

Markscheme

May 2024

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 mark

- Extended response questions for HLP2 each 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	a. all four organisms correct in each trophic level;	<p><i>The names of the trophic level are not required. Check to see if the chain starts with a producer and then 1 from each of the other trophic levels.</i></p>	2															
			<table border="1"> <thead> <tr> <th>Producer</th> <th>Consumer 1</th> <th>Consumer 2</th> <th>Consumer 3</th> </tr> </thead> <tbody> <tr> <td>Algae</td> <td>Herbivorous fish</td> <td>Piscivorous Fish</td> <td>Omnivorous Fish</td> </tr> <tr> <td>Phytoplankton</td> <td>Zooplankton</td> <td>Omnivorous Fish</td> <td>Piscivorous Fish</td> </tr> <tr> <td>Macrophytes</td> <td>Planktivorous fish</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Omnivorous fish</td> <td></td> <td></td> </tr> </tbody> </table>			Producer	Consumer 1	Consumer 2	Consumer 3	Algae	Herbivorous fish	Piscivorous Fish	Omnivorous Fish	Phytoplankton	Zooplankton	Omnivorous Fish	Piscivorous Fish	Macrophytes	Planktivorous fish	
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			b. all the arrows in the correct direction;																	
1.	a	ii	<p>a. increase through excretion (of minerals/urea)/feces/waste products;</p> <p>b. increase CO₂ through breathing/(cell) respiration;</p> <p>c. increase through decay (of dead fish);</p> <p>d. fish that eat flies and bring that matter into the lake;</p>		1 max															
1.	b		<p>a. (far) more species present / greater number of species in subtropical lakes;</p> <p>b. (far) more dense populations/more individuals per m² in the subtropical lakes;</p> <p>c. no common species in the two types of lakes;</p>	<p>a. OWTTE.</p> <p>a. and b. Accept vice versa.</p> <p>Numbers with a comparative reference is acceptable for marking point a. or b.</p>	2 max															

Continued...

Question 1 continued

Question			Answers	Notes	Total
1.	c	i	<p><i>Max 1</i></p> <p>a. both lakes have fish of variable lengths; b. all lengths (for both lakes) fall in the range of 1 cm – 8 cm;</p> <p><i>Max 1</i></p> <p>c. the smallest/longest fish was found in the temperate lake OR range (of lengths) is greater in temperate lakes; d. the average length of fish in the subtropical lakes appears to be/is smaller;</p>	<p><i>Answer must have one similarity and one difference in <u>length</u> for 2 marks.</i></p> <p><i>Accept marking point c. and d. that are stated vice versa.</i></p>	2 max
1.	c	ii	1.8 +/- 0.1 cm;	<i>Units required</i>	1
1.	d	i	subtropical (lake and submerged plants);		1
1.	d	ii	<p>a. piscivores may be larger in size/length so less density possible OR planktivores may be smaller in size/length so greater density possible;</p> <p>b. planktivores may have more food sources than piscivores;</p> <p>c. planktivores are found at a lower trophic level / piscivores at higher trophic level OR less energy available for piscivores as they are at higher trophic level;</p>		1 max
1.	d	iii	<p>a. more protection/hiding places/cover / OWTTE; b. more food available among the submerged plants OR richer feeding habitat;</p> <p>c. more breeding sites;</p>		1 max

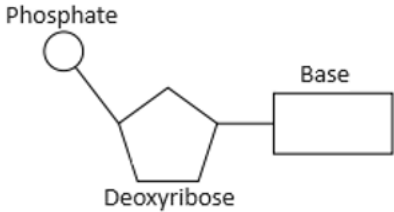
Continued...

Question 1 continued

Question		Answers	Notes	Total
1.	e	<p>a. in temperate water transparency does not seem to affect the number of species OR in temperate water the numbers of species in both habitats remain fairly constant/don't change much;</p> <p>b. in subtropical water the number of species increases with increased water transparency;</p> <p>c. more clear/transparent water allows greater productivity (in subtropical lakes) therefore more species / OWTTE;</p>	<p><i>b. Accept positive correlation as OWTTE.</i></p>	2 max
1.	f	<p>a. change in (fish) species number/type/profile OR some species may die out because they can't adapt (to warmer temperatures) OR different species are able to survive in warmer waters;</p> <p>b. more omnivores present (as they predominant in the subtropical lakes but are not in the temperate ones);</p> <p>c. fish size/length/biomass/number/density may decrease/increase/change as water warms;</p> <p>d. fish may change/increase/decrease the depth at which they live;</p>	<p><i>a. Must refer to community structure/species. Do not accept answers that refer to a single population.</i></p>	1 max

Question			Answers	Notes	Total
2.	a	i	a. chloroplasts; b. cell wall; c. vacuole/starch grains;	Mark only first two structures named.	2 max
2.	a	ii	2.8 +/-0.3 μm	<i>Units required</i>	1
2.	a	iii	a. excretion is the removal of waste substances from metabolism; b. waste products may be toxic to the cell; c. oxygen is a waste product of photosynthesis OR carbon dioxide is a waste product of respiration; d. (excess) oxygen diffuses out of the cell OR (excess) carbon dioxide diffuses out of the cell;	c. <i>Both the waste and the process that generates it must be included.</i> d. <i>Must include diffusion/diffuses.</i>	2 max
2.	b		a. (high mitotic index shows) rapid (rate of) cell division / more cells in division OR (high mitotic index shows) higher proportion/number of cells in mitosis; b. indicating <u>high</u> growth rate/repair of (plant) tissue; c. (rapid rate of cell division) indicating formation of tumor/cancer/active meristem;		2 max

Question			Answers	Notes	Total
3.	a	i	mammoth;	Accept <i>Mammuthus</i> .	1
3.	a	ii	(gradual) divergence / divergent;	Accept "Adaptive radiation" Do not accept "speciation"	1
3.	b	i	a. 70S ribosomes; b. no nucleus / has nucleoid OR naked DNA/no histones OR circular or loop DNA OR has mesosomes; c. plasmid; d. (may have) pili / slime capsule / binary fission / no internal compartmentalization;	Mark the first two responses.	2 max
3.	b	ii	a. some bacteria may randomly mutate OR random (genetic) variation among bacteria of the same species; b. some bacteria exposed to specific antibiotics will die but others may survive; c. they reproduce and pass on favourable antibiotic resistant gene; d. natural selection increases the frequency of those best adapted; e. bacteria with the antibiotic resistant gene/allele become prevalent/dominant /common/frequent over generations;		3 max

Question			Answers	Notes	Total
4.	a		 <p>a. <u>deoxyribose</u> drawn as a pentagon and labelled; b. base linked correctly (to C1) of deoxyribose and labelled; c. phosphate linked correctly (to C5) of deoxyribose and labelled;</p>		3
4.	b	i	<p><i>First generation:</i> a. one strand contains ^{14}N and one strand contains ^{15}N OR each DNA (molecule) contains both ^{14}N and ^{15}N;</p> <p><i>Second generation:</i> b. some DNA molecules have all ^{14}N and some DNA molecules have half ^{14}N and half ^{15}N; c. location of the band in tube is based on the density of DNA / bacteria reproduces every 20 minutes;</p>	Accept light DNA as ^{14}N and heavy DNA as ^{15}N .	2 max
4.	b	ii	DNA has semi-conservative (replication);	OWTTE	1

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
5.	a	<p><i>Structure:</i></p> <p>a. made of carbon, hydrogen and oxygen OR are a group of lipids;</p> <p>b. (made of) one glycerol molecule and three fatty acids; c. formed by condensation reactions; d. fatty acids may be saturated or unsaturated; e. unsaturated fatty acids can be cis or trans (isomers);</p> <p><i>Properties:</i></p> <p>f. hydrophobic/insoluble/not very soluble in water/soluble in non-polar solvents OR can be liquid or solid at room temperature;</p> <p>g. release/store <u>large quantity</u> of energy OR release/store more energy than carbohydrates (during cell respiration)/ OWTTE OR long term storage of energy;</p> <p>h. do not conduct heat well / heat insulators (as in fat layers/blubber);</p>	<p><i>Max [3] if only mention structure.</i></p> <p><i>Accept <u>labelled</u> diagrams.</i></p> <p><i>Do not accept polymer.</i></p>	4 max

Continued...

Question 5 continued

Question		Answers	Notes	Total
5.	b	a. non-cyclical/one-way flow of energy / energy is not cycled/recycled; b. plants/producers carry out photosynthesis / convert solar energy to chemical energy in carbon compounds / sun is the source of energy in an ecosystem; c. chemical energy passes through food chains by feeding / through trophic levels; d. energy released from carbon compounds through (cell) <u>respiration</u> ; e. some energy is released/lost as heat OR lost between levels due to excretion/uneaten material/death; f. only 10%/small percentage/small amount of energy passes to the next trophic level; g. food chains/webs are limited in length/size due to energy losses (between trophic levels);	Accept marking points stated in the converse.	4 max

Continued...

Question 5 continued

Question		Answers	Notes	Total
5.	c	<p>a. food is broken into small pieces by chewing (in the mouth);</p> <p>b. saliva mixes with the pieces to help swallowing;</p> <p>c. muscle contractions/peristalsis move food through the digestive system/gut;</p> <p>d. muscle contractions in the stomach/small intestine mix the food and enzymes;</p> <p>e. pancreas produces lipase;</p> <p>f. lipase is released into the small intestine;</p> <p>g. (lipase) breaks down/hydrolyses lipids into smaller molecules</p> <p>OR</p> <p>(lipase) breaks down/hydrolyses triglycerides into fatty acids and glycerol;</p> <p>h. absorption of products of digestion/fatty acids/glycerol from villi/small intestine;</p> <p>i. fatty acids/glycerol diffuse through the plasma membrane (of intestinal microvilli/cells)</p> <p>OR</p> <p>some absorption of fatty acids by facilitated diffusion/fatty acid transporters/proteins in membrane</p> <p>OR</p> <p>some absorption by endocytosis;</p> <p>j. absorption is enhanced by the large surface area provided by the villi/microvilli;</p>	<p>b. OWTTE</p>	<p>7 max</p>

Question		Answers	Notes	Total
6.	a	<p>Protein composition: a. (proteins) are made of (20) amino acids;</p> <p>Primary structure: b. amino acids are linked by peptide bonds; c. joined by condensation; d. joined/linked into polypeptides;</p> <p>Secondary and tertiary structure: e. interactions between/sequence amino acids lead to the 3-dimensional conformation/shape of proteins;</p> <p>Quaternary structure: f. (some) proteins many consist of more than one polypeptide/amino acid chain linked together;</p>	<p><i>Students are not expected to name the structure types.</i></p> <p><i>Accept references to H bonds or R groups</i></p>	4 max
6.	b	<p>a. <u>Insulin and glucagon</u> released (from the pancreas to regulate blood glucose levels); b. blood glucose levels are regulated by negative feedback;</p> <p><i>At least 1 of these:</i> c. when blood glucose levels are above normal, insulin is released from the β/beta-cells of the pancreas; d. insulin stimulates cells to take up glucose;</p> <p><i>At least 1 of these:</i> e. when blood glucose levels are below normal, glucagon is released from the α/alpha-cells of the pancreas; f. glucagon stimulates the release of glucose, from glycogen stored in the liver;</p>	<p><i>a. It is sufficient to say the hormones are insulin and glucagon.</i></p> <p><i>For maximum marks students must give marking point c or d and marking point e or f.</i></p> <p><i>Accept labelled table or diagram.</i></p>	4 max

6.	c	<p>a. meiosis divides a diploid nucleus to produce (4) haploid nuclei; b. meiosis halves the chromosome number; c. chromosomes consist of two sister chromatids at the start of meiosis; d. <u>homologous</u> chromosomes are paired; e. crossing over occurs between homologous chromosomes; f. crossing over promotes genetic variation/new gene/allele combinations; g. pairs of homologous chromosomes are randomly oriented/assorted in the first division of meiosis</p> <p>OR</p> <p>sister chromatids are randomly assorted during the second division of meiosis; h. in the first division of meiosis pairs of homologous chromosomes are separated; i. random orientation promotes genetic variation/new gene/allele/chromosome combinations; j. meiosis produces haploid gametes (to ensure offspring have complete set of chromosomes); k. fusion of gametes from different parents promotes (genetic) variation;</p>	<p><i>Drawings which are annotated to explain are acceptable.</i></p>	<p>7 max</p>
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