



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY

0610/42

Paper 4 Theory (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 80

Published

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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **R** reject
- **ignore** mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **AW** alternative wording (accept other ways of expressing the same idea)
- underline words underlined (or grammatical variants of them) must be present
- **max** indicates the maximum number of marks that can be awarded
- **mark independently** the second mark may be given even if the first mark is wrong
- **ecf** credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- **ora** or reverse argument
- **AVP** any valid point

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Question	Answer	Marks	Guidance Notes																		
1 (a)	septum ;	[1]																			
(b) (i)	blood flows through heart twice, for one (complete) circuit / to get back to the same point ; one loop to lungs, and one loop to rest of the body ;	[max 1]																			
(ii)	high(er), blood pressure / flow rate (than single circulation) ; allows different blood pressure in each loop ; prevent mixing of oxygenated and deoxygenated blood ; allows animals to have high metabolic rates ; allows animals to be, large / tall ;	[max 1]	A more efficient / faster, delivery / removal, of a named blood component e.g. oxygen I maintain blood pressure																		
(c)	<table border="1"> <thead> <tr> <th>description</th> <th>name of structure</th> <th>letter on Fig 1.1</th> </tr> </thead> <tbody> <tr> <td>heart chamber with the thickest muscular wall</td> <td>left ventricle</td> <td>C ;</td> </tr> <tr> <td>the blood vessel carrying oxygenated blood to the heart</td> <td>pulmonary vein</td> <td>K ;</td> </tr> <tr> <td>the blood vessel that carries oxygenated blood away from the heart</td> <td>aorta</td> <td>P ;</td> </tr> <tr> <td>a blood vessel that carries blood away from the kidneys</td> <td>renal vein</td> <td>M ;</td> </tr> <tr> <td>the blood vessel with the largest lumen</td> <td>vena cava</td> <td>N</td> </tr> </tbody> </table>	description	name of structure	letter on Fig 1.1	heart chamber with the thickest muscular wall	left ventricle	C ;	the blood vessel carrying oxygenated blood to the heart	pulmonary vein	K ;	the blood vessel that carries oxygenated blood away from the heart	aorta	P ;	a blood vessel that carries blood away from the kidneys	renal vein	M ;	the blood vessel with the largest lumen	vena cava	N	[4]	one mark for each correct row
description	name of structure	letter on Fig 1.1																			
heart chamber with the thickest muscular wall	left ventricle	C ;																			
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Question	Answer	Marks	Guidance Notes
(d)	(blood) enters heart at <u>right</u> atrium / A (from the vena cava / N) ; then atrium contracts ; correct ref to atrioventricular valve ; then to <u>right</u> ventricle / D ; then ventricle contracts ; correct ref to semi-lunar valves ; then pulmonary artery / J , <u>to lungs</u> / O ;	[max 4]	R contradictions between letters and structures I valves unqualified
(e) (i)	(more) exercise / AW ; stop / less, smoking ; reduced stress ;	[max 1]	I ref to diet
(ii)	stent ; small mesh tube inserted in artery ; opens / supports, (narrow / weak) artery ; (balloon) angioplasty / dilatation ; (tube / catheter with) balloon inserted into artery ; inflate balloon to widen artery ; by-pass ; (another / shunt) blood vessel joined / grafted / replace, artery ;	[max 2]	max 1 if no named procedure. I open heart surgery / heart transplants
		[Total: 14]	

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Question	Answer	Marks	Guidance Notes
2 (a) (i)	single celled / unicellular ; no (true) nucleus / no nuclear membrane ; loop of DNA ; no, (membrane-bound) organelles ; e.g. no mitochondria / chloroplasts (peptidoglycan / murein) cell wall ; reproduce by binary fission ; small(er) / 70S, ribosomes ; plasmids ;	[max 2]	I DNA strand unqualified A naked DNA I flagella, capsule, pili, cilia R cellulose cell wall
(ii)	swim / movement / AW ;	[1]	
(b)	harmless / attenuated / dead / AW, form of, (named) pathogen / antigen used ; (vaccine) injected / swallowed ; ref to <u>specific / unique / AW</u> , antigen ; <u>lymphocytes make antibodies</u> ; ref to memory cells ; ref to <u>active immunity</u> ; <u>rapid</u> , immune response / AW, if exposure to <u>same</u> pathogen ; herd immunity ; AVP ; e.g. detail of active immunity / smallpox became extinct	[max 4]	A long term immunity
(c) (i)	12 – 0.4 ; 11.6, <u>au / arbitrary units</u> ;	[2]	
(ii)	large / rapid / immediate increases ; peaks at, <u>50 s / 12 AU</u> ; then decrease to, around 5 – 4.6 AU / by 125 – 150 s ; fluctuates / stays (fairly) constant, between 125 – 150 s and 250 s / 4.4 and 4.8 ± 0.2 AU ;	[max 3]	I comparisons to 'without toxins' on graph A increases and decreases from 50 s

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Question	Answer	Marks	Guidance Notes
(iii)	active transport; (through) <u>protein</u> (molecules/gates/pumps/AW) ; (protein) in cell membrane ; using, energy/ATP (from respiration) ; (movement) against a concentration gradient/AW ;	[max 3]	
(d) (i)	(small) intestine ;	[1]	A large intestine / duodenum / jejunum / ileum / rectum / colon
(ii)	<u>oral rehydration</u> (therapy/salts/treatment/solution) ; drink mixture of, sugar/nutrients <u>and</u> , salt/ions ; <u>replace lost</u> , water/fluids ; water must be, uncontaminated / boiled / sterilised / clean / AW ; antibiotics ;	[2]	A receive intravenous fluids I drink more water
		[Total: 18]	

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Question	Answer	Marks	Guidance Notes
3 (a) (i)	1 cross/breed, (parent) plants with <u>desired</u> feature ; 2 (grow seeds and) chose offspring for (desired) feature(s) ; 3 cross (offspring) plants showing features with, original variety/self/ each other ; 4 keep/many generations of, crossing and selecting ; 5 any detail ; e.g. bagging flowers/transfer of pollen (with paintbrush)/ detail of seed collection	[max 3]	
(ii)	1 two parents/gametes, are required ; 2 variation in offspring/offspring might not all be red ; 3 time consuming ; 4 AVP ; e.g. harvesting seeds/finding pollinators, can be difficult/limited number of seeds/wasteful in context of unused pollen	[max 2]	1 cost / energy
(b)	1 <u>reduction/nuclear, division</u> ; 2 chromosome <u>number</u> is halved ; 3 (diploid to) haploid ; 4 results in <u>genetically</u> different, cells/gametes /AW ;	[max 2]	
(c) (i)	$F^A F^N$;	[1]	
(ii)	pink (flowers) ;	[1]	ecf from (c)(i)
(iii)	<i>gametes:</i> F^A , F^N , F^A , F^A ; <i>offspring genotype:</i> $F^A F^A$, $F^A F^N$; <i>offspring phenotype:</i> red, pink ; <i>proportion of pure breeding carnation plants:</i> 50% / 1:1 / 0.5 / half ;	[4]	
		[Total:13]	

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Question	Answer	Marks	Guidance Notes
4 (a)	movement/diffusion, of water (molecules) ; from high water <u>potential</u> to low water <u>potential</u> / down water <u>potential</u> gradient ; across a partially permeable membrane ;	[3]	
(b) (i)	<u>1.0</u> (mol dm ⁻³ sodium chloride solution) ;	[1]	
(ii)	(to remove) excess/surface/AW, water/AW, on potato sticks ; to measure the mass of the potato (stick) only ;	[max 1]	I inaccurate unqualified R dry mass
(c)	cells/potato sticks, have lost water (by osmosis) ; from high water <u>potential</u> to low water <u>potential</u> / down water <u>potential</u> gradient ; (cells/tissue/potato) were, plasmolysed/flaccid ; loss of <u>turgor</u> (pressure) ; not enough pressure of water pushing on cell walls ;	[max 3]	I water concentration I incipient (plasmolysis) A reduced turgidity / description
(d)	protein denatured (when cooked) ; cell membrane, damaged/destroyed (when cooked) ; no <u>osmosis</u> will occur ;	[max 2]	R killed proteins I killed/denatured, cells I damaged <u>cell wall</u>
		[Total: 10]	

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Question	Answer	Marks	Guidance Notes
5 (a) (i)	testes ;	[1]	A adrenal gland / ovaries
(ii)	increases, muscle mass / strength / power ; improved recovery of muscle damage / promotes protein synthesis ; increase, competitive drive / aggression / AW ; increases bone, density / mass ;	[max 1]	
(iii)	maintains, uterine lining / endometrium ; inhibits, FSH / LH (release) ;	[max 1]	R uterus wall. I thickens lining
(iv)	oestrogen ;	[1]	
(b)	<i>A is most polluted because:</i> greater (overall) concentration of hormones ; all hormones at higher concentration except oestrogen ; comparative data quote with units ; (but) similar levels of oestrogen / (natural) progesterone (to B) ; <i>B is most polluted because</i> more oestrogen (than A) ; more <u>types</u> of hormones ;	[max 3]	
(c) (i)	<i>Lake B</i> oestrogen decreases (slightly) ; progesterone / testosterone, increases (slightly) ; <i>Lake A or Lake B</i> <u>no / little</u> , effect on oestrogen / progesterone / testosterone <u>without</u> ozone ; <i>Lake A</i> chlorine <u>with ozone</u> caused, decrease in testosterone / synthetic progesterone / increase in natural progesterone ;	[max 2]	A mp 1, 2, 4 as data quotes R little effect on testosterone <u>with ozone</u>
(ii)	make the water safe, to return to the environment / for human use ; kill, pathogens / (harmful) microorganisms / bacteria ;	[1]	I germs A disinfectant / sterilisation

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Question	Answer	Marks	Guidance Notes
(d)	<p><u>eutrophication</u> ;</p> <p>(aquatic) plants, die/cannot photosynthesise (due to blocked light) algae/ (aquatic) plants/organic material, decayed by bacteria ;</p> <p>(aerobic) respiration (by bacteria/decomposers) ; decreased pH / increased acidity (due to low oxygen) ;</p> <p>oxygen concentration decreases (due to bacteria /decomposers) ; (aquatic) animals/fish, migrate/die, due to lack of oxygen ;</p> <p>disrupted / altered, (aquatic) food chains/habitats ; more, flies /mosquitoes ; (more) waterborne (named) disease ; e.g. cholera/typhoid smelly/visual pollution ; toxicity / mutations caused, by heavy metals/sewage ;</p> <p>(female contraceptive) hormones cause feminisation of (aquatic) organisms ; (female contraceptive) hormones cause reduced sperm count (in aquatic animals) ;</p>	[max 6]	<p>I marine and other non-lake ecosystems I unqualified death/ extinction throughout</p> <p>A growth of, floating aquatic plants / algae / algal bloom A nutrients in sewage as organic material A microorganisms / decomposers for bacteria</p> <p>I <u>all</u> oxygen used up</p> <p>A diseases / pathogen in humans or aquatic organisms</p> <p>A biomagnification / bioaccumulation / death of (aquatic) organisms by, heavy metals / toxins / poisons, in sewage</p> <p>A hormone may cause gender change in fish</p>
		[Total : 16]	

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Question	Answer	Marks	Guidance Notes
6 (a)	homeostasis / negative feedback ;	[1]	
(b) (i)	insulin ;	[1]	
(ii)	liver / muscle / pancreas ;	[1]	
(iii)	glycogen ;	[1]	
(c)	<p><i>Symptoms:</i> fatigue / AW ; thirst / AW ; increased urination / glucose in urine / fruity breath / ketosis / flushed face ; weight loss / nausea / vomiting / abdominal pain / hunger ; blurred vision / glaucoma ; behavioural changes / confusion / faint / unconscious / coma(tose) / dizzy / rapid breathing / deep breathing ; slow (wound) healing / poor circulation ;</p> <p><i>Treatment:</i> insulin ; by injection / insulin pump ; regular blood glucose tests ; regular meals / controlled diet ;</p>	[max 5]	<p>max 3 from either section A weakness I death</p> <p>A meal plan / healthy eating / monitoring carbohydrates / avoid sugary foods, drinks and fruit juices / eat complex carbohydrates / intake of sugar if blood sugar concentration is too low</p>
		[Total: 9]	