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BIOLOGY **0610/42**

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

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

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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) membrane(s); no carrier protein for it ;	2	**A** no lactase / not enough enzyme **A** not broken down to small(er) molecules
1(c)(ii)	1 dehydration / loss of water; 2 loss of, (named) salt(s) / ions / minerals / vitamins; 3 decrease in, volume of blood / blood pressure; 4 increase in blood concentration / decrease in water potential; 5 any effect on cells **;** 6 AVP; e.g. less efficient reactions / slower metabolism / kidney failure / ref to effect on brain cells / coma / death	3	**I** fatigue / weakness / weight loss / headache / deficiency disease / dizziness / AW **A** loss / poor absorption, of nutrients / malnutrition **I** 'food' **A** volume of plasma e.g. cell shrinkage / loss of water from cells by osmosis mp6 **A** *idea that* less water as a solvent **R** no solvent
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**	*units – h and ppm must be used at least once* *if no units then don't award MP3 and MP4* mp1 must be comparative
		Total: 21	

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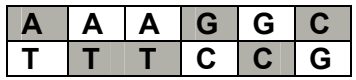
Question	Answer	Mark	Additional Guidance
2(a)	 A A A G G C T T T C C G TAA; CGG;	2	
2(b)	1 mRNA is a copy of the, gene / DNA / base sequence; 2 gene / DNA, remains in the nucleus; 3 takes instructions to cytoplasm; 4 mRNA, passes through / attaches to / 'read by', ribosome; 5 base sequence determines sequence of amino acids (in proteins);	3	**A** transcription **I** genetic material / genetic code / genetic sequence **A** translation
2(c)(i)	**A** and **B** / *Aspergillus flavus* and *A. oryzae*;	1	
2(c)(ii)	long(est) distance from the branching point; branched / split, the longest time ago; no other species on its branch / AW; only one ancestor (in the diagram); many differences in base sequence (from the others);	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)	renal artery;	**1**	
3(b)(ii)	renal vein;	**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; *removes / excretes / loses* 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)	anabolic (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	*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 ½ × ½ = ¼, ¼ × 50 = 12.5 (ng cm^{-3}) *or* $\frac{50}{2 \times 2} = 12.5$(ng cm^{-3})
		Total: 17	

Question	Answer	Mark	Additional Guidance
4(a)	guard cells;	1	
4(b)	Brazilian waterweed / *E. densa*, exchanges (dissolved) (named) gas(es) with the <u>water</u>; Water lily / *N. lutea*, 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	**R** cuticle **A** aerenchyma

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Question	Answer	Mark	Additional Guidance
4(d)	air spaces in the leaf for, buoyancy / AW; *max 1 for any of the following* leaves are closer to the light / 'gets more light' to absorb more light; for more photosynthesis; to exchange gases with the, air / atmosphere;	**2**	**1 + 1** **A** floating **I** being on the surface
4(e)	xerophyte(s);	**1**	
4(f)	inherited feature ; feature helps an organism survive and 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 memory, cells / lymphocytes; memory cells produced in first infection;	**2**	
5(e)(i)	decrease, steep / in short period of time / in two months / AW, to 500 cells per mm^3**;** 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)	1 ringing allows monitoring 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)	1. to prevent extinction; 2. maintain biodiversity; 3. provide feeding grounds for animals / ref. to disruption of food, chains / web; 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	

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