**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

**BIOLOGY** **0610/43**

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 | Guidance |
|---|---|---|---|
| 1(a)(i) | **A**: vagina;<br>**B**: oviduct / Fallopian tube;<br>**D**: sperm / male gamete; | **3** | |
| 1(a)(ii) | to remove, egg cells / ova / female gametes; | **1** | |
| 1(b)(i) | follicle stimulating hormone / FSH;<br>luteinizing hormone / LH; | **1** | |
| 1(b)(ii) | start of new cycle / days 1–10 / during menstruation / AW; | **1** | |
| 1(b)(iii) | **X** positioned anywhere in uterus (wall / lining); | **1** | |
| 1(c) | 1 allows infertile couples / single parents / same sex couples (to have children);<br>2 religious / legal / moral / ethical, concerns about IVF;<br>3 may not treat infertility successfully;<br>4 expense of fertility treatment;<br>5 may lead to multiple births;<br>6 *idea of* genetic screening before implanting is possible;<br>7 storage of, eggs / embryos, is possible (during chemotherapy);<br>8 qualification of an religious / ethical / legal / moral, issue;<br>9 has allowed stem cell research on embryos;<br>10 AVP; | **4** | **A** high chance of miscarriage / stress<br>**A** cost to health services / cost means restricted availability |
| | | **Total: 11** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 2(a) | 1 enzymes are proteins;<br>2 enzymes can be reused / are unchanged in a reaction;<br>3 enzymes are specific;<br>4 (enzymes are) catalyst / speeds up reaction;<br>5 lowers (activation) energy needed for the reaction;<br>6 successful collisions;<br>7 enzyme-substrate complex / ESC;<br>8 <u>active site</u>;<br>9 (enzyme and substrate) complementary shape / AW;<br>10 ref. to <u>optimum</u>, temperature / pH;<br>11 too much heat results in denatured enzymes;<br>12 too little kinetic energy / heat, less (successful) reactions;<br>13 incorrect pH results in denatured enzymes;<br>14 (substrate) is <u>pectin</u> / cell wall;<br>15 results / product, is clear juice;<br>16 mass / cheaper / more (volume) / yield, juice production; | **6** | **R** cellulose |
| 2(b) | read at eye level / avoid error of parallax;<br>read bottom of meniscus;<br>place measuring cylinder on a level / flat, surface;<br>remove funnel / ensure all drops have fallen to the bottom; | **2** | **A** parallel / horizontal to meniscus |
| 2(c)(i) | 19 ÷ 10 **or** 17.5 ÷ 10;<br>2 ($cm^3$ per min); | **2** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 2(c)(ii) | **A** / 0.5 ($cm^3$ cubes);<br>large(st) surface area (to volume); | **2** | **A** smallest cubes |
| | | **Total: 12** | |

| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 3(a) | human / largest mammal, has the longest / bat has the shortest (small intestine);<br>(small intestine of) rat and cat are very similar in length;<br>comparative data, quote / calculation with units at least once;<br>negative correlation between length and length relative to body mass; | **3** | **A** relative to body mass bat much larger than other three animals / smallest length relative to body mass is in humans |
| 3(b) | movement into / out of / through, (epithelial) cells / villi;<br>into, capillaries;<br>across cell membranes;<br>by active transport;<br>through protein carriers;<br>against a concentration gradient;<br>using energy; | **3** | **I** walls<br>**I** into blood |
| 3(c)(i) | (insect-eating) bat; | **1** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 3(c)(ii) | ratios are higher in the duodenum;<br>higher (inner) surface area (than ileum);<br>data comparison (for any one animal);<br>more villi;<br>more microvilli; | **3** | |
| 3(d) | emulsification;<br>increased surface area of fat (globules);<br>faster, digestion / break down (of fat by enzymes);<br>by lipase / to fatty acids and glycerol;<br>neutralises (stomach) acid / chyme;<br>provides alkaline medium for, pancreatic enzymes / lipase;<br>denatures, pepsin / stomach, enzymes;<br>AVP; | **4** | **I** faster break down of fats unqualified |
| | | **Total: 14** | |

| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 4(a) | (nicotine is) a (chemical) substance taken into the body;<br>that modifies / affects / influences, (chemical reactions in) the body;<br>addictive / can cause withdrawal symptoms (when stopped) / AW; | **2** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 4(b) | *carbon monoxide:*<br>binds to haemoglobin (permanently); Accept carboxyhaemoglobin<br>reduced oxygen (transport);<br><br>*tar (max 3):*<br>carcinogenic / causes lung cancer;<br>sticks to / blocks / damages, alveoli / cilia;<br>produce more mucus;<br>making prone to (named) respiratory infections;<br>reduced, diffusion / gas exchange; | **4** | **A** irritates, gas exchange surface / airways / emphysema |
| 4(c)(i) | 1 more men smoked (between 1950–1998 than women); ORA<br>2 both decrease overall / between 1950 and 1998;<br>3 (overall) drop in men is more (than in women); ORA<br>Ignore data<br>4 (1950)–1970: men decreasing and women increasing;<br>5 1970 onwards : both genders decreasing;<br>6 larger difference in numbers / %, before 1970s / earlier<br>OR<br>smaller difference in numbers / %, after 1970s / later; AW<br>7 maximum (implied) for women was 50% and 82% for men;<br>8 comparative data quote between men and women with units stated once; | **4** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 4(c)(ii) | number of deaths by (lung) cancer shows similar trend as percentage smokers;<br>(correlation) in both men and women / AW;<br>lag in the death rate trend (compared with smokers) / AW;<br>relevant data quote from both graphs;<br>trend more obvious in men / death rate in women is increasing overall;<br>impossible to show conclusive link;<br>(because) cannot control experimental conditions / other lifestyle factors;<br>AVP; | **4** | e.g. lag in/ drop of 7–8 years in men |
| 4(d) | toxins / AW, in smoke can cross the placenta;<br>increased risk, of miscarriage / still birth / premature birth / low birth weight / deformities;<br>reduces oxygen available to the foetus / foetal brain damage;<br>increased risk, of reduced lung, function / infection, in foetus / infants;<br>babies more likely to become addicted / have withdrawal symptoms;<br>AVP; | **3** | |
| | | **Total: 17** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 5(a)(i) | double helix;<br>(strands) contain, bases / A and T and C and G;<br>A joins with T / C joins with G;<br>strands / bases, join / pair up, by crosslinks / hydrogen bonds;<br>AVP; | 3 | **A** labelled drawing or description |
| 5(a)(ii) | codes for a protein; | 1 | |
| 5(b) | respiration;<br>aerobic (respiration);<br>release energy / make ATP; | 2 | **R** produce energy |
| 5(c) | cytoplasm;<br>cell membrane;<br>single celled / unicellular;<br>no (true) nucleus / no nuclear membrane;<br>loop of DNA / chromosome / naked DNA;<br>no, (membrane-bound) organelles / mitochondria / chloroplasts;<br>(peptidoglycan / murein) cell wall;<br>AVP; e.g. plasmids | 2 | **A** nucleoid<br>**R** cellulose cell wall<br>**I** flagella, pili, mesosomes, capsules |
| 5(d) | **B** and **D** in box 1 and 2 (any order);<br>**C** in box 3;<br>**A** and **F** in box 6 and box 7 (any order); | 3 | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 5(e) | it is (more) accurate (than traditional classification systems);<br>easi(er) / cheap(er) / quick(er) / (more) efficient / to use (than other (named) identification methods); **ora**<br>allows large-scale identification (of many species simultaneously);<br>only trace samples are required;<br>(DNA sequences) within a species are very similar; | **1** | **A** samples do not need to purified<br>**A** early identification of (pathogenic bacteria) for infections |
| | | **Total: 12** | |

| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 6(a) | (branching) veins; **ora**<br>shape / broad (leaves); **ora** | **1** | **I** petioles |
| 6(b) | it is (made of a group of) tissues working together to perform specific function(s); | **1** | |
| 6(c) | $6CO_2 + 6H_2O$ (LHS);<br>$C_6H_{12}O_6 + 6O_2$ (RHS);<br>energy / light / chlorophyll; | **3** | |
| 6(d)(i) | palisade (mesophyll / tissue / cells / parenchyma);<br><br>tightly packed / contain many chloroplast / stacked upright; | **2** | <br><br>**A** lots of chlorophyll |
| 6(d)(ii) | (upper) epidermis / epidermal cells;<br><br>transparent / allows light to pass through / thin; | **2** | |

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| Question | Answer | Mark | Guidance |
|---|---|---|---|
| 6(d)(iii) | spongy, mesophyll / tissue / cells / parenchyma / layer;<br><br>air spaces / loosely packed / gas exchange / diffusion of gases; | **2** | Mark points are not linked |
| 6(e) | nitrates are useable source of nitrogen;<br>needed to make amino acids;<br>(amino acids) to make proteins;<br>protein / DNA, needed for growth;<br>to make DNA / RNA / nucleotides / bases;<br>other suitable named use of organic nitrogenous compounds found in plants; | **3** | |
| | | **Total: 14** | |

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