**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**

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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**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

<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 ;<br>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) ;<br>allows different blood pressure in each loop ;<br>prevent mixing of oxygenated and deoxygenated blood ;<br>allows animals to have high metabolic rates ;<br>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<br>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>

| Question | Answer | Marks | Guidance Notes |
|---|---|---|---|
| **(d)** | (blood) enters heart at <u>right</u> atrium / **A** (from the vena cava / **N**) ;<br>then atrium contracts ;<br>correct ref to atrioventricular valve ;<br>then to <u>right</u> ventricle / **D** ;<br>then ventricle contracts ;<br>correct ref to semi-lunar valves ;<br>then pulmonary artery / **J**, <u>to lungs</u> / **O** ; | [max 4] | **R** contradictions between letters and structures<br>**I** valves unqualified |
| **(e) (i)** | (more) exercise / AW ;<br>stop / less, smoking ;<br>reduced stress ; | [max 1] | **I** ref to diet |
| **(ii)** | stent ;<br>small mesh tube inserted in artery ;<br>opens / supports, (narrow / weak) artery ;<br>(balloon) angioplasty / dilatation ;<br>(tube / catheter with) balloon inserted into artery ;<br>inflate balloon to widen artery ;<br>by-pass ;<br>(another / shunt) blood vessel joined / grafted / replace, artery ; | [max 2] | max 1 if no named procedure.<br><br>**I** open heart surgery / heart transplants |
| | | **[Total: 14]** | |

| Question | Answer | Marks | Guidance Notes |
|---|---|---|---|
| 2 (a) (i) | single celled / unicellular ;<br>no (true) nucleus / no nuclear membrane ;<br>loop of DNA ;<br>no, (membrane-bound) organelles ; e.g. no mitochondria / chloroplasts<br>(peptidoglycan / murein) cell wall ;<br>reproduce by binary fission ;<br>small(er) / 70S, ribosomes ;<br>plasmids ; | [max 2] | **I** DNA strand unqualified **A** naked DNA<br>**I** flagella, capsule, pili, cilia<br>**R** cellulose cell wall |
| (ii) | swim / movement / AW ; | [1] | |
| (b) | harmless / attenuated / dead / AW, form of, (named) pathogen / antigen used ;<br>(vaccine) injected / swallowed ;<br>ref to specific / unique / AW, antigen ;<br>lymphocytes make antibodies ;<br>ref to memory cells ;<br>ref to active immunity ;<br>rapid, immune response / AW, if exposure to same pathogen ;<br>herd immunity ;<br>AVP ; e.g. detail of active immunity / smallpox became extinct | [max 4] | **A** long term immunity |
| (c) (i) | 12 – 0.4 ;<br>11.6, au / arbitrary units ; | [2] | |
| (ii) | large / rapid / immediate increases ;<br>peaks at, 50 s / 12 AU ;<br>then decrease to, around 5 – 4.6 AU / by 125 –150 s ;<br>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<br>**A** increases and decreases from 50 s |

| Question | Answer | Marks | Guidance Notes |
|---|---|---|---|
| (iii) | active transport;<br>(through) protein (molecules / gates / pumps / AW) ;<br>(protein) in cell membrane ;<br>using, energy / ATP (from respiration) ;<br>(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) ;<br>drink mixture of, sugar / nutrients and, salt / ions ;<br>replace lost, water / fluids ;<br>water must be, uncontaminated / boiled / sterilised / clean / AW ;<br>antibiotics ; | [2] | **A** receive intravenous fluids **I** drink more water |
| | | **[Total: 18]** | |

| Question | Answer | Marks | Guidance Notes |
|---|---|---|---|
| 3 (a) (i) | 1 cross / breed, (parent) plants with <u>desired</u> feature ;<br>2 (grow seeds and) chose offspring for (desired) feature(s) ;<br>3 cross (offspring) plants showing features with, original variety / self / each other ;<br>4 keep / many generations of, crossing and selecting ;<br>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 ;<br>2 variation in offspring / offspring might not all be red ;<br>3 time consuming ;<br>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> ;<br>2 chromosome <u>number</u> is halved ;<br>3 (diploid to) haploid ;<br>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:* $F^A$ , $F^N$ , $F^A$ , $F^A$ ;<br>*offspring genotype:* $F^AF^A$, $F^AF^N$ ;<br>*offspring phenotype:* red, pink ;<br>*proportion of pure breeding carnation plants*: 50% / 1:1 / 0.5 / half ; | [4] | |
| | | **[Total:13]** | |

| Question | Answer | Marks | Guidance Notes |
|---|---|---|---|
| **4 (a)** | movement / diffusion, of water (molecules) **;**<br>from high water <u>potential</u> to low water <u>potential</u> / down water <u>potential</u> gradient **;**<br>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 **;**<br>to measure the mass of the potato (stick) only **;** | [max 1] | **I** inaccurate unqualified<br>**R** dry mass |
| **(c)** | cells / potato sticks, have lost water (by osmosis) **;**<br>from high water <u>potential</u> to low water <u>potential</u> / down water <u>potential</u> gradient **;**<br>(cells / tissue / potato) were, plasmolysed / flaccid **;**<br>loss of <u>turg</u>or (pressure) **;**<br>not enough pressure of water pushing on cell walls **;** | [max 3] | **I** water concentration<br><br>**I** incipient (plasmolysis)<br>**A** reduced turgidity / description |
| **(d)** | protein denatured (when cooked) **;**<br>cell membrane, damaged / destroyed (when cooked) **;**<br>no <u>osmosis</u> will occur **;** | [max 2] | **R** killed proteins<br>**I** killed / denatured, cells<br>**I** damaged <u>cell wall</u> |
| | | **[Total: 10]** | |

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

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

| 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:*<br>fatigue / AW ;<br>thirst / AW ;<br>increased urination / glucose in urine / fruity breath / ketosis / flushed face;<br>weight loss / nausea / vomiting / abdominal pain / hunger ;<br>blurred vision / glaucoma ;<br>behavioural changes / confusion / faint / unconscious / coma(tose) / dizzy / rapid breathing / deep breathing ;<br>slow (wound) healing / poor circulation ;<br><br>*Treatment:*<br>insulin ;<br>by injection / insulin pump ;<br>regular blood glucose tests ;<br>regular meals / controlled diet ; | [max 5] | max 3 from either section<br>**A** weakness **I** death<br><br>**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]** | |