Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2017

Biology

Standard level

Paper 3

20 pages

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 ✓	*Both needed.* *Accept answers in the range of 7.8 to 8.5 pH and 44 to 48 °C .* *Units required.*	**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**		*I*: neural groove/plate/fold ✓ *II*: 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 ✓	*eg: the regulation of heart rate*	**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 ✓	*OWTTE*	**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><tr><th></th><th>***photoreceptor***</th><th>***olfactory receptor***</th><th></th></tr><tr><td>***stimulus perceived***</td><td>light</td><td>dissolved molecules ***OR*** chemicals</td><td>✓</td></tr><tr><td>***tissue where it is found***</td><td>retina</td><td>«olfactory» epithelium</td><td>✓</td></tr></table>		**2**

Question			Answers	Notes	Total
8.			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 ✓ 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 ✓ c. impulses travel through optic nerve ✓ d. optic nerves from each eye meet at the **«**optic**»** chiasma ✓ e. information from inner fields **«**closer to the nose**»** cross at the **«**optic**»** chiasma ✓ f. impulses continue to the brain ✓ g. an image forms in the visual cortex ✓	*Accept answer in a clearly annotated diagram.* *OWTTE*	**4 max**

Option B — Biotechnology and bioinformatics

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

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

(continued…)

(Question 11 continued)

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td></td><td>b</td><td></td><td>temperature
OR
optical density/turbidity
OR
oxygen
OR
CO_2 ✓</td><td></td><td>1</td></tr>
<tr><td></td><td>c</td><td></td><td>
<table>
<tr><th>factor</th><th>batch</th><th>continuous</th></tr>
<tr><td>a. introduction of nutrients</td><td>at the beginning</td><td>all the time ✓</td></tr>
<tr><td>b. collection of products</td><td>all products at the end/OWTTE</td><td>small quantities throughout/OWTTE ✓</td></tr>
<tr><td>c. cleaning and sterilization</td><td>between batches</td><td>after a long time/OWTTE ✓</td></tr>
<tr><td>d. contamination</td><td>ruins only one batch</td><td>ruins the whole production ✓</td></tr>
</table>
</td><td></td><td>2 max</td></tr>
</table>

Question			Answers	Notes	Total
13.			a. **«**bioremediation**»** is the use of microbes to remove environmental contaminants from oil spill ✓ b. some pollutants are metabolized/degraded by microorganisms ✓ c. microorganisms can be eubacteria/archaeans ✓ d. microorganisms are useful in bioremediation because they can multiply very quickly **«**by binary fission**»** ✓ e. microorganisms can use pollutants/oil spills/crude oil as energy sources/carbon sources/electron acceptors in cellular respiration ✓ f. *eg: Pseudomonas* used **«**in bioremediation**»** ✓ g. *Pseudomonas* 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**»** ✓		**4 max**

Option C — Ecology and conservation

Question			Answers	Notes	Total
14.			a. when they are alone they both show a greater population than when together ✓ b. two species cannot survive indefinitely in the same habitat if their niches are identical ***OR*** competitive exclusion ✓ c. *Paramecia* compete for food/space ✓ d. *P. caudatum* starts to disappear/decrease after day 6–8 days **«**whereas *P. aurelia* reaches a plateau**»** ***OR*** the population of *P.caudatum* decreases much more than the population of *P. aurelia* ✓ e. *P. aurelia* is better suited/fitted than *P. caudatum* ✓	*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		*definition* a. keystone species is one in which presence has a disproportionate impact on the ecosystem ✓ *impact* b. removal often leads to significant changes ***OR*** valid example ✓		**2**

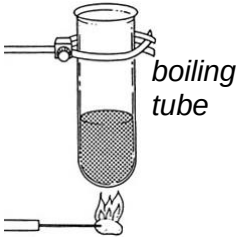
18.			a. indicator species are organisms that indicate health of ecosystem/level of pollution ✓ b. they exist in higher relative numbers under certain environmental conditions ***OR*** if certain environmental conditions are not found, indicator species die/reproduce ✓ c. are very sensitive/highly tolerant species ✓ d. provides quantitative information on the quality of the environment around it ✓ e. <u>named</u> example of indicator species and susceptibility ✓ f. indicator species are used to calculate biotic index ✓	*Must state a named species. eg: Lichens used to detect air quality.*	**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**		*systolic*: 115 ✓ *diastolic*: 77 **«**mm Hg**»** ✓	*Both needed for the mark.*	**1**
	b		a. **«**systolic/diastolic**»** pressure is the force of blood on arteries ✓ b. systolic pressure is measured when the ventricle contracts ***OR*** systolic pressure is when blood is being pumped out of the heart ✓ c. diastolic pressure is measured when the ventricles are filled with blood ***OR*** heart is at rest/relaxed ✓		**3 max**
	c		*I*: nucleus ✓ *II*: intercalated disc ✓		**2**

Question			Answers	Notes	Total
22.			a. description of apparatus ***OR*** drawing ***OR*** measured with a calorimeter ✓ b. measure the initial mass/volume of water ✓ c. measure the initial temperature of the water ✓ d. measure the mass of the food ✓ e. ignite the food and place under the container of water ✓ f. measure the final temperature of the water ***OR*** calculate the change in temperature of the water ✓ 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 ✓	*Allow other correct described method.*  	**4 max**