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Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

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Abbreviations used in the Mark Scheme:

- **;** separates marking points
- / alternatives
- **I** ignore
- **R** reject
- **A** accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording
- AVP any valid point
- ecf credit a correct statement / calculation that follows a previous wrong response
- **ora** or reverse argument
- ( ) the word / phrase in brackets is not required, but sets the context
- underline actual words given must be used by the candidate (or grammatical variants of them)

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Question	Answer	Mark	Guidance
1(a)(i)	(antibiotics) kill / damage / destroy / eliminate, pathogens / bacteria / fungi; Bacteria / fungi / pathogen can cause illness / disease / infections; (antibiotics),prevent growth / reproduction of, bacteria / fungi / pathogen; AVP ref. to how antibiotics kill bacteria; e.g. ref. to cell wall / production of proteins / inhibition metabolism;	**2**	**I** virus
1(a)(ii)	1 all (bacteria / pathogens) need to be killed / destroyed; 2 any remaining (bacteria) will reproduce / multiply; 3 illness / disease would continue; 4 ref to problem of antibiotic resistance; 5 antibiotics no longer effective; 6 new antibiotics have to be developed;	**3**	**A** prevents growth **I** virus **I** any reference to immunity
1(b)	fungus / mould;	**1**	**A** *Penicill<u>ium</u> (notatum)*
1(c)(i)	steam; autoclave / high temperature <u>and</u> high pressure; UV / gamma, radiation / X rays; bleach; AVP; e.g. sterilise nutrients / air supply / items, entering fermenter	**2**	**A** any reference to sterilizing substances that are <u>added</u> to the fermenter.

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Question	Answer	Mark	Guidance
1(c)(ii)	see table below	**5**	one mark for each correct row

letter from Fig. 1.1	name	function
P	water jacket	Maintain / control, temperature;
S	paddles / stirrers / mixers / vanes	mixes / stirs / maintains a suspension / stops solids settling / keeps nutrients moving / gives uniform mixture;
Q	nutrient inlet	supplies glucose / ammonia / amino acids / nutrients for growth / nutrients for respiration / energy;
R	Probe / sensor / data logger	monitors, temperature / pH;
U	air supply	supplies oxygen for respiration;
T	outlet	allows collection of the liquid containing penicillin after fermentation

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Question	Answer	Mark	Guidance
1(d)	penicillin is, separated / extracted / filtered / centrifuged / evaporated / purified / crystalised / precipitated / dried / impurities removed;	**1**	**A** downstream processing
		Total: 14	

Question	Answer	Mark	Guidance
2(a)	group / number, of organisms / AW, from one species; living in same, area / place / environment / time, together;	**2**	
2(b)	1 mode is / majority / most fish are, between 12.1 and 16.0 cm long; 2 range / body length, varies up to 24 cm / varies 0 to 24 cm; 3 very few fish are less than 4 cm; 4 no fish longer than 24 cm; 5 normal distribution / bell-shaped curve / similar number of fish longer and shorter than the mean; AW 6 Data quote of range with units and thousands of fish; 7 AVP ref to actual range may be shorter than 0–24 cm;	**3**	**A** mean
2(c)(i)	4 + 8 + 10 + 6 + 4 + 2 (thousand); = 34 thousand (fish);	**2**	

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Question	Answer	Mark	Guidance
2(c)(ii)	quotas / licences / permits / limits; fines for overfishing / taxes; only adult fish caught / young fish returned; (laws to) restrict net size; no fishing, zones / seasons; encourage, fish farms / nurseries / hatcheries / captive breeding; international fishing agreements / treaties; reduce, pollution / silting (of rivers) / avoidance of environmental factors detrimental to fish; education; restocking / add more, fish than removed / AW;	**4**	**A** 'regulation of fishing' **A** 'eutrophication' if linked to the death of fish.
2(d)(i)	genetics / inherited (genes); environmental factors ; any two named environmental factors; (natural) selection;	**2**	examples of named environmental factors: nutrition / pollution / temperature / predation / disease / fishing
2(d)(ii)	bar chart;	**1**	
		Total: 14	

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Question	Answer	Mark	Guidance
3(a)(i)	amino acids;	**1**	
3(a)(ii)	stomach;	**1**	
3(b)(i)	ref. to surface area; affecting enzyme / enzyme activity; allows comparison; make experiment valid; controlled variable;	**2**	
3(b)(ii)	water-bath / in a beaker of water / incubator; insulate test-tube; allow solutions to equilibrate to temperature (before experiment); use a thermometer to check the temperature (is constant);	**2**	
3(c)	(pH) 8 ± 1;	**1**	

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Question	Answer	Mark	Guidance
3(d)	enzymes are protein; enzymes can be reused / are unchanged in the reaction; enzymes are specific; (enzymes are)catalysts / speeds up reaction; lowers the energy needed for the reaction; successful collisions / enzyme-substrate complex / ESC; active site; (enzyme and substrate) fit together; complementary shape; (digestive enzymes perform) chemical digestion / hydrolysis / catabolic reactions; break down, large / insoluble, molecules into, small / soluble, molecules; amylase converts starch to sugars / maltose; lipase converts lipid / fats, to fatty acids and glycerol; maltase converts maltose to simple sugars / glucose; ref to pH; ref to denaturation;	**6**	
		Total: 13	

Question	Answer	Mark	Guidance
4(a)(i)	pancreas;	**1**	
4(a)(ii)	recognize a specific, pathogen / antigen; lock on antigens / antibody-antigen complex; agglutination / clumping; destruction by, phagocytes / white blood cells / lymphocytes; AVP; e.g. neutralise / inhibit toxins;	**2**	**A** bacteria / fungus / virus / parasite

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Question	Answer	Mark	Guidance
4(b)(i)	lack of sun(light) / dark skin AW; lack of fish (oils) / egg (yolk) / liver; unbalanced diet; kidney / liver / digestive, disease;	**1**	
4(b)(ii)	muscle cramps; soft / bent, bones / rickets; stunted growth; prone to infections; fatigue; reduced ability to absorb calcium (ions);	**2**	
4(c)	lack of vitamin D leads to more cases of type 1 diabetes in mice / ora; there is no difference in cases / same number of cases (wrt normal mice) until after 50 days; at 100 days there are more cases (in vitamin D mice); (vitamin D mice) levels off before normal mice / levels off after 150 days; comparative data use ;e.g. 20% more cases at day 200 **or** at 250 days normal mice is 46% , deficient mice is 65%;	**3**	

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Question	Answer	Mark	Guidance
4(d)	frequent urination; thirst / AW; hunger; fatigue; weight loss; itchy skin; wounds heal slowly / more susceptible to infection; blurred vision / AW; vomiting; glucose in urine; high blood, glucose/sugar;	**4**	**A** nausea **A** hyperglycaemia.
4(e)	insulin; by injection / insulin pump; regular blood sugar tests; regular meals; AVP; exercise / restrict carbohydrate content of diet	**3**	
		Total: 16	

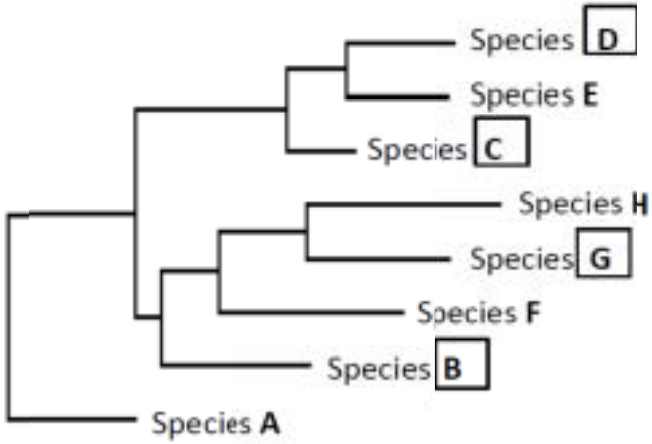
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Question	Answer	Mark	Guidance
5(a)	root hair (cells); long and thin; thin cell wall; large surface area; for absorption; (water by) osmosis ; (ion / nutrients by) active transport; against the concentration gradient; protein (pumps) in membrane; require energy / ATP; ref. to many mitochondria;	**5**	
5(b)(i)	(positive) gravitropism;	**1**	**A** geotropism **R** negative gravitropism
5(b)(ii)	auxin;	**1**	

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Question	Answer	Mark	Guidance
5(b)(iii)	in space / AW; because no gravity; in a clinostat / AW; gravity constantly changing / AW; remove root tip; no auxin source; lateral roots; searching for, water / nutrients / hydrotropic; light source below, plant / root; roots grow away from light / negatively phototropic; anaerobic mud / mangrove swamp / pneumatophores; need oxygen (for respiration); ORA roots attaching plant to solid objects for support eg walls / other host plants; material is too hard for root to grow through (takes line of least resistance); AVP; e.g. epiphytes / parasitic plants	**2**	paired marking points
		Total: 9	

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Question	Answer	Mark	Guidance
6(a)(i)	T, C, A, G;	**2**	all correct = 2 marks 2 or 3 correct = 1 mark
6(a)(ii)	double helix;	**1**	
6(b)	*species C with species D*: 4; *species G with species H*: 3;	**2**	
6(c)	species **A** and species **D**	**1**	
6(d)		**3**	4 correct = 3 marks 2 or 3 correct = 2 marks 1 correct = 1 marks
6(e)(i)	genetic engineering;	**1**	

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Question	Answer	Mark	Guidance
6(e)(ii)	drought / salt / pollution / metal / frost / stress / cold, resistant; increased, yield / productivity; extend range where crops can be grown; herbicide resistance; increased yield / productivity; pesticide resistance; increased yield / productivity; crop plants produce own insecticides; less insecticide used; increased yield; vitamin / nutrient, enrichment / β carotene (Golden rice); increased nutritional value; pathogen resistant / Bt; increased productivity / less pesticide use; antigens / vaccines / pharmaceuticals; e.g. insulin cheap production of medicines; flavour / texture / ripening; Improved customer satisfaction / shelf life;	**4**	linked marking points 2+2 **R** bacteria (as not a crop plant) **A** 'more profit' once.
		Total: 14	

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