

# **Biology**

Advanced GCE **A2 7881**

Advanced Subsidiary GCE **AS 3881**

## **Mark Schemes for the Units**

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**January 2009**

**3881/7881/MS/R/09J**

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# 2801 Biology Foundation

| Question |     | Expected Answers   | Marks | Additional Guidance  |
|----------|-----|--|-------|--|
| 1        | (a) | 2000 / $2 \times 10^3$ ; ;   | 2     | <p>Correct answer = 2 marks</p> <p>If answer is not 2000, <b>ALLOW</b> 1 mark for<br/> <math>2(\text{cm}) \div 10</math> OR <math>20(\text{mm}) \div 10</math></p> <p>Award this working mark if the original measurement is correct and they have attempted to divide this measurement by 10. (They may have tried to convert mm to <math>\mu\text{m}</math> but not done this correctly, so apply an error carried forward.)</p> <p>If the answer is 2000 and units given in the answer, then <b>ALLOW</b> 1 mark only.</p> <p><b>CREDIT</b> correct answers that used <math>20\text{mm} \pm 1\text{mm}</math> (i.e. 1900 or 2100)</p> |
|          |     |  |       |  |
| 1        | (b) | water will enter by <u>osmosis</u> ;   |       |  |
|          |     | <u>down</u> water potential gradient / from high $\Psi$ to low $\Psi$ ;                        |       | <b>IGNORE</b> concentration  |
|          |     | (because) water potential of cells is, (more) negative / <u>lower</u> (than distilled water) ; |       | <p>Award mark in the context of cell, not leaf<br/>           ora</p> <p><b>IGNORE</b> concentration</p> <p><b>DO NOT CREDIT</b> 'low' unless comparison</p>   |
|          |     | cells / vacuoles, get bigger / swell / expand / increase in volume ;                           |       | <b>IGNORE</b> 'turgid' as this is given in the question  |
|          |     | cell membrane / cytoplasm / protoplast , presses against cell wall ;                           |       | <p><b>ACCEPT</b> 'cell contents'</p> <p><b>IGNORE</b> 'turgid' as this is given in the question</p>  |

| Question |            |             | Expected Answers   | Marks        | Additional Guidance   |
|----------|------------|-------------|--|--------------|---|
|          |            |             | $\Psi$ increases until equilibrium / AW ;  |              | Needs water potential increasing in mp  |
|          |            |             | cell wall , stops it from bursting / resists expansion / AW ;                        | <b>4 max</b> | <b>IGNORE</b> 'turgid' as this is given in the question   |
|          |            |             |  |              |   |
| <b>1</b> | <b>(c)</b> | <b>(i)</b>  | chloroplast ;  | <b>1</b>     |   |
| <b>1</b> | <b>(c)</b> | <b>(ii)</b> | separates organelle from cell / allows reactions to take place in isolation ;        |              | Make sure that comments relate to the <i>outer membrane</i> .<br><b>DO NOT CREDIT</b> <i>site for photosynthesis</i> without the idea of compartmentalisation, as the question refers to the membranes <i>around</i> the organelle.<br><b>IGNORE</b> additional detail if incorrect for chloroplast, treating as an ecf |
|          |            |             | permits / controls / allows , what can , enter / exit ;                              |              | Make sure that comments relate to the <i>outer membrane</i> .<br><br><b>DO NOT CREDIT</b> if stated in the context of allowing substances into the <b>cell</b> as the question refers to an organelle.<br><br><b>IGNORE</b> additional detail if substances quoted are incorrect for chloroplast, treating as an ecf    |
|          |            |             |  | <b>1 max</b> |   |
| <b>1</b> | <b>(d)</b> |             | (organelle) will take up water (by osmosis) ;  |              | <b>DO NOT CREDIT</b> if stated in the context of <b>cell</b> as the question refers to an organelle   |
|          |            |             | burst ;  |              | <b>IGNORE</b> explode<br><b>DO NOT CREDIT</b> 'cell bursts' but otherwise give BOD  |
|          |            |             | because there is no wall (to restrict expansion) / membrane not strong enough / AW ; | <b>2 max</b> |   |
|          |            |             | <b>Total</b>   | <b>10</b>    |   |

| Question |  |  | Expected Answers                             |               |                 |                  |                | Marks | Additional Guidance  |
|----------|--|--|--|---------------|-----------------|------------------|----------------|-------|--|
| 2        |  |  |  | <i>starch</i> | <i>glycogen</i> | <i>cellulose</i> | <i>protein</i> | 6     | <p><b>AWARD</b> one mark for a correct row.</p> <p>Each cell <i>should</i> have a tick or a cross.</p> <p>If the <b>whole table</b> has ticks and empty cells, assume the empty cells are meant to be crosses.</p> <p>If the <b>whole table</b> has crosses and empty cells, assume that the empty cells are meant to be ticks.</p> <p>If there are ticks, crosses <u>and</u> empty cells in the table, then <b>DO NOT CREDIT</b> a row with a blank cell.</p> <p><b>DO NOT CREDIT</b> 'hybrid ticks' unless it is perfectly clear what was the intended answer.</p> |
|          |  |  | <i>found in an animal cell</i>               | x             | ✓               | x                | ✓              |       |  |
|          |  |  | <i>contains α glucose units</i>              | ✓             | ✓               | x                | x              |       |  |
|          |  |  | <i>contains β glucose units</i>              | x             | x               | ✓                | x              |       |  |
|          |  |  | <i>contains bonds formed by condensation</i> | ✓             | ✓               | ✓                | ✓              |       |  |
|          |  |  | <i>is a branched structure</i>               | ✓             | ✓               | x                | x              |       |  |
|          |  |  | <i>contains peptide bonds</i>                | x             | x               | x                | ✓              |       |  |
|          |  |  | <i>found in a plant cell</i>                 | ✓             | x               | ✓                | ✓              |       |  |
|          |  |  | Total  |               |                 |                  |                | 6     |  |

| Question |     |       | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|-------|---|-------|--|
| 3        | (a) | (i)   | interphase ;  | 1     | <b>DO NOT CREDIT</b> a choice of answers   |
|          |     |       |   |       |  |
| 3        | (a) | (ii)  | 2 (daughter) cells ;  |       | Reference to 'both daughter cells' implies 2 cells   |
|          |     |       | same chromosome number as , parent (cell) / each other ;  |       | <b>ACCEPT</b> both diploid, as we can assume that the parent was diploid<br><b>ACCEPT</b> both haploid <b>only if</b> it is clear that mitosis is being referred to, and not meiosis, usually indicated by only 2 cells produced               |
|          |     |       | <u>genetically identical</u> to / <u>clone</u> of , each other ;  |       | <b>ALLOW</b> 1 mark for 'genetically identical' / 'clone' unqualified  |
|          |     |       | <u>genetically identical</u> to / <u>clone</u> of , the parent (cell) ;   | 3 max |  |
|          |     |       |   |       |  |
| 3        | (a) | (iii) | doubling / 20 to 40 / halving / 40 to 20 , needed / required / must happen / is essential (before cell divides) ; |       | <b>IGNORE</b> 'increasing' or 'decreasing' without qualification<br><b>ALLOW</b> DNA needs to be , duplicated / replicated / copied , before cell divides<br><b>DO NOT CREDIT</b> ref to chromosomes   |
|          |     |       | to maintain DNA content (in subsequent cells) / AW ;  |       | <b>ALLOW</b> ref to the correct amount of DNA in the resulting cells<br><b>ACCEPT</b> reverse argument (e.g. 'make sure that cells don't have the wrong amount of DNA')<br><b>IGNORE</b> refs to chromosomes (as not in Fig. 3.1 or table 3.1) |
|          |     |       |   | 2     |  |
|          |     |       |   |       |  |

| Question |     |     | Expected Answers   | Marks | Additional Guidance  |
|----------|-----|-----|--|-------|--|
| 3        | (b) | (i) | <i>Do not credit reverse argument for any points, as the normal function of p53 is stated in the question.</i>   |       |  |
|          |     |     | <p>1 <u>genes</u> controlling cell cycle not regulated ;</p> <p>2 cell cycle not paused (at G1) ;</p> <p>3 DNA not repaired / DNA not recognised as being damaged / DNA (still) damaged ;</p> <p>4 DNA replication takes place / cycle moves onto S stage ;</p> <p>5 no , cell death / apoptosis ;</p> <p>6 uncontrolled , cell division / mitosis ;</p> |       | <p><b>ACCEPT</b> idea of rapid G1 stage</p> <p>Marking point is in the context of DNA and not cell.</p> <p><b>CREDIT</b> 'immortal'</p> <p><b>ACCEPT</b> 'multiplication' instead of 'mitosis'</p> <p><b>IGNORE</b> quickly / rapid / other speed ref.</p> <p><b>IGNORE</b> ref to replication (even if cell replication stated) as this term is associated with DNA rather than cell division</p> <p><b>DO NOT CREDIT</b> reproduction</p> <p><b>DO NOT CREDIT</b> 'tumour formation' as this is defining cancerous growth rather than explaining the impact of the destruction of p53.</p> |



| Question |     |      | Expected Answers  | Marks        | Additional Guidance  |
|----------|-----|------|---|--------------|--|
| 3        | (b) | (ii) | <p>Mark this part of the question as prose, ignoring the 1 and 2 prompt lines. Credit any two correct answers.</p> <p>Do not credit 'mutation' alone as we are looking for factors that will cause mutation of the genes controlling cell division.</p> |              |  |
|          |     |      | <u>UV</u> , rays / radiation / light ;  |              | <b>IGNORE</b> radiation unqualified  |
|          |     |      | $\beta$ / $\gamma$ / ionising / X , rays / radiation ;  |              | <b>IGNORE</b> radiation unqualified  |
|          |     |      | genetic predisposition / oncogenes / inherited / AW ;   |              | <b>IGNORE</b> 'genetics' unqualified   |
|          |     |      | <p>named carcinogen ;</p> <p>named carcinogen ;</p>   |              | <p><b>2 marks available for named carcinogens</b></p> <p><b>IGNORE</b> 'carcinogen / carcinogenic' unqualified</p> <p>e.g. tar <b>ALLOW</b> smoking / chewing tobacco</p> <p>alcohol</p> <p>aniline dyes</p> <p>asbestos</p> <p>benzpyrene</p> <p>benzene</p> <p>vinyl chloride</p> <p>radon</p> |
|          |     |      | AVP ;   | <b>2 max</b> | <p>increasing age with specific cancer e.g.</p> <p>obesity with specific cancer e.g.</p> <p>diet with , low fibre / high fat / other qualification</p> <p>high voltage power cables / mobile phones / mobile phone transmitters</p>  |
|          |     |      | <b>Total</b>  | <b>11</b>    |  |

| Question |     |      | Expected Answers  | Marks | Additional Guidance   |
|----------|-----|------|---|-------|---|
| 4        | (a) | (i)  | snake / hawk / owl ;  | 1     | <b>CREDIT</b> a choice of answers if all alternatives given are correct (e.g. 'snake or owl')<br><b>DO NOT CREDIT</b> a choice of answers if an alternative given is incorrect (e.g. 'snake or frog')   |
| 4        | (a) | (ii) | <u>frog</u> ;   | 1     | <b>DO NOT CREDIT</b> a choice of answers  |
| 4        | (b) |      | wheat → grasshopper → frog → snake → owl / hawk<br><br>OR<br><br>clover / dandelion → caterpillar → frog → snake → owl / hawk ; | 1     | Orientation is unimportant (i.e. can go up, down, across, etc).<br>Arrows <b>MUST</b> point from and to correct organism.<br><b>ACCEPT</b> diagrams as long as arrows present and organisms named.<br><b>DO NOT CREDIT</b> if no arrows.<br><b>DO NOT CREDIT</b> a pyramid.<br><b>DO NOT CREDIT</b> a choice, unless all alternatives given are correct |
| 4        | (c) | (i)  | large surface area ;  |       | <b>IGNORE</b> large numbers as this is not a feature of the root hair cell  |
|          |     |      | thin cell wall ;  |       | <b>DO NOT CREDIT</b> thin membrane<br><b>DO NOT CREDIT</b> wall only one cell thick   |
|          |     |      | uncutinisised / not waterproof / permeable wall / AW ;  |       |   |
|          |     |      | large number of / many , mitochondria ;   |       | <b>IGNORE</b> 'have mitochondria' alone, with no indication of many   |
|          |     |      | long ;  |       |   |
|          |     |      | maintain lower water potential than soil ;  |       | <b>CREDIT</b> correct ref to concentrations or concentration gradient   |
|          |     |      | ref to membrane features related to uptake ;  | 3 max | e.g. transport / channel / carrier , proteins<br><b>DO NOT CREDIT</b> thin membrane   |

| Question |     |      | Expected Answers  | Marks | Additional Guidance   |
|----------|-----|------|---|-------|---|
| 4        | (c) | (ii) | carrier / transport , <u>proteins</u> (in cell membrane) ;                                |       | <b>ACCEPT</b> protein pump but <b>not</b> in the context of Na/K pump<br><b>IGNORE</b> protein channel in a list  |
|          |     |      | active transport ;  |       |   |
|          |     |      | (ions move) against / up , concentration gradient ;                                       |       | <b>ACCEPT</b> from low to high concentration  |
|          |     |      | (because) concentration (of ions) will be greater inside cell ;                           |       | <b>ACCEPT</b> lower concentration outside cell<br><b>DO NOT CREDIT</b> 'low' without a comparison   |
|          |     |      | requires , energy / ATP ;   | 3 max |   |
|          |     |      |   |       |   |
| 4        | (d) |      | ( <i>Rhizobium</i> ) fixes nitrogen / nitrogen fixation ;                                 |       | <b>DO NOT CREDIT</b> if also ref to nitrifying or denitrifying  |
|          |     |      | converts (gaseous) nitrogen into , ammonia / $\text{NH}_3$ / ammonium / $\text{NH}_4^+$ ; |       | <b>DO NOT CREDIT</b> if converting to nitrites / nitrates<br><b>DO NOT CREDIT</b> incorrect symbols alone   |
|          |     |      | provides plant with a useable form of nitrogen / AW ;                                     |       | <b>IGNORE</b> nature of the nitrogenous compound – it's the idea of nitrogen in a form that the plant can <b>use</b><br><b>DO NOT CREDIT</b> use by 'organisms' alone or 'plants and animals' |
|          |     |      | allows , legumes / clover , to grow in soils that are low in nitrates;                    |       | 'plants' is not quite precise enough  |
|          |     |      | eliminates / reduces , the need for additional (nitrogenous) fertiliser ;                 |       |   |
|          |     |      | ref to (transfer to) consumers / enriches soil (on death / decay of clover) ;             |       |   |

| Question |  |  | Expected Answers | Marks | Additional Guidance  |
|----------|--|--|------------------|-------|--|
|          |  |  | detail ;         | 4 max | e.g. suitable ref to anaerobic conditions<br>leghaemoglobin<br>nitrogenase<br>ref. mutualism / symbiotic relationship /<br>described |
|          |  |  | Total            | 13    |  |

| Question |     |  | Expected Answers  | Marks | Additional Guidance   |
|----------|-----|--|---|-------|---|
| 5        | (a) |  | <u>deoxyribose</u> ;  | 1     | <b>DO NOT CREDIT</b> a choice of answers<br><b>DO NOT CREDIT</b> dioxyribose  |
| 5        | (b) |  | <i>Ignore transcription / translation if only mentioned / stated</i><br><i>Stop marking when it is clear that transcription / translation / mitosis is being described and use <b>NAQ</b> annotation at that point</i><br><i>Continue to read through in case they clearly return to the process later.</i> |       |   |
|          |     |  | 1 DNA (molecule) / double helix , unwinds / uncoils / separates / unzips ;  |       | <b>DO NOT CREDIT</b> alpha helix  |
|          |     |  | 2 <u>DNA</u> polymerase ;   |       |   |
|          |     |  | 3 hydrogen bonds (break) ;  |       | <b>CREDIT</b> either in the context of breaking now or forming later on   |
|          |     |  | 4 free ( <u>DNA</u> ) <u>nucleotides</u> align with (exposed) , bases / strand(s) ;   |       |   |
|          |     |  | 5 <u>complementary</u> (base) <u>pairing</u> ;  |       | Do not award for simply the term 'complementary'  |
|          |     |  | 6 purine to pyrimidine ;  |       |   |
|          |     |  | 7 adenine to thymine <u>and</u> cytosine to guanine ;   |       | <b>ACCEPT</b> A + T <u>and</u> C + G<br><b>ACCEPT</b> from a diagram<br><b>DO NOT CREDIT</b> thiamine / thyamine / adenosine  |
|          |     |  | 8 2 hydrogen bonds between A and T <u>and</u> 3 between C and G ;   |       | <b>ACCEPT</b> from a labelled diagram<br>'2 H bonds between A and T and 3 H bonds between C and G' will get both marking points 7 and 8<br>'2 H bonds form between A and T and 3 H bonds form between C and G' will get marking points 7 and 8 and point 3 (if it has not already been awarded) |
|          |     |  | 9 adjacent nucleotides join / formation of sugar-phosphate backbone ;   |       |   |

| Question |  |  | Expected Answers  | Marks     | Additional Guidance   |
|----------|--|--|---|-----------|---|
|          |  |  | 10 each (new DNA molecule) has 1 original strand and 1 new strand ;     |           | <b>NOT</b> ½ original and ½ new   |
|          |  |  | 11 semi-conservative ;  |           | <b>DO NOT CREDIT</b> if other theories or methods are described (as currently acceptable alternatives)  |
|          |  |  | 12 AVP ;  |           | e.g. ref. (DNA polymerase) joins the nucleotides in carbon 5 to carbon 3 direction only<br>phosphorylated free DNA nucleotides (with 2 phosphates)<br>phosphodiester bonds (in the backbone)<br>DNA helicase (to unwind molecule)<br>DNA ligase (to join adjacent nucleotides)<br>Okazaki fragments |
|          |  |  | 13 AVP ;  | 8 max     |   |
|          |  |  | <b>QWC</b> ~ legible text with accurate punctuation, spelling & grammar | 1         | Judge on at least ½ a page of <b>writing</b> (12 lines)<br>Assume that the candidate has this mark unless they make too many errors. Account should be easy to follow, read and spelling mistakes should not impair the flow and understanding.   |
|          |  |  | <b>Total</b>  | <b>10</b> |   |

| Question |     |      | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|------|---|-------|--|
| 6        | (a) | (i)  | <u>disulphide</u> / <u>disulfide</u> (bridge) ;   | 1     | <b>CREDIT</b> covalent   |
|          |     |      |   |       |  |
| 6        | (a) | (ii) | <i>This question can be answered in terms of binding at active site or allosteric site. It can also be in the context of lock-and-key or induced fit.</i> |       |  |
|          |     |      | breaks / disrupts / weakens , (disulphide) bonds ;  |       | <b>IGNORE</b> binds to (in Q)  |
|          |     |      | denatures / distorts / changes structure of / changes shape of , enzyme ;   |       | <b>CREDIT</b> ref to preventing enzyme from changing shape in the context of induced fit                                   |
|          |     |      | ref. to , tertiary / quaternary , structure ;   |       | <b>IGNORE</b> ref to secondary structure   |
|          |     |      | blocks / distorts / changes shape of , <u>active</u> site ;   |       | <b>CREDIT</b> ref to preventing active site from changing shape to accommodate the substrate in the context of induced fit |
|          |     |      | (enzyme and substrate) no longer <u>complementary</u> ;   |       |  |
|          |     |      | unable to , function / catalyse reaction / form ESC / fit substrate / AW ;  | 4 max | <b>IGNORE</b> ref to efficiency  |
|          |     |      |   |       |  |
| 6        | (b) | (i)  | (in tin) apple less exposed to , air / oxygen ;   |       |  |
|          |     |      | <u>catechol</u> (in apple) not oxidised to <u>melanin</u> ;   |       |  |
|          |     |      | lack of / denatured , enzyme / catechol oxidase ;   |       |  |
|          |     |      | AVP ;   | 1 max | e.g. (surrounding liquid is) acidic / low pH<br>enzyme inhibited   |
|          |     |      |   |       |  |

| Question |     |      | Expected Answers   | Marks     | Additional Guidance   |
|----------|-----|------|--|-----------|---|
| 6        | (b) | (ii) | 1 lead ethanoate is an (enzyme) inhibitor ;  |           | <b>IGNORE</b> competitive   |
|          |     |      | 2 (very) low rate of reaction (when Pb present) ;  |           | ora<br><b>ACCEPT</b> little / no , activity<br><b>ACCEPT</b> no reaction / reaction stops |
|          |     |      | 3 (when Pb present) increasing , substrate / catechol , concentration does not increase rate ; |           | ora if specifically stating when, no lead / enzyme alone, present                         |
|          |     |      | 4 lead ethanoate is non-competitive ;  |           | <b>DO NOT CREDIT</b> if both competitive and non-competitive stated                       |
|          |     |      | 5 (probably) permanent / irreversible ;  |           |   |
|          |     |      | 6 (as) $V_{\max}$ is lower ;   | 4 max     |   |
|          |     |      |  |           |   |
|          |     |      | <b>Total</b>   | <b>10</b> |   |



## 2802 Human Health and Disease

| Question |     |       | Expected Answers   | Marks          | Additional Guidance   |
|----------|-----|-------|--|----------------|---|
| 1        | (a) |       | <b>P</b> alveolus / alveoli ;<br><b>Q</b> (branch of pulmonary), artery / arteriole ;<br><b>R</b> (branch of pulmonary), vein / venule ;<br><b>S</b> bronchiole / bronchus / bronchi ; | 4              |   |
|          |     |       |  |                |   |
|          | (b) | (i)   | to allow expansion / to prevent bursting /<br>to cause (elastic) recoil / to help breathing out / AW ;   | 1              | <b>ALLOW</b> : stretch / spring back / widening of lumen /<br>increase SA for gas exchange / increase capacity<br><b>IGNORE</b> : lung<br><b>DO NOT CREDIT</b> : contract / relax / rebound |
|          |     |       |  |                |   |
|          |     | (ii)  | (vaso) <u>constriction</u> / to maintain pressure of blood / AW ;  | 1              | <b>DO NOT CREDIT</b> : refs to pumping / increases blood<br>pressure / reference to airway<br><b>IGNORE</b> : contracts on its own  |
|          |     |       |  |                |   |
|          |     | (iii) | to, move / waft, <u>mucus</u> / AW ;   | 1              | <b>IGNORE</b> : refs to what is in the mucus<br><b>ALLOW</b> : sweep / beat / wave  |
|          |     |       |  |                |   |
|          |     |       |  | <b>Total 7</b> |   |

| Question |     |      | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|------|---|-------|--|
| 2        | (a) | (i)  | a departure from good health / reduces / stops, mental / social / physical, wellbeing ; (malfunction) of mind or body / AW ;  | 2     | <b>ALLOW</b> : 'organism' for body / 'abnormality' for malfunction   |
|          |     |      |   |       |  |
|          |     | (ii) | substantial / severe / rapid / AW, loss of (body), mass / weight ;<br>wasting of, muscles / heart muscle ;<br>low blood pressure ;<br>hair becomes, thin / sparse / brittle ;<br>lanugo / (fine) body hair ;<br>cold hands and feet ;<br>increased susceptibility to infection / weak immune system ;<br>menstrual cycle halted / failure to undergo puberty / growth retardation ;<br>obsession with body image / see themselves as fat / obsession with food / obsession with exercise / eating rituals / deceitful / AW ;<br><u>named</u> vitamin deficiency ; | 3 max | Mark any three correct responses. Do not need to be on lines 1,2 and 3<br><b>ALLOW</b> : very underweight / very thin<br><br><b>ALLOW</b> : periods stop / amenorrhoea |
|          |     |      |   |       |  |
|          | (b) |      | (target) screening ;<br>(target) (health) education / health promotion / personal health social education (raise self esteem) / AW ;<br>use, schools / teen magazines / role models / TV / inform parents / inform teachers ;<br>guide / target, allocation of funds ;  | 2 max | <b>ACCEPT</b> PHSE   |

| Question |     |  | Expected Answers  | Marks     | Additional Guidance   |
|----------|-----|--|---|-----------|---|
|          | (c) |  | <p><i>mental</i><br/>cause changes to the mind / behaviour / thoughts / perceptions / loss of brain function ;</p> <p><i>social</i><br/>result from living in society OR effect of, way of life / environment OR idea of peer pressure ;</p> <p><i>degenerative</i><br/>involve the gradual / progressive, deterioration of, function / tissues / organs / body ;</p> <p><i>self-inflicted</i><br/>result from a persons own, actions / behaviour ;</p> | 4         | <p><b>ALLOW</b> : affects mind / psyche / psychological disorder</p> <p><b>ALLOW</b> : idea of social isolation / ref. to poor housing / drug misuse</p> <p><b>DO NOT CREDIT</b> : 'wear and tear' or 'progressive worsening of health'</p> <p><b>ALLOW</b> : caused by person themselves / idea of 'you damage your own body'</p> <p><b>DO NOT CREDIT</b> : self harm on its own</p> |
|          |     |  | <b>Total</b>  | <b>11</b> |   |

| Question |     |      | Expected Answers   | Marks | Additional Guidance   |
|----------|-----|------|--|-------|---|
| 3        | (a) | (i)  | 64 / 65 / 66 ;;  | 2     | <p>If answer correct = 2 marks</p> <p><b>ACCEPT FOR ONE MARK :</b><br/> 164 / 165 / 166<br/> 64.8 or other non-rounded up<br/> <math>1750 / 2700 \times 100</math><br/> <math>(4450 / 2700 \times 100) - 100</math><br/> <math>(4450 / 2700 \times 100)</math><br/> method correct but figures slightly wrong e.g. <math>1700 / 2700 \times 100</math></p>  |
|          |     | (ii) | <p>both men and women / people, have increased (incidence of TB) ;<br/> both lines show a marked dip at one point / correct ref to men dip at 1999 / women 2003 / men dips twice and women only once ;<br/> in men slow increase until 1998 / faster increase after 1999 / dip / 1993 / AW ;<br/> always fewer cases in women than in men ;</p> <p>greater rate of increase in women ;<br/> increase in women more uniform ;<br/> use of figures to illustrate ;</p> | 3 max | <p><b>EXAMPLES OF FIGS :</b><br/> men increase by 1750 / 1800 (from 1988 – 2005) (increase) from 2700 in 1988 to 4450 in 2005<br/> women 2000 in 1988 and 3550 in 2005 / increase by about 1600<br/> overall increase for women is 78 / 79%<br/> in 1988, 4700 people with TB and in 2005, 8000 people with TB / 70% increase for all cases / increase of about 3300 / men by about 1750 <u>and</u> women by about 1600<br/> two dates with two figures within the time period e.g. men, after dip / 1999, is 3050 and in 2001 up to, 3600 / 3650</p> <p><b>IGNORE :</b> 65 % for men (as given in 3 (a))</p> |
|          | (b) | (i)  | <u>Mycobacterium</u> (tuberculosis / bovis) ;  | 1     | <p>must be correct spelling<br/> <b>DO NOT CREDIT :</b> Myobacterium, Microbacterium, Mycobacterium<br/> <b>IGNORE :</b> specific name</p>  |

| Question |      | Expected Answers   | Marks        | Additional Guidance   |
|----------|------|--|--------------|---|
|          | (ii) | in sputum / spit ;<br>droplet infection / coughing / sneezing ;<br>(open mouth) kissing / saliva ;<br>unpasteurised / contaminated, dairy products<br>OR undercooked / contaminated, <u>beef</u> ;   | <b>2 max</b> | <b>DO NOT CREDIT</b> : 'through airways / breathe in'<br>unqualified / particles in the air / milk or beef<br>unqualified   |
|          |      |  |              |   |
| (c)      | (i)  | not all people have completed treatment ;<br>treatment takes a long time/ infectious for a long time ;<br>a number of people moved away so possibly carried TB<br>elsewhere ;<br>a number of people have an unknown outcome so could be<br>spreading TB ;<br>difficult to, follow up / treat homeless ;<br>people choose to stop treatment / reason for stopping e.g. feel<br>better / AW ;<br>ref. to figs. ; | <b>3 max</b> | <b>REF TO FIGS</b> :<br>need a number out of the total e.g. 777 out of 1163<br>completed treatment<br>a percentage e.g. 67% completed treatment, 28% still<br>infectious<br>a fraction e.g. a fifth have an unknown outcome,<br>between a quarter and a third are still infectious<br>sum of different categories e.g. still infectious = 327   |
|          |      |  |              |   |
|          | (ii) | pathogen / <u>bacterium</u> , mutates / has many strains ;<br><br>(to become) <u>resistant</u> ;<br><br>ref to multiple resistance / AW ;<br><br>synergistic effect of more than one antibiotic / AW ;   | <b>2 max</b> | <b>ALLOW</b> : 'forms' or 'types' for strains<br><b>ALLOW</b> : TB causing organism instead of pathogen<br><b>DO NOT CREDIT</b> : strains of, disease / TB<br><b>DO NOT CREDIT</b> : 'strands' of bacteria / pathogen<br><b>DO NOT CREDIT</b> : 'bacteria immune' / 'person<br>resistant' / TB or tuberculosis resistant<br><b>IGNORE</b> : refs to 'virus' (for second and subsequent<br>marking points)<br><b>DO NOT CREDIT</b> : 'MDR' on its own in place of multi-<br>drug resistant |
|          |      |  |              |   |
|          |      | <b>Total</b>   | <b>13</b>    |   |

| Question |     | Expected Answers   | Marks | Additional Guidance   |
|----------|-----|--|-------|---|
| 4        | (a) | <p><i>vitamin A</i><br/> dry / rough, skin ;<br/> inflammation of eyes ;<br/> drying / scarring, of cornea / xerophthalmia ;<br/> night blindness (described) / lack of rhodopsin / rods do not function ;<br/> blindness ;<br/> increase susceptibility to infections ;</p> <p style="text-align: right;"><b>max 1</b></p> <p><i>vitamin D</i><br/> rickets ;<br/> lack of Ca absorbed into bone / lack of Ca absorbed from gut ;<br/> osteomalacia ;<br/> osteopenia / low bone density ;</p> <p style="text-align: right;"><b>max 1</b></p> <p><i>carbohydrate</i><br/> apathy / lethargy / tired / fatigue / lack of energy / use of other respiratory substrates / AW ;<br/> emaciation (described) / underweight / weight loss ;<br/> starvation ;<br/> ketosis ;<br/> low metabolic rate ;</p> <p style="text-align: right;"><b>max 1</b></p> | 3     | <p><b>ALLOW</b> : soft / bendy, bones</p> <p><b>DO NOT CREDIT</b> : 'osteoporosis'</p> <p><b>DO NOT CREDIT</b> : 'less energy FOR respiration'</p> <p><b>ALLOW</b> : marasmus</p> |

| Question |     | Expected Answers   | Marks               | Additional Guidance  |
|----------|-----|--|---------------------|--|
|          | (b) | <p>high level of, fat / carbohydrate / food / energy, in diet causes, obesity / overweight ;</p> <p>puts strain on heart / makes heart work harder ;</p> <p>excess, salt / caffeine / alcohol, increases, blood pressure / heart rate ;</p> <p>damage / AW, wall / lining / endothelium, of <u>arteries</u>;</p> <p>high level of, saturated / animal, fats in diet linked to high <u>blood</u> cholesterol ;</p> <p>(increased) levels of LDLs in blood ;</p> <p>(greater) deposition of fatty substances / cholesterol / plaques / atheroma ;</p> <p><u>in wall</u> of artery / under endothelium of artery ;</p> <p><u>atherosclerosis</u> / described ;</p> <p>(increased chance of) blood clotting / thrombosis ;</p> <p>(reduced flow of blood / thrombosis) in <u>coronary</u> arteries ;</p> <p>reduced supply of, oxygen / nutrients / named nutrient to heart <u>muscle</u> ;</p> <p>angina / chest pain / myocardial infarction / heart attack / ischaemic heart disease ;</p> <p>correct ref to protective foods e.g.</p> <p>fish oil / fibre / antioxidants / vitamins A, C, D or E / moderate amounts of red wine / cholesterol-reducing f foods ;</p> | <p><b>max 7</b></p> | <p><b>DO NOT CREDIT</b> : high cholesterol in diet</p> <p><b>DO NOT CREDIT</b> : fat build up</p> <p><b>DO NOT CREDIT</b> : 'atherosclerosis / atherosclerosis / asttherosclerosis'</p> <p><b>DO NOT CREDIT</b> : 'blockage' on its own'<br/>Named nutrient: fatty acids / glucose</p> |
|          |     | <b>QWC – legible text with accurate spelling, punctuation and grammar ;</b>  | <b>1</b>            | Award QWC if account is easily followed and understandable   |
|          |     | <b>Total</b>   | <b>11</b>           |  |

| Question |     |      | Expected Answers   | Marks     | Additional Guidance  |
|----------|-----|------|--|-----------|--|
| 5        | (a) |      | carcinogens ;<br>oxygen / O <sub>2</sub> ;<br>haemoglobin / Hb ;<br>oxygen / O <sub>2</sub> ;<br>nicotine ;  | 5         |  |
|          |     |      |  |           |  |
|          | (b) | (i)  | (vaso)constriction / described, of arterioles ;<br>stimulates release of adrenaline / noradrenaline ;<br>heart rate increased ;<br>cardiac output / stroke volume / volume of blood out of heart, increased ;  | 2 max     | <b>ALLOW</b> : smooth muscle in arterioles contracts   |
|          |     |      |  |           |  |
|          |     | (ii) | education about the effects (of smoke) / anti-smoking campaigns ;<br>health warnings on cigarette packs ;<br>ban advertising ;<br>(increase) taxes on cigarettes / cigarettes more expensive / financial help to stop e.g. free nicotine patches ;<br>ban smoking in public places / have smoke-free areas / named e.g. ;<br>raise the age at which people can buy cigarettes ;<br>limit the amount of tar / other named carcinogen, in cigarettes ;<br>greater / new, penalties for adults who buy / sell cigarettes for or to children ; | 3 max     | <b>NB</b> Mark any three correct responses. Do not need to be on lines 1, 2 and 3<br><br><b>DO NOT CREDIT</b> 'legislation' unless qualified<br><br><b>IGNORE</b> : refs to exercise or diet |
|          |     |      | <b>Total</b>   | <b>10</b> |  |



| Question |     | Expected Answers   | Marks    | Additional Guidance  |
|----------|-----|--|----------|--|
| 6        | (a) | (injection of) <u>antigenic</u> material / AW ;<br>activates, immune, system / response / description of any stage ;<br>body produces memory cells / B memory / T memory cells ;<br>memory cells remain (in body) ;<br>secondary response is much faster ;   | 3 max    | Look for refs to the antigen in correct context, they may talk of injecting a pathogen but refer to antigen presenting cells (APC)<br><br><b>IGNORE</b> : any refs to bacteria |
|          | (b) | people vaccinated, cannot catch / immune to, smallpox ;<br>unable to pass the pathogen on / stops transmission / stops spread of disease / limits to small group of people ;<br>contains outbreak within, small / confined, area ;   | 2 max    |  |
|          | (c) | (smallpox) <u>virus</u> / <u>pathogen</u> is stable / does not mutate / one strain / one type of antigen / AW ;<br><br>live vaccine used ;<br>vaccine, is very effective / is very efficient / a high rate of success / gives immunity in nearly all those vaccinated / AW ;<br><br>vaccine is easy to produce / cheap / high availability / AW ;<br>vaccine could be, freeze dried / stored easily / heat stable ;<br><br>infected people easy to identify / people readily cooperate ;<br>vaccine easy to administer / reusable needle / no booster needed / only one inoculation needed ;<br><br>no reservoir of infection / no other hosts / not found in animals / AW ;<br>spotters used to find new cases / volunteers or young people used / easy to administer vaccine ;<br>money / funds, provided by international organisations ; | 3 max    | <b>NB</b> Mark any three correct responses. Do not need to be on lines 1,2 and 3.<br><br><b>IGNORE</b> : ref to bacteria<br><br><b>DO NOT CREDIT</b> : vaccine frozen          |
|          |     | <b>Total</b>   | <b>8</b> |  |

## 2803/01 Transport - Written Paper

| Question |     | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|---|-------|--|
| 1        | (a) | <p>1 cut shoot under water ;</p> <p>2 insert shoot into apparatus under water / AW ;</p> <p>3 (completely) full of water / no (extra) bubbles / no airlocks ;</p> <p>4 cut shoot at a slant / AW ;</p> <p>5 dry off leaves / AW ;</p> <p>6 ensure, air- / water-, tight joints / apparatus / AW ;</p> <p>7 use a, healthy / non-wilted / AW, shoot ;</p> <p>8 allow time to acclimatise / equilibrate / AW ;</p> <p>9 ref to scale e.g. note where meniscus is at start / keep ruler fixed / AW ;</p> | 4 max | <p>The numbers 1 – 4 are to help the candidates. Please mark as a paragraph and credit where points appear.</p> <p><b>1. DO NOT CREDIT</b> cutting the <b>root</b>, but ecf afterwards</p> <p><b>2. ACCEPT</b> “set up under water”</p> <p><b>3.</b> Can refer to plant or apparatus</p> <p><b>5. ACCEPT</b> “ensure leaves / shoot were dry” statements</p> <p><b>6. ACCEPT</b> idea of Vaseline on joints / shut tap.<br/><b>DO NOT CREDIT</b> general statements such as “shoot firmly in rubber tubing” or “no leaks or holes”</p> <p><b>8. DO NOT CREDIT</b> general statements such as “leave before starting” i.e. looking for some qualification for the time</p> <p><b>9. ACCEPT</b> “set at zero” or “set at end of scale”</p> <p><b>DO NOT CREDIT</b> “calibrate” (often appears for mp 8 or 9)</p> <p><b>DO NOT CREDIT</b> references to maintaining constant conditions / named condition as this is subsequent to the set up</p> |

| Question |            | Expected Answers  | Marks | Additional guidance  |
|----------|------------|---|-------|--|
|          | <b>(b)</b> | 1 <i>Describe</i><br><u>both</u> show increased uptake / (meniscus) movement / AW ;   |       | ora throughout for cooler / less wind  |
|          |            | 2 figs to support one condition change ;  |       | 2. figures for temperature must be at similar wind speed and reverse for wind speed<br>e.g. exp 1 and 3 / 2 and 4 / 3 and 5 / 1 and 5 / 2 and 6<br>e.g. exp 1 and 2 / 3 and 4 / 5 and 6<br><b>IGNORE</b> units<br><b>ACCEPT</b> – ideas like ‘doubles’ ‘nearly doubles’ ‘times 5-6’ if appropriate. <b>DO NOT CREDIT</b> if figures described as “rate of transpiration” |
|          |            | 3 <i>Explain</i><br>increase evaporation / transpiration ;  |       | 3. <b>ACCEPT</b> as long as it is mentioned for one condition  |
|          |            | 4 <i>idea that</i> this will increase rate of uptake via transpiration pull / AW ;  |       | 4. use professional judgement – but <b>DO NOT CREDIT</b> just ‘more uptake to replace loss’. Needs to imply the link to the transpiration stream.  |
|          |            | 5 (temperature) increases, kinetic energy / movement of molecules ;   |       | 5. if described in terms of energy must use the word <b>kinetic</b>  |
|          |            | 6 warm air holds more water (than cold air) / AW ;  |       |  |
|          |            | 7 <i>idea that</i> air movement takes, moist / humid, air / water, vapour / molecules , away <b>OR</b> air, around leaf / outside stomata is, not saturated / less humid / less moist ; |       | 7. <b>DO NOT CREDIT</b> water / H <sub>2</sub> O unqualified.<br><b>ACCEPT</b> moisture for moist air  |
|          |            | 8 ref to steeper water potential gradient ;   | 4 max | 8. <b>ACCEPT</b> lowering water potential (outside).<br><b>DO NOT CREDIT</b> lowering of water potential <b>gradient</b>   |

| Question |     |   | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|---|---|-------|--|
|          | (c) | 1 | limited supply of water from the soil / AW ;                                  | 2 max | 1. ora if answered in terms of plentiful water supply from potometer   |
|          |     | 2 | (so)limited (rate of) water uptake by the <u>root(s)</u> ;                    |       | 2. no ora for potometer here, unless lack of root mentioned  |
|          |     | 3 | (idea of) resistance to water flow inside the (root of) plant ;               |       | 3. idea of resistance is key – “in root” is implied in stem of Q as it mentions a whole plant  |
|          |     | 4 | (idea of) greater distance to travel <b>OR</b> a description of the pathway ; |       | 4. just greater distance is acceptable <b>OR</b> pathway of water through, root cortex / apoplast / symplast / vacuolar /cell walls / endodermis / casparian strip |

| Question |     | Expected Answers   | Marks        | Additional Guidance   |
|----------|-----|--|--------------|---|
|          | (d) | <i>apply ecf where possible to avoid double penalty if feature too vague e.g. "dead" - look to allow the explanation</i>   |              | <p>2 marks for features, 2 marks for matching explanation. Mark the two features first - then see if explanation matches</p> <p>The two features may appear in the same line e.g. "lignified so no cell contents" = 2 marks. Feature and explanation may appear under the explanation. This could gain 2 marks provided feature links with explanation e.g. feature "dead" = 0 marks, explanation "no cell contents so ease of flow" = 2 marks. Only allow feature on explanation line if the following explanation matches.</p> <p><b>1. IGNORE</b> continuous column, look for idea of no end walls<br/> <b>DO NOT CREDIT</b> phloem reference e.g. "no end plate" but ecf for explanation in terms of ease of flow etc.<br/> <b>DO NOT CREDIT</b> in explanation "more water"</p> <p><b>2. DO NOT CREDIT</b> 'dead' unqualified / single named organelles / no living content<br/> <b>ACCEPT</b> "hollow"</p> <p><b>3. DO NOT CREDIT</b> support / prevent bursting / keep shape<br/> <b>ACCEPT</b> "lignin allows adhesion"<br/> <b>IGNORE</b> "lignin allows adhesion and cohesion" as contradiction</p> <p><b>4. IGNORE</b> references to narrow lumen and capillarity</p> <p><b>5. DO NOT CREDIT</b> perforations / holes<br/> <b>ACCEPT</b> gets round airlocks / blockages<br/> <b>DO NOT CREDIT</b> "prevents airlocks"</p> |
|          |     | <p><b>1</b> f no, cross / end, walls / AW ;<br/>ex ease of flow / little resistance / less friction ;</p> <p><b>2</b> f no, cytoplasm / cell contents / organelles ;<br/>ex ease of flow / little resistance / less friction / more water carried ;</p> <p><b>3</b> f lignin / lignified <b>OR</b> thick(ened) strengthened / AW, wall ;<br/>ex preventing collapse (under tension) <b>OR</b> lignin waterproofs ;</p> <p><b>4</b> f wide lumen ;<br/>ex more water carried ;</p> <p><b>5</b> f pits / pores ;<br/>ex idea of lateral movement / exit or entry ;</p> | <b>4 max</b> |   |
|          |     | <b>Total</b>   | <b>[14]</b>  |   |

| Question |     | Expected Answers |   | Marks      | Additional Guidance  |
|----------|-----|------------------|---|------------|--|
| 2        | (a) | 1                | small surface area, <u>relative to / AW</u> , volume ;                    | 3 max      | ora for <i>Amoeba</i> as appropriate for mp 1, 2, 4 and 5<br><b>1. DO NOT CREDIT</b> large volume relative to surface area   |
|          |     | 2                | distance (to centre) too great / cells deep in body / AW ;                |            | <b>2. DO NOT CREDIT</b> just 'larger' / "more cells" unqualified. "Many cells" is in stem of question. Key idea is distance so<br><b>ACCEPT</b> "diffusion path is too long"                           |
|          |     | 3                | an example of the transport of named substance or substances in a human ; |            | 3. either "around" or "from and to" e.g. "oxygen transported around the body" or "oxygen from lungs to tissues / body / cells" or "oxygen to <b>every</b> cell".<br><b>DO NOT CREDIT</b> "blood round" |
|          |     | 4                | diffusion too slow ;  |            | 4. Must have speed / time idea. Not just "diffusion inadequate" or "diffusion inefficient"   |
|          |     | 5                | more (metabolically) active / AW ;  |            | 5. <b>ACCEPT</b> in the physical sense   |
|          |     |                  |   |            |  |
|          | (b) | 1                | large surface area ;  | 3 max      | The numbers 1 – 3 are to help the candidates. Please mark as a paragraph and credit where points appear.<br><b>DO NOT CREDIT</b> just 'have alveoli' unqualified                                       |
|          |     | 2                | thin walled / short diffusion path / AW ;                                 |            | <b>2. DO NOT CREDIT</b> thin membrane / thin CELL wall / lungs one cell thick. "Thin walled" mark must imply walls of alveoli  |
|          |     | 3                | permeable wall ;  |            | <b>3. DO NOT CREDIT</b> selectively / semi etc – permeable   |
|          |     | 4                | capillary network / capillaries ;   |            | 4. <b>CREDIT</b> (good) blood supply / vascular.   |
|          |     | 5                | surfactant ;  |            |  |
|          |     | 6                | elastic recoil ;  |            | <b>6. DO NOT CREDIT</b> refs to contraction. Need idea of "elastic" <b>and</b> "recoiling" not just elastic tissue   |
|          |     | 7                | (thin) moist (layer) ;  |            |  |
|          |     |                  | <b>Total</b>  | <b>[6]</b> |  |

| Question |     |   | Expected Answers  | Marks | Additional Guidance   |
|----------|-----|---|---|-------|---|
| 3        | (a) |   | 75 ;;   | 2     | Correct answer = 2 marks<br>If answer is not 75, allow 1 mark for showing 60 / 0.8  |
|          | (b) |   |   |       | <b>key is to look for the sequence i.e. not valves opening and then the idea of pressure or blood into artery before valve opening. Needs to be pressure opening the valves</b>             |
|          |     | 1 | <b>X</b><br>(at X) pressure in ventricles, reaches / exceeds, that in arteries ;        |       | 1. must have idea of pressure difference  |
|          |     | 2 | (so higher)ventricular pressure opens valve / pushes blood through valve ;              |       | 2. Must link to idea of <b>raised</b> pressure or pressure difference (in ventricles).<br><b>DO NOT CREDIT</b> if <b>arterial</b> pressure  |
|          |     | 3 | <b>Y</b><br>(at Y) pressure in ventricles, reaches / drops below, that in atria / AW ;  |       | 3. must have idea of pressure difference.<br><b>ACCEPT</b> atrial pressure exceeds ventricular pressure but <b>DO NOT CREDIT</b> in context of atrial contraction. Penalise once, then ecf. |
|          |     | 4 | (so higher atrial) pressure opens valve / pushes blood through valve ;                  |       | 4. Must link to idea of raised pressure or pressure difference.   |
|          |     | 5 | In X blood flows to arteries / named artery <b>AND</b> in Y blood flows to ventricles ; | 4 max | 5. read whole paragraph before awarding this mark   |

| Question |     |   | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|---|---|-------|--|
|          | (c) | 1 | high(er) <u>ventricle</u> pressure in <b>A</b> ;                    | 2 max | 1. <b>ACCEPT</b> ora for B. <b>ACCEPT</b> from comparative figures |
|          |     | 2 | (due to) thicker wall / larger wall / being more muscular ;         |       | 2. <b>ACCEPT</b> ora for B   |
|          |     | 3 | (because) <b>A</b> pumps to body / <b>B</b> (only) pumps to lungs ; |       | 3. <b>IGNORE</b> refs to different distances                       |
|          |     | 4 | higher pressure in <u>aorta</u> ;                                   |       | 4. <b>ACCEPT</b> ora for <u>pulmonary artery</u> in B              |



| Question |     | Expected Answers  | Marks | Additional Guidance  |
|----------|-----|---|-------|--|
|          | (d) |   |       | <i>credit 5 marks from labelled diagrams</i>   |
|          |     | <b>S1</b> tunica intima / inner layer of, endothelium / squamous (epithelial) cells ;   |       | <b>S1 ACCEPT</b> t. interna <b>DO NOT CREDIT</b> t. interior / interia   |
|          |     | <b>S2</b> tunica media / middle layer / AW, is thin / narrow / AW ;   |       |  |
|          |     | <b>S3</b> tunica media / AW, of <u>smooth</u> muscle <u>and</u> elastic tissue / fibres ;   |       | <b>S3. IGNORE</b> collagen unless large quantities mentioned – then <b>DO NOT CREDIT</b> .<br><b>S3. ACCEPT</b> elastin and “is elastic”   |
|          |     | <b>S4</b> tunica externa / external layer, of collagen ;  |       | <b>S4. DO NOT CREDIT</b> if muscle mentioned as present here. <b>IGNORE</b> references to elastin / elastic<br><b>S4. ACCEPT</b> t. exteria  |
|          |     | <b>S5</b> (semilunar) valves ;  |       |  |
|          |     | <b>S6</b> large / wide lumen ; 4 max  |       |  |
|          |     | <b>F7</b> (smooth) endothelium / epithelium / lining / AW, reduces friction / resistance ;  |       | <b>F7 DO NOT CREDIT</b> friction reduction related to smooth muscle.<br><b>F7 DO NOT CREDIT</b> friction reduction related to t. intima without lining / AW<br><b>F7 DO NOT CREDIT</b> ideas of “eases flow”, “smooths flow” |
|          |     | <b>F8</b> credit one reference to, thinness / strength, of whole wall / tunica media / muscle, related to low pressure ;  |       |  |
|          |     | <b>F9</b> thinness of wall to allow skeletal muscle to squeeze vein ;   |       | <b>F9 DO NOT CREDIT</b> skeletal muscle squeezing vein without relating to thinness of wall  |
|          |     | <b>F10</b> valves to prevent backflow / AW ;  |       |  |
|          |     | <b>F11</b> wide lumen / walls distending, to accommodate large volume of blood ; detail of this e.g. relationship between large volume and slow flow rate ; 3 max | max 6 | <b>F11 DO NOT CREDIT</b> without reference to idea of large volume of blood  |

| Question |  |  | Expected Answers                                    | Marks       | Additional Guidance   |
|----------|--|--|---|-------------|---|
|          |  |  | QWC – clear well organised using specialist terms ; | 1           | <p>3 <b>bold</b> terms in correct context.</p> <p>Terms such as collagen and smooth muscle need to be in the correct areas.</p> <p>The 3 tunicas can stand alone, but <b>if described</b> need to have a correct description in the context of the mark scheme. For example “the t.intima is composed of collagen” would not get either QWC. “t. media has elastic muscle” would get QWC points for t.media and elastic because already penalised for not mentioning smooth for marking point S3.</p> |
|          |  |  | <b>Total</b>  | <b>[15]</b> |   |

| Question |     |  | Expected Answers  | Marks       | Additional Guidance  |
|----------|-----|--|---|-------------|--|
| 4        | (a) |  | <b>C</b> erythrocyte / red blood (cell) ;<br><b>D</b> neutrophil / phagocyte / granulocyte / polymorphonuclear (PMN), leucocytes / cells ;              | 2           | <b>DO NOT CREDIT</b> leucocyte unqualified<br><b>DO NOT CREDIT</b> monocyte / macrophage <b>OR</b> contradiction e.g. phagocyte – macrophage   |
|          | (b) | (i)  | (large) proteins / named proteins, missing in tissue fluid ;  | 1           | ora for plasma<br><b>ACCEPT</b> fewer / AW, (large) proteins<br><b>IGNORE</b> refs to cells<br><b>ACCEPT</b> plasma is within blood (vessels) / named vessel(s) <b>AND</b> tissue fluid surrounds / bathes tissues   |
|          |     | (ii)   | (high) pressure ;<br>at the arterial end / from the heart / AW ;<br>(it / fluid) moves out of capillary through gaps, in capillary wall / endothelium ; | 2 max       | <b>IGNORE</b> references to ultrafiltration<br><b>2. DO NOT CREDIT</b> implication that the artery itself generates the pressure<br><b>3. ACCEPT</b> pores / perforations / wall is leaky<br><b>ACCEPT</b> named fluid moving out e.g. water / plasma                      |
|          | (c) | 1 iron / Fe ;<br>2 four / 4 ;<br>3 Bohr, effect / shift ;<br>4 <u>carbonic anhydrase</u> ;<br>5 haemoglobinic acid ; |   | 5           | 1. <b>ACCEPT</b> Fe <sup>++</sup><br>2. <b>ACCEPT</b> 8 O (i.e. 4 x O <sub>2</sub> )<br>3. <b>ACCEPT</b> phonetic spellings of Bohr<br>5. <b>ACCEPT</b> reduced haemoglobin / HHb / phonetic approximations to haemoglobinic (usual ones are haemoglobonic or haemoglobic) |
|          |     |  | <b>Total</b>  | <b>[10]</b> |  |

## 2803/03 Practical Examination

- **Planning Exercise**

The mark scheme for the planning exercise is set out on page 35. The marking points **A** to **T** follow the coursework descriptors for Skill P.

Indicate on the plans where the marking points are met by using a tick and an appropriate letter. There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

- **Practical Test**

Pages 37 to 40 have the mark scheme for Questions 1 and 2 for the Practical Test.

**AS Biology. Planning exercise**

| Checking Point | Descriptor | The candidate   |
|----------------|------------|---|
| A              | P.1a       | Plans a suitable procedure that involves treating fruit extract with different temperatures and then adding to gel, and recording appearance of gel or measuring consistency ; <b>A</b> time to set   |
| B              | P.1a       | Gives a prediction about the effect of temperature stating that there will be no enzyme activity at x °C / gel will set at x °C ; <b>A</b> ref to denaturation  |
| C              | P.1b       | Selects suitable apparatus e.g. water bath / kettle / Bunsen etc, thermometer, apparatus for measuring volumes ;  |
| D              | P.3a       | States the action of protease, on <u>peptide</u> bonds (in collagen) ;  |
| E              | P.3a       | Identifies at least 2 key variables to control, e.g. concentration of enzyme / extract, volume of enzyme / extract, volume of gelatine (in Petri dish / core), concentration of gelatine, temperature at which enzyme is added to gelatine, time protease left at different temperatures, method of applying enzyme to gelatine ; |
| F              | P.3b       | Decides on an appropriate number of measurements to take, minimum of <b>five</b> different temperatures ;   |
| G              | P.3b       | Decides on an appropriate range of temperatures to heat treat the enzyme (must include 40 °C to 70 °C) ;  |
| H              | P.5b       | Describes way of obtaining reliable results, e.g. carrying out three replicates / “repeating each temperature twice” ;  |
| I              | P.5a       | <b>Uses</b> appropriate AS scientific knowledge and understanding to explain denaturation, e.g. named bonds break, change to active site / tertiary structure ;   |
| J              | P.5a       | <b>Uses</b> results from preliminary work or previous practical work to inform the plan ;   |
| K              | P.5a       | Refers to a safety aspect – gives hazard and precaution e.g. hot water and gloves or safety precautions when using enzymes – allergy ;  |
| L*             | P.5b       | <i>Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC) ;</i>  |
| M              | P.7a       | Describes how precise results are obtained, e.g. measuring an area around a well in a Petri dish / weighing cores of gelatine / dropping marbles / volume of liquid left after setting time ;   |
| N              | P.7a       | <b>Uses</b> information from two identified sources, e.g. text-book, web site, article, class notes ;   |
| O              | P.7b       | Shows how results are to be presented in a table <b>with all relevant units in column and/or row headings</b> ;   |
| P*             | P.7b       | <i>Uses spelling, punctuation and grammar accurately ;</i>  |
| Q              | P.7b       | Explains how data would be interpreted to show the effect of temperature on, setting / enzyme activity ;  |
| R              | P.7b       | Comments on precision, e.g. method given in <b>M</b> , use of intermediate temperatures ;   |
| S              | P.7b       | Comments on reliability, e.g. subjective nature of setting/not setting ;  |
| T              | P.7b       | Comments on validity, e.g. not using pure enzyme, maybe other compounds in fruit that influence setting of gel, effect of progressive denaturation during time held at x °C, temperature at which gelatine poured may influence enzyme action ;   |

Point mark up to **14** by placing letters **A** to **T** **excluding L and P** in the margin at appropriate points.

Then award **1** mark for each of **L** and **P** (QWC).

**Total: 16**

## 2803/03 Practical Examination

| Question |     |  | Expected Answers  | Marks |
|----------|-----|--|---|-------|
| 1        | (a) |  | <p>table format ;<br/> column / row headings – temperature and <u>conc</u>(entration) ;<br/> units (°C and %) in column headings ; <i>ecf</i> from MP2<br/> <b>R</b> if in body of table<br/> temperature in left hand column ;<br/> results – % at 70 °C is greater than % at 40 °C ;<br/> at least one result is given as an estimate ; <b>A</b> range between two concentrations<br/> time discs are immersed recorded / start and stop time recorded ;</p>  | 7     |
|          | (b) |  | <p>remove all, betalain / pigment ; <b>A</b> colour<br/> ref to colour of washing water ;<br/> cutting breaks cells ;<br/> vacuoles broken open / tonoplasts broken ;<br/> <i>idea that</i> if pigment leaks, then do not know how much caused by treatment ;<br/> <b>A</b> colour would be more intense than it should be / results are overestimates</p>  | 4 max |
|          | (c) |  | <p><i>description, allow ecf for results from (a)</i><br/> <b>1</b> trend of colour intensity / concentration as shown in table ;<br/> <b>2</b> ref to any individual result ; temperature and colour or concentration must be given<br/> <b>3</b> ref to concentration of betalain from colour standard ;<br/> <b>4</b> ref to any genuine anomalous result(s) ;</p> <p><i>explanation</i><br/> <b>5</b> pathway taken by, betalain / pigment, from vacuole to water described ;<br/> <i>vacuole → tonoplast / vacuolar membrane → cytoplasm → cell surface membrane</i><br/> <b>6</b> betalain / pigment, <u>diffuses</u> (out of, vacuoles / cells) ;<br/> <b>7</b> tonoplast / membrane, broken down / damaged / <u>more</u> permeable ;<br/> <b>8</b> cell surface membrane, broken down / damaged / <u>more</u> permeable ;<br/> <i>membrane unqualified = 1 mark</i></p> |       |
|          |     |  | <p><b>9</b> ref to more <u>kinetic</u> energy ;<br/> <b>10</b> <u>rate of</u>, diffusion / loss of / movement of, betalain increases as temperature increases ; (linked to 9)<br/> <b>11</b> proteins in membrane are denatured ;<br/> <b>12</b> tertiary structure, destroyed / changed ;<br/> <b>13</b> ref to named bonds broken ; <b>R</b> if only disulphide<br/> <b>14</b> phospholipids in membrane ;<br/> <b>15</b> become more fluid ; <b>A</b> membrane becomes more fluid<br/> <b>16</b> ref to fatty acid, chains / 'tails' ;</p>   | 8 max |

| Question |     | Expected Answers  | Marks                                      |
|----------|-----|---|--|
|          | (d) | <p>1 <i>idea that it is difficult to match colours ; A subjective</i><br/> 2 colours were intermediate between colour standards ;<br/> 3 make wider range of colour standards ;<br/> 4 use more intermediates (of colour standards) ;<br/> 5 example(s) from range used ; e.g. 'it was difficult to estimate the concentration at x °C</p> <p>6 stated problem with using syringes / AW ; A air bubbles<br/> R less accurate<br/> 7 use a graduated pipette / burette ; R 'biuret'</p> <p>8 volume of water added to specimen tubes not the same each time / ora ;</p> <p>9 discs not all uniform size ;<br/> 10 discs not rinsed sufficiently ;<br/> 11 appropriate improvement for cutting discs to uniform size ; R weighing<br/> 12 rinse until no purple colour visible in the water ; <i>rinse for longer</i> is neutral</p> <p>13 temperature of the water not maintained ;<br/> 14 leave in a thermostatically-controlled water bath ;</p> <p>15 discs not in the water for the same length of time / ora ;</p> <p>16 <i>idea of</i> lowest temperature at which membrane(s) destroyed not identified ;<br/> 17 using intermediate temperatures (at key point in range) ;<br/> 18 use higher temperature(s) ;</p> <p>19 results are, qualitative / not quantitative ;<br/> 20 use a colour scale (e.g. paint cards) ;<br/> 21 put experimental tube next to standard ;<br/> 22 use a colorimeter ; R calorimeter<br/> 23 need to calibrate the colorimeter ;<br/> 24 further detail ;<br/> 25 plot a calibration graph ;<br/> 26 use an intercept to find out exact concentration of betalain ;</p> <p>27 no replicates / no repeats ; A 'only did it once' / 'investigation should be repeated'<br/> 28 do at least three per temperature ; 'repeat until two results are the same' find / eliminate, anomalies ;</p> <p>29 AVP ;<br/> 30 AVP ;<br/> e.g. RT not recorded<br/> rinsing water left in the tube(s)<br/> dry discs before using them<br/> discs not left longer enough / leave discs for longer<br/> <i>idea that</i> discs 'stuck together'</p> <p>R contamination</p> | <p>12<br/>max<br/><br/>[Total:<br/>28]</p> |



| Question |  |     | Expected Answers  | Marks |
|----------|--|-----|---|-------|
| 2        | (a)  |     | <p><i>plan drawing with two main regions clearly labelled where mitoses occur A shaded</i></p> <p>lower zone near the root cap ;</p> <p>zones either side ; A go to edge but not meet it</p>  | 2     |
|          | (b)  | (i) | D =, L = A = in right hand margin   |       |
|          |  |     | <p><i>general drawing points, reject text book diagrams for MP3</i></p> <p><b>1</b> four cells with regular outlines ; <i>square / rectangular</i><br/>R if oval / cleavage furrow</p> <p><b>2</b> clear, continuous lines for cell walls ; <i>circle offending areas</i></p> <p><b>3</b> clear outlines of chromosomes in metaphase and anaphase ;<br/>R if thin lines</p> <p><b>4</b> no nuclear envelope in metaphase and anaphase ;</p> | 4     |
|          |  |     | <i>max 2 marks per phase reject text book diagrams for points in bold</i>   |       |
|          | <p><i>prophase</i></p> <p>nucleus intact / nuclear envelope drawn ;<br/>nucleolus ;<br/><b>nuclear detail (granular / thin threads) ;</b><br/><b>random arrangement of threads ;</b></p> |     | <p><i>metaphase</i></p> <p><b>chromosomes, in centre of cell /</b><br/><b>across equator ;</b><br/><b>chromatids shown on at least</b><br/><b>one chromosome ;</b></p>  |       |
|          | <p><i>anaphase</i></p> <p><b>fan-like arrangement of chromosomes ;</b><br/>symmetry about equator of cell ;<br/><b>chromosomes drawn as V's or U's ;</b></p>                             |     | <p><i>telophase</i></p> <p><b>two groups of chromosomes /</b><br/>two nuclei ;<br/>R if shown as two cells</p>  | 7 max |
|          |  |     |   |       |

| Question |  |       | Expected Answers   | Marks              |
|----------|--|-------|--|--------------------|
|          |  | (ii)  | <i>labels</i><br><br><b>1</b> cell wall ;<br><b>2</b> nucleus / nuclear envelope / nuclear membrane ;<br><b>3</b> nucleolus / chromatin ;<br><b>4</b> pole(s) ; <b>R</b> centriole(s)<br><b>5</b> chromosome ;<br><b>6</b> (position of) centromere ; metaphase and anaphase only<br><b>7</b> chromatid ; metaphase and anaphase only  | <b>4 max</b>       |
|          |  | (iii) | <i>prophase</i> chromatids / chromosomes, condensing / shortening / coiling / AW ;<br>chromosomes / chromatids, visible ;<br><i>metaphase</i> chromosomes aligned on, equator / metaphase plate ;<br><b>R</b> middle attach to spindle ;<br><i>anaphase</i> chromosomes / (sister) chromatids, separated ;<br><b>A</b> pulled apart chromosomes / chromatids, moving to poles ;<br><b>R</b> sides / ends<br><i>telophase</i> chromosomes, decondensing / uncoiling / AW ;<br><b>R</b> cytokinesis<br>AVP ; e.g. centromeres dividing | <b>4 max</b>       |
|          |  | (c)   | not, condensed / coiled / supercoiled / thickened / shortened / AW ;<br><b>A</b> long and thin<br>not stained intensely / AW ;<br>DNA synthesis ;<br>S phase (of mitotic cycle) ;<br>replication ;<br>semi-conservative ;<br>transcription / described ;<br>ref to protein synthesis ; <b>A</b> protein / enzymes, made<br>AVP ;   | <b>3 max</b>       |
|          |  |       |  | <b>[Total: 16]</b> |

## 2804 Central concepts

| Question |     |      | Expected Answers  | Marks       |
|----------|-----|------|---|-------------|
| 1        | (a) |      | E <u>phosphate</u> ;<br>F adenine / nitrogenous base ; R adenosine<br>G ribose / pentose / 5C sugar ;   | 3           |
|          | (b) | (i)  | water ; A ATPase / ATP synthase / ATP synthetase<br>hydrolysis ;  | 2           |
|          |     | (ii) | 30.6 ; A 30 - 31  | 1           |
|          | (c) |      | 1 found in all, cells / organisms ; R most cells, cells unqualified.<br>2 immediate source of energy ;<br>3 links energy releasing reactions to energy requiring processes;<br>4 named energy requiring process ;<br>5 phosphate to phosphate <u>bond</u> easily broken ;<br>6 releases, small packets/ AW, of energy ;<br>7 small / water soluble, so easily transported ; | 3 max       |
|          | (d) |      | 1 glycolysis (in cytoplasm) ;<br>2 substrate level phosphorylation ;<br>3 triose phosphate (TP) to pyruvate ;<br>4 gain of 2ATP ;<br>5 hydrogen removed from reduced NAD ; A NAD recycled<br>6 (so) glycolysis can continue ;   | 3 max       |
|          |     |      |   | [Total: 12] |

| Question |     |      | Expected Answers   | Marks |
|----------|-----|------|--|-------|
| 2        | (a) | (i)  | class ;<br>order ;<br><i>Canis</i> ;<br><i>lupus</i> ; <b>A</b> <i>Canis lupus</i> / <i>C. lupus</i>   | 4     |
|          |     | (ii) | capable of interbreeding ; <b>A</b> reproducing, mating<br>producing fertile offspring ;<br>belong to same gene pool / reproductively isolated ;<br>have a common ancestry ;<br>occupy the same (ecological) niche ;<br>have similar morphological, biochemical, behavioural, physiological<br>and anatomical features ( <i>must name two of these for mark</i> ) ;  | 2 max |
|          | (b) |      | <b>1</b> selected by humans ;<br><b>2/3</b> two examples of characteristic ; ; e.g. long back, muscular back,<br>long legs, small feet, fast<br><br><b>4</b> allowed to, mate / AW ;<br><b>5</b> offspring with ideal characteristics chosen to mate ; <b>A</b> best<br>offspring chosen (repeated) over many generations ;<br><b>6</b> allele frequency for desired characteristics increases / ref to<br>directional selection ;<br><b>7</b> precautions against, inbreeding / selection of undesirable traits ;   | 5 max |
|          | (c) | (i)  | <i>Jackal</i> - sympatric / behavioural / ecological / temporal ; <i>ignore<br/>reproductive isolation unqualified</i><br><br><i>Dingo</i> – geographical / allopatric ;   | 2     |
|          |     | (ii) | <b>1</b> all forms (fertile) hybrids with domestic dog ; <b>A</b> one named<br>species forming (fertile)<br><b>2</b> offspring with domestic dog (evidence suggests) domestic dog<br>not separate species ; <i>must be linked to mp1</i><br><br><b>3</b> red wolf and coyote form hybrids ; <b>R</b> fertile hybrids<br><b>4</b> may / may not, be fertile ;<br><b>5</b> may / may not, be separate species ;<br><b>6</b> (three types of) jackals do not interbreed ;<br><b>7</b> (evidence suggests) they are separate species ; <i>must be<br/>linked to mp 6</i> | 3 max |

| Question |     |  | Expected Answers   | Marks |
|----------|-----|--|--|-------|
| 3        | (a) |  | maintaining a, balanced / stable / constant ;<br>internal, environment /conditions ;   | 2     |
|          |     |  |  |       |
|          | (b) |  | <p>1 ref to basal membrane (of epithelial cell) ;</p> <p>2 <math>\text{Na}^+ - \text{K}^+</math> pump ;</p> <p>3 active process / uses ATP ;</p> <p>4 results in, low <math>\text{Na}^+</math> in (epithelial) cell / <math>\text{Na}^+</math> concentration gradient ; <b>A</b> sodium</p> <p>5 cotransport ;</p> <p>6 (binds) <math>\text{Na}^+</math> and amino acid ;</p> <p>7 <math>\text{Na}^+</math> ions move down concentration gradient ; <b>A</b> sodium</p> <p>8 amino acid transported into (epithelial) cell ;</p> <p>9 <u>facilitated</u> diffusion (of amino acids) into intercellular fluid ;</p> <p>10 using, membrane / carrier, protein ; <b>A</b> protein channel <i>must be in correct context</i></p> <p>11 <u>diffusion</u> (of amino acids) into, capillary / blood (from intercellular fluid) ;</p> <p>12 specific carriers for different amino acids ;</p> <p>13 AVP ; eg flow of blood in capillary maintains steep concentration gradient. ref to lots of mitochondria or microvilli.</p> | 7 max |
|          |     |  | QWC – legible text with accurate spelling, punctuation and grammar ;   | 1     |
|          |     |  | <b>[Total: 10]</b>   |       |

| Question |     |  | Expected Answers   | Marks |
|----------|-----|--|--|-------|
| 4        | (a) |  | more than two ;<br>forms / varieties, of a gene ;<br>interaction of genotype and environment ;<br>observable / measurable, characteristics (of organism) ; <b>A</b> physical features  | 4     |
|          | (b) |  | parental genotypes: $I^A I^O$ $I^B I^O$ ;<br>gametes: $I^A$ $I^O$ $I^B$ $I^O$ ;<br>children genotypes: $I^A I^B$ $I^A I^O$ $I^B I^O$ $I^O I^O$ ;<br>children phenotypes: AB   A   B   O ;<br><i>max 3 if fail to use symbols given</i>   | 4     |
|          | (c) |  | $\frac{1}{4} \times \frac{1}{4}$ ;<br>1/16 / 1 in 16 / 0.0625 / 6.25% ;<br><i>apply ecf if incorrect phenotypes in section b</i><br><i>2 marks awarded for correct answer without any working</i>  | 2     |
|          |     |  | <ol style="list-style-type: none"> <li>1 idea of identifying those most at risk / ref screening ;<br/><b>A</b> early diagnosis</li> <li>2 identify faulty, genes / alleles / DNA , <b>or</b> identify carriers ;<br/><i>(prenatal) diagnosis can allow</i></li> <li>3 early treatment / termination / selection of embryo ;</li> <li>4 genetic counselling / life style advice ;</li> <li>5 drugs targeted for individual / AW ;</li> <li>6 gene therapy ;</li> <li>7 problem with, false positives / negatives ;</li> <li>8 idea of identifying disorders for which there is no treatment ;</li> <li>9 leading to e.g. discrimination / insurance problems / employment problems ;</li> </ol> | 3 max |
|          |     |  | <b>[Total: 13]</b>   |       |

| Question |     |      | Expected Answers  | Marks              |
|----------|-----|------|---|--------------------|
| 5        | (a) | (i)  | islets of Langerhans ; <b>R Islands</b>   | 1                  |
|          |     | (ii) | globular ;<br>proteins / polypeptide ;<br>(made up of chains of) amino acids ;<br>peptide bonds ;<br>small / insulin 51 amino acids / glucagon 29 amino acids ;<br>AVP ; e.g. (each molecule) made up of two chains. Held together by disulphide bonds / bridges.   | 2 max              |
|          | (b) | (i)  | 237/60 x 100 <b>A</b> 235 - 239<br><br>395 ; ; <b>A</b> 390 – 399<br><i>Award two marks for correct answer if no working given.</i>   | 2                  |
|          |     |      | <b>1</b> (insulin) released into / transported in, blood ;<br><b>2</b> binds to (glycoprotein) <b>receptors</b> ;<br><b>3</b> on cell (surface) membrane ; <b>A</b> plasma membrane<br><b>4</b> (cells) of liver, muscle and <b>adipose</b> tissue ;<br><b>A</b> any two of the three for the mark<br><b>5</b> increases, membrane permeability ;<br><b>6</b> rate of glucose, absorption / uptake, increases (particularly in muscle tissue) ;<br><b>7</b> ref to, increased activity / release of, enzymes ;<br><b>8</b> rate of conversion of glucose to fat increases (in adipose tissue / liver) ;<br><b>9</b> <u>glucose</u> <b>respiration</b> increases ;<br><b>10</b> suppresses / AW, <b>gluconeogenesis</b> / AW ;<br><b>11</b> glucose to <b>glycogen</b> / <b>glycogenesis</b> (in liver and muscles) ;<br><b>12</b> inhibits glucagon secretion ; <b>A</b> glucagon concentration falls<br>correct data quote relating to fall in glucose<br><br><b>13</b> concentrations over a stated time <b>or</b> from max (7.6) to min (4.1) including units ;<br><br><b>14</b> AVP ; e.g. details of changes of membrane permeability or named enzyme such as <b>glycogen synth(et)ase</b> | 7 max              |
|          |     |      | <b>QWC – clear well organised using three specialist terms in the correct context ; <i>Specialist terms are in bold.</i></b>  | 1                  |
|          |     |      |   | <b>[Total: 13]</b> |

| Question |     |       | Expected Answers   | Marks       |
|----------|-----|-------|--|-------------|
| 6        | (a) | (i)   | instability of, mud / soil ;<br>waterlogged / low oxygen levels in soil / low nitrate ;<br>varying salinity / high salt concentration / low water potential ;<br>idea of periodic, desiccation / submergence ;<br>ref to wave action on plants ;   | 2 max       |
|          |     | (ii)  | <i>similarity</i> – same, sequence / zonation / pattern, as move up shore ;<br><i>Salicornia</i> always at lowest elevation / first in succession ;<br><i>Juncus</i> always at highest elevation / final plant in succession ;<br>all plants found between 4 and 34 cm above sea level / ora ;<br>species have similar spread on both marshes (23/24 cm) ;<br>elevation range of <i>Salicornia</i> does not overlap with any other species / ora ;<br><i>Salicornia</i> only species with non overlapping ranges on A and B ;<br><i>max 1</i><br><i>difference</i> – plants found at higher elevations in salt marsh B / ora ;<br><i>Limonium</i> found at higher elevation than <i>Sarcocornia</i> in A / ora ;<br>species mean soil elevations greater range in A than B (19/15) ;<br><i>max 1</i> | 2 max       |
|          |     | (iii) | <i>Salicornia</i> ;  | 1           |
|          |     | (iv)  | stabilise soil / develop soil structure ;<br>increase humus content ;<br>raise soil levels ;<br>aerate soil ;<br>decrease salinity / change pH ;<br>provide food ;<br>shelter / form microhabitat ;<br>nitrogen fixation / increase nitrates / increase minerals ;   | 2 max       |
|          | (b) | (i)   | two from <i>Spartina</i> , <i>Limonium</i> and <i>Sarcocornia</i> ; mark first two answers   | 1           |
|          |     | (ii)  | light / minerals / named mineral / carbon dioxide / pollinators / space ;<br>R water, nutrients. mark first answer in list   | 1           |
|          | (c) |       | 1 transect ;<br>2 continuous / belt / interrupted / line ;<br>3 random placement of transect / AW ;<br>4 use quadrats / point quadrat ; R quadrant<br>5 measurement of elevation for each quadrat ;<br>6 percentage cover within quadrat / number of hits with point quadrat ;<br>7 use ACFOR scale ;<br>8 reliability – large number of quadrats / repeat transect ;<br>9 AVP ; e.g. use of keys, reference to safety, calculate mean percentage cover.<br><i>max 3 if no transect</i>  | 4 max       |
|          |     |       |  | [Total: 13] |



| Question |     |       | Expected Answers   | Marks              |
|----------|-----|-------|--|--------------------|
| 7        | (a) |       | <p><b>P</b> – photosystem 2 / P680 ;</p> <p><b>Q</b> – electron carrier / electron acceptor / cytochrome / plastoquinone / plastocyanin ;</p> <p><b>A</b> ETC</p> <p><b>R</b> – photosystem 1 / P700 ;</p> <p><b>S</b> – ATP syn(thet)ase / stalked particle / protein channel ;</p>   | 4                  |
|          | (b) | (i)   | <p><b>1</b> changes shape of electron carrier ;</p> <p><b>2</b> no / reduced, pumping of protons / proton gradient / proton motive force / chemiosmosis ;</p> <p><b>3</b> <u>photophosphorylation</u> stops ; <b>A</b> only cyclic hotophosphorylation occurs</p> <p><b>4</b> no / less, ATP produced ;</p> <p><b>5</b> no reduced NADP produced ;</p> <p><b>6</b> GP not converted to TP ; <b>A</b> PGA and GALP</p> <p><b>7</b> no, carbon fixation / Calvin cycle / light independent stage ;</p> <p><b>8</b> no (hexose) sugars / organic molecules, formed ;</p> <p><b>A</b> <i>named, hexose / organic molecule</i></p> <p><b>9</b> no respiratory substrate / respiration stops ;</p> | 5 max              |
|          |     | (ii)  | <p>mutation / allele to produce tripeptide ;</p> <p>atrazine inactive in bound form ;</p> <p>ref to tonoplast being a barrier / idea of isolated in vacuole ;</p> <p>does not enter chloroplast / does not bind with, chloroplast protein / named protein / ETC / thylakoid ;</p>  | 2 max              |
|          |     | (iii) | <p><b>1</b> (if crop plant insensitive to atrazine) only weeds killed / AW ;</p> <p><b>2</b> ref to, removal / reduction, of <u>competition</u> ;</p> <p><b>3</b> e.g. of competition ; (minerals / named mineral / light / space / water) increased yield of maize ;</p> <p><b>4</b> can spray whole field / AW ;</p> <p><b>5</b> can spray (at any time) after germination of maize ;</p> <p><b>6</b> easier / cheaper to administer ;</p>   | 2 max              |
|          |     |       |  | <b>[Total: 13]</b> |

## 2805/01 Growth, Development and Reproduction

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
| 1        | (a) |  | Prokaryotae / Prokaryote ; <b>A</b> Monera <span style="float: right;">1 max</span>  |                    |
|          |     |  |  |                    |
|          |     |  | <i>any two from</i><br>no membrane-bound organelles / No ER ; <b>A</b> named organelle<br>cell walls, murein / peptidoglycan ;<br>DNA, free in cytoplasm / not in nucleus ;<br>DNA, naked / not associated with histones / proteins / not organised into chromosomes / AW ;<br>circular DNA ;<br>no mitosis ;<br>70s / smaller ribosomes ; <span style="float: right;">2 max</span>  | <b>3 max</b>       |
|          |     |  |  |                    |
|          | (b) |  | 1.27 $\mu\text{m}$ ;; <span style="margin-left: 20px;"><b>A</b> within range 1.27 – 1.32 <math>\mu\text{m}</math></span><br><br>$\frac{28 \times 1000}{21 \ 250}$ <span style="margin-left: 20px;"><b>A</b> within range 27 – 28 mm</span> <span style="float: right;">1 max</span>  |                    |
|          |     |  |  |                    |
|          | (c) |  | <i>Answers may be taken from a labelled diagram</i><br><br>binary fission ; <span style="margin-left: 100px;"><i>cell division neutral</i></span><br>DNA replicates ;<br>cell wall grows in across middle / ref to mesosome / AW ;<br>may take only twenty minutes / is very fast ;<br>asexual / genetically identical / produces a clone ;<br>plasmids replicate ; <span style="float: right;">3 max</span>   |                    |
|          |     |  |  |                    |
|          | (d) |  | <i>idea of opportunistic bacterium ;</i><br>(people in hospital) may be immune compromised / AW ;<br>(people in hospital) may have open wounds ;<br>incoming patients not screened / ref to enclosed environment, increases spread ;<br>bacterium able to multiply (because resistant to antibiotics) ;<br>transfer by (medical) personnel / visitors ;<br>hospital personnel leave hospital in hospital clothing ; <span style="float: right;">3 max</span> |                    |
|          |     |  |  |                    |
|          |     |  |  | <b>[Total: 11]</b> |

| Question |     |  | Expected Answers  | Marks        |
|----------|-----|--|---|--------------|
| 2        | (a) |  | <p style="text-align: right;"><i>5 max for D (describe) statements</i></p> <p><b>D1</b> tetrad ;</p> <p><b>D2</b> the (four) pollen <u>grains</u> separate ;</p> <p><b>D3</b> each develops an outer wall ;</p> <p><b>D4</b> <b>exine</b> ;</p> <p><b>E5</b> sculptured to match stigma of own species / AW ;</p> <p><b>D6</b> <b>sporopollenin</b> ;</p> <p><b>E7</b> enables, long term survival / protection, of pollen / AW ;</p> <p><b>D8</b> <b>intine</b> ;</p> <p><b>D9</b> thin inner wall / pits ;</p> <p><b>E10</b> allows growth of pollen tube ;</p> <p><b>D11</b> <u>pollen</u> grain <u>nucleus</u> divides into two ;</p> <p><b>D12</b> <b>generative nucleus</b> ; <span style="float: right;"><i>R degenerative</i></span></p> <p><b>D13</b> divides into two (male) <b>gametes</b> ;</p> <p><b>D14</b> <b>haploid</b> ;</p> <p><b>E15</b> to maintain chromosome number / fuse with haploid ovum forming diploid zygote/AW ;</p> <p><b>D16</b> <b>pollen tube nucleus</b> ;</p> <p><b>E17</b> controls growth of pollen tube ;</p> | <b>7 max</b> |
|          |     |  |   |              |
|          |     |  | <b>QWC - clear, well organised using specialist terms ;</b>   | <b>1</b>     |
|          |     |  | <b>At least 3 of the terms shown in bold: tetrad, exine, sporopollenin, intine, generative nucleus, gametes, haploid, pollen tube nucleus</b>   |              |

| Question |     |       | Expected Answers   | Marks              |
|----------|-----|-------|--|--------------------|
|          | (b) |       | spray crop for weeds growing amongst oil seed rape, without damaging crop / AW ;<br>reduce competition for, space / nutrients / qualified ;<br>increased yield / more profitable / AW ;  | 2 max              |
|          | (c) | (i)   | most GM seeds occurred within 75m of GM crop ;<br>the closer to the GM crop the greater the percentage of GM seeds ;<br>some GM seeds found significant distance from GM crop / AW ;<br>figs to illustrate both axes ;<br>percentages are small overall / AW ;<br>negative correlation ;   | 3 max              |
|          |     | (ii)  | (small percentages of resistant seeds because) majority of pollen will have come from pollination within non-GM crop ;<br>gene for weed killer resistance is in, nucleus / genome / chromosome / genetic material, of the GM pollen ;<br>must have been <u>cross-pollination</u> between GM and non-GM ;<br>(cross-) pollination limited by distance pollen travels, qualified ;<br>AVP ; modified gene passed on to other generations / method of cross pollination | 3 max              |
|          |     | (iii) | (transect is long) line / AW ;<br>sample along line ;<br>used to assess changes along line ; 2 max<br><br><i>explanation must be linked to purpose of investigation in question</i><br>increases reliability of the results ;<br>calculate means / averages ;<br>samples larger area ;<br>AVP ; e.g. belt / point / interrupted / ref to sampling technique 2 max  | 3 max              |
|          |     |       |  |                    |
|          |     |       |  | <b>[Total: 19]</b> |

| Question |     |       | Expected Answers   | Marks              |
|----------|-----|-------|--|--------------------|
| 3        | (a) |       | <p>interstitial cells / cells of Leydig ;<br/> secrete a hormone / testosterone ;      <b>A</b> inhibin<br/> directly into blood / ductless ;<br/> controlled by negative feedback loop / described / controls secretion of<br/> LH / FSH ;<br/> long term effect / described ;      <i>3 max</i></p> <p>(testes) contain germ cells / germinal epithelium ;<br/> seminiferous tubules ;<br/> produce, sperm / male gamete / spermatids etc ;<br/> (by) <u>spermatogenesis</u> ;      <i>3 max</i></p> | <b>5 max</b>       |
|          | (b) |       | <p><i>need a lot...</i><br/> to help one penetrate (fertilisation ) membrane / zona / follicle cells ;<br/> to increase the chances of sperm meeting <u>2ndry oocyte</u> ;<br/> many are, malformed / poor swimmers / AW ;<br/> many die in hostile vaginal environment / AW ;</p>   | <b>3 max</b>       |
|          | (c) | (i)   | <p>0.73 (%) ;;</p> <p><math>\frac{66 \times 100}{9\,000}</math>      <i>1 max</i></p> <p><i>if not two decimal places 1 max</i></p>  | <b>2 max</b>       |
|          |     | (ii)  | <p>Na<sup>+</sup> / K<sup>+</sup> / ion / electrolyte / water, balance upset ;<br/> needed for nerve impulse transmission ;<br/> detail of role K<sup>+</sup> / NA<sup>+</sup> in nerve transmission ;<br/> detail of role K<sup>+</sup> / NA<sup>+</sup> in nephron ;<br/> heart muscle would not contract ;<br/> respiratory muscle would not contract ;<br/> AVP ; eg. renal failure / co-factor for enzymes</p>  | <b>3 max</b>       |
|          |     | (iii) | it is not reversible / AW ;  | <b>1</b>           |
|          | (d) |       | <p>high doses of testosterone inhibit hypothalamus / GnRH ;<br/> also inhibit <u>anterior</u> pituitary gland ;<br/> so no / less, FSH / LH / ICSH ;<br/> seminiferous tubules, not stimulated to produce sperm / inhibit<br/> spermatogenesis ;<br/> Sertoli cells not stimulated ;<br/> reduced libido ;</p>   | <b>4 max</b>       |
|          |     |       |  | <b>[Total: 18]</b> |

| Question                    |                       |           | Expected Answers   | Marks   |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
|-----------------------------|-----------------------|-----------|--|---------|-----------------------|-----------|------------|---|---|-----------------------------|---|---|-------------|---|---|--------------|---|---|-------------------|---|---|-----------------|---|---|-------------|---|---|-------|
| 4                           | (a)                   | (i)       | <p>One mark for each correct row. If only ticks given throughout assume blank spaces are crosses. R hybrid ticks</p> <table><tr><th>symptom</th><th>premenstrual syndrome</th><th>menopause</th></tr><tr><td>depression</td><td>✓</td><td>✓</td></tr><tr><td>water retention or bloating</td><td>✓</td><td>X</td></tr><tr><td>mood swings</td><td>✓</td><td>✓</td></tr><tr><td>night sweats</td><td>X</td><td>✓</td></tr><tr><td>loss of bone mass</td><td>X</td><td>✓</td></tr><tr><td>aches and pains</td><td>✓</td><td>X</td></tr><tr><td>hot flushes</td><td>X</td><td>✓</td></tr></table> | symptom | premenstrual syndrome | menopause | depression | ✓ | ✓ | water retention or bloating | ✓ | X | mood swings | ✓ | ✓ | night sweats | X | ✓ | loss of bone mass | X | ✓ | aches and pains | ✓ | X | hot flushes | X | ✓ | 6 max |
| symptom                     | premenstrual syndrome | menopause |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| depression                  | ✓                     | ✓         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| water retention or bloating | ✓                     | X         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| mood swings                 | ✓                     | ✓         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| night sweats                | X                     | ✓         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| loss of bone mass           | X                     | ✓         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| aches and pains             | ✓                     | X         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| hot flushes                 | X                     | ✓         |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
|                             |                       | (ii)      | an imbalance of, oestrogen and progesterone ;<br>(oestrogen and progesterone ) decline at different rates ;<br>progesterone deficiency / lack of progesterone (is most likely cause) ;   | 2 max   |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
|                             |                       | (iii)     | ovarian <u>follicles</u> do not develop ;<br>oestrogen / progesterone production, stops / decreases ;<br>ovaries respond less to FSH ;<br>AVP ;  | 2 max   |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |
| continued                   |                       |           |  |         |                       |           |            |   |   |                             |   |   |             |   |   |              |   |   |                   |   |   |                 |   |   |             |   |   |       |

| Question |     |  | Expected Answers  | Marks              |
|----------|-----|--|---|--------------------|
|          | (b) |  | <p><i>Table 4.1</i></p> <p><b>1</b> the first statement (in the question) is supported by Table 4.1 / AW / post menopausal women are more likely to suffer CHD than pre menopausal women ;</p> <p><b>2</b> CHD increases as women age in both groups ;</p> <p><b>3</b> comparative figs to illustrate ;</p> <p><b>4</b> the <u>rate</u> of increase / AW, is <u>greater</u> as the women become older (in both groups) ;</p> <p><b>5</b> the risk of CHD increases, <u>significantly</u> / AW, with age in post-menopausal women ;</p> <p><b>6</b> the <u>rate</u> of increase is greater in post-menopausal women ;</p> <p><b>7</b> calculate comparative figs between pre- and post-menopausal women to illustrate ;</p> <p><b>8</b> AVP ; <span style="float: right;"><i>5 max</i></span></p> <p><i>Table 4.2</i></p> <p><b>9</b> the second statement (in the question) is <b>not</b> supported by Table 4.2 / AW / the risk of heart attacks is not much reduced by HRT ;</p> <p><b>10</b> data show there are slightly less non-fatal heart attack if taking HRT ;</p> <p><b>11</b> fatal heart attacks more common if taking HRT ;</p> <p><b>12</b> (but) not, statistically / enough to be valid / AW ;</p> <p><b>13</b> differences in data on fatal and non fatal heart attacks</p> <p><b>14</b> cancels out / total incidence of heart attack is almost equal ;</p> <p><b>15</b> comparative figs to illustrate ;</p> <p><b>16</b> AVP ; <span style="float: right;"><i>5 max</i></span></p> | <b>7 max</b>       |
|          |     |  | <b>QWC - legible text with accurate spelling, punctuation and grammar;</b>  | <b>1</b>           |
|          |     |  | <i>Candidates should have no more than three different spelling errors; sentences should be accurately punctuated according to spoken English and text should be legible.</i>   |                    |
|          |     |  |   | <b>[Total: 18]</b> |

| Question |     |       | Expected Answers   | Marks              |
|----------|-----|-------|--|--------------------|
| 5        | (a) | (i)   | (they are) stem cells ;<br>can develop into any kind of cell ;<br>pluripotent ; <b>A</b> <i>totipotent / omnipotent</i><br>undifferentiated / unspecialised ;  | <b>1 max</b>       |
|          |     | (ii)  | <i>ethical issue ;<br/>qualification ;</i><br><br>e.g. rights of embryo ;                      may have unpredictable effects ;<br>qualified ;                                      qualified ;<br><br>named religious objection ;              AVP ;<br>qualified ;                                      AVP ;<br><br>potential for curing (degenerative) disease ;<br>example of disease ; | <b>4 max</b>       |
|          |     | (iii) | only one, oocyte and one sperm (involved in fertilisation) / fertilised ovum ;<br>monozygotic ;<br>embryo splits ( after fertilisation ) ;<br>they are <u>clones</u> ;   | <b>2 max</b>       |
|          | (b) | (i)   | mitosis ;<br>increase in cell number / AW ;<br>embryo increases in, mass / size ;<br>blastocyst / blastomere ;<br>uses food store / nutrients, from ovum ;<br>absorbs oxygen from surroundings by diffusion ;  | <b>3 max</b>       |
|          |     | (ii)  | <u>differentiate</u> ;<br>all cells <u>genetically</u> identical ;<br>genes are switched on / off ;<br>differentiate / specialise for a particular function / form, tissues / organs<br>/ named e.g.;  | <b>2 max</b>       |
|          |     | (iii) | maintains the <u>corpus luteum</u> ;<br>for first 3 months (of pregnancy) ;<br>the corpus luteum secretes progesterone ;<br>which maintains the <u>endometrium</u> / <u>lining</u> of uterus ;<br><b>R</b> growth of   | <b>2 max</b>       |
|          |     |       |  | <b>[Total: 14]</b> |



| Question           |  |  | Expected Answers  |                         |  | Marks |
|--------------------|--|--|---|-------------------------|--|-------|
| 6                  |  |  | substance exchanged   | the method used         | description of transport mechanism across the placental membrane   |       |
|                    |  |  | water   | osmosis                 | partially permeable membranes in capillaries and chorionic villi, with a water potential gradient across them.<br>Water moves down a water potential gradient  |       |
|                    |  |  | glucose   | facilitated diffusion ; | through chorionic villi ; <b>A once in any description</b><br><br>hydrophilic channels ;<br><u>protein</u> , channel / carrier / transport <u>protein</u> ;<br>specific (for glucose) ;<br>passive / correct ref to concentration gradient ; 3 max |       |
|                    |  |  | antibodies  | pinocytosis ;           | (small) vacuoles / vesicles form ;<br>ref exo- and endocytosis;  |       |
|                    |  |  | calcium ions  | active transport ;      | specific ;<br>protein channels / carriers / gates ;<br><b>R</b> transport energy / ATP, required ;<br>from low to high concentration / AW; 3 max   |       |
|                    |  |  | <i>allow ecf for correct description of method, even if method is wrong for a particular substance</i><br><i>If diffusion quoted, no mark for the Method, but mark the description as if it were facilitated diffusion.</i> |                         |  |       |
| <b>[Total: 10]</b> |  |  |   |                         |  |       |

## 2805/02 Applications of Genetics

| Question |     |      | Expected Answers  | Marks |
|----------|-----|------|---|-------|
| 1        | (a) |      | hybrid is triploid/3n ;<br>uneven number / 3, of each chromosome ;<br>(homologous) chromosomes cannot, pair / synapse, in meiosis ;<br>meiosis fails ; <b>A</b> can not undergo meiosis<br>no, ovules / pollen, produced / no viable gametes ;  | max 3 |
|          | (b) |      | sterile conditions ;<br>explant / description ;<br>meristematic / cambial / totipotent / pluripotent, cells ;<br>nutrient solution to stimulate mitosis ;<br><u>callus</u> formed ;<br>subdivided ;<br>nutrient / hormone / pgf solution to stimulate differentiation into<br>plantlets ;<br>named, nutrient / PGR ;  | max 5 |
|          | (c) | (i)  | store of genetic variation / diversity ;<br>store of different <u>alleles</u> ; <b>R</b> 'genes'<br>stored as complete, genotype / genome / organism ;<br>not stored as separate lengths of DNA ;<br><br><i>any two examples of how kept from ; ;</i><br>wild population<br>rare breed<br>zoo<br>botanic garden<br>cultivated crop<br>tissue culture<br>seed bank<br>sperm bank / frozen sperm<br>frozen embryos<br>frozen eggs             | max 3 |
|          |     | (ii) | ref. genetic / DNA fingerprinting ;<br>DNA cut by restriction enzyme(s) ;<br>VNTRs / equivalent pieces of DNA / alleles (A genes), may be same<br>or different lengths ;<br>different lengths = genetic variation ;<br>use of electrophoresis ;<br>negatively charged pieces move to anode ;<br>smaller, pieces / AW, move further / ora ;<br>visualisation of bands ;<br>bands in different places show genetic variation / ora ;<br>AVP ; | max 4 |
|          |     |      | <b>[Total: 15]</b>  |       |

| Question |     |      | Expected Answers  | Marks              |
|----------|-----|------|---|--------------------|
| 2        | (a) |      | lack of oxygen / anaerobic conditions ;<br>so anaerobic respiration ;<br>ethanol / ethyl alcohol, produced ;<br>toxic ;<br>ALD breaks down alcohol ;<br>detail ; <i>for example</i> NAD to reduced NAD / NAD dependent /<br>ethanol to, ethanal / acetaldehyde  | max 3              |
|          | (b) |      | different R groups ;<br>different bonds available ;<br>shape / 3D / 3', structure of protein different ;<br>cannot bind to DNA / active site changed / can not bind to DNA ;<br>hydrophil replaced by hydrophobe ;  | max 3              |
|          | (c) | (i)  | all three elongate during submergence ;<br>expression of <i>Sub1-A1</i> reduced elongation ;<br>I more than doubles height / x 2.4 / grows 28 cm ;<br>T, very slightly taller / insignificant change / grows 2 cm ;<br>I*, much smaller before submergence ;<br>extends x1.5 / grows 5 cm ;<br>comparative figures ;          | max 4              |
|          |     | (ii) | <i>any two of the following reasons ; ;</i><br>rapid growth so increased respiration<br>runs out of, energy / ATP<br>oxygen deficit<br>build up of toxic ethanol<br>mutant more tolerant of toxins<br>rapid elongation of cells<br>cell walls too thin / too little, cellulose / lignin, laid down<br>poor support / collapse | max 2              |
|          | (d) |      | <i>any three of the following advantages of genetic engineering ;;;</i><br>quicker<br>desired trait(s) only<br>does not dilute desirable traits of high yield variety<br>does not dilute alleles of background genes<br>can use genes from different species  | max 3              |
|          |     |      |   | <b>[Total: 15]</b> |

| Question |     |  | Expected Answers  | Marks              |
|----------|-----|--|---|--------------------|
| 3        | (a) |  | mitosis in egg cell but no cytokinesis / AW ;<br>doubles haploid chromosome number to diploid ;<br>products of mitosis genetically identical ;<br>replication of chromatids results in homozygosity at all loci ;<br>so bands found in genetic fingerprinting offspring all found in female ;<br>egg was produced by meiosis ;<br>eggs not genetically identical ;<br>ref. independent assortment ;<br>ref. crossing over / recombination ;   | max 4              |
|          | (b) |  | doubling chromosome number gives WW and ZZ ;<br>only ZZ survive / ora ;<br>suggests, at least one Z essential / Z carries essential gene(s) ;<br>WW not viable because embryo lacks essential gene(s) ;   | max 2              |
|          | (c) |  | <ol style="list-style-type: none"> <li>1 programme needs to maintain genetic diversity ;</li> <li>2 by making many different matings ;</li> <li>3 unattractive / weak / AW, individuals may have alleles needed for survival in wild ;</li> <li>4 isolated females may use asexual reproduction ;</li> <li>5 offspring, not heterozygous / homozygous at all loci ;</li> <li>6 allows expression of deleterious recessive alleles/increased effect of genes ;</li> <li>7 ref. inbreeding depression ;</li> <li>8 loss of, vigour / fertility / fitness ;</li> <li>9 reduced genetic variation ;</li> <li>10 less chance advantageous variant ;</li> <li>11 loss of alleles ;</li> <li>12 loss of all, alleles / genes, on W ;</li> <li>13 genetic erosion / smaller gene pool ;</li> <li>14 problems when animals returned to wild ;</li> <li>15 all male so sex ratio upset ;</li> </ol> | max 8              |
|          |     |  | <b>QWC - legible text with accurate spelling, punctuation and grammar</b>   | 1                  |
|          |     |  |   | <b>[Total: 15]</b> |

| Question |     |       | Expected Answers   | Marks |
|----------|-----|-------|--|-------|
| 4        | (a) |       | mutation giving resistance ;<br>random / chance / pre-existing ;<br>mutation acquired by conjugation / transformation / transduction /<br>AW ;<br>antibiotic is selective agent ;<br>resistance is selective advantage ;<br>resistants survive and pass mutation to offspring / reproduce ;<br>vertical transmission ;<br>importance of rapid multiplication ;<br>frequency of mutation increases in population ;<br>natural selection ; | max 4 |
|          | (b) | (i)   | first generation <b>str</b> has slower protein synthesis than sensitive ;<br>9 aa sec <sup>-1</sup> compared with 18 ;<br>so slower growth means at disadvantage ;<br>final generations, protein synthesis almost the same / <b>str</b> not<br>significantly different from, sensitive ;<br>18 aa sec <sup>-1</sup> compared with 20 ;<br>very small disadvantage / not a disadvantage ;   | max 4 |
|          |     | (ii)  | (other) mutations ;<br>more effective enzymes ;<br>detail ; e.g. increased affinity / increased turnover number / better<br>fit of active site<br>allows alternative pathways / different metabolism ;<br>differences not from change in resistance mutation ;<br>ref. natural selection ;   | max 3 |
|          |     | (iii) | not successful for this mutation ;<br>kept resistance ;<br>kept, mutation / DNA triplet ;<br>but limited time frame [ <i>could be as little as 90 h</i> ] ;<br>laboratory experiment / not in natural environment ;<br>not growing in competition with other bacteria ;<br>difference may be significant in competitive environments ;<br>no evidence about other, mutations / antibiotics ;   | max 4 |
|          |     |       | <b>[Total: 15]</b>   |       |

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
| 5        | (a) |  | likelihood of trisomy / chromosome abnormalities increases with maternal age ;<br>very rapid increase at, 35 / 40 ;<br>increased chance of non-disjunction in meiosis ;<br>homologues fail to separate properly ;<br>ref. oocytes in suspended, meiosis / prophase 1, since mother was a fetus / long time ;<br>vulnerable to, internal / external, factors ;  | max 4              |
|          | (b) |  | <i>any three comments from</i> ;;;<br>embryo is female<br>embryo has, chromosomal / genetic, abnormality<br>embryo would not be implanted<br>shows trisomy 18<br>18 larger than 21 so more severe abnormality<br>not, trisomy 21 / Down's / triple X / trisomy 13 / Patau<br>shows non-disjunction has occurred<br>increased chance of spontaneous abortion if implanted<br>decreased quality of life of future child if implanted<br>decreased life expectancy of future child if implanted   | max 3              |
|          |     |  | 1 (desirable) female <b>superovulated</b> / AW ;<br>2 ref. FSH ;<br>3 desirability of, female / male, determined by <b>progeny testing</b> ;<br>4 eggs harvested ;<br>5 <b>IVF</b> / fertilised <i>in vitro</i> ;<br>6 or female inseminated by, male / <b>AI</b> ;<br>7 and embryos, washed out of uterus / recovered from oviduct ;<br>8 may be <b>cloned</b> ;<br>9 may be, genetically tested / sexed ;<br>10 may be implanted in <b>surrogate</b> ;<br>11 which may be different species ;<br>12 may be temporarily implanted in small 'portmanteau' species / AW ;<br>13 surrogate treated with hormones to prepare uterus / synchronise <b>oestrus</b> ;<br>14 AVP ; e.g. frozen for future use / 2 + implanted same time | max 7              |
|          |     |  | <b>QWC - clear, well-organised answer using 3 specialist terms</b>   | 1                  |
|          |     |  |  | <b>[Total: 15]</b> |

| Question |     |      | Expected Answers   | Marks              |
|----------|-----|------|--|--------------------|
| 6        | (a) |      | large number of different (deleterious) mutations ;<br>recessive allele ;<br>only expressed when homozygous ;<br>autosomal / not sex-linked / (commonly mutated gene) on chromosome 7 ;<br>heterozygote unaffected ;<br>2, heterozygotes / carriers, have 1 in 4 chance of affected offspring ;<br>applies to carriers of same mutation ;  | max 4              |
|          | (b) |      | chloride / $\text{Cl}^-$ , (not pumped) out of cell ;<br>also, hydrogen carbonate / bicarbonate / $\text{HCO}_3^-$ ;<br>water does not follow ;<br>so mucus, dehydrated / thick ;<br>blocks, airway / gut / ducts ; <b>R</b> not blocks lungs<br>breathing problems/scared lungs ;<br>lung infections ;<br>poor digestion/enzymes can leave the pancreas to gut ;<br>sterility ; | max 4              |
|          | (c) | (i)  | greater percentage open at higher concentrations of ATP in all 3 cases ;<br>both A and B require higher concentrations of ATP to reach same percentage open as normal CFTR ;<br>A responds to lower concentrations of ATP than B / A more sensitive than B ;<br>A 85% & B 60% when normal CFTR 100% ; <b>A other valid comparison</b>  | max 3              |
|          |     | (ii) | (supports suggestion because)<br>higher concentrations of ATP needed for same effect as normal ;<br>suggests lower affinity for ATP ;<br>A and B require different concentrations for same effect ;<br>because change in shape of binding site ;<br>because change in available bonds at binding site ;  | max 2              |
|          | (d) |      | ATP binding site not affected ;<br>change somewhere on periphery of molecule/out side ATP binding site ;<br>affects how transported ;<br>affects action of chaperones / how protein guided to membrane ;<br>affects entry into membrane bilayer / if placed in bilayer works ;<br>change in hydrophobic bonds needed ;<br>AVP ; e.g. in binding site to membrane                 | max 2              |
|          |     |      |  | <b>[Total: 15]</b> |

## 2805/03 Environmental Biology

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
| 1        | (a) |  | hedgehog presence linked to decrease in (both) bird populations (south island) ;<br>correct ref to relevant data ;<br>hedgehog absence linked to increase in (both) bird populations (north island) ;<br>correct ref to relevant data ;  | max 4              |
|          | (b) |  | hedgehogs do not eat oystercatcher eggs ;<br>eggs too large ;<br>eggs camouflaged ;<br>eggs distasteful to hedgehogs ;<br>eggs inaccessible / AW ;<br>oystercatchers defend eggs / nest ;<br>AVP ; e.g. feeding preferences or time for eggs to develop  | max 2              |
|          | (c) |  | use of trap e.g. Longworth trap ;<br>use of baits ;<br>use of suitable method of mark tagging, e.g. chip / ear tag / hair clipping / neck collar ;<br>marking should not affect behaviour / AW ;<br>marking should not affect predation ;<br>marking should not directly harm ;  | max 3              |
|          | (d) |  | geographical isolation / allopatric speciation ;<br>ref to genetic drift / genetic isolation ;<br>leading to creation of subspecies ;<br>ref to natural selection and evolution ;<br>ref to founder effect ;<br>loss of alleles / reduced gene pool ;<br>ref to increase effect of disease ;<br>increased chance of mutations ;<br>behavioural differences e.g. feeding preference ; | max 4              |
|          | (e) |  | SSSI are not fully protected / no government control ;<br>no (direct) government funding ;<br>land owned by individual groups responsible for management ;<br>compromises often made regarding land use ;<br>people entering land and effects of trampling / AW ;  | max 2              |
|          | (f) |  | <i>reject references to predation and migration</i><br><br>death rate = birth rate ;<br>named limited resource 1 e.g. food ;<br>named limited resource 2 e.g. space / breeding sites ;<br>disease ;<br>parasites ;<br>idea of increased intraspecific competition ;  | max 3              |
|          |     |  |  | <b>[Total: 16]</b> |



| Question |     |  | Expected Answers  | Marks        |
|----------|-----|--|---|--------------|
| 2        | (a) |  | <p><i>Cause and effect must be given for max 4</i></p> <p><u>nitrate</u> pollution ;<br/>(leading to) eutrophication ;</p> <p>pollution by <u>hormones</u> ;<br/>(leading to) demascolarisation ;</p> <p>pollution of <u>pesticides</u> ;<br/>(leading to) bioaccumulation ;</p> <p>escapes to the wild ;<br/><i>one from</i><br/>(leading to) risk of altering genetics of wild fish populations / AW ;<br/>increase of disease to aquatic ecosystems ;</p> <p>habitat destruction ;<br/>in named example e.g. mangrove / loch ;</p> <p>antibiotic use / overuse ;<br/>(leading to) resistance ;</p> | <b>max 4</b> |
|          |     |  |   |              |
|          | (b) |  | <p>pesticide has no significant effect on mean number of lice per fish in treated sample / AW ;<br/>ref to relevant data quote ;<br/>pesticide does not eliminate lice infection ;<br/>untreated fish have lower infection rate up to 2 weeks ;<br/>comparative paired data quote ;<br/>pesticide-treated fish have significantly lower mean number of lice per fish after three weeks / AW ;<br/>comparative paired data quote ;<br/>study not replicated ;</p>  | <b>max 4</b> |
|          |     |  |   |              |

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
|          | (c) |  | prevent spread of lice between cages ;<br>prevent cross-contamination by feed / pesticide ;<br>prevent cross-contamination by fish escapees ;  | max 1              |
|          |     |  |  |                    |
|          | (d) |  | temperature ;<br>pH ;<br>turbidity / AW ;<br>salinity ;<br>current flow / direction (relative to cages) ;<br>nutrient level ;<br>AVP ;   | max 2              |
|          |     |  |  |                    |
|          | (e) |  | storage in fat tissue / AW ;<br>ref to bioaccumulation / AW ;<br>pesticide passed on through food chain(s) ;<br>increased toxicity to higher organisms / AW ;<br>links to human food consumption ;<br>ref to time delay in effect of pesticide ;<br>idea of no control of, mass / amount, of pesticide / fish feed consumed by each fish ;<br>possible negative effects on food webs / chains ;<br>AVP ; | max 3              |
|          |     |  |  |                    |
|          | (f) |  | less dense population (in the wild) / AW ;<br>(leading to) lower infestation rate (in the wild) ;<br>possible natural defence e.g. (smaller) fish eating lice off salmon ;<br>genotypic differences ;<br>idea of leading to resistance to infestation ;<br>idea to effect of abrasion and, loss of / attraction of, lice ;<br>AVP ;  | max 2              |
|          |     |  |  | <b>[Total: 16]</b> |

| Question |     |  | Expected Answers  | Marks              |
|----------|-----|--|---|--------------------|
| 3        | (a) |  | divide area into grid / axes ;<br>appropriate grid size (for the habitat being studied) ;<br>appropriate size of quadrat ;<br>suitable number of quadrats ;<br>random coordinates ;<br>use of random number generator / AW ;<br>use of keys to identify ;   | max 4              |
|          | (b) |  | belt transect is systematic / AW (regular / controlled) <i>or</i> random sampling is not ;<br>transect data along line / random data is within a grid ;<br><br>heathland habitat not uniform / species not distributed uniformly ;<br>belt transect data may show (biotic / abiotic) gradient / AW ;  | max 2              |
|          | (c) |  | difficult / impossible, to identify individual plants ;<br>avoids effect of different sizes ;<br>(may be) too many to count ;<br>quicker ;  | max 1              |
|          | (d) |  | kite diagrams ;<br>graphs of % cover against study site ;   | max 1              |
|          | (e) |  | <ol style="list-style-type: none"> <li>1 use specific mass of soil from each sample site / AW ;</li> <li>2 dry sample(s) ;</li> <li>3 to constant mass ;</li> <li>4 using desiccator ;</li> <li>5 (crush sample and) heat strongly / burn ;</li> <li>6 at stated temperature over 105°C to 500°C (to burn off organic matter) ;</li> <li>7 detail of calculation ;</li> <li>8 idea of (need for) replication ;</li> </ol> | max 5              |
|          |     |  |   | <b>[Total: 13]</b> |

| Question |     |      | Expected Answers  | Marks |
|----------|-----|------|---|-------|
| 4        | (a) |      | idea of direct kill ;<br>denatures enzymes ;<br>detail of process affected e.g. respiration, (active) transport ;<br>effect on calcium carbonate solubility ;<br>lowers calcium ion uptake ;<br>increased concentration of metal ions e.g. aluminium, copper and nickel ;<br>ref to effect of these metal ions e.g. aluminium, gill permeability in fish / mucus ;  | max 2 |
|          |     |      |   |       |
|          | (b) |      | <ol style="list-style-type: none"> <li>1 sediments become too toxic for reeds / AW ;</li> <li>2 heavy metals / pollutants, accumulate in reeds ;</li> <li>3 heavy metals / pollutants, inhibit enzyme activity ;</li> <li>4 decrease in ATP production ;</li> <li>5 ref to enzymes in respiratory chains ;</li> <li>6 named enzyme such as cytochrome C ;</li> <li>7 prevention / inhibition of active uptake ;</li> <li>8 damage to root hairs / regeneration affected ;</li> <li>9 effect upon protein transport channels ;</li> <li>10 succession takes place ;</li> </ol> | max 5 |
|          |     |      |   |       |
|          | (c) | (i)  | species that is sensitive to pollution ;<br>presence or absence indicates level / type of pollution / AW ; e.g. abundance<br>ref to named example (not oligochaete worms) ;   | max 2 |
|          |     |      |   |       |
|          |     | (ii) | sewage effluent leads to rise in aerobic bacteria ;<br>bacteria use up oxygen ;<br>leading to high BOD / AW ;<br>worms have Hb to absorb limited oxygen / low $ppO_2$ ;   | max 2 |
|          |     |      | [Total: 11]   |       |

| Question |     |  | Expected Answers  | Marks        |
|----------|-----|--|---|--------------|
| 5        | (a) |  | roots hold soil (particles) together ;<br>prevents, rain / flood, washing away soil ;<br>affects on local climate which affects soil ;<br>prevention of desertification ;<br>canopy effect preventing soil erosion / AW ; <i>max 2</i><br>provide organic matter when they decompose / AW ;<br>ref. to humic acid(s) ;<br>idea of nutrient cycling ;<br>nutrient acquisition e.g. nitrate formation in root nodules / mycorrhizae;<br><i>max 2</i>  | <b>max 3</b> |
|          |     |  |   |              |
|          | (b) |  | selective cutting / AW ;<br>coppicing / pollarding ;<br>managing access / development ;<br>replanting / reforestation ;   | <b>max 2</b> |
|          |     |  |   |              |
|          | (c) |  | may outcompete native species / AW ;<br>may become a pest ;<br>no natural herbivore(s) ; <b>A predator</b><br>may bring in disease / parasitic infection ;<br>AVP ; e.g. affects on food webs   | <b>max 2</b> |
|          |     |  |   |              |
|          | (d) |  | 1 idea of setting up captive breeding program ;<br>2 idea of fewer wild animals need to caught in wild ;<br>3 provides a <b>refuge</b> for endangered species ;<br>4 provides research opportunity to study species in depth ;<br>5 reduces risk of <b>extinction</b> ;<br>6 idea of reintroduction ;<br>7 need to avoid <b>inbreeding</b> / <b>inbreeding depression</b> ;<br>8 ref to <b>gene pool</b> / varied <b>genetic diversity</b> ;<br>9 detail of problem of inbreeding or captivity e.g. loss of natural behaviour ;<br>10 idea of using stud books or similar to <b>outbreed</b> / AW ;<br>11 ref to <b>artificial insemination</b> , exchange of <b>sperm</b> and <b>secondary oocytes</b> ;<br>12 idea of need for technical / knowledge base in zoos ;<br>13 ref to funding and costs of such programs ;<br>14 AVP ; e.g. credit for detail from another named example eg. Golden Lion Tamarin<br>e.g. idea of raising awareness / education ; | <b>max 8</b> |
|          |     |  |   |              |
|          |     |  | <b>QWC – any three terms from those highlighted</b>   | <b>1</b>     |
|          |     |  | <b>[Total: 16]</b>  |              |

| Question |     |      | Expected Answers  | Marks              |
|----------|-----|------|---|--------------------|
| 6        | (a) |      | (appropriate) named example e.g. pig or chicken ;<br><br><i>any two of</i><br>greater yield per animal ;<br>idea of efficiency of production ;<br>efficiency qualified e.g. increased yield per unit area ;<br>greater control of inputs e.g. antibiotics / hormones / pesticides /<br>fertilisers ;<br>less labour intensive ;   | <b>max 3</b>       |
|          | (b) |      | idea of continued disturbance ;<br>selective grazing / AW ;<br>leading to deflected succession ; <b>A</b> plagioclimax<br>idea of increased damage by trampling ;<br>effect of, animal / nitrogenous, waste ;   | <b>max 3</b>       |
|          | (c) | (i)  | reacts with amino acids ;<br>bonds to R-group of amino acids ;<br>attracted to positively or negatively charged amino acids ;<br>trapped in 3D protein structure ;<br>AVP ; e.g. attaching to protein through hydrogen bonding  | <b>max 1</b>       |
|          |     | (ii) | mutation / alters DNA ; <b>R</b> cells mutate<br>(leading to) uncontrolled, cell division / mitosis ;   | <b>max 1</b>       |
|          |     |      | <ol style="list-style-type: none"> <li><b>1</b> idea of legislation e.g. disposal of fridges / changed propellants e.g. HFC's ;</li> <li><b>2</b> signing of, Montreal Protocol / international agreement(s) ;</li> <li><b>3</b> idea of signing by many countries ;</li> <li><b>4</b> idea of target setting ;</li> <li><b>5</b> detail of target that was set e.g. halving of emissions over a period ;</li> <li><b>6</b> funding to help LEDC meet targets ;</li> <li><b>7</b> raising, consumer / public, awareness e.g. labelling / advertising / education ; <i>max 5</i></li> <li><b>8</b> signing of Kyoto or named agreement ;</li> <li><b>9</b> use of scientific evidence / reasons linking CO<sub>2</sub> to climate change ;</li> <li><b>10</b> setting of targets ;</li> <li><b>12</b> idea of legislation e.g. carbon / green, taxes / trading ;</li> <li><b>13</b> trading carbon emissions, qualified ;</li> <li><b>14</b> idea of seeking Green technology e.g. to, wind / wave / nuclear / geothermal / catalytic converters ;</li> <li><b>15</b> raising, consumer / public, awareness / education e.g. carbon footprints / reduced air travel / public transport ; <i>max 5</i></li> </ol> | <b>max 7</b>       |
|          |     |      | <b>QWC</b> - mark is available for the quality of spelling, punctuation and grammar.  | <b>1</b>           |
|          |     |      |   | <b>[Total: 16]</b> |

## 2805/04 Microbiology and Biotechnology

| Question |     |     | Expected Answer   | Grade |
|----------|-----|-----|---|-------|
| 1        | (a) | (i) | <p>idea of transfer from stock broth culture to flask, using appropriate equipment e.g. inoculating loop, pipette, syringe ; <b>R</b> ref to agar stock culture</p> <p><i>any three from:</i></p> <p>use of, spirit / Bunsen, burner for, sterilising / updraft of air to prevent contaminants entering work area / AW ;</p> <p>work area sterilised e.g. with disinfectant, to avoid contamination ;<br/>cotton wool plug not placed on surface, to avoid contamination ;<br/>flame neck of, boiling tube / flask, to destroy (contaminating) microorganisms ;<br/>use sterile equipment to avoid contamination ; e.g. pass loop through flame / use alcohol and flame, sterile pipette, sterile syringe<br/>use of a transfer chamber, qualified ;</p> <p><i>if aseptic technique correct but no explanation then max 2</i></p> | 4 max |

| Question  |   | Expected Answers  | Marks                      |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
|---|---|---|----------------------------|---|----------|---|---|---|--------------|---|--------------------|---|----------------------------------|---|--|--|--|--|-------|
|   | (ii)  | <p>1 mark for a relevant addition / modification<br/>max 1 mark for each accompanying explanation<br/>examples below</p> <p>stage 2</p> <table><tr><td>air inlet / AW / sparger ;</td><td>provides oxygen for (aerobic) respiration ;<br/>diffusion of oxygen via surface no longer sufficient ;</td></tr><tr><td>filter ;</td><td>to sterilise / prevent contamination of, incoming air ;<br/>to sterilise waste gases out / prevent contamination of environment ; AW</td></tr><tr><td>(small) syringe ;<br/>A ref. to inlet in correct context</td><td>for inoculation ;<br/>for addition of antifoam ;<br/>for addition of, acid / alkali ;</td></tr><tr><td>air outlet ;</td><td>release / vent / AW, waste / exhaust gases / CO<sub>2</sub> ;<br/>avoid pressure build-up ;</td></tr><tr><td>(larger) syringe ;</td><td>for sampling ; A removal of product / waste</td></tr></table> <p>stage 3</p> <table><tr><td>cooling / heating water jacket ;</td><td>removes excess heat from respiration (of organisms) ; prevents denaturation of enzymes ;<br/>prevents death of organisms (ref. to excess heat) ;<br/>maintains, constant / optimum, temperature ;<br/>to heat up culture medium initially ; AW</td></tr><tr><td>impeller / baffles / stirrer / paddles ;</td><td>allows cells to mix with nutrients ; A dispersion of oxygen helps to disperse heat ;<br/>prevent clumping of cells / AW ;</td></tr><tr><td>one named probe / AW ;<br/>e.g. temperature, pH, oxygen</td><td>to monitor, conditions / named condition ;<br/>conditions more likely to change ;<br/>to allow conditions to be controlled ;</td></tr></table> | air inlet / AW / sparger ; | provides oxygen for (aerobic) respiration ;<br>diffusion of oxygen via surface no longer sufficient ; | filter ; | to sterilise / prevent contamination of, incoming air ;<br>to sterilise waste gases out / prevent contamination of environment ; AW | (small) syringe ;<br>A ref. to inlet in correct context | for inoculation ;<br>for addition of antifoam ;<br>for addition of, acid / alkali ; | air outlet ; | release / vent / AW, waste / exhaust gases / CO <sub>2</sub> ;<br>avoid pressure build-up ; | (larger) syringe ; | for sampling ; A removal of product / waste | cooling / heating water jacket ; | removes excess heat from respiration (of organisms) ; prevents denaturation of enzymes ;<br>prevents death of organisms (ref. to excess heat) ;<br>maintains, constant / optimum, temperature ;<br>to heat up culture medium initially ; AW | impeller / baffles / stirrer / paddles ; | allows cells to mix with nutrients ; A dispersion of oxygen helps to disperse heat ;<br>prevent clumping of cells / AW ; | one named probe / AW ;<br>e.g. temperature, pH, oxygen | to monitor, conditions / named condition ;<br>conditions more likely to change ;<br>to allow conditions to be controlled ; | 4 max |
| air inlet / AW / sparger ;                              | provides oxygen for (aerobic) respiration ;<br>diffusion of oxygen via surface no longer sufficient ;   |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| filter ;  | to sterilise / prevent contamination of, incoming air ;<br>to sterilise waste gases out / prevent contamination of environment ; AW   |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| (small) syringe ;<br>A ref. to inlet in correct context | for inoculation ;<br>for addition of antifoam ;<br>for addition of, acid / alkali ;   |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| air outlet ;  | release / vent / AW, waste / exhaust gases / CO <sub>2</sub> ;<br>avoid pressure build-up ;   |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| (larger) syringe ;                                      | for sampling ; A removal of product / waste   |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| cooling / heating water jacket ;                        | removes excess heat from respiration (of organisms) ; prevents denaturation of enzymes ;<br>prevents death of organisms (ref. to excess heat) ;<br>maintains, constant / optimum, temperature ;<br>to heat up culture medium initially ; AW |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| impeller / baffles / stirrer / paddles ;                | allows cells to mix with nutrients ; A dispersion of oxygen helps to disperse heat ;<br>prevent clumping of cells / AW ;  |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |
| one named probe / AW ;<br>e.g. temperature, pH, oxygen  | to monitor, conditions / named condition ;<br>conditions more likely to change ;<br>to allow conditions to be controlled ;  |   |                            |   |          |   |   |   |              |   |                    |   |                                  |   |  |  |  |  |       |



| Question |     |       | Expected Answers   | Marks              |
|----------|-----|-------|--|--------------------|
|          |     | (iii) | <p><i>max 1 for each step</i></p> <p><i>agitate</i><br/>to prevent clumping of cells ;<br/><i>idea of spreading out of cells to enable counting</i><br/>to disperse cells evenly ;<br/><i>idea of ensuring reliability of count</i></p> <p><i>wait five minutes</i><br/>allows time for yeast cells to, settle / stop moving ;<br/>to allow easy focusing of cells / in focus in one plane / don't need to change focus during counting ;</p> <p><i>North West rule</i><br/>to prevent counting the same cell twice ;<br/>(is a) reliable method to deal with cells that overlap two squares ;</p> <p><i>count cells in a number of squares</i><br/>in case one square gives an unrepresentative count / AW ;<br/>to provide a more reliable estimate of cell number / AW ;<br/>can calculate a mean ;</p>   | 4 max              |
|          |     |       |  |                    |
|          | (b) |       | <p>inoculation / recycling / starter culture, of <i>Saccharomyces</i> ; <b>A</b> yeast</p> <p>(<i>Saccharomyces</i> is a) <u>facultative</u>, aerobe / anaerobe ;<br/>initially / AW, aerobic respiration ;<br/>increase in cell number / population growth / log phase ; <b>R</b> yeast growth</p> <p>maltose (respiratory) substrate ; <b>R</b> sugar <b>A</b> other named sugar</p> <p>conditions anaerobic (because), CO<sub>2</sub> produced / O<sub>2</sub> used up / yeast in deep tank ;<br/>anaerobic respiration, ethanol produced ; <b>A</b> alcohol</p> <p>further detail of, maltose hydrolysis / respiration ; e.g. of glycolysis / link reaction / Krebs's cycle / oxidative phosphorylation<br/>ref. to stationary phase reached ;<br/>ethanol / alcohol, toxic to / kills, cells ;</p> <p><i>any one from</i><br/>differences in energy yield / (cooled sweet) wort as nutrient, medium / broth / use of other named nutrients for growth / ref. to correct conditions for growth</p> | 5 max              |
|          |     |       |  |                    |
|          | (c) |       | <p>nutrients added at constant rate ; <b>A</b> continuously <b>R</b> culture / inoculum products / waste, removed at same constant rate ; <b>A</b> (so) volume kept constant</p> <p>culture maintained in, log / exponential / maximum growth, phase ;<br/>production of primary metabolites ;<br/>conditions kept at optimum / environmental conditions kept constant ;<br/><b>A</b> no factor limiting</p>   | 2 max              |
|          |     |       |  |                    |
|          |     |       |  | <b>[Total: 19]</b> |



| Question   |                  |  | Expected Answers  | Marks |                  |  |
|--|------------------|--|---|-------|------------------|--|
|  | (b)              |  | <p>1 mark if <i>Chlamydomonas</i> largest<br/>1 mark if HIV smallest<br/>1 mark for correct order of the other three</p> <table><tr><th>size</th><th>name of organism</th></tr><tr><td rowspan="5">largest 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|                  |  |   |       |                  |  |

| Question |     |       | Expected Answers   | Marks |
|----------|-----|-------|--|-------|
| 3        | (a) | (i)   | <p><i>two elements chosen one mark max for each element</i></p> <p><i>calcium</i><br/> ref. middle lamella / cell wall<br/> or<br/> balance, organic anions / ref. vacuole<br/> or<br/> (enzyme) cofactor ;</p> <p><i>magnesium</i><br/> chlorophyll structure<br/> or<br/> (enzyme) cofactor<br/> or<br/> ref. to ribosomes / translation ;</p> <p><i>potassium</i><br/> (enzyme) cofactor<br/> or<br/> reference to osmotic balance / AW<br/> or<br/> protein synthesis ;</p> <p><i>phosphorus</i><br/> ATP<br/> or<br/> DNA / RNA / nucleotides / nucleic acids<br/> or<br/> membrane structure / phospholipids ;</p> <p><i>sulphur</i><br/> amino acids / proteins / polypeptides<br/> or<br/> vitamins / thiamine / biotin<br/> or<br/> (enzyme) cofactor ;</p> | 2     |
|          |     | (ii)  | <p>photosynthesis, not yet occurring / low rate ;<br/> therefore sugars not being synthesised ;<br/> (sugars) required, as energy source / for respiration / for ATP<br/> production / as respiratory substrate ;<br/> source of carbon for, organic molecules / named molecule ;</p>  | 2 max |
|          |     | (iii) | <p>(plant) growth, regulators / substances ; <b>A</b> hormones / named<br/> examples</p>   | 1     |
|          |     | (iv)  | <p>immature tissue ;<br/> (still) producing plant growth regulators / named ;<br/> meristematic / mitotic tissue ; <b>A</b> correct ref. to cell division</p>  | 1 max |

| Question |     |  | Expected Answers   | Marks        |
|----------|-----|--|--|--------------|
|          | (b) |  | <p><i>max 4 for features</i></p> <p>description of general design ; <b>A</b> from diagram<br/> air in through, <u>HEPA</u> filter / filter with small pore size (0.22 / 0.3 <math>\mu\text{m}</math>) ;<br/> prevents entry microorganisms / contaminating particles / dust (into work area) ; <b>A</b> production of sterile air<br/> air out through open front ;<br/> laminar air flow / parallel streams / unidirectional air / AW ;<br/> correct ref. to negative pressure e.g. in air flow hood to draw in incoming air / in room to ensure air moves out through front / recirculated ;</p> <p>prevents contamination of the culture / AW ;<br/> idea of prevents (unfiltered) air from worker entering ;<br/> idea of prevents (unfiltered) air from environment from entering ;</p> | <b>5 max</b> |
|          | (c) |  | <p>idea of, desirable characteristic / example, maintained in all plants ;<br/> no variation so consistency of product / AW ;<br/> no need for (artificial) selection ;<br/> no requirement for plants without desired characteristics to be discarded ;</p>   | <b>1 max</b> |

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
|          | (d) |  | <p><i>allow annotations on Fig. 3.1</i></p> <ol style="list-style-type: none"> <li>1 detach leaf and surface <b>sterilise</b> / AW ;</li> <li>2 washing (sterile water) ;</li> <li>3 <b>aseptic</b> handling ; e.g. flame scalpel / forceps</li> <li>4 transfer plant piece to, growth / nutrient / culture medium ;</li> <li>5 M &amp; S (<b>Murashige &amp; Skoog</b>) / description of, growth / nutrient / culture, medium ;</li> <li>6 <b>callus</b> culture ;</li> <li>7 description of callus culture ; e.g. mass of <b>undifferentiated</b> cells</li> <li>8 use of <b>plant growth regulator</b> / <b>plant growth substance</b> / plant hormone / named ;</li> <li>9 <b>auxin</b> to <b>cytokinin</b> ratio important ;</li> <li>10 ref. to possibility / avoidance of, fungal / bacterial <b>contamination</b> ;</li> <li>11 (emerging) shoots removed ;</li> <li>12 rooting ;</li> <li>13 plantlets produced ;</li> <li>14 <b>incubation</b> in light ;</li> <li>15 use of sterile soil ;</li> <li>16 AVP ; one other ref. to aseptic technique, subdivision, 16 hours light, 8 hours dark,</li> <li>17 AVP ; ref. to <b>totipotency</b>, ref to lack of hardiness for plantlets, culture in temperatures 20-25 °C, hardening off, different PGRs for differentiation</li> </ol> | <b>7 max</b>       |
|          |     |  |  |                    |
|          |     |  | <p><b>QWC – clear, well organised using specialist terms ;</b><br/>any three from<br/>sterile / sterilise, aseptic, callus, M &amp; S medium, undifferentiated / de-differentiation, plant growth regulator, plant hormone, auxin, cytokinin, contamination, incubation</p>  | <b>1</b>           |
|          |     |  |  | <b>[Total: 20]</b> |

| Question |     |     | Expected Answers  | Marks        |
|----------|-----|-----|---|--------------|
| 4        | (a) | (i) | <p>able to / (relatively) easy to, genetically manipulate ; <b>A</b> description avoids risk of, infection / disease / named e.g. ;</p> <p>avoids problems of allergic effects / immune responses / side effects ;</p> <p>high, replication / growth, rate ; <i>ora</i></p> <p>comparative ref. to, large amounts / high productivity ; e.g. <i>with insulin (from pigs) / GH from corpses</i></p> <p>small, area / volume / space, required for culturing microorganisms ;</p> <p>can be cultured anywhere in world / AW ;</p> <p>overcomes, moral / ethical / religious / qualified, objections ;</p> <p>cost, suitably qualified ;</p> | <b>3 max</b> |
|          |     |     |   |              |

| Question   |   |      | Expected Answers   | Marks              |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
|--|---|------|--|--------------------|--------------------|---|---|--|--|--|--|----------------------------|---|-------------------------|--|---|--|--|---|--|---|--------------|
|  |   | (ii) | <p><i>one mark for each relevant description / explanation examples given below</i></p> <table><tr><th><i>description</i></th><th><i>explanation</i></th></tr><tr><td><i>obtain copies of gene with 'sticky ends'</i></td><td><i>the gene codes for the synthesis of HGH, the desired product</i></td></tr><tr><td>remove / obtain / AW, a plasmid ; <b>A</b> cut open cleave</td><td><i>acts as a vector for the transfer of the gene into the host</i></td></tr><tr><td><i>use restriction endonuclease enzyme</i></td><td>to obtain, sticky / overlapping, ends / AW<br/><b>A</b> cut open / cleaves plasmid <i>unless accepted for mp1</i><br/>or<br/>cuts at specific (base / nucleotide) sequences ;</td></tr><tr><td><i>mix vector and gene</i></td><td>so gene inserts into vector by (complementary)base pairing<br/>or<br/>(complementary) base pairing between, vector / plasmid, and gene<br/>or<br/>H bonds form between, sticky ends / complementary bases ;</td></tr><tr><td>add / use, DNA ligase ;</td><td><i>completes gene splicing by sealing the sugar-phosphate backbone</i></td></tr><tr><td>insert / introduce / AW, plasmid / vector, into host cells / <i>E. coli</i> ;</td><td><i>to obtain transformed or recombinant host E. coli cells</i></td></tr><tr><td><i>screen for successfully transformed cells</i></td><td>to avoid culturing non-recombinant cells ;<br/>or<br/>so only recombinant hosts / cells producing HGH cultured<br/>or<br/>use antibiotic-resistance markers</td></tr><tr><td>large-scale culture / culture in a, fermenter / bioreactor <b>A</b> correct ref. to downstream processing<br/>or<br/>gene cloning<br/>or<br/>replication / reproduction host cells ;</td><td><i>to obtain large amounts of HGH for extraction and purification</i></td></tr></table> | <i>description</i> | <i>explanation</i> | <i>obtain copies of gene with 'sticky ends'</i> | <i>the gene codes for the synthesis of HGH, the desired product</i> | remove / obtain / AW, a plasmid ; <b>A</b> cut open cleave | <i>acts as a vector for the transfer of the gene into the host</i> | <i>use restriction endonuclease enzyme</i> | to obtain, sticky / overlapping, ends / AW<br><b>A</b> cut open / cleaves plasmid <i>unless accepted for mp1</i><br>or<br>cuts at specific (base / nucleotide) sequences ; | <i>mix vector and gene</i> | so gene inserts into vector by (complementary)base pairing<br>or<br>(complementary) base pairing between, vector / plasmid, and gene<br>or<br>H bonds form between, sticky ends / complementary bases ; | add / use, DNA ligase ; | <i>completes gene splicing by sealing the sugar-phosphate backbone</i> | insert / introduce / AW, plasmid / vector, into host cells / <i>E. coli</i> ; | <i>to obtain transformed or recombinant host E. coli cells</i> | <i>screen for successfully transformed cells</i> | to avoid culturing non-recombinant cells ;<br>or<br>so only recombinant hosts / cells producing HGH cultured<br>or<br>use antibiotic-resistance markers | large-scale culture / culture in a, fermenter / bioreactor <b>A</b> correct ref. to downstream processing<br>or<br>gene cloning<br>or<br>replication / reproduction host cells ; | <i>to obtain large amounts of HGH for extraction and purification</i> | <b>7 max</b> |
| <i>description</i>   | <i>explanation</i>  |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| <i>obtain copies of gene with 'sticky ends'</i>  | <i>the gene codes for the synthesis of HGH, the desired product</i>   |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| remove / obtain / AW, a plasmid ; <b>A</b> cut open cleave   | <i>acts as a vector for the transfer of the gene into the host</i>  |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| <i>use restriction endonuclease enzyme</i>   | to obtain, sticky / overlapping, ends / AW<br><b>A</b> cut open / cleaves plasmid <i>unless accepted for mp1</i><br>or<br>cuts at specific (base / nucleotide) sequences ;                              |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| <i>mix vector and gene</i>   | so gene inserts into vector by (complementary)base pairing<br>or<br>(complementary) base pairing between, vector / plasmid, and gene<br>or<br>H bonds form between, sticky ends / complementary bases ; |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| add / use, DNA ligase ;  | <i>completes gene splicing by sealing the sugar-phosphate backbone</i>  |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| insert / introduce / AW, plasmid / vector, into host cells / <i>E. coli</i> ;  | <i>to obtain transformed or recombinant host E. coli cells</i>  |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| <i>screen for successfully transformed cells</i>   | to avoid culturing non-recombinant cells ;<br>or<br>so only recombinant hosts / cells producing HGH cultured<br>or<br>use antibiotic-resistance markers   |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
| large-scale culture / culture in a, fermenter / bioreactor <b>A</b> correct ref. to downstream processing<br>or<br>gene cloning<br>or<br>replication / reproduction host cells ; | <i>to obtain large amounts of HGH for extraction and purification</i>   |      |  |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |
|  |   |      | <b>[Total: 10]</b>   |                    |                    |   |   |  |  |  |  |                            |   |                         |  |   |  |  |   |  |   |              |



| Question |     |      | Expected Answers   | Marks             |
|----------|-----|------|--|-------------------|
| 5        | (a) | (i)  | continuous monitoring possible ;<br>ref. to adaptations possible ; e.g. possibility of insulin delivery as and when required, alarm to warn of hypo- / hyperglycaemia removes, burden / pain / inconvenience, of self-testing for glucose ; <b>A</b> no need for blood sampling<br>no problems with memory lapse ;<br>can't be lost ;  | 1 max             |
|          |     | (ii) | (loss of immobilised enzyme) may decrease sensitivity of test / give inaccurate values / AW ;<br>reduced shelf-life / AW ;<br>problems of glucose oxidase (from fungus) as antigen / ref immune response problems ;<br>ref. to specific effect of glucose oxidase on metabolism ;  | 1 max             |
|          | (b) |      | (mouse antibody) acts as foreign <u>antigen</u> / <u>more antigenic</u> ; ora (human sections antibody less antigenic / act as self-antigens) ;<br><br><i>ora for following mps if referenced to humanised antibody</i><br>(mouse antibody) no initial problems / effective on first treatment ;<br>(but) primary (immune) response ; <b>A</b> immune response qualified e.g. initiated / sensitisation<br>detail of immune response ; e.g. memory cells / killer T-lymphocytes / B / plasma cells produced<br>problems giving further treatment ;<br>detail of problems of secondary immune response e.g.<br>higher levels / more rapid, production of antibody<br>rapid increase in number of lymphocytes<br>(mouse antibody) unable to reach target cells (as inactivated by antibody) <b>A</b> (mouse antibody) rejection<br><br>ref. to recognition by phagocytes ; | 3 max             |
|          | (c) |      | <i>accept ora for chemotherapy</i><br>(Trastuzumab / monoclonal antibody) more specific ;<br>(Trastuzumab / monoclonal antibody) does not damage, healthy / non-tumour, cells ; <b>A</b> fewer side-effects  | 1 max             |
|          |     | (ii) | ref. to tertiary structure complementary to antigen ;<br>so binds to (receptors) certain types of tumour cell only / not all tumours have HER2 receptor / AW ;<br>other types of tumour have different cell surface characteristics / AW ;   | 1 max             |
|          | (d) |      | antibodies are, polypeptides / proteins / glycoproteins ;<br><br><i>mammalian cells</i><br>have, necessary cell structures / Golgi bodies / RER / ER, for glycosylation ; ora for <i>E.coli</i><br><br><i>E. coli</i> prokaryotic ;<br>transcription and translation / protein synthesis, possible but, cannot glycosylate antibodies / antibodies not (fully) functioning ;   | 2 max             |
|          |     |      |  | <b>[Total: 9]</b> |

| Question |     |  | Expected Answers  | Marks |
|----------|-----|--|---|-------|
| 6        | (a) |  | <p>1 attached to, insoluble / inert, support material / matrix / AW ;</p> <p>2 held in place during reaction / remain in fermenter / not lost / recoverable ;</p> <p>3 able to reuse / no need for fresh supplies / longer use / longer shelf life ;</p> <p>4 reduced problem of contamination of product ;</p> <p>5 (so) downstream processing easier ;</p> <p>6 high concentration of enzyme possible ;</p> <p>7 allows rapid conversion of, unstable reactants / substrates ;</p> <p>8 protected by, matrix / support material ;</p> <p>9 increased stability to / less likely to denature with, extremes of, pH / temperature ;</p> <p>10 allows reactions to occur at, higher temperatures / wider pH range ;</p> <p>11 greater productivity / higher yield, <i>linked to any relevant mark point</i> ;</p> <p>12 reduced cost <i>linked to any relevant mark point</i> ;</p> <p>13 suitable for continuous fermentation ;</p> <p>14 valid example ; e.g. production of lactose-free milk</p> <p>15 use of immobilised cells for multi-enzyme systems ;</p> <p>16 <i>one from:</i><br/>enzyme activity may be, improved / altered, and benefit process, more accurate control, another valid example, less pollution, fewer side reactions, higher temperatures reduces reaction time, consistency of product quality, easier to use by non-qualified staff, may reduce requirement to strictly control temperatures ;</p> | max 7 |
|          |     |  | <b>QWC – legible text with accurate spelling, punctuation and grammar ;</b>   | 1     |

| Question |     | Expected Answers  | Marks   |
|----------|-----|---|---|
|          | (b) | <p><i>must score in each Fig. to gain max marks</i></p> <p><i>Fig. 6.1</i><br/>           general description of curve including ref. to rates / % conversion over time ;<br/>           statement of difference e.g. immobilised performs better ;<br/>           use of figures to support either of above (both axes, units required) ;<br/>           ref. to both curves similar / no great differences ; <b>A</b> acceptable to use either for glucose production</p> <p><i>Fig. 6.2</i><br/>           comparison of any two curves to show differences ; <i>allow once only for Fig. 6.2 or 6.3</i><br/>           use of figures ; <i>penalise once for lack of units – see above</i><br/>           ref. to, reduced performance immobilised / decreased effect on bacterial cells ;<br/>           ref. to type of immobilisation having different effects ;<br/>           no change in optimum for chemically bonded (method 1) / change in optimum for adsorbed (method 2) ;</p> <p><i>Fig. 6.3</i><br/>           general description of shape of both curves to give comparison ; <i>see above</i><br/>           change in optimum / ref. to figures ;<br/>           ref, to decreased performance immobilised below pH 8 ;<br/>           ref. to increased performance immobilised above pH 8 ;</p> | <p><b>max 6</b></p> <p><b>[Total: 14]</b></p> |

## 2805/05 Mammalian Physiology and Behaviour

| Question                     |          |   | Expected Answers   |          | Marks |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|------------------------------|----------|---|--|----------|-------|---------------------|----------|-----------------------|-----|----------------------------|----------|------------------------------|----------|----------------------|-----|--------------------------|-----|---|
| 1                            | (a)      |   | <table><tr><td>egestion</td><td>H</td></tr><tr><td>digestion by lipase</td><td>C or G ;</td></tr><tr><td>absorption of glucose</td><td>G ;</td></tr><tr><td>digestion by exopeptidases</td><td>C or G ;</td></tr><tr><td>absorption of inorganic ions</td><td>D or G ;</td></tr><tr><td>digestion by amylase</td><td>C ;</td></tr><tr><td>synthesis of trypsinogen</td><td>F ;</td></tr></table> | egestion | H     | digestion by lipase | C or G ; | absorption of glucose | G ; | digestion by exopeptidases | C or G ; | absorption of inorganic ions | D or G ; | digestion by amylase | C ; | synthesis of trypsinogen | F ; | 6 |
| egestion                     | H        |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| digestion by lipase          | C or G ; |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| absorption of glucose        | G ;      |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| digestion by exopeptidases   | C or G ; |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| absorption of inorganic ions | D or G ; |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| digestion by amylase         | C ;      |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
| synthesis of trypsinogen     | F ;      |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              | (b)      | 1 | (primary structure is), order / sequence, of amino acids ;   | 3 max    |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          | 2 | (secondary structure contains alpha) helix ; <i>ignore B-pleated sheet</i>   |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          | 3 | tertiary structure is, folded / AW ; <i>ignore 3D shape</i>  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          | 4 | globular (protein) ;   |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          | 5 | ref. to hydrogen / ionic / Van der Waals forces / disulphide / peptide, bonds ;  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |
|                              |          |   |  |          |       |                     |          |                       |     |                            |          |                              |          |                      |     |                          |     |   |

| Question |            | Expected Answers  | Marks             |
|----------|------------|---|-------------------|
|          | <b>(c)</b> | <p>1 <i>describe</i><br/>fall in, pancreatic / <math>\text{HCO}_3^-</math>, secretion ; <b>R</b> produce</p> <p>2 paired figs ;</p> <p>3 (slight) rise (after 80 min) ;</p> <p>4 <i>explain</i><br/>secretin, promotes / controls, <math>\text{HCO}_3^-</math>, production / secretion ;</p> <p>5 PP inhibits, secretin / secretion of <math>\text{HCO}_3^-</math> ;</p> <p>6 AVP ; e.g. PP binds to exocrine cells</p> | <b>4 max</b>      |
|          | <b>(d)</b> | <p>1 (tumour is) non-cancerous ;</p> <p>2 <u>cells</u> do not break off and spread / no metastasis ;</p> <p>3 no production of secondary tumours / do not invade other tissues or other parts of the body ; <b>A</b> tumour is localised</p> <p>4 can, compress / displace, surrounding tissue ;</p>  | <b>2 max</b>      |
|          | <b>(e)</b> | high BMI / obese / overweight, people / animals, to reduce, appetite / food intake ; <b>A</b> help obese people to lose weight  | <b>1 max</b>      |
|          |            |   | <b>[Total:16]</b> |

| Question |     |      | Expected Answers  | Marks |
|----------|-----|------|---|-------|
| 2        | (a) | (i)  | (blood) glucose concentration falls after, injection / insulin given ;<br><br>paired figs ;<br><br>rises after 6 hours ;  | 2 max |
|          |     | (ii) | 1. (raised blood glucose concentration) causes drop in, water / solute, potential (of blood) ;<br><br>2. detected by osmoreceptors ;<br><br>3. in the hypothalamus ;<br><br>4. feelings of thirst ;<br><br>5. glucose not converted to, fat / glycogen ;<br><br>6. glucose lost in urine ;<br><br>7. more glucose, respired / metabolised ;<br><br>8. protein / fat, metabolised ;<br><br>9. AVP ; e.g. diabetic dogs do not produce, insulin / enough insulin<br>e.g. water moves into blood from cells / cells dehydrated | 5 max |
|          | (b) | (i)  | hepatic portal vein ; <b>A</b> hepatic artery   | 1     |
|          |     | (ii) | hepatic vein ;  | 1     |

| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
|          | (c) |  | <p><b>1</b> <b>homeostasis</b> / described ;<br/><i>when blood glucose concentration is high</i></p> <p><b>2</b> insulin binds to <b>receptors</b> on, <b>hepatocytes</b> / liver cells ;</p> <p><b>3</b> increased <b>permeability</b> of (cell) membrane / AW ;</p> <p><b>4</b> increased uptake of glucose ;</p> <p><b>5</b> <b>glycogenesis</b> / AW ;</p> <p><b>6</b> increased use of glucose in <u>respiration</u> ;</p> <p><b>7</b> glucose can be converted to lipid ; <b>A</b> fat / triglyceride / LDL / lipoprotein / cholesterol<br/><i>when blood glucose concentration is low</i></p> <p><b>8</b> <b>glucagon</b> binds to receptors on, hepatocytes / liver cells ;</p> <p><b>9</b> inhibits action of insulin ;</p> <p><b>10</b> activates enzymes / (enzyme) <b>cascade effect</b> ; <b>A</b> named enzyme</p> <p><b>11</b> (to bring about) <b>glycogenolysis</b> / AW ;</p> <p><b>12</b> <b>gluconeogenesis</b> / AW ;</p> <p><b>13</b> e.g. from, amino acids / glycerol / lactate ;</p> <p><b>14</b> ref to action of adrenaline ;</p> <p><b>15</b> AVP ; e.g. extra detail of a process</p> | <b>8 max</b>       |
|          |     |  | <b>QWC – clear well organised using specialist terms;</b>  | <b>1</b>           |
|          |     |  | <i>any three from: homeostasis, receptors, hepatocytes, permeability, glycogenesis, glucagon, glycogenolysis, gluconeogenesis, cascade effect</i>  |                    |
|          |     |  |  | <b>[Total: 18]</b> |

| Question |     |  | Expected Answers  | Marks             |
|----------|-----|--|---|-------------------|
| 3        | (a) |  | cerebral cortex / cerebral hemisphere / cerebrum ;<br><b>A</b> parietal / occipital, lobe<br><br><i>human – ora for rat brain</i><br>bigger proportion of whole brain ; <b>R</b> large / bigger<br><br>(much) more folded ;<br><br>larger (surface) area ;<br><br><div style="text-align: right;">2 max</div> | 3 max             |
|          |     |  |   |                   |
|          | (b) |  | poor balance / falling over ;<br><br>uncoordinated (movement) ;<br><br>poor posture ;   | 2 max             |
|          |     |  |   |                   |
|          | (c) |  | <b>control</b> of (any two from)<br><br>breathing ;<br><br>heart rate ;<br><br>blood pressure / arterial pressure ;<br><br>peristalsis / swallowing ;<br><br>salivation / secretion of gastric juice ;<br><br>cranial reflexes ;  | 2 max             |
|          |     |  |   |                   |
|          | (d) |  | 17.14 : 1 ;<br><br>10.00 : 1 ; <b>A</b> 10 : 1  | 2                 |
|          |     |  |   |                   |
|          | (e) |  | neurotransmitters have no proteins to bind to ;<br><br>(postsynaptic membrane) not depolarised / action potentials not transmitted ;<br><br>'pain' areas of brain not stimulated ;  | 2 max             |
|          |     |  |   | <b>[Total:11]</b> |



| Question |     |      | Expected Answers   | Marks        |
|----------|-----|------|--|--------------|
| 4        | (a) | (i)  | correct label ;  | 1            |
|          |     | (ii) | 1. $\text{Ca}^{2+}$ channels open in, presynaptic membrane / presynaptic knob / motor end plate ;<br>2. $\text{Ca}^{2+}$ enter, presynaptic knob / motor end plate ;<br>3. vesicles contain, neurotransmitter / ACh ;<br>4. (vesicles) move towards / fuse, with <u>presynaptic membrane</u> ;<br>5. (ACh / neurotransmitter) released / exocytosis ;<br>6. (ACh / neurotransmitter) <u>diffuses</u> across (cleft) ;<br>7. binds to receptors on, <u>postsynaptic membrane</u> / sarcolemma ;<br>8. $\text{Na}^+$ channels open ;<br>9. $\text{Na}^+$ enters, muscle fibre / sarcoplasm ; <b>R</b> sarcolemma | <b>5 max</b> |
|          |     |      |  |              |

|               | (b)          | <p>any three from</p> <p>1 bind to receptors on, postsynaptic membrane / sarcolemma ;</p> <p>2 ref. competes with, ACh / neurotransmitter ;</p> <p>3 inhibits depolarisation of sarcolemma ;</p> <p>4 reduces release of, ACh / neurotransmitter, (by presynaptic neurone) ;</p> <p>5 inhibits (acetyl)cholinesterase / AW ;</p> <p>6 inhibits uptake of <math>\text{Ca}^{2+}</math> at motor end plate ;</p>  |               | 3 max        |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
|---------------|--------------|--|---------------|--------------|--|-----|----------|--|--|--|--|-----|----------|--|--|--|--|-----|----------|--|--|--|--|-----|----------|---|--|--|--|-----|----------|--|--|--|
|               |              | <p>alternate marking points</p> <p>accept any one from list above plus two detail marks as below</p> <table><tr><th>marking point</th><th colspan="2">detail marks</th></tr><tr><td>1 ;</td><td>1a<br/>1b</td><td>prevents binding / less binding, of ACh ;<br/>therefore no depolarisation ;</td></tr><tr><td></td><td></td><td></td></tr><tr><td>2 ;</td><td>2a<br/>2b</td><td>prevents binding / less binding, of ACh ;<br/>therefore no depolarisation ;</td></tr><tr><td></td><td></td><td></td></tr><tr><td>4 ;</td><td>4a<br/>4b</td><td>prevents binding / less binding, of ACh ;<br/>therefore no depolarisation ;</td></tr><tr><td></td><td></td><td></td></tr><tr><td>5 ;</td><td>5a<br/>5b</td><td>ACh not broken down ;<br/>permanent depolarisation ;</td></tr><tr><td></td><td></td><td></td></tr><tr><td>6 ;</td><td>6a<br/>6b</td><td>vesicles do not fuse with presynaptic membrane ;<br/>ACh not released ;</td></tr></table> | marking point | detail marks |  | 1 ; | 1a<br>1b | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ; |  |  |  | 2 ; | 2a<br>2b | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ; |  |  |  | 4 ; | 4a<br>4b | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ; |  |  |  | 5 ; | 5a<br>5b | ACh not broken down ;<br>permanent depolarisation ; |  |  |  | 6 ; | 6a<br>6b | vesicles do not fuse with presynaptic membrane ;<br>ACh not released ; |  |  |
| marking point | detail marks |  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
| 1 ;           | 1a<br>1b     | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ;   |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
|               |              |  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
| 2 ;           | 2a<br>2b     | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ;   |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
|               |              |  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
| 4 ;           | 4a<br>4b     | prevents binding / less binding, of ACh ;<br>therefore no depolarisation ;   |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
|               |              |  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
| 5 ;           | 5a<br>5b     | ACh not broken down ;<br>permanent depolarisation ;  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
|               |              |  |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |
| 6 ;           | 6a<br>6b     | vesicles do not fuse with presynaptic membrane ;<br>ACh not released ;   |               |              |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |  |  |  |  |     |          |   |  |  |  |     |          |  |  |  |

|  |     |  |  |                   |
|--|-----|--|--|-------------------|
|  |     |  |  |                   |
|  | (c) |  | 1 myosin is a fibrous protein ;<br>2 heads are, globular protein / ATPase ;<br>3 heads, form cross bridges / can bind to actin ;<br>4 (heads) have (two) binding sites ;<br>5 tails are anchored in M line / AW ;<br>6 actin is a globular protein ;<br>7 molecules form long chains ;<br>8 (two) chains twisted together ;<br>9 myosin binding site (on actin) ;<br>10 anchored in Z line / AW ;<br>11 actin and myosin overlap ;<br>12 tropomyosin covers (myosin) binding site (on actin) ;<br>13 troponin is a globular protein ;<br>14 troponin is attached to tropomyosin ;<br>15 AVP ; e.g. (actin and myosin) arranged in regular pattern<br>e.g. actin and myosin form (myo)filaments<br>e.g. correct description of, A / H / I, band | 7 max             |
|  |     |  | <b>QWC – legible text with accurate spelling, punctuation and grammar;</b>   | 1                 |
|  |     |  |  | <b>[Total:17]</b> |

| Question |                                       |                            | Expected Answers  | Marks                 |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|----------|---------------------------------------|----------------------------|---|-----------------------|----------------------|----------------------------|---|-------------------------------------|-------------------------|---|---------------------------------------|-----------------------|---|-----------------------|----------------------|---|
| 5        | (a)                                   |                            | <b>L</b> ganglion (cell) ;<br><b>M</b> bipolar (cell) ;<br><b>N</b> rod (cell) ;  | 3                     |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          |                                       |                            |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          | (b)                                   |                            | night blindness / night vision lost ;<br>loss of peripheral vision / tunnel vision ;<br><i>alternative if cone chosen for N</i><br>blurred (central) vision / AW ;<br>no colour vision / colour vision impaired ;   | 2                     |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          |                                       |                            |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          | (c)                                   |                            | <table><tr><td></td><td>family history of RP</td><td>likely inheritance pattern</td></tr><tr><td>1</td><td>only present in male family members</td><td>X-linked / sex linked ;</td></tr><tr><td>2</td><td>not present in last three generations</td><td>autosomal recessive ;</td></tr><tr><td>3</td><td>present in one parent</td><td>autosomal dominant ;</td></tr></table> |                       | family history of RP | likely inheritance pattern | 1 | only present in male family members | X-linked / sex linked ; | 2 | not present in last three generations | autosomal recessive ; | 3 | present in one parent | autosomal dominant ; | 3 |
|          | family history of RP                  | likely inheritance pattern |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
| 1        | only present in male family members   | X-linked / sex linked ;    |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
| 2        | not present in last three generations | autosomal recessive ;      |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
| 3        | present in one parent                 | autosomal dominant ;       |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          |                                       |                            |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          | (d)                                   |                            | <i>any two from</i><br>cell <b>L</b> / ganglion cell ;<br>cell <b>M</b> / bipolar cell ;<br>cones cell ;<br>these cells have not been, degenerated / affected by the disease ;<br><b>ora</b> for rod cell   | <i>2 max</i><br>3 max |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |
|          |                                       |                            |   |                       |                      |                            |   |                                     |                         |   |                                       |                       |   |                       |                      |   |

| Question |     |      | Expected Answers   | Marks             |
|----------|-----|------|--|-------------------|
|          | (e) | (i)  | 1. lens made of cells ;<br>2. reduced oxygen to, lens / cells ;<br>3. proteins (in cells) denature ;<br>4. loss of, tertiary structure / 3D shape ;<br>5. (proteins), coagulate / clump together / precipitate ;<br>6. AVP ; e.g. effect of UV light | 3 max             |
|          |     |      |  |                   |
|          |     | (ii) | 1. use local anaesthetic ;<br>2. use surgical technique <b>or</b> break lens using, laser / ultrasound ;<br>3. remove / replace, lens ; <b>A</b> have cataracts removed<br>4. with artificial lens ;<br>5. ref. glasses / contact lens ;             | 3 max             |
|          |     |      |  | <b>[Total:17]</b> |

| Question |     |       | Expected Answers  | Marks             |
|----------|-----|-------|---|-------------------|
| 6        | (a) |       | <p>1 chimp stacks crates ;</p> <p>2 uses same activity to reach bananas ;</p> <p>3 problem solving ;</p> <p>4 insight learning ;</p> <p>5 use, previously learnt behaviour / experience ;</p> <p>6 in novel situation / AW ;</p> <p>7 trial and error ;</p>   | 4 max             |
|          | (b) |       | <p>1 rapid / immediate ;</p> <p>2 automatic response / conscious thought not required / does not involve brain ;</p> <p>3 innate / stereotypical / inborn / genetic ;</p> <p>4 can be conditioned ;</p> <p>5 not learned ;</p> <p>6 involves fewer neurones than usual pathways / only 3 neurones used / 3 named neurones ;</p> <p>7 response to, life threatening stimuli / potential damage <b>or</b> good survival value ;</p> | 4 max             |
|          | (c) | (i)   | operant – (negative / positive) reinforcement idea ; <i>A training</i>  | 1                 |
|          |     | (ii)  | classical – associates brakes with crash ;  | 1                 |
|          |     | (iii) | operant – positive reinforcement idea ;   | 1                 |
|          |     |       |   | <b>[Total:11]</b> |

# 2806/01 Unifying Concepts in Biology - Written Paper

| Question |     |       | Expected Answers  | Marks              |
|----------|-----|-------|---|--------------------|
| 1        | (a) |       | glucose ;<br>1000(+) ; <b>A</b> > 200<br>$\alpha$ 1-4 ; <b>A</b> $\alpha$ 1-6<br>insoluble ;<br>plastid / chloroplast / starch grain ; <b>A</b> amyloplast, leucoplast<br><b>IGNORE</b> cytoplasm   | 5                  |
|          | (b) |       | carboxylation of RuBP / AW ;<br>reduction of GP / AW ; <b>A</b> PGA for GP<br>using (energy from) ATP ;<br>(2 X) TP to make, hexose / glucose ; <b>A</b> PGAL / GALP for TP<br>isomerisation of glucose to fructose ;<br>polymerisation of, hexose / fructose / AW ;<br>ref. (named) enzyme ;<br>AVP ; e.g. ref. regeneration of RuBP | max 4              |
|          | (c) | (i)   | possesses a, foreign / new, gene / AW ;   | 1                  |
|          |     | (ii)  | $4.4 - 2.9 = 1.5$ ;<br>$(1.5 / 2.9) \times 100 = 52\%$ ; <b>A</b> 51.7%<br><i>award two marks for the correct answer</i>  | 2                  |
|          |     | (iii) | water content variable / AW ;<br>measuring fresh mass would bias in favour of control conditions ;<br>dry mass measures, fructans / starch / organic chemicals /<br>photosynthetic products ;   | max 2              |
|          | (d) |       | ponies, evolved / adapted to ;<br>low(er), fructan / energy / grass, supply (in mountains / moorlands) ;<br>reduced <u>soil</u> nutrients / less sunlight / colder, in mountains / moorlands ;  | max 2              |
|          |     |       |   | <b>[Total: 16]</b> |

| Question |     | Expected Answers                               |             |                  |                    |                       | Marks |
|----------|-----|--|-------------|------------------|--------------------|-----------------------|-------|
| 2        | (a) |  | kingdom     | phylum           | GENUS              | SPECIES               |       |
|          |     | A  | Animalia    | Chordata         | <i>Arothron</i>    | <i>nigropunctatus</i> |       |
|          |     | B  | ANIMALIA    | Mollusca         | <i>Conus</i>       | <i>textile</i>        |       |
|          |     | C  | PROKARYOTAE | Anoxybacteria    | <i>Clostridium</i> | <i>botulinum</i>      |       |
|          |     | D  | PLANTAE     | Angiospermophyta | <i>Physostigma</i> | <i>venenosum</i>      |       |
|          |     | A English names (animals, prokaryotes, plants) |             |                  |                    |                       | 5     |
|          |     |  |             |                  |                    |                       |       |



| Question |     |  | Expected Answers   | Marks              |
|----------|-----|--|--|--------------------|
|          | (b) |  | <p>D1 resting potential negative inside ;</p> <p>D2 action potential / nerve impulse, reverses potential / makes it positive inside ;</p> <p>D3 as sodium ions move in ;</p> <p>E4 <math>\text{Na}^+</math> in prevented by, <i>Arothron</i> / (puffer) fish / A, (poison) ;</p> <p>D5 (impulse / action potential, reaches synaptic terminal) opens calcium channels ;</p> <p>D6 calcium ions move in ;</p> <p>E7 rise in / entry of, calcium ions prevented by, <i>Conus</i> / cone shell / B, (poison) ;</p> <p>D8 triggers exocytosis of, neurotransmitter / ACh ;</p> <p>E9 neurotransmitter / ACh, release prevented by, <i>Clostridium</i> / botulism / C, (poison) ;</p> <p>D10 neurotransmitter / ACh, diffuses ;</p> <p>D11 across synaptic cleft ;</p> <p>D12 binds to post-synaptic receptors ;</p> <p>D13 activating / opening (sodium) channels / new action potential ;</p> <p>E14 <i>Physostigma</i> / plant / D, (poison) prevents breakdown of ACh ;</p> <p>E15 therefore receptors continually stimulated / AW ;</p> <p style="text-align: right;"><i>internal max 7D marks</i></p> | max 10             |
|          |     |  | <b>QWC – legible text with accurate spelling, punctuation and grammar ;</b>  | 1                  |
|          |     |  |  | <b>[Total: 16]</b> |

| Question |     |       | Expected Answers   | Marks             |
|----------|-----|-------|--|-------------------|
| 3        | (a) | (i)   | straight / curved, line showing negative correlation ;   | 1                 |
|          |     | (ii)  | as fish intake increases heart, disease / deaths, decrease / AW ; <b>ora</b> supporting figs ; (2 countries x and y refs with units)   | 2                 |
|          |     | (iii) | USA ;<br>further from, Belgium / line of best fit ; (reason re. graph)<br>higher intake of food / obesity / insufficient exercise ;<br>(reason re. USA lifestyle)  | max 2             |
|          | (b) |       | COOH head ;<br>more than one C-C double bond ;<br>C-C double bond in $\omega$ -3 position ;<br>terminal CH <sub>3</sub> ;  | max 2             |
|          | (c) | (i)   | fish oils better as, only tests one thing / fewer variables / dose known ;<br>another, compound / mineral / vitamin, in fish could affect results ;<br><b>A example - selenium, iodine, calcium, vitamin A, vitamin E</b>  | 2                 |
|          |     | (ii)  | decreases blood pressure ;<br>slows clotting ;   | 2                 |
|          | (d) |       | less exercise ;<br>poor diet / description ;<br>more alcohol ;<br>smoking ;  | max 2             |
|          | (e) | (i)   | ref. different years / diet may have changed between 1986 and 1998 ;<br>ref. different study methods for, measuring / estimating, fish intake ;<br>ref. men in first graph, whole population in second ;   | max 1             |
|          |     | (ii)  | lifestyle not only reason for link / poor hypothesis ;<br>depression correlates with low fish intake ;<br>figs. in support ; (2 countries x and y refs with units)<br>ref. fatty acids in, brain metabolism / nerve cell membranes ;<br>ref. having CVD causing depression ; | max 2             |
|          |     |       |  | <b>[Total:16]</b> |

| Question    |     |       | Expected Answers  | Marks |
|-------------|-----|-------|---|-------|
| 4           | (a) | (i)   | (tree that) re-grows branches from cut, base / trunk / AW ;   | 1     |
|             |     | (ii)  | eutrophication ;  | 1     |
|             |     | (iii) | <p><i>for an identified species, larger taxon or grouping -</i><br/> 1<sup>st</sup> MP: increase / decrease, in, population size / number / abundance ;<br/> 2<sup>nd</sup> MP: explanation (abiotic or biotic change related to beaver activity described) ;</p> <p><i>Examples (not an exhaustive list)</i><br/> decrease in, tree-nesting birds / squirrels / insects on trees ;<br/> due to felling of trees / loss of habitat ;</p> <p>decrease in (named) herbivore(s) ;<br/> due to competition with beavers ;</p> <p>decrease / increase, in (named) forest carnivore(s) ;<br/> due to, decrease in herbivores / increase in beavers ;</p> <p>increase in, wading birds / ducks / aquatic animals ;<br/> due to creation of wetlands ;</p> <p>increase / decrease, in fish ;<br/> due to, blocking of stream / change in flow ;</p> <p>increase in abundance of aquatic algae ;<br/> due to, reduction in water turbidity / more light penetrating water ;</p> <p>decrease in, algae / aquatic plants / decomposer bacteria ;<br/> due to reduced eutrophication ;</p> <p>increase in, fungi / decomposers / saprotrophs ;<br/> due to increase in dead trees ;</p> | max 4 |
|             | (b) | (i)   | physical property ; e.g. ice floats / denser than air / refracts light /<br>benefit to beaver ; e.g. blocks predators / predators can't, move / see /<br>smell, as well<br>detail of how benefit achieved ; e.g. explanation ref. H bonds   | 3     |
|             |     | (ii)  | xylem, tough / fibrous / hard / lignified ;<br>outer part / phloem / cambium, rich in sugars / nutrients ;<br>beavers can't break down xylem / lack enzymes to digest, cellulose /<br>lignin ;  | max 2 |
|             | (c) |       | succession ;  | 1     |
| [Total: 12] |     |       |   |       |

## 2806/03 Practical Examination

- **Planning Exercise**

The mark scheme for the planning exercise is set out on page 99 and 100. The marking points **A** to **U** follow the coursework descriptors for Skill P.

Indicate on the plans where the marking points are met by using a tick and an appropriate letter. There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

- **Practical Test**

Pages 101 to 104 have the mark scheme for Questions 1 and 2 for the Practical Test.

**A2 Biology. Planning exercise**

| Checking Point | Descriptor | The candidate  |
|----------------|------------|--|
| A              | P.1a       | Plans a suitable procedure that involves using <b>at least two</b> different environmental conditions and recording population growth of <i>T. confusum</i> and <i>T. castaneum</i> when cultured together ;                             |
| B              | P.1a       | Gives a prediction about the effect of <b>at least two</b> named environmental conditions on competition between <i>T. confusum</i> and <i>T. castaneum</i> (this may be shown in a graph) ;   |
| C              | P.1b       | Selects <b>at least one</b> piece of suitable equipment for <b>at least two</b> named conditions e.g. incubator, desiccator, balance, size of containers ;   |
| D              | P.3a       | States that this investigation involves <b>interspecific</b> competition ;   |
| E              | P.3a       | Identifies <b>at least two key factors to control</b> e.g. duration of experiment, humidity, temperature, starting numbers of beetles in cultures, numbers of males and females, size of container, type of flour, quantity of flour ;   |
| F              | P.3b       | Decides on <b>at least five</b> measurements to take for one of the independent variables ;  |
| G              | P.3b       | Decides on a suitable range for <b>one</b> continuous variable ; e.g. temperature, humidity, quantity of flour   |
| H              | P.3b       | Describes a way of obtaining reliable results by using a minimum of <b>three</b> cultures per set of conditions ;  |
| I              | P.5a       | <b>Uses</b> appropriate scientific knowledge and understanding in developing a plan, e.g. population growth, limiting factors, carrying capacity, intraspecific competition, interspecific competition, variation, species differences ; |
| J              | P.5a       | <b>Uses</b> preliminary work or previous practical work in developing a plan ;   |
| K              | P.5a       | Refers to <b>at least one</b> hazard and an appropriate precaution e.g. potential allergies ;  |
| L*             | P.5b       | <i>Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC) ;</i>   |
| M              | P.5b       | <b>Describes</b> way(s) of obtaining precise results e.g. careful sieving, leaving culture for eggs to hatch / larvae to develop into adults, how to use microscope to aid identification / immobilise for counting by cooling / ether ; |
| N              | P.7a       | Uses relevant information from any <b>two written sources</b> , e.g. class notes / text book / web site, etc ; <i>must be cited in plan</i>  |
| O              | P.7a       | Shows how results are to be presented in table including correct use of units, RH as %, temperature as °C, mass g/kg, for both named environmental conditions ;  |
| P*             | P.7a       | <i>Uses spelling, punctuation and grammar accurately (QWC) ;</i>   |
| Q              | P.7a       | Explains that the two species are competing for the same <u>niche</u> ;  |
| R              | P.7b       | Shows how results are to be presented ; suitable graph for one condition   |
| S              | P.7b       | Shows how results are to be analysed ; e.g. % change in population or named statistical test e.g. Chi-square, t-test   |
| T              | P.7b       | Comments on difficulty in distinguishing between the species ;   |
| U              | P.7b       | Comments on validity, e.g. investigation uses very confined space – in flour mills / storage silos habitat may be more complex, effect of intraspecific competition when species cultured separately ;                                   |

Point mark up to **14** by placing letters **A** to **U** **excluding L and P** in the margin at appropriate points.

Then award **1** mark for each of **L** and **P** (QWC).

**Total: 16**

## 2806/03 Practical Examination

| Question |  |            | Expected Answers  | Marks        |
|----------|--|------------|---|--------------|
| 1        |  |            | <i>filtered potato extract – negative</i><br>no marks   |              |
|          |  |            |   |              |
|          |  |            | <i>table</i><br>table format with correct times in left hand column or along the top ;<br>units (min or s) in column heading ; <b>R</b> if units in body of table<br>contents of test-tubes in, column / row, headings ;<br>informative, column / row, headings ; colour / observation / key with<br>iodine <b><u>and time</u></b><br>correct trend - darkens in <b>A</b> , no change in others ;<br><b>ignore</b> small changes in <b>B</b> and <b>C</b> | <b>5</b>     |
|          |  |            |   |              |
|          |  | <b>(a)</b> | <i>extract</i><br>to make sure no starch present (at time 0) ;<br>to show the expected result at time 0 for tubes <b>A</b> , <b>B</b> and <b>C</b> ;  | <b>1 max</b> |
|          |  |            |   |              |
|          |  | <b>(b)</b> | enzyme / starch phosphorylase may (start to) denature (at higher temperatures) ;<br>hydrolytic enzymes released from lysosomes ;<br>will not break down starch phosphorylase at this temperature / AW ;   | <b>2 max</b> |
|          |  |            |   |              |

| Question |  |     | Expected Answers   | Marks  |
|----------|--|-----|--|--------|
|          |  | (c) | <p><i>test-tube A</i><br/>           at time 0 / start, (iodine solution) is yellow / brown in colour ; <b>A</b> no starch<br/>           after candidates time (iodine solution) blue black colour ; <b>A</b> starch (present / formed)</p> <p>starch formed from G 1-P ; <b>R</b> if linked to incorrect chemical process</p> <p>by condensation ;<br/>           reaction proceeds (from right) to left / ref. to equilibrium ;<br/>           phosphorylase / enzyme, specific for G 1-P (substrate) ;<br/>           ref to active site ;<br/>           G 1-P has appropriate shape ;<br/>           so (idea of forming) ES complexes ;<br/>           (idea that) G 1-P is 'energised' ;</p> <p><i>test-tube B</i><br/>           (iodine solution) no change / stays yellow / AW ;</p> <p>no starch formed / present ;<br/>           too many phosphate ions / high concentration of phosphate ions ;<br/>           reaction towards starch unfavourable / AW / ref to equilibrium ;<br/>           ref to possible role of <math>K^{\pm}</math> as inhibitor ;</p> <p><i>test-tube C</i><br/>           (iodine solution) no change / stays yellow / AW ;</p> <p>no starch formed / present ;<br/>           phosphorylase / enzyme, not specific for glucose / specific for G 1-P ;<br/>           glucose cannot fit active site / enzymes have specific active sites ;<br/>           (idea of) no ES complexes ;</p> | 10 max |
|          |  | (d) | <p>(if tested at time 0 iodine solution) would give blue black colour as starch present ;<br/>           (after 35 min iodine colour indicates) starch broken down to G 1-P ;<br/>           reaction proceeds (from left) to right / ref to equilibrium ;<br/>           concentration of reactants (starch <u>and</u> <math>KH_2PO_4</math>) favours reaction to G 1-P / AW ;</p>  | 3 max  |



|  |            |   |                        |
|--|------------|---|------------------------|
|  |            | <i>mark (e) and (f) together to max 10</i>  |                        |
|  | <b>(e)</b> | <p><i>to obtain quantitative results</i></p> <p>1 make known concentrations of starch and add to iodine ;</p> <p>2 use same volumes ;</p> <p>3 use a colorimeter / data logger with light probe ;</p> <p>4 detail ; e.g. use of suitable filter / measure absorbance / measure transmission ;</p> <p>5 calibration curve ;</p> <p>6 use intercept (to find concentration) ;</p> <p>7 repeat (at least) twice ;</p> <p>8 calculate means ;</p> <p>9 calculate standard deviation / calculate standard error / use error bars ;</p>   |                        |
|  | <b>(f)</b> | <p><i>to show reaction is enzymic</i></p> <p>1 no enzyme / extract / AW ;</p> <p>2 idea of following same procedure ;</p> <p>3 expect no change / AW ;</p> <p>4 use boiled extract / suitable quoted temperature (60°C or above) ;</p> <p>5 denatured enzyme ;</p> <p>6 expect, no change if enzymic / change if non-enzymic ;</p> <p>7 use solutions of different pH ;</p> <p>8 denatured enzyme ;</p> <p>9 expect <u>optimum</u> pH ;</p> <p>10 use an appropriate range of temperatures ;</p> <p>11 below optimum (60°C) ;</p> <p>12 expect <math>Q_{10} = 2</math> / described ;</p> <p>13 add inhibitor ;</p> <p>14 named inhibitor ;</p> <p>15 expect no result / slowing of reaction ;</p> | <b>10<br/>max</b>      |
|  | <b>(g)</b> | <p>did not sample precisely at time 0 / AW ;</p> <p>long intervals between taking samples ;</p> <p>cannot take samples exactly at the same time ;</p> <p>temperature, fluctuated / not controlled ;</p> <p>no repeats / AW ;</p> <p>ref to accuracy of measurement e.g. 'drops', syringes etc. ;</p> <p>R contamination and air bubbles in syringes</p> <p>no buffer used / pH not controlled ;</p>   | <b>2<br/>max</b>       |
|  |            |   |                        |
|  |            |   | <b>[Total: max 29]</b> |

| Question |     |       | Expected Answers  | Marks           |
|----------|-----|-------|---|-----------------|
| 2        | (a) | (i)   | label Y correctly positioned <b>in</b> pollen sac ;   | 1               |
|          |     | (ii)  | <i>drawing</i><br>clear, continuous lines ;<br>no shading / stippling ; <b>A</b> shading in chromosomes<br>cellulose walls shown as double lines ;<br>chromosomes <b>not</b> shown as single lines ;<br>chromosomes positioned along equator / on equatorial plate ;<br><br><i>labels</i><br>cell wall ;<br>(chromosomes on) equator / AW ;<br>chromosome(s) ;<br>chromatid(s) / bivalent(s) ;<br>cytoplasm ; | 8 max           |
|          | (b) |       | haploid / n / contain half number of chromosomes ;<br><b>R</b> half genetic information<br>show <u>genetic</u> variation ;<br><u>DNA</u> different due to crossing over / chiasmata formation ;   | 2 max           |
|          | (c) | (i)   | prophase ;<br>(meiosis) I ; ecf if wrong stage  | 2               |
|          |     | (ii)  | <i>prophase</i><br>chromosomes / chromatids visible ;<br>chromosomes in different positions / scattered / AW ;<br><b>A</b> not at ends / equator<br>(chromosomes contained by) nuclear envelope / separated from cytoplasm ; <b>A</b> nuclear membrane<br>no nucleolus ;<br><br><i>meiosis I</i><br>one cell / one nucleus ;  | 4 max           |
|          |     | (iii) | homologous chromosomes pair ;<br>synapsis ;<br>(chromosomes) thicken / condense / spiralise / AW ;<br>chiasma(ta) form / crossing over ;<br>described ; e.g. breakage and exchange of (non-sister) chromatids /<br>DNA <b>R</b> chromosome  | 4 max           |
|          |     |       |   | [Total: max 15] |

# Grade Thresholds

Advanced GCE Biology 3881 7881  
January 2009 Examination Series

## Unit Threshold Marks

| Unit   |     | Maximum Mark | A  | B  | C  | D  | E  | U |
|--------|-----|--------------|----|----|----|----|----|---|
| 2801   | Raw | 60           | 42 | 37 | 32 | 27 | 23 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2802   | Raw | 60           | 45 | 41 | 37 | 33 | 30 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2803A  | Raw | 120          | 95 | 85 | 75 | 65 | 55 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |
| 2803B  | Raw | 120          | 95 | 85 | 75 | 65 | 55 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |
| 2803C  | Raw | 120          | 84 | 76 | 68 | 60 | 52 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |
| 2804   | Raw | 90           | 63 | 56 | 49 | 43 | 37 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2805 A | Raw | 90           | 60 | 54 | 49 | 44 | 39 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2805 B | Raw | 90           | 59 | 53 | 47 | 41 | 35 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2805 C | Raw | 90           | 60 | 54 | 48 | 43 | 38 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2805 D | Raw | 90           | 66 | 59 | 52 | 45 | 39 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2805 E | Raw | 90           | 65 | 58 | 51 | 44 | 38 | 0 |
|        | UMS | 90           | 72 | 63 | 54 | 45 | 36 | 0 |
| 2806 A | Raw | 120          | 91 | 82 | 73 | 64 | 56 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |
| 2806 B | Raw | 120          | 91 | 82 | 73 | 64 | 56 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |
| 2806 C | Raw | 120          | 87 | 79 | 71 | 63 | 55 | 0 |
|        | UMS | 120          | 96 | 84 | 72 | 60 | 48 | 0 |

## Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

|             | <b>Maximum Mark</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>U</b> |
|-------------|---------------------|----------|----------|----------|----------|----------|----------|
| <b>3881</b> | 300                 | 240      | 210      | 180      | 150      | 120      | 0        |
| <b>7881</b> | 600                 | 480      | 420      | 360      | 300      | 240      | 0        |

The cumulative percentage of candidates awarded each grade was as follows:

|             | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>U</b> | <b>Total Number of Candidates</b> |
|-------------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| <b>3881</b> | 9.6      | 29.2     | 55.4     | 80.5     | 96.6     | 0        | 1462                              |
| <b>7881</b> | 11.4     | 37.9     | 66.9     | 87.1     | 98.7     | 0        | 418                               |

### 1880 candidates aggregated this series

For a description of how UMS marks are calculated see:

[http://www.ocr.org.uk/learners/ums\\_results.html](http://www.ocr.org.uk/learners/ums_results.html)

Statistics are correct at the time of publication.

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