

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**GATEWAY SCIENCE**

**B741/01**

**CHEMISTRY B**

Unit B741: Chemistry modules C1, C2, C3 (Foundation Tier)

**MARK SCHEME**

**Duration:** 1 hour 15 minutes

**MAXIMUM MARK      75**

**Guidance for Examiners**

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/ = alternative and acceptable answers for the same marking point

(1) = separates marking points

**not/reject** = answers which are not worthy of credit

**ignore** = statements which are irrelevant - applies to neutral answers

**allow/accept** = answers that can be accepted

(words) = words which are not essential to gain credit

words = underlined words must be present in answer to score a mark

ecf = error carried forward

AW/owtte = alternative wording

ora = or reverse argument

eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)

work done = 0 marks

work done lifting = 1 mark

change in potential energy = 0 marks

gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

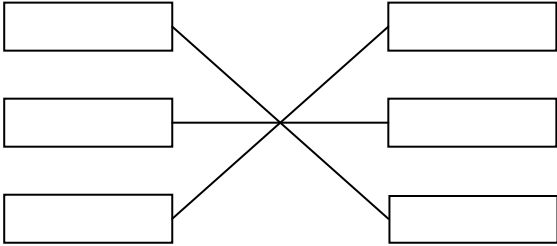
| Question   | Answer                                                                               | Marks    | Guidance                                                                                                                                                      |
|------------|--------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1 a</b> | <b>D</b> (1)<br>contains oxygen or O / does not contain hydrogen and carbon only (1) | 2        |                                                                                                                                                               |
| <b>b</b>   | ethene (1)                                                                           | 1        |                                                                                                                                                               |
| <b>c</b>   | <b>any two from</b><br>landfill (1)<br>burning (1)<br>recycling (1)                  | 2        | <b>allow tip</b><br><b>allow</b> incineration / combustion<br><br><b>allow</b> method and explanation for 2 marks i.e. burning polymers makes toxic fumes (2) |
|            | <b>Total</b>                                                                         | <b>5</b> |                                                                                                                                                               |

| Question   | Answer                                                                                                                        | Marks    | Guidance                                 |
|------------|-------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------|
| <b>2 a</b> | 270 ( $\mu\text{g}/\text{m}^3$ ) (1)                                                                                          | 1        |                                          |
| <b>b</b>   | highest concentrations at 9am and 5pm (1)<br>lowest concentrations at night (1)<br>idea of peaks correspond to rush hours (1) | 3        |                                          |
| <b>c</b>   | acid rain (1)<br>(photochemical) smog (1)                                                                                     | 2        | <b>allow</b> asthma / breathing problems |
|            | <b>Total</b>                                                                                                                  | <b>6</b> |                                          |

| Question | Expected answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Mark     | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3        | <p><b>[Level 3]</b><br/>Answer identifies two or more properties required by the rope and correctly identifies polymer <b>B</b> with correct reasoning. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling.<br/>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>Answer identifies two properties required by the rope and suggests polymer <b>B</b> with an attempt at a reason, For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling.<br/>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>Answer identifies one property required by the rope and / or suggests polymer <b>B</b>. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science.<br/>(1 – 2 marks)</p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science. Answer not worthy of credit.<br/>(0 marks)</p> | 6        | <p><b>Relevant points include:</b></p> <ul style="list-style-type: none"> <li>• ropes need to be strong</li> <li>• ropes need to stretch (a little but not too much)</li> <li>• rope should not absorb water</li> <li>• rope must be flexible</li> <li>• polymer B is the best choice</li> <li>• polymer B is the best choice because it can carry a heavy load / is strong</li> <li>• polymer B is the best choice because it will stretch a little but not too much</li> <li>• polymers A and C will break below 300kg load</li> </ul> <p><b>If polymer D selected as it is the strongest and other criteria matched then level 3 can be awarded</b></p> |
|          | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>6</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Question   | Answer                                                                                                                         | Marks    | Guidance                                                 |
|------------|--------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------|
| <b>4 a</b> | 3.62 (g) (1)<br>dept of health guidelines not exceeded (1)                                                                     | 2        | guidelines mark is ecf on total salt content             |
| <b>b</b>   | antioxidant – <b>stop food reacting with oxygen</b> (1)<br><br><b>emulsifier</b> (1)– helps oil and water mix and not separate | 2        | <b>ignore</b> stops food going off or extends shelf life |
| <b>c</b>   | limewater (1)<br>turns cloudy or milky or white precipitate (1)                                                                | 2        |                                                          |
|            | <b>Total</b>                                                                                                                   | <b>6</b> |                                                          |

| Question | Answer                                                                                                                    | Marks    | Guidance |
|----------|---------------------------------------------------------------------------------------------------------------------------|----------|----------|
| <b>5</b> | <b>any two from</b><br>evaporates easily (1)<br>non-toxic (1)<br>does not irritate the skin (1)<br>insoluble in water (1) | 2        |          |
|          | <b>Total</b>                                                                                                              | <b>2</b> |          |

| Question     | Answer                                                                            | Marks    | Guidance                                            |
|--------------|-----------------------------------------------------------------------------------|----------|-----------------------------------------------------|
| <b>6 a</b>   | hydrogen (1)                                                                      | 1        | <b>allow</b> H / H <sub>2</sub>                     |
| <b>b</b>     | moist litmus paper (1)<br>bleached / loses colour (1)                             | 2        | <b>allow</b> moist universal indicator paper        |
| <b>c</b>     |  | 2        | all correct scores 2<br>one or two correct scores 1 |
| <b>Total</b> |                                                                                   | <b>5</b> |                                                     |

| Question     | Answer                                                                                                                      | Marks    | Guidance                                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------|
| <b>7 a</b>   | diamond (1)                                                                                                                 | 1        | <b>allow</b> C                                   |
| <b>b</b>     | limestone (1)<br>lowest (relative) hardness (1)                                                                             | 2        |                                                  |
| <b>c</b>     | marble or granite (1)<br><b>then any one from:</b><br>reasonably hard so wear resistant (1)<br>diamond is too expensive (1) | 2        | <b>allow</b> limestone as it is the cheapest (2) |
| <b>d</b>     | calcium oxide (1)<br>carbon dioxide (1)                                                                                     | 2        | <b>allow</b> quicklime (1)<br>order unimportant  |
| <b>Total</b> |                                                                                                                             | <b>7</b> |                                                  |

| Question   | Answer                                                                                                      | Marks    | Guidance                              |
|------------|-------------------------------------------------------------------------------------------------------------|----------|---------------------------------------|
| <b>8 a</b> | burette (1)                                                                                                 | 1        |                                       |
| <b>b</b>   | ammonium nitrate (1)                                                                                        | 1        | <b>allow</b> $\text{NH}_4\text{NO}_3$ |
| <b>c</b>   | sulfuric acid (1)                                                                                           | 1        | <b>allow</b> $\text{H}_2\text{SO}_4$  |
| <b>d</b>   | 4 (1)<br>nitrogen (1)                                                                                       | 2        |                                       |
| <b>e</b>   | idea of increase crop yield / faster growth of crops (1)<br>idea of kills aquatic life / eutrophication (1) | 2        | <b>ignore</b> 'to get better plants'  |
|            | <b>Total</b>                                                                                                | <b>7</b> |                                       |

| Question | Expected answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Mark | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9        | <p><b>[Level 3]</b><br/>A range of correct properties is suggested. A sensible choice is made with good reasoning. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling.<br/>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>Two or more correct properties are suggested and a sensible choice is given with reasons. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling.<br/>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>At least one property is suggested and / or a sensible choice is made. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science.<br/>(1 – 2 marks)</p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science. Answer not worthy of credit.<br/>(0 marks)</p> | 6    | <p><b>Relevant points include:</b></p> <ul style="list-style-type: none"> <li>• idea that car bodies need to be strong</li> <li>• idea that car bodies need to be as low density as possible</li> <li>• idea that car bodies should not corrode much</li> <li>• idea that materials for car bodies need to be malleable</li> <li>• idea that materials for car bodies need to be as cheap as possible</li> </ul><br><ul style="list-style-type: none"> <li>• use steel as it is cheap, malleable and strong</li> <li>• use aluminium because it is low density, quite strong and does not corrode</li> </ul> |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



| Question | Answer                                                                                                              | Marks    | Guidance                                                                                                                    |
|----------|---------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------|
| 10 a     | 70 (cm <sup>3</sup> ) (1)                                                                                           | 1        | unit <b>not</b> needed                                                                                                      |
| b        | 60-90 seconds                                                                                                       | 1        | <b>allow</b> other ways of indicating the answer e.g. circling, ticking or underlining but the answer line takes precedence |
| c i      | 135-142 (seconds)                                                                                                   | 1        | unit <b>not</b> needed                                                                                                      |
| ii       | a shorter time (1)                                                                                                  | 1        | <b>allow</b> any numerical value less than quoted in (c)(i)                                                                 |
| d        | 90 cm <sup>3</sup> given off in first experiment (1)<br>with half reactant 45 cm <sup>3</sup> will be given off (1) | 2        |                                                                                                                             |
|          | <b>Total</b>                                                                                                        | <b>6</b> |                                                                                                                             |

| Question | Answer                                                                                                                                                                                                                                         | Marks    | Guidance                                                         |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------|
| 11 a     | 98 (1)                                                                                                                                                                                                                                         | 1        |                                                                  |
| b i      | $\text{atom economy} = \frac{160}{160+18} / \frac{160}{80+98} / \frac{160}{178} \text{ (1)}$ <p><b>but</b></p> $\text{atom economy} = \frac{160}{160+18} \times 100 / \frac{160}{80+98} \times 100 /$ $\frac{160}{178} \times 100 \text{ (2)}$ | 2        | <b>allow</b> atom economy formula in words for one mark          |
| ii       | $\text{percentage yield} = \frac{17.2}{20} \text{ (1)}$ <p><b>but</b></p> $\text{atom economy} = \frac{17.2}{20} \times 100 \text{ (2)}$                                                                                                       | 2        | <b>allow</b> percentage yield formula in words for one mark      |
| c        | Process 1 – has the highest atom economy (1)                                                                                                                                                                                                   | 1        | both process 1 and reference to atom economy needed for the mark |
|          | <b>Total</b>                                                                                                                                                                                                                                   | <b>6</b> |                                                                  |

| Question | Answer                                                                                                                                                                                                                                                                                                                        | Marks    | Guidance                                                            |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------|
| 12 a     | buckminster fullerene (1)                                                                                                                                                                                                                                                                                                     | 1        | <b>allow</b> 'bucky ball'                                           |
| b i      | graphite (1)                                                                                                                                                                                                                                                                                                                  | 1        |                                                                     |
|          | <p><b>any two from:</b></p> <p>hard (1)<br/>           does not conduct electricity (1)<br/>           (good) conductor of heat (1)<br/>           high melting point (1)<br/>           insoluble of water (1)<br/>           shiny / lustrous (1)</p> <p><b>and</b></p> <p>used in cutting tools because it is hard (1)</p> | 3        |                                                                     |
|          | <b>Total</b>                                                                                                                                                                                                                                                                                                                  | <b>5</b> | <b>allow</b> has a high melting point / is a good conductor of heat |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 a     | <p><b>[Level 3]</b><br/>Complete description of the calorimetry experiment in words or a labelled diagram. Experimental results analysed to demonstrate that the prediction is not supported by the evidence. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling.<br/>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>Description of calorimetry experiment in words or a labelled diagram and partial analysis of the table of results using temperature increases. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling.<br/>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>Description of calorimetry experiment in words or as a labelled diagram or use of temperature changes to start to analyse the table of results. Answer may be simplistic. Errors of grammar, punctuation and spelling prevent communication of the science<br/>(1 – 2 marks)</p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. (0 marks)</p> | 6     | <p><b>Relevant points include:</b></p> <p><b>Experiment</b></p> <ul style="list-style-type: none"> <li>• use of a spirit burner</li> <li>• beaker of water / copper can with water above the spirit burner</li> <li>• thermometer in the water</li> <li>• laboratory mat</li> </ul> <p><b>Prediction</b></p> <ul style="list-style-type: none"> <li>• use of temperature increases / temperature increases calculated</li> <li>• prediction not supported</li> <li>• use of data for 1 minute and 2 minute or use of data for 2 minutes and 4 minutes</li> </ul> |

| Question | Answer                                                                                                                                                                         | Marks    | Guidance |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| <b>b</b> | <b>any two from</b><br>so work can be evaluated / work can be checked (1)<br>work can be repeated (1)<br>work can be extended / suggestions about further work can be made (1) | 2        |          |
|          | <b>Total</b>                                                                                                                                                                   | <b>8</b> |          |