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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance Notes</th></tr>
<tr><td>1 (a)</td><td>septum ;</td><td>[1]</td><td></td></tr>
<tr><td>(b) (i)</td><td>blood flows through heart twice, for one (complete) circuit / to get backto the same point ;
one loop to lungs, and one loop to rest of the body ;</td><td>[max 1]</td><td></td></tr>
<tr><td>(ii)</td><td>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 ;</td><td>[max 1]</td><td>A more efficient / faster, delivery / removal, of a named blood component e.g. oxygen
I maintain blood pressure</td></tr>
<tr><td>(c)</td><td>
<table>
<tr><th>description</th><th>name of structure</th><th>letter on Fig 1.1</th></tr>
<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>
</table>
</td><td>[4]</td><td>one mark for each correct row</td></tr>
</table>

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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 specific / unique / AW, antigen ; lymphocytes make antibodies ; ref to memory cells ; ref to active immunity ; rapid, immune response / AW, if exposure to same 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, au / arbitrary units ;	[2]	
(ii)	large / rapid / immediate increases ; peaks at, 50 s / 12 AU ; 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) protein (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)	oral rehydration (therapy / salts / treatment / solution) ; drink mixture of, sugar / nutrients and, salt / ions ; replace lost, 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]	**I** 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)	*gametes:* F^A , F^N , F^A , F^A ; *offspring genotype:* F^AF^A, F^AF^N ; *offspring phenotype:* red, pink ; *proportion of pure breeding carnation plants*: 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>turg</u>or (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)	***A*** *is most polluted because:* 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**) ; ***B*** *is most polluted because* more oestrogen (than **A**) ; more <u>types</u> of hormones ;	[max 3]	
(c) (i)	*Lake **B*** oestrogen decreases (slightly) ; progesterone / testosterone, increases (slightly) ; *Lake **A** or Lake **B*** <u>no / little</u>, effect on oestrogen / progesterone / testosterone <u>without</u> ozone**;** *Lake **A*** 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)	<u>eutrophication</u> ; (aquatic) plants, die / cannot photosynthesise (due to blocked light) algae / (aquatic) plants / organic material, decayed by bacteria ; (aerobic) respiration (by bacteria / decomposers) ; decreased pH / increased acidity (due to low oxygen) ; oxygen concentration decreases (due to bacteria / decomposers) ; (aquatic) animals / fish, migrate / die, due to lack of oxygen ; 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 ; (female contraceptive) hormones cause feminisation of (aquatic) organisms ; (female contraceptive) hormones cause reduced sperm count (in aquatic animals) ;	[max 6]	**I** marine and other non-lake ecosystems **I** unqualified death / extinction throughout **A** growth of, floating aquatic plants / algae / algal bloom **A** nutrients in sewage as organic material **A** microorganisms / decomposers for bacteria **I** <u>all</u> oxygen used up **A** diseases / pathogen in humans or aquatic organisms **A** biomagnification / bioaccumulation / death of (aquatic) organisms by, heavy metals / toxins / poisons, in sewage **A** hormone may cause gender change in fish
		[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)	*Symptoms:* 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 ; *Treatment:* insulin ; by injection / insulin pump ; regular blood glucose tests ; regular meals / controlled diet ;	[max 5]	max 3 from either section **A** weakness **I** death **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
		[Total: 9]	

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