**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**

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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*<br>for growth / making new cells / repair / replacement (of tissues) / making (named) tissue;<br>provides amino acids (for making protein);<br><br>*lactose*<br>(provides) energy / (glucose for) respiration;<br><br>*calcium to max 1*<br>(strengthening) bones / teeth;<br>needed for vitamin D to function;<br>blood clotting;<br>for muscle contraction;<br>for nerve impulse conduction; | **3** | <br><br><br><br><br>**R** 'produces energy'<br><br><br>**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;<br>2 ref to specificity;<br>3 active site;<br>4 substrate / protein, fits into / AW, enzyme / active site;<br>5 ref to, complementary shape of molecules;<br>6 enzyme-substrate complex / ESC;<br>7 enzymes, lower energy needed for reaction;<br>8 enzymes are, unchanged (at end of reaction) / reused;<br>9 (enzymes) carry out, chemical digestion / hydrolysis / catabolic reactions;<br>10 break down, large / insoluble, molecules into, small(er) / soluble, molecules;<br>11 protein broken down to, polypeptides / peptides / amino acids;<br>12 pepsin, active in stomach;<br>13 trypsin, active in, small intestine / duodenum / ileum;<br><br>*ref. to conditions in alimentary canal*<br>14 low pH / pH 1–3 / (hydrochloric) acid, in stomach;<br>15 high pH / alkaline / neutral / non-acidic / pH 7–9, in, small intestine / duodenum / ileum;<br>16 ref. to denaturation;<br>17 temperature is 37 °C;<br>18 ref. to successful collisions; | **6** | **A** lower activation energy<br><br>**A** gastric juice **I** rennin<br><br>**A** ± 1 °C |

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| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 1(c)(i) | no enzyme to, digest / break down, lactose;<br>lactose (molecule) is (too) large / complex;<br>cannot pass through, (cell) membrane(s);<br>no carrier protein for it ; | **2** | **A** no lactase / not enough enzyme<br>**A** not broken down to small(er) molecules |
| 1(c)(ii) | 1 dehydration / loss of water;<br>2 loss of, (named) salt(s) / ions / minerals / vitamins;<br>3 decrease in, volume of blood / blood pressure;<br>4 increase in blood concentration / decrease in water potential;<br>5 any effect on cells **;**<br>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<br>**A** loss / poor absorption, of nutrients / malnutrition **I** 'food'<br>**A** volume of plasma<br>e.g. cell shrinkage / loss of water from cells by osmosis<br>mp6 **A** *idea that* less water as a solvent **R** no solvent |
| 1(d)(i) | control;<br>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;<br>molecules, are small enough to be absorbed / do not pass straight through, small intestine / AW;<br>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**<br>concentration / amount, of hydrogen, shows small, fluctuations / changes / AW;<br>(concentration / amount) not higher than 15 (±1)<br>ppm / between 9 – 15 (±1) ppm;<br>comparative data quote between D and A, B or C; | **3** | *units – h and ppm must be used at least once*<br>*if no units then don't award MP3 and MP4*<br>mp1 must be comparative |
| | | **Total: 21** | |

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| 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><br>TAA; CGG; | 2 | |
| 2(b) | 1 mRNA is a copy of the, gene / DNA / base sequence;<br>2 gene / DNA, remains in the nucleus;<br>3 takes instructions to <u>cytoplasm</u>;<br>4 mRNA, passes through / attaches to / 'read by', ribosome;<br>5 base sequence determines sequence of amino acids (in proteins); | 3 | **A** transcription<br><br>**I** genetic material / genetic code / genetic sequence<br>**A** translation |
| 2(c)(i) | **A** and **B** / *Aspergillus flavus* and *A. oryzae*; | 1 | |
| 2(c)(ii) | long(est) distance from the branching point;<br>branched / split, the longest time ago;<br>no other species on its branch / AW;<br>only one ancestor (in the diagram);<br>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;<br>2 any example; e.g. presence or absence of wings<br>3 study, similarities / differences in, anatomy / internal structure of organisms;<br>4 any example; e.g. skeleton / organs / bones / teeth<br>5 AVP; study, similarities / differences in, any other type of evidence<br>6 AVP; any example of the type of evidence given | **2** | **A** compare morphologies<br>**I** size<br><br>**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;<br>medulla;<br>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;<br>2 (filtration occurs) in the glomerulus;<br>3 reabsorption of (named) useful substances;<br><br>*removes / excretes / loses*<br>4 (named) nitrogenous waste; e.g. urea<br>5 excess, (named) salt(s) / mineral(s) / ion(s);<br>6 (named) hormones;<br>7 excess water; | **4** | |
| 3(d)(i) | chemical / substance, secreted / produced / released, by a (endocrine) gland;<br>into the blood / carried in the blood;<br>controls / regulates / affects, (activity of) target organ(s); | **3** | **R** impulse(s) |
| 3(d)(ii) | testis / testes; | **1** | |
| 3(d)(iii) | anabolic (steroid);<br>promotes protein synthesis;<br>promotes, growth / strength, of muscle (tissue);<br>makes people more, aggressive / competitive / AW;<br>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*<br>*either*<br>after 7 days it has fallen from 50 to 25 ng $cm^{-3}$, after another 7 days it has fallen to 12.5 ng $cm^{-3}$<br>*or*<br>decreases by ½ × ½ = ¼, ¼ × 50 = 12.5 (ng $cm^{-3}$)<br>*or*<br>$\frac{50}{2 \times 2} = 12.5$(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>;<br>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;<br>phloem;<br>epidermis;<br>spongy mesophyll; | **2** | **R** cuticle<br><br>**A** aerenchyma |

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| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 4(d) | air spaces in the leaf for, buoyancy / AW;<br><br>*max 1 for any of the following*<br>leaves are closer to the light / 'gets more light'<br>to absorb more light;<br>for more photosynthesis;<br>to exchange gases with the, air / atmosphere; | **2** | **1 + 1**<br>**A** floating **I** being on the surface |
| 4(e) | xerophyte(s); | **1** | |
| 4(f) | inherited feature ;<br>feature helps an organism survive and reproduce;<br>in its, habitat / environment;<br>(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;<br>fibrinogen changes to fibrin;<br>soluble to insoluble;<br>fibrin forms a mesh;<br>traps blood cells;<br>prevents loss of blood / stops bleeding;<br>prevents entry of pathogens;<br>AVP; | **4** | **I** ref. to scab formation<br><br>**A** net<br>**A** RBCs / WBCs / platelets |
| 5(c) | secrete / produce / release, antibodies; | **1** | |

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| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 5(d) | active immunity;<br>ref to memory, cells / lymphocytes;<br>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 $mm^3$**;**<br>increase to 650 – 670 cells per $mm^3$;<br>gradual / AW, decrease until 10 years;<br>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;<br>reduced production of antibodies;<br>vulnerable to, infections / (opportunistic) disease / TB / cancers / pneumonia / AW;<br>AIDS;<br>weight loss / death / reduce life span; | **3** | |
| | | **Total: 14** | |

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| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 6(a) | 1 ringing allows <u>monitoring</u> of, species / population;<br>2 to check on (population) numbers;<br>3 find out about life span;<br>4 to find out where they go (during migration) / to track their position;<br>5 find out how far birds travel;<br>6 to find out when they migrate;<br>7 allows checks on, health of birds / survival rates;<br>8 breeding success;<br>9 do not harm the birds / do not make them obvious to predators;<br>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;<br>2. maintain biodiversity;<br>3. provide feeding grounds for animals / ref. to disruption of food, chains / web;<br>4. provide, breeding grounds / places for breeding;<br>5. provide, habitats / shelter;<br>6. vulnerable to the effects of, development / drainage / AW;<br>7. ref to flooding / natural disasters;<br>8. ref to nitrogen cycle;<br>9. ref to maintenance of water cycle;<br>10. ref to carbon cycle; e.g. greenhouse gas / carbon storage / carbon sink<br>11. waste disposal;<br>12. provide, resources / food / fuel / drugs / raw materials;<br>13. idea of areas for, recreation / (eco)tourism / education;<br>14. ethical reasons / aesthetic reasons / AW;<br>15. AVP; e.g. soil erosion | **5** | **I** food chain (singular) |
| | | **Total: 7** | |

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