

# 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	i	<p><b>Compare (max 3)</b></p> <p>a. both eat both types of prey in both conditions;                      b. both eat similar numbers of mussels in both conditions;                      c. both eat slightly less prey in total when given a choice compared to no choice;                      d. both show large variation/ have large error bars in both conditions;</p> <p><b>Contrast. (max 3)</b></p> <p>e. males (always) eat more mussels whereas females eat more amphipods (in both conditions);                      f. males eat a larger total quantity/mean number of prey whereas females (in both conditions) eat less;                      g. female feeding remains unchanged whereas males eat fewer amphipods when they have a choice;                      h. males eat fewer mussels when they have a choice whereas this does not happen for females;</p>		4 max
1.	a	ii	<p>a. males have larger/stronger pincers/claws (to open the mussel) than females;                      b. (large) male pincers/claw may not be suitable/agile enough for grasping amphipods;                      c. prey choice depends on different nutrient/energy requirements in male and female;</p>	<p><i>Allow vice versa for females for marking points a. and b.</i></p>	1 max
1.	a.	iii	<p>protective shell / are sessile/attached to rocks / speed of movement of amphipods / nutrients/energy content / taste / difference in prey size;</p>		1

Question			Answers	Notes	Total
1.	b	i	37.5;	<i>Accept 38 (%) (rounded up from 37.5).</i>	1
1.	b	ii	males (are more flexible), as they eat both types of prey <b>OR</b> females are <u>less flexible</u> as they eat very few mussels even when they have no choice <b>OR</b> males as females consume fewer mussels when there is no choice;	<i>Reason must be given.</i>	1
1.	b	iii	a. as $p > 0.05$ (for each sex); b. chi-square value likely to be smaller than critical value / must be compared with critical value <b>OR</b> critical value not shown so significance cannot be judged; c. error bars are very large suggesting less reliable data;		2 max
1.	c		a. small sample size/ <i>OWTTE</i> ; b. short experimental time; c. (choice of) only 2 types of prey used (whereas in nature there are many types of prey); d. natural conditions not fully replicated in the aquarium / currents / contents of water / other predators / population densities of predator and prey;		1 max

Question			Answers	Notes	Total
2.	a		a group of organisms that (share traits and) can breed/interbreed/sexually reproduce <b>and</b> produce <u>fertile</u> offspring;		1
2.	b		<p>a. the number/type/size of chromosomes can be investigated/ deduced through karyotyping;</p> <p><b>OR</b></p> <p>species have a characteristic number of chromosomes</p> <p><b>OR</b></p> <p>chromosomes are classified/identified by banding, length and position of centromere;</p> <p>b. individuals/dogs with the same number <b>and</b> type/size of chromosomes (probably)belong to the same species;</p>	<p><i>Allow converse for marking point b.</i></p>	2

Question		Answers	Notes	Total
3.	a	X: produce proteins/lipids; Y: transport/modify/packaging proteins/lipids;		2
3.	b	a. <u>simple diffusion</u> along/down a concentration gradient / from high to low; b. <u>osmosis</u> is the movement of <u>water</u> from low solute concentration to high solute concentration/ from a dilute solution to a more concentrated solution; c. <u>facilitated diffusion</u> uses channel proteins to transport along/down a concentration gradient / from high to low; d. active transport/protein pumps/sodium pump use energy//ATP to transport against/up a concentration gradient /from low to high;		3 max
3.	c	a. prokaryotes have no membrane bound organelles/nucleus/other named organelle whereas eukaryotes do <b>OR</b> prokaryotes are not compartmentalized whereas eukaryotes are; b. prokaryotes have a single loop of DNA (in the cytoplasm) whereas eukaryotes have (linear) chromosomes (in a nucleus); c. prokaryotes have naked DNA/not bound to histones whereas eukaryotes have DNA bound to histones; d. prokaryotes have 70s ribosomes whereas eukaryotes have 80s/both 70s and 80s; e. prokaryote cell walls have a different structure and composition to eukaryote cell walls;	<i>Both comparative statements about the aspect are required to gain the 1 mark.</i> <i>Accept answers presented as a table.</i>	1 max

Question		Answers	Notes	Total
4.	a	<p>a. disproportionate effect/large impact on ecosystems/community structure;</p> <p>b. regulate (size/density of) populations of other organisms;</p> <p>c. maintain ecosystem stability/balance/community structure / prevent ecosystem collapse;</p>		2 max
4.	b	<p>a. high biodiversity provides more complex food webs/increased food sources <b>OR</b> low biodiversity leads to less complex food webs and reduced food sources;</p> <p>b. high biodiversity leads to a more stable ecosystem / more adaptability/sustainability <b>OR</b> low biodiversity leads to a less stable ecosystem / less adaptability/sustainability;</p> <p>c. high biodiversity leads to more resistance to change/damage <b>OR</b> low biodiversity leads to less resistance to change/damage;</p>		2 max
4.	c	<p>a. reintroduction of top/apex predators/native species/original forms <b>OR</b> retrobreeding/ artificial breeding/selection to restore wildtype <b>OR</b> remove invasive species;</p> <p>b. restore habitats/rehabilitate degraded habitats /re-establishment of connectivity of habitats over large areas (where natural ecosystems have become fragmented)/land protection / reforestation;</p> <p>c. minimize human impact / regulate/limit/reduce/eliminate human activity in the ecosystem / creation of national parks/game/natural reserve;</p> <p>d. allow natural processes of regeneration and recovery;</p>	<p>b. Do not accept "afforestation"</p>	2 max

Question		Answers	Notes	Total
5.	a	<p>a. lack of cell contents making it hollow/empty with minimal resistance to the flow of sap / easier flow of sap/water;</p> <p>b. incomplete/absent end walls (creating a long continuous tube) for flow;</p> <p>c. lignocellulose/lignified walls to withstand tensions /prevent collapsing;</p> <p>d. pits/gaps/pores for entry/exit/ horizontal movement of water;</p>	<p><i>The adaptation must be accompanied by a brief account</i></p>	<p><b>2 max</b></p>
5.	b	<p>a. water is lost through the stomata/leaves by evaporation;</p> <p>b. water is drawn out of xylem vessels / spongy mesophyll into leaf airspaces;</p> <p>c. adhesion allows water to travel through cell walls (by capillary action) / against gravity;</p> <p>d. this generates tension/pulling force/negative pressure potentials inside the xylem vessels;</p> <p>e. tension/transpirational pull draws water up in the xylem;</p> <p>f. cohesion ensures a continuous column of water in the xylem/<i>OWTTE</i>;</p> <p>g. concentration gradient created in roots allowing water intake by osmosis (from soil)</p>		<p><b>3 max</b></p>

Question		Answers	Notes	Total
6.	a	a. high daytime / low nighttime temperatures; b. lack of water / low precipitation/rainfall / dry climate/ low humidity; c. sandy (soil) /bare rock; d. high light intensity;		2 max
6.	b	a. light color of fur (to reflect the light/reduces heat absorption/to avoid predation); b. large ears (enhance heat loss/ release body heat); c. may be nocturnal/ live in burrows/underground /other behavioural adaptation;	<i>Accept other reasonable anatomical or physiological adaptation.</i>	1 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
7.	a	a. compact/less storage space needed due to coiling and branching; b. insoluble/poorly soluble due to larger molecular size; c. relative ease of adding/condensation of monosaccharides/glucose to store energy; d. relative ease of removing/hydrolysis of monosaccharides/glucose to mobilize energy;		<b>3 max</b>
7.	b	a. photosynthesis (in plants) transforms sunlight to chemical energy in carbon compounds/glucose; b. herbivores/ primary consumers obtain energy by eating plants/producers; c. energy is passed along the food chain by feeding; d. energy is lost by organisms through cell respiration/movement/maintaining body temperature/ named process (as heat); e. approximately 10 % of energy passes to the next trophic level; f. energy available for higher trophic levels is limited (by energy loss); g. number of trophic levels / lengths of food chains is limited (by energy loss); h. decomposers gain energy by breaking down dead organisms;		<b>4 max</b>

Question		Answers	Notes	Total
7.	c	<p><b>The need for energy</b></p> <p>a. life processes/active transport/metabolism/movement require energy;</p> <p>b. ATP provides energy for cell processes;</p> <p>c. energy need to break bonds in a substrate during enzyme reactions;</p> <p>d. energy is required to synthesize ATP from ADP</p> <p><b>OR</b></p> <p>energy is released when ATP is hydrolysed;</p> <p><b>Release of energy</b></p> <p>e. cell respiration produces ATP using energy stored in carbon compounds/glucose/fatty acids;</p> <p>f. aerobic respiration occurs in mitochondria;</p> <p>g. aerobic respiration requires oxygen;</p> <p>h. aerobic respiration provides more ATP/energy than anaerobic respiration;</p> <p>i. cells use mainly glucose and/or fatty acids as a fuel/substrate for respiration;</p> <p>j. in aerobic respiration carbon dioxide and water are waste products</p> <p><b>OR</b></p> <p>fuel/glucose + O<sub>2</sub> → CO<sub>2</sub> + H<sub>2</sub>O (+ energy/ATP);</p> <p>k. anaerobic respiration (in humans) yields lactic acid as a waste product</p> <p><b>OR</b></p> <p>fuel/glucose → lactic acid (+ energy/ATP);</p>	<p><i>Correct equation can gain marking points g. and j. Equation does not need to be balanced.</i></p>	<p><b>8 max</b></p>

Question		Answers	Notes	Total
8.	a	<p>a. DNA is replicated before mitosis / during interphase;                      b. after replication chromosomes consist of 2 chromatids/DNA molecules held together;                      c. during anaphase the sister chromatids are separated;                      d. each new/daughter cell receives copies of the original chromosomes;                      e. two genetically identical daughter cells are produced</p> <p><b>OR</b></p> <p>mitosis maintains chromosome number in new/daughter cells;</p>		<b>3 max</b>
8.	b	<p>a. speciation is the splitting of a species into two or more species;                      b. organisms in the same species share most of their genome/DNA</p> <p><b>OR</b></p> <p>there is some variation in the genome/DNA/alleles within a species;</p> <p>c. variations arise through mutation/random orientation of bivalents/crossing over;                      d. these alleles/variations are passed on to offspring during sexual reproduction;                      e. selection pressures change the allele frequency / favourable alleles increase in frequency / unfavourable decrease;                      f. reproductive/geographical isolation/physical barrier may then lead to speciation;</p>		<b>4 max</b>

Question		Answers	Notes	Total
8.	c	a. offspring inherit genetic traits from sexually reproducing parents via the gametes; b. genetic information contained in the DNA is copied/replicated and passed on to offspring; c. diploid organisms have two copies of each gene/allele; d. alleles may be dominant or recessive / valid example of simple dominance/recessive inheritance; e. dominant phenotype may be homozygous or heterozygous; f. recessive phenotype is expressed in homozygous individuals / with two copies of the recessive allele; g. heterozygous individuals do not display the recessive phenotype but may have offspring that do; h. alleles may display codominance / partial dominance / incomplete dominance / valid example; i. some traits result from multiple alleles / valid example; j. multiple allele inheritance results in continuous variation; k. genes carried on the sex chromosomes /X chromosome display sex linkage / valid example; l. genes may be linked on autosomes / display autosomal linkage; m. new alleles may arise by mutation;	Accept annotated examples/ diagrams /punnett grid/crosses.	8 max