water moves equally in and out of the cell/dynamic equilibrium;</p>		7 max

Question		Answers	Notes	Total
7.	a	a. carbon can form 4 bonds; b. carbon forms <u>covalent</u> bonds; c. carbon can form single or double/triple bonds; d. carbon can form bonds with other carbon atoms / with other (non-metallic) elements; e. carbon can form branched / unbranched chains; f. carbon can form single / multiple rings;		4 max
7.	b	a. (short term) storage of carbon/CO ₂ in the atmosphere/aquatic environments as CO ₂ ; b. photosynthesis/carbon fixation: carbon/CO ₂ is absorbed; c. feeding: carbon is passed through food chains in organic molecules; d. (cellular) respiration returns carbon/CO ₂ to the environment; e. (long term) storage of carbon in fossil fuels/ limestone/ forests; f. decomposition returns carbon/CO ₂ to the atmosphere OR decomposers/saprotrophs return carbon to the soil; g. carbon dioxide is put into the environment by burning/combustion OR carbon dioxide is put into atmosphere by volcanic activity; h. used by coral/mollusca/specific organism as calcium carbonate to build shells;	Accept answers shown as an annotated carbon cycle.	4 max

Question	Answers	Notes	Total
<p>7. c</p>	<p>a. greenhouse effect describes that greenhouse gases trap long-wave radiation from the Earth's surface and absorbs it keeping the Earth warm OR increase in greenhouse gases trapped in atmosphere increases Earth's temperature;</p> <p>b. burning of fossil fuels/peat/coal/natural gas by humans has released more CO₂ into the atmosphere causing temperature rise on Earth;</p> <p>c. raising livestock for feed has added methane/greenhouse gas to the atmosphere causing more heat to be trapped on Earth;</p> <p>d. industrial processes / fertilizer production has increased the concentration of nitrous oxides/greenhouse gases in the atmosphere;</p> <p>e. deforestation has increased the amount of CO₂ in the atmosphere/reduced an important sink for CO₂;</p> <p>f. increased temperatures have caused melting of land ice leading to changes to polar habitats/decreasing species ability to survive OR melting of ice/snow causes reduction in albedo, so there is more insolation absorbed at Earth's surface;</p> <p>g. warmer surface water prevents upwelling of nutrients/decreases ocean productivity;</p> <p>h. coral reef habitat destruction due to changes in water pH / temperature;</p> <p>i. warmer temperatures/decreased snowfall has led to droughts and loss of life/habitats;</p> <p>j. rates of decomposition of peat/organic matter increases greenhouse gases;</p> <p>k. ocean/sea level rise from melting ice/thermal expansion of oceans has impacted coastal regions/loss of land;</p> <p>l. changing weather patterns due to global warming has caused loss of life and infrastructure;</p> <p>m. poleward migrations/migrations to more suitable places due to climate changes at lower latitudes;</p>		<p>7 max</p>