

# Markscheme

**May 2017**

**Biology**

**Standard level**

**Paper 2**

16 pages

This markscheme is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of the IB Global Centre, Cardiff.

**Section A**

Question		Answers	Notes	Total
1.	a	shells might dissolve/deteriorate / become smaller/thinner/weaker / OWTTE <b>OR</b> shell formation reduced / more difficult ✓		1
	b	a. positive correlation between shell thickness and shell size <b>OR</b> as shell thickness increases, shell size «also» increases ✓ b. (positive correlation) occurs at two different CO <sub>2</sub> concentrations / both high and normal concentrations ✓ c. trend for thickness is «slightly» lower with high CO <sub>2</sub> ✓		2 max
	c	«approximately» 0.2 mm <sup>2</sup> <b>OR</b> «approximately» 40 % «smaller» ✓	<i>unit required</i>	1
	d	i	a. significant factor: concentration of CO <sub>2</sub> in which oysters were raised ✓ b. insignificant factor: concentration of CO <sub>2</sub> at which oysters were presented to gastropods ✓	2

(continued...)

(Question 1d continued)

Question		Answers	Notes	Total
d	ii	<p>a. (because) shells are thinner/smaller when the oyster is raised in high CO<sub>2</sub>/lower pH  <b>OR</b>                      «because» lower pH/higher acidity prevents/reduces deposition of calcium carbonate ✓</p> <p>b. gastropods target smaller/thinner-shelled oysters more ✓</p> <p>c. gastropods can eat/drill thin-shelled/smaller oysters at a faster rate (and move onto another) ✓</p> <p>d. eating smaller oysters «from high CO<sub>2</sub> environments» means given population of gastropods require more oysters for same food intake ✓</p>		2 max
d	iii	<p>a. data shows that similar numbers are drilled regardless of conditions ✓</p> <p>b. since radulas are not affected by acidification  <b>OR</b>                      radulas not made of calcium carbonate so (remain) strong/successful at drilling ✓</p>		2 max

Question		Answers	Notes	Total
1.	e	<p>a. the data/trend lines indicate that a higher CO<sub>2</sub> concentration diminishes the shell thickness, making gastropod predation more successful  <b>OR</b>                      the bar graphs suggest that oysters raised in a higher CO<sub>2</sub> concentration are smaller, making gastropod predation more successful ✓</p> <p>b. CO<sub>2</sub> concentrations «during feeding» do not change the occurrence of drilling/predation «by gastropods» ✓</p> <p>c. «limitation» no information about how exaggerated the CO<sub>2</sub> concentrations were  <b>OR</b>                      «limitation» no information about numbers of gastropods used «in each setting» ✓</p>		2 max

Question		Answers	Notes	Total
2.	a	<p>a. spontaneous generation is life appearing from nothing / from non-living / cells only come from pre-existing cells/life ✓</p> <p>b. broth/culture medium (for bacteria) (used/placed) in flasks ✓</p> <p>c. broth boiled/sterilized «in some flasks» to kill microbes ✓</p> <p>d. no clouding/signs of bacterial growth/reproduction / microbes did not appear «in flasks of boiled broth» ✓</p> <p>e. after necks of flasks were snapped boiled broth became cloudy/growth of microbes ✓</p> <p>f. because microbes from the air contaminated the «boiled» broth ✓</p> <p>g. curved necks allowed indirect exposure to air but prevented entry of microbes ✓</p>	<p><i>Allow bacteria or organisms instead of microbes.</i></p>	3 max
	b	i	<p>movement / locomotion <b>OR</b> feeding/nutrition ✓</p>	1
		ii	<p>homeostasis <b>OR</b> maintain osmotic balance / expels «excess» water / maintains «cell» water content ✓</p>	1

Question	Answers	Notes	Total
<p><b>c</b></p>	<p><i>Advantages:</i></p> <ul style="list-style-type: none"> <li>a. «adult stem cells» can divide «endlessly» / can differentiate ✓</li> <li>b. «adult stem cells» can be used to repair/regenerate «tissues» ✓</li> <li>c. fewer ethical objections «than with embryonic stem cells» ✓</li> <li>d. adults can give «informed» consent for use of their stem cells ✓</li> <li>e. adult source is not killed / «source» would not have grown into new human / no death of embryos used to provide stem cells ✓</li> <li>f. no rejection problems / patient's own cells used ✓</li> <li>g. less chance of cancer/«malignant» tumor development «than from embryonic stem cells» ✓</li> <li>h. most tissues in adults contain some stem cells ✓</li> </ul> <p><i>Disadvantages:</i></p> <ul style="list-style-type: none"> <li>i. difficult to obtain/collect/find in adult body/very few available ✓</li> <li>j. some «adult» tissues contain few/no stem cells ✓</li> <li>k. «adult stem cells» differentiate into fewer cell types «than embryonic cells» / OWTTE ✓</li> </ul>		<p><b>3 max</b></p>

Question			Answers	Notes	Total
2.	d		<p>a. saprotrophs/decomposers feed on/break down dead «organic» matter ✓</p> <p>b. saprotrophs/decomposers release energy «heat» accelerating decomposition/warming soil ✓</p> <p>c. saprotrophs/decomposers recycle nutrients / make nutrients available (to producers) <b>OR</b> improves soil fertility / returns nutrients (minerals/nitrates/phosphates/carbon) to soil/water/environment ✓</p> <p>d. saprotrophs/decomposers detoxify waste ✓</p>		2 max

Question		Answers	Notes	Total
3.	a	X: short-/ultraviolet/UV/visible/EMR/electromagnetic radiation ✓ Y: long-/infrared/IR ✓		2
	b	a. greenhouse gases present (at Z) ✓ b. greenhouse gases «CO <sub>2</sub> , methane, nitrous oxide, water vapour» absorb long-wavelengths/infrared <b>OR</b> long wavelengths/infrared waves blocked from leaving the atmosphere ✓ c. (long-wavelengths/infrared absorbed and) reradiated/re-emitted (heat Earth) ✓		2 max
	c	a. rising ocean levels/more extreme weather «due to global warming» may destroy breeding/nesting sites <b>OR</b> rising sea level may put island underwater causing young birds/chicks to drown ✓ b. populations may not find/adapt to new colony sites ✓ c. warming seas may affect the food supply ✓		1 max

Question			Answers	Notes	Total
4.	a	i	Tuatara ✓		1
		ii	some «taxa» are extinct <b>OR</b> convergence «of body form» could have occurred (confusing interpretation of the data) ✓		1
	b	i	a. base sequences of a gene/DNA/mtDNA <b>OR</b> amino acid sequences of a protein ✓  b. species with the most similarities «in base sequence/amino acid sequence/genomes» have recently diverged/a common ancestor/are closely related <b>OR</b> members of a clade accumulate the fewest mutations on same base sequences / <i>vice versa</i> / <i>OWTTE</i> ✓		2 max
		ii	fossils / comparative anatomy / homologous structures / vestigial structures ✓		1
	c		a. «because» it allows easier identification of a species ✓ b. «because» it can help identify common ancestors/evolutionary paths/close relationships (showing degree of biodiversity) / <i>OWTTE</i> ✓ c. «because» it is universal/cross-cultural language that avoids problems of local names of organisms <b>OR</b> «because» it promotes international collaboration <b>OR</b> «because» it facilitates access to the history/background of the species / indexing for retrieval of relevant «taxonomic» information / <i>OWTTE</i> ✓ d. «because» it allows «biodiversity» research of larger taxa « <i>ie</i> examination of a family of large cats rather than one species» ✓		2 max

**Section B**

**Clarity of communication: [1]**

*The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.*

Question		Answers	Notes	Total
5.	a	a. translation converts a sequence of mRNA nucleotides/codons to a sequence of amino acids/polypeptide/protein ✓ b. «triplets of» nucleotides/bases on «activated» tRNAs pair with complementary «triplets of» nucleotides/bases on mRNA / <i>vice versa</i> ✓ c. base pairing occurs when adenine/A pairs with uracil/U and guanine/G pairs with cytosine/C ✓ d. specific amino acids are attached to specific of tRNA ✓ e. mRNA has codons <b>AND</b> tRNA has anticodons ✓		3 max
	b	a. PCR is process by which a small sample of DNA can be amplified/copied many times ✓ b. PCR involves repeated cycling through high and lower temperatures «to promote melting and annealing of DNA strands» ✓ c. «mixture» is heated to high temperatures to break «hydrogen» bonds between strands of DNA/to separate the double-stranded DNA ✓ d. Taq DNA polymerase can withstand high temperatures without denaturing ✓ e. primers bind to «targeted» DNA sequences at lower temp ✓ f. Taq DNA polymerase forms new «double-stranded» DNA by adding «complementary» bases/nucleotides ✓		4 max

Question		Answers	Notes	Total
5.	c	<p><i>Environment benefits:</i></p> <ul style="list-style-type: none"> <li>a. pest-resistant crops can be made ✓</li> <li>b. so less spraying of insecticides/pesticides ✓</li> <li>c. less fuel burned in management of crops ✓</li> <li>d. longer shelf-life for fruits and vegetables so less spoilage ✓</li> <li>e. greater quantity/shorter growing time/less land needed ✓</li> <li>f. increase variety of growing locations / can grow in threatened conditions ✓</li> </ul> <p><i>Environment risks:</i></p> <ul style="list-style-type: none"> <li>g. non-target organisms can be affected ✓</li> <li>h. genes transferred to crop plants to make them herbicide resistant could spread to wild plants making super-weeds ✓</li> <li>i. GMOs (encourage monoculture which) reduces biodiversity ✓</li> <li>j. GM crops encourage overuse of herbicides ✓</li> </ul> <p><i>Health benefits:</i></p> <ul style="list-style-type: none"> <li>k. nutritional value of food improved by increasing nutrient content ✓</li> <li>l. crops could be produced that lack toxins or allergens ✓</li> <li>m. crops could be produced to contain edible vaccines to provide natural disease resistance ✓</li> </ul>		<b>8 max</b>

(continued...)

(Question 5c continued)

Question		Answers	Notes	Total
5	c	<p><i>Health risks:</i></p> <p>n. proteins from transferred genes could be toxic or cause allergic reactions ✓</p> <p>o. antibiotic resistance genes used as markers during gene transfer could spread to «pathogenic» bacteria ✓</p> <p>p. transferred genes could cause unexpected/not anticipated problems</p> <p><b>OR</b></p> <p>health effects of exposure to GMO unclear ✓</p>		

Question		Answers	Notes	Total
6.	a	<p>a. contraction of muscle «layers»/peristalsis helps move food  <b>OR</b>                      circular muscle contraction prevents backward movement of food  <b>OR</b>                      longitudinal muscle contraction moves food along gut ✓</p> <p>b. peristalsis/muscle contractions mix food with intestinal enzymes ✓</p> <p>c. enzymes digest macromolecules into monomers ✓</p> <p>d. pancreatic enzymes/amylase/lipase/endopeptidase «chemically» digest food in «lumen of» small intestine ✓</p> <p>e. «pancreatic» amylase digests starch  <b>OR</b>                      lipases digest lipids/fats/triglycerides  <b>OR</b>                      endopeptidases/dipeptidases digest proteins/polypeptides ✓</p> <p>f. bile/bicarbonate secreted into the small intestine creates favorable pH for enzymes  <b>OR</b>                      bile emulsifies fat ✓</p> <p>g. some final digestion into monomers is associated with epithelial cells/epithelium «of small intestine» ✓</p> <p>h. mucosa layer/inside surface/lining of small intestine contains villi/finger-like projections ✓</p> <p>i. villi/microvilli increase surface area for better absorption ✓</p> <p>j. villi absorb products of digestion/monomers/mineral «ions»/vitamins ✓</p>	<p><i>Accept an example for mp c</i></p>	<p><b>8 max</b></p>

(continued...)

(Question 6a continued)

Question		Answers	Notes	Total
6	a	k. glucose/amino acids enter blood «capillaries» <b>OR</b> lipids enter lymph vessels/lacteals ✓ l. absorption involves active transport/diffusion/facilitated diffusion ✓ m. different nutrients are absorbed by different transport mechanisms ✓		
	b	a. fatty acids can be saturated or unsaturated ✓ b. unsaturated can be monounsaturated or polyunsaturated ✓ c. saturated fats have no double bonds/have maximum number of hydrogen atoms <b>OR</b> unsaturated fatty acids have «at least one» double C=C bond <b>OR</b> polyunsaturated fatty acids have more than one double bond / OWTTE ✓ d. cis-form has hydrogen atoms on same side of carbon double bond <b>OR</b> cis-form has bend at carbon double bond ✓ e. trans-form has hydrogens on opposite sides of carbon double bond <b>OR</b> trans-form makes a straight carbon chain ✓ f. length of hydrocarbon chain can vary <b>OR</b> position/number of carbon double bonds can vary ✓	Accept labeled diagrams that illustrate these marking points	4 max

Question	Answers	Notes	Total
c	a. leptin suppresses/inhibits appetite ✓ b. is secreted by adipose tissue/fat «storage» tissue ✓ c. level is controlled by amount of adipose tissue/«ongoing» food intake ✓ d. leptin targets cells in hypothalamus/appetite control centre in brain ✓ e. causes hypothalamus/control centre in brain to inhibit appetite ✓ f. if amount of adipose tissue increases, blood leptin concentration rises ✓		3 max

---