

Markscheme

May 2017

Biology

Standard level

Paper 3

20 pages

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Section A

Question		Answers	Notes	Total
1.	a	a. the data logger measures the differences in oxygen concentration OR the oxygen concentration is measured before and after the water passes through the respirometer ✓ b. over time ✓ c. the mass of fish needs to be measured ✓		2 max
	b	greater body mass, less consumption of oxygen OR indirect/negative relationship ✓		1
	c	a. higher temperature, more oxygen consumption ✓ b. «more oxygen consumption» is due to more respiration/metabolism ✓ c. less oxygen can dissolve in warmer water so less «aerobic» respiration OR more carbon dioxide dissolved so less oxygen for respiration ✓		2 max

Question		Answers	Notes	Total
2.	a	pH = 8 AND temperature = 46°C ✓	<i>Both needed.</i> <i>Accept answers in the range of 7.8 to 8.5 pH and 44 to 48°C .</i> <i>Units required.</i>	1
	b	a. the amount of keratin measured OR decrease in keratin mass OR size of keratin containing object ✓ b. the increase in peptides/amino acids/product ✓ c. changes in colour/absorbance/smell ✓	OWTTE	2 max
	c	a. amount/concentration of enzyme ✓ b. amount/concentration of keratin/substrate ✓ c. amount of buffer ✓ d. time/duration of experiment ✓		2 max

Question			Answers	Notes	Total
3.	a		no effect with fructose diet but «statistically significant» reduction in control ✓		1
	b		a. effectiveness/effect of leptin depends on diet ✓ b. «if obese people/humans have a» high fructose diet, then it will not suppress appetite ✓ c. «for obese people/humans with a» control/low fructose diet, then it will suppress appetite ✓ d. results for mice may not be the same for humans ✓	OWTTE OWTTE	2 max
	c	i	adipose/fat tissue ✓		1
		ii	hypothalamus ✓		1

Section B

Option A — Neurobiology and behaviour

Question		Answers	Notes	Total
4.	a	/: neural groove/plate/fold ✓ //: ectoderm ✓		2
	b	brain ✓ spinal cord ✓		2
	c	spina bifida ✓		1
5.	a	a. controls involuntary processes in the body ✓ b. «uses centres located» in the brain stem/medulla ✓ c. example of action of autonomic nervous system ✓	<i>eg: the regulation of heart rate</i>	2 max
	b	a. a light is shone in the eye ✓ b. «when light shone in eyes» if pupil does not constrict then there is some brain damage ✓ c. if the pupil constricts it rules out certain types of brain damage ✓ d. different response from each eye could indicate brain damage ✓ e. more testing is needed to determine area/extent of brain damage ✓	<i>OWTTE</i>	3 max

Question		Answers	Notes	Total
6.		a. in all groups an increase in body mass means an increase in brain volume ✓ b. in the apes, brain volume has increased only slightly with body mass ✓ c. in the Homo group brain volume increases steeply with body mass ✓ d. in Australopithecines brain volume has increased only slightly with body mass OR in Australopithecines fewer species were studied ✓ e. at a small mass the brain volumes are more similar ✓		3 max

7.	a	rod ✓		1												
	b	<table border="1"> <thead> <tr> <th></th> <th><i>photoreceptor</i></th> <th><i>olfactory receptor</i></th> <th></th> </tr> </thead> <tbody> <tr> <td><i>stimulus perceived</i></td> <td>light</td> <td>dissolved molecules OR chemicals</td> <td>✓</td> </tr> <tr> <td><i>tissue where it is found</i></td> <td>retina</td> <td>«olfactory» epithelium</td> <td>✓</td> </tr> </tbody> </table>		<i>photoreceptor</i>	<i>olfactory receptor</i>		<i>stimulus perceived</i>	light	dissolved molecules OR chemicals	✓	<i>tissue where it is found</i>	retina	«olfactory» epithelium	✓		2
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Question	Answers	Notes	Total
8.	<p>a. information from the left-half of the visual field is detected by the right-half of the retina OR information from the right-half of the visual field is detected by the left-half of the retina ✓</p> <p>b. information from left-half of visual field is processed by the right hemisphere OR information from right-half of visual field is processed by the left hemisphere ✓</p> <p>c. impulses travel through optic nerve ✓</p> <p>d. optic nerves from each eye meet at the «optic» chiasma ✓</p> <p>e. information from inner fields «closer to the nose» cross at the «optic» chiasma ✓</p> <p>f. impulses continue to the brain ✓</p> <p>g. an image forms in the visual cortex ✓</p>	<p><i>Accept answer in a clearly annotated diagram.</i></p> <p><i>OWTTE</i></p>	<p>4 max</p>

Option B — Biotechnology and bioinformatics

Question	Answers	Notes	Total
9.	<p>a. «in biofilms» bacteria exhibit «emergent» properties not predictable from the individual components of the system</p> <p>OR</p> <p>biofilm exhibits its own properties, quite different in comparison with those shown by the single species ✓</p> <p>b. biofilms form when bacteria adhere to surface of tooth and begin to excrete an EPS/extracellular polymeric substances/exopolysaccharides ✓</p> <p>c. formation of EPS maintains bacteria together «in biofilm» ✓</p> <p>d. interspecies relationships are favourable</p> <p>OR</p> <p>one species produces growth factors for/facilitates attachment of another species ✓</p> <p>e. individual forces are low but the overall binding force can exceed that of covalent bonds ✓</p> <p>f. glue properties/cohesiveness given by different types of bonding ✓</p> <p>g. biofilms show resistance to antibiotics/other pathogen ✓</p>		3 max

Question		Answers	Notes	Total
10.	a	<p>a. high amylopectin potatoes/low amylose need more heat to form gel «so hypothesis supported» ✓</p> <p>b. «normal» potato and normal barley have similar amylose concentration but different gel formation temperatures «so hypothesis not supported» ✓</p> <p>c. normal barley and high amylose barley have same gel formation temperature «so hypothesis not supported» ✓</p>		2 max
	b	<p>a. «high amylopectin potato starch is» used in paper production because it forms a clearer film «when forming a gel» ✓</p> <p>b. «high amylopectin potato starch is» used in adhesive production as it forms a stickier paste ✓</p> <p>c. «high amylopectin potato starch is» used in paper/adhesive production because there is less thickening of starch film/paste during storage compared to regular potato starch ✓</p>		1 max
	c	<p><i>supporting:</i></p> <p>a. potatoes cheap to grow ✓</p> <p>b. benefits farmers/local producers «so less pollution» ✓</p> <p>c. reduces costs in «paper» industry ✓</p> <p>d. beneficial uses in industry ✓</p> <p><i>opposing:</i></p> <p>e. perceived health risks/allergens ✓</p> <p>f. may cross pollinate with existing species ✓</p> <p>g. could be eaten accidentally ✓</p>	<i>eg: paper or adhesives</i>	3 max

Question		Answers	Notes	Total
11.	a	a. transgenic organisms produce proteins that were not previously part of their species' proteome ✓ b. golden rice has genes belonging to other species «flower and bacterium» that were not there naturally/originally ✓		1 max
	b	database/NCBI/BLAST/BLASTn/BLASTp search «to find target gene» ✓		1

12.	a	a. alkali/base ✓ b. nutrients ✓ c. glucose/carbon source ✓ d. antibiotic ✓ e. nitrogen source ✓ f. water ✓		2 max
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(continued...)

(Question 11 continued)

Question		Answers	Notes	Total															
	b	temperature OR optical density/turbidity OR oxygen OR CO ₂ ✓		1															
	c	<table border="1"> <thead> <tr> <th><i>factor</i></th> <th><i>batch</i></th> <th><i>continuous</i></th> </tr> </thead> <tbody> <tr> <td><i>a. introduction of nutrients</i></td> <td>at the beginning</td> <td>all the time ✓</td> </tr> <tr> <td><i>b. collection of products</i></td> <td>all products at the end/OWTTE</td> <td>small quantities throughout/OWTTE ✓</td> </tr> <tr> <td><i>c. cleaning and sterilization</i></td> <td>between batches</td> <td>after a long time/OWTTE ✓</td> </tr> <tr> <td><i>d. contamination</i></td> <td>ruins only one batch</td> <td>ruins the whole production ✓</td> </tr> </tbody> </table>	<i>factor</i>	<i>batch</i>	<i>continuous</i>	<i>a. introduction of nutrients</i>	at the beginning	all the time ✓	<i>b. collection of products</i>	all products at the end/OWTTE	small quantities throughout/OWTTE ✓	<i>c. cleaning and sterilization</i>	between batches	after a long time/OWTTE ✓	<i>d. contamination</i>	ruins only one batch	ruins the whole production ✓		2 max
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Question	Answers	Notes	Total
13.	<p>a. «bioremediation» is the use of microbes to remove environmental contaminants from oil spill ✓</p> <p>b. some pollutants are metabolized/degraded by microorganisms ✓</p> <p>c. microorganisms can be eubacteria/archaeans ✓</p> <p>d. microorganisms are useful in bioremediation because they can multiply very quickly «by binary fission» ✓</p> <p>e. microorganisms can use pollutants/oil spills/crude oil as energy sources/carbon sources/electron acceptors in cellular respiration ✓</p> <p>f. <i>eg: Pseudomonas</i> used «in bioremediation» ✓</p> <p>g. <i>Pseudomonas</i> requires nutrients «such as potassium and urea» to metabolize the oil at a faster rate «so sprayed on to an oil spill to aid the bacteria in their work» ✓</p>		4 max

Option C — Ecology and conservation

Question		Answers	Notes	Total
14.		<p>a. when they are alone they both show a greater population than when together ✓</p> <p>b. two species cannot survive indefinitely in the same habitat if their niches are identical OR competitive exclusion ✓</p> <p>c. <i>Paramecia</i> compete for food/space ✓</p> <p>d. <i>P. caudatum</i> starts to disappear/decrease after day 6–8 days «whereas <i>P. aurelia</i> reaches a plateau» OR the population of <i>P. caudatum</i> decreases much more than the population of <i>P. aurelia</i> ✓</p> <p>e. <i>P. aurelia</i> is better suited/fitted than <i>P. caudatum</i> ✓</p>	Vice versa	3 max

15.	a	net primary productivity increases with mean annual temperature while with precipitation increases and then decreases ✓		1
	b	any value between 0 and 4 mg C ha ⁻¹ y ⁻¹ ✓		1
	c	tropical rainforest OR jungle ✓		1

Question		Answers	Notes	Total
16.	a	any value between 15 kg and 22 kg ✓		1
	b	a. biomass decreases going up the trophic levels ✓ b. autotrophs have greatest biomass «around 40 040 kg» OR tertiary consumers have the least biomass ✓ c. greatest loss of biomass is from autotrophs to primary consumers ✓		2 max
	c	parasites feed on secondary and primary consumers ✓		1
17.	a	reduction in number of species/richness/diversity ✓		1
	b	a. biological control of/reduction in corn pests ✓ b. reduction in the use of pesticides ✓ c. damage on beneficial species ✓ d. reduction in insect diversity can have broad ecosystem negative impact OR example of negative effect ✓ e. long-term effects unknown ✓	OWTTE	3 max

(continued...)

(Question 11 continued)

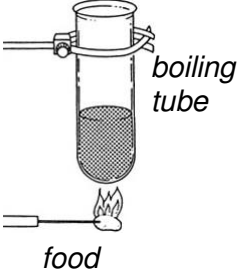
Question	Answers	Notes	Total
c	<p><i>definition</i> a. keystone species is one in which presence has a disproportionate impact on the ecosystem ✓</p> <p><i>impact</i> b. removal often leads to significant changes</p> <p>OR valid example ✓</p>		2
18.	<p>a. indicator species are organisms that indicate health of ecosystem/level of pollution ✓</p> <p>b. they exist in higher relative numbers under certain environmental conditions</p> <p>OR if certain environmental conditions are not found, indicator species die/reproduce ✓</p> <p>c. are very sensitive/highly tolerant species ✓</p> <p>d. provides quantitative information on the quality of the environment around it ✓</p> <p>e. <u>named</u> example of indicator species and susceptibility ✓</p> <p>f. indicator species are used to calculate biotic index ✓</p>	<p><i>Must state a named species. eg: Lichens used to detect air quality.</i></p>	4 max

Option D — Human physiology

Question		Answers	Notes	Total
19.	a	a. pumps protons/H ⁺ into the stomach ✓ b. allows for the production of «hydrochloric» acid ✓ c. «hydrochloric» acid accelerates digestion/activates enzymes ✓ d. gives optimal pH for pepsin/enzyme digestion ✓		2 max
	b	a. proton pump is a «transmembrane» protein ✓ b. proton pump inhibitors bind to the proton pump ✓ c. hydrogen ions are not sent into stomach lumen OR reduction of «gastric» acid production ✓ d. increase in pH of stomach ✓ e. relieve symptoms of acid reflux/gastritis/ulcers ✓		3 max

Question		Answers	Notes	Total
20.	a	Kupffer ✓		1
	b	a. cells phagocytose/engulf the erythrocytes ✓ b. hemoglobin is split into heme group and globins OR heme is removed from hemoglobin ✓ c. globins broken down/hydrolyzed to peptides/amino acids ✓ d. heme group separated into iron and bilirubin ✓		3 max
	c	a. carried to bone marrow ✓ b. used in the production of hemoglobin/new erythrocytes ✓		1 max

Question		Answers	Notes	Total
21.	a	<p><i>systolic</i>: 115 ✓</p> <p><i>diastolic</i>: 77 «mm Hg» ✓</p>	<i>Both needed for the mark.</i>	1
	b	<p>a. «systolic/diastolic» pressure is the force of blood on arteries ✓</p> <p>b. systolic pressure is measured when the ventricle contracts</p> <p>OR</p> <p>systolic pressure is when blood is being pumped out of the heart ✓</p> <p>c. diastolic pressure is measured when the ventricles are filled with blood</p> <p>OR</p> <p>heart is at rest/relaxed ✓</p>		3 max
	c	<p><i>I</i>: nucleus ✓</p> <p><i>II</i>: intercalated disc ✓</p>		2

Question	Answers	Notes	Total
22.	<p>a. description of apparatus OR drawing OR measured with a calorimeter ✓</p> <p>b. measure the initial mass/volume of water ✓</p> <p>c. measure the initial temperature of the water ✓</p> <p>d. measure the mass of the food ✓</p> <p>e. ignite the food and place under the container of water ✓</p> <p>f. measure the final temperature of the water OR calculate the change in temperature of the water ✓</p> <p>g. heat gained by the water = heat lost by the food OR energy = mass of water × temperature rise in water × specific heat capacity of water / mass of food ✓</p>	<p>Allow other correct described method.</p>  <p>The diagram shows a vertical boiling tube held by a clamp. Inside the tube, there is a shaded area representing water. Below the tube, a small piece of food is being burned, with a flame underneath it. Labels 'boiling tube' and 'food' are placed next to their respective parts.</p>	4 max