



National  
Qualifications  
2015

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# 2015 Chemistry

## National 5

### Finalised Marking Instructions

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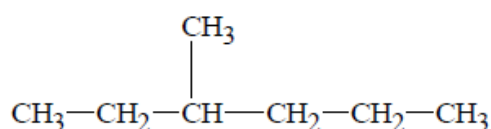
## General Marking Principles for National 5 Chemistry

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the specific Marking Instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

A guiding principle in marking is to give credit for correct chemistry rather than to look for reasons not to award marks.

**Example 1:** The structure of a hydrocarbon found in petrol is shown below.



Name the hydrocarbon.

Although the punctuation is not correct, '3, methyl-hexane' should gain the mark.

**Example 2:** A student measured the pH of four carboxylic acids to find out how their strength is related to the number of chlorine atoms in the molecule. The results are shown in the table

| <i>Structural formula</i> | <i>pH</i> |
|---------------------------|-----------|
| CH <sub>3</sub> COOH      | 1.65      |
| CH <sub>2</sub> ClCOOH    | 1.27      |
| CHCl <sub>2</sub> COOH    | 0.90      |
| CCl <sub>3</sub> COOH     | 0.51      |

State how the strength of the acids is related to the number of chlorine atoms in the molecule.

Although not completely correct, an answer such as 'the more Cl<sub>2</sub>, the stronger the acid' should gain the mark.

- (c) If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader.
- (d) There are no half marks awarded.
- (e) Candidates must respond to the "command" word as appropriate and may be required to write extended answers in order to communicate fully their knowledge and understanding.
- (f) Marks should be awarded for answers that have incorrect spelling or loose language as long as the meaning of the word(s) is conveyed, unless stated otherwise in the marking instructions.

**Example:** Answers like ‘distilling’ (for ‘distillation’) and ‘it gets hotter’ (for ‘the temperature rises’) should be accepted.

However the example below would not be given any credit, as an incorrect chemical term, which the candidate should know, has been given.

**Example:** If the correct answer is “ethene”, and the candidate’s answer is “ethane”, this should **not** be accepted.

- (g) A correct answer followed by a wrong answer should be treated as a cancelling error and no marks should be awarded.

**Example:** State what colour is seen when blue Fehling’s solution is warmed with an aldehyde.

The answer ‘red, green’ gains no marks.

- (h) If a correct answer is followed by additional information which does not conflict, the additional information should be ignored, whether correct or not.

**Example:** State why the tube cannot be made of copper.

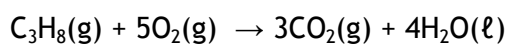
If the correct answer is related to a low melting point, ‘Copper has a low melting point and is coloured grey’ would **not** be treated as having a cancelling error.

- (i) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units if required) on its own.

The partial marks shown in the marking scheme are for use when working is given but the final answer is incorrect. An exception is when candidates are asked to ‘Find, by calculation’, when full marks cannot be awarded for the correct answer without working.

- (j) Where the marking instructions specifically allocate a mark for units in a calculation, this mark should not be awarded if the units are incorrect or missing. Missing or incorrect units at intermediate stages in a calculation should be ignored.
- (k) As a general rule, where a wrong numerical answer (already penalised) is carried forward to another step, credit will be given provided the result is used correctly. The exception to this rule is where the marking instructions for a numerical question assign separate “concept marks” and an “arithmetic mark”. In such situations, the marking instructions will give clear guidance on the assignment of partial marks.
- (l) Ignore the omission of one H atom from a full structural formula provided the bond is shown.
- (m) A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the marking instructions.**
- (n) When formulae of ionic compounds are given as answers it will only be necessary to show ion charges if these have been specifically asked for. However, if ion charges are shown, they must be correct. If incorrect charges are shown, no marks should be awarded.
- (o) If an answer comes directly from the text of the question, no marks should be awarded.  
**Example:** A student found that 0.05 mol of propane, C<sub>3</sub>H<sub>8</sub> burned to give 82.4 kJ of

energy.



Name the type of enthalpy change which the student measured.

No marks should be awarded for 'burning' since the word 'burned' appears in the text.

- (p) Unless the question is clearly about a non-chemistry issue, e.g. costs in industrial chemical process, a non-chemical answer gains no marks.

**Example:** Suggest why the (catalytic) converter has a honeycomb structure.

A response such as 'to make it work' may be correct but it is not a chemical answer and the mark should not be awarded.

## Detailed Marking Instructions for each question

### Section 1

| Question | Answer | Max Mark |
|----------|--------|----------|
| 1.       | A      | 1        |
| 2.       | B      | 1        |
| 3.       | D      | 1        |
| 4.       | C      | 1        |
| 5.       | D      | 1        |
| 6.       | C      | 1        |
| 7.       | C      | 1        |
| 8.       | B      | 1        |
| 9.       | A      | 1        |
| 10.      | B      | 1        |
| 11.      | B      | 1        |
| 12.      | C      | 1        |
| 13.      | A      | 1        |
| 14.      | D      | 1        |
| 15.      | C      | 1        |
| 16.      | D      | 1        |
| 17.      | A      | 1        |
| 18.      | A      | 1        |
| 19.      | D      | 1        |
| 20.      | D      | 1        |

Section 2

| Question | Answer   | Max Mark | Additional Guidance  |
|----------|--|----------|--|
| 1.       | <p>(a)</p> <p>0.8 cm<sup>3</sup> s<sup>-1</sup> or 0.8 cm<sup>3</sup>/s with no working (3)</p> <p>.....</p> <p>For partial marking</p> <p><b>Maximum 2 marks for calculation.</b></p> <p><b>Final mark is awarded for the correct unit.</b></p> <p><math>\frac{120 - 96}{90 - 60}</math> or <math>\frac{96 - 120}{60 - 90}</math> or 24/30 (1)</p> <p>0.8 (1)<br/>(this answer without working 2 marks)</p> <p>The mark for the correct unit, cm<sup>3</sup> s<sup>-1</sup> or cm<sup>3</sup>/s or cubic centimetres per second or cm<sup>3</sup> per second, <b>is independent of the other marks.</b> (1)</p> | 3        | <p>Please note that the unit mark is independent of the other marks.</p> <p>Correct method (i.e. change in volume/change in time) but incorrect arithmetic using correct values from table.<br/>1 mark for calculation</p> <p>Correct method but incorrect values <b>from the table</b> used (subtractions must be shown).<br/>1 mark for calculation</p> <p>If correct method is used but values used are <b>not</b> in the table.<br/>0 marks for calculation</p> <p>If incorrect method used (i.e. change in time/change in volume).<br/>0 marks for calculation</p> <p>Do not accept cm<sup>3</sup>/s<sup>-1</sup> or cm<sup>3</sup>s<sup>-1</sup> or cm3s-1 etc. 's' is the only acceptable abbreviation of second.</p> <p>Refer to General Marking Principle (j) for guidance.</p> |

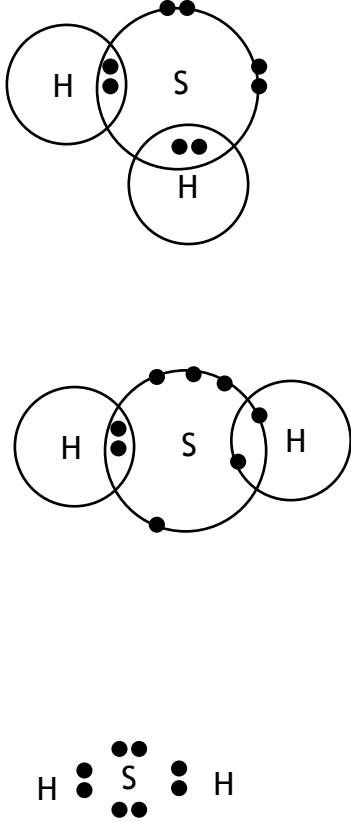
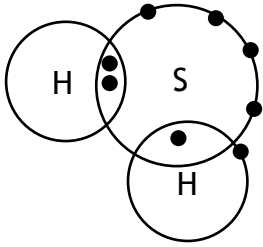
| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
|          | (b) | <p>Both axes labelled with units (1)</p> <p>Both scales (1)</p> <p>Graph drawn accurately (1)<br/>(points must be plotted correctly and line drawn, either by joining the dots or by a smooth curve or curve of best fit)<br/>The line must be drawn from the origin.</p> | 3        | <p>Accept volume of ethyne (<math>\text{cm}^3</math>), volume of <math>\text{C}_2\text{H}_2</math> (<math>\text{cm}^3</math>), volume of gas (<math>\text{cm}^3</math>), volume (<math>\text{cm}^3</math>), as label.</p> <p>Accept 0/0 or a common zero on the axis. The zero does not have to be shown on the scale.</p> <p>Accept time on the x axis and volume on the y axis or vice versa.</p> <p>Allow 1 plotting error. Line not drawn to the origin does not count as a plotting error i.e. if the line is not drawn to the origin a maximum of two marks can be awarded.<br/>Allow <math>\frac{1}{2}</math> box tolerance</p> <p>Bar graph maximum 2 marks</p> <p>Max 2 marks if the graph plotted takes up less than half of the graph paper for either axis.</p> |

| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
| 2.       | (a) | Neptunium or Np<br><br>or<br>$^{237}_{93}\text{Np}$ $^{237}_{93}\text{Np}$ $_{93}\text{Np}$ | 1        | If mass or atomic number are given incorrectly<br>e.g. $^{236}\text{Np}$ $^{93}\text{Np}$ 0 marks<br><br>Do not penalise if the atomic number/mass number is written on the right hand side of the symbol.<br><br>NP or np or nP are awarded zero marks and negates (cancels) the correct name. |
|          | (b) | Alpha or $\alpha$ or $\frac{4}{2}\alpha$  | 1        | $^4_2\text{He}$ or $^4_2\text{He}^{2+}$<br>on their own they are <b>not</b> acceptable but if given with a correct answer they do not negate the correct answer.<br><br>Any mention of beta or gamma negates the correct answer<br>eg Alpha $\beta$ award 0 marks                               |

| Question |         | Answer  | Max Mark | Additional Guidance  |
|----------|---------|---|----------|--|
|          | (c) (i) | <p>1 with no working (2)</p> <p>.....</p> <p>Partial marking</p> <p>Three half-lives stated or correct working shown (1)</p> <p>Final answer = 1 (1)<br/>(this step on its own 2 marks)</p>   | 2        | <p>If number of half-lives is incorrect allow follow through to second step - maximum 1 mark can be awarded.</p> <p>Unit is not required however if the wrong unit is given a maximum of 1 mark out of 2 can be awarded.</p> <p>A correct answer clearly derived from incorrect working is awarded zero marks.</p>   |
|          | (ii)    | <p>(It/Americium 241/Am-241) has a long/longer half life</p> <p><b>or</b></p> <p>will not need to be replaced as often or words to this effect</p> <p><b>or</b></p> <p>(It/Americium 241/Am-241) emits alpha radiation (particles) which has a low penetrating power/doesn't travel far/stopped by the smoke particles.</p> | 1        | <p>If candidate states -shorter/short/lower half-life/needs replaced more often/does not last as long/<b>only</b> has a half-life of 16 hours it <b>must</b> be stated that they are referring to <b>americium -242</b></p> <p>Zero marks awarded for It/Am-241 has a half-life of 432 years <b>or</b> Am-242 has a half-life of 16 hours.</p> <p>Socio-economical answers <b>or</b> answers relating to safety are not accepted but do not negate the correct answer. Refer to General Marking Principle (<b>p</b>) for guidance.</p> |

| Question |     |      | Answer                          | Max Mark | Additional Guidance   |
|----------|-----|------|---------------------------------|----------|---|
| 3.       | (a) | (i)  | Hydroxyl or OH or -OH           | 1        | <p>Zero marks awarded for hydroxide/OH<sup>-</sup></p> <p>Refer to General Marking Principle (m) for guidance.</p> <p>Zero marks awarded if hydroxide is given along with hydroxyl.</p> <p>Refer to General Marking Principle (g) for guidance.</p> |
|          |     | (ii) | Ester or esters or fats or oils | 1        |   |

| Question |     | Answer | Max Mark | Additional Guidance  |
|----------|-----|--------|----------|--|
|          | (b) | (i)    | 1        | <p>Spelling must be correct and the word acid must be included.</p> <p>If candidate draws a structure that is incorrect then this does not negate.</p> <p>Refer to General Marking Principles (b) and (f) for guidance.</p>  |
|          |     | (ii)   | 1        | <p>Accept bromine/bromine water/bromine solution but do <b>not</b> accept bromide or Br.</p> <p>Zero marks awarded for 'goes clear' however if given in addition to a correct answer it does not negate.</p> <p>Award zero marks if candidate explicitly states compound Y is decolourised or the unsaturated compound is decolourised.</p> <p>If starting colour is given it must be correct e.g. orange/yellow/red-brown or brown.</p> <p>If candidate states correct answer followed by incorrect statement such as because it has a carbon to carbon single bond zero marks are awarded.</p> <p>Refer to General Marking Principle (g) for guidance.</p> |

| Question | Answer   | Max Mark | Additional Guidance  |
|----------|--|----------|--|
| 4 (a)    | <p>Diagram showing two hydrogen atoms and one sulfur atom with two pairs of bonding electrons and two non-bonding pair of electrons in sulfur e.g.</p>   | 1        | <p>All symbols must be shown.</p> <p>Accept cross or dot or e to represent electrons or a mixture of these.</p> <p>Accept petal diagram for sulfur but <b>not</b> for hydrogen.</p> <p>The non-bonding electrons in sulfur must be shown but do <b>not</b> need to be shown as a pair or be together or be on the line.</p> <p>Bonding electrons <b>MUST</b> be on the line or in the overlapping area. The example below is awarded 0 marks.</p>  <p>If inner electrons on sulfur are shown they must be correct ie 2,8</p> |
|          | <p>(b)</p> <p>1<sup>st</sup> = hydrogen</p> <p>2<sup>nd</sup> = hydroxide</p> <p><b>Both required for 1 mark</b></p>   | 1        | <p>Accept corrects words underlined/highlighted rather than circled.</p>   |
|          | <p>(c)</p> <p>It/calcium oxide is a base</p> <p><b>or</b></p> <p>forms an alkaline solution (alkali) when dissolved in water. For the mention of alkali the candidate must explicitly state the calcium oxide is in solution/dissolved in water (1)</p> <p>Mention of it neutralising sulfur dioxide/it neutralises it/or a neutralisation reaction takes place. (1)</p> | 2        | <p>Calcium is a base or alkali is <b>not</b> acceptable for the first mark.</p> <p>The two marks are <b>independent</b> of each other. e.g. a candidate who <b>only</b> states 'it neutralises it' would be awarded 1 mark out of a possible two.</p> <p>A candidate who states that calcium oxide is a base and reacts with sulfur dioxide would be awarded 1 mark out of a possible two.</p>   |

| Question |     | Answer   | Max Mark | Additional Guidance   |
|----------|-----|--|----------|---|
| 5.       | (a) | Iron or Fe   | 1        | Refer to General Marking Principle (m) for guidance.  |
|          | (b) | Any value from 52 - 56 inclusive   | 1        |   |
|          | (c) | As temperature increases the yield decreases.<br><br>or<br><br>As temperature decreases the yield increases.<br><br>or<br><br>The yield increases as the temperature decreases.<br><br>or<br><br>The yield decreases as the temperature increases.<br><br>Accept percentage in place of yield. | 1        | <b>Cause and effect</b> must be stated correctly.<br><br>Zero marks awarded for<br><br>The temperature increases as the yield decreases.<br><br>or<br><br>As the yield increases the temperature decreases.<br><br>Accept alternatives to increases e.g. goes up/gets higher<br>decreases e.g. goes down/gets lower/gets less |
|          | (d) | temperature 200 °C or a value below 200 °C<br><br>and<br><br>pressure 500 atmospheres or a value greater than 500 atmospheres<br><br><b>Both required for 1 mark</b>   | 1        | Do <b>not</b> accept correct values without either unit or label. eg temperature 200 and 500 atmospheres is awarded 1 mark; 200 °C and pressure of 500 is awarded 1 mark.<br><br>The candidate must link each value given to the correct condition.<br><br>eg 500 and 200 - 0 marks; 500 atmospheres and 200 - 0 marks        |

| Question |     | Answer   | Max Mark | Additional Guidance  |
|----------|-----|--|----------|--|
| 6        | (a) | 3  | 1        | Unit is not required however if the wrong unit is given do <b>not</b> award the mark.<br><br>0 marks are awarded for 3.03<br><br>Accept abbreviations for unit that convey the meaning.  |
|          | (b) | $(\text{Fe}^{3+})_2(\text{O}^{2-})_3$<br><b>or</b><br>$\text{Fe}^{3+}_2 \text{O}^{2-}_3$<br><b>or</b><br>$(\text{Fe}^{3+})_2 \text{O}^{2-}_3$<br><b>or</b><br>$\text{Fe}^{3+}_2(\text{O}^{2-})_3$<br><b>or</b><br>$\text{Fe}_2^{3+} \text{O}_3^{2-}$ | 1        | Refer to General Marking Principle (n) for guidance.<br><br>Both charges <b>must</b> be shown and correct<br><br>Award zero marks for<br><br>$\text{Fe}_2\text{O}_3$<br><br>$\text{Fe}^{3+}_2\text{O}_3$<br><br>$\text{Fe}_2\text{O}^{2-}_3$<br><br>$2\text{Fe}^{3+}(\text{O}^{2-})_3$ |
|          | (c) | Exothermic or exothermal   | 1        | Any mention of endothermic negates the correct answer. Refer General Marking Principle (f) for guidance.   |

| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
| 7.       | (a) | Boil it<br>or boil off the water<br>or heat it<br>or leave it for some time/overnight/next lesson<br>or leave it on the window ledge<br>or use Bunsen (burner)<br>or appropriate diagram  | 1        | Any mention of filtering negates the correct answer. Refer to General Marking Principle (g) for guidance.<br><br>Award zero marks for leave it with no indication of appropriate time or do nothing.<br><br>Award zero marks awarded for mention of burn or burning. This negates the correct answer.   |
|          | (b) | 0.2 with no working (2)<br>-----<br>Partial marking<br><br>$3.19/159.5 = 0.02$ (1)<br><br>$0.02/0.1 = 0.2$ (1)<br>(this step on its own 2 marks)<br><br>or<br><br>(3.19 in 100 cm <sup>3</sup> )<br>31.9 in 1000 cm <sup>3</sup> or 1 litre (1)<br><br>$31.9/159.5 = 0.2$ (1)<br>(this step on its own 2 marks) | 2        | Allow follow through from step 1<br><br>Award 1 mark for<br>0.1 --> 3.19<br>1 --> 31.9<br><br>Zero marks are awarded for only showing $c=n/v$ where the answer is not 0.2<br><br>Unit is not required however if the wrong unit is given a maximum of 1 mark out of 2 can be awarded.<br><br>Accept mol l <sup>-1</sup> or mol/l ('L' in place of 'l')<br><br>Do not accept mol/l <sup>-1</sup> or mol <sup>-1</sup> or mol l |

| Question |     | Answer   | Max Mark | Additional Guidance  |
|----------|-----|--|----------|--|
| 8.       | (a) | <p><u>Method B (it)</u><br/>           Complete combustion/more oxygen/pure oxygen<br/>           Less/no heat loss (to surroundings)<br/>           Better insulation<br/>           Metal/platinum is a better conductor</p> <p>or</p> <p><u>Method A</u><br/>           Incomplete combustion<br/>           Less oxygen<br/>           (More) heat loss to surroundings<br/>           No draught shield/no insulation<br/>           Glass is a poor conductor<br/>           Flame too far away from beaker</p> <p>or</p> <p>Any other reasonable answer</p> | 1        | <p>If answer relates to method A it must be clear that it is method A they are referring to.</p> <p>If the method is not identified in the candidates answer as method A or method B then assume that the answer refers to method B.</p> <p>Award zero marks for the beaker is made from glass without the effect<br/>           or<br/>           the walls are thick without the effect<br/>           or<br/>           the water evaporates.</p> |

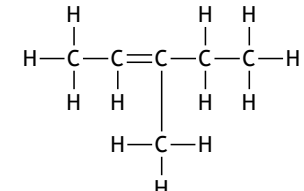
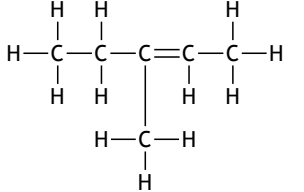
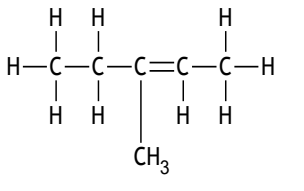
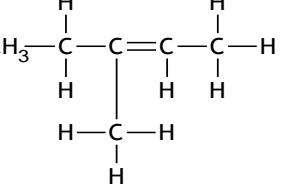
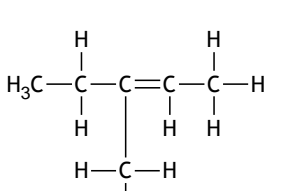
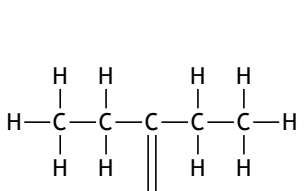
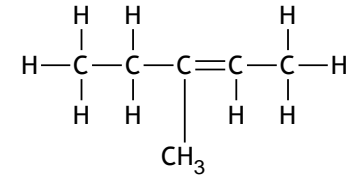
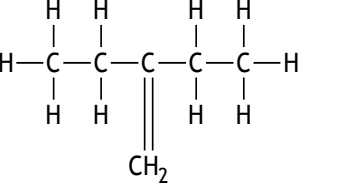
| Question | Answer   | Max Mark | Additional Guidance   |
|----------|--|----------|---|
| (b)      | <p>14 / 14·2 / 14·21 / 14·212 with no working (3)</p> <p>.....</p> <p>Partial marking</p> <p>using concept <math>cm\Delta T</math> with <math>c = 4\cdot18</math></p> <p>To be awarded the concept mark candidates do not specifically need to write <math>cm\Delta T</math>. The concept mark is awarded for using this relationship with values - three values, one of which must be 4·18 (1)</p> <p>using data correctly i.e. both 0·1 and 34 °C (1)</p> <p>final answer 14/14·2/14·21/14·212 (1)</p> <p>If awarding partial marks, the mark for the final answer can only be awarded if the concept mark has been awarded.</p> | 3        | <p><math>4\cdot18 \times 0\cdot5 \times 34 = 71\cdot06</math> would be awarded 2 marks (concept mark and follow through)</p> <p><math>4\cdot18 \times 0\cdot5 \times 58 = 121\cdot22</math> would be awarded 2 marks (concept mark and follow through)</p> <p>If <b>Method A</b> data is used i.e. <math>0\cdot1 \times 8</math>, a maximum of 2 marks can be awarded (1 for concept mark and 1 for final answer 3·344).</p> <p>If <b>Method A</b> data is used and <b>no working shown</b> award <b>zero marks</b> (for answer 3·344 with no working).</p> <p>Ignore negative sign if present.</p> <p>Unit is not required however if the wrong unit is given do <b>not</b> award mark for final answer e.g. <math>\text{kJ}^{-1}</math> or kg is incorrect</p> <p>Accept kj, kJ, KJ or KJ.</p> <p><math>4\cdot18 \times 100 \times 34 = 14212(\text{KJ})</math> is worth 2 marks as it contains wrong data.</p> <p>The answer in joules is accepted but the units must be given. e.g. 14212 J is acceptable and would be awarded 3 marks.</p> <p>14212 on its own is <b>not</b> acceptable without working.</p> |

| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
| 9.       | (a) | (Metal) ore/ores  | 1        | Zero marks awarded for mineral/alloy<br>These also negate the correct answer.<br>Refer to General Marking Principle (f) for guidance.   |
|          | (b) | (i) $4\text{Al}^{3+} + 6\text{O}^{2-} \rightarrow 4\text{Al} + 3\text{O}_2$<br><br>(or correct multiples)<br><br>All must be correct for 1 mark | 1        | Zero marks awarded for any electrons shown in equation.<br><br>Ignore state symbols if given.   |
|          |     | (ii) Ions free to move<br><br>or<br><br>ions able to move<br><br>or<br><br>ions mobile  | 1        | Any mention of electrons negates the correct answer.<br>Refer to General Marking Principle (g) for guidance.<br><br>The word 'ion' must be mentioned.<br><br>Zero marks awarded for they can move<br>or (charged) particles<br>or molecules<br>or electrons can move. |
|          | (c) | Mg<br><br>or<br><br>magnesium<br><br>or<br><br>2Mg<br><br>or<br><br>Mg circled/highlighted/underlined in equation.                              | 1        | Any other substance indicated, in addition to Mg, negates the correct answer.<br>Refer General Marking Principle (g) for guidance.  |

| Question | Answer   | Max Mark | Additional Guidance |
|----------|--|----------|---------------------|
| 10.      | <p>This is an open ended question</p> <p><b>1 mark:</b> The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.</p> <p><b>2 marks:</b> The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) which is/are relevant to the situation, showing that the problem is understood.</p> <p><b>3 marks:</b> The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved. The student shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an “excellent” answer or a “complete” one.</p> | 3        |                     |

| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
| 11.      | (a) | 2,8,6<br><br>or<br><br>a correct target diagram   | 1        | Punctuation between numbers is not required.<br><br>Zero marks awarded for values in the wrong order eg 6.8.2   |
|          | (b) | $\text{Mg(g)} \rightarrow \text{Mg}^+(\text{g}) + \text{e}^-$<br><br>$\text{Mg} \rightarrow \text{Mg}^+ + \text{e}$<br><br>$\text{Mg(g)} \rightarrow \text{Mg}^+ + \text{e}^-$<br><br>$\text{Mg} \rightarrow \text{Mg}^+(\text{g}) + \text{e}$<br><br>or<br><br>$\text{Mg(g)} - \text{e}^- \rightarrow \text{Mg}^+(\text{g})$<br><br>etc. | 1        | State symbols are not required, however if shown they must be correct ie (g)<br><br>Negative charge on electron is not needed.  |
|          | (c) | Decreases<br><br>or<br><br>As you go from lithium to potassium (alkali metals) it (ionisation energy) decreases.<br><br>or<br><br>As you go from fluorine to bromine (halogens) it (ionisation energy) decreases.<br><br>or<br><br>as the atomic number in the group increases it decreases   | 1        | Accept alternatives to decreases e.g. goes down, gets less, gets lower<br><br>If answer states trend is for going across a period<br>or<br>specific elements not in a group award zero marks.<br><br>Zero marks awarded for as you go from potassium to lithium it decreases.<br><br>Zero marks awarded for relating ionisation energy to reactivity.<br><br>If candidate answers the question in terms of going up a group this is acceptable as long as they state both the direction (going up a group) and the trend (increases). |

| Question |     | Answer  | Max Mark | Additional Guidance   |
|----------|-----|---|----------|---|
| 12.      | (a) | But-2-ene<br><br>or<br><br>2-butene   | 1        | Refer to General Marking Principle (b) for guidance.<br><br>Zero marks awarded for butene<br><br>or<br>but-2-ane<br><br>or<br>butan-2-ene   |
|          | (b) | (Molecules/compounds /hydrocarbons/alkenes) with same molecular/chemical formula but a different structural formula | 1        | The same number of carbons and hydrogens but different structure or atoms are arranged differently is acceptable.<br><br>Different <b>shape</b> is <b>not</b> acceptable.<br><br>Zero marks awarded for 'general formula' instead of 'molecular formula'.<br><br>Zero marks awarded for <b>elements</b> with..... |

| Question | Answer  | Max Mark | Additional Guidance  |
|----------|---|----------|--|
| (c)      | <p>Correct structural formula for</p> <p>3-methylpent-2-ene</p> <p>or</p> <p>2 ethyl but-1-ene</p> <p>eg</p>       <p>or mirror images</p> <p>or correct shortened structural formula e.g.</p> <p><chem>CH3CHC(CH3)CH2CH3</chem></p> | 1        | <p>Accept shortened structural formula or full structural formula or combination of both</p> <p>Allow one H bonded to a carbon to be missing as long as bond from carbon is shown. Allow one bond between a carbon and a hydrogen to be missing as long as hydrogen is shown. Refer to General Marking Principle (I) for guidance.</p> <p>As the vertical bond is not to the carbon, award zero marks for</p>   |

| Question |     | Answer   | Max Mark | Additional Guidance  |   |
|----------|-----|----------|----------|--|---|
| 13.      | (a) | Carboxyl | 1        | Zero marks awarded for carboxylic (acid).<br><br>Zero marks awarded for -COOH circled or drawn but this does not negate the correct answer 'carboxyl'. Refer to General Marking Principle (h) for guidance.  |   |
|          | (b) | (i)      | 1        | Any mention of 'addition' or any other reaction type negates the correct answer. Refer to General Marking Principle (g) for guidance.  |   |
|          |     | (ii)     | 1        | <p> <math display="block">\begin{array}{ccccccc} &amp; \text{H} &amp; \text{H} &amp; &amp; \text{O} &amp; \text{H} &amp; \text{H} &amp; \text{O} \\ &amp;   &amp;   &amp; &amp;    &amp;   &amp;   &amp;    \\ -\text{O} &amp; -\text{C} &amp; -\text{C} &amp; -\text{O} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; - \\ &amp;   &amp;   &amp; &amp; &amp;   &amp;   &amp; \\ &amp; \text{H} &amp; \text{H} &amp; &amp; &amp; \text{H} &amp; \text{H} &amp; \end{array}</math> <br/> <math display="block">\begin{array}{ccccccc} &amp; \text{H} &amp; \text{H} &amp; &amp; \text{O} &amp; \text{H} &amp; \text{H} &amp; \text{O} \\ &amp;   &amp;   &amp; &amp;    &amp;   &amp;   &amp;    \\ -\text{C} &amp; -\text{C} &amp; -\text{O} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{O}- \\ &amp;   &amp;   &amp; &amp; &amp;   &amp;   &amp; \\ &amp; \text{H} &amp; \text{H} &amp; &amp; &amp; \text{H} &amp; \text{H} &amp; \end{array}</math> </p> <p>or mirror images</p> <p>Accept full or shortened structural formula or combination of both.</p> | <p>1</p> <p>Allow dot or ~ to represent end bond. Ignore brackets or n written outside the bracket at side of repeating unit.</p> <p>Allow one end bond to be missing without penalty.</p> <p>Allow <b>one</b> hydrogen bonded to a carbon to be missing as long as bond from carbon is shown. Allow <b>one</b> bond between a carbon and a hydrogen to be missing as long as hydrogen is shown. Refer to General Marking Principle (l) for guidance.</p> <p>Zero marks awarded if <b>both</b> end bonds are missing<br/><b>or</b><br/>both/either end has a H<br/><b>or</b><br/>both ends have an O<br/><b>or</b><br/>bond between carbon and oxygen or another carbon is missing.</p> |

| Question |     |      | Answer  | Max Mark | Additional Guidance   |
|----------|-----|------|---|----------|---|
| 14.      | (a) | (i)  | Carbon monoxide<br><br>or<br><br>CO/2CO   | 1        | Zero marks awarded for Co or cO   |
|          |     | (ii) | Covalent  | 1        | Ignore the mention of single or double bonds.<br>Refer to General Marking Principle (h) for guidance.<br><br>Accept covalent molecular/ covalent discrete/covalent discrete molecular.<br><br>Do not accept molecular on its own.<br><br>Do not accept covalent network<br><br>The mention of ionic negates the correct answer.<br>Refer to General Marking Principle (g) for guidance.   |
|          | (b) |      | Distillation/distilling   | 1        | Zero marks awarded for fractional on its own, however it does not negate the correct answer.<br><br>Zero marks awarded for 'evaporation then condensation'.   |
|          | (c) |      | The sodium or chlorine or products can be recycled/reused<br><br>or<br><br>Chlorine can be used in the first step<br><br>or<br><br>Sodium can be used in final step | 1        | Award zero marks for sodium or chlorine or products could be sold etc. However, this does not negate a correct answer.<br><br>A statement about recycling or reusing for anything outwith this process on its own should be awarded zero marks but does not negate a correct answer.<br><br>Any mention of 'will not pollute' etc. is awarded zero marks on its own but does not negate a correct answer.<br><br>Zero marks awarded for 'it can be recycled' as 'it' refers to sodium chloride. |

| Question |     | Answer | Max Mark | Additional Guidance   |
|----------|-----|--------|----------|---|
| 15.      | (a) | 16     | 1        | Unit is not required however if the wrong unit is given do <b>not</b> award mark. |

| Question | Answer  | Max Mark | Additional Guidance   |
|----------|---|----------|---|
| (b)      | <p>0.0032/3.2 x 10<sup>-3</sup> with no working or correctly rounded answer (3)</p> <hr/> <p>Partial marking</p> <p>0.0050 x 0.016 = 0.00008 mol I<sub>2</sub> (1)</p> <p>0.00008 mol of Vit C (1)<br/>(this step on its own gets 2 marks)</p> <p>0.00008/0.025 = 0.0032/3.2 x 10<sup>-3</sup> (1)<br/>(this step on its own gets 3 marks)</p> <p>or</p> <p>0.0050 x 16 = 0.08 mol I<sub>2</sub> (1)</p> <p>0.08 mol of Vit C (1)<br/>(this step on its own gets 2 marks)</p> <p>0.08/25 = 0.0032/3.2 x 10<sup>-3</sup> (1)<br/>(this step on its own gets 3 marks)</p> <p>or</p> $\frac{C_1 \times 25}{1} = \frac{0.0050 \times 16}{1} \quad (1)$ <p>C<sub>1</sub> x 25 = 0.08<br/>(this step on its own gets 2 marks)</p> <p>C<sub>1</sub> = 0.0032/3.2 x 10<sup>-3</sup> (1)<br/>(this step on its own gets 3 marks)</p> <p>or</p> $\frac{C_1 \times 0.025}{1} = \frac{0.0050 \times 0.016}{1} \quad (1)$ <p>C<sub>1</sub> x 0.025 = 0.00008<br/>(this step on its own gets 2 marks)</p> <p>C<sub>1</sub> = 0.0032/3.2 x 10<sup>-3</sup> (1)<br/>(this step on its own gets 3 marks)</p> <p>OR ANY OTHER ACCEPTABLE METHOD</p> | 3        | <p>Allow follow through from part 15(a).<br/>Refer to General Marking Principle (k) for guidance.</p> <p>Candidates should not be penalised if 16 (or volume from part a) and 25 (volume of vitamin C solution) are both expressed in cm<sup>3</sup>.</p> <p>If candidate expresses one volume in cm<sup>3</sup> and the other in litres then a maximum of two marks can be awarded.</p> <p>If candidate <b>only</b> calculates number of moles of iodine the volume must be in litres to be awarded 1 mark i.e. 0.0050 x 16 = 0.08 mol I<sub>2</sub> on its own with no further working is awarded zero marks.</p> <p>Zero marks are awarded if values for C, V and n are given but not used in an appropriate method.</p> <p>For method using relationship shown in the data book 1 mark is awarded for the correct pairings of volume (in the same unit) and concentration.</p> <p>1 mark is awarded for the correct mole ratio being applied.</p> <p>1 mark is awarded for the correct arithmetic. This mark can only be awarded if an appropriate method has been used.</p> <p>Unit is not required however if the wrong unit is given then the final mark cannot be awarded.</p> <p>Accept mol l<sup>-1</sup> or mol/l<br/>but <b>not</b> mol/l<sup>-1</sup> or mol<sup>-1</sup> or mol l</p> |

| Question | Answer   | Max Mark | Additional Guidance |
|----------|--|----------|---------------------|
| 16.      | <p><b>1 mark:</b> The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.</p> <p><b>2 marks:</b> The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) which is/are relevant to the situation, showing that the problem is understood.</p> <p><b>3 marks:</b> The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved. The student shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an “excellent” answer or a “complete” one.</p> | 3        |                     |

[END OF MARKING INSTRUCTIONS]