

**GCSE**

**Chemistry A**

Unit **A171/02**: Modules C1, C2, C3 (Higher Tier)

General Certificate of Secondary Education

**Mark Scheme for June 2014**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.










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### Annotations

Used in the detailed Mark Scheme:

| Annotation          | Meaning   |
|---------------------|---|
| /                   | alternative and acceptable answers for the same marking point |
| (1)                 | separates marking points                                      |
| <b>not/reject</b>   | answers which are not worthy of credit                        |
| <b>ignore</b>       | statements which are irrelevant - applies to neutral answers  |
| <b>allow/accept</b> | answers that can be accepted                                  |
| (words)             | words which are not essential to gain credit                  |
| <u>words</u>        | underlined words must be present in answer to score a mark    |
| ecf                 | error carried forward   |
| AW/owtte            | credit alternative wording / or words to that effect          |
| ORA                 | or reverse argument   |

Available in scoris to annotate scripts:

|   |   |
|---|---|
|    | Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response. |
|    | correct response  |
|    | incorrect response  |
|  | benefit of doubt  |
|  | no benefit of doubt   |
|  | error carried forward   |
|  | indicate level awarded for a question marked by level of response   |
|  | information omitted   |
|  | contradiction   |

|   |   |
|---|---|
|  | reject  |
|  | indicate uncertainty or ambiguity                         |
|  | draw attention to particular part of candidate's response |

**ADDITIONAL OBJECTS:** You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

**Subject-specific Marking Instructions**

- a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- b. 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.

*e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:*

|              |
|--------------|
|              |
|              |
| <del>✗</del> |
| <del>✗</del> |
|              |

*This would be worth  
1 mark.*

|              |
|--------------|
|              |
|              |
| ✓            |
| <del>✗</del> |
|              |

*This would be worth  
0 marks.*

|              |
|--------------|
| <del>✗</del> |
| <del>✗</del> |
| ✓            |
| ✓            |
|              |

*This would be worth  
1 mark.*

c. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

*e.g. if a question requires candidates to identify cities in England:*

|             |                          |
|-------------|--------------------------|
| Edinburgh   | <input type="checkbox"/> |
| Manchester  | <input type="checkbox"/> |
| Paris       | <input type="checkbox"/> |
| Southampton | <input type="checkbox"/> |

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

|               |          |          |          |          |          |          |          |          |          |           |
|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Edinburgh     |          |          | ✓        |          |          | ✓        | ✓        | ✓        | ✓        |           |
| Manchester    | ✓        | x        | ✓        | ✓        | ✓        |          |          |          | ✓        |           |
| Paris         |          |          |          | ✓        | ✓        |          | ✓        | ✓        | ✓        |           |
| Southampton   | ✓        | x        |          | ✓        |          | ✓        | ✓        |          | ✓        |           |
| <b>Score:</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>1</b> | <b>1</b> | <b>1</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>NR</b> |

- d. For answers marked by levels of response:
- i. **Read through the whole answer from start to finish**
  - ii. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
  - iii. **To determine the mark within the level**, consider the following:

| Descriptor                           | Award mark                   |
|--------------------------------------|------------------------------|
| A good match to the level descriptor | The higher mark in the level |
| Just matches the level descriptor    | The lower mark in the level  |

- iv. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

| Question |   |    | Answer   | Marks    | Guidance  |
|----------|---|----|--|----------|---|
| 1        | a | i  | 1/3  | 1        |   |
|          |   | ii | (Almost always equal to 1/3 or very near because)<br><br>Any two of:<br>Reference to (ai) 2000 - 2010;<br>ref to calculation over a different 10 years;<br>ref to calculation over another different 10 years; | 2        |   |
|          | b |    | identifies number of power stations decreases and amount of sulfur dioxide decreases (2)   | 2        | idea of 'as one( graph) goes down the other (graph) goes down' is 1 mark<br><br><b>ignore</b> positive and negative correlation |
|          | c | i  | Diagram shows 3 hydrogen molecules $\text{O O}$ ; (1)<br>diagram shows 2 hydrogen sulfide molecules $\text{O } \text{O}$ ; (1)   | 2        | <b>accept</b> balancing numbers<br>Molecules should be separate<br>Atoms within each molecule should touch                      |
|          |   | ii | sulfur /product is easier to handle ( than a gas) / may be more useful / can be separated easily / easier to sell; (1)<br>hydrogen sulfide is toxic / foul smelling / causes air pollution / acid rain; (1)    | 2        | <b>Ignore</b> harmful<br><b>Ignore</b> pollution alone<br><b>Allow</b> acidic   |
|          |   |    | <b>Total</b>   | <b>9</b> |   |



| Question |   | Answer  | Marks | Guidance  |
|----------|---|---|-------|---|
| 2        | a | <p><b>[Level 3]</b><br/>Makes a choice and justifies this choice. Statements that discuss the amount of fuel burned <b>and</b> the amount of air pollution for cars and buses. Quality of written communication does not impede communication of the science at this level.</p> <p>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>Makes a choice and justifies this choice. Answer gives comparison between buses and cars in terms of air pollution <b>or</b> fuel burned. Quality of written communication partly impedes communication of the science at this level.</p> <p>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>Simple statement about benefit of using a type of transport<br/>Quality of written communication impedes communication of the science at this level.</p> <p>(1 – 2 marks)</p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science. Answer not worthy of credit.</p> <p>(0 marks)</p> | 6     | <p><b>This question is targeted at grades up to C</b></p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> <li>• choice of Dom or neither or both</li> <li>• fewer cars make less pollution/burn less fuel</li> <li>• if people travel on a bus rather than in cars then less fuel is burned overall/per person</li> <li>• one bus burns less fuel/ makes less pollution than a number of cars</li> <li>• faster journey by bus linked to less fuel burned/ less pollution</li> <li>• cars stuck in traffic burn extra fuel /make more pollution</li> <li>• pollution increases as more fuel burned.</li> </ul> <p><b>Simple statements:</b></p> <ul style="list-style-type: none"> <li>• each bus carries more people than each car</li> <li>• if people travel on buses there will be fewer cars</li> <li>• journey time is longer in a car / shorter in a bus</li> <li>• some buses may not be full</li> </ul> <p><b>Only credit these statements if qualified or linked</b></p> <ul style="list-style-type: none"> <li>• more people travel by bus</li> <li>• bus burns more fuel</li> <li>• bus travels faster</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> |

| Question |   | Answer  | Marks  | Guidance  |
|----------|---|---|--|---|
|          | b | Biofuels do not change the amount of CO <sub>2</sub> in the air overall / carbon neutral;(1) ORA<br><br>they are renewable;(1) ORA  | 2  | <b>ignore</b> sustainable or reusable<br><b>ignore</b> bland statements such as environmentally friendly  |
|          | c | Fuel contains hydrogen and carbon/is a hydrocarbon;<br>(1)<br>complete combustion / burned in plenty of air/oxygen;<br>(1)  | 2  | <b>accept</b> 'it is a carbohydrate/alcohol' / contains hydrogen, carbon and oxygen   |
|          | d | oxidised  | 1  |   |
|          |   | <b>Total</b>  | <b>11</b>  |   |
|          |   |   |  |   |
| 3        | a | i   | ( 6.5 + 8.2 + 6.1 + 10.2 + 9.0 ) / 5 (1)<br>= 8.0 kg (1)   | 2<br>Correct answer without working = 2 marks<br><b>accept</b> 8  |
|          |   | ii  | Means are different/ mean of old bags higher than new ones;(1)<br><br>Idea of small overlap of ranges; (1) | 2<br><b>ignore</b> weaker or stronger<br><br><b>allow</b> average<br><b>allow</b> mass is different<br><b>allow</b> numbers 14.5 and 8 or 6.5 difference<br>ecf from 3ai<br><br>mean of one is outside the range of the other = 2 marks     |
|          | b | Any two from:<br><br>Polymer chains are closer together in HDPE / more regular / aligned;<br><br>LDPE is branched and HDPE is not;<br><br>so there are more /stronger forces between chains;<br><br>Therefore need more energy/harder to pull the chains apart so HDPE is stronger; | 2  | 'it' is HDPE<br><br><b>ignore</b> any other structure eg plasticizers, cross links<br><b>allow</b> other words for chains eg molecules, polymers<br><br><b>ignore</b> 'stronger bonds' but<br><b>accept</b> 'stronger bonds between chains' |
|          |   | <b>Total</b>  | <b>6</b>   |   |

| Question |   | Answer  | Marks    | Guidance   |
|----------|---|---|----------|--|
| 4        | a | 3 + 40 + 88 or 131(1)<br><br>81.875%/81.88%/81.9%/82% (1)   | 2        | <b>Allow</b> 29 are <b>not</b> fuels<br><br><b>allow</b> (80% of 160 =) 128 (1)<br>2 marks for correct answer without working  |
|          | b | <p><b>[Level 3]</b><br/>States trend between the size of molecules and boiling point. Explains the trend in terms of intermolecular forces <b>and</b> the energy required to overcome these forces.<br/>Quality of written communication does not impede communication of the science at this level.<br/>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>States trend between size of molecules and boiling point. Links this to intermolecular forces <b>or</b> the energy required to boil.<br/>Quality of written communication partly impedes communication of the science at this level.<br/>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>Describes the trend in boiling points and link this to size of the molecules.<br/>Quality of written communication impedes communication of the science at this level.<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>This question is targeted at grades up to A/A*</b></p> <p><b>Indicative scientific points may include:</b></p> <ul style="list-style-type: none"> <li>the boiling points increase as you go down</li> <li>the boiling points increase with increasing size of molecules</li> <li>larger molecules have more/stronger intermolecular forces between them</li> <li>the more / stronger the intermolecular forces the more energy is required to boil</li> <li>the more energy needed the higher the boiling point</li> <li>separating molecules / chains / hydrocarbons</li> </ul> <p><b>Allow</b> alternative wording for the size of molecules eg greater number of carbon atoms in molecule / longer chain / larger mass / larger <math>M_r</math></p> <p>Wrong terminology eg confusion between atoms, elements or molecules: reference to breaking up of molecules/chains impedes communication at level 2 and 3.</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> |
|          |   | <b>Total</b>  | <b>8</b> |  |

| Question     |  | Answer   | Marks   | Guidance |              |   |  |  |  |  |  |  |   |  |
|--------------|--|--|---|----------|--------------|---|--|--|--|--|--|--|---|--|
| 5            | a  | <table border="1"> <tr><td></td><td></td></tr> <tr><td>1.0 to 100.0</td><td>✓</td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table> |   |          | 1.0 to 100.0 | ✓ |  |  |  |  |  |  | 1 |  |
|              |  |  |   |          |              |   |  |  |  |  |  |  |   |  |
|              | 1.0 to 100.0   | ✓  |   |          |              |   |  |  |  |  |  |  |   |  |
|              |  |  |   |          |              |   |  |  |  |  |  |  |   |  |
|              |  |  |   |          |              |   |  |  |  |  |  |  |   |  |
|              |  |  |   |          |              |   |  |  |  |  |  |  |   |  |
| b            | Any two from:<br><br>larger surface area;<br><b>more</b> (light) absorbed;<br>minimises the cost / cost effective / cheaper / uses less gold;  | 2  | Larger surface area to volume ratio = 2 marks   |          |              |   |  |  |  |  |  |  |   |  |
| c            | Any two from:<br><br>(may) get into the body/cells/blood/brain;<br><br>(may) have health effects;<br><br>not fully investigated/researched;<br><br>not used long enough / not enough data collected; | 2  | <b>allow</b> any named health effect<br><b>ignore</b> 'harmful' or 'risk' or 'danger' to humans/the body<br>'harmful' or 'risk' or 'danger' must be linked to a named body part |          |              |   |  |  |  |  |  |  |   |  |
| <b>Total</b> |  |  | <b>5</b>  |          |              |   |  |  |  |  |  |  |   |  |

| Question |   |                 | Answer  | Marks | Guidance |   |
|----------|---|-----------------|---|-------|----------|---|
| 6        | a | i               | Dr Abbott   |       | 1        | both ticks needed for mark  |
|          |   |                 | Miss Brown  | ✓     |          |   |
|          |   |                 | Mr Collins  |       |          |   |
|          |   |                 | Professor Derry   | ✓     |          |   |
|          |   |                 | Mrs Evans   |       |          |   |
|          |   | ii              | Dr Abbott   | ✓     | 1        |   |
|          |   | Miss Brown      |   |       |          |   |
|          |   | Mr Collins      |   |       |          |   |
|          |   | Professor Derry |   |       |          |   |
|          |   | Mrs Evans       |   |       |          |   |
|          |   | iii             | Dr Abbott   |       | 1        |   |
|          |   | Miss Brown      |   |       |          |   |
|          |   | Mr Collins      | ✓   |       |          |   |
|          |   | Professor Derry |   |       |          |   |
|          |   | Mrs Evans       |   |       |          |   |
|          |   | iv              | Flavouring / taste  |       | 1        |   |
|          | b | i               | <b>Any two from:</b>  |       | 2        | <p><b>accept</b> alternative wording for impurities eg grit, dirt, mud, rock</p> <p><b>ignore</b> subsidence</p> <p><b>ignore</b> cleaner</p> |
|          |   |                 | <p>KCl mined in solution mining has greater purity / contains less impurities;</p> <p>Solution mining uses less labour / more economic / less hazardous for workforce / makes less waste / uses less energy / less of an eyesore;</p> <p>this is more suitable for turning into other chemicals / electrolysis;</p> |       |          |   |
|          |   | ii              | chlorine and hydrogen;(1)<br>potassium hydroxide;(1)  |       | 2        | <p><b>allow</b> correct symbols/formulae</p> <p><b>do not allow</b> chloride</p>  |
|          |   |                 | <b>Total</b>  |       | <b>8</b> |   |

|   |   |   |  |
|---|---|---|--|
| 7 | <p><b>[Level 3]</b><br/>Describes both graphs in detail and links them together. Explains the cause for the reduction in disease or evaluates the effectiveness of adding chlorine.<br/>Quality of written communication does not impede communication of the science at this level.<br/>(5 – 6 marks)</p> <p><b>[Level 2]</b><br/>Links both graphs together and either gives extra detail of one graph or explains the cause for reduction.<br/>Quality of written communication partly impedes communication of the science at this level.<br/>(3 – 4 marks)</p> <p><b>[Level 1]</b><br/>Describes one graph or explains the cause for the reduction in disease. Quality of written communication impedes communication of the science at this level.<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>This question is targeted at grades up to A/A*</b><br/><b>Indicative scientific points may include:</b></p> <p><b>Statements about graph 1</b></p> <ul style="list-style-type: none"> <li>• number of people with chlorine added to water has increased</li> <li>• large increase in 2012</li> <li>• quotes correct numbers from graph eg about 15 000 to over 400 000</li> </ul> <p><b>Statements about graph 2</b></p> <ul style="list-style-type: none"> <li>• graph shows a reduction in diseases</li> <li>• decrease is continual</li> <li>• slow decrease at start and faster decrease later</li> <li>• quotes correct numbers from graph eg 100 000 people with disease to less than 40 000</li> </ul> <p><b>Linking graphs together</b></p> <ul style="list-style-type: none"> <li>• graph shows a reduction in diseases as chlorine put in drinking water of more people</li> <li>• increase in number of people with chlorine added to drinking water correlates with decline in disease</li> </ul> <p><b>Causes for reduction</b></p> <ul style="list-style-type: none"> <li>• chlorine is used to kill microorganisms</li> <li>• addition of chlorine to drinking water make a major contribution to public health</li> </ul> <p><b>Evaluates the effectiveness</b></p> <ul style="list-style-type: none"> <li>• although a large reduction there is still plenty of disease.</li> <li>• Large increase in chlorine added in 2012 but no large decrease in disease.</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> |
|---|---|---|--|

| Question                   |   | Answer   | Marks    | Guidance  |  |  |                            |   |  |  |                           |   |   |  |
|----------------------------|---|--|----------|---|--|--|----------------------------|---|--|--|---------------------------|---|---|--|
| 8                          | a |  | 3        | All 4 lines correct = 3<br>2 or 3 lines correct = 2<br>1 line correct = 1   |  |  |                            |   |  |  |                           |   |   |  |
|                            | b | <table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>When continents....changed</td><td>✓</td></tr> <tr><td></td><td></td></tr> <tr><td>Tectonic plates.....Earth</td><td>✓</td></tr> </table> |          |   |  |  | When continents....changed | ✓ |  |  | Tectonic plates.....Earth | ✓ | 2 |  |
|                            |   |  |          |   |  |  |                            |   |  |  |                           |   |   |  |
|                            |   |  |          |   |  |  |                            |   |  |  |                           |   |   |  |
| When continents....changed | ✓ |  |          |   |  |  |                            |   |  |  |                           |   |   |  |
|                            |   |  |          |   |  |  |                            |   |  |  |                           |   |   |  |
| Tectonic plates.....Earth  | ✓ |  |          |   |  |  |                            |   |  |  |                           |   |   |  |
|                            | c | polarity/alignment / direction of magnetism (in the rock);(1)<br>evidence for theory of moving plates / where/ when rock was formed / about sea floor spreading; (1)   | 2        | <b>ignore</b> references to layers<br>Magnetic poles switching / earth's polarity is not enough for polarity mark |  |  |                            |   |  |  |                           |   |   |  |
|                            |   | <b>Total</b>   | <b>7</b> |   |  |  |                            |   |  |  |                           |   |   |  |

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