Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2021

Biology

Standard level

Paper 2

14 pages

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. Each row in the "Question" column relates to the smallest subpart of the question.

2. The maximum mark for each question subpart is indicated in the "Total" column.

3. Each marking point in the "Answers" column is shown by means of a tick (✓) at the end of the marking point.

4. A question subpart may have more marking points than the total allows. This will be indicated by "**max**" written after the mark in the "Total" column. The related rubric, if necessary, will be outlined in the "Notes" column.

5. An alternative word is indicated in the "Answers" column by a slash (/). Either word can be accepted.

6. An alternative answer is indicated in the "Answers" column by "***OR***". Either answer can be accepted.

7. An alternative markscheme is indicated in the "Answers" column under heading ***ALTERNATIVE 1*** *etc*. Either alternative can be accepted.

8. Words inside brackets **( )** in the "Answers" column are not necessary to gain the mark.

9. Words that are <u>underlined</u> are essential for the mark.

10. The order of marking points does not have to be as in the "Answers" column, unless stated otherwise in the "Notes" column.

11. 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 "Answers" column 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) in the "Notes" column.

12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

13. 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.

14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the "Notes" column.

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		Oceania ✓		1
1.	b		thiamethoxam is the most used in North America (but not in South America) / CONVERSE ***OR*** in South America they use different neonicotinoids to thiamethoxam ✓	*OWTTE* *Allow numerical comparison.*	1
1.	c		57 (%) ✓	*Allow range 56% to 58%.*	1
1.	d		a. reduced acetylcholine does not affect larval survival in the first two days ✓ b. reduced acetylcholine causes increased mortality from day 3 onwards ✓ c. 90% versus 40% survival/other valid numerical comparison by day 5 ***OR*** (much) greater decrease in survival occurs between days 4 and 5/by day 5 for the reduced group ✓	*Do not accept answers without times/ days*	2 max
1.	e		(larvae lacking acetylcholine/with reduced AcH cannot survive because) acetylcholine is a neurotransmitter taking message from one neuron to another in synapses of nervous tissues ***OR*** messages would not pass from one neuron to the other ***OR*** (larvae) unable to synthesise/produce AcH, so need it from their diet ✓	*OWTTE*	1
1.	f		a. both neonicotinoids reduce the concentration of acetylcholine in royal jelly (compared to control) ✓ b. clothianidin reduces the concentration of acetylcholine in royal jelly more than thiacloprid (but perhaps not statistically different) ✓ c. clothianidin is used in smaller concentrations **(**than thiacloprid**)** so no firm conclusion can be obtained ✓	*Need one similarity and one difference.*	2 max

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
1.	**g**		a. neonicotinoids bind to the (acetylcholine) receptor (in insects) ✓ b. (binding happens) in (cholinergic) synapses/at motor end plate/between motor neuron and muscles ✓ c. neonicotinoids bind irreversibly (to receptors) ***OR*** (receptors are blocked so) acetylcholine is unable to bind ✓ d. acetylcholinesterase/enzymes cannot break down neonicotinoids ✓ e. (synaptic) transmission prevented ✓ f. (causing) insect paralysis/death ✓		**3 max**
1.	**h**		a. neonicotinoids are used in every continent ✓ b. the choice of specific neonicotinoid varies considerably around the world ✓ c. neonicotinoids contaminate honey (so must get into honeybees) ✓ d. only a minority of honey samples from around the world contain no neonicotinoids ✓ e. neonicotinoids reduce the acetylcholine (content of royal jelly) ***OR*** only a small amount of clothianidin can reduce acetylcholine in royal jelly ✓ f. survival of honeybee larvae is lower if the acetylcholine is lower/content of royal jelly is reduced ✓		**4 max**

Question			Answers	Notes	Total
2.	a		a. DNA replication ✓ b. cell growth ✓ c. duplication of organelles/mitochondria / production of microtubules/protein synthesis ✓	*Accept first two answers only*	**2 max**
2.	b	i	prophase ✓	*The stage should be clearly labelled. If more than one stage is shown the candidate does not receive a mark.*	**1**
2.	b	ii	anaphase ✓	*The stage should be clearly labelled. If more than one stage is shown the candidate does not receive a mark.*	**1**
2.	c		a. mitosis produces two daughter cells while meiosis four ✓ b. mitosis produces cells with same number of chromosomes (2n) while in meiosis they are halved (n) ✓ c. mitosis produces body cells but meiosis produces gametes ***OR*** mitosis produces genetically identical cells but meiosis does not ✓	*Allow answers in a table.* *Reference to both has to be present for the mark*	**2 max**
2.	d		number of cells (seen under the microscope) undergoing mitosis divided by the total number of cells (observed in sample area) ✓	*Can be given as a %*	**1**

Question			Answers	Notes	Total
3	a		a. enzyme involved in photosynthesis/carbon fixation/Calvin cycle ***OR*** speeds up chemical reactions in photosynthesis ✓ b. carboxylation of RuBP ✓ c. production of carbohydrate in photosynthesis ✓ d. addition of carbon dioxide to form glucose (in Calvin cycle) ✓	*Either photosynthesis or carbon fixation must be mentioned*	**1 max**
3.	b		site to which substrate binds ***OR*** catalytic site ✓	*Give credit for the lock and key analogy*	**1**
3.	c		*Pisum* ✓		**1**
3.	d		a. name of factor ✓ b. how it affects rate of reaction ✓	*Example answer:* *temperature ✓* *as the temperature increases the rate of reaction increases until it reaches a maximum and then decreases rapidly ✓* *Accept answers in a graph.*	**2**

Question			Answers	Notes	Total
4.	**a**		a. (aerobic/cellular) respiration ✓ b. gas exchange / diffusion ✓	*Do not accept photosynthesis.* *Do not accept breathing* *Organism is taken to be a living thing.*	**1 max**
4.	**b**		a. photosynthesis ✓ b. absorption of (dissolved) carbon dioxide / (hydrogen)carbonate directly from the oceans ✓	*Accept reference to carbonate or hydrogencarbonate ions*	**1 max**
4.	**c**		a. light energy is converted to chemical energy (in carbon compounds/sugars) by photosynthesis ✓ b. (chemical) energy (in carbon compounds) flows by means of feeding/through food chains/webs ✓ c. only (approximately) 10% of energy is passed to the next trophic level ✓ d. energy released as heat (by respiration) ✓ e. energy is not recycled ✓ f. after death, energy may remain trapped as undigested detritus/fossils/fossil fuels ✓		**3 max**

(continued…)

(Question 4 continued)

Question			Answers	Notes	Total
4.	**d**	**i**	crustacean as they have more carbon per unit volume ***OR*** crustacean as jellyfish has little carbon per total body size ✓	*OWTTE* *The conclusion must be supported from the information given*	**1**
4.	**d**	**ii**	a. advantage of large size is ability to eat /catch large prey ✓ b. (advantage as) lower rates of predation of large jellyfish ✓ c. (advantage as) can produce more reproductive cells ✓ d. (disadvantage as) can move slower to escape from predators/capture prey ✓ e. (disadvantage as) needs more energy/nutrients to maintain structure/move/grow ✓ f. (disadvantage as) low surface area to volume ratio and thus possibly difficulty with materials/gas/nutrient exchange ✓ g. (disadvantage as) more prone to mechanical damage during storms ✓	*Accept other reasonable answer.* *Must say advantage or disadvantage*	**1 max**

Section B

Question			Answers	Notes	Total
5.	a		a. starch is a carbohydrate ✓ b. starch is formed by carbon, hydrogen and oxygen ✓ c. it is a polymer/chain/polysaccharide ✓ d. formed from monosaccharides/simple sugars/glucose ✓ e. linked together by condensation/dehydration ✓ f. consists of amylose and amylopectin ✓ g. amylose is a long chain/unbranched ✓ h. amylopectin is branched ✓		**5 max**
5.	b		a. food is mechanically/physically digested in the mouth through mastication/chewing ✓ b. mixed with saliva **(**to form the bolus**)** in mouth ✓ c. moved through esophagus/peristalsis ✓ d. proteins digested in the stomach (pepsin) ✓ e. pancreas secretes enzymes into lumen of small intestine ***OR*** (endo)peptidases/trypsin) are secreted by pancreas ✓ f. enzymes digest macromolecules to monomers ***OR*** endopeptidases digest polypeptides to peptides/amino acids ✓ g. villi of small intestine absorb amino acids ✓ h. amino acids carried to blood capillaries ✓ i. blood (capillaries) carry amino acids to **(**hepatic portal**)** vein/blood vessel going to liver ✓ j. amino acids absorbed by active transport/protein pumps in the villi ✓	*Allow pepsin.*	**7 max**

(continued…)

(Question 5 continued)

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>5.</td><td>c</td><td></td><td>a. gametes of both parents shown as a capital and small letter (eg L and l) ✓
b. possible F1 genotypes ✓
c. 25% lactose intolerant, 50% carriers, 25% lactose tolerant
OR
75% tolerant and 25% intolerant
OR
child has 25%/1:4/$\frac{1}{4}$ chances of inheritance of intolerance ✓</td><td><table><tr><td></td><td>L</td><td>l</td></tr><tr><td>L</td><td>LL</td><td>Ll</td></tr><tr><td>l</td><td>Ll</td><td>ll</td></tr></table></td><td>3 max</td></tr>
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Question			Answers	Notes	Total
6.	a		a. cell wall ✓ b. pili/flagella ✓ c. 70S ribosomes ✓ d. nucleoid / circular DNA ***OR*** naked DNA ✓ e. plasmids ✓	*As candidates do not need to know the structure of Mycobacterium tuberculosis, all prokaryotic structures are accepted.* *Ignore references to membrane bound organelles*	**3 max**
6.	b		a. phagocytes/lymphocytes are white blood cells ✓ b. TB bacterium has a specific antigen ✓ c. this antigen is recognised by white blood cells ✓ d. a clone of lymphocytes/plasma cells/B cells are produced ✓ e. antibodies are produced by lymphocytes ✓ f. each lymphocyte produces just one type of antibody ✓ g. (this is) specific immunity ✓ h. (part of the) antibody/immunoglobulin binds to the antigen / specific antibody binds to the specific antigen ✓ i. antibodies are proteins/immunoglobulins ✓ j. (some) plasma cells become memory cells ✓ k. memory cells reproduce quickly ✓ l. memory cells prevent infection in the future ✓	*Allow annotated diagrams to explain the process.*	**7 max**

(continued…)

(Question 6 continued)

Question			Answers	Notes	Total
6.	**c**		a. antibiotics block bacterial processes ✓ b. example of bacterial process ✓ c. variations exist naturally in a population / some are naturally resistant to the antibiotic ✓ d. bacteria that are not resistant to this antibiotic will die / only resistant will survive (when antibiotic given) ✓ e. this characteristic could be passed to next generation ✓ f. (natural selection) leads to changes in the proportions/frequency in the population ✓ g. human population will be exposed to antibiotic resistant bacteria and will not have antibiotic to kill them ✓ h. (antibiotic resistant bacteria) may pass resistance to other bacteria species/types by means of plasmids (so other bacteria species turn resistant too) ✓	*e.g. cell wall formation*	**5 max**