Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2019

Biology

Standard level

Paper 2

16 pages

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 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.

Section A

Question			Answers	Notes	Total
1.	a		10–25 «%» ✓		1
1.	b		G1 always respond more than 25% «except control», while G2 and G3 always respond 25% or less ✓ G1 always responds more than G2 and G3/all of the others ✓	*OWTTE*	1
1.	c		oscilloscope ✓		1
1.	d		mouse chemicals cause action potentials «in all six neurons» while control ones cause none «remain in resting potential»/mouse chemicals cause greater responses ✓	O*WTTE*	1
1.	e		a. both chemicals cause action potentials ***OR*** both chemicals respond in the majority of/five/most neurons ✓ b. stoat scent causes a higher action potential/longer/bigger response than mouse alarm compound «in each neuron» ***OR*** neuron 2 reacts strongly to the stoat scent but has a minimal/no response to the mouse alarm compound ✓		2

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
1.	**f**		a. there is a positive relationship/correlation between the size of neural traces and the percentage of responding G1 neurons ***OR*** the chemicals that cause stronger/higher neural traces also cause the greatest percentage of responding G1 neurons ✓ b. fox and stoat scents have **«**approximately**»** the same/similar neural traces and the same percentage of responding neurons/>75 % ✓ c. mouse alarm compounds cause smaller neural traces and smaller percentage of responding neurons/25–75 % ✓ d. control chemicals have no response in both cases ***OR*** no percentage of **«**G1 neurons**»** response and no action potential **«**in neural traces**»** ✓	*Accept vice versa.*	**2 max**
1.	**g**		the mice would have the same response to another mouse's danger signal as to the actual presence of the predator/fox ***OR*** adaptation to fool predator by producing a scent similar to predator's own scent ***OR*** allows a group response to a predator/fox/danger when just one mouse detects the danger ✓	*Accept any other feasible answer.*	**1 max**

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
1.	**h**		the aphids that were fed on wild-type thale cress/W as they had 80 % **«**or more**»** repelled each generation/ always had the higher % response ***OR*** the aphids that fed on wild-type thale cress plants/W of G3 as they had **«**about**»** 85 % repelled/had the higher % response ✓	*Answer should refer to a percentage.*	**1**
1.	**i**		a. **«**over the generations**»** fewer are repelled by EBF ✓ b. **«**over the generations**»** more are attracted to EBF ✓ c. by G3 a **«**slight**»** increase in no choice ✓ d. aphids respond less to EBF/alarm compound if they feed on plants that produce it/exposed to it constantly ✓ e. mutant aphids with attraction to transgenic plants can arise from aphids with no attraction or repulsion to transgenic plants ***OR*** aphids with no attraction or repulsion to transgenic plants may produce new type of aphids with attraction to transgenic plants ✓		**2 max**

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
1.	**j**		a. mutant aphids/varieties may be indifferent to/attracted to transgenic plants as these do not present a hazard **«**not favour**»** ✓ b. initially/for limited time the plants would thrive as the aphids would be **«**largely**»** repelled and thus not eat the plants **«**so natural selection would favour them**»** ✓ c. over time/in a few generations, the aphids population become more resistant/more attracted/less repelled to EBF and return to feed on the plants so long-term benefit very limited **«**so natural selection would not favour them**»** ✓ d. the aphids resistant to EBF would not respond to other aphid alarms and **«**likely**»** be more readily eaten by predators **«**so the long-term benefit to plants could be supported by natural selection**»** ✓	*The answers must indicate whether natural selection would support or not for each statement.*	**2 max**

Question			Answers	Notes	Total
2.	a		telophase because the chromosomes/chromatids have reached the poles ***OR*** **«**late**»** anaphase as some chromosomes/chromatids are still moving/tails visible ✓	*OWTTE*	**1**
2.	b		a. is a photograph/diagram of homologous pairs of chromosomes that can be analysed ✓ b. information may be used to determine other chromosome abnormalities/changes in chromosome numbers/possible birth defects ✓ c. Down syndrome/trisomy can be detected if there are three copies of a chromosome ***OR*** accept any other valid example ✓ d. other missing or extra pieces of chromosomes can be detected ✓ e. sex can be determined as the Y chromosome is shorter than the X ✓	*Not just "Down syndrome".* *Or correct ref to X and Y.*	**3 max**

Question			Answers	Notes	Total
3.	a	i	a. «cell» respiration/loss of CO_2/biomass consumed to provide/as a source of energy ✓ b. loss of energy «as heat» between trophic levels means less energy available for building biomass ✓ c. waste products «other than CO_2»/loss of urea/feces/egesta ✓ d. material used/CO_2 released by saprotrophs ✓ e. undigested/uneaten material «teeth, bones, etc»/detritus buried/not consumed ***OR*** formation of peat/fossils/limestone ✓		**2 max**
3.	a	ii	a. increased CO_2 flux to the atmosphere due to increased burning of fossil fuels by industry/transportation / cement production ✓ b. «land use change leading to» decreased rate of forest burning ***OR*** better fire suppression leading to decrease in CO_2 release ***OR*** example of land use changes that uses less fossil fuel ***OR*** increase in land covered by forests/plants / forests recovering from historical forestry ***OR*** any other reasonable explanation of land use change that would lead to decreased rate of carbon flow to atmosphere ✓ c. carbon storage in land decreased as less photosynthesis due to fewer forests/more construction ***OR*** release of methane due to «drying of» wetlands/sealing of land with concrete/buildings/roads ✓ d. carbon storage in ocean increased due to more photosynthesis/algae/greater concentration of CO_2 in the atmosphere ***OR*** increased diffusion/rate of dissolving of CO_2 into ocean from the atmosphere ***OR*** limestone/carbonate accumulation «more snails» ✓		**3 max**

continued…)

(Question 3 continued)

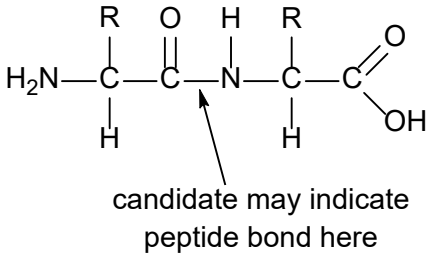
Question			Answers	Notes	Total
3.	**b**		a. individuals in a population will show a variation of adaptations to climate change ✓ b. organisms that resist temperature changes ***OR*** current changes of the ocean/melting ice/more acidity/changes in food chains will survive better ✓ c. reproduce more and pass on their characteristics ✓ d. organisms with less adaptation will disappear with time ✓ e. example **«***eg* polar bears have less ice to be able to catch prey/seals and are starving the ones that manage to find other food sources will survive**»** OWTTE ✓ f. changes will occur within species ***OR*** new species may appear **«**over time**»** ✓	*Accept any valid example of an Arctic ocean organism.*	**3 max**

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>4.</td><td>a</td><td></td><td>X: Filicinophyta ✓
Y: Coniferophyta/Conifera/Gymnosperms ✓</td><td></td><td>2</td></tr>
<tr><td>4.</td><td>b</td><td></td><td><table><tr><td>mpa</td><td>mpb</td></tr><tr><td>radiation/mutagenic chemicals ✓</td><td>can increase mutation rate/frequency of mutations ✓</td></tr><tr><td>OR</td><td>OR</td></tr><tr><td>radiation/mutagenic chemicals ✓</td><td>can affect nucleotides/bases in DNA ✓</td></tr><tr><td>OR</td><td>OR</td></tr><tr><td>errors in replicating DNA ✓</td><td>may cause changes in protein functions in some cells ✓</td></tr></table></td><td>Not chromosomal.</td><td>2 max</td></tr>
<tr><td>4.</td><td>c</td><td></td><td>a. a clade is a group of organisms that have evolved from a common ancestor ✓
b. identify the base sequences of a gene ✓
c. identify amino acid sequence of a protein ✓
d. comparing homologous structures ✓
e. the fewer the differences, the closer they diverged in time from a common ancestor ✓</td><td>Accept vice versa.</td><td>3 max</td></tr>
<tr><td>4.</td><td>d</td><td></td><td>Vombatidae/wombats ✓</td><td></td><td>1</td></tr>
</table>

Question			Answers	Notes	Total
5.	a		a. simple diffusion is passive movement of molecules/ions along a concentration gradient ✓ b. facilitated diffusion is passive movement of molecules/ions along a concentration gradient through a protein channel «without use of energy» ✓ c. osmosis is the passage of water <u>through a membrane</u> from lower solute concentration to higher ✓ d. active transport is movement of molecules/ions <u>against the concentration gradient</u> «through membrane pumps» with the use of ATP/energy ✓ e. endocytosis is the infolding of membrane/formation of vesicles to bring molecules into cell with use of energy ***OR*** exocytosis is the infolding of membrane/formation of vesicles to release molecules from cell with use of energy ✓ f. chemiosmosis occurs when protons diffuse through ATP synthase «in membrane» to produce ATP ✓	*The description of each type of transport should include the name and brief description.* *mpa, mpb and mpc require reference to concentration.* *OWTTE* *Active transport requires mention of the use of energy.*	**4 max**

(continued…)

(Question 5 continued)

Question			Answers	Notes	Total
5.	**b**		a. two amino acids, one with NH_2/NH_3^+ end and one with COOH/COO^- end ✓ b. peptide bond between C=0 and N—H correctly drawn ✓ c. «chiral» C with H and R group on each amino acid ✓ d. peptide bond labelled/clearly indicated between C terminal of one amino acid and N terminal of the second amino acid ✓	 *Labels not required for amino group and carboxyl group.*	**3 max**

(continued…)

(Question 5 continued)

Question			Answers	Notes	Total
5.	**c**		a. enzymes catalyse/speed up chemical reactions/lower the energy needed ✓ b. have specific <u>active sites</u> to which specific substrates bind ✓ c. enzyme catalysis involves molecular motion and the collision of substrates with the active site ✓ d. enzymes break macromolecules into monomers/smaller molecules in digestion ✓ e. smaller molecules/monomers more readily absorbed ✓ f. <<pancreas>> secretes enzymes into the «lumen of» small intestine ✓ g. the small intestine has an alkaline pH ✓ h. enzymes have maximum action at specific pHs ***OR*** enzymes can be denatured at other pHs ✓ i. amylase breaks down starch into sugars/disaccharides ✓ j. lipase breaks lipids/triglycerides into monoglycerides/fatty acids and glycerol ✓ k. endopeptidase/protease breaks «peptide» bonds in proteins/polypeptides ✓ **I.** accept any other valid pancreatic enzyme, substrate and product ✓	*Award **[6 max]** if there is no mention of two specific groups of enzymes.* *OWTTE* *OWTTE*	**8 max**

Question			Answers	Notes	Total
6.	a		a. eukaryotes evolved from prokaryotes ✓ b. prokaryotes engulfed other prokaryotes without digesting them ✓ c. engulfed aerobic cell/prokaryote became mitochondria ✓ d. engulfed photosynthetic cell/ prokaryotes became chloroplasts ✓ e. these organelles have a double membrane «due to the engulfing process» ✓ f. mitochondria/chloroplasts contain DNA/small ribosomes/70S ribosomes ✓		**3 max**
6.	b		a. solar/light energy is converted to chemical energy ✓ b. energy needed to produce glucose ✓ c. only specific wavelengths are absorbed by chlorophyll ***OR*** red and blue absorbed most strongly. ***OR*** chlorophyll is the pigment that absorbs light energy ✓ d. $H^{(+)}$/electrons from water are used to reduce compounds ✓ e CO_2 is absorbed/used/reduced to produce carbohydrates ✓ f. correct word/<u>balanced</u> symbol equation of photosynthesis ✓	*Accept correct reference to NADPH/ATP from AHL.*	**4 max**

(continued…)

(Question 6 continued)

Question			Answers	Notes	Total
6.	**c**		*control:* ***[6 max]*** a. homeostasis is the maintenance of a constant internal environment ✓ b. the pancreas produces hormones that control the levels of glucose ✓ c. if glucose levels in blood are high, beta-cells **«**of the pancreas**»** produce insulin ✓ d. **«**insulin**»** causes the cells to take up /absorb glucose ✓ e. liver stores excess glucose as glycogen ✓ f. if glucose levels in blood are low, alpha-cells **«**of the pancreas**»** produce glucagon ✓ g. **«**glucagon**»** causes the liver to break down glycogen into glucose ✓ h. **«**glucagon**»** increase levels of glucose in the blood ✓ i. negative feedback controls the glucose levels ✓ *consequences*: j. if the pancreas produces little/no insulin a person can develop <u>type I</u> diabetes ✓ k. a person with <u>type I</u> diabetes **«**usually**»** needs/is dependent on injections of insulin ✓ l. <u>type II</u> diabetes occurs when the body becomes resistant to insulin/cells do not respond to insulin ✓ m. <u>type II</u> diabetes can **«**sometimes**»** be controlled by diet and exercise ✓ n. named consequence of having diabetes **«***eg*: eye damage**»** ✓	*Award* ***[6 max]*** *if no consequences are given.* *OWTTE*	**8 max**