Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2017

Biology

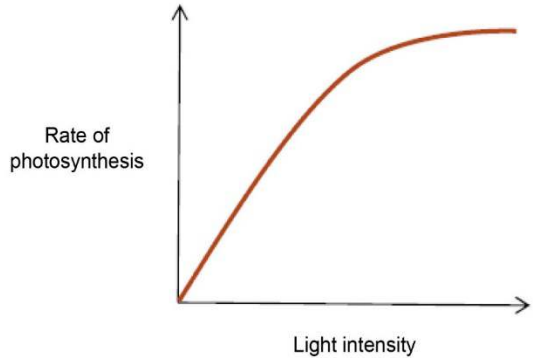
Standard level

Paper 3

19 pages

Section A

Question			Answers	Notes	Total
1.	a		a. standard deviation indicates the degree of variation in the data ***OR*** the spread of data around the mean ✓ b. high standard deviation <u>at 30°C</u> «in proportion to the average» indicates less <u>reliable</u> data ✓ c. low standard deviation for results from <u>40 to 70°C</u> indicates more <u>reliable</u> data ✓		**2 max**
	b		a. outliers should not be deleted from the data set ***OR*** trend lines may ignore outliers ***OR*** use a z-score/test ✓ b. could be incorrectly entered or measured data ✓ c. repeat experiment/reading/trial «for that point» ✓		**2**
	c		a. the reaction / activity increases with temperature ✓ b. rate slows from 60°C to 70°C ✓ c. fastest increase in activity is between 30°C - 40°C ✓ d. optimum temperature is 60°C ✓		**2**
	d		a. concentration / volume of urea «solution» ✓ b. concentration / volume of urease «solution» ✓ c. concentration / volume of indicator ✓ d. lighting conditions / background «to test tubes» ✓		**1 max**

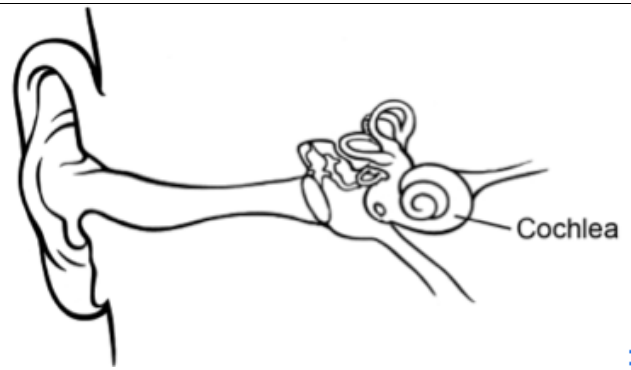
Question			Answers	Notes	Total
2.	a		*Compare:* a. both the theoretical data and the experimental data show an increase in photosynthetic rate/oxygen production with increased light intensity ***OR*** the rate of photosynthesis in the experimental data starts to level off at high light intensity as expected in theoretical data ✓ *Contrast:* b. the experimental data do not reach a plateau whereas theoretical data do ***OR*** data show photosynthesis is occurring at zero lux/light intensity whereas theoretical data would not ✓	*Accept answers using an annotated graph.* *Accept answers as annotations of the graph or a new graph drawn:*  	**2 max**
	b		«the rate of photosynthesis» would be slower/fewer bubbles ***OR*** rise to lower level/would plateau at a lower level/would be half the height ✓		**1 max**
	c		a. measure the absorption/decrease of CO_2 ✓ b. measure the increase in biomass ✓ c. measure rise in pH ✓		**1 max**

Question			Answers	Notes	Total
3.	a		25 – 22 = 3 breaths in 2 min = 1.5 breaths per min/0.025 breaths per sec ✓	*Units required.*	**1 max**
	b		a. exercise increases / results in higher rate of <u>respiration</u> ✓ b. exercise produces more carbon dioxide / consumes more oxygen ✓ c. increased tidal volume excretes more carbon dioxide / obtains more oxygen ✓ d. increased tidal volume increases gas exchange «across alveoli» ✓ e. concentration gradient«s» of gases is maintained ✓		**3 max**

Question			Answers	Notes	Total
4.	a		a. cell moves 25–28mm ***OR*** 71–93µm ✓ b. speed range is 71–93 µm in 5 hours ✓ c. answer in the range 14–19 µm/h or µm h^{-1} ✓		**2 max**
	b		a. «neural migration» positions cell types from different origins into specific locations ✓ b. «neural migration» allows formation of connections/synapses ✓ c. allows for differentiation of cell types/types of neuron ✓		**1 max**
	c		a. neural pruning is the removal of synapses/dendrites/ neural connections ✓ b. caused by lack of use ✓ c. it occurs during brain development/between birth and end of puberty ✓ d. allows new neural connections/makes nervous system more efficient / plasticity ✓		**2 max**

Question			Answers	Notes	Total
5.	a		a. positive correlation «between grey matter volume and white matter volume» ***OR*** as white matter «volume» increases so does grey matter «volume» ✓ b. As animal/brain size increase the volume of grey and white matter are «approaching» equal ***OR*** as volume of grey matter increases, the ratio grey : white becomes closer to 1 ✓		**1 max**
	b		*Structure:* a. divided into left and right hemisphere ✓ b. has extensive folding ✓ c. has a large surface area : volume ratio ✓ *Function:* d. responsible for higher order functions/thinking/learning/memory/language ✓ e. functions are located in specific areas of the cortex/lobes ✓ f. sensory/motor functions of the left hemisphere correspond to the right side of the body ✓		**3 max**
	c		a. «brain» cells/neurons carry out large amount of respiration/metabolic activity ✓ b. maintenance of resting potential requires energy/ATP ***OR*** functioning of Na-K pumps requires energy/ATP ***OR*** nerve impulse requires energy/ATP ✓		**1 max**

Question			Answers	Notes	Total
6.	**a**		left «side»		**1**
	b		a. speech production ✓ b. language comprehension/processing ✓ c. damage leads to difficulty in verbalising thoughts ✓		**2**

Question			Answers	Notes	Total
7.	a				1 max
	b		a. there are three semi-circular canals set perpendicular to one another / orientated in three planes of space / the direction of movement of the head in any direction is sensed ✓ b. each canal is filled with liquid/perilymph ✓ c. each canal contains «sensory» hairs ✓ d. when the head moves the liquid in the canal moves more slowly/lags behind ✓ e. this causes the sensory hairs to bend ✓ f. send impulses to the brain «via the vestibular nerve» ✓		4 max
	c		a. ganglion cells transfer information to the brain ✓ b. they receive visual information from photoreceptors/rod and cone cells/bipolar cells ✓ c. their long axon extends to the brain «in the optic nerve» ✓ d. they detect/process movement/colour ✓		2 max

Option B — Biotechnology and bioinformatics

Question			Answers	Notes	Total
8.	**a**	**i**	lack of oxygen/anoxic/anaerobic conditions / acidic pH / warm temperature / methanogens / acidogenic bacteria ✓		**1 max**
		ii	a. increased variety of substrates used ✓ b. change in the proportion of substrates used ***OR*** from 1997 to 2004 increase in slaughterhouse waste ✓ c. less reliance on manure/increase use from food industry ✓ d. waste from food industry results in higher biogas yield ✓		**2 max**
	b		a. microbial population can be maintained in a state of exponential growth for a long time ***OR*** concentration of microorganisms in fermenter stable ✓ b. «balanced growth is» maintained by keeping nutrients/medium/pH/ temperature/ oxygen level constant ✓ c. nutrients are added ***AND*** products removed «at steady rate» ✓ d. probes used to monitor conditions within fermenters ✓ e. open fermentation/fermenter ✓		**3 max**

Question			Answers	Notes	Total
9.	**a**		a. there is little/no significant difference in the success of transfecting DNA ✓ b. there is «significantly» less damage to the cells with the smaller/40nm particles ✓		**2**
	b		electroporation / microinjection ✓		**1 max**
10.	**a**		a. bacteria spread out further with ginger/more than twice the distance with ginger/more spreading with ginger ✓ b. more spreading means less biofilm formation ✓ c. biofilms are usually made up of many species ***OR*** only tested the effect of ginger on one species ✓ d. only tested over 24 hours ✓ e. only tested with agar substrate/other substrates may have different effects ✓		**3 max**
	b		a. biofilms reduce flow rate in pipes ✓ b. contamination of the drinking water supplies by biofilm microbes ✓ c. biofilms may cause corrosion of pipes ✓		**2 max**
11.	**a**		1 mol dm^{-3} ✓		**1**
	b		*Marinobacter* ✓		**1**

Question			Answers	Notes	Total
12.			a. antibiotic resistance «from marker genes» in the crops could be transferred to bacteria ✓ b. but this has never been demonstrated ✓ c. the precautionary principle should be applied ✓ d. genetically modified crops could hybridise with wild plants/other crops ✓ e. escape «of GM crop» could lead to outcompeting endemic species/wild plants / becoming invasive/superweed ✓ f. herbicide resistance could develop in wild plants ***OR*** pesticide resistance could develop in pests ✓ g. modifications can affect pollinating insects ✓ h. example of genetically modified crop ✓ *eg Amflora potato / Bt maize*		**4 max**

Option C — Ecology and conservation

Question			Answers	Notes	Total
13.	**a**		mutualism ✓		**1 max**
	b		a. polyp is a source of carbon dioxide for the *Zooxanthellae* ✓ ***OR*** polyp is a source of ammonia/nitrogen for the *Zooxanthellae* ✓ b. *Zooxanthellae* provide oxygen to the polyp ***OR*** *Zooxanthellae* provide sugars/glucose/glycerol/lipids/amino acids to the polyp ✓		**2 max**
	c		light / temperature / salinity / carbon dioxide / pH ✓		**1 max**

14.			a. increased biomass «with higher temperatures» ✓ b. «so» increased uptake of nutrients from soil «into the biomass» ✓ c. increased decomposition of litter «due to growth of decomposers» ✓ d. «so» increased nutrient composition of soil «L→ S» ✓ e. increased weathering of rocks «increasing minerals in soil» ✓ f. weather changes cause increased runoff from litter/leaching from soil ✓		**2 max**

Question			Answers	Notes	Total
15.	**a**		a. uncontrolled increase of numbers «in alien species» ***OR*** become invasive ***OR*** have no «natural» predators ✓ b. outcompetes native species / reduces biodiversity ***OR*** carries disease ***OR*** preys on local species decreasing population size ***OR*** disrupts food chains/webs ✓		**2 max**
	b		Central/South/Latin America ✓		**1**
	c		a. the baited traps catch a lot more tadpoles than the unbaited traps / traps with bait are more effective than those without ✓ b. baited traps are almost 20 times more effective ✓ c. traps without toxin reach capacity sooner than those with toxin ✓ d. there may be environmental/health/safety problems with the toad toxin used ✓ e. there is no information on how toads are controlled since the toxin does not kill the tadpoles ✓		**3 max**

Question			Answers	Notes	Total
16.	**a**		a. $\frac{21 \times 20}{42 + 72 + 2 + 2}$ ✓ b. $= 3.56$ ✓ «allow 3.55»		**2 max**
	b		a. the species in Site A are more evenly represented than site B ✓ b. site B has a large number of one species «but very few in the other 5» ✓ c. Simpson's reciprocal index is a measure of species evenness as well as species richness ✓		**2 max**
	c		a. conservation in the natural habitat / ecosystem ✓ *Advantages:* b. the species will have all the resources that it is adapted to ✓ c. the species will continue to evolve in their environment / can maintain genetic diversity ✓ d. the species have more space so a bigger breeding populations can be kept ✓ e. it is cheaper to keep an organism in its natural habitat ✓ f. established food webs/ species interactions can be maintained ✓ *Disadvantages:* g. it is difficult to control illegal exploitation «*eg* poaching»/harder to monitor populations ✓ h. the area may need restoring / may be required for other purposes ✓ i. alien species are difficult to control ✓ j. species close to extinction are harder to conserve ✓ k. management/protection may represent a significant cost ✓		**4 max**

Option D — Human physiology

Question			Answers	Notes	Total
17.	**a**	**i**	infants from mothers with low levels of vitamin D have an increased chance of developing seizures ✓	*Accept answers in the converse.*	**1**
		ii	lack of vitamin D in breast milk ***OR*** lack of vitamin D leads to lack of bone mineralization/calcium uptake ✓		**1**
	b		it can be synthesized by humans «in skin» ✓		**1**
	c		a. they cannot be synthesized by humans ✓ b. they must be present in the diet ✓		**1 max**

Question			Answers	Notes	Total
18.	**a**		a. activation of enzymes/protease/pepsinogen ✓ b. bactericidal action / kills pathogens ✓ c. hydrolysis / breakdown of food ✓		**2 max**
	b		a. secretin stimulates an increase in pancreatic secretions ✓ b. pancreatic secretions are released rapidly / within 10 minutes ✓ c. «$NaHCO_3$ in pancreatic secretions» neutralises stomach acid / HCl ✓ d. provides optimal conditions for digestion / enzymes «in the small intestine» ✓ e. by 40 minutes no more hydrochloric acid enters the small intestine ✓		**3 max**
	c		an infection by *Helicobacter pylori* / H. pylori ***OR*** overuse of NSAIDs /aspirin / ibuprofen ✓		**1**

Question			Answers	Notes	Total
19.			a. the liver can respond quickly to hormones made by the pancreas ✓ b. the pancreas secretes insulin / glucagon into the blood «traveling directly to the liver» ✓ c. «the hormones released by the pancreas» stimulate the liver to store / release glucose ✓ d. allows rapid regulation of blood glucose levels ✓		**2 max**

20.	**a**		QRS/ Q to S ✓		**1 max**
	b		one cardiac cycle ✓		**1**
	c		a. artificial pacemakers deliver electrical impulses «to heart muscle» ✓ b. they maintain a regular heart rate / supplement the natural pacemaker ✓ c. they sense missing heart beats and stimulate the heart ***OR*** correct malfunction of SAN / sinoatrial node ✓ d. they coordinate contractions of atria and ventricles / left and right atria ✓		**2 max**

Question			Answers	Notes	Total
21.			*Causes:* a. phenylketonuria is an inherited / genetic condition / caused by a mutation ✓ b. enzyme phenylalanine hydroxylase/PAH not present/deficient ✓ c. phenylalanine is an essential amino acid ✓ d. inability to convert phenylalanine into tyrosine / phenylalanine builds up in the body ✓ *Treatment:* e. requires diet rich in tyrosine «supplements» ✓ f. low in phenylalanine ✓ g. monitor blood phenylalanine levels ✓ h. monitor growth rates / intellectual development ✓		**4 max**