



Markscheme

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Biology

Standard level

Paper 3

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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

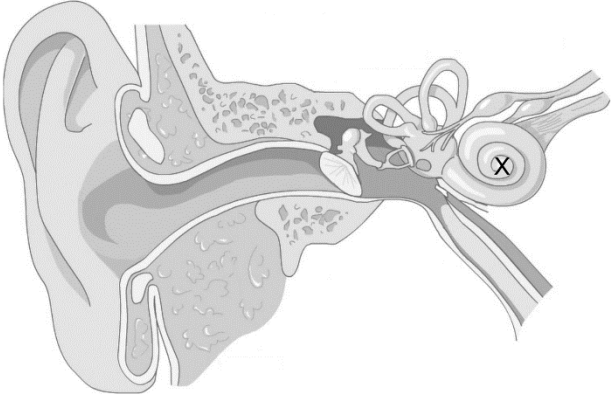
Question			Answers	Notes	Total
2.	a	i	a. a CO ₂ absorber/KOH is added ✓ b. a bubble/starting water level is measured ✓ c. «the rate of» movement of the bubble/pressure reduction is a measure of O ₂ consumption ✓		2 max
2.	a	ii	a. as fungus grows, the rate of oxygen consumption increases ✓ b. around day 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	<p>cochlea annotated with an X ✓</p> <p>eg:</p> 	<i>X can be anywhere in the spiral of the cochlea</i>	1
6.	e	<p>a. connects the oval window to the eardrum/ossicles ✓</p> <p>b. mechanical transmission of vibration of eardrum OR amplify vibration/sound ✓</p> <p>c. moves oval window with frequency of the vibration/sound OR transmits vibration/sound to inner ear/cochlea ✓</p>		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 ✓	<i>Accept converse for all points</i> <i>Distinguish contrasts must be made</i>	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 ✓	<i>Award no marks for repeating the stem</i>	3 max
8.	a	14–16 mm or 1.5–3 mm «around the disc» ✓	<i>Units required</i>	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 ✓	<p><i>Award [2 max] if the environmental disturbance is not named.</i></p> <p><i>The environmental disturbance may be a factor such as fire, farming, construction, extreme weather, introduction of an alien species/other human intervention.</i></p> <p><i>Explanations are not required.</i></p>	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 ✓	<p><i>[3 max] if the invasive species is not named.</i></p> <p><i>Do not allow humans.</i></p>	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