

# Markscheme

**May 2017**

**Biology**

**Standard level**

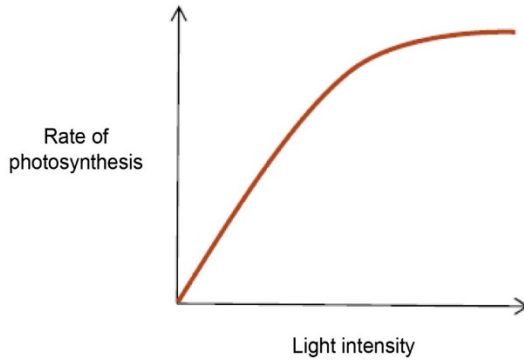
**Paper 3**

19 pages

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**Section A**

Question		Answers	Notes	Total
1.	a	a. standard deviation indicates the degree of variation in the data <b>OR</b> 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 <b>OR</b> trend lines may ignore outliers <b>OR</b> 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	<p><i>Compare:</i></p> <p>a. both the theoretical data and the experimental data show an increase in photosynthetic rate/oxygen production with increased light intensity  <b>OR</b>                      the rate of photosynthesis in the experimental data starts to level off at high light intensity as expected in theoretical data ✓</p> <p><i>Contrast:</i></p> <p>b. the experimental data do not reach a plateau whereas theoretical data do  <b>OR</b>                      data show photosynthesis is occurring at zero lux/light intensity whereas theoretical data would not ✓</p>	<p><i>Accept answers using an annotated graph.</i></p> <p><i>Accept answers as annotations of the graph or a new graph drawn:</i></p>  <p style="text-align: center;">Rate of photosynthesis</p> <p style="text-align: center;">Light intensity</p>	<b>2 max</b>
	b	<p>«the rate of photosynthesis» would be slower/fewer bubbles  <b>OR</b>                      rise to lower level/would plateau at a lower level/would be half the height ✓</p>		<b>1 max</b>
	c	<p>a. measure the absorption/decrease of CO<sub>2</sub> ✓                      b. measure the increase in biomass ✓                      c. measure rise in pH ✓</p>		<b>1 max</b>

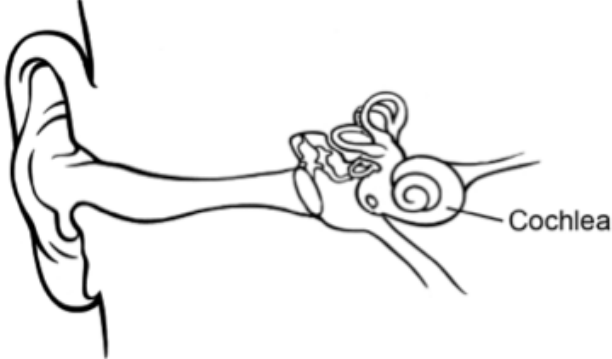
Question		Answers	Notes	Total
3.	a	25 – 22 = 3 breaths in 2 min = 1.5 breaths per min/0.025 breaths per sec ✓	<i>Units required.</i>	1 max
	b	a. exercise increases / results in higher rate of <u>respiration</u> ✓ b. exercise produces more carbon dioxide / consumes more oxygen ✓ c. increased tidal volume 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 <b>OR</b> 71–93µm ✓ b. speed range is 71–93 µm in 5 hours ✓ c. answer in the range 14–19 µm/h or µm h <sup>-1</sup> ✓		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	<p>a. positive correlation «between grey matter volume and white matter volume»  <b>OR</b>                      as white matter «volume» increases so does grey matter «volume» ✓</p> <p>b. As animal/brain size increase the volume of grey and white matter are «approaching» equal  <b>OR</b>                      as volume of grey matter increases, the ratio grey : white becomes closer to 1 ✓</p>		1 max
	b	<p><i>Structure:</i></p> <p>a. divided into left and right <u>hemisphere</u> ✓                      b. has extensive folding ✓                      c. has a large surface area : volume ratio ✓</p> <p><i>Function:</i></p> <p>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 ✓</p>		3 max
	c	<p>a. «brain» cells/neurons carry out large amount of respiration/metabolic activity ✓                      b. maintenance of resting potential requires energy/ATP  <b>OR</b>                      functioning of Na-K pumps requires energy/ATP  <b>OR</b>                      nerve impulse requires energy/ATP ✓</p>		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	<ul style="list-style-type: none"> <li>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 ✓</li> <li>b. each canal is filled with liquid/perilymph ✓</li> <li>c. each canal contains «sensory» hairs ✓</li> <li>d. when the head moves the liquid in the canal moves more slowly/lags behind ✓</li> <li>e. this causes the sensory hairs to bend ✓</li> <li>f. send impulses to the brain «via the vestibular nerve» ✓</li> </ul>		4 max
	c	<ul style="list-style-type: none"> <li>a. ganglion cells transfer information to the brain ✓</li> <li>b. they receive visual information from photoreceptors/rod and cone cells/bipolar cells ✓</li> <li>c. their long axon extends to the brain «in the optic nerve» ✓</li> <li>d. they detect/process movement/colour ✓</li> </ul>		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 <b>OR</b> 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 <b>OR</b> concentration of microorganisms in fermenter stable ✓ b. «balanced growth is» maintained by keeping nutrients/medium/pH/temperature/ oxygen level constant ✓ c. nutrients are added <b>AND</b> 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 <b>OR</b> 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 <sup>-3</sup> ✓		1
	b	<i>Marinobacter</i> ✓		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 <b>OR</b> pesticide resistance could develop in pests ✓ g. modifications can affect pollinating insects ✓ h. example of genetically modified crop ✓ <i>eg Amflora potato / Bt maize</i>		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 <i>Zooxanthellae</i> ✓ <b>OR</b> polyp is a source of ammonia/nitrogen for the <i>Zooxanthellae</i> ✓ b. <i>Zooxanthellae</i> provide oxygen to the polyp <b>OR</b> <i>Zooxanthellae</i> 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» <b>OR</b> become invasive <b>OR</b> have no «natural» predators ✓  b. outcompetes native species / reduces biodiversity <b>OR</b> carries disease <b>OR</b> preys on local species decreasing population size <b>OR</b> 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	<p>a. <math>\frac{21 \times 20}{42 + 72 + 2 + 2}</math> ✓</p> <p>b. = 3.56 ✓ «allow 3.55»</p>		2 max
	b	<p>a. the species in Site A are more evenly represented than site B ✓</p> <p>b. site B has a large number of one species «but very few in the other 5» ✓</p> <p>c. Simpson's reciprocal index is a measure of species evenness as well as species richness ✓</p>		2 max
	c	<p>a. conservation in the natural habitat / ecosystem ✓</p> <p><i>Advantages:</i></p> <p>b. the species will have all the resources that it is adapted to ✓</p> <p>c. the species will continue to evolve in their environment / can maintain genetic diversity ✓</p> <p>d. the species have more space so a bigger breeding populations can be kept ✓</p> <p>e. it is cheaper to keep an organism in its natural habitat ✓</p> <p>f. established food webs/ species interactions can be maintained ✓</p> <p><i>Disadvantages:</i></p> <p>g. it is difficult to control illegal exploitation «eg poaching»/harder to monitor populations ✓</p> <p>h. the area may need restoring / may be required for other purposes ✓</p> <p>i. alien species are difficult to control ✓</p> <p>j. species close to extinction are harder to conserve ✓</p> <p>k. management/protection may represent a significant cost ✓</p>		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 ✓	<i>Accept answers in the converse.</i>	1
		ii	lack of vitamin D in breast milk <b>OR</b> 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 <sub>3</sub> 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 <i>Helicobacter pylori</i> / H. pylori <b>OR</b> 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 <b>OR</b> 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.	<p><i>Causes:</i></p> <ul style="list-style-type: none"> <li>a. phenylketonuria is an inherited / genetic condition / caused by a mutation ✓</li> <li>b. enzyme phenylalanine hydroxylase/PAH not present/deficient ✓</li> <li>c. phenylalanine is an essential amino acid ✓</li> <li>d. inability to convert phenylalanine into tyrosine / phenylalanine builds up in the body ✓</li> </ul> <p><i>Treatment:</i></p> <ul style="list-style-type: none"> <li>e. requires diet rich in tyrosine «supplements» ✓</li> <li>f. low in phenylalanine ✓</li> <li>g. monitor blood phenylalanine levels ✓</li> <li>h. monitor growth rates / intellectual development ✓</li> </ul>		<b>4 max</b>