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

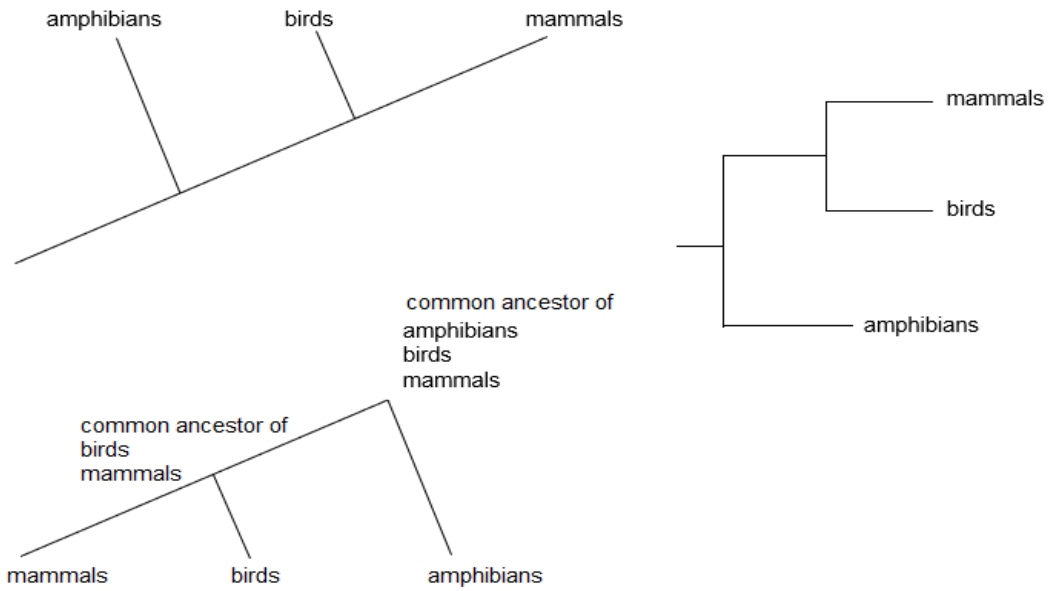
Question			Answers	Notes	Total
1.	a	i	75 µmol ✓	*Deduce* *Allow answers in the range of 70 µmol-80 µmol*	1
1.	a	ii	24 % ✓	*Identify* *Allow answers in the range 23%-25%*	1
1.	b		*Similarities:* a. reduce root length (compared to the control) ✓ b. (ZDV and NVP) have greatest change (in growth) at lowest concentrations (of ZDV and NVP) ✓ c. same effect at 200 µmol ✓ d. above/at about 400 µmol effect levels off ✓ *Differences:* e. the change/differences become significant after 200 µmol ✓ f. ZDV has a (slightly) larger effect / NVP has a (slightly) smaller effect / WTTE ***OR*** above 400 µmol effect of ZDV remains higher / NVP remains lower ✓	*Compare and contrast* *Answer must contain one similarity and one difference* *Credit may be given for numeric differences when accurately stated*	2 max
1.	c		a. Y (will become more common) ✓ b. spindle not formed yet ***OR*** cells x and z have spindles ✓ c. cells in Y cannot progress (into Z/into metaphase) ✓	*Suggest*	2 max

1.	**d**		a. still some mitosis ✓ b. individual cells grow/elongate (expand by absorbing water) ✓ c. NVP is not 100% effective / does not enter all of the cells / not all cells have come in contact with NVP ✓ d. roots have reached maximum saturation of NVP and are no longer functionally affected ✓ e. some cells are resistant to the drug ✓	*Suggest* *Accept reasonable suggestions. If in doubt contact your team leader.*	**1 max**
1.	**e**		0.3 / 100% increase / doubling ✓	*Deduce* *Do not penalize errors in significant figures. For example, 0.34 would be acceptable.*	**1**
1.	**f**		a. mitotic index in treatment greater than in control/leptin appears to promote mitosis ✓ b. mitotic index increases with time suggests ongoing regeneration/growth ***OR*** positive correlation between exposure to leptin and increased mitotic index ✓ c. but experiment limited to 72 hours/regeneration/recovery may take longer than 72 hours ✓ d. no error bars shown/no information on significance/sample size ✓	*Evaluate* *Acknowledge WTTE*	**3 max**
1.	**g**		a. acts on receptors in the hypothalamus/appetite centre ✓ b. inhibits appetite ✓	*Outline* *Accept WTTE for mpb*	**1 max**

Question			Answers	Notes	Total
2.	**a**	**i**	*process Y*: photosynthesis ✓ *organelle*: chloroplast ✓	*Identify* *Both needed*	**1**
2.	**a**	**ii**	glycerol /glycerin ✓	*Identify*	**1**
2.	**b**		condensation/dehydration/synthesis/anabolic/anabolism ✓	*State*	**1**
2.	**c**		aerobic respiration ✓	*Identify*	**1**
2.	**d**		a. used as an energy source ✓ b. supplies/releases energy for biochemical reactions ✓ c. photosynthesis/active transport/other verifiable example of reaction or process ✓	*Outline*	**2 max**
2.	**e**		a. (letter X) breakdown of monosaccharides/respiration ✓ b. (letter Y) hydrolysis/photolysis in photosynthesis/oxidation of water ✓	*Identify* *Answer must come from the diagram*	**1**

Question			Answers	Notes	Total
3	a		a. increase the surface area for absorption ✓ b. absorption of digested foods/nutrients ✓ c. absorption of mineral ions/vitamins ✓	*Outline*	**2 max**
3	b		a. (celiac disease/gluten causes) much smaller villi/flattened villi/smaller surface area (of villi) / no villi ✓ b. (smaller villi leads to) less efficient/less/slower/poor absorption ***OR*** nutrients/energy lost / fatigue/malnutrition may result ✓ c. (celiac sufferers) must eat a gluten-free diet / WTTE ✓	*Explain* *Note that this question requires an explain not an outline*	**2 max**
3	c		a. enzymes/protease required ✓ b. (protease/peptidase) breaks peptide bonds/bonds between amino acids ✓ c. hydrolysis adds water molecules/breaks peptide bonds between amino acids ✓ d. protein/macromolecule converted to monomer/amino acids ✓ e. endopeptidase/enzymes/protease/trypsin secreted by the pancreas ✓	*Outline* *Peptidase/endopeptidase can be accepted instead of protease for mpa* *mpd can be awarded for an appropriate equation*	**2 max**

Question			Answers	Notes	Total
4.	a		– 65 mV ✓	*Estimate* *Unit required; minus sign required* *Accept answers from -62mV to -65mV*	1
4.	b		a. sodium/potassium pump pumps sodium ions Na^+ out of axon and pumps potassium ions/K^+ in ✓ b. requires energy/ATP/against concentration gradients/active transport ✓ c. three sodium ions pumped out for every two potassium ions pumped in ✓ d. results in charge difference between inside and outside where outside is positive relative to inside ✓	*Outline*	2 max

Question			Answers	Notes	Total
5.	a	i	a. analogous traits have a different evolutionary history/ancestry ✓ b. different structures are adaptations for flight ✓ c. selective pressure leads to a similar solution to the problem of flying ✓	*Outline*	**2 max**
5.	a	ii	a. bird and bat share a more recent common ancestor (than the insect) ✓ b. bird and bat are more closely related than insect and bat / insect and bird ✓ c. bird and bat wings evolved from a common ancestor (by natural selection) ✓	*Outline*	**1 max**
5.	b		a. (cladistics) shows evolutionary relationships through a common ancestor ✓ b. cladistics uses DNA/protein/derived/shared anatomical characteristics/traits ✓ c. time of divergence is related to the number of differences in DNA (base sequence) / protein (sequence of amino acids) ✓ d. homologous (versus analogous) traits are used to place an organism in a clade ✓ e. more shared characteristics mean a more recent common ancestor ✓	*Explain*	**2 max**
5.	c			*Draw* *What is important is that the proper relationships are shown not the style used.*	**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
6.	**a**		a. protein formed from amino acids ***OR*** 20 different amino acids ✓ b. linked together by peptide bonds ✓ c. may consist of one or more polypeptides linked together ✓ d. have a specific shape/conformation/folding ✓ e. shape determines function ✓	*Outline*	**3 max**
6.	**b**		a. protein is produced when a gene is expressed / switched on ✓ b. genetic code/codons consists of three nucleotides/bases/base triplet ✓ c. genetic code in DNA is transcribed/transcription (to mRNA) ✓ d. mRNA exits the nucleus ✓ e. mRNA (code) is translated/translation into a polypeptide/protein ✓ f. amino acid sequence/polypeptide formation occurs at a ribosome ✓ g. one codon translates to one amino acid ✓ h. tRNA carries code for specific amino acids ✓ i. tRNA anticodon matches with specific codon in mRNA ✓ j. amino acids joined **(**by peptide bonds**)** to form polypeptide ✓ k. sequence of amino acids determined by order of bases/nucleotides/codons in DNA/mRNA ✓ l. proteins vary based on which amino acids are used and their order ***OR*** protein variety increases by mutations to DNA ✓	*Explain*	**7 max**

(continued…)

(Question 6 continued)

Question			Answers	Notes	Total
6.	**c**		a. enzymes that catalyse/speed up/control (the rate and direction of) metabolic reactions ✓ b. proteins can be hormones which are chemical messengers to cells ✓ c. proteins that transport through the membrane such as channel/carrier/pumps / that regulate what enters/leaves the cell ✓ d. hemoglobin in red blood cells that transports/ binds oxygen ✓ e. membrane proteins for cell/tissue recognition/cell adhesion/communication ✓ f. structural elements of muscle fibre/actin/myosin for movement ***OR*** spindle fibres move chromosomes ✓ g. histones condense DNA into chromosomes ✓	*Outline* *The question requires answer that the function is <u>in cells</u>*	**5 max**

Question			Answers	Notes	Total
7.	**a**		a. diaphragm contracts / moves downwards/flattens ✓ b. <u>external</u> intercostal muscles contract ✓ c. (muscle contraction) moves the rib cage upwards and outwards ✓ d. increases volume of the thorax / lungs ✓ e. difference in pressure/decreasing pressure causes air to flow into lungs / lungs inflate ✓	*Outline*	**4 max**

(continued…)

(Question 7 continued)

Question			Answers	Notes	Total
7.	**b**		a. O_2 diffuses into blood and CO_2 diffuses out from blood ✓ b. blood entering the alveoli is high in CO_2/low in O_2 ✓ ***OR*** air in alveolus is high in O_2/low in CO_2 ✓ c. diffusion (in either direction) take place due to concentration gradients ✓ d. concentration gradients maintained by ventilation/blood flow ✓ e. large surface area created by many alveoli/spherical shape of alveoli for more efficient diffusion ✓ f. rich supply of capillaries (around alveoli) allows efficient exchange ✓ g. type I pneumocytes are thin to allow easy diffusion/short distances ✓ h. gases must dissolve in liquid lining of alveolus in order to be exchanged ✓ i. type II pneumocytes secrete surfactants to reduce surface tension/prevent lungs sticking together ✓ j. type II pneumocytes create moist conditions in alveoli ✓	*Explain*	**7 max**

(continued…)

(Question 7 continued)

Question			Answers	Notes	Total
7.	**c**		a. greenhouse effect keeps Earth warm ✓ b. (over-time) earth's temperature has fluctuated naturally ✓ c. changes in human activities have led to increases in CO_2 concentration ✓ d. CO_2 absorbs infrared/long wave radiation / trapping heat ✓ e. increase in atmospheric CO_2 (concentration) correlates with/causes increased global average temperature ✓ f. use of fossil fuels increases atmospheric CO_2 ✓ g. deforestation removes a carbon sink / less CO_2 absorbed ✓ h. loss of polar ice causes less reflection of surface light/ more reradiation as heat contributing to (global) warming ✓ i. CO_2 is not the only greenhouse gas/ there are other greenhouse gases ✓	*Discuss*	**4 max**