

AQA A-LEVEL BIOLOGY

# BIOLOGY



**EXAM QUESTION PACK**

**UNIT 3 OLD SPECIFICATION PAPERS**

**STEMUP**

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|------------------|--|--|--|--|--|
| Centre Number                                                                                                                                                                                                                  |  |  |  |  |  | Candidate Number |  |  |  |  |  |
| Surname                                                                                                                                                                                                                        |  |  |  |  |  | Other Names      |  |  |  |  |  |
| <b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.         |  |  |  |  |  |                  |  |  |  |  |  |
| <b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment. |  |  |  |  |  |                  |  |  |  |  |  |
| Candidate Signature                                                                                                                                                                                                            |  |  |  |  |  | Date             |  |  |  |  |  |

| For Teacher's Use |      |
|-------------------|------|
| Section           | Mark |
| PSA               |      |
| Stage 1 Skills    |      |
| Stage 2 Skills    |      |
| Section A         |      |
| Section B         |      |
| TOTAL (max 50)    |      |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2014

## Biology

## BIO3T/P14/test

### Unit 3T AS Investigative Skills Assignment

#### Written Test

For submission by 15 May 2014

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>For this paper you must have:</b> <ul style="list-style-type: none"> <li>the task sheet, your results and your graph</li> <li>a ruler with millimetre measurements</li> <li>a calculator.</li> </ul>                                                                                                                                                                                                                              | <b>Time allowed</b> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Instructions</b> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul> | <b>Information</b> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>The maximum mark for this paper is 35.</li> <li>You are expected to use a calculator where appropriate.</li> <li>You will be marked on your ability to:               <ul style="list-style-type: none"> <li>use good English</li> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul> |

|                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Details of additional assistance (if any).</b> Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.<br><br>Yes <input type="checkbox"/> No <input type="checkbox"/> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Teacher Declaration:

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

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### Section A

These questions relate to your investigation into the effect of concentration of blackcurrant squash on osmosis in potato cylinders.

Use your Task Sheet, your results and your graph to answer the questions.

Answer **all** questions in the spaces provided.

- 1** In this investigation, you were given potato cylinders taken from potatoes of the same variety.

Give **one** reason why this was important.

[1 mark]

.....

.....

- 2** Complete **Table 1** to show how to make 20 cm<sup>3</sup> of each concentration of blackcurrant squash.

[2 marks]

**Table 1**

| Percentage concentration of blackcurrant squash | Volume of 100% blackcurrant squash / cm <sup>3</sup> | Volume of water / cm <sup>3</sup> |
|-------------------------------------------------|------------------------------------------------------|-----------------------------------|
| 20                                              | .....                                                | .....                             |
| .....                                           | 12                                                   | .....                             |

- 3** Potato skin had been removed from the cylinders given to you.

Suggest **one** reason why the potato skin could have affected osmosis.

[1 mark]

.....

.....

.....

- 4** In this investigation, you should have used potato cylinders that were all the same length.

Suggest and explain **one** reason why this was important.

**[2 marks]**

.....

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.....

.....

- 5** Describe how you would use your results for 100% blackcurrant squash to find the rate of osmosis.

**[2 marks]**

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.....

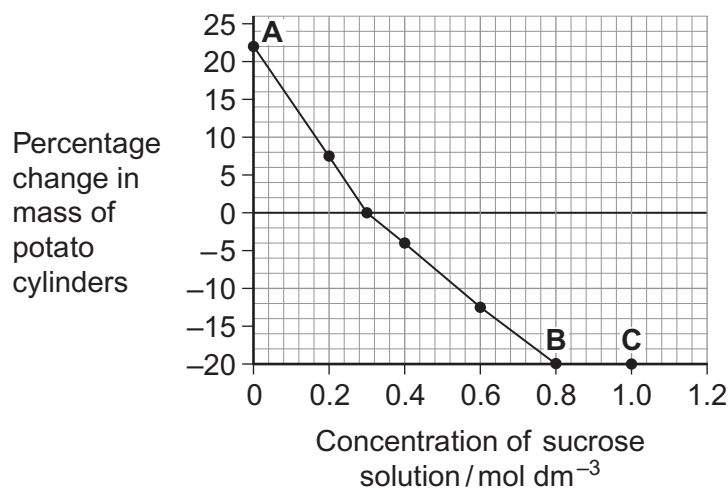
**Turn over for the next question**

**Turn over ►**

- 6** A student carried out a similar experiment to yours, but she used sucrose solutions instead of blackcurrant squash.

**Figure 1** shows her results.

**Figure 1**



- 6 (a)** Explain the changes in mass of the potato cylinders between **A** and **B**.

**[3 marks]**

.....

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- 6 (b)** Explain why the percentage change in mass of the potato cylinders is the same in solutions **B** and **C**.

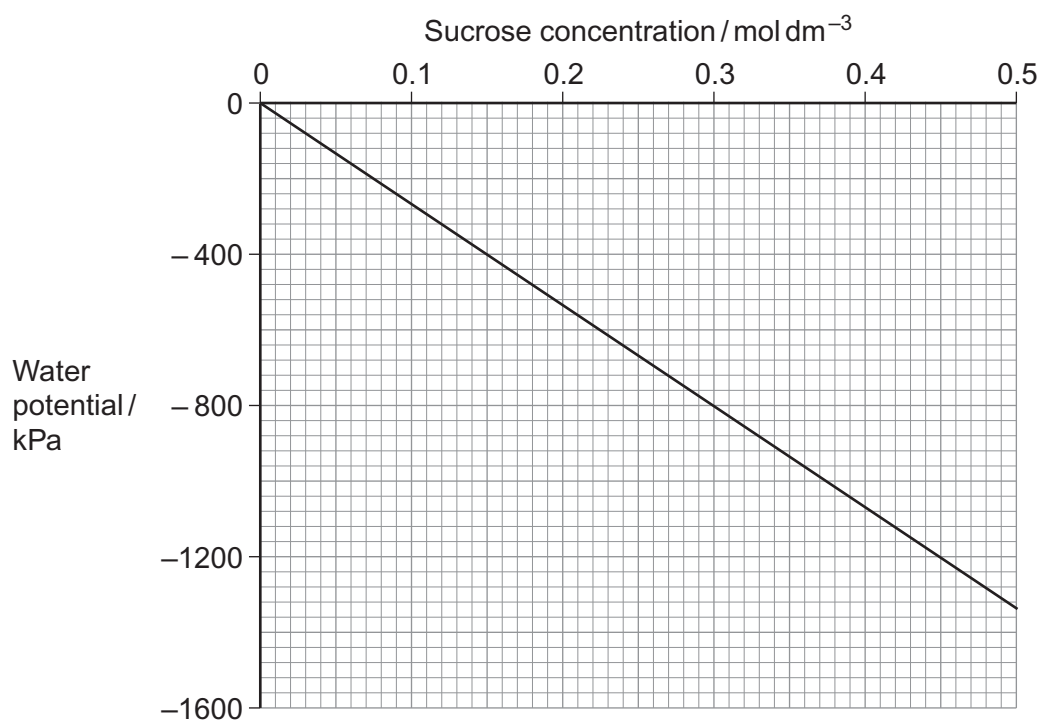
**[1 mark]**

.....

.....

6 (c) **Figure 2** shows the relationship between sucrose concentration and water potential.

**Figure 2**



Use **Figure 1** and **Figure 2** to work out the water potential of the potato tissue.

Explain how you arrived at your answer.

**[3 marks]**

Water potential of potato tissue ..... kPa

Explanation .....

.....

.....

.....

.....

## Resource Sheet

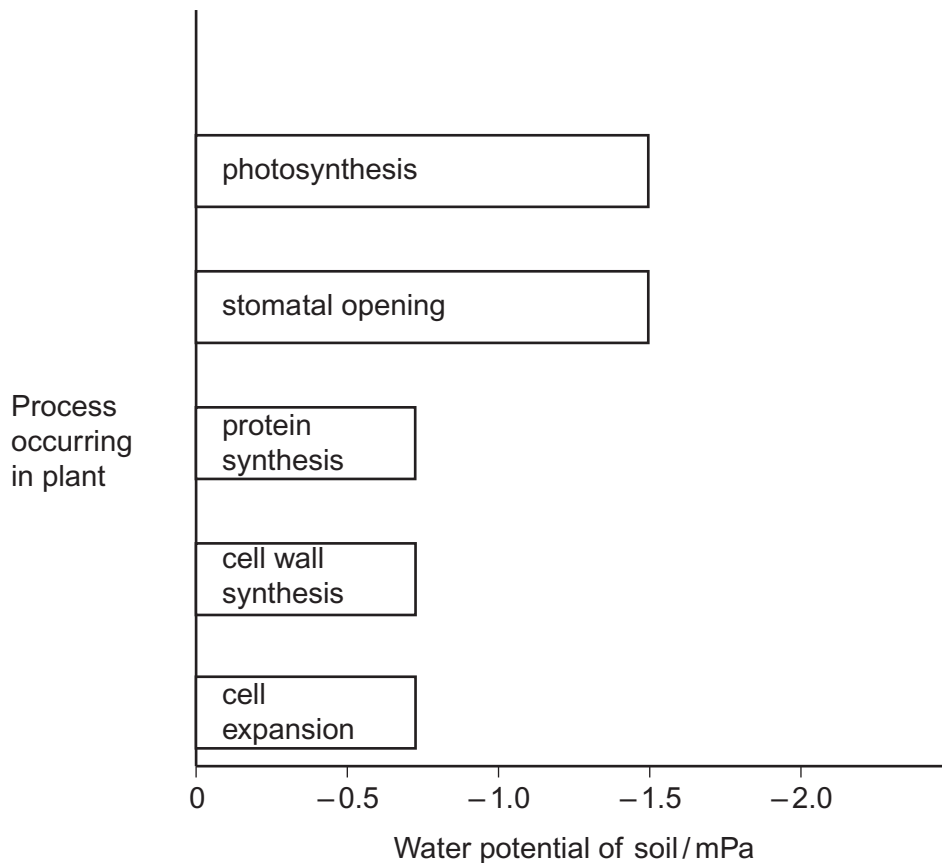
### Resource A

Scientists investigated the effect of the water potential of soil water on plant growth. They investigated the effect of this water potential on several plant processes.

**Figure 3** shows their results in the form they were presented. The bars show whether or not each process was occurring.

The plants stopped growing when the water potential of the soil water was below  $-0.7$  mPa. All of the changes in the plants were related to the ability of the roots to take up water from the soil.

**Figure 3**



**Resource B**

If red blood cells are placed in pure water, water enters the cells by osmosis and they burst. This is called haemolysis. As red blood cells burst they release pigment.

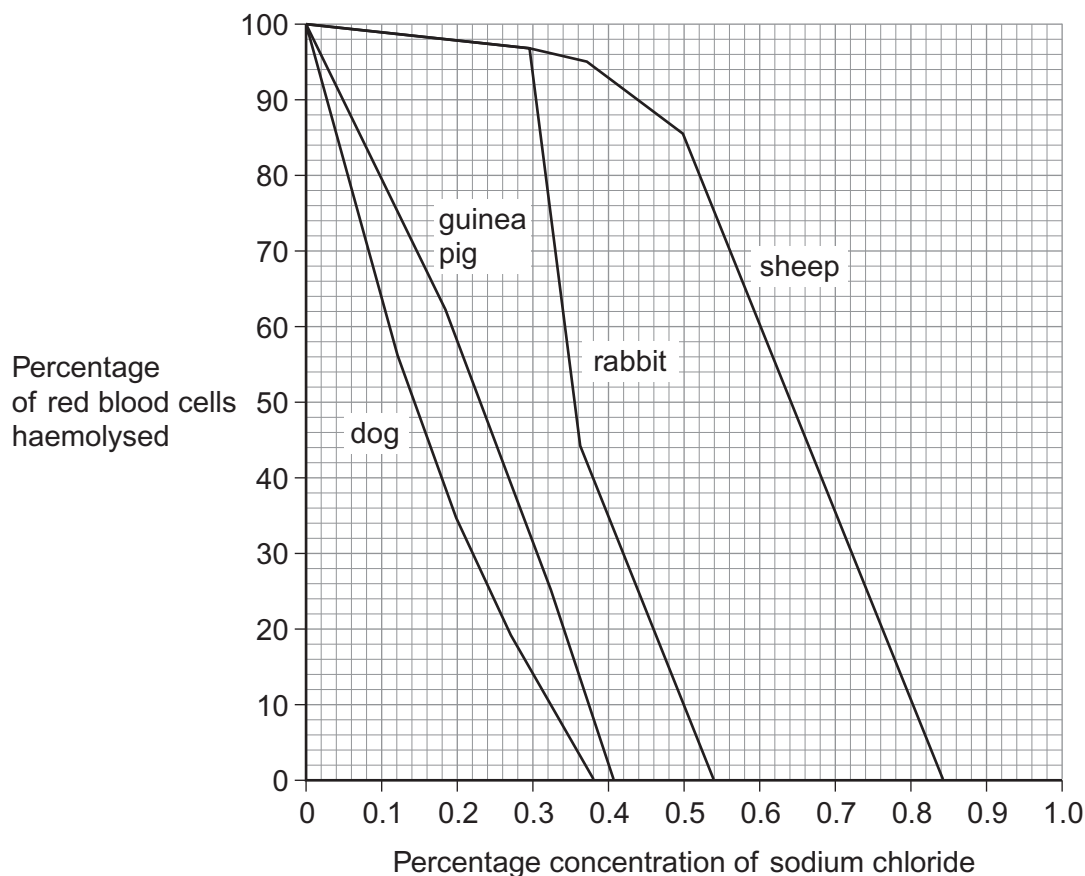
Scientists placed samples of red blood cells in different concentrations of sodium chloride solution for the same period of time. They used red blood cells from four different mammals: dog, guinea pig, rabbit and sheep.

If haemolysis had taken place, the solution turned red. The scientists measured the intensity of the red colour using a colorimeter. The more intense the red colour, the greater the amount of haemolysis.

The scientists calculated the percentage of red blood cells that were haemolysed in each sodium chloride solution.

**Figure 4** shows the scientists' results.

**Figure 4**



**Section B**

Use the information in the **Resource Sheet** and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 7 to 11**.

- 7** Describe the results in **Figure 3**. **[2 marks]**

.....

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- 8** Explain the relationship between stomatal opening and photosynthesis. **[2 marks]**

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- 9** Although photosynthesis is still occurring, plants stop growing when the soil water potential falls below  $-0.7$  mPa.  
Use information from **Figure 3** to suggest **two** reasons why. **[3 marks]**

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- 10** Most of the water uptake in a root takes place in the region just behind the root tip.  
Explain why.

**[2 marks]**

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- 11** In a root, water passes through the endodermis and enters the xylem.  
Explain how.

**[4 marks]**

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.....

.....

**[Extra space]** .....

.....

.....

Use **Resource B** to answer **Questions 12 to 15**.

- 12** Use **Figure 4** to give **two** differences between the results for dog and sheep.

**[2 marks]**

Difference 1 .....

.....

Difference 2 .....

.....

**Turn over for the next question**

**Turn over ►**

- 13** Calculate the difference in the percentage of haemolysed cells between sheep and rabbit at a sodium chloride concentration of 0.5%.

[1 mark]

- 14** Explain the relationship between the depth of the red colour of the solution and how much haemolysis has taken place.

[2 marks]

- 15** During treatment in a veterinary surgery, any of the mammals in **Figure 4** may be given an infusion of sodium chloride solution directly into a vein. The concentration of sodium chloride solution used is 0.9%, rather than 0.5%, regardless of the species of mammal.

Explain the advantage to the vet of using this concentration.

[2 marks]

[Extra space]

END OF QUESTIONS

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# A-level **BIOLOGY**

Investigative and Practical Skills in AS Biology – BI03T/P14  
Final Marking Guidelines

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Specification 2410  
June 2014

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Version: 0.1 Final Marking Guidelines

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Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

## Guidance for teachers marking Biology ISAs

These are the final **Marking Guidelines**, which provide guidance on the marking of the ISA.

### General principles

In general, you are looking for evidence that the student knows and understands the point required by the Marking Guidelines.

It is important to mark what the student has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

### Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used  
For example anaphase, the term must appear  
For example ..... and ....., both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a student's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed
- Additional instructions are shown in the comments column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example, 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a student will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

## The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the student has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a  $\Lambda$  symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the student's response in the order in which they appear in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the student contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the student gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents students from gaining full marks from a list of right and wrong answers.

Example:

Name two substances that are produced in photosynthesis.

(2 marks)

| Answer                          | Marks | Comment                                                                         |
|---------------------------------|-------|---------------------------------------------------------------------------------|
| Oxygen, glucose                 | 2     | Both correct                                                                    |
| Oxygen, carbon dioxide          | 1     | One correct, one incorrect                                                      |
| Carbon dioxide, oxygen, glucose | 1     | Carbon dioxide is clearly incorrect and cancels one of the marks                |
| Oxygen, glucose, water          | 2     | Regard water as a neutral point. It is not worth a mark but it is not incorrect |

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the comments column in the Marking Guidelines to show that misspellings must not be credited.

**BIO3T/P14 TASK**

Before you mark any work, please make sure that you have read **Guidance for teachers marking Biology ISAs** on pages 3 to 5 of these Marking Guidelines.

**Stage 1 – Marking of table showing raw data**

| Marking Guidance                                                                                                                                                                                                                    | Mark     | Comments                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Marking points 1 to 4 can be awarded whatever the 'quality' of data shown.</p> <p>Where data are shown in rows instead of columns, the same principles apply.</p> <p>'Percentage' can be written or shown as '%' throughout.</p> |          |                                                                                                                                                                          |
| 1. Data presented clearly <b>and</b> with full description of independent variable, i.e. concentration/percentage/dilution of blackcurrant/squash <b>in first column</b> ;                                                          | 1        | There must be a reference to 'blackcurrant' or 'squash'<br><br>Ignore additional information that is neutral, eg 'tube number' even if this is given as the first column |
| 2. Columns showing initial mass/weight <b>and</b> final mass/weight <b>and</b> percentage change in mass/weight;                                                                                                                    | 1        | Ignore additional information that is neutral, eg 'difference in mass/weight'                                                                                            |
| 3. Unit for mass/weight shown as gram(s)/g and only shown in the column heading. 'Percentage' or '%' should only appear in column headings and not anywhere in the body of the table;                                               | 1        | Allow the use of '%' as a unit                                                                                                                                           |
| 4. Correct calculations of percentage change in mass;                                                                                                                                                                               | 1        | Do not award unless calculations for all concentrations are correct                                                                                                      |
| <b>Total</b>                                                                                                                                                                                                                        | <b>4</b> |                                                                                                                                                                          |

**The Candidate Results Sheet: Stage 1 is required for moderation and must be attached to the ISA test.**

**Stage 2 – Marking of graph**

| Marking Guidance                                                                                                                                   | Mark     | Comments                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Graph has (concentration/ percentage/dilution of) blackcurrant/squash on <i>x</i> -axis and percentage change in mass/weight on <i>y</i> -axis; | 1        | Reject plotting of final mass/weight or just change in mass/weight <b>for this marking point only</b>                                                                                                 |
| 2. Both axes labelled correctly including appropriate units for labels given;                                                                      | 1        | Do not further penalise students who have plotted final mass/weight or change in mass/weight for marking points 2 to 5<br><br>Do not reward if 'water' is shown to be a concentration (rather than 0) |
| 3. Appropriate scales selected for <i>x</i> and <i>y</i> axes;                                                                                     | 1        | To enable points to be plotted accurately                                                                                                                                                             |
| 4. All points plotted correctly;                                                                                                                   | 1        | Reject if less than the 6 concentrations shown or if any one plot is inaccurate                                                                                                                       |
| 5. Points joined correctly or line of best fit as appropriate;                                                                                     | 1        | Reject extrapolation of the line beyond the plotted points. A line of best fit must reflect the plotted data                                                                                          |
| <b>Total</b>                                                                                                                                       | <b>5</b> |                                                                                                                                                                                                       |

**The Candidate Results Sheet: Stage 2 is required for moderation and must be attached to the ISA test.**

**BIO3T/P14 Section A**

| Question | Marking Guidance                                                                                                                                      | Mark  | Comments                                                                                                                                                                                                                                                |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | 1. (Cells/tissues) have same/similar water potential/sugar content;<br>2. (So) no genetic differences/all genetically the same;                       | 1 max | Accept either approach for 1 mark<br><br>Accept converse, eg different varieties have different sugar contents. Accept 'removes sugar content/genetic difference as a confounding variable'. Do not credit 'confounding variable' without qualification |
| 2        | 1. 4 <b>and</b> 16;<br>2. 60 <b>and</b> 8;                                                                                                            | 2     | 1 mark per row. Both figures must be correct, and in the right box, to gain each mark                                                                                                                                                                   |
| 3        | 1. (Skin is) impermeable to water;<br>2. (Skin is) a different tissue;<br>3. <u>Cells</u> of skin have different water potential (to rest of tissue); | 1 max | Allow any of 3 different approaches but only 1 mark<br><br>Accept 'it' as referring to skin unless another tissue is identified<br><br>Ignore references to surface area<br>3. Reference to cells required                                              |
| 4        | 1. Same/similar surface area;<br>2. (Otherwise) affects rate of water uptake/water loss/osmosis/diffusion;                                            | 2     | 2. A reference to rate or speed of process is required. Ignore reference to 'rate of reaction'                                                                                                                                                          |
| 5        | 1. (Find) change/difference in mass;<br>2. Divide by time/30 minutes;                                                                                 | 2     | 1. Accept final mass minus initial mass<br><br><u>Final mass – initial mass</u> = 2 marks<br><br>Time<br><br>Accept correct use of student results to show 'how'                                                                                        |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6(a)                             | <ol style="list-style-type: none"> <li>1. (Mass increases) between 0 – 0.3 (mol dm<sup>-3</sup>) water potential outside higher than inside so water taken up;</li> <li>2. In 0.3 (mol dm<sup>-3</sup>) no change in mass because solutions have same water potential so no net movement of water (in or out);</li> <li>3. (Mass decreases) between 0.3 – 0.8 (mol dm<sup>-3</sup>) water potential outside lower than inside so water lost;</li> </ol> | 3         | <p>Each marking point requires both the identification of correct values <b>and</b> an explanation</p> <p>Accept 'water potential' represented by the symbol 'Ψ'</p> <ol style="list-style-type: none"> <li>2. Accept description of 'net' movement. Reject suggestion of no movement</li> <li>2. Accept 'isotonic' for 'same water potential'</li> <li>3. Accept 'above 0.3'</li> </ol> |
| 6(b)                             | No further loss of water / maximum loss of water;                                                                                                                                                                                                                                                                                                                                                                                                       | 1         | <p>Accept 'all cell water has moved out'</p> <p>Accept 'cells (fully) plasmolysed'</p>                                                                                                                                                                                                                                                                                                   |
| 6(c)                             | <ol style="list-style-type: none"> <li>1. (Water potential is) -800 (kPa);</li> <li>2. (Using Figure 1) read off 0.3/concentration (of sucrose) where no (percentage) change in mass/crosses x-axis;</li> <li>3. (Using Figure 2) read off water potential corresponding to this concentration (of sucrose);</li> </ol>                                                                                                                                 | 3         | Marking points 2 and 3 still available for incorrect water potential                                                                                                                                                                                                                                                                                                                     |
| <b>Total marks for Section A</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>15</b> |                                                                                                                                                                                                                                                                                                                                                                                          |

**BIO3T/P14 Section B**

| Question | Marking Guidance                                                                                                                                                                                                                                                                                                                                                                                                       | Mark  | Comments                                                                                                                                                                                                                                                                                                                                           |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7        | <ol style="list-style-type: none"> <li>1. Protein synthesis <b>and</b> cell wall synthesis <b>and</b> cell expansion stop at -0.7/at a <i>higher</i> water potential than other two;</li> <li>2. Photosynthesis <b>and</b> stomatal opening stop at -1.5/at a <i>lower</i> water potential than other three;</li> </ol>                                                                                                | 2     | <p>If all 3 are correctly identified in marking point 1, accept 'the others/the other two' in marking point 2, and <i>vice versa</i></p> <p>Correct processes must be named in at least one of marking point 1 or marking point 2</p> <p>Where reference to water potential differences are made, they must be comparative, eg '<i>higher</i>'</p> |
| 8        | <ol style="list-style-type: none"> <li>1. Stomata allow uptake of carbon dioxide;</li> <li>2. Carbon dioxide used in/required for photosynthesis;</li> </ol>                                                                                                                                                                                                                                                           | 2     |                                                                                                                                                                                                                                                                                                                                                    |
| 9        | <ol style="list-style-type: none"> <li>1. Growth involves cell division/cell expansion/increase in mass;</li> <li>2. Protein synthesis stops <b>so</b> no enzymes/no membrane proteins/no <u>named</u> protein (for growth/division);</li> <li>3. Cell wall synthesis stops <b>so</b> no new cells can be made;</li> <li>4. No cell expansion/increase in mass <b>because</b> (cells) stop taking up water;</li> </ol> | 3 max | <p>Marking point 1 is for the principle</p> <p>Marking points 2, 3 and 4 require appreciation of 'why' before credit can be awarded</p> <p>2. 'named' protein must relate to proteins involved in growth or cell division</p> <p>Full credit is possible without a statement of the principle (marking point 1)</p>                                |
| 10       | <ol style="list-style-type: none"> <li>1. (Presence of) root hairs;</li> <li>2. (This area) has a large surface area;</li> <li>3. This area is permeable to water;</li> </ol>                                                                                                                                                                                                                                          | 2 max | <p>3. Accept 'root tip is not permeable'</p>                                                                                                                                                                                                                                                                                                       |

|    |                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | <ol style="list-style-type: none"> <li>1. Suberin/waterproof material in <u>cell walls</u> (of endodermis);</li> <li>2. Blocks apoplast (pathway) / only syplast (pathway);</li> <li>3. Water moves across membranes;</li> <li>4. Ions moved by active transport into xylem;</li> <li>5. (This) lowers the water potential (in the xylem) <b>and</b> water enters by osmosis (into xylem);</li> </ol> | 4 max | <ol style="list-style-type: none"> <li>1. You can award marking point 1 for reference to Casparian strip without further qualification</li> <li>4. Need idea of what is moved and how they are moved</li> <li>5. Both aspects needed for credit. Context of xylem is required</li> </ol>                                                                                                                                                                                              |
| 12 | <ol style="list-style-type: none"> <li>1. (Curve for) dog falls rapidly at the start but (curve for) sheep falls slowly at first;</li> <li>2. Sheep doesn't fall rapidly until 0.5 (but dog falls rapidly from 0);</li> <li>3. (Trend shows that) for any concentration of sodium chloride haemolysis is lower in the dog;</li> </ol>                                                                 | 2 max | <p>Do <b>not</b> allow curve for dog falls more steeply (since from 0.5% NaCl fall in sheep is just as steep as fall in dog)</p> <ol style="list-style-type: none"> <li>3. The idea of a trend is required. Statement of individual values alone is insufficient, eg 'at 0.2, 34% in dog and 98% in sheep' is insufficient</li> <li>3. Accept dog reaches 0 at lower concentration of sodium chloride than for sheep / dog reaches 0 at 0.38% compared to 0.84 % in sheep;</li> </ol> |
| 13 | 74 to 76;                                                                                                                                                                                                                                                                                                                                                                                             | 1     | Accept a value within this range                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 14 | <ol style="list-style-type: none"> <li>1. (Red) colour is due to haemoglobin;</li> <li>2. The more haemoglobin released the more red the solution;</li> </ol>                                                                                                                                                                                                                                         | 2     | <p>Note: a correct response to marking point 2 also scores marking point 1</p> <ol style="list-style-type: none"> <li>2. Need idea of haemoglobin release before giving credit</li> </ol>                                                                                                                                                                                                                                                                                             |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15                               | <p>1. (Use of 0.9%) will not cause haemolysis in any (of the mammals);</p> <p>2. (So) will not kill any of the animals;</p> <p>or</p> <p>Only need to use/store/buy one concentration of sodium chloride solution/cheaper to have one concentration of sodium chloride solution/can buy in bulk;</p> <p>or</p> <p>Anyone can give it/no need to find out what concentration any animal requires;</p> | 2 max     | <p>Full credit requires statement of marking point 1 and any approach from marking point 2</p> <p>2. Different approaches available for this marking point</p> |
| <b>Total marks for Section B</b> |                                                                                                                                                                                                                                                                                                                                                                                                      | <b>20</b> |                                                                                                                                                                |

|                                                                                                                                                                                                                                |  |  |  |  |  |                  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|------------------|--|--|--|--|--|
| Centre Number                                                                                                                                                                                                                  |  |  |  |  |  | Candidate Number |  |  |  |  |  |
| Surname                                                                                                                                                                                                                        |  |  |  |  |  | Other Names      |  |  |  |  |  |
| <b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.         |  |  |  |  |  |                  |  |  |  |  |  |
| <b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment. |  |  |  |  |  |                  |  |  |  |  |  |
| Candidate Signature                                                                                                                                                                                                            |  |  |  |  |  | Date             |  |  |  |  |  |

| For Teacher's Use |      |
|-------------------|------|
| Section           | Mark |
| PSA               |      |
| Stage 1 Skills    |      |
| Stage 2 Skills    |      |
| Section A         |      |
| Section B         |      |
| TOTAL (max 50)    |      |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2013

# Biology

# BIO3T/P13/test

## Unit 3T AS Investigative Skills Assignment

### Written Test

For submission by 15 May 2013

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>For this paper you must have:</b> <ul style="list-style-type: none"> <li>the task sheet, your results and your graph</li> <li>a ruler with millimetre measurements</li> <li>a calculator.</li> </ul>                                                                                                                                                                                                                              | <b>Time allowed</b> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Instructions:</b> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul> | <b>Information</b> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>You are expected to use a calculator where appropriate.</li> <li>The maximum mark for this paper is 35.</li> <li>You will be marked on your ability to:               <ul style="list-style-type: none"> <li>use good English</li> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul> |

**Details of additional assistance (if any).** Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes ☐ No ☐

### Teacher Declaration:

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

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**Section A**

These questions relate to your investigation into the effect of pH on the time taken by amylase to hydrolyse starch.

Use your Task Sheet, your results and your graph to answer the questions.

Answer **all** questions in the spaces provided.

- 1** In this investigation, you were given buffers with a pH range from 5 to 8.

Suggest why.

.....

.....

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(2 marks)

- 2** You were told to carry out the reaction in a water bath at 30 °C, rather than at room temperature.

Explain why the reaction would be faster at 30 °C than at room temperature.

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(2 marks)

- 3** You were told to decide for yourself when the blue-black colour failed to appear. What did you do to ensure your decision was consistent?

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(1 mark)

- 4** Apart from deciding when the blue-black colour failed to appear, give **three** limitations of the method you used that could have affected the reliability of your results.

1 .....

.....

2 .....

.....

3 .....

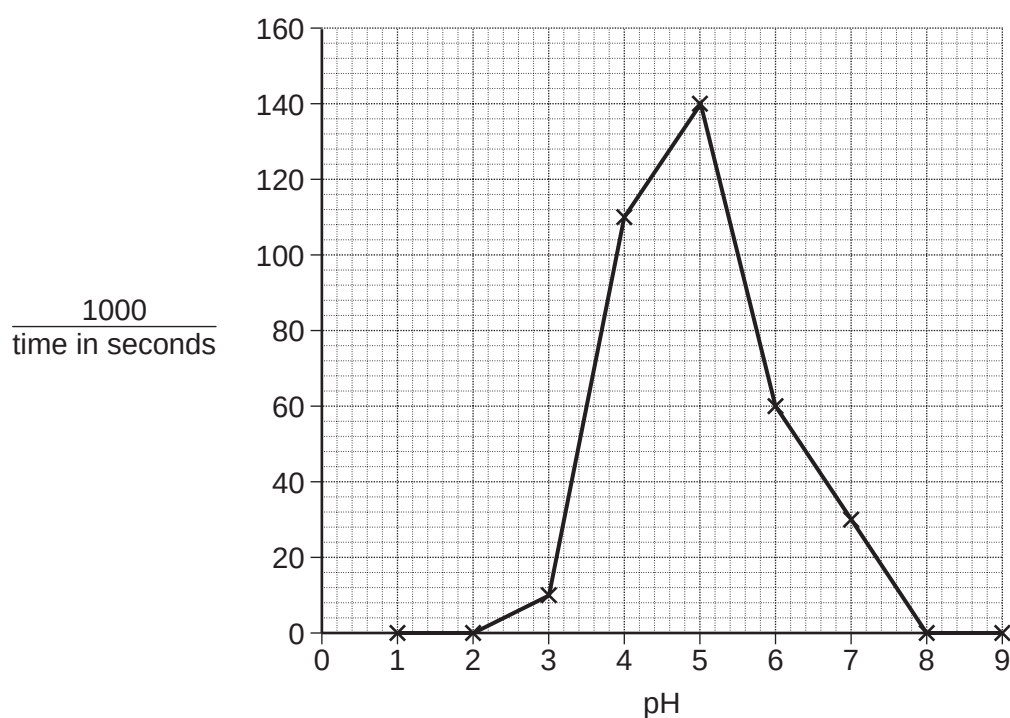
.....

(3 marks)

**Turn over for the next question**

**Turn over ►**

- 5 A student carried out a similar experiment to yours. The graph shows her results.



- 5 (a) Explain the difference in her results at pH3 and pH4.

.....

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.....

.....

.....

.....

(3 marks)

(Extra space) .....

.....

- 5 (b)** The student chose to join the points on the graph with straight lines, rather than drawing a line of best fit.  
Suggest why she did this.

.....

.....

.....

(1 mark)

- 6 (a)** Name the disaccharide formed when starch is hydrolysed.

.....

(1 mark)

- 6 (b)** In your investigation you tested for the disappearance of starch.

Describe a test you could have carried out to show that products of starch hydrolysis are present.

.....

.....

.....

.....

.....

(2 marks)

**Turn over for the next question**

## Resource Sheet

### Resource A

Some people have a medical condition called pancreatitis. This can lead to their pancreatic duct becoming blocked. As a result, a high concentration of amylase is found in their blood.

At 12-hour intervals, a doctor measured the concentration of amylase in the blood of a person suffering from a blocked pancreatic duct. He also measured the concentration of amylase in the blood of a healthy person.

**Figure 1** shows his results.

**Figure 1**

| Time / hours | Concentration of amylase in the blood / arbitrary units |                |
|--------------|---------------------------------------------------------|----------------|
|              | Person with blocked pancreatic duct                     | Healthy person |
| 0            | 1800                                                    | 800            |
| 12           | 2200                                                    | 750            |
| 24           | 2500                                                    | 700            |
| 36           | 2000                                                    | 750            |
| 48           | 1400                                                    | 800            |

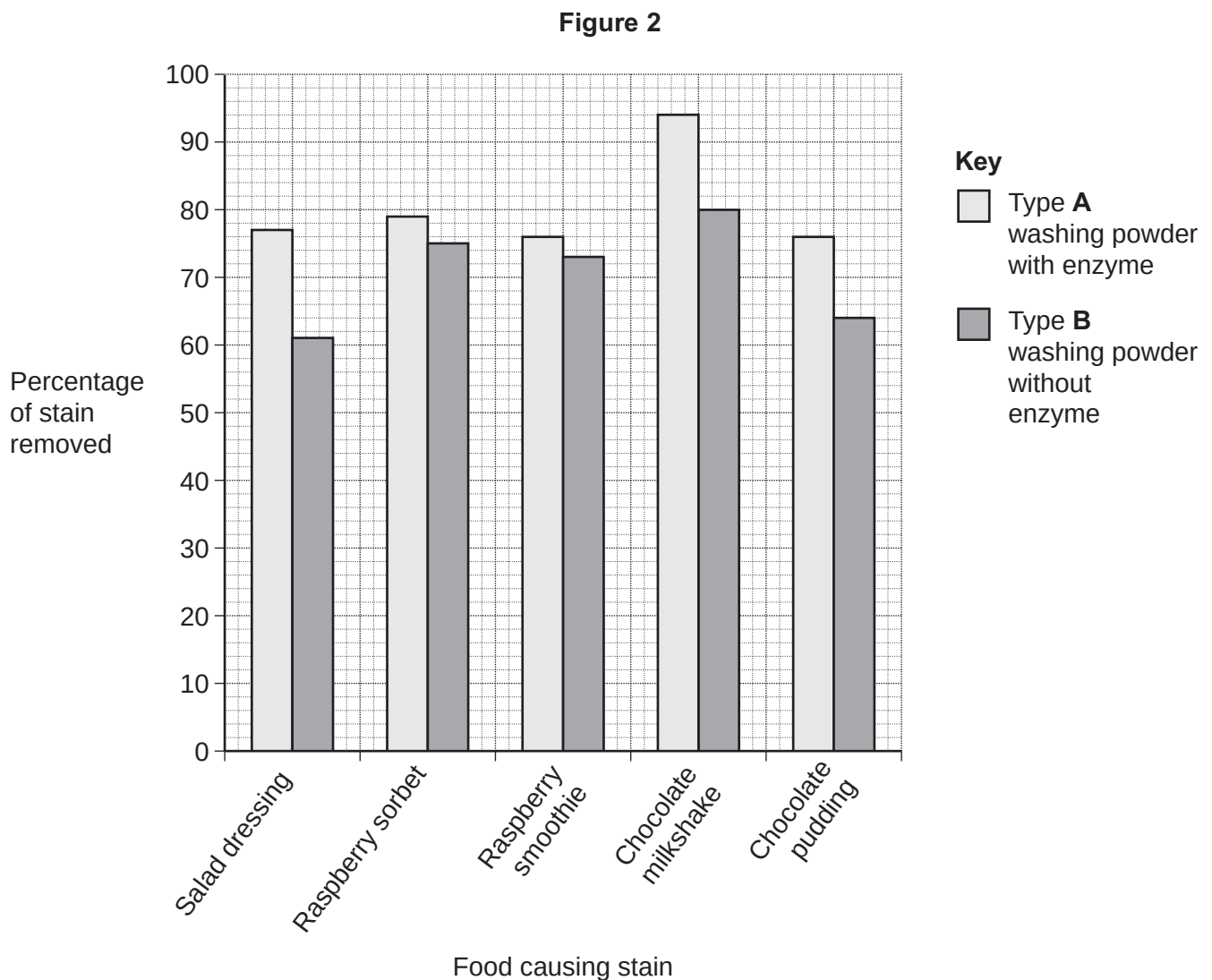
**Resource B**

Biological washing powders contain enzymes which hydrolyse substances that cause stains on clothes.

A manufacturer tested the ability of two types of the same brand of washing powder to remove different food substances that stain clothes.

- Type **A** contained an enzyme.
- Type **B** was identical to **A** except it did **not** contain the enzyme.

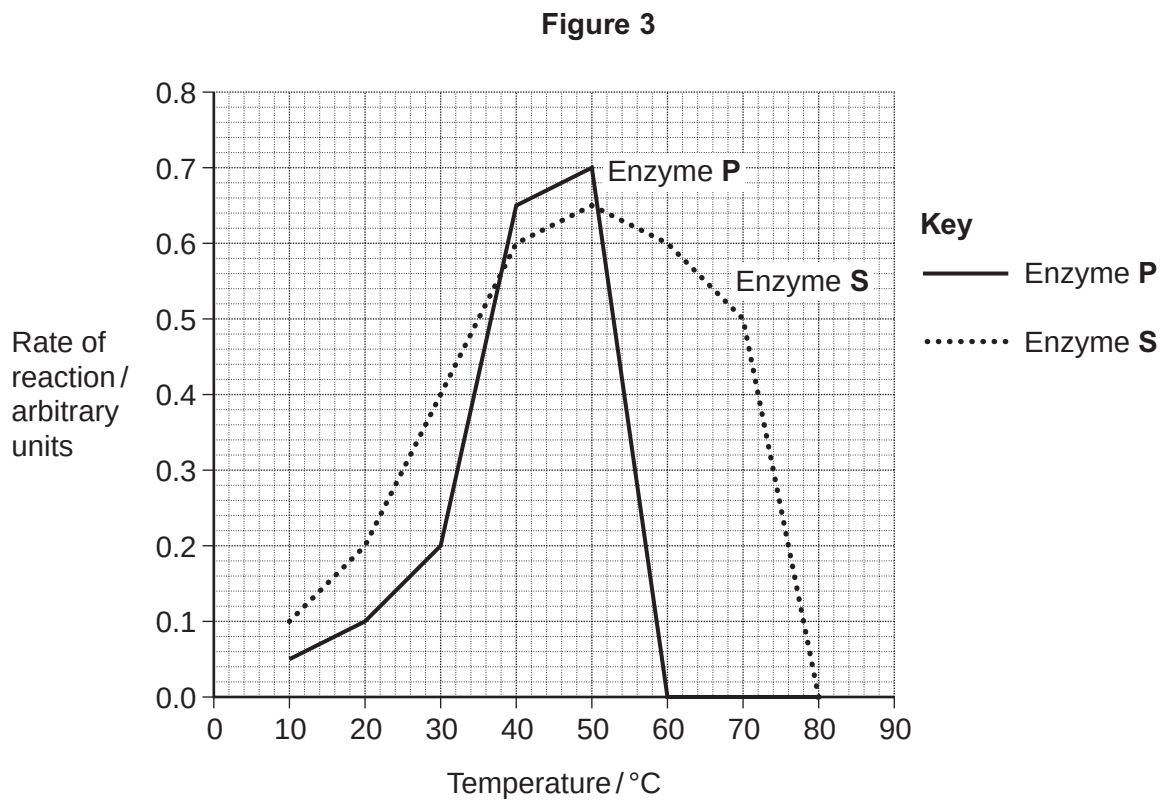
**Figure 2** shows the results.



Turn over ►

A scientist worked for a company that wanted to develop a biological washing powder that was effective over a range of temperatures. He investigated the effect of temperature on the rates of the reaction catalysed by two enzymes, **P** and **S** used in biological washing powders.

**Figure 3** shows his results.



**Section B**

Use the information in the **Resource Sheet** to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 7 to 9**.

- 7 (a)** The changes in concentration of amylase in the blood of a person with a blocked pancreatic duct are different from those of a healthy person during the period shown in **Figure 1**.

Describe **two** of these differences.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

- 7 (b)** In a person with a blocked pancreatic duct, starch digestion is affected. Explain how.

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(2 marks)

Turn over ►

- 8** Healthy people have amylase in their blood. This does not cause any harmful effects in the body.  
Explain why.

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(2 marks)

- 9** Pancreatitis can lead to the release of protein-digesting enzymes into the blood. This is harmful to the body.  
Suggest **one** reason why.

.....

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(2 marks)

Use **Resource B** to answer **Questions 10 to 13**.

- 10** Many of the substances causing the food stains are large, insoluble proteins.  
Suggest how a biological washing powder removes this type of stain.

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(2 marks)

11

The manufacturer of type **A** and type **B** washing powder claimed that these results showed that biological washing powders are better at removing stains from clothes.

Use the information in **Figure 2** to evaluate this claim.

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(4 marks)

(Extra space) .....

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**Turn over for the next question**

**Turn over ►**

- 12** Most customers want a washing powder which removes stains from clothes over a range of temperatures. After obtaining the results shown in **Figure 3**, which enzyme should the scientist recommend for use in a biological powder?

Give reasons for your answer.

.....

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(3 marks)

(Extra space) .....

.....

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- 13** Biological washing powders often contain a number of different enzymes. This enables them to remove a wider range of stains from clothes. Explain why a number of enzymes are required to remove a wider range of stains.

.....

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.....

(3 marks)

(Extra space) .....

.....

.....

**END OF QUESTIONS**

**General Certificate of Education (A-level)**  
**June 2013**

**Biology**

**BIO3T/P13**

**(Specification 2410)**

**Unit 3T: Investigative Skills Assignment**

**Final**

***Marking Guidelines***

Mark schemes are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

Further copies of these Marking Guidelines are available from: [aqa.org.uk](http://aqa.org.uk)

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## Guidance for teachers marking Biology ISAs

**Final Marking Guidelines** must be used to mark students' work.

### General principles

In general, you are looking for evidence that the student knows and understands the point required by the Marking Guidelines.

It is important to mark what the student has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

### Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used  
For example anaphase, the term must appear  
For example ..... and ....., both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a student's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed
- Additional instructions are shown in the comments column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example, 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a student will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

## The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the student has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a  $\wedge$  symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the student's response in the order in which they appear in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the student contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the student gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents students from gaining full marks from a list of right and wrong answers.

Example:

Name two substances that are produced in photosynthesis. (2 marks)

| Answer                          | Marks | Comment                                                                         |
|---------------------------------|-------|---------------------------------------------------------------------------------|
| Oxygen, glucose                 | 2     | Both correct                                                                    |
| Oxygen, carbon dioxide          | 1     | One correct, one incorrect                                                      |
| Carbon dioxide, oxygen, glucose | 1     | Carbon dioxide is clearly incorrect and cancels one of the marks                |
| Oxygen, glucose, water          | 2     | Regard water as a neutral point. It is not worth a mark but it is not incorrect |

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the comments column in the Marking Guidelines to show that misspellings must not be credited.

## BIO3T/P13 TASK

Before you mark any work, please make sure that you have read **Guidance for teachers marking Biology ISAs** on pages 3 and 4 of these Marking Guidelines.

### Stage 1 – Marking of table showing raw data

| Marking Guidance                                                                                                                                                                                     | Mark     | Comments                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Student's own data presented clearly with full description of independent variable [pH of amylase/buffer/solution/mixture] and dependent variable [time taken for (blue-black) colour to disappear]; | 1        | Credit additional information given in a title<br><br>'pH' alone is insufficient. The pH must be of something. 'Time' alone is insufficient<br><br>Note: all 3 marks can be awarded irrespective of the quality of the data |
| Independent variable (pH) in first column;                                                                                                                                                           | 1        | Ignore columns providing additional but neutral information such as 'tube number'                                                                                                                                           |
| Unit for time is seconds and only in column heading. No unit for pH;                                                                                                                                 | 1        | Accept minutes as unit but reject mixed units, e.g. result of 1 min 20 seconds should only be accepted if shown as either 80 seconds or 1.33 minutes                                                                        |
| <b>Total</b>                                                                                                                                                                                         | <b>3</b> |                                                                                                                                                                                                                             |

**The Candidate Results Sheet: Stage 1 is required for moderation and must be attached to the ISA test.**

**Stage 2 – Marking of calculations and graph**

| Marking Guidance                                                                | Mark     | Comments                                                                                                                         |
|---------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------|
| All 5 calculations of $1000/t$ correct;                                         | 1        | Reject if less than 5 results                                                                                                    |
| Graph has independent variable (pH) on x-axis and 'rate' or $1000/t$ on y-axis; | 1        | Reject plotting of time taken for this marking point only                                                                        |
| Both axes labelled correctly, with appropriate unit for y-axis;                 | 1        | Accept rate unit as $1000/t$ . Ignore any further detail<br>If time taken has been plotted, unit is s/sec/seconds or min/minutes |
| Appropriate scales selected for x and y axes;                                   | 1        | Ensure scale for pH is linear                                                                                                    |
| All points plotted correctly;                                                   | 1        | For chosen y-axis label                                                                                                          |
| Points joined correctly or line of best fit as appropriate;                     | 1        | Reject extrapolation beyond plotted points. The line of best fit must match the data plotted                                     |
| <b>Stage 2 Total</b>                                                            | <b>6</b> |                                                                                                                                  |

**The Candidate Results Sheet: Stage 2 is required for moderation and must be attached to the ISA test.**

**BIO3T/P13 Section A**

| Question | Marking Guidance                                                                                                                                                                                                                                                                                                                                                      | Mark  | Comments                                                                                                                                                                                                                                                                                                                                                                          |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | <ol style="list-style-type: none"> <li>Outside this range reaction is slow/reaction doesn't work;</li> <li>(Because) enzyme is denatured outside this range;</li> <li>Optimum pH is within this range;</li> </ol>                                                                                                                                                     | 2 max | <ol style="list-style-type: none"> <li>and 2. Accept converse</li> <li>and 2. Range could be expressed numerically i.e. pH 5 to 8</li> <li>Accept descriptions of denaturation or changes in shape</li> </ol>                                                                                                                                                                     |
| 2        | <ol style="list-style-type: none"> <li>(Molecules at 30 °C) have more kinetic energy/move faster;</li> <li>So more collisions between enzyme and substrate / more enzyme-substrate complexes formed;</li> </ol>                                                                                                                                                       | 2     | <ol style="list-style-type: none"> <li>Accept answers that explain why reaction slower at room temperature</li> <li>'More collisions' is insufficient</li> </ol>                                                                                                                                                                                                                  |
| 3        | <ol style="list-style-type: none"> <li>Compared with the colour of iodine (solution);</li> <li>Compared to one already changed colour / 'gone';</li> <li>Checked the next (20 second) sample to see no further change;</li> </ol>                                                                                                                                     | 1 max | <ol style="list-style-type: none"> <li>Idea of using a previous test where the blue-black colour has been lost i.e. a standard</li> </ol>                                                                                                                                                                                                                                         |
| 4        | <ol style="list-style-type: none"> <li>Volume of iodine not fixed/not controlled;</li> <li>Volume of mixture not fixed/not controlled;</li> <li>(End point is) qualitative / not quantitative;</li> <li>Only tested every 20 seconds / reaction could be completed between (20 second) samples;</li> <li>Temperature could fluctuate;</li> <li>No repeats;</li> </ol> | 3 max | <ol style="list-style-type: none"> <li>Ignore any reference to human error</li> <li>Marking points 1 and 2 could be expressed by reference to variation in drop size</li> <li>Accept alternative ways of expressing the ideas e.g. subjective or based on opinion</li> <li>Accept why it might fluctuate e.g. not controlled, not monitored, water bath not 'electric'</li> </ol> |
| 5(a)     | <ol style="list-style-type: none"> <li>Change in charge (of enzyme);</li> <li>Change in shape (of enzyme);</li> <li>Less/fewer enzyme-substrate complexes formed (per second) at pH3 / more ES complexes (per second) at pH4;</li> </ol>                                                                                                                              | 3     | <ol style="list-style-type: none"> <li>Accept other ways of expressing charge e.g. reference to ionic groups</li> <li>Accept reference to denaturation for change in shape</li> <li>Must be in the correct pH context and with reference to ES complexes</li> </ol>                                                                                                               |

|                                  |                                                                                                                                        |           |                                                                                                                                                                                                                                                                                       |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5(b)                             | No intermediate values / cannot predict between plotted values;                                                                        | 1         | 'Plotted values' could be expressed as 'pHs used'                                                                                                                                                                                                                                     |
| 6(a)                             | Maltose;                                                                                                                               | 1         |                                                                                                                                                                                                                                                                                       |
| 6(b)                             | 1. Benedict's solution <i>and</i> heat;<br>2. Orange/brick red/ brown/ orange/ yellow/green colour (indicates reducing sugar present); | 2         | 1. Need both aspects. Do not credit this point if acid is also added. Do not credit 'place in a water bath' unless it is qualified as warm or hot<br><br>2. Mark independently of point 1 but reject if the colour change is related to the wrong biological molecule e.g. amino acid |
| <b>Total marks for Section A</b> |                                                                                                                                        | <b>15</b> |                                                                                                                                                                                                                                                                                       |

**BIO3T/P13 Section B**

| Question | Marking Guidance                                                                                                                                                                                                                                                                                                                                                             | Mark  | Comments                                                                                                                                                                                                                 |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7(a)     | <p>For person with pancreatitis/blocked pancreatic duct:</p> <ol style="list-style-type: none"> <li>1. At 0 h/start higher than healthy person / higher than healthy person throughout;</li> <li>2. Rises then falls whereas healthy person falls then rises;</li> <li>3. At 48 h/end, below the starting value whereas healthy person is the same (as at start);</li> </ol> | 2 max | Differences required for all points                                                                                                                                                                                      |
| 7(b)     | <ol style="list-style-type: none"> <li>1. Little/less/no amylase can enter small intestine;</li> <li>2. Little/less/no starch digested (in intestine);</li> <li>3. Salivary amylase not affected / some starch digested by salivary amylase;</li> </ol>                                                                                                                      | 2 max | <p>1. Accept gut or intestine but reject wrong locations e.g. stomach</p> <p>3. Accept 'amylase from mouth'</p>                                                                                                          |
| 8        | <ol style="list-style-type: none"> <li>1. Amylase is specific (to starch);</li> <li>2. No starch in human blood/cells/tissues / starch only in plants;</li> </ol>                                                                                                                                                                                                            | 2     |                                                                                                                                                                                                                          |
| 9        | <ol style="list-style-type: none"> <li>1. Could digest own body/own proteins;</li> <li>2. Example of protein digested e.g. membrane protein, antibody, named protein in blood;</li> </ol>                                                                                                                                                                                    | 2     | <p>e.g. 'could digest carrier proteins in body cells' would score 2 marks</p> <p>e.g. 'could digest antibodies in blood' would also score 2 marks</p> <p>2. Do not credit unsuitable example such as muscle proteins</p> |
| 10       | <ol style="list-style-type: none"> <li>1. Enzyme hydrolyses/breaks down protein to amino acids;</li> <li>2. Products are soluble/can be washed away;</li> </ol>                                                                                                                                                                                                              | 2     |                                                                                                                                                                                                                          |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | <p><b>Arguments for biological washing powder:</b></p> <ol style="list-style-type: none"> <li>1. More effective with all stains;</li> <li>2. Greater improvement with salad dressing/chocolate milkshake/chocolate pudding;</li> </ol> <p><b>Arguments against biological washing powder:</b></p> <ol style="list-style-type: none"> <li>3. Little/less improvement with raspberry sorbet/raspberry smoothie;</li> <li>4. Only tested 5/a small number of stains;</li> <li>5. Only chose stains that would work / didn't select stains that wouldn't work;</li> <li>6. Only included results that did work / didn't show results that didn't work;</li> <li>7. Only one set of results / not repeated;</li> <li>8. Only compared against one washing powder / may not be true for other washing powders;</li> </ol> | 4 max | <p>3 max if only arguments against biological washing powder are referred to</p> <ol style="list-style-type: none"> <li>1. Accept different ways of expressing 'effective' e.g. higher % of stain removed</li> </ol> <p>Ignore references to unknown masses of powder, temperature of washes or other aspects of technique or different fabrics</p> |
| 12 | <ol style="list-style-type: none"> <li>1. Enzyme <b>S</b> effective across a wider range of temperatures;</li> <li>2. Enzyme <b>S</b> <i>more</i> active above 50 °C / active up to 80 °C / active above 60 °C;</li> <li>3. Enzyme <b>S</b> <i>more</i> active below (about) 37 °C temperature;</li> <li>4. (Although) Enzyme <b>P</b> has higher rate of reaction at optimum/40 – 50 °C;</li> <li>5. Enzyme <b>P</b> denatured above 50 °C;</li> </ol>                                                                                                                                                                                                                                                                                                                                                             | 3 max | <p>Answers should be in the context of choosing enzyme <b>S</b> but, if <b>P</b> is chosen, points 4 and 5 may still be awarded, if described</p> <p>In points 2 and 3, a temperature must be stated. Allow <math>\pm 5</math> degrees of values shown</p>                                                                                          |

|                                  |                                                                                                                                                                                                                                      |           |                                                                                                           |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------|
| 13                               | <ol style="list-style-type: none"> <li>1. Stains caused by different substances;</li> <li>2. Enzymes are specific;</li> <li>3. <u>Active site</u> specific to substrate / other substrates cannot fit <u>active site</u>;</li> </ol> | 3         | 3. This could be expressed in other ways e.g. 'other substrates are not complementary to the active site' |
| <b>Total marks for Section B</b> |                                                                                                                                                                                                                                      | <b>20</b> |                                                                                                           |

|                                                                                                                                                                                                                                |  |  |  |  |  |                  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|------------------|--|--|--|--|--|
| Centre Number                                                                                                                                                                                                                  |  |  |  |  |  | Candidate Number |  |  |  |  |  |
| Surname                                                                                                                                                                                                                        |  |  |  |  |  | Other Names      |  |  |  |  |  |
| <b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.         |  |  |  |  |  |                  |  |  |  |  |  |
| <b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment. |  |  |  |  |  |                  |  |  |  |  |  |
| Candidate Signature                                                                                                                                                                                                            |  |  |  |  |  | Date             |  |  |  |  |  |

| For Examiner's Use  |      |
|---------------------|------|
| Total EMPA mark     |      |
| Examiner's Initials |      |
| Section             | Mark |
| Task 1              |      |
| Task 2              |      |
| Section A           |      |
| Section B           |      |
| TOTAL EMPA MARK     |      |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2012

# Biology

# BIO3X

## Unit 3X AS Externally Marked Practical Assignment Written Test

For submission by 15 May 2012

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>For this paper you must have:</b> <ul style="list-style-type: none"> <li>the Task Sheet 2, your results and your graph</li> <li>a ruler with millimetre measurements</li> <li>a calculator.</li> </ul>                                                                                                                                                                                                                            | <b>Time allowed</b> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>                                                                                                                                                                                                                                                                                                     |
| <b>Instructions:</b> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul> | <b>Information</b> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>The maximum mark for this paper is 30.</li> <li>You will be marked on your ability to:               <ul style="list-style-type: none"> <li>use good English</li> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul> |

**Details of additional assistance (if any).** Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes ☐ No ☐

### Teacher Declaration:

I confirm that the candidate has met the requirements of the practical skills verification (PSV) in accordance with the instructions and criteria in section 3.8 of the specification.

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| <b>Practical Skills Verification</b> | <b>Yes</b> <input type="checkbox"/> |
|--------------------------------------|-------------------------------------|

Signature of teacher ..... Date .....

As part of AQA's commitment to assist students, AQA may make your coursework available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your coursework is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns please contact AQA.

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### Section A

These questions are about your investigation into the effect of exercise on pulse rate.  
Use your copy of Task Sheet 2, your results and your graph to answer them.

Answer **all** questions in the spaces provided.

- 7** Give **two** things you did to standardise the way in which you exercised that would have allowed you or another person to repeat the investigation in exactly the same way.

1 .....

.....

2 .....

.....

(2 marks)

- 8** At rest, you measured your pulse every minute. After exercise, you measured your pulse every 30 seconds (step 4). Explain the advantage of measuring your pulse every 30 seconds.

.....

.....

(1 mark)

- 9** You were told to draw a graph (Question 6). You may have decided to join your points with straight lines or to draw a curve of best fit.  
When should you join the points with straight lines?

.....

.....

(1 mark)

- 10** A student wanted to analyse the results from the whole class.  
She decided to calculate the percentage increase in pulse rate with exercise for each student. Do you think this was a good idea? Explain your answer.

.....

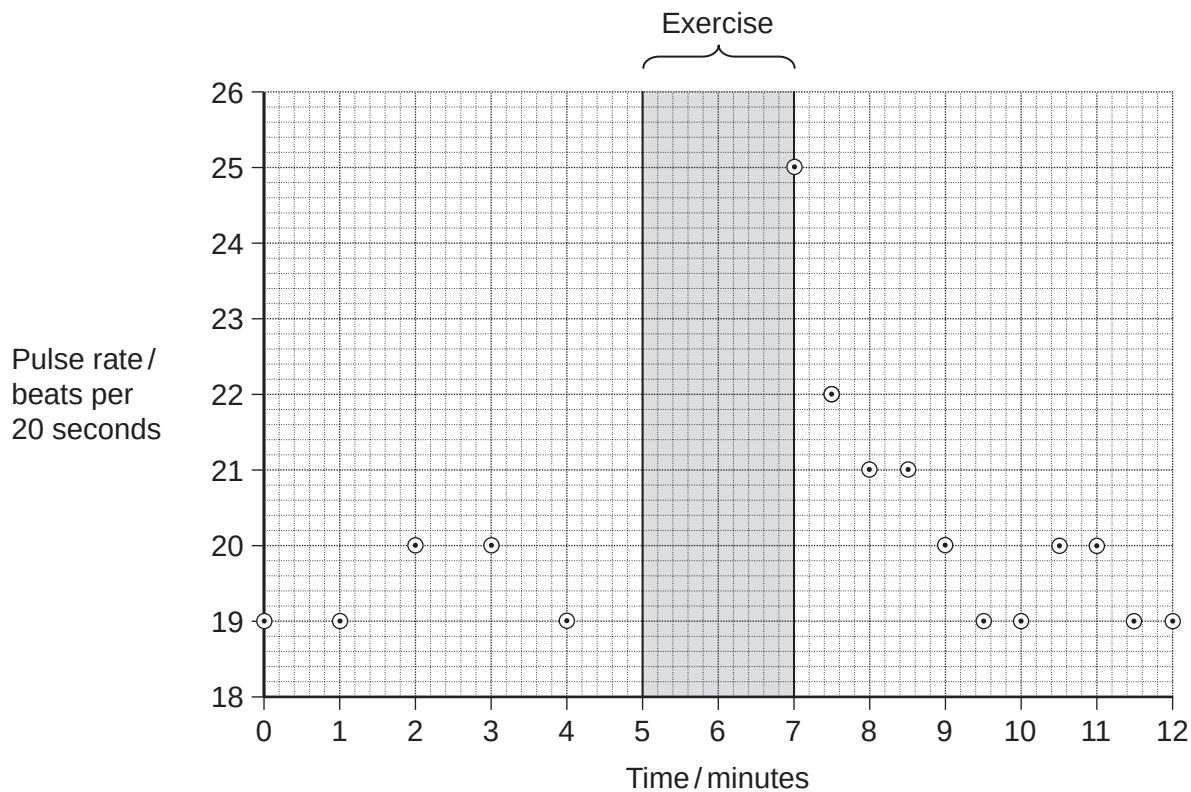
.....

.....

.....

(2 marks)

The graph shows the results collected by another student.



- 11 Use the graph to calculate the student's **resting** pulse rate in beats per minute. Show your working.

Answer ..... beats per minute  
(2 marks)

- 12 The pulse rate changed between the start and finish of exercise. Explain the advantage of this change in pulse rate to the muscles involved in the exercise.

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.....

(2 marks)

## Resource Sheet

### Resource A

An electrocardiogram is made by attaching recording electrodes to a person's chest. It shows the electrical changes that take place in a person's heart each time it beats. A sports physiologist produced electrocardiograms for a fit adult male.

Chart X shows an electrocardiogram from this man after 10 minutes of complete rest. A cardiac cycle consists of the filling time and the contraction time. The filling time and the contraction time for one cardiac cycle are shown on this chart.

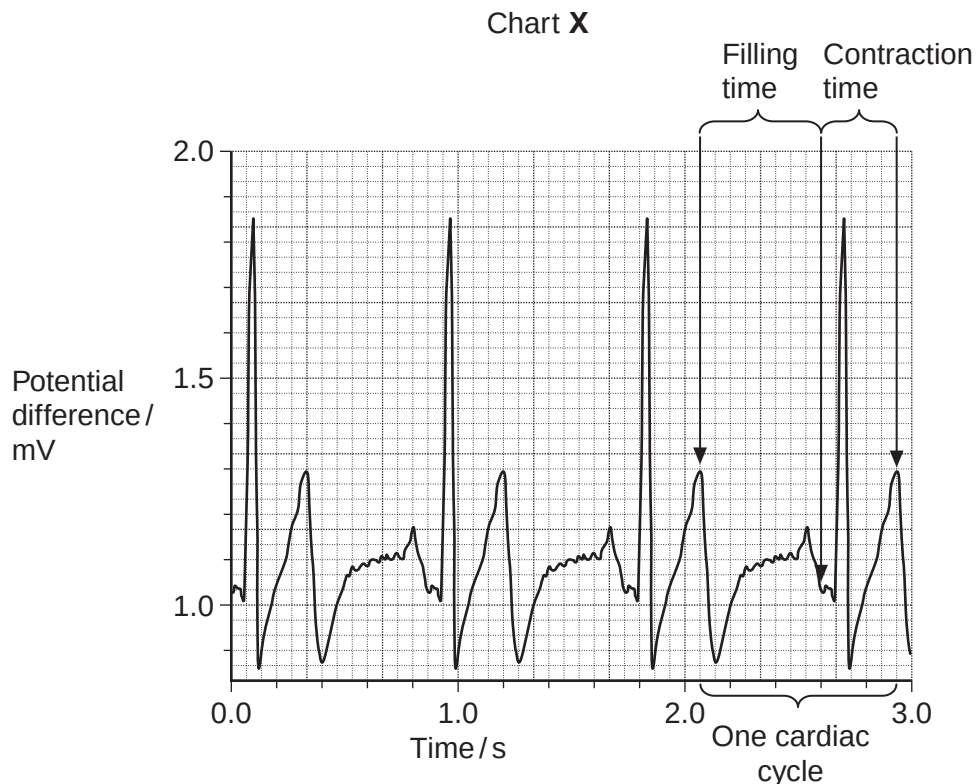
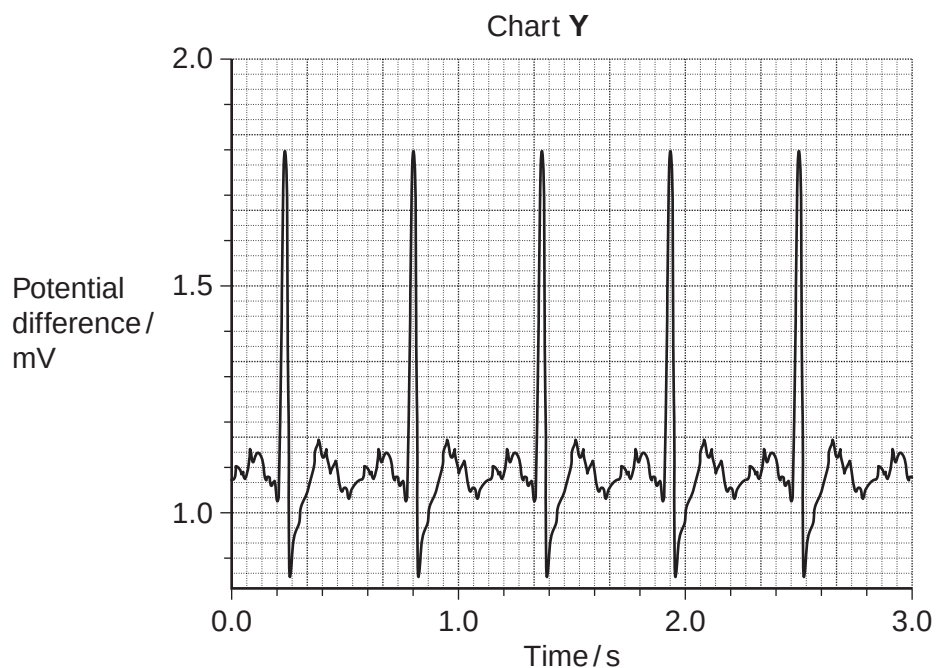


Chart Y shows an electrocardiogram from the same man immediately after a period of exercise.



## Resource B

Doctors investigated the relationship between resting heart rate and the probability of dying from coronary heart disease.

- They carried out a trial on a total of 24 913 patients. These patients had just been diagnosed with coronary heart disease.
- They adjusted their data to take into account other risk factors. These factors included age, sex and blood pressure.

Their adjusted results are shown in the table.

| Time after first being diagnosed with coronary heart disease /years | Percentage of patients still surviving with initial resting heart rate of |                       |
|---------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------|
|                                                                     | < 62 beats per minute                                                     | > 83 beats per minute |
| 0                                                                   | 100                                                                       | 100                   |
| 5                                                                   | 92                                                                        | 90                    |
| 10                                                                  | 83                                                                        | 77                    |
| 15                                                                  | 71                                                                        | 62                    |
| 18                                                                  | 62                                                                        | 51                    |

## Resource C

Ivabradine is a drug that slows heart rate. It is taken as a pill. Doctors investigated its value in reducing the resting heart rate of patients with coronary heart disease.

- They described their investigation as a large-scale, controlled trial. It was also carried out on people living in different areas.
- The results of the trial showed that ivabradine slowed heart rate.
- Angina is a pain in the chest. It results when insufficient oxygen is brought to the heart muscle during exercise. The doctors found that ivabradine reduced angina.

Turn over ►

**Section B**

Use the information in the **Resource Sheet** and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 13 to 16**.

- 13** Give **one** way in which an electrocardiogram could have produced more reliable results than counting the pulse.

.....

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.....

(1 mark)

- 14 (a)** Chart **X** shows that the man's resting heart rate was 69.2 beats per minute. What was his pulse rate? Explain your answer.

.....

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.....

(2 marks)

- 14 (b)** Use chart **Y** to calculate the man's heart rate after the period of exercise. Show your working.

Answer ..... beats per minute  
(2 marks)

- 15** Use charts **X** and **Y** to describe how exercise affected filling time.

.....

.....

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(2 marks)

- 16** The physiologist used electrocardiograms to investigate the effect of increasing heart rate on filling time.  
Describe how she could have modified the method of exercising you used to produce a range of increases in heart rate.

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(2 marks)

**Turn over for the next question**

**Turn over ►**

Use **Resource B** to answer **Question 17**.

- 17** The doctors who investigated the link between resting heart rate and the probability of dying from coronary heart disease concluded that a high resting heart rate was a strong predictor of likely death from coronary heart disease.  
Evaluate this conclusion.

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.....

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.....

(3 marks)

(Extra space) .....

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Use **Resource C** to answer **Questions 18 to 20**.

**18** The results of the ivabradine trial were reliable.

**18 (a)** Explain the importance of the ivabradine investigation being a large-scale trial.

.....

.....

.....

(1 mark)

**18 (b)** Explain the importance of the ivabradine investigation being carried out on people living in different areas.

.....

.....

.....

(1 mark)

**19** The ivabradine investigation was a controlled trial. Suggest how the control group would have been treated.

.....

.....

.....

.....

.....

(2 marks)

**Turn over for the next question**

**Turn over ►**

**20** Ivabradine slows heart rate.

**20 (a)** Use information from **Resource A** to explain why ivabradine increases the volume of blood entering the heart during a cardiac cycle.

.....  
.....  
(1 mark)

**20 (b)** Ivabradine reduces angina. Suggest how an increase in the volume of blood entering the heart reduces angina.

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.....  
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.....  
.....  
(3 marks)  
(Extra space) .....

.....  
.....

|    |
|----|
| 20 |
|----|

**END OF QUESTIONS**

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ANSWER IN THE SPACES PROVIDED**

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ANSWER IN THE SPACES PROVIDED**

**General Certificate of Education (A-level)**  
**June 2012**

**Biology**

**BIO3X**

**(Specification 2410)**

**Unit 3X: Externally Marked Practical  
Assignment**

**Final**

***Mark Scheme***

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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**BIO3X 2012: TASK 1**

| Question     | Marking guidance                                                                                                                                                                                                             | Mark      | Comments                                                                                                     |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------|
| Table        | 1. Mean number of beats per trial calculated correctly;<br>2. Standard deviation calculated correctly;<br>3. Mean pulse rate in beats per minute;                                                                            | 3         | Accept either $\sigma_n$ or $\sigma_{(n-1)}$<br><br>Use candidate's value for mean number of beats per trial |
| 1            | 1. (Sit down for) longer period /keep taking the pulse within/after 5 minutes;<br>2. Pulse rate should be the same / consistent/similar;                                                                                     | 2         | 1. Must relate to resting pulse                                                                              |
| 2            | 1. Shows how spread out the measurements are;<br>2. Around the mean / involves all the measurements;<br>3. Gives an idea of how reliable measurements are/the mean is / overlapping SD results due to chance;                | 2 max     | "Shows how spread out all the measurements are" gains 2 marks                                                |
| 3(a)         | 1. Idea of not measuring complete beats/cycles;<br>2. Small difference in measurements can produce large difference in pulse rate/when multiplied;                                                                           | 2         |                                                                                                              |
| 3(b)         | 1. Pulse rate changes after exercise / returns to resting rate;<br>2. More likely to change in longer time;<br>3. Could lose count/difficult to concentrate for longer period of time;<br>4. Results may not be so accurate; | 2 max     |                                                                                                              |
| <b>Total</b> |                                                                                                                                                                                                                              | <b>11</b> |                                                                                                              |

**BIO3X 2012: TASK 2**

| Question                                 | Marking guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Mark     | Comments                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 –<br>Candidate's own table of raw data | 1. Candidate's own data presented clearly with time and pulse/number of beats per 20 seconds/number of beats per minute clearly indicated;<br><br>2. Independent variable (time) in first column;<br><br>3. Units of time clearly stated and given only in column headings;                                                                                                                                                                                                                             | 3        | 1. Accept any heading that provides more detail<br>"Time", and "pulse/number of beats per 20 seconds" are the minimum requirements for the column headings<br><br>2. Time should be expressed in minutes or seconds<br><br>3. Although AQA uses the convention of separating units by a solidus (/) credit may be given for any method of expressing units |
| 5 - Quality of data                      | Values more or less identical when at rest and decrease after activity;                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1        | This mark can only be awarded if the candidate has collected the data                                                                                                                                                                                                                                                                                      |
| 6 - Graph                                | 1. Pulse (rate) on y axis and time on x axis;<br><br>2. Both axes labelled to indicate units;<br><br><br><br><br><br><br>3. Appropriate scales selected for both x and y axes;<br><br>4. All points plotted accurately. If ICT has been used, it should be possible to read the points with appropriate precision;<br><br>5. Data presented as a line graph(s) with appropriate key/titles;<br><br>Alternatively accept two sets of points, appropriately keyed or labelled, before and after exercise. | 5        | 2. Number of beats/pulse rate per 20 seconds<br><br>Time in minutes/seconds<br>Although AQA uses the convention of separating units by a solidus (/) credit may be given for any method of expressing units                                                                                                                                                |
| <b>Total</b>                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>9</b> |                                                                                                                                                                                                                                                                                                                                                            |

**BIO3X 2012: WRITTEN TEST****Section A**

| Question     | Marking guidance                                                                                                                                                                                                                            | Mark      | Comments                                                                                                           |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------|
| 7            | 1. Total time/duration;<br>2. Number of repeats/rate of repeating;<br>3. Action taken to standardise exercise;                                                                                                                              | 2 max     | 3. E.g. Squatting completely each time                                                                             |
| 8            | Gives a better idea of change/recovery/shows change/recovery in more detail;                                                                                                                                                                | 1         | Accept more reliable if qualified                                                                                  |
| 9            | When you cannot predict /are uncertain about intermediate values;                                                                                                                                                                           | 1         |                                                                                                                    |
| 10           | (Yes)<br>1. Allows results (from different students) to be compared;<br>2. Resting pulse may be different;<br>(No)<br>3. Exercise not standardised;<br>4. So cannot compare results;                                                        | 2         |                                                                                                                    |
| 11           | Two marks for correct answer in the range 57-60 beats per minute;;<br>One mark for incorrect answer where a curve is shown as intersecting y axis between 19 and 20 / where candidate has found a mean value for the five resting readings; | 2         | Ignore figures after decimal point if in range                                                                     |
| 12           | 1. Supplies more oxygen / glucose / removes more carbon dioxide / removes lactate;<br>2. Respiration / energy released / ATP produced / CO <sub>2</sub> /lactate increasing acidity / decreasing pH;                                        | 2         | 1. Needs to be an idea of relative increase other than for lactate<br>2. Do not credit references to making energy |
| <b>Total</b> |                                                                                                                                                                                                                                             | <b>10</b> |                                                                                                                    |

**BIO3X 2012: WRITTEN TEST****Section B**

| Question | Marking guidance                                                                                                                                                                            | Mark | Comments                                                                                                                       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------|
| 13       | Records every heart beat / does not miss heart beats / gives more precise/accurate measurements;                                                                                            | 1    | Qualified reference to human error e.g. in counting                                                                            |
| 14(a)    | 1. 67 / 69.2 / the same;<br>2. There is one surge in pressure / pulse each time the heart contracts / beats;                                                                                | 2    | 1. All that is required here is a connection to be established between heart rate and pulse rate                               |
| 14(b)    | Two marks for correct answer in range 90.0 – 113.0;;<br>One mark for incorrect answer in which duration of one heart beat is clearly identified as between 0.53 and 0.66 seconds;           | 2    |                                                                                                                                |
| 15       | Allow two marks for quantitative statement: e.g. filling time decreases from $0.55 \pm 0.1$ to $0.30 \pm 0.1$ s;;<br>Allow one mark for qualitative statement: e.g. Filling time decreases; | 2    | Accept other quantitative statements such as those based on proportion of cardiac cycle                                        |
| 16       | One mark for more general answer, e.g. increase exercise;<br>Two marks for detailed answer, e.g. increase frequency/duration of exercise;;                                                  | 2    | This is the general principle. Detail may vary if centre uses different exercise<br>Reject comments not related to method used |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                                                                                                                                               |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17           | <ol style="list-style-type: none"> <li>1. Percentage of patients surviving is lower/ percentage of patients dying is higher with higher heart rate;</li> <li>2. Data corrected for other risk factors;</li> <li>3. Large number of patients (so data likely to be reliable);</li> <li>4. But difference small for 5 years (and below)/difference only large/significant for 10 years and above / no data between 62 and 83 (beats per minute);</li> <li>5. Cause of death may not be CHD;</li> </ol> | 3 max     | <p>No mark for yes/no</p> <p>Please write point number by tick to indicate where marking points have been awarded</p>                                         |
| 18(a)        | Identifies anomalies/minimises effect of anomalies / unusual results / results more likely to be representative / more reliable mean;                                                                                                                                                                                                                                                                                                                                                                | 1         | Accept likely to see side effects                                                                                                                             |
| 18(b)        | Minimises / avoids regional bias/effects;                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1         | <p>This is the basic principle. Accept examples that make this basic point, e.g.</p> <p>There may be factors that affect people living in different areas</p> |
| 19           | <ol style="list-style-type: none"> <li>1. Treated the same as those on ivabradine / experimental group;</li> <li>2. Given dummy pill/placebo;</li> </ol>                                                                                                                                                                                                                                                                                                                                             | 2         | Do not accept: given no pill                                                                                                                                  |
| 20(a)        | Increases filling time;                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1         |                                                                                                                                                               |
| 20(b)        | <ol style="list-style-type: none"> <li>1. Maximum / large amount of blood leaves heart / ventricles / increases stroke volume/cardiac output;</li> <li>2. More blood / more oxygen to heart muscle/heart tissue;</li> <li>3. Via coronary arteries;</li> </ol>                                                                                                                                                                                                                                       | 3 max     | <ol style="list-style-type: none"> <li>1. Must be in context of blood leaving the heart</li> <li>2. Accept wall of heart</li> </ol>                           |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>20</b> |                                                                                                                                                               |

|                                                                                                                                                                                                                                |  |  |  |  |  |                  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|------------------|--|--|--|--|--|
| Centre Number                                                                                                                                                                                                                  |  |  |  |  |  | Candidate Number |  |  |  |  |  |
| Surname                                                                                                                                                                                                                        |  |  |  |  |  | Other Names      |  |  |  |  |  |
| <b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.         |  |  |  |  |  |                  |  |  |  |  |  |
| <b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment. |  |  |  |  |  |                  |  |  |  |  |  |
| Candidate Signature                                                                                                                                                                                                            |  |  |  |  |  | Date             |  |  |  |  |  |

| For Teacher's Use |      |
|-------------------|------|
| Section           | Mark |
| PSA               |      |
| Stage 1 Skills    |      |
| Stage 2 Skills    |      |
| Section A         |      |
| Section B         |      |
| TOTAL (max 50)    |      |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2011

# Biology

# BIO3T/P11/test

## Unit 3T AS Investigative Skills Assignment

For submission by 15 May 2011

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>For this paper you must have:</b> <ul style="list-style-type: none"> <li>the task sheet, your results and graph</li> <li>a ruler with millimetre measurement</li> <li>a calculator.</li> </ul>                                                                                                                                                                                                                                    | <b>Time allowed</b> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>                                                                                                                                                                                                                                                                                                     |
| <b>Instructions:</b> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul> | <b>Information</b> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>The maximum mark for this paper is 36.</li> <li>You will be marked on your ability to:               <ul style="list-style-type: none"> <li>use good English</li> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul> |
| <b>Details of additional assistance (if any).</b> Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.<br><br>Yes <input type="checkbox"/> No <input type="checkbox"/>                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                             |

### Teacher Declaration:

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

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**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Section A**

These questions relate to your investigation of the effect of different enzymes on apple juice production.

Use your Task Sheet and your results table and graph to answer them.

Answer **all** questions in the spaces provided.

**1** Give **two** variables which were controlled in your investigation.

1. ....

2. ....

(2 marks)

**2** Temperature was not controlled in your investigation. How did you find out if there were temperature changes which could have influenced your data?

.....

.....

.....

(1 mark)

**3** The pH was not controlled in your investigation. The optimum pH for pectinase activity is 6.0. The optimum pH for cellulase activity is 5.0. Describe how this information could be used to improve your investigation.

.....

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.....

(2 marks)

**4** Is a control experiment necessary in this investigation? Explain your answer.

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.....

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(1 mark)

Turn over ►

- 5 Your investigation was carried out only once. Give **two** ways in which repeating your investigation several times would make it more reliable.

1 .....

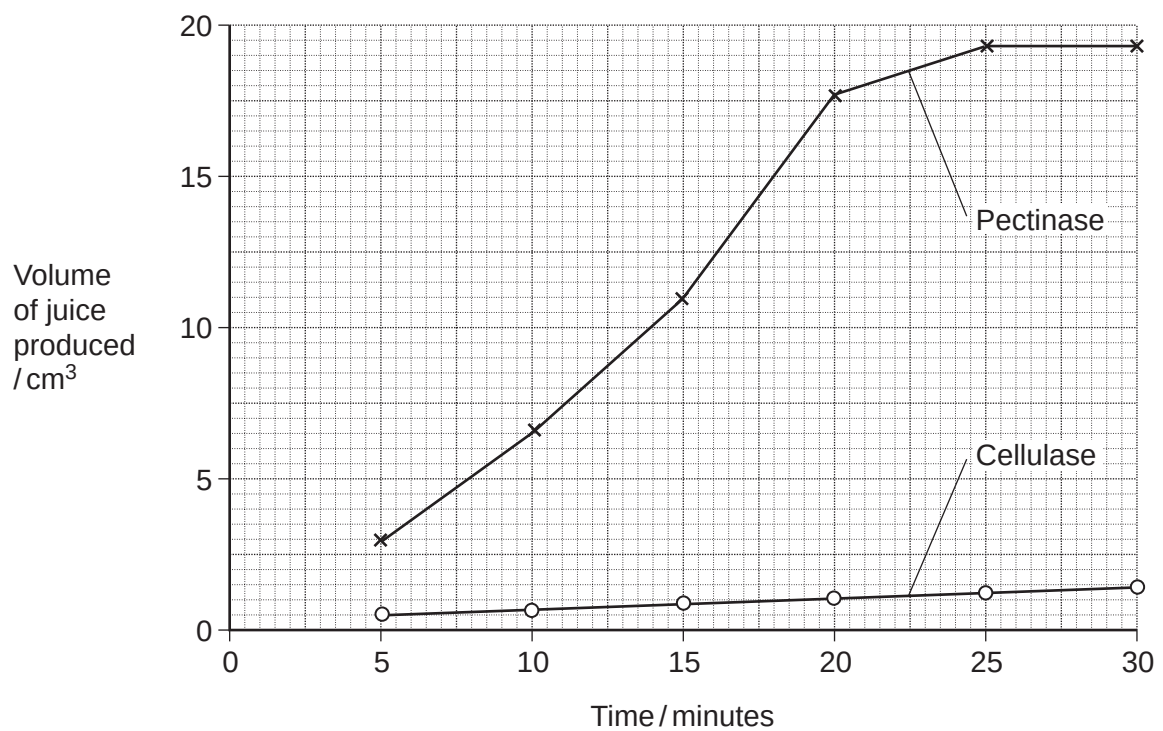
.....

2 .....

.....

(2 marks)

- 6 A student carried out a similar investigation to yours. He obtained the following results.



- 6 (a) Describe these results.

.....

.....

.....

.....

.....

(2 marks)

- 6 (b) The student suggested that more juice would be produced if the enzymes were used together. In order to investigate this, he used the same procedure as in the Task Sheet, but added 1 cm<sup>3</sup> of pectinase and 1 cm<sup>3</sup> of cellulase to the apple pulp. Was he correct to use these volumes of the enzymes? Explain your answer.

.....

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(2 marks)

- 7 Commercial juice makers add both pectinase and cellulase to the fruit. This produces more juice. Suggest why adding both enzymes produces more juice than either enzyme on its own.

.....

.....

.....

.....

.....

(2 marks)

14

**Turn over for the next question**

**Turn over ►**

---

## Resource Sheet

### Introduction

There are many reports of fruit and substances produced from fruit being beneficial to health. Two of the fruit products which have been studied are cranberry juice and a substance from the peel of oranges called modified citrus pectin (MCP).

### Resource A

This resource is about an investigation into the effect of cranberry juice on the concentration of high density lipoprotein (HDL) in the blood.

HDL removes cholesterol from cells such as those in coronary artery walls. HDL takes this cholesterol to the liver where it is removed from the body.

Scientists advertised for volunteers to take part in an investigation. From these volunteers they selected 31 healthy men to take part in a 16 week investigation. The scientists gave each volunteer 500 cm<sup>3</sup> of juice to drink each day. Every 4 weeks they increased the concentration of cranberry juice in the drink.

The scientists recorded the concentration of HDL in the blood of the volunteers. The results are shown in the table.

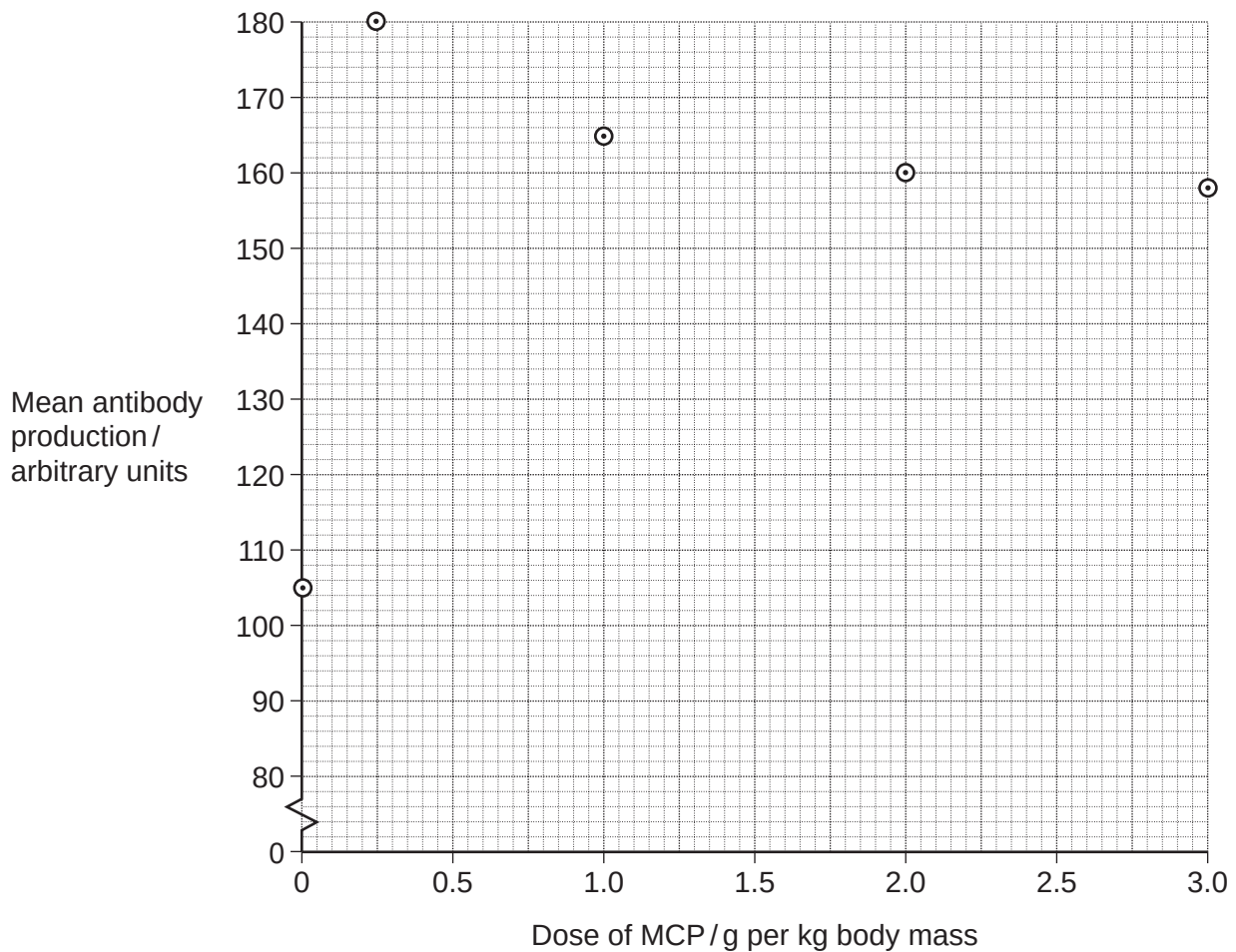
| Time / weeks | Concentration of cranberry juice / % | Mean concentration of HDL in the blood at end of the 4 week period ( $\pm$ SD) / mol dm <sup>-3</sup> |
|--------------|--------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1 – 4        | 0                                    | 1.19 ( $\pm$ 0.20)                                                                                    |
| 5 – 8        | 25                                   | 1.22 ( $\pm$ 0.17)                                                                                    |
| 9 – 12       | 50                                   | 1.27 ( $\pm$ 0.18)                                                                                    |
| 13 – 16      | 100                                  | 1.27 ( $\pm$ 0.20)                                                                                    |

**Resource B**

Scientists tested a claim that modified citrus pectin (MCP) increased the production of antibodies by the immune system.

- They divided a large number of mice into five groups.
- They gave the mice in each group a different amount of MCP in their food.
- The scientists then stimulated antibody production in the mice. They did this by injecting them with a solution containing sheep red blood cells.

The results are shown in the graph.



Turn over ►

**Section B**

Use the information in the **Resource Sheet**  
to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 8 to 11**.

- 8** A low concentration of HDL increases the risk of coronary heart disease.  
Explain why.

.....

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.....

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(3 marks)

*Extra space* .....

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- 9** A placebo juice was used to dilute the cranberry juice. This placebo juice had the same concentration of sugars, minerals and vitamins as the cranberry juice. Explain why the placebo juice was used rather than water.

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(2 marks)

- 10** Can you conclude from this investigation that drinking cranberry juice results in a lower risk of coronary heart disease? Explain your answer.

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(4 marks)

Extra space .....

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- 11** Before starting this investigation the scientists obtained the approval of the ethics committee at their university. The ethics committee decided that the investigation was ethical and safe. Suggest **two** reasons why.

1 .....

.....

2 .....

.....

(2 marks)

Turn over ►

Use **Resource B** to answer **Questions 12 to 17**

- 12** The data obtained in this investigation have been plotted on a graph. How would you join the points? Give a reason for your answer.

.....

.....

.....

(1 mark)

- 13** Use the graph to describe the effect of MCP on mean antibody production.

.....

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.....

(2 marks)

- 14** Calculate the percentage increase in antibody production from when there was no MCP in the diet to when the dose is 1.0 g per kg.

Answer ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,% (2 marks)

- 15** The dose of MCP given to the mice was calculated in g per kg body mass. Explain why the dose was calculated per unit mass.

.....  
 .....  
 (1 mark)

- 16** Explain how antibodies were produced when the mice were injected with sheep red blood cells.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 (3 marks)

(Extra space).....  
 .....  
 .....

- 17** A newspaper suggested that these data show that taking MCP will give people increased resistance to disease. With reference to the data give **two** reasons why this conclusion may **not** be valid.

1 .....  
 .....  
 2 .....  
 .....  
 (2 marks)

**END OF QUESTIONS**

**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



# **General Certificate of Education**

## **Biology**

**Unit 3T AS Investigative Skills Assignment**

**BIO3T/P11/MG**

# **Final Marking Guidelines v2**

*2011 examination – June series*

Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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## Guidance for teachers marking Biology ISAs

**Final Marking Guidelines** must be used to mark candidates' work

### General principles

In general, you are looking for evidence that the candidate knows and understands the point required by the Marking Guidelines.

It is important to mark what the candidate has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

### Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used  
For example anaphase, the term must appear  
For example ..... and ....., both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a candidate's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed.
- Additional instructions are shown in the final column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a candidate will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

### The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the candidate has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a  $\Delta$  symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the candidate's response in the order in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the candidate contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the candidate gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents candidates from gaining full marks from a list of right and wrong answers.

Name **two** substances that are produced in photosynthesis.

(2 marks)

| Answer                          | Marks | Comment                                                                         |
|---------------------------------|-------|---------------------------------------------------------------------------------|
| Oxygen, glucose                 | 2     | Both correct                                                                    |
| Oxygen, carbon dioxide          | 1     | One correct, one incorrect                                                      |
| Carbon dioxide, oxygen, glucose | 1     | Carbon dioxide is clearly incorrect and cancels one of the marks                |
| Oxygen, glucose, water          | 2     | Regard water as a neutral point. It is not worth a mark but it is not incorrect |

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the final column in the Marking Guidelines to show that misspellings must not be credited.

## Provisional Marking Guidelines

### Stage 1

Candidates should be assessed on their ability to present raw data in an appropriate way.

| Marking Guidance                                                                                                                                                                                     | Mark     | Comments                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data presented clearly with full descriptions of both variables; e.g. 'Time from the start of filtering' / 'Time for juice to come through' / 'Volume of juice produced with pectinase / cellulase'. | 1        | This may be recorded either by a full title or by complete headings at the top of the table (e.g. if 'Volume' and 'Time' only recorded in the table, the title should give more detail by reference to apple juice. The name of the enzyme must appear either in the column heading or in the title to gain this mark. |
| Time in first column;                                                                                                                                                                                | 1        | If table in horizontal format, time in first row.                                                                                                                                                                                                                                                                      |
| Units stated clearly and only in the heading to the appropriate columns;                                                                                                                             | 1        | Although AQA uses the IOB convention of separating units by a solidus(/), credit should not be awarded or withheld for the way in which they are presented, provided they are clear. Time must be measured in appropriate units e.g. minutes or seconds, not a combination of both.                                    |
| <b>Total</b>                                                                                                                                                                                         | <b>3</b> |                                                                                                                                                                                                                                                                                                                        |

## Stage 2

| Marking Guidance                                                                                                          | Mark     | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Graph has time on x-axis and volume on y-axis;                                                                            | 1        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Appropriate scales selected for both the x and y axis;                                                                    | 1        | These scales should allow for both accurate plotting and reading the graph.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Both axes correctly labelled with appropriate units;                                                                      | 1        | Credit should not be awarded or withheld for the way in which units are presented, provided they are clear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| All points plotted accurately. If ICT has been used, it should be possible to read the points with appropriate precision; | 1        | Do not award if candidate has only plotted data for 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Data presented as two labelled curves on a line graph;                                                                    | 1        | <p>Do not award this mark if the curves have been extrapolated beyond the range of data collection. Ignore extrapolations to the origin (0,0).</p> <p>Depending on the data obtained by the student,</p> <ul style="list-style-type: none"> <li>• points may be joined by a curve of best fit if it felt immediate values are likely to fall on such a curve.</li> <li>• alternatively, all points should be joined with straight lines if it felt that the position of intermediate points cannot be predicted reliably.</li> </ul> <p>Do not award if candidate has only plotted data for 30 minutes.</p> |
| <b>Total</b>                                                                                                              | <b>5</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## Section A

| Question    | Marking Guidance                                                                                                                                                                                                                                                                    | Mark  | Comments                                                                                                                                                |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>    | 1 Volume of enzyme;<br>2 Mass of apple pulp;<br>3 Concentration of enzyme;<br>4 Variety of apple;<br>5 Time of mixing;<br>6 Time before filtering;<br>7 Time between readings;                                                                                                      | 2 max |                                                                                                                                                         |
| <b>2</b>    | Temperature of room recorded regularly throughout investigation / at beginning and end of investigation / temperature of apple pulp recorded regularly throughout the investigation / at beginning and end of investigation;                                                        | 1     | Must be reference to temperature and time span.                                                                                                         |
| <b>3</b>    | 1 Use buffers;<br>2 Use different buffers for each enzyme / pH 5 for cellulase and pH 6 for pectinase;                                                                                                                                                                              | 2     | Award one mark for basic answer referring to buffer.<br>Award two marks for more detailed answer referring to use of different buffers for each enzyme. |
| <b>4</b>    | Either<br>1 (Yes) – shows that juice produced as a result of enzyme activity / yes – shows if juice is produced without enzyme;<br>Or<br>2 (No) – investigation is to determine if there is a difference in juice production with the enzymes used / no – comparing (two) enzymes;  | 1     |                                                                                                                                                         |
| <b>5</b>    | 1 Able to check that results are similar / concordant;<br>2 Able to reduce / identify effect of anomalies / extreme values;<br>3 Gives <u>reliable mean</u><br>4 Allows statistics test to be carried out;                                                                          | 2 max | Do not credit able to calculate mean                                                                                                                    |
| <b>6(a)</b> | 1 Pectinase produces a greater volume of juice than cellulase;<br>2 With pectinase volume of juice produced increases then levels out at 20/25 minutes / 17.5/19.5 cm <sup>3</sup> ;<br>3 With cellulase volume of juice increases at same rate / is directly proportional to time; | 2 max | Accept figures within range of extremes given.                                                                                                          |

### Section A—continued

| Question     | Marking Guidance                                                                                                                                                                                                                                                                                                                                   | Mark      | Comments |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|
| <b>6(b)</b>  | 1 Overall <u>volume</u> is the same;<br>2 (If 1c <del>3</del> ) less enzyme present / (should have used 2 cm <sup>3</sup> ) so same amount of enzyme present;<br>3 (If 1c <del>3</del> ) valid comparison cannot be made / rate of reaction lower for each enzyme;<br>4 (With 2c <del>3</del> ) same amount of enzyme (as in original experiment); | 2 max     |          |
| <b>7</b>     | 1 Pectinase breaks cells apart;<br>2 More surface / cells for cellulase to act on;<br>3 Cellulase breaks down cell walls / cellulase releases juice;                                                                                                                                                                                               | 2 max     |          |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                    | <b>14</b> |          |

### Section B

| Question | Marking Guidance                                                                                                                                                                                                                                | Mark  | Comments                                                                            |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------|
| <b>8</b> | 1 Cholesterol not removed / accumulates;<br>2 In artery walls<br>3 Atheroma forms;<br>4 Oxygen supply / blood flow to heart muscle reduced;<br>5 (Increased risk of) myocardial infarction / thrombosis;                                        | 3 max | 5 Do not accept 'heart attack' or 'clot'. Technical term required. Reject aneurysm. |
| <b>9</b> | 1 Maintain constant intake of energy / carbohydrate / vitamins;<br>2 (Otherwise) result might have been due to different amounts of sugars / minerals / vitamins;<br>3 So that participants did not know the concentration of juice being used; | 2 max |                                                                                     |

**Section B—continued**

| Question     | Marking Guidance                                                                                                                                                                                                                                                                                                                                           | Mark      | Comments                                                                                                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10</b>    | 1. Increase in high density lipoprotein may be due to other factor / named factor;<br>2. High standard deviations / standard deviations overlapping;<br>3. So may not be a difference in HDL concentrations;<br>4. HDL only one of the risk factors in CHD;<br>5. No control;<br>6. Sample size small / only 31;<br>7. Change both time and concentration; | 4 max     | 1. Eg diet not controlled<br><br>When marking, please number the marking points e.g. <sup>4</sup> ✓ means a mark awarded for point 4.<br><br>7. Idea of two independent variables |
| <b>11</b>    | 1 Natural product used / cranberry juice safe / has no harmful effects;<br>2 No change in normal lifestyle of participants;<br>3 Participants were volunteers;<br>4 Participants were healthy;                                                                                                                                                             | 2 max     |                                                                                                                                                                                   |
| <b>12</b>    | Straight lines point to point as not possible to predict intermediate values/values between points;                                                                                                                                                                                                                                                        | 1         |                                                                                                                                                                                   |
| <b>13</b>    | 1 ncreases then levels/falls;<br>2 Maximum antibody production 180 units/ at dose of 0.25 g per kg;                                                                                                                                                                                                                                                        | 2         |                                                                                                                                                                                   |
| <b>14</b>    | Two marks for correct answer of 57.14 / 57.1;;<br>One mark for incorrect answer in which candidate clearly divides difference in antibody production / 60 by 105;                                                                                                                                                                                          | 2         |                                                                                                                                                                                   |
| <b>15</b>    | Takes into account different masses of mice / allows comparison;                                                                                                                                                                                                                                                                                           | 1         | Accept different weights of mice.<br>Do not accept different size.                                                                                                                |
| <b>16</b>    | 1 Sheep red blood cells have antigens (on their surface);<br>2 Antigens are proteins;<br>3 Foreign to mice / are non-self;<br>4 Stimulate B cells to produce antibodies;                                                                                                                                                                                   | 3 max     |                                                                                                                                                                                   |
| <b>17</b>    | 1 Response only observed in mice;<br>2 Disease organisms not investigated;<br>3 Not all disease caused by pathogens / cured by <u>antibodies</u>                                                                                                                                                                                                           | 2 max     | i.e. not tested on humans                                                                                                                                                         |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                            | <b>22</b> |                                                                                                                                                                                   |

|                     |  |  |  |  |  |                  |  |  |  |  |
|---------------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre Number       |  |  |  |  |  | Candidate Number |  |  |  |  |
| Surname             |  |  |  |  |  |                  |  |  |  |  |
| Other Names         |  |  |  |  |  |                  |  |  |  |  |
| Candidate Signature |  |  |  |  |  |                  |  |  |  |  |

| For Teacher's Use |      |
|-------------------|------|
|                   | Mark |
| Stage 1 Skills    |      |
| Stage 2 Skills    |      |
| Section A         |      |
| Section B         |      |
| TOTAL ISA Mark    |      |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2010

## Biology

## BIO3T/P10/test

### Unit 3T AS Investigative Skills Assignment

#### Written Test

**For submission by 15 May 2010**

**For this paper you must have:**

- the task sheet, your results and your graph
- a ruler with millimetre measurement
- a calculator.

#### Time allowed

- 1 hour 15 minutes

#### Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

#### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 35.
- You will be marked on your ability to
  - use good English
  - organise information clearly
  - use accurate scientific terminology.

Signature of Teacher marking the ISA ..... Date .....

**Section A**

These questions relate to your investigation into the effect of bile salts and lipase on the digestion of triglycerides in milk.

Use your Task Sheet and your results table and graph to answer them.

Answer **all** questions in the spaces provided.

- 1** What temperature did you choose for the water bath? Give a reason for choosing this temperature.

.....  
.....  
.....

(1 mark)

- 2 (a)** You left tube **1** in the water bath for 5 minutes before adding the water and lipase solution. Explain why you left the tube for 5 minutes.

.....  
.....  
.....

(1 mark)

- 2 (b)** You were **not** told to incubate the water and the lipase solution in the water bath before adding them to tube **1**.  
Would it have made any difference to your result if you had incubated them?  
Explain your answer.

.....  
.....  
.....

(1 mark)

- 3** Sodium carbonate solution is alkaline. Explain why you added sodium carbonate solution to each tube at the start of the investigation.

.....  
.....

(1 mark)

- 4** You investigated the effect of bile salts and lipase on the digestion of triglycerides. In tube **1** you added lipase and water to the milk.  
Explain why you were told to set up tube **1** like this.

.....

.....

.....

(1 mark)

- 5** Digestion of triglycerides in milk caused phenolphthalein indicator to change colour.  
Explain how.

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.....

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.....

(3 marks)

*Extra space* .....

.....

.....

- 6** In investigations involving enzymes, buffers are often used.  
Why is it **not** appropriate to use a buffer in this investigation?

.....

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.....

(2 marks)

- 7** A student carried out the same investigation as you did. He recorded the following results.

| Tube number | Solutions added to tubes<br>(in addition to<br>phenolphthalein, sodium<br>carbonate and milk) | Time taken for<br>phenolphthalein to go<br>colourless/minutes |
|-------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <b>1</b>    | Lipase and water                                                                              | 7                                                             |
| <b>2</b>    | Bile salts and water                                                                          | More than 15                                                  |
| <b>3</b>    | Lipase and bile salts                                                                         | 5                                                             |
| <b>4</b>    | Boiled lipase and bile salts                                                                  | More than 15                                                  |
| <b>5</b>    | Lipase and boiled bile salts                                                                  | 5                                                             |

- 7 (a)** The student's result for tube **4** was different from his result for tube **3**. Use your knowledge of enzymes to explain why.

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(3 marks)

Extra space .....

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- 7 (b)** Describe what the table shows about the effect of bile salts on the digestion of triglycerides. Give the evidence from the table that supports your answer.

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(2 marks)

15

**Turn over for the next question**

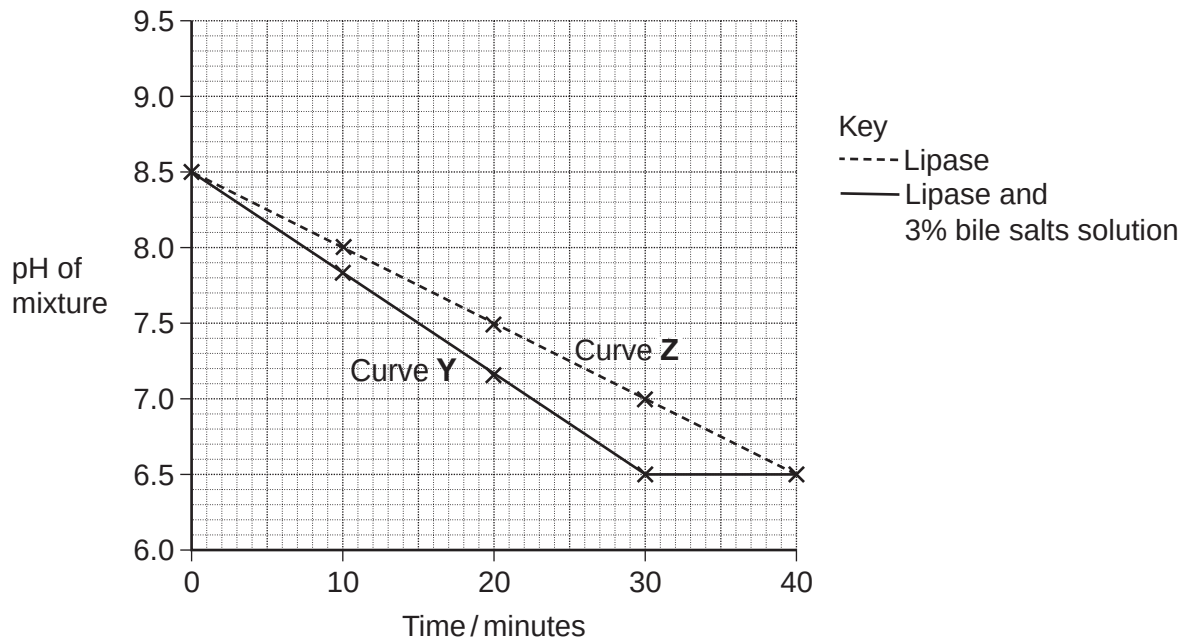
**Turn over ►**

## RESOURCE SHEET

### Resource A

Scientists investigated the effect of lipase and a 3% bile salts solution on the digestion of triglycerides. **Figure 1** shows their results.

**Figure 1**



### Resource B

The scientists also incubated triglycerides with different concentrations of bile salts. After 30 minutes they measured the diameter of the triglyceride droplets. They used the results to calculate the mean radius of the droplets at each concentration. **Figure 2** shows their results.

**Figure 2**

|                                                     |   |   |   |   |   |   |
|-----------------------------------------------------|---|---|---|---|---|---|
| Concentration of bile salts /%                      | 0 | 1 | 2 | 3 | 4 | 5 |
| Mean radius of triglyceride droplet / $\mu\text{m}$ | 6 | 5 | 4 | 3 | 2 | 1 |

### Resource C

Scientists fed different diets to three groups of monkeys of different ages. They fed half the monkeys in each age group a diet in which all the triglycerides were saturated and half on a diet in which all the triglycerides were unsaturated. All other aspects of the diets and living conditions were kept as similar as possible. The scientists measured the plasma cholesterol concentration of the monkeys. **Figure 3** shows their results.

**Figure 3**

| Age group / months | Type of triglyceride in diet | Number of monkeys in group | Mean plasma cholesterol concentration / mmol dm <sup>-3</sup> ( ± standard deviation) |
|--------------------|------------------------------|----------------------------|---------------------------------------------------------------------------------------|
| 16                 | Saturated                    | 10                         | 8.45 ( ± 1.96)                                                                        |
| 32                 | Saturated                    | 8                          | 9.75 ( ± 2.60)                                                                        |
| 60                 | Saturated                    | 12                         | 10.42 ( ± 4.12)                                                                       |
| 16                 | Unsaturated                  | 9                          | 6.59 ( ± 1.56)                                                                        |
| 32                 | Unsaturated                  | 8                          | 7.24 ( ± 2.60)                                                                        |
| 60                 | Unsaturated                  | 11                         | 8.84 ( ± 2.32)                                                                        |

**Section B**

Use the information in the **Resource Sheet** to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resources A** and **B** to answer Questions **8** to **12**.

- 8** Describe what curve **Y** shows about the effect of lipase and bile salts on the pH of the mixture.

.....

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(2 marks)

- 9** The concentration of lipase did not change during the course of the investigation. Explain why.

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.....

(1 mark)

- 10** One of the scientists decided to repeat the investigation described in **Resource A** at a temperature 10 °C below the original temperature. Describe how you would expect his plotted curve to be different from curve **Z**.

.....

.....

(1 mark)

11

Describe how you would use a microscope to find the mean diameter of triglyceride droplets on a slide.

.....

.....

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.....

.....

(3 marks)

*Extra space* .....

.....

.....

**Turn over for the next question**

**Turn over ►**

- 12 (a)** The ratio of mean radius of triglyceride droplets in bile salts at a concentration of 0 % to the mean radius in bile salts at a concentration of 3 % is 2 : 1.

What is the ratio of their surface areas? Show your working.

You can calculate the surface area of a droplet from the formula

$$A = 4\pi r^2$$

Where  $A$  = surface area

$r$  = radius

$\pi = 3.14$

(2 marks)

- 12 (b)** Use the data in **Figure 2** to explain the difference between curves **Y** and **Z** in **Figure 1**.

.....

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(3 marks)

*Extra space* .....

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Use **Resource C** to answer Questions 13 to 15.

- 13** The scientists concluded that a diet high in saturated triglyceride raises the concentration of blood plasma cholesterol. Evaluate their conclusion.

.....

.....

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.....

(3 marks)

Extra space .....

.....

.....

- 14** The monkeys in this investigation were all of the same sex.  
Explain how selecting monkeys of the same sex would help the scientists to draw reliable conclusions.

.....

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.....

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(2 marks)

**Turn over for the next question**

**Turn over ►**

15

Is the research described in **Resource C** relevant to human health? Explain your answer.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

(Extra space) .....

.....

.....

20

**END OF QUESTIONS**



# **General Certificate of Education**

## **Biology**

**Unit 3T AS Investigative Skills Assignment**

**BIO3T/P10/MG**

## **Marking Guidelines**

*2010 examination – June series*

Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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## Guidance for teachers marking Biology ISAs

### General principles

In general, you are looking for evidence that the candidate knows and understands the point required by the Marking Guidelines.

It is important to mark what the candidate has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

### Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used  
For example anaphase, the term must appear  
For example ..... and ....., both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a candidate's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed.
- Additional instructions are shown in the final column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a candidate will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

## The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the candidate has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a  $\Delta$  symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the candidate's response in the order in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the candidate contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the candidate gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents candidates from gaining full marks from a list of right and wrong answers.

| Answer                          | Marks | Comment                                                                         |
|---------------------------------|-------|---------------------------------------------------------------------------------|
| Oxygen, glucose                 | 2     | Both correct                                                                    |
| Oxygen, carbon dioxide          | 1     | One correct, one incorrect                                                      |
| Carbon dioxide, oxygen, glucose | 1     | Carbon dioxide is clearly incorrect and cancels one of the marks                |
| Oxygen, glucose, water          | 2     | Regard water as a neutral point. It is not worth a mark but it is not incorrect |

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the final column in the Marking Guidelines to show that misspellings must not be credited.

**Stage 1****Assessment of presentation of raw data**

Candidates should be assessed on their ability to present raw data in an appropriate way.

The following criteria should be used to mark this skill.

| <b>Marking Guidance</b>                                                                                                                                    | <b>Mark</b> | <b>Comments</b>                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data presented clearly with full descriptions of both the independent and dependent variable i.e. tube number and time taken for pink colour to disappear; | 1           | This may be recorded either by a full title or by complete headings at the top of the table.                                                                                                                                                                                                 |
| Independent variable (tube number) in the first column;                                                                                                    | 1           |                                                                                                                                                                                                                                                                                              |
| Units clearly stated and only in the head of the appropriate column;                                                                                       | 1           | Although AQA uses the IOB convention of separating the units by a solidus (/), credit should not be recorded or withheld for the way in which they are presented, provided they are clear.<br>(Time must be measured in appropriate units e.g. minutes or seconds not a combination of both) |
| <b>Total</b>                                                                                                                                               | <b>3</b>    |                                                                                                                                                                                                                                                                                              |

The table of raw data collected during implementation is required for moderation and must be attached to the ISA written test.

## Stage 2

## Assessment of processing

| Marking Guidance                                                                                                | Mark     | Comments                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Rate of reaction calculated correctly (1/time taken for pink colour to disappear);                              | 1        |                                                                                                                                               |
| Data presented as a bar chart;                                                                                  | 1        | Accept bars touching                                                                                                                          |
| Graph has independent variable (tube number / tube contents) on x axis and dependent variable (rate) on y axis; | 1        |                                                                                                                                               |
| Both axes correctly labelled with appropriate units;                                                            | 1        | For independent variable, tube number or tube. For dependent variable, rate as $\text{minutes}^{-1}$ or $\text{seconds}^{-1}$                 |
| Appropriate scales selected for the x and y axes:                                                               | 1        | These scales should allow for both accurate plotting and reading of the graph<br>The bars should not be touching and should be of equal width |
| All bars plotted accurately;                                                                                    | 1        | If ICT has been used to plot the graph, it should be possible to read the height of the bars with appropriate precision                       |
| <b>Total</b>                                                                                                    | <b>6</b> |                                                                                                                                               |

The graph produced is required for moderation and must be attached to the ISA written test.

## Section A

| Question | Marking Guidance                                                                                                                                                                                                                                            | Mark | Comments                                                                                                                                                              |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | This is a temperature very similar to (mammal) body temperature / because enzymes work fast enough at this temperature to get results / optimum temperature / temperature easy to control;                                                                  | 1    | No mark for temperature<br>1 mark for reason<br><br>Mark the reason first and then check this matches with the temperature chosen. If it does not, withhold the mark. |
| 2        | (a) To equilibrate / (for the solution) to reach the temperature of the water bath;                                                                                                                                                                         | 1    |                                                                                                                                                                       |
| 2        | (b) If room temperature higher than incubated temperature rate of reaction increased / if room temperature lower than incubated temperature rate of reaction lowered / if room temperature same as incubated temperature rate of reaction will be the same; | 1    |                                                                                                                                                                       |
| 3        | To produce a pink solution;                                                                                                                                                                                                                                 | 1    |                                                                                                                                                                       |
| 4        | (b) To see if lipase on its own could break down / hydrolyse triglycerides / to compare with tube containing bile salts and enzyme;                                                                                                                         | 1    | Ignore references to 'control'                                                                                                                                        |

**Section A—continued**

| <b>Question</b>                  | <b>Marking Guidance</b>                                                                                                                                                                                                       | <b>Mark</b> | <b>Comments</b>                   |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------|
| <b>5</b>                         | Tryglycerides are broken down into fatty acids (and glycerol);<br>By hydrolysis;<br>Fatty acids decrease pH;<br>Phenolphthalein changes colour when solution becomes more acidic / pH decreases;                              | 3 max       | Accept lipids broken down         |
| <b>6</b>                         | A buffer keeps the pH the same;<br>This investigation uses change in pH to measure the progress of the reaction;                                                                                                              | 2           |                                   |
| <b>7</b>                         | (a)<br>Lipase / enzyme denatured by boiling;<br>Active site changes shape;<br>Substrate no longer fits / binds / no or fewer enzyme-substrate complexes formed;                                                               | 3           |                                   |
| <b>7</b>                         | (b)<br>From tube <b>2</b> , bile salts do not digest triglyceride;<br>From tubes <b>3</b> and <b>1</b> , bile salts speed up action of lipase;<br>From tube <b>5</b> , bile salts not an enzyme / protein / is not denatured; | 2 max       | Assume 'they' refer to bile salts |
| <b>Total marks for Section A</b> |                                                                                                                                                                                                                               | <b>15</b>   |                                   |

## Section B

| Question | Marking Guidance                                                                                                                                                                                                                                                                                                                     | Mark  | Comments                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------|
| 8        | pH goes down and levels out;<br>after 30 min / pH 6.5;                                                                                                                                                                                                                                                                               | 2     |                                                                   |
|          | Enzyme not used up in reaction;                                                                                                                                                                                                                                                                                                      | 1     |                                                                   |
| 10       | Curve will be less steep:                                                                                                                                                                                                                                                                                                            | 1     | Only accept answers relating to curve <b>not</b> rate of reaction |
| 11       | Measure with eyepiece graticule/scale;<br>Calibrate with stage micrometer / scale on slide/object of known size;<br>Repeats and calculate the mean;<br>OR<br>Use a ruler to estimate the field diameter under microscope;<br>How many droplets go across the field;<br>Repeats and calculate mean;                                   | 3     | Accept references to radius                                       |
| 12       | (a)<br>Two mark for correct answer of 4 : 1;;<br>One mark for incorrect answer but working shows that candidate has clearly attempted to compare values of $r^2 / 6^2$ and $3^2 / 36$ and 9;                                                                                                                                         | 2     | Idea of comparing ratios<br>A ratio of 1 : 4 should gain 1 mark   |
| 12       | (b)<br>Small droplets have a larger surface area to volume ratio;<br>More surface for lipase (to act);<br>Faster digestion of triglycerides;<br>Fatty acids are produced more quickly so pH will drop more quickly in curve <b>Y</b> /with bile salts/less fatty acids in curve <b>Z</b> /without bile salts so pH drop more slowly; | 3 max |                                                                   |

**Section B—continued**

| <b>Question</b>                  | <b>Marking Guidance</b>                                                                                                                                                                                                                                                                                                       | <b>Mark</b> | <b>Comments</b> |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|
| <b>13</b>                        | Diet including saturated fats leads to higher plasma cholesterol concentrations;<br>Higher in all age groups;<br>But sample size is very small;<br>Standard deviations overlap / suggest wide variation;                                                                                                                      | 3 max       |                 |
| <b>14</b>                        | The sex of individual is a risk factor for high cholesterol;<br>To remove a / one variable / to establish a fair test;                                                                                                                                                                                                        | 2           |                 |
| <b>15</b>                        | Monkeys and humans closely related therefore similar conclusions might be drawn;<br>High concentrations of plasma cholesterol lead to an increased risk of cardiovascular disease in humans;<br>Don't know if diet has the same effect in monkeys (as in humans) / could have different effects because not the same species; | 3           |                 |
| <b>Total marks for Section B</b> |                                                                                                                                                                                                                                                                                                                               | <b>20</b>   |                 |