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**BIOLOGY**

**0610/42**

Paper 4 Theory (Extended)

**October/November 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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This document consists of **11** printed pages.

**Mark schemes will use these abbreviations**

- ; separates marking points
- / alternatives
- I ignore
- R reject
- A accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- 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 word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

| Question  | Answer   | Marks | Guidance   |
|-----------|--|-------|--|
| 1(a)(i)   | carbon dioxide / CO <sub>2</sub> / water / H <sub>2</sub> O (vapour) ;<br>(respiring / all) cells / tissues / mitochondria / named tissue(s) /<br>named organ(s) ;   | 2     | R alveoli / lungs  |
| 1(a)(ii)  | urea ;<br><br>toxic / poisonous / harmful / waste / AW ;   | 2     | A ammonia / ammonium / creatin(ine)<br>/ uric acid / urine   |
| 1(b)(i)   | glomerulus ;   | 1     | A ball / knot / AW, of capillaries<br>A Bowman's capsule / basement<br>membrane  |
| 1(b)(ii)  | red (blood) cells / erythrocytes ;<br>phagocytes ;<br>lymphocytes ;<br>named plasma proteins ; ;<br><br>platelets ;  | 2     | e.g. albumen / fibrinogen / insulin<br>/ glucagon / thrombin / antibodies<br>/ clotting factors                            |
| 1(c)(i)   | microvilli – E ;<br>nucleus – A ;<br>mitochondrion – C ;   | 3     |  |
| 1(c)(ii)  | stores / contains, chromosomes / genes / alleles / genetic information / DNA ;<br>controls the (activity / reactions of the) cell ;<br>controls how cells, develop / divide / reproduce / grow ;<br><i>idea that it stores instructions for, making proteins / protein synthesis / making RNA ;</i><br>AVP ; | 1     | I 'controls movement of cell'<br><br>I giving instructions unqualified<br>A 'codes for protein'<br>e.g. making ribosome(s) |
| 1(c)(iii) | small intestine / duodenum / ileum ;   | 1     | A villi / jejunum / tongue / liver / egg cell<br>/ white blood cells / ear / nose  |

| Question | Answer   | Marks    | Guidance  |
|----------|--|----------|---|
| 1(c)(iv) | <p>(microvilli give a) large surface area ;<br/>for diffusion / described as movement down a concentration gradient ;</p> <p>lots of, mitochondria / <b>C</b> ;<br/><b>C</b> / mitochondria, are the site of (aerobic) respiration ;<br/><b>C</b> / mitochondria, provide energy / make ATP ;<br/>energy / ATP, is needed for active transport ;<br/>(active transport needed for) movement against concentration gradient ;</p> <p>ref to carrier proteins (in cell membrane) ;<br/>AVP ;</p> | <b>4</b> | <p>mp2 is linked to mp1</p> <p><b>R</b> 'produces energy'</p> <p>e.g. substances pass to blood to maintain concentration gradient</p> |

| Question | Answer  | Marks    | Guidance   |
|----------|---|----------|--|
| 2(a)     | prevents contamination / transmission, of (named) pathogen / toxin ;<br><br>prevents, infection / spreading of disease / illness ; <b>ora</b>   | <b>2</b> |  |
| 2(b)     | 1 low (concentration) of lactic acid in blood at, rest / the start / before ;<br>2 lactic acid (concentration) increases, steeply / quickly / AW, during exercise ;<br>3 reaches a peak / increases and decreases ;<br>4 decreases steeply, then gradually after exercise ;<br>5 any use of figures ;<br><br><i>explanation</i><br>6 oxygen, demand increases / does not reach muscles fast enough / AW ;<br>7 <u>anaerobic respiration</u> ;<br>8 provides / releases, energy ;<br><br>9 anaerobic respiration produces lactic acid ;<br>10 lactic acid diffuses from muscles into the blood ;<br>11 lactic acid is, broken down / respired / oxidised / converted to glucose / AW ;<br>12 in the liver ;<br>13 ref. to <u>oxygen debt</u> ; | <b>6</b> | e.g. peak at $13.2 \text{ mmol dm}^{-3}$ at 15 minutes $\pm 0.2 \text{ mmol}$<br><br><b>A</b> produces ATP <b>R</b> produce / makes, energy' |
| 2(c)(i)  | <b>P</b> $12 \text{ (km h}^{-1}\text{)}$ <b>and Q</b> $10 \text{ (km h}^{-1}\text{)}$ ;   | <b>1</b> | <i>One mark only both must be right</i>  |
| 2(c)(ii) | <i>idea that</i> trained athlete / <b>P</b> , has a higher level of (aerobic) fitness (than <b>Q</b> ) ;<br><br>difference in, gender / age / height / mass / lung capacity / lung mass / stroke volume / muscle type ;<br>AVP ;  | <b>1</b> | <b>A P</b> , is fitter than <b>Q</b> / has trained more than <b>Q</b><br><br>e.g. ref to genetics but not different genes                    |

| Question  | Answer   | Marks    | Guidance   |
|-----------|--|----------|--|
| 2(c)(iii) | <ol style="list-style-type: none"> <li>1 increase in demand for energy ;</li> <li>2 increase in (aerobic) respiration ;</li> <li>3 increase in demand for oxygen ;</li> <li>4 increase in carbon dioxide (concentration) ;</li> <li>5 decrease in pH / increase in acid, in the blood ;</li> <li>6 detected by the, brain / chemoreceptors ;</li> <li>7 (brain stimulates) an increase in breathing rate / faster breathing ;</li> <li>8 (brain stimulates) an increase in depth of breathing / AW ;</li> <li>9 ref to negative feedback in correct context ;</li> </ol> | <b>4</b> | <p><b>A</b> 'needs' more energy</p> <p>e.g. rate of breathing remains high until carbon dioxide concentration returns to, normal / set point</p> |

| Question | Answer   | Marks    | Guidance |
|----------|--|----------|----------|
| 3(a)     | <ol style="list-style-type: none"> <li>1 (immediate / steep) increase in numbers / no lag phase ;</li> <li>2 exponential / log, phase ;</li> <li>3 decelerating phase / described as increase slowing down ;</li> <li>4 stationary phase / plateau / levels off / remains constant ;</li> <li>5 levels, at 1.6 to 1.65 million / from between 1850 and 1875 ;</li> </ol> | <b>3</b> |          |

| Question | Answer   | Marks | Guidance   |
|----------|--|-------|--|
| 3(b)     | <p><i>population increases</i></p> <p>1 more births than deaths ;<br/>           2 more sheep are imported ;<br/>           3 more food needed for increasing human population ;<br/>           4 <i>idea that</i> more sheep needed for, export / economy of Tasmania ;</p> <p><i>population remains constant</i></p> <p>5 <i>idea that</i> population reaches, carrying capacity / described ;<br/>           6 number of births = number of deaths / culling for meat / AW ;</p> <p>7 any ref to <u>limiting factor(s)</u> in correct context in either increase or plateau ;<br/>           8 any example of a limiting factor ;<br/>           resources<br/>           food supply<br/>           water supply<br/>           space / area of land for grazing / AW<br/>           disease<br/>           predators<br/>           competitors</p> | 3     | <p>e.g. maximum that the land can support</p> <p>I drought / floods / any other natural disaster</p> |
| 3(c)     | <p>1 <i>idea that</i> farmer, chooses / selects (animals that are best adapted to conditions) ;<br/>           2 appropriate named feature(s) ;<br/>           3 selected animals bred together / (cross) breed them ;<br/>           4 select the offspring that show the features required ;<br/>           5 repeat, the selection and breeding / the process ;<br/>           6 <i>idea that</i> imports (male) sheep with desired features to mate with flock ;<br/>           7 uses artificial insemination ;</p>   | 4     |  |
| 3(d)     | <p>providing for the needs of (the increasing) humans (population) ;</p> <p>without harm to the (natural) environment / ecosystem(s) / habitat / biodiversity ;</p>  | 2     | <p><b>A</b> examples of development, e.g. roads / houses / cities / urbanisation / AW</p>            |

| Question              | Answer  | Marks | Guidance  |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
|-----------------------|---|-------|---|----------------|----------------|------------------|------------|-----------|--|---------------------|--------------------------------|-----------------------|-------------|---|--|
| 4(a)                  | <p>little / less / AW / no, variation / (genetic) diversity ;<br/> ref to becoming homozygous ;<br/> less chance of, surviving / adapting / evolving, to, changing conditions / new environments / (new) disease ;<br/> risk of <u>extinction</u> ;<br/> increase chance of genetic disease ;</p> <p>adapted variety spreads / AW ;<br/> only one plant needed / no mate required ; <b>R</b> if 'asexual reproduction' is given<br/> greater chance of pollination / ensures pollination occurs ;<br/> <i>idea that</i> reproduction / fertilisation, successful if no other plants (of same species)<br/> nearby ;<br/> less wastage of pollen ;<br/> not dependent on (named) agent of pollination ;</p> <p>AVP ; no hybrid vigour / smaller gene pool</p>  | 4     | <p><b>A</b> fewer <u>alleles</u> <b>I</b> ref to gene(s)<br/> <b>R</b> cloning / uniform(ity)</p> <p><b>A</b> increased risk of abnormalities<br/> /genetic 'weakness' / AW</p> <p><b>A</b> gametes <b>I</b> no wastage</p> |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| 4(b)(i)               | <table border="1" data-bbox="412 740 1337 1177"> <thead> <tr> <th data-bbox="412 740 770 786">term</th> <th data-bbox="770 740 1337 786">example in <i>P. sativum</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="412 786 770 866">dominant trait</td> <td data-bbox="770 786 1337 866">purple flowers</td> </tr> <tr> <td data-bbox="412 866 770 946">recessive allele</td> <td data-bbox="770 866 1337 946"><b>b</b> ;</td> </tr> <tr> <td data-bbox="412 946 770 1026">phenotype</td> <td data-bbox="770 946 1337 1026">(flower) colour / purple (flowers) / white (flowers) ;</td> </tr> <tr> <td data-bbox="412 1026 770 1106">homozygous genotype</td> <td data-bbox="770 1026 1337 1106"><b>BB</b> and / or <b>bb</b> ;</td> </tr> <tr> <td data-bbox="412 1106 770 1177">heterozygous genotype</td> <td data-bbox="770 1106 1337 1177"><b>Bb</b> ;</td> </tr> </tbody> </table> | term  | example in <i>P. sativum</i>  | dominant trait | purple flowers | recessive allele | <b>b</b> ; | phenotype | (flower) colour / purple (flowers) / white (flowers) ; | homozygous genotype | <b>BB</b> and / or <b>bb</b> ; | heterozygous genotype | <b>Bb</b> ; | 4 |  |
| term                  | example in <i>P. sativum</i>  |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| dominant trait        | purple flowers  |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| recessive allele      | <b>b</b> ;  |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| phenotype             | (flower) colour / purple (flowers) / white (flowers) ;  |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| homozygous genotype   | <b>BB</b> and / or <b>bb</b> ;  |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |
| heterozygous genotype | <b>Bb</b> ;   |       |   |                |                |                  |            |           |  |                     |                                |                       |             |   |  |



| Question | Answer  | Marks | Guidance                     |
|----------|---|-------|------------------------------|
| 4(b)(ii) | <p><i>parental phenotype</i>      purple flowers x white flowers    purple flowers x white flowers</p> <p><i>parental genotype</i>                      Bb      x      bb                                      BB      x      bb ;</p> <p><i>genotypes of gametes</i>      B      b      +      b      (b)      B      B      +      b      (b)      ;</p> <p><i>offspring genotypes</i>                      Bb                      bb                                      Bb                      (Bb);</p> <p><i>offspring phenotypes</i>                      purple flowers, white flowers ;                                      purple flowers ;</p> | 5     |                              |
| 4(c)(i)  | <p><i>test cross 1</i></p> <p><b>GG x GG / GG x Gg    A GG on its own    R GG x gg ;</b></p> <p><i>test cross 2</i></p> <p><b>Gg x Gg ;</b></p>   | 2     | <b>A Gg on its own</b>       |
| 4(c)(ii) | <p>white plants are, homozygous recessive / <b>gg</b> ;<br/>(white plants / no chlorophyll) cannot, photosynthesise / produce own food ;<br/>(therefore white plants) do not grow into mature plants / do not produce flowers / die before reproducing / AW ;</p>   | 2     | I cannot survive unqualified |

| Question | Answer  | Marks | Guidance  |
|----------|---|-------|---|
| 5(a)     | <i>Helicobacter</i> ;   | 1     |   |
| 5(b)     | circular DNA / chromosome ;<br>plasmid(s) ;<br>cell membrane ;<br>cell wall (not made of cellulose) ;<br>cytoplasm ;<br>capsule ;<br>(small) ribosomes ;<br>flagella ;<br>AVP ;   | 2     | A naked, DNA / chromosome<br><br>I cilia<br>e.g. pili |
| 5(c)(i)  | antibiotic(s) ;   | 1     |   |
| 5(c)(ii) | (stomach / hydrochloric / gastric) acid / HCl / mucus ;   | 1     |   |
| 5(d)     | <i>active immunity</i><br>1 exposure to <u>antigen</u> ; <b>ora</b><br>2 after, infection by pathogen / vaccination ;<br>3 immune response occurs / antibodies produced ;<br><br><i>passive immunity</i><br>4 <u>antibodies</u> acquired from another individual ;<br>5 e.g. by breast milk / injection of antibodies ;<br>6 active is, permanent / long-term (immunity) ; <b>ora</b><br>7 ref to memory cells, in active / not in passive ;<br>8 response is slow on first exposure in active ; <b>ora</b> | 4     |   |

| Question     | Answer  | Marks                     | Guidance  |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
|--------------|---|---------------------------|---|---------------------------|----------|---------------------|----------------|----------|----------------------|----------------|----------|----------------|--------------|----------|-------|--------------|----------|----------------|--------------|---|--|
| 6(a)         | <table border="1" data-bbox="439 240 1308 711"> <thead> <tr> <th data-bbox="439 240 685 320">blood vessel</th> <th data-bbox="685 240 1066 320">name of blood vessel</th> <th data-bbox="1066 240 1308 320">oxygenated / deoxygenated</th> </tr> </thead> <tbody> <tr> <td data-bbox="439 320 685 400"><b>A</b></td> <td data-bbox="685 320 1066 400">hepatic portal vein</td> <td data-bbox="1066 320 1308 400">deoxygenated ;</td> </tr> <tr> <td data-bbox="439 400 685 480"><b>B</b></td> <td data-bbox="685 400 1066 480">(inferior) vena cava</td> <td data-bbox="1066 400 1308 480">deoxygenated ;</td> </tr> <tr> <td data-bbox="439 480 685 560"><b>C</b></td> <td data-bbox="685 480 1066 560">pulmonary vein</td> <td data-bbox="1066 480 1308 560">oxygenated ;</td> </tr> <tr> <td data-bbox="439 560 685 639"><b>D</b></td> <td data-bbox="685 560 1066 639">aorta</td> <td data-bbox="1066 560 1308 639">oxygenated ;</td> </tr> <tr> <td data-bbox="439 639 685 711"><b>E</b></td> <td data-bbox="685 639 1066 711">femoral artery</td> <td data-bbox="1066 639 1308 711">oxygenated ;</td> </tr> </tbody> </table> | blood vessel              | name of blood vessel  | oxygenated / deoxygenated | <b>A</b> | hepatic portal vein | deoxygenated ; | <b>B</b> | (inferior) vena cava | deoxygenated ; | <b>C</b> | pulmonary vein | oxygenated ; | <b>D</b> | aorta | oxygenated ; | <b>E</b> | femoral artery | oxygenated ; | 4 |  |
| blood vessel | name of blood vessel  | oxygenated / deoxygenated |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| <b>A</b>     | hepatic portal vein   | deoxygenated ;            |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| <b>B</b>     | (inferior) vena cava  | deoxygenated ;            |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| <b>C</b>     | pulmonary vein  | oxygenated ;              |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| <b>D</b>     | aorta   | oxygenated ;              |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| <b>E</b>     | femoral artery  | oxygenated ;              |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| 6(b)(i)      | <p>chemical / substance, made by a gland ;<br/>travels in the blood (plasma) ;<br/>alters the activity of one or more specific target organs ;</p>  | 2                         | <p><b>I</b> proteins <b>R</b> enzymes</p> <p><b>A</b> alters activity of / affects, target organ(s)<br/><b>A</b> controls</p> |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| 6(b)(ii)     | <p>1 controls blood, glucose / sugar, concentration / level ;<br/>2 increased, uptake / respiration, of glucose ;<br/>3 (stimulates cells to) convert glucose to <u>glycogen</u> ;<br/>4 <i>idea that</i> target organs are, muscle / liver ;<br/>5 (so) decreases blood glucose concentration ;<br/>6 ref to, negative feedback / homeostasis ;</p>  | 3                         |   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |
| 6(c)         | <p>1 shunt vessels, constrict / close / AW ;<br/>2 less blood flow through shunt vessels ;<br/>3 arterioles, widen / dilate / relax ;<br/>4 <u>vasodilation</u> (in context of arteries and arterioles) ;</p> <p>5 more blood flow (through capillaries) near the surface of the skin / AW ;<br/>6 (more) heat loss from blood (by radiation) ;</p>   | 3                         | <p><b>R</b> if in context of capillaries / veins<br/><b>A</b> 'blood vessels'</p>   |                           |          |                     |                |          |                      |                |          |                |              |          |       |              |          |                |              |   |  |