

Mark Scheme (Results)

November 2021

Pearson Edexcel GCSE In Biology (1BI0) Paper 1H

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#### **General Marking Guidance**

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

| Assessment<br>Objective |              | Commai  | nd Word   |
|-------------------------|--------------|---|---|
| Strand                  | Element      | Describe  | Explain   |
| AO1                     |              | An answer that combines the marking points to provide a logical description   | An explanation that links identification of a point with reasoning/justification(s) as required   |
| AO2                     |              | An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding | An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding) |
| AO3                     | 1a and<br>1b | An answer that combines points of interpretation/evaluation to provide a logical description                                    |   |
| AO3                     | 2a and<br>2b |   | An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning                            |
| AO3                     | За           | An answer that combines the marking points to provide a logical description of the plan/method/experiment                       |   |
| AO3                     | 3b           |   | An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning             |

| Question<br>Number | Answer                    |                       |                       | Mark  |
|--------------------|---------------------------|-----------------------|-----------------------|-------|
| 1 (a)(i)           | (a)(i)                    |                       | (1)                   |       |
|                    | D                         | refracts light        | refracts light        | AO1 1 |
|                    |                           |                       |                       |       |
|                    | The only correc           | ct answer is D        |                       |       |
|                    | <b>A</b> is not correct b | ecause structure Y do | oes not detect light  |       |
|                    | <b>B</b> is not correct b | ecause structure X do | oes not detect light  |       |
|                    | <b>C</b> is not correct b | ecause structure X do | oes not reflect light |       |

| Question<br>Number | Answer   | Additional Guidance   | Mark         |
|--------------------|--|---|--------------|
| 1 (a)(ii)          | A description including <b>two</b> from:  • pupil becomes smaller (1)                          |   | (2)<br>AO2 1 |
|                    | • the iris changes shape (1)   | accept the iris get larger  |              |
|                    | <ul> <li>correct light intensity is<br/>detected by {retina /<br/>rods / cones} (1)</li> </ul> | accept reduces the amount of light entering the eye / protects the retina |              |

| Question<br>Number | Answer              | Additional Guidance | Mark         |
|--------------------|---------------------|---------------------|--------------|
| 1 (b)(i)           | {CT / PET} scanning | accept MRI / X-ray  | (1)<br>AO1 1 |

| Question<br>Number | Answer  | Additional<br>Guidance   | Mark         |
|--------------------|---|--|--------------|
| 1 (b)(ii)          | A description including two from:                               |  | (2)<br>AO1 1 |
|                    | <ul> <li>brain is protected by skull</li> <li>(1)</li> </ul>    | accept bone for<br>skull   |              |
|                    | • it is difficult to access (1)                                 |  |              |
|                    | <ul> <li>nerves do not<br/>{repair / regenerate} (1)</li> </ul> |  |              |
|                    | <ul> <li>the risk of damage to the brain (1)</li> </ul>         | accept must not<br>damage healthy<br>cells/can cause<br>side effects |              |

(Total for question 1 = 6 marks)

| Question<br>Number | Answer  | Additional guidance          | Mark  |
|--------------------|---|------------------------------|-------|
| 2(a)(i)            | A description including <b>three</b> from:  |                              | (3)   |
|                    | the impulse (in the relay<br>neurone) triggers the release<br>of a chemical (1)         |                              | AO1 1 |
|                    | • neurotransmitter (1)  | accept chemical<br>messenger |       |
|                    | • (neurotransmitter) <b>diffuses</b> (1)  |                              |       |
|                    | across the synapse (1)  | accept across the gap        |       |
|                    | <ul> <li>new impulse triggered in<br/>{motor neurone / next<br/>neurone} (1)</li> </ul> |                              |       |

| Question<br>Number | Answer   | Additional<br>Guidance  | Mark  |
|--------------------|--|---|-------|
| 2(a)(ii)           | An explanation linking <b>two</b> from:  |   | (2)   |
|                    | <ul> <li>a process that occurs in<br/>response to danger (1)</li> </ul>  |   | AO1 1 |
|                    | <ul> <li>which bypasses the {brain /<br/>parts of the brain} / is an<br/>{involuntary process /<br/>subconscious process} (1)</li> </ul>   | accept goes to<br>the spinal cord<br>accept react<br>without thinking             |       |
|                    | <ul> <li>so there is a faster transmission<br/>(of electrical impulses) / faster<br/>response / allows a quick<br/>reaction (1)</li> </ul> |   |       |
|                    | <ul> <li>to protect the body from harm</li> <li>(1)</li> </ul>   | accept examples<br>of actions to<br>protect the body<br>e.g. pulling hand<br>away |       |

| Question<br>Number | Answer   | Mark         |
|--------------------|--|--------------|
| 2(b)(i)            | C 215 milliseconds   | (1)<br>AO2 1 |
|                    | The only correct answer is C                                       |              |
|                    | <b>A</b> is not correct because the median is not 200 milliseconds |              |
|                    | <b>B</b> is not correct because the median is not 210 milliseconds |              |
|                    | <b>D</b> is not correct because the median is not 225 milliseconds |              |

| Question | Answer  | Additional  | Mark   |
|----------|---|---|--------|
| Number   |   | Guidance  |        |
| 2(b)(ii) | A description including <b>three</b> from:  |   | (3)    |
|          |   |   | AO3 3a |
|          | measure their reaction  | accept see how fast                                 |        |
|          | time using red squares (1)  | they react with red squares                         |        |
|          | <ul> <li>keep everything else the<br/>same (as using blue<br/>squares) (1)</li> </ul> |   |        |
|          | <ul> <li>repeat measurements (for each student) (1)</li> </ul>                        |   |        |
|          | <ul> <li>calculate a mean reaction<br/>time (1)</li> </ul>                            |   |        |
|          | <ul> <li>control other variables (1)</li> </ul>                                       | accept examples of other variables e.g. tiredness / |        |
|          |   | environment / health                                |        |

(Total for question 2 = 9 marks)

| Question | Answer                          | Mark  |
|----------|---------------------------------|-------|
| Number   |                                 |       |
| 3(a)     | World Health Organization / WHO | (1)   |
|          |                                 |       |
|          |                                 | AO1 1 |
|          |                                 |       |

| Question<br>Number | Answer   | Additional guidance  | Mark  |
|--------------------|--|--|-------|
| 3(b)(i)            | An answer including <b>two</b> from:   |  | (2)   |
|                    | • (communicable) is passed from <b>person to person</b> (1)                                | accept reverse<br>arguments for non-<br>communicable<br>diseases | AO1 1 |
|                    | <ul> <li>(communicable) caused by<br/>{pathogens / example of<br/>pathogen} (1)</li> </ul> |  |       |
|                    | <ul> <li>(communicable diseases)<br/>cannot be inherited (1)</li> </ul>                    |  |       |

| Question<br>Number | Answer  | Additional<br>Guidance  | Mark  |
|--------------------|---|---|-------|
| 3(b)(ii)           | An explanation including:   |   | (2)   |
|                    | <ul> <li>{cough / sneeze} into a<br/>tissue / avoid close<br/>contact with infected<br/>people / avoid cramped<br/>living conditions (1)</li> </ul>                   | accept regular hand<br>washing / wear a<br>mask / isolate an<br>infected person | AO2 1 |
|                    | because spread of TB is<br>airborne droplets / TB<br>is spread through the<br>air (1)   | accept spread by coughing / breathing it {in / out}                             |       |
|                    | <ul> <li>vaccination /         immunisation (1)</li> <li>to provide immunity /         reduces the chance of a         person getting infected         (1)</li> </ul> | accept reduces the<br>chances of contact<br>with an infected<br>person          |       |
|                    | <ul> <li>treat infected people with antibiotics (1)</li> <li>reduces the number of infected people (1)</li> </ul>   |   |       |

| Question<br>Number | Answer  | Additional guidance  | Mark         |
|--------------------|---|--|--------------|
| 3(b)(iii)          | <ul> <li>suitable heading for<br/>each column, with<br/>country in the left<br/>column (1)</li> </ul> | accept country /<br>region / number of<br>people / people with<br>TB | (2)<br>AO2 1 |
|                    | <ul> <li>all data entered<br/>accurately (1)</li> </ul>   | countries can be entered in any order                                |              |

| Question<br>Number | Answer  | Additional guidance  | Mark         |
|--------------------|---|--|--------------|
| 3(c)               | An explanation linking the following:   |  | (2)<br>AO1 1 |
|                    | HIV destroys white<br>blood cells / HIV<br>weakens the immune<br>system (1)   | accept people with<br>AIDS have fewer white<br>blood cells             |              |
|                    | <ul> <li>so the body is unable<br/>to {destroy the TB<br/>pathogen / prevent the<br/>pathogen invading the<br/>body} (1)</li> </ul> | accept unable to produce antibodies to TB ignore fight off the disease |              |

(Total for Question 3 = 9 marks)

| Question<br>Number | Answer   | Mark  |
|--------------------|--|-------|
| 4 (ai)             | C aseptic  | (1)   |
|                    | The only correct answer is C   | AO1 2 |
|                    | <b>A</b> is not correct because clinical is not a technique                        |       |
|                    | <b>B</b> is not correct because diagnostic does not prevent contamination          |       |
|                    | <b>D</b> is not correct because lysogenic describes a stage of the virus lifecycle |       |

| Question<br>Number | Answer  | Additional Guidance  | Mark  |
|--------------------|---|--|-------|
| 4 (a)(ii)          | Any <b>two</b> from:  |  | (2)   |
|                    | <ul> <li>keep the lid on at all possible times (1)</li> </ul> |  | AO1 2 |
|                    | <ul> <li>use sterile equipment</li> <li>(1)</li> </ul>        | accept a method of<br>sterilising equipment<br>e.g. flaming loops /<br>disinfect the working<br>area |       |
|                    | • autoclave agar (1)  | accept use sterile<br>growth medium  |       |
|                    | • wear gloves / mask (1)                                      |  |       |
|                    | work close to a    Bunsen (burner) (1)                        |  |       |

| Question<br>Number | Answer   | Additional Guidance   | Mark  |
|--------------------|--|---|-------|
| 4 (b)(i)           | radius   | award full marks for  | (3)   |
|                    | 4.5 mm (1)   | correct answer with no working  | AO2 1 |
|                    | calculation<br>(3.14 x 4.5 x 4.5 /<br>3.14 x 4.5 <sup>2</sup> ) = 63.585 (1) | accept 63.617<br>ecf if diameter used<br>254.469 / 254.34 for one<br>mark |       |
|                    | evaluation<br>63.6 (mm²)   | ecf if diameter used<br>254.5 / 254.3 (mm²) to 1                          |       |
|                    |  | DP for two marks  |       |

| Question<br>Number | Answer                    | Additional Guidance   | Mark         |
|--------------------|---------------------------|---|--------------|
| 4 (b)(ii)          | as a control / to compare | accept to see the effect<br>without using<br>toothpaste / to see the<br>effect of just saliva | (1)<br>AO2 2 |

| Question<br>Number | Answer  | Additional Guidance  | Mark  |
|--------------------|---|--|-------|
| 4 (b)(iii)         | Any <b>two</b> from:  |  | (2)   |
|                    | • the test only uses one species of bacteria (1)                                  |  | AO2 2 |
|                    | • there are still bacteria on the agar plate (1)                                  |  |       |
|                    | <ul> <li>the test is not done<br/>on teeth (1)</li> </ul>                         |  |       |
|                    | <ul> <li>the conditions in the<br/>mouth are different<br/>(1)</li> </ul>         | accept temperature in<br>the mouth may not be<br>37°C      |       |
|                    | <ul> <li>toothpaste is only<br/>used on teeth for a<br/>short time (1)</li> </ul> |  |       |
|                    |   | accept the test only<br>uses one type of<br>toothpaste (1) |       |

| Question<br>Number | Answer   | Additional<br>Guidance  | Mark           |
|--------------------|--|---|----------------|
| 4(c)               | An explanation linking:  |   | (2)            |
|                    | the toothpastes were not<br>harmful to the cells (1)                         | accept toothpaste<br>has the same<br>effect as saliva<br>accept toothpaste<br>2 is less harmful<br>to cells | AO3 2a +<br>2b |
|                    | because the % of healthy<br>cells after 2 hours was<br>similar to saliva (1) | accept a<br>description of the<br>data values to<br>illustrate a similar<br>effect                          |                |

(Total for question 4 = 11 marks)

| Question<br>Number | Answer   | Mark  |
|--------------------|--|-------|
| 5(a)(i)            | A metaphase anaphase                                     | (1)   |
|                    | The only correct answer is A                             | AO2 1 |
|                    | <b>B</b> is not correct because cell Q is not telophase  |       |
|                    | <b>C</b> is not correct because cell R is not interphase |       |
|                    | <b>D</b> is not correct because cell R is not interphase |       |

| Question<br>Number | Answer   | Additional<br>Guidance                                | Mark  |
|--------------------|--|---|-------|
| 5(a)(ii)           | A description including <b>two</b> from:                 |   | (2)   |
|                    |  |   | AO1 1 |
|                    | • chromatids condense (1)                                | accept  |       |
|                    |  | chromosomes<br>condense / coil up /<br>become visible |       |
|                    | <ul> <li>identical chromatids are joined (1)</li> </ul>  | accept<br>chromosomes join                            |       |
|                    | <ul> <li>nuclear membrane<br/>breaks down (1)</li> </ul> | accept nucleus<br>breaks down                         |       |
|                    |  | accept spindle<br>fibres form (1)                     |       |

| Question<br>Number | Answer      | Mark  |
|--------------------|-------------|-------|
| 5(a)(iii)          | cytokinesis | (1)   |
|                    |             | AO1 1 |

| Question<br>Number | Answer  | Mark  |
|--------------------|---|-------|
| 5(a)(iv)           | B 75 μm   | (1)   |
|                    | The only correct answer is B                          | AO1 1 |
|                    | <b>A</b> is not correct because 0.75 μm is 0.00075 mm |       |
|                    | <b>C</b> is not correct because 750 µm is 0.75mm      |       |
|                    | <b>D</b> is not correct because 75 000 μm is 75 mm    |       |

| Question<br>Number | Answer                                  | Additional<br>Guidance                    | Mark  |
|--------------------|---|---|-------|
| 5(b)               | An answer including:                    |   | (2)   |
|                    | • use the x40 <b>objective</b> lens (1) | accept other combinations of x 400 lenses | AO1 1 |
|                    | and <b>one</b> from:                    | for two marks                             |       |
|                    | • use the x10 <b>eye piece</b> lens (1) |   |       |
|                    | use the focusing wheel (1)              | accept move<br>the {stage /<br>lens}      |       |

| Question | Answer   | Additional   | Mark  |
|----------|--|--|-------|
| Number   |  | Guidance   |       |
| 5(c)     | An answer including <b>four</b> from:  |  | (4)   |
|          | Benefits (maximum 2 marks):  |  | AO2 1 |
|          | stem cells can differentiate / become specialised (1)                                    | accept can become<br>{joint cells / any<br>type of cell}                                     |       |
|          | • replace (damage) cells (1)   | accept repair<br>damaged joints  |       |
|          | <ul> <li>reduce symptoms of<br/>arthritis (1)</li> </ul>                                 | asinagea joine   |       |
|          | Risks (maximum 2 marks):   |  |       |
|          | new cells do not function<br>correctly (1)   |  |       |
|          | stem cells continue to divide     (1)  | accept cell division<br>could develop into<br>cancer   |       |
|          | <ul> <li>risk of side effects /<br/>symptoms worsen /<br/>rejecting cells (1)</li> </ul> | accept may have to<br>take medication to<br>prevent rejection /<br>suppress immune<br>system |       |

(Total marks for question 5 = 11 marks)

| Question<br>Number | Answer   | Additional<br>Guidance  | Mark       |
|--------------------|--|---|------------|
| 6(a)(i)            | (8 x 4) = 32 (grams of alcohol) (1)<br>1.2 / 1.20 (x risk) | award full marks<br>for the correct<br>answer with no<br>workings | (2)<br>AO3 |

| Question<br>Number | Answer  | Additional<br>Guidance                          | Mark  |
|--------------------|---|---|-------|
| 6(a)(ii)           | An answer including two from:   |   | (2)   |
|                    | • mutations in DNA (1)  | accept change<br>in the gene/cell<br>mutates    | AO2 1 |
|                    | cell division is     uncontrolled (1)   | accept {rapid /<br>continuous} cell<br>division |       |
|                    | <ul> <li>leading to the formation<br/>of a tumour / growth /<br/>mass of cells (1)</li> </ul> |   |       |

| Question<br>Number | Answer   | Additional Guidance   | Mark  |
|--------------------|--|---|-------|
| 6(b)(i)            | Any <b>two</b> from:   |   | (2)   |
|                    | • wear gloves (1)  | accept wash hands /<br>wear a mask                              | AO2 2 |
|                    | <ul> <li>clean the area of skin<br/>where blood being<br/>removed (1)</li> </ul> | accept disinfect /<br>clean the wound                           |       |
|                    | <ul> <li>cover the wound after (1)</li> </ul>                                    |   |       |
|                    | • use a sterile needle (1)   | ignore clean  |       |
|                    |  | accept sit the person<br>down (1)                               |       |
|                    |  | ignore references to<br>removing the correct<br>volume of blood |       |

| Answer                           | Additional Guidance  | Mark  |
|----------------------------------|--|---|
| <ul> <li>heterozygous</li> </ul> | accept carrier / dominant and recessive  | (3)   |
|                                  | allele / Hh  | AO3   |
| An explanation linking:          |  |   |
| affected offspring               | accept one offspring is  |   |
| the recessive allele (1)         | nomozygous recessive   |   |
| unaffected offspring             | accept one / two   |   |
| dominant allele (1)              | homozygous dominant  |   |
|                                  |  |   |
|                                  | accept a <b>labelled</b>   |   |
|                                  | •  |   |
|                                  | <ul> <li>heterozygous</li> <li>An explanation linking:         <ul> <li>affected offspring must have inherited the recessive allele (1)</li> <li>unaffected offspring must have inherited</li> </ul> </li> </ul> | <ul> <li>heterozygous         <ul> <li>accept carrier / dominant and recessive allele / Hh</li> </ul> </li> <li>An explanation linking:         <ul> <li>affected offspring must have inherited the recessive allele (1)</li> <li>unaffected offspring must have inherited dominant allele (1)</li> </ul> </li> <li>accept one offspring is homozygous recessive</li> <li>accept one / two offspring are homozygous dominant</li> </ul> |

| Question<br>Number | Answer   | Additional Guidance  | Mark         |
|--------------------|--|--|--------------|
| 7(a)(i)            | location in the rock layer / age of fossils surrounding it | accept radiometric<br>dating / stratigraphy /<br>comparison to other<br><i>Hipparion</i> fossils | (1)<br>AO2 1 |
|                    |  | ignore carbon dating   |              |

| Question<br>Number | Answer   | Additional Guidance          | Mark       |
|--------------------|--|------------------------------|------------|
| 7(a)(ii)           | similar (pentadactyl) limb<br>structure / similarities in the<br>{skeleton / bone} structure | ignore similar body<br>shape | (1)<br>AO3 |

| Question<br>Number | Answer  | Additional Guidance                               | Mark  |
|--------------------|---|---|-------|
| 7(b)               | An answer including:  |   | (3)   |
|                    | breed two animals<br>that can run fast (1)                                    | accept beneficial characteristic for running fast | AO2 1 |
|                    | <ul> <li>selection of offspring<br/>that can run fast (1)</li> </ul>          |   |       |
|                    | <ul> <li>repeat the process<br/>over many generations</li> <li>(1)</li> </ul> |   |       |

| Question<br>Number | Indicative content   | Mark |
|--------------------|--|------|
| 7 *(c)             | AO1 6 marks  Sexual reproduction Advantages  | (6)  |
|                    | <ul> <li>process takes longer</li> <li>offspring can have features that are less advantageous than the parents.</li> </ul> Asexual reproduction  |      |
|                    | <ul> <li>Advantages</li> <li>no requirement to find a mate</li> <li>rapid productive cycle</li> <li>organisms with beneficial characteristics of<br/>the parent can be produced</li> </ul> |      |
|                    | <ul> <li>Disadvantages</li> <li>there is no variation</li> <li>a selection pressure could affect all organisms of a species.</li> </ul>  |      |

| Level   | Mark | Descriptor   |
|---------|------|--|
|         | 0    | No rewardable material.  |
| Level 1 | 1-2  | <ul> <li>Demonstrates elements of biological understanding,<br/>some of which is inaccurate. Understanding of<br/>scientific ideas lacks detail.</li> </ul>  |
|         |      | <ul> <li>Presents an explanation with some structure and coherence.</li> </ul>   |
| Level 2 | 3-4  | <ul> <li>Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed.</li> <li>Presents an explanation that has a structure which is</li> </ul> |
|         |      | mostly clear, coherent and logical.  |
| Level 3 | 5-6  | <ul> <li>Demonstrates accurate and relevant biological<br/>understanding throughout. Understanding of the<br/>scientific ideas is detailed and fully developed.</li> </ul>   |
|         |      | <ul> <li>Presents an explanation that has a well-developed<br/>structure which is clear, coherent and logical.</li> </ul>  |

# **Additional Guidance**

| Level 1 | 1-2 | <ul> <li>A brief discussion of advantages or disadvantages for sexual OR asexual reproduction.</li> <li>The response identifies the statements as advantageous or disadvantageous.</li> </ul>  |
|---------|-----|--|
| Level 2 | 3-4 | <ul> <li>A brief discussion of advantages or disadvantages for sexual and asexual reproduction OR a brief discussion of the advantages and disadvantages for sexual or asexual reproduction.</li> <li>The response is mainly error free and identifies the descriptions as advantageous or disadvantageous.</li> </ul> |
| Level 3 | 5-6 | <ul> <li>A detailed discussion of the advantages and disadvantages for sexual and asexual reproduction including the consequences of being genetically identical or genetically different.</li> <li>The response is error free identifies all the discussion points as advantageous or disadvantageous.</li> </ul>     |

(Total for Question 7 = 11 marks)

| Question<br>Number | Answer   | Mark         |
|--------------------|--|--------------|
| 8(a)(i)            | C the volume of milk and the concentration of chymosin           | (1)<br>AO2 2 |
|                    | The only correct answer is C                                     |              |
|                    | <b>A</b> is not correct because time is being measured           |              |
|                    | <b>B</b> is not correct because the temperature is being changed |              |
|                    | <b>D</b> is not correct because the temperature is being changed |              |

| Question<br>Number | Answer   | Additional Mark<br>Guidance       | Mark         |
|--------------------|--|-----------------------------------|--------------|
| 8(a)(ii)           | An explanation linking <b>two</b> from:  |                                   | (2)<br>AO2 1 |
|                    | 40°C is the {optimum / closer to the optimum} / there is a faster rate of reaction (1) | accept the enzyme<br>works faster | 7.02         |
|                    | because as temperature increases (kinetic) energy increases (1)                        |                                   |              |
|                    | more chance of collision<br>(between the chymosin<br>and the milk protein) (1)         |                                   |              |
|                    | <ul> <li>more enzyme-substrate<br/>complexes are formed<br/>(1)</li> </ul>             |                                   |              |

| Question<br>Number | Answer   | Additional<br>Guidance   | Mark  |
|--------------------|--|--|-------|
| 8(a)(iii)          | An explanation linking:  |  | (2)   |
|                    | <ul> <li>time taken would be<br/>longer / the milk would not<br/>curdle (1)</li> </ul> | accept slow rate<br>of reaction / a<br>time greater than<br>75 seconds | AO2 1 |
|                    | <ul> <li>because the enzyme is<br/>denatured / the active site</li> </ul>              |  |       |
|                    | has changed shape (1)  |  |       |

| Question<br>Number | Answer   | Additional<br>Guidance                                | Mark  |
|--------------------|--|---|-------|
| 8(a)(iv)           | Any <b>one</b> from:   |   | (1)   |
|                    | • it is a control (1)  |   | AO2 2 |
|                    | <ul> <li>to confirm that the milk<br/>doesn't curdle at that<br/>temperature without<br/>chymosin (1)</li> </ul> | accept to see the<br>effect of not<br>adding chymosin |       |
|                    | <ul> <li>allows for a comparison with the results (1)</li> </ul>   |   |       |

| Question<br>Number | Answer   | Additional Guidance  | Mark |
|--------------------|--|--|------|
| 8(a)(v)            | Any <b>two</b> from:   |  | (2)  |
|                    | <ul> <li>use a smaller interval<br/>between the<br/>temperatures (1)</li> </ul>  |  | AO3b |
|                    | <ul> <li>measure temperatures<br/>between the range of<br/>35°C and 45°C (1)</li> </ul>                                    | ignore a wider range of temperatures                                   |      |
|                    | <ul> <li>controlling a variable<br/>not identified in the<br/>method (1)</li> </ul>  | accept e.g. volume of<br>milk / type of milk /<br>enzyme concentration |      |
|                    | <ul> <li>keep the tubes at the<br/>required temperature<br/>after adding chymosin<br/>by using a water bath (1)</li> </ul> | accept use a water bath<br>to control temperature                      |      |
|                    | <ul> <li>repeat the test at each<br/>temperature (1)</li> </ul>  | accept calculate a mean / identify anomalies                           |      |

| Question<br>Number | Answer  | Additional Guidance  | Mark         |
|--------------------|---|--|--------------|
| 8(b)               | An explanation linking three from:  • plasmid is cut with restriction enzymes/ chymosin gene is cut with a restriction enzyme (1)  • sticky ends are complementary (1)  • ligase is used to connect the chymosin gene and the plasmid (1) |  | (3)<br>AO2 1 |
|                    | <ul> <li>recombinant plasmid is<br/>inserted back into the<br/>bacterial cell (1)</li> </ul>  | accept insert a plasmid<br>with chymosin gene into<br>the bacteria |              |

(Total for question 8 = 11 marks)

| Question<br>Number | Answer  | Additional Guidance              | Mark  |
|--------------------|---|----------------------------------|-------|
| 9(a)               |   |                                  | (2)   |
|                    | Structure A   |                                  |       |
|                    | <ul> <li>the mitochondria<br/>{release energy / for<br/>respiration} (1)</li> </ul> | reject produces / creates energy | AO1 1 |
|                    | Structure B   |                                  |       |
|                    | <ul> <li>{acrosome / contains</li> </ul>  |                                  |       |
|                    | enzymes} to digest the  |                                  |       |
|                    | egg cell membrane (1)   |                                  |       |

| Question<br>Number | Answer   | Additional Guidance                                 | Mark  |
|--------------------|--|---|-------|
| 9(b)               |  | award full marks for the                            | (3)   |
|                    |  | correct answer with no workings                     | AO1 1 |
|                    | measurement                                      |   |       |
|                    | 45 (mm) / 4.5 <b>cm</b> (1)                      | allow 44-46 (mm)                                    |       |
|                    | calculation<br>(45 ÷ 700) = 0.0643 (1)           | allow ecf for incorrect                             |       |
|                    | (43 ÷ 700) = 0.0043 (1)                          | measurement   |       |
|                    | conversion into standard form and millimetres    |   |       |
|                    | 6.43 x 10 <sup>-2</sup> / 6.4 x 10 <sup>-2</sup> | allow ecf for incorrect substitution                |       |
|                    |  | accept answer to any<br>number of decimal<br>places |       |

| Question<br>Number |  |     |  |  |
|--------------------|--|-----|--|--|
| 9 *(c)             | AO2 3 marks/AO3 3 marks  | (6) |  |  |
|                    | Analysis of data   |     |  |  |
|                    | <ul> <li>the egg in the water has gained mass / water</li> </ul>   |     |  |  |
|                    | <ul> <li>the egg in the 5% salt has no mass change</li> </ul>  |     |  |  |
|                    | <ul> <li>the egg in the 10% salt has lost mass / water</li> </ul>  |     |  |  |
|                    | <ul> <li>mass increase is 7 g for the egg in water</li> </ul>  |     |  |  |
|                    | <ul> <li>mass increase is 0 g for 5% salt</li> </ul>   |     |  |  |
|                    | <ul> <li>the mass decrease is 2g for 10% salt</li> </ul>   |     |  |  |
|                    | • % mass change +9% / 0% / -3%   |     |  |  |
|                    | Water movement   |     |  |  |
|                    | osmosis is the movement of water   |     |  |  |
|                    | <ul> <li>across a partially permeable membrane</li> </ul>  |     |  |  |
|                    | <ul> <li>from a high concentration of water molecules<br/>to a low concentration of water molecules</li> </ul> |     |  |  |
|                    | • 5% salt is an isotonic solution  |     |  |  |
|                    |  |     |  |  |

| Level   | Mark | Descriptor  |
|---------|------|---|
|         | 0    | No rewardable material.   |
| Level 1 | 1-2  | <ul> <li>Demonstrates elements of biological understanding, some of which is inaccurate.         Understanding of scientific ideas lacks detail.     </li> <li>Presents an explanation with some structure and coherence.</li> </ul>  |
| Level 2 | 3-4  | <ul> <li>Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed.</li> <li>Presents an explanation that has a structure which is mostly clear, coherent and logical.</li> </ul> |
| Level 3 | 5–6  | <ul> <li>Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed.</li> <li>Presents an explanation that has a well-developed structure which is clear, coherent and logical.</li> </ul>                       |

## **Additional Guidance**

| Level 1 | 1-2 | <ul><li>a brief analysis of the experimental data.</li><li>with reference to the movement of water.</li></ul>   |
|---------|-----|---|
| Level 2 | 3-4 | <ul> <li>an evaluation of the data including a calculation of mass gain or loss.</li> <li>with reference to the direction of movement of the water for tap water or 10% salt.</li> </ul>          |
| Level 3 | 5-6 | <ul> <li>a detailed evaluation of the data including a % mass change calculation.</li> <li>with reference to the direction of movement of water by osmosis for tap water and 10% salt.</li> </ul> |

(Total for question 9 = 11 marks)

| Question<br>Number | Answer   | Additional<br>Guidance                                       | Mark  |
|--------------------|--|--|-------|
| 10(a)              | An explanation linking <b>three</b> from:  | Culturitee   | (3)   |
|                    | <ul> <li>alleles have different DNA<br/>{sequences / mutations} (1)</li> </ul>                           |  | AO1 1 |
|                    | <ul> <li>mRNA strand has a different<br/>sequence / triplets have<br/>different sequences (1)</li> </ul> |  |       |
|                    | <ul> <li>codes for a different amino<br/>acid / order of amino acids is<br/>different (1)</li> </ul>     |  |       |
|                    | <ul> <li>protein <b>folds</b> with a different<br/>structure (1)</li> </ul>                              | accept the order of the amino acids determines the structure |       |

| Question<br>Number | Answer   | Mark |  |
|--------------------|--|------|--|
| 10(b)(i)           | C cancer cell  | (1)  |  |
|                    | The only correct answer is C   |      |  |
|                    | <b>A</b> is not correct because a phagocytic cell is a white blood cell    |      |  |
|                    | <b>B</b> is not correct because a red blood cell does not divide           |      |  |
|                    | <b>D</b> is not correct because an epithelial cell does not divide rapidly |      |  |

| Question<br>Number | Answer  | Additional<br>Guidance                          | Mark  |
|--------------------|---|---|-------|
| 10(b)(ii)          | An explanation linking:   |   | (3)   |
|                    | the shape of the antibody is<br>complementary to the A<br>antigen / antibodies only<br>react with specific antigens |   | AO2 1 |
|                    | <ul> <li>the B antigen has a different<br/>{shape / structure} (1)</li> </ul>                                       | accept antigen A<br>has a specific<br>structure |       |
|                    | • (therefore) it will only <b>bind</b> to the A antigen / it will not bind  | accept blood<br>group B does not                |       |
|                    | to the B antigen (1)  | have the A antigen                              |       |

| Question<br>Number | Answer  | Additional<br>Guidance           | Mark         |
|--------------------|---|----------------------------------|--------------|
| 10(c)(i)           | I <sup>w</sup> I <sup>w</sup> / homozygous I <sup>w</sup> | ignore<br>homozygous<br>dominant | (1)<br>AO2 1 |

| Question<br>Number | Answer   |                                       |            |    | Additional Guidance | Mark |
|--------------------|--|---------------------------------------|------------|----|---------------------|------|
| 10(c)(ii)          | <ul> <li>An explanation linking the following:</li> <li>correct gametes / parental genotype (1)</li> <li>correct completion of the Punnett square (1)</li> </ul> |                                       |            |    |                     | (4)  |
|                    |  |                                       |            |    |                     | AO3  |
|                    |  | lM                                    | , IR       |    |                     |      |
|                    | IM   | . IMM                                 | IMIR       |    |                     |      |
|                    | ĮR   | IRIW                                  | IRIR       |    |                     |      |
|                    | pir<br>• 25<br>flo   | nk flowers<br>% will prod<br>wers and | duce white | ce |                     |      |

(Total for Question 10 = 12 marks)