



Markscheme

May 2019

Biology

Standard level

Paper 3

14 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 A

Question		Answers	Notes	Total
1.	a	$\frac{\text{scale bar length}}{\text{image size}} = \times 660 \checkmark$		2
1.	b	a. the Davson–Danielli model proposed two layers of protein on either side of a lipid bilayer \checkmark b. micrographs illustrate proteins in and/or crossing the membrane \checkmark	OWTTE	2
1.	c	a. amphipathic means that they are both <u>hydrophilic</u> and <u>hydrophobic</u> \checkmark b. the outside hydrophilic parts are exposed to water \checkmark c. hydrophobic parts are away from water in the inside \checkmark	<i>Water or lack of needs to be mentioned for mpb or mpc</i>	2 max

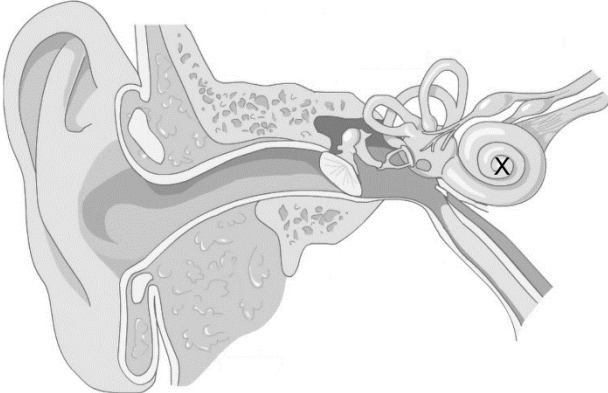
Question			Answers	Notes	Total
2.	a	i	a. a CO ₂ absorber/KOH is added ✓ b. a bubble/starting water level is measured ✓ c. «the rate of» movement of the bubble/pressure reduction is a measure of O ₂ consumption ✓		2 max
2.	a	ii	a. as fungus grows, the rate of oxygen consumption increases ✓ b. around day 4/5 fungus begins to grow/no growth in days 1–3 ✓ c. the rate of fungus growth/rate of respiration is highest after 5 days ✓		1 max
2.	a	iii	temperature/amount or type of feed «in the respirometer»/amount of CO ₂ absorber OR other reasonable suggestion ✓	<i>Do not accept light</i>	1
2.	b		a. act as saprotrophs/decomposers ✓ b. rot/feed on/break down organic matter/food/organisms OR return nutrients trapped in organic matter to the cycle/soil ✓	<i>Do not accept detritivores</i>	2
3.	a		vein/veins ✓		1
3.	b		a. blood flows towards the heart ✓ b. valves prevent backflow ✓ c. blood flow is unidirectional ✓		2 max

Section B

Option A — Neurobiology and behaviour

Question		Answers	Notes	Total
4.	a	cerebrum/ <u>cerebral</u> hemisphere/ <u>cerebral</u> cortex ✓		1
4.	b	a. «neural plasticity» is the ability to form new neural connections/synapses ✓ b. the area that is damaged by the stroke had a specific function ✓ c. <u>other</u> area of the brain can take on these functions ✓		2 max
4.	c	a. lesions are areas of brain injury ✓ b. diagnosed in living people using fMRI/CAT scan/PET scan ✓ c. autopsies reveal the position and extent of lesions/animal experimentation ✓ d. the behaviour/functioning of patient with lesion was observed ✓		3 max

Question		Answers	Notes	Total
5.	a	<ul style="list-style-type: none"> a. voluntary passage of food through the mouth ✓ b. «bolus of» food touches the walls of the pharynx ✓ c. nerve sends message/impulse to brain ✓ d. swallowing centre in the medulla «oblongata» ✓ e. now involuntary/unconscious/autonomic responses/reflexes ✓ f. triggers closing of epiglottis «to prevent choking» ✓ g. leading to contraction of muscles/peristalsis «in the pharynx and esophagus» ✓ 		3 max
5.	b	<ul style="list-style-type: none"> a. axons are extensions of the neuron cell body ✓ b. some axons grow out of the neural tube and connect to other parts of the developing embryo ✓ c. chemical stimuli affect axon growth ✓ d. more dendrites form ✓ e. axon reaches the target cell ✓ f. forms single/multiple synapse«s» ✓ g. neural pruning involves the loss of neurons/synapses ✓ 	<i>Do not accept migration of neurons</i>	4 max

Question		Answers	Notes	Total	
6.	a	the further from the base, the lower the frequency detected ✓	<i>Allow vice versa</i>	1	
6.	b	20 000 Hz «20 kHz» to 20 Hz ✓	<i>Unit required. Allow 19 980 Hz.</i>	1	
6.	c	mechanoreceptor ✓		1	
6.	d	i	auditory/cochlear/acoustic nerve ✓	1	
6.	d	ii	cochlea annotated with an X ✓ eg: 	<i>X can be anywhere in the spiral of the cochlea</i>	1
6.	e	a. connects the oval window to the eardrum/ossicles ✓ b. mechanical transmission of vibration of eardrum OR amplify vibration/sound ✓ c. moves oval window with frequency of the vibration/sound OR transmits vibration/sound to inner ear/cochlea ✓		2 max	

Option B — Biotechnology and bioinformatics

Question		Answers	Notes	Total
7.	a	a. covered lagoon is more variable than plug flow ✓ b. the monthly plug flow production is always higher ✓ c. covered lagoon is affected by the time of year while the plug flow is not ✓	Accept converse for all points Distinguish contrasts must be made	2 max
7.	b	«colder temperatures» reduce the metabolic/enzyme activity of the «methanogenic» bacteria ✓		1
7.	c	anaerobic/low oxygen levels/optimum pH/water/suitable/sufficient substrate ✓		1
7.	d	a. grow a <u>biofilm</u> on a trickle filter bed ✓ b. the biofilm contains <i>Thiobacillus</i> ✓ c. bubble the gas through the mixture/bed ✓ d. while water washes down from the top ✓ e. capturing the solid sulfur ✓	Award no marks for repeating the stem	3 max
8.	a	14–16 mm or 1.5–3 mm «around the disc» ✓	Units required	1
8.	b	a. use the Gram staining procedure ✓ b. Gram-positive bacteria take up/retain «crystal violet» stain ✓ c. «Gram-positive bacteria» appear purple-coloured seen through a microscope ✓		2 max
8.	c	a. <i>P. aeruginosa</i> not killed by the HCP OR disinfectant kills Gram-positive bacteria/ <i>S. aureus</i> ✓ b. leading to less competition for <i>P. aeruginosa</i> ✓		2
8.	d	microorganisms growing in a biofilm are resistant to antimicrobial agents ✓		1

Question		Answers	Notes	Total
9.	a	<ul style="list-style-type: none"> a. named example of a marker gene, eg: ampicillin resistance ✓ b. target gene and marker gene combined «in the same construct» ✓ c. taken up by host ✓ d. evidence of the marker gene measurable ✓ e. indicates successful gene modification/incorporation ✓ 		3 max
9.	b	<ul style="list-style-type: none"> a. hepatitis B gene coding for an antigen ✓ b. fused with a tobacco mosaic virus/capsid gene ✓ c. tobacco plant is infected with the «recombinant» virus ✓ d. hepatitis B antigens are extracted from the plants ✓ e. antigens are purified to produce vaccine ✓ f. «antigens in» the vaccine stimulates antibody production ✓ 		4 max

Option C — Ecology and conservation

Question		Answers	Notes	Total
10.	a	herbivore/primary consumer ✓	<i>Do not accept second trophic level</i>	1
10.	b	<p><i>compare:</i></p> <p>a. all three species present in both OR richness is the same ✓</p> <p>b. sea urchin numbers highest in both OR sea bream density less than sea urchin density in both ✓</p> <p>c. all species numbers are affected by fishing ✓</p> <p><i>contrast:</i></p> <p>d. sea urchin population is greater outside the marine protected area ✓</p> <p>e. reduction in sea bream/sea grass percent cover outside the marine protected area ✓</p> <p>f. less species evenness outside the marine protected area ✓</p>	<i>Allow converse answer</i>	3 max
10.	c	<p>a. keystone species have a disproportionate effect on the biological community ✓</p> <p>b. removal of the sea bream «due to fishing» ✓</p> <p>c. results in more sea urchins ✓</p> <p>d. which significantly reduce the producers/seagrass ✓</p>	<i>Do not accept first trophic level for mpd</i>	3 max

Question		Answers	Notes	Total
11.	a	6.5 m ✓	<i>Unit required</i>	1
11.	b	a. a symbiotic/mutualistic relationship ✓ b. <i>Zooxanthellae</i> obtain shelter/habitat/exposure to light ✓ c. coral obtains energy/food through photosynthesis of the <i>Zooxanthellae</i> ✓		2 max
11.	c	low light levels/lower temperatures cannot support growth/metabolism ✓	<i>Requires the explanation for the mark</i>	1
12.		a. name of strategy ✓ b. detail of the strategy ✓ <i>example:</i> a. <i>anti-poaching restrictions within a nature reserve</i> b. <i>patrolling of the reserve to enforce restrictions</i>	<i>Accept only the first stated strategy if several are listed.</i> <i>The outline must match the strategy.</i>	2

Question	Answers	Notes	Total
13.	a. numbers of species ✓ b. types of species ✓ c. impacts on food chains/webs ✓ d. food production/availability ✓ e. habitat/ecosystem alteration ✓ f. biochemical processes «photosynthesis/respiration/decomposition» ✓ g. biogeochemical processes «erosion/nutrient cycles» ✓ h. first example of abiotic environmental factor ✓ i. second example of abiotic environmental factor ✓	Award [2 max] if the environmental disturbance is not named. The environmental disturbance may be a factor such as fire, farming, construction, extreme weather, introduction of an alien species/other human intervention. Explanations are not required.	3 max
14.	a. when two species with similar niches occupy the same habitat ✓ b. the competition increases OR reduction in resources ✓ c. the population of one species will die/be excluded ✓ d. an invasive species «often» lacks predators ✓ e. the endemic species is usually the one that cannot compete ✓ f. eg: grey squirrel/Japanese knot weed/cane toad ✓	[3 max] if the invasive species is not named. Do not allow humans.	4 max

Option D — Human physiology/

Question			Answers	Notes	Total
15.	a		softened/weakened bones/bone pain/increased fractures/difficulty walking/stunted growth ✓		1
15.	b	i	a. direct relationship/ <u>positive</u> correlation ✓ b. increased latitude, higher mortality from falls ✓	<i>Or vice versa</i>	1 max
15.	b	ii	a. higher latitude, lower levels of sunlight ✓ b. less uptake of calcium OR less vitamin D ✓ c. higher incidence of osteomalacia leads to higher risk of broken bones/mortality ✓		2 max
15.	c	i	<i>compare:</i> a. no difference in the P wave/QRS wave OR both traces have all 4 waves/PQRST ✓ <i>contrast:</i> b. delayed T wave OR T wave is shorter/higher in hypocalcemia ✓	<i>Allow reference to events in the cardiac cycle for mpa or mpb</i> <i>Allow converse statements for mpb.</i>	2
15.	c	ii	a. repolarization of ventricles ✓ b. ventricles are in diastole/relaxation ✓		1 max
16.	a		breakdown/weakening of heart muscle OR electrolyte imbalance affecting the cardiac cycle OR low blood pressure/heart rate ✓		1
16.	b		intercalated disc ✓		1

Question		Answers	Notes	Total
17.	a	a. <u>hepatic</u> artery ✓ b. hepatic <u>portal</u> vein ✓		2
17.	b	a. fenestrations/gaps/holes between cells ✓ b. walls are one cell thick ✓		1 max
17.	c	iron/glucose/«fat soluble» vitamins/glycogen ✓		1

18.	a	a. reduced resistance to pathogens ✓ b. pH not optimum for pepsin activity ✓ c. activation of enzymes/pepsinogen is reduced ✓ d. reduced food/protein digestion ✓		3 max
18.	b	a. regulated by both hormonal <u>and</u> nervous systems ✓ b. smell/sight of food causes the brain to send nerve impulses ✓ c. via the «vagus» nerve from the medulla «oblongata» ✓ d. «gland» cells in the stomach wall are stimulated to secrete gastric juice ✓ e. chemoreceptors in the stomach wall detect food «and send an impulse to the brain» ✓ f. stretch receptors detect stretching/distension of the stomach «and send impulses to the brain» ✓ g. release of «hormone» gastrin ✓ h. gastrin stimulates secretion of acid OR pepsinogen by exocrine gland cells in the stomach wall ✓ i. secretin and somatostatin inhibit gastrin secretion if the pH in the stomach falls too low ✓		4 max