Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/42**

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

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	42

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)

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

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

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**	

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	

Question	Answer	Mark	Additional Guidance
2(a)	<table><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> 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 <u>cytoplasm</u>; 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

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**	

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**	

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

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**	

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	

Question	Answer	Mark	Additional Guidance
6(a)	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

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	