

# Markscheme

**May 2019**

**Biology**

**Standard level**

**Paper 2**

16 pages

No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without written permission from the IB.

Additionally, the license tied with this product prohibits commercial use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, is not permitted and is subject to the IB's prior written consent via a license. More information on how to request a license can be obtained from <http://www.ibo.org/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite de l'IB.

De plus, la licence associée à ce produit interdit toute utilisation commerciale de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, n'est pas autorisée et est soumise au consentement écrit préalable de l'IB par l'intermédiaire d'une licence. Pour plus d'informations sur la procédure à suivre pour demander une licence, rendez-vous à l'adresse <http://www.ibo.org/fr/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin que medie la autorización escrita del IB.

Además, la licencia vinculada a este producto prohíbe el uso con fines comerciales de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales— no está permitido y estará sujeto al otorgamiento previo de una licencia escrita por parte del IB. En este enlace encontrará más información sobre cómo solicitar una licencia: <http://www.ibo.org/es/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

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

(continued...)

(Question 1 continued)

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

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	j	<p>a. mutant aphids/varieties may be indifferent to/attracted to transgenic plants as these do not present a hazard «not favour» ✓</p> <p>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» ✓</p> <p>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» ✓</p> <p>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» ✓</p>	<p><i>The answers must indicate whether natural selection would support or not for each statement.</i></p>	<p><b>2 max</b></p>

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



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

continued...)

(Question 3 continued)

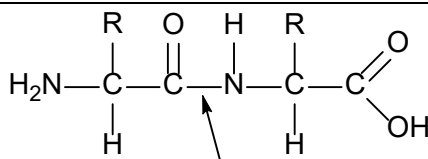
Question		Answers	Notes	Total
3.	b	<p>a. individuals in a population will show a variation of adaptations to climate change ✓</p> <p>b. organisms that resist temperature changes <b>OR</b> current changes of the ocean/melting ice/more acidity/changes in food chains will survive better ✓</p> <p>c. reproduce more and pass on their characteristics ✓</p> <p>d. organisms with less adaptation will disappear with time ✓</p> <p>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 ✓</p> <p>f. changes will occur within species <b>OR</b> new species may appear «over time» ✓</p>	<p><i>Accept any valid example of an Arctic ocean organism.</i></p>	<p><b>3 max</b></p>

Question		Answers	Notes	Total												
4.	a	X: Filicinophyta ✓ Y: Coniferophyta/Conifera/Gymnosperms ✓		2												
4.	b	<table border="1"> <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><b>OR</b></td> <td><b>OR</b></td> </tr> <tr> <td>radiation/mutagenic chemicals ✓</td> <td>can affect nucleotides/bases in DNA ✓</td> </tr> <tr> <td><b>OR</b></td> <td><b>OR</b></td> </tr> <tr> <td>errors in replicating DNA ✓</td> <td>may cause changes in protein functions in some cells ✓</td> </tr> </table>	mpa	mpb	radiation/mutagenic chemicals ✓	can increase mutation rate/frequency of mutations ✓	<b>OR</b>	<b>OR</b>	radiation/mutagenic chemicals ✓	can affect nucleotides/bases in DNA ✓	<b>OR</b>	<b>OR</b>	errors in replicating DNA ✓	may cause changes in protein functions in some cells ✓	<i>Not chromosomal.</i>	2 max
mpa	mpb															
radiation/mutagenic chemicals ✓	can increase mutation rate/frequency of mutations ✓															
<b>OR</b>	<b>OR</b>															
radiation/mutagenic chemicals ✓	can affect nucleotides/bases in DNA ✓															
<b>OR</b>	<b>OR</b>															
errors in replicating DNA ✓	may cause changes in protein functions in some cells ✓															
4.	c	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 ✓	<i>Accept vice versa.</i>	3 max												
4.	d	Vombatidae/wombats ✓		1												

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

(continued...)

(Question 5 continued)

Question		Answers	Notes	Total
5.	b	<p>a. two amino acids, one with NH<sub>2</sub>/NH<sub>3</sub><sup>+</sup> end and one with COOH/COO<sup>-</sup> end ✓</p> <p>b. peptide bond between C=O and N—H correctly drawn ✓</p> <p>c. «chiral» C with H and R group on each amino acid ✓</p> <p>d. peptide bond labelled/clearly indicated between C terminal of one amino acid and N terminal of the second amino acid ✓</p>	 <p>candidate may indicate peptide bond here</p> <p><i>Labels not required for amino group and carboxyl group.</i></p>	3 max

(continued...)

(Question 5 continued)

Question		Answers	Notes	Total
5.	c	<p>a. enzymes catalyse/speed up chemical reactions/lower the energy needed ✓</p> <p>b. have specific <u>active sites</u> to which specific substrates bind ✓</p> <p>c. enzyme catalysis involves molecular motion and the collision of substrates with the active site ✓</p> <p>d. enzymes break macromolecules into monomers/smaller molecules in digestion ✓</p> <p>e. smaller molecules/monomers more readily absorbed ✓</p> <p>f. &lt;&lt;pancreas&gt;&gt; secretes enzymes into the «lumen of» small intestine ✓</p> <p>g. the small intestine has an alkaline pH ✓</p> <p>h. enzymes have maximum action at specific pHs <b>OR</b> enzymes can be denatured at other pHs ✓</p> <p>i. amylase breaks down starch into sugars/disaccharides ✓</p> <p>j. lipase breaks lipids/triglycerides into monoglycerides/fatty acids and glycerol ✓</p> <p>k. endopeptidase/protease breaks «peptide» bonds in proteins/polypeptides ✓</p> <p>l. accept any other valid pancreatic enzyme, substrate and product ✓</p>	<p>Award <b>[6 max]</b> if there is no mention of two specific groups of enzymes.</p> <p>OWTTE</p> <p>OWTTE</p>	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 <b>OR</b> red and blue absorbed most strongly. <b>OR</b> chlorophyll is the pigment that absorbs light energy ✓  d. H <sup>(+)</sup> /electrons from water are used to reduce compounds ✓ e. CO <sub>2</sub> 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	<p><i>control: [6 max]</i></p> <p>a. homeostasis is the maintenance of a constant internal environment ✓</p> <p>b. the pancreas produces hormones that control the levels of glucose ✓</p> <p>c. if glucose levels in blood are high, beta-cells «of the pancreas» produce insulin ✓</p> <p>d. «insulin» causes the cells to take up /absorb glucose ✓</p> <p>e. liver stores excess glucose as glycogen ✓</p> <p>f. if glucose levels in blood are low, alpha-cells «of the pancreas» produce glucagon ✓</p> <p>g. «glucagon» causes the liver to break down glycogen into glucose ✓</p> <p>h. «glucagon» increase levels of glucose in the blood ✓</p> <p>i. negative feedback controls the glucose levels ✓</p> <p><i>consequences:</i></p> <p>j. if the pancreas produces little/no insulin a person can develop <u>type I</u> diabetes ✓</p> <p>k. a person with <u>type I</u> diabetes «usually» needs/is dependent on injections of insulin ✓</p> <p>l. <u>type II</u> diabetes occurs when the body becomes resistant to insulin/cells do not respond to insulin ✓</p> <p>m. <u>type II</u> diabetes can «sometimes» be controlled by diet and exercise ✓</p> <p>n. named consequence of having diabetes «eg: eye damage» ✓</p>	<p><i>Award [6 max] if no consequences are given.</i></p> <p>OWTTE</p>	8 max