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Cambridge International General Certificate of Secondary Education

BIOLOGY

0610/42

Paper 4 Theory (Extended)

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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This document consists of **14** printed pages.

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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	Additional Guidance
1(a)	<p><i>protein to max 1</i> for growth / making new cells / repair / replacement (of tissues) / making (named) tissue; provides amino acids (for making protein);</p> <p><i>lactose</i> (provides) energy / (glucose for) respiration;</p> <p><i>calcium to max 1</i> (strengthening) bones / teeth; needed for vitamin D to function; blood clotting; for muscle contraction; for nerve impulse conduction;</p>	3	<p>R 'produces energy'</p> <p>I ref. to deficiency diseases – not a role</p>

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Question	Answer	Mark	Additional Guidance
1(b)	<p>1 enzymes are, biological / protein, catalysts / speed up reactions;</p> <p>2 ref to <u>specificity</u>;</p> <p>3 <u>active site</u>;</p> <p>4 substrate / protein, fits into / AW, enzyme / active site;</p> <p>5 ref to, complementary shape of molecules;</p> <p>6 enzyme-substrate complex / ESC;</p> <p>7 enzymes, lower energy needed for reaction;</p> <p>8 enzymes are, unchanged (at end of reaction) / reused;</p> <p>9 (enzymes) carry out, chemical digestion / hydrolysis / catabolic reactions;</p> <p>10 break down, large / insoluble, molecules into, small(er) / soluble, molecules;</p> <p>11 protein broken down to, polypeptides / peptides / amino acids;</p> <p>12 pepsin, active in stomach;</p> <p>13 trypsin, active in, small intestine / duodenum / ileum;</p> <p><i>ref. to conditions in alimentary canal</i></p> <p>14 low pH / pH 1–3 / (hydrochloric) acid, in stomach;</p> <p>15 high pH / alkaline / neutral / non-acidic / pH 7–9, in, small intestine / duodenum / ileum;</p> <p>16 ref. to denaturation;</p> <p>17 temperature is 37 °C;</p> <p>18 ref. to successful collisions;</p>	6	<p>A lower activation energy</p> <p>A gastric juice I rennin</p> <p>A ± 1 °C</p>

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Question	Answer	Mark	Additional Guidance
1(c)(i)	no enzyme to, digest / break down, lactose; lactose (molecule) is (too) large / complex; cannot pass through, (cell) <u>membrane(s)</u> ; no carrier protein for it ;	2	A no <u>lactase</u> / not enough enzyme A not broken down to small(er) molecules
1(c)(ii)	<p>1 dehydration / loss of water;</p> <p>2 loss of, (named) salt(s) / ions / minerals / vitamins;</p> <p>3 decrease in, volume of blood / blood pressure;</p> <p>4 increase in blood concentration / decrease in water potential;</p> <p>5 any effect on cells ;</p> <p>6 AVP; e.g. less efficient reactions / slower metabolism / kidney failure / ref to effect on brain cells / coma / death</p>	3	<p>I fatigue / weakness / weight loss / headache / deficiency disease / dizziness / AW</p> <p>A loss / poor absorption, of nutrients / malnutrition I 'food'</p> <p>A volume of plasma</p> <p>e.g. cell shrinkage / loss of water from cells by osmosis</p> <p>mp6 A <i>idea that</i> less water as a <u>solvent</u> R no solvent</p>
1(d)(i)	control; for comparison (with different treatments) / to see if there is any difference between effects of treated milk and untreated milk;	2	I 'fair test'
1(d)(ii)	(lactase) digests / breaks down, lactose; molecules, are small enough to be absorbed / do not pass straight through, small intestine / AW; reduces chance of diarrhoea / means lactose intolerant people can consume milk / AW;	2	

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Question	Answer	Mark	Additional Guidance
1(d)(iii)	(concentration / amount of) hydrogen is the lowest / least; ora concentration / amount, of hydrogen, shows small, fluctuations / changes / AW; (concentration / amount) not higher than 15 (± 1) ppm / between 9 – 15 (± 1) ppm; comparative data quote between D and A, B or C;	3	<i>units – h and ppm must be used at least once if no units then don't award MP3 and MP4 mp1 must be comparative</i>
		Total: 21	

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Question	Answer	Mark	Additional Guidance												
2(a)	<table border="1"> <tr> <td>A</td><td>A</td><td>A</td><td>G</td><td>G</td><td>C</td> </tr> <tr> <td>T</td><td>T</td><td>T</td><td>C</td><td>C</td><td>G</td> </tr> </table> <p>TAA; CGG;</p>	A	A	A	G	G	C	T	T	T	C	C	G	2	
A	A	A	G	G	C										
T	T	T	C	C	G										
2(b)	<ol style="list-style-type: none"> 1 mRNA is a copy of the, gene / DNA / base sequence; 2 gene / DNA, remains in the nucleus; 3 takes instructions to <u>cytoplasm</u>; 4 mRNA, passes through / attaches to / 'read by', ribosome; 5 base sequence determines sequence of amino acids (in proteins); 	3	<p>A transcription</p> <p>I genetic material / genetic code / genetic sequence</p> <p>A translation</p>												
2(c)(i)	A and B / <i>Aspergillus flavus</i> and <i>A. oryzae</i> ;	1													
2(c)(ii)	<p>long(est) distance from the branching point;</p> <p>branched / split, the longest time ago;</p> <p>no other species on its branch / AW;</p> <p>only one ancestor (in the diagram);</p> <p>many differences in base sequence (from the others);</p>	2	A branched only once / only one branch												

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Question	Answer	Mark	Additional Guidance
2(d)	1 study, similarities / differences in, morphology / appearance / phenotype / features / characteristics / shape; 2 any example; e.g. presence or absence of wings 3 study, similarities / differences in, anatomy / internal structure of organisms; 4 any example; e.g. skeleton / organs / bones / teeth 5 AVP; study, similarities / differences in, any other type of evidence 6 AVP; any example of the type of evidence given	2	A compare morphologies I size A biochemistry, e.g. amino acid sequences in proteins, behaviour, e.g. courtship displays, ecology, e.g. niches / habitats, geographical distribution, e.g. New World monkeys
		Total: 10	

Question	Answer	Mark	Additional Guidance
3(a)	cortex; medulla; ureter;	3	
3(b)(i)	<u>renal artery</u> ;	1	
3(b)(ii)	<u>renal vein</u> ;	1	

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Question	Answer	Mark	Additional Guidance
3(c)	1 filters, blood / plasma; 2 (filtration occurs) in the glomerulus; 3 reabsorption of (named) useful substances; <i>removes/excretes/loses</i> 4 (named) nitrogenous waste; e.g. urea 5 excess, (named) salt(s) / mineral(s) / ion(s); 6 (named) hormones; 7 excess water;	4	
3(d)(i)	chemical / substance, secreted / produced / released, by a (endocrine) gland; into the blood / carried in the blood; controls / regulates / affects, (activity of) target organ(s);	3	R impulse(s)
3(d)(ii)	testis / testes;	1	
3(d)(iii)	<u>anabolic</u> (steroid); promotes protein synthesis; promotes, growth / strength, of muscle (tissue); makes people more, aggressive / competitive / AW; AVP; e.g. ref to bone density / bone mass / changes body composition	2	

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Question	Answer	Mark	Additional Guidance
3(e)	12.5 (ng cm ⁻³);;	2	<p>working either after 7 days it has fallen from 50 to 25 ng cm⁻³, after another 7 days it has fallen to 12.5 ng cm⁻³ or decreases by $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$, $\frac{1}{4} \times 50 = 12.5$ (ng cm⁻³) or $\frac{50}{2 \times 2} = 12.5$(ng cm⁻³)</p>
		Total: 17	

Question	Answer	Mark	Additional Guidance
4(a)	guard cells;	1	
4(b)	Brazilian waterweed / <i>E. densa</i> , exchanges (dissolved) (named) gas(es) with the <u>water</u> ; Water lily / <i>N. lutea</i> , exchanges (named) gas(es) with the <u>air</u> ;	2	
4(c)(i)	(group of) similar cells that, work together / carry out a shared (named) function;	1	
4(c)(ii)	xylem; phloem; epidermis; spongy mesophyll;	2	<p>R cuticle</p> <p>A aerenchyma</p>

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Question	Answer	Mark	Additional Guidance
4(d)	air spaces in the leaf for, buoyancy / AW; <i>max 1 for any of the following</i> leaves are closer to the light / 'gets more light' to absorb more light; for more photosynthesis; to exchange gases with the, <u>air / atmosphere</u> ;	2	1 + 1 A floating l being on the surface
4(e)	xerophyte(s);	1	
4(f)	inherited feature ; feature helps an organism survive <u>and</u> reproduce; in its, habitat / environment; (a named) adaptive feature increases organism's fitness;	2	
		Total: 11	

Question	Answer	Mark	Additional Guidance
5(a)	4.92 / 4.93;	1	
5(b)	(platelets) promote / involved in, clotting; fibrinogen changes to fibrin; soluble to insoluble; fibrin forms a mesh; traps blood cells; prevents loss of blood / stops bleeding; prevents entry of pathogens; AVP;	4	I ref. to scab formation A net A RBCs / WBCs / platelets
5(c)	secrete / produce / release, antibodies;	1	

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Question	Answer	Mark	Additional Guidance
5(d)	active immunity; ref to <u>memory</u> , <u>cells</u> / <u>lymphocytes</u> ; memory cells produced in first infection;	2	
5(e)(i)	decrease, steep/in short period of time/in two months/AW, to 500 <u>cells per mm³</u> ; increase to 650–670 cells per mm ³ ; gradual/AW, decrease until 10 years; to 40 cells per mm ³ at 10 years;	3	A by 500–700 cells per mm ³
5(e)(ii)	no/reduced, (active) immune response; reduced production of antibodies; vulnerable to, infections/(opportunistic) disease/TB/cancers/pneumonia / AW; AIDS; weight loss/death/reduce life span;	3	
		Total: 14	

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Question	Answer	Mark	Additional Guidance
6(a)	<ol style="list-style-type: none"> 1 ringing allows <u>monitoring</u> of, species / population; 2 to check on (population) numbers; 3 find out about life span; 4 to find out where they go (during migration)/to track their position; 5 find out how far birds travel; 6 to find out when they migrate; 7 allows checks on, health of birds / survival rates; 8 breeding success; 9 do not harm the birds / do not make them obvious to predators; 10 AVP; e.g. information from ringing is used in conservation 	2	I 'to track them' unqualified

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Question	Answer	Mark	Additional Guidance
6(b)	<ol style="list-style-type: none"> 1. to prevent <u>extinction</u>; 2. maintain biodiversity; 3. provide feeding grounds for animals / ref. to disruption of <u>food, chains / web</u>; 4. provide, breeding grounds / places for breeding; 5. provide, habitats / shelter; 6. vulnerable to the effects of, development / drainage / AW; 7. ref to flooding / natural disasters; 8. ref to nitrogen cycle; 9. ref to maintenance of water cycle; 10. ref to carbon cycle; e.g. greenhouse gas / carbon storage / carbon sink 11. waste disposal; 12. provide, resources / food / fuel / drugs / raw materials; 13. idea of areas for, recreation / (eco)tourism / education; 14. ethical reasons / aesthetic reasons / AW; 15. AVP; e.g. soil erosion 	5	I food chain (singular)
		Total: 7	