



# **Mark Scheme (Results)**

Summer 2018

Pearson Edexcel GCSE  
Chemistry (1CH0 2F) Paper 2F

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## General Marking Guidance

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

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

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

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

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

\*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

| Question Number | Answer                                                     | Mark                          |
|-----------------|------------------------------------------------------------|-------------------------------|
| 1(a)            | R P S Q T<br><br>R P S as first 3 (1)<br>Q T as last 2 (1) | (2)<br><br>AO 3 2a<br>AO 3 2b |

| Question Number | Answer                                                                                                                                                                                                                                      | Mark              |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 1(b)            | A always higher<br><br><b>The only correct answer is A</b><br><br><i>B is not correct because temperature rise</i><br><br><i>C is not correct because temperature always rises</i><br><br><i>D is not correct because temperature rises</i> | (1)<br><br>AO 2 2 |

| Question Number | Answer                          | Additional guidance                                                    | Mark           |
|-----------------|---------------------------------|------------------------------------------------------------------------|----------------|
| 1(c)            | use a <b>measuring cylinder</b> | allow pipette/ burette<br><br>ignore syringe , measuring jug/tube etc. | (1)<br>AO 3 3a |

| Question Number | Answer                                                                                                                                                                             | Additional guidance                                                                                                       | Mark          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------|
| 1(d)(i)         | An explanation including <ul style="list-style-type: none"> <li>the solid {dissolves/ reacts with the water} (1)</li> <li>{takes in /absorbs} heat / is endothermic (1)</li> </ul> | Ignore just 'a (chemical) reaction occurs' etc<br><br>allow energy for heat<br><br>ignore reference to temperature change | (2)<br>AO 2 1 |

| Question Number | Answer                  | Additional guidance                                                                                                                                                                                  | Mark                      |
|-----------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1(d)(ii)        | (reaction) irreversible | allow <b>reaction</b> can only occur once<br><br>allow reactants are used up / reaction is complete / the reaction has happened<br><br>allow bag can only burst once/ cannot get water back into bag | <b>(1)</b><br><br>AO 3 1a |

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**(Total for Question 1 = 7 marks)**

| Question Number | Answer                                                                                                                                                                                                                                                                    | Mark                            |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 2(a)            | <p><b>B</b> sodium</p> <p><b>The only correct answer is B</b></p> <p><i>A is not correct because lithium gives red flame</i></p> <p><i>C is not correct because potassium gives lilac flame</i></p> <p><i>D is not correct because calcium gives red-orange flame</i></p> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer         | Additional Guidance                                 | Mark                            |
|-----------------|----------------|-----------------------------------------------------|---------------------------------|
| 2(b)(i)         | carbon dioxide | Allow CO <sub>2</sub><br>Reject carbon monoxide/ CO | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                    | Mark                            |
|-----------------|-------------------------------------------|---------------------------------|
| 2(b)(ii)        | carbonate / CO <sub>3</sub> <sup>2-</sup> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                                                                                      | Additional guidance                                                                                                                                                                                                                                                                                                                                                  | Mark                            |
|-----------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 2(c)(i)         | <ul style="list-style-type: none"> <li>point plotted correctly (1)</li> <li>line of best fit (1)</li> </ul> | <p>Point must be on correct line (35 mg dm<sup>-3</sup>), +/- half a square, i.e. between 6.8-7.2 inclusive</p> <p>Line of best fit must be one <b>single ruler-drawn</b> line that goes through 3 printed points (allow within +/- half a square of every point).<br/>           Ignore any extrapolation below first printed point or above last printed point</p> | <p><b>(2)</b></p> <p>AO 2 1</p> |

| Question Number | Answer                             | Additional guidance                                                                                                                                                                                                             | Mark                            |
|-----------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 2(c)(ii)        | value taken from candidate's graph | <p>Examiner to read value from candidates' line of best fit (whether correct line or not) and allow +/- 1 mg dm<sup>-3</sup></p> <p>If no best fit line at all, or if best fit line does not reach 9, then no marks scored.</p> | <p><b>(1)</b></p> <p>AO 2 1</p> |

**(Total for Question 2 = 6 marks)**

| Question Number | Answer        | Mark          |
|-----------------|---------------|---------------|
| 3(a)            | (gas) syringe | (1)<br>AO 1 2 |

| Question Number | Answer              | Additional guidance                                                                                                   | Mark          |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------|---------------|
| 3(b)            | (splint) (re)lights | allow alternatives indicating that splint burns e.g. flame<br><br>allow glows more brightly<br><br>reject squeaky pop | (1)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                        | Mark          |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 3(c)(i)         | <p><b>B</b> water and oxygen are the only products of the reaction</p> <p><b>The only correct answer is B</b></p> <p><i>A is not correct because rate increases</i></p> <p><i>C is not correct because catalysts do not get used up</i></p> <p><i>D is not correct because amount of product is unaltered by catalyst</i></p> | (1)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                                                                                                                                                 | Mark           |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 3(c)(ii)        | <p><b>A</b> dry the filter paper and catalyst before finding their mass</p> <p><b>The only correct answer is A</b></p> <p><i>B this does not remove the water</i></p> <p><i>C dry residue is needed, not filtrate</i></p> <p><i>D water would still be present</i></p> | (1)<br>AO 3 3a |

| Question Number | Answer                                          | Additional guidance                                | Mark          |
|-----------------|-------------------------------------------------|----------------------------------------------------|---------------|
| 3(c)(iii)       | powder / cut up / break up / use smaller pieces | ignore reference to surface area/ squash / flatten | (1)<br>AO 1 2 |

| Question Number | Answer                                                                                                                                                                     | Additional guidance                                                                                                                            | Mark          |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 3(d)            | <ul style="list-style-type: none"> <li>• slower</li> <li>• slower</li> <li>• unchanged</li> </ul> <p>all 3 rows correct – 2 marks<br/>one or two rows correct – 1 mark</p> | <p>may indicate correct answer in any way<br/>e.g. by underlining</p> <p>do not credit a row if more than one answer is indicated in a row</p> | (2)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                                                                    | Additional guidance                                                                                                                                         | Mark                        |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 3(e)            | $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$<br>(2)<br><br>OR<br><br>$2\text{H}_2\text{O}_2$ (1)<br><br><br>state symbols l, g (1) | do not allow first marking point if equation unbalanced<br><br>allow capital or small letters for state symbols<br><br>do not allow words for state symbols | (2)<br><br>AO 1 1<br>AO 2 1 |

**(Total for Question 3 = 9 marks)**

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| Question Number | Answer                                                                                                                                                                                                                                      | Mark                            |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(a)(i)         | <p><b>C</b> 50 nm</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because this is too small</i></p> <p><i>B is not correct because this is too small</i></p> <p><i>D is not correct because this is too large</i></p> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                                                                                                                                                                                                                                                             | Mark                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(a)(ii)        | <p><b>D</b> prevent harmful UV radiation reaching the skin</p> <p><b>The only correct answer is D</b></p> <p><i>A is not correct because ratio is high</i></p> <p><i>B is not correct because this is not useful</i></p> <p><i>C is not correct because this is not useful</i></p> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                                                                                                   | Additional guidance                                                                                                                               | Mark                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(a)(iii)       | <p>allow 2 for correct answer with or without working</p> <p><math>\frac{51200}{38400}(1)</math></p> <p>1 : 1.33 (1)</p> | <p>allow 2 marks for 3:4</p> <p>allow 1.3, 1.333...</p> <p>Allow 1 mark for final answer</p> <p>1.00: 0.75 or 4:3</p> <p>Ignore 'rec' or dots</p> | <p><b>(2)</b></p> <p>AO 2 1</p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                    | Additional guidance                      | Mark                                            |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------|
| 4(b)(i)         | <p>An explanation that includes</p> <ul style="list-style-type: none"> <li>A is {an alkene/ unsaturated/ has C=C/ has double bond} (1)</li> <li>B is {an alkene/ unsaturated/ has C=C/ has double bond} (1)</li> <li>C {is alkane/ is saturated/ no C=C/ has no double bond/ has <b>only</b> single bonds} (1)</li> </ul> | <p>Do not accept alkynes for alkenes</p> | <p><b>(3)</b></p> <p>AO 3 2a</p> <p>AO 3 2b</p> |

| Question Number | Answer                                                                                                                                                                                                         | Additional guidance                                                                                                                                                                                   | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(b)(ii)        | $  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ <p>Fully correct with all capital letters (2)</p> | <p>Allow 1 if fully correct but any small letters</p> <p>allow 1 for any molecule containing 2 carbon atoms and one single C-C bond</p> <p>Reject ethene (=0)</p> <p>Allow Dot-and-cross diagrams</p> | <p><b>(2)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                                                                      | Additional guidance                                                                                                                   | Mark                            |
|-----------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(b)(iii)       | <p>contains carbon and hydrogen (atoms) (1)</p> <p>only (1)</p> <p>MP2 dependent on MP1</p> | <p>Allow 1: contains carbon and hydrogen molecules <b>only</b></p> <p>Allow 1: Element containing carbon and hydrogen <b>only</b></p> | <p><b>(2)</b></p> <p>AO 1 1</p> |

**(Total for Question 4 = 11 marks)**

| Question Number | Answer                                                                                                                                                                                                                                                                                                            | Mark                            |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 5(a)            | <p><b>A</b> crude oil is a finite resource</p> <p><b>The only correct answer is A</b></p> <p><i>B is not correct because crude oil is a mixture of compounds</i></p> <p><i>C is not correct because most molecules are chains</i></p> <p><i>D is not correct because crude oil must be fractionated first</i></p> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                         | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 5(b)            | <p><b>C</b> are in the same homologous series</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because they have different formulae</i></p> <p><i>B is not correct because they have different bpts</i></p> <p><i>D is not correct because they all form carbon dioxide and water</i></p> | <p><b>(1)</b></p> <p>AO 2 1</p> |

| Question Number | Answer                                                                              | Mark                            |
|-----------------|-------------------------------------------------------------------------------------|---------------------------------|
| 5(c)(i)         | <ul style="list-style-type: none"> <li>heated (1)</li> <li>condensed (1)</li> </ul> | <p><b>(2)</b></p> <p>AO 1 1</p> |

| Question Number | Answer                             | Additional guidance                                                                                            | Mark                            |
|-----------------|------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------|
| 5(c)(ii)        | has more carbon atoms per molecule | <p>allow any way of indicating answer e.g. circling</p> <p>reject any answer with two or more underlinings</p> | <p><b>(1)</b></p> <p>AO 1 1</p> |

| Question Number | Answer   | Mark                             |
|-----------------|----------|----------------------------------|
| 5(d)            | fuel oil | <p><b>(1)</b></p> <p>AO 3 2b</p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                             | Additional guidance                                                                                                                                                                                                                                                                      | Mark                         |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 5(e)            | <p>380 000 with or without working scores 3<br/>382 500 with or without working scores 2</p> <p>OR</p> $\frac{45}{100} (1) = (0.45)$ $(0.45) \times 850\,000 (1) = (382\,500)$ $= 380\,000 (1)$ <p>OR</p> $\frac{850\,000}{100} (1) (= 8500)$ $(8500) \times 45 (1) (= 382\,500)$ $380\,000 (1)$ <p>OR</p> $4 \times 10\% = 340\,000 \text{ and } 1 \times 5\% = 42\,500 (1)$ $340\,000 + 42\,500 (= 382\,500) (1)$ $380\,000 (1)$ | <p>allow ECF throughout</p> <p>(answers based on 55%)<br/>470 000 scores 2<br/>467 500 scores 1</p> <p>allow alternative chunking methods that add to 45%</p> <p>The clear <u>rounding of</u> any <u>worked out</u> final answer (<u>using data provided</u>) to 2 sig figs scores 1</p> | <p><b>(3)</b><br/>AO 2 1</p> |

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**(Total for Question 5 = 9 marks)**

| Question Number | Answer          | Additional guidance                                                | Mark          |
|-----------------|-----------------|--------------------------------------------------------------------|---------------|
| 6(a)            | SO <sub>2</sub> | allow O <sub>2</sub> S<br>reject SO <sub>2</sub> , SO <sup>2</sup> | (1)<br>AO 2 1 |

| Question Number | Answer                              | Additional guidance                                                                                                                                                                                                                                                                                                   | Mark          |
|-----------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 6(b)(i)         | hydrogen + oxygen →<br><b>water</b> | allow 2H <sub>2</sub> + O <sub>2</sub> → 2H <sub>2</sub> O: this must be fully correct and balanced with correct subscripts<br><br>reject 'hydrogen and oxygen', hydrogen oxide, hydrogen hydroxide<br><br>if word and symbol equation given or mixture of symbols and words, ignore all symbols<br><br>allow = for → | (1)<br>AO 2 1 |

| Question Number | Answer  | Additional guidance                                                                                                  | Mark           |
|-----------------|---------|----------------------------------------------------------------------------------------------------------------------|----------------|
| 6(b)(ii)        | B and D | For B allow SO <sub>2</sub><br>For D allow CO <sub>2</sub><br><br>reject answers containing any other letters/ names | (1)<br>AO 3 2a |

| Question Number | Answer                                                                                                                                              | Additional guidance                                                                                                          | Mark          |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------|
| 6(c)            | An explanation including <ul style="list-style-type: none"> <li>plants (grow/ evolve etc.) (1)</li> <li><b>photosynthesis</b> occurs (1)</li> </ul> | allow trees or any other reference to plants<br><br>reject respiration/breathing for MP2<br><br>ignore all other information | (2)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                    | Mark          |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 6(d)            | <p>change in the amount of carbon dioxide in the atmosphere</p> <p>process causing the change</p> <p>reject multiple lines from a box</p> | (2)<br>AO 1 1 |

| Question Number | Answer                                                   | Additional guidance                                                                                                                                                                                         | Mark           |
|-----------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 6(e)(i)         | suitable description of variation (within a year)<br>(1) | <p>allow increases and decreases / goes up and down [or vice-versa]</p> <p>allow fluctuates</p> <p>reject a pattern described for a timescale other than a year e.g. goes up one year and down the next</p> | (1)<br>AO 3 2a |

| Question Number | Answer                       | Additional guidance                                                                   | Mark           |
|-----------------|------------------------------|---------------------------------------------------------------------------------------|----------------|
| 6(e)(ii)        | increases (over time)<br>(1) | <p>ignore from (number) to (number)</p> <p>allow positive correlation, trend etc.</p> | (1)<br>AO 3 2a |

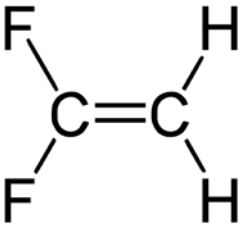
| Question Number | Answer                                                                                                                                                        | Additional guidance                                       | Mark          |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------|
| 6(e)(iii)       | <p>15 with no working or correct working scores 2</p> <p>figures read from graph 364-366 and 349-351<br/>(1)</p> <p>subtraction of numbers from above (1)</p> | <p>negative answer does not score 2<sup>nd</sup> mark</p> | (2)<br>AO 2 1 |

**(Total for Question 6 = 11 marks)**

| Question Number | Answer                                                                                                                                                                                                                                                                     | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 7(a)(i)         | <p><b>D</b> the metal conducts electricity</p> <p><b>The only correct answer is D</b></p> <p><i>A is not correct because metals are not hard</i></p> <p><i>B is not correct because this is not useful</i></p> <p><i>C is not correct because this is not relevant</i></p> | <p><b>(1)</b></p> <p>AO 2 1</p> |

| Question Number | Answer                                                                                                                                                                                                                                                    | Mark                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 7(a)(ii)        | <p><b>C</b> the polymer</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because this is not flexible</i></p> <p><i>B is not correct because this is not flexible</i></p> <p><i>D is not correct because this is a conductor</i></p> | <p><b>(1)</b></p> <p>AO 3 1a</p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                         | Additional guidance                                                                                                               | Mark                                         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 7(b)            | <p>Correct property</p> <ul style="list-style-type: none"> <li>no reaction with water/unreactive/ high melting point / low flexibility (1)</li> </ul> <p>Linked to correct reason</p> <ul style="list-style-type: none"> <li>drinks contain water/will not react with drink/ ceramic will not melt / cup will not distort / cup will keep shape (1)</li> </ul> | <p>No property given = no marks</p> <p>If more than one property given Ignore any incorrect properties and associated reasons</p> | <p><b>(2)</b></p> <p>AO 3 1a<br/>AO 3 1b</p> |

| Question Number | Answer                                                                                                                                                                    | Mark                            |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 7(c)(i)         |  <p>(2)</p> <p>1 mark for each correct bond<br/>-1 for each <u>additional</u> bond</p> | <p><b>(2)</b></p> <p>AO 2 1</p> |

| Question Number | Indicative content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mark                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| *7(c)(ii)       | <p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><b>Aspect 1: MANUFACTURE</b></p> <ul style="list-style-type: none"> <li>• crude oil is a raw material</li> <li>• crude oil is finite</li> <li>• cracking requires a lot of energy</li> <li>• generation of energy for fractional distillation and cracking may cause release of carbon dioxide</li> <li>• carbon dioxide is a greenhouse gas and may lead to global warming</li> </ul> <p><b>Aspect 2: DISPOSAL</b></p> <ul style="list-style-type: none"> <li>• some polymers disposed of in landfill sites</li> <li>• non-biodegradable</li> <li>• persists in landfill</li> <li>• landfill space runs out</li> <li>• some plastic ends up as litter/ in oceans</li> <li>• this may be hazardous to wildlife</li> <li>• some polymers are recycled</li> <li>• polymers must be sorted into different types</li> <li>• public must make effort to sort/ recycle</li> <li>• some polymers are burnt</li> <li>• produces carbon dioxide</li> <li>• carbon dioxide is a greenhouse gas</li> <li>• greenhouse gases may cause global warming</li> <li>• toxic gases may be produced</li> </ul> <p>Ignore all irrelevant material<br/>Ignore general statements such as 'disposal of polymers is harmful to the environment'<br/>If carbon dioxide/ greenhouse effect etc. mentioned in both aspects, only credit once</p> | <p><b>(6)</b></p> <p>AO 1 1</p> |
| Level           | Descriptor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |
|                 | No rewardable material.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |
| Level 1         | <ul style="list-style-type: none"> <li>• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail.</li> <li>• Presents an explanation with some structure and coherence.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |

|         |                                                                                                                                                                                                                                                                                                                                    |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level 2 | <ul style="list-style-type: none"><li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed.</li><li>• Presents an explanation that has a structure which is mostly clear, coherent and logical.</li></ul> |
| Level 3 | <ul style="list-style-type: none"><li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed.</li><li>• Presents an explanation that has a well-developed structure which is clear, coherent and logical.</li></ul>                       |

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**(Total for Question 7 = 12 marks)**

| Question Number | Answer | Additional guidance | Mark          |
|-----------------|--------|---------------------|---------------|
| 8(a)(i)         | 35     | reject 35.5         | (1)<br>AO 1 1 |

| Question Number | Answer | Additional guidance                                                                 | Mark          |
|-----------------|--------|-------------------------------------------------------------------------------------|---------------|
| 8(a)(ii)        | 2.8.7  | allow any separator including gaps<br>e.g. 2 8 7<br><br>send to review any diagrams | (1)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                                    | Additional guidance                                                                                                                                                                                                     | Mark          |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 8(b)            | A description to include <ul style="list-style-type: none"> <li>(blue litmus) (first turns) red (1)</li> <li>(then) bleaches / turns white (1)</li> </ul> | allow shades of red and pink but not other colours e.g. red-purple<br><br>allow colour disappears/goes colourless<br><br>ignore yellow/<br>colour fades<br>/discolours<br><br>white then red = 0; just 'goes white' = 1 | (2)<br>AO 1 2 |

| Question Number | Answer                                                                                                                                                     | Additional guidance                                                                                                  | Mark          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------|
| 8(c)(i)         | A description to include <ul style="list-style-type: none"> <li>shared <b>electron</b>(s) (1)</li> <li>{a pair of / two} (<b>electrons</b>) (1)</li> </ul> | allow a diagram for both mark points<br><br>reference to ionic bonding/ions scores 0<br>e.g. gains two electrons = 0 | (2)<br>AO 1 1 |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                  | Additional guidance                                                                                                                                                                     | Mark                         |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 8(c)(ii)        | <p>An explanation linking any two from</p> <ul style="list-style-type: none"> <li>intermolecular forces / forces <b>between</b> molecules (1)</li> <li>(intermolecular) forces {weak / take little energy to break} / little energy to separate molecules (1)</li> <li>boiling point is below room temperature / has a low boiling point (1)</li> </ul> | <p>if answer relates to the breaking of any type of <b>bond</b> first two marking points cannot be scored (but 3<sup>rd</sup> could)</p> <p>allow “attractions” instead of “forces”</p> | <p><b>(2)</b><br/>AO 1 1</p> |

| Question Number | Answer                                                                 | Additional guidance                                                                                                                                        | Mark                         |
|-----------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 8(d)            | (the solution is) acid(ic) / contains {hydrogen ions/ H <sup>+</sup> } | <p>allow pH &lt; 7</p> <p>allow hydrogen chloride is acidic</p> <p>If incorrect identity of acidic solution then 0 marks (e.g. chlorine is acidic = 0)</p> | <p><b>(1)</b><br/>AO 2 1</p> |

| Question Number | Answer                   | Additional guidance                                                                                                                                                                           | Mark                         |
|-----------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 8(e)(i)         | any value from 20 to 301 | <p>allow a range within these numbers e.g. 25 to 45</p> <p>answer may be given in the table. if values are given on the answer line and the table mark only the answer on the answer line</p> | <p><b>(1)</b><br/>AO 1 1</p> |

| Question Number | Answer             | Additional guidance                                                            | Mark                         |
|-----------------|--------------------|--------------------------------------------------------------------------------|------------------------------|
| 8(e)(ii)        | fluorine/ chlorine | <p>reject iodine / astatine</p> <p>allow F/F<sub>2</sub>/Cl/Cl<sub>2</sub></p> | <p><b>(1)</b><br/>AO 2 1</p> |

**(Total for Question 8 = 11 marks)**

| Question Number | Answer                                                                                                                                                                    | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Mark          |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 9(a)            | <p>Na : O</p> <p><math>\frac{0.92}{23} : \frac{0.32}{16}</math> (1)</p> <p>0.04 : 0.02<br/>OR 2 : 1 (1)</p> <p>(empirical formula from ratio)<br/>Na<sub>2</sub>O (1)</p> | <p>formula alone scores 0</p> <p>2<sup>nd</sup> MP is either for working out correct number of moles OR for finding the correct ratio by dividing by the smaller number from an incorrect first step</p> <p>3<sup>rd</sup> MP is for correctly converting a ratio to a formula with whole numbers only</p> <p>example<br/> <math>\frac{23}{0.92} : \frac{16}{0.32}</math><br/>           25 : 50 (0)<br/>           1 : 2 (1)<br/>           NaO<sub>2</sub> (1)</p> | (3)<br>AO 2 1 |

| Question Number | Answer                                                                                                             | Additional guidance               | Mark          |
|-----------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------|
| 9(b)            | <p>2Na(s) + 2H<sub>2</sub>O(l) → 2NaOH(aq) + H<sub>2</sub>(g)</p> <p>2Na (1)<br/>2NaOH (1)<br/>s, l, aq, g (1)</p> | allow S, L, AQ, G<br>ignore words | (3)<br>AO 2 1 |

| Question Number | Answer                                                                                                                                                                                                                                                 | Mark          |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 9(c) (i)        | <p>C is the most reactive</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because this is irrelevant</i></p> <p><i>B is not correct because this is irrelevant</i></p> <p><i>D is not correct because this is irrelevant</i></p> | (1)<br>AO 2 1 |

| Question Number | Indicative content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Mark                                                    |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| *9(c)(ii)       | <p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><b>Aspect one: METHOD</b></p> <ul style="list-style-type: none"> <li>• trough/large container of water</li> <li>• equal volumes of water for each experiment</li> <li>• remove metal from container with tongs</li> <li>• remove oil</li> <li>• cut small piece</li> <li>• add metal with tongs/tweezers etc. to water</li> <li>• teacher wears safety glasses</li> <li>• gloves</li> <li>• use of safety screen</li> <li>• class well back</li> <li>• class wear goggles</li> </ul> <p>ignore general safety ideas – hair tied back, lab coat etc.<br/>ignore equal sized pieces of metal</p> <p><b>Aspect 2: ANALYSIS</b></p> <ul style="list-style-type: none"> <li>• most vigorous effervescence of hydrogen with potassium and least with lithium</li> <li>• fastest movement with potassium and slowest with lithium</li> <li>• potassium is most reactive, then sodium, then lithium</li> </ul> <p>ignore copying of results from table<br/>e.g potassium bubbles very fast<br/>ignore writing up of results/ put in table etc</p> | <p><b>(6)</b></p> <p>AO 2 2<br/>AO 3 1a<br/>AO 3 1b</p> |
| Level           | Descriptor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |
|                 | No rewardable material.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Level 1         | <ul style="list-style-type: none"> <li>• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail.</li> <li>• Presents an explanation with some structure and coherence.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                         |
| Level 2         | <ul style="list-style-type: none"> <li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed.</li> <li>• Presents an explanation that has a structure which is mostly clear, coherent and logical.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         |
| Level 3         | <ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed.</li> <li>• Presents an explanation that has a well-developed structure which is clear, coherent and logical.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                         |

**(Total for Question 9 = 13 marks)**

| Question Number | Answer                        | Additional guidance                                                            | Mark           |
|-----------------|-------------------------------|--------------------------------------------------------------------------------|----------------|
| 10(a)(i)        | {heat/energy} is lost/escapes | Allow anywhere heat is transferred e.g. can absorb heat, heat lost to air etc. | (1)<br>AO 3 2b |

| Question Number | Answer                                                                                                                                                                                                                           | Additional guidance                                                                                                                                    | Mark           |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 10(a)(ii)       | <p>An explanation including:</p> <ul style="list-style-type: none"> <li>add a lid/ use of draught shield (1)</li> <li>so more {heat/energy} goes to water/ less {heat/energy} escapes (1)</li> </ul> <p>MP2 dependent on MP1</p> | <p>Ignore altering distance between flame and can</p> <p>Allow any <u>suitable</u> insulating material</p> <p>Ignore burning more fuel/ less water</p> | (2)<br>AO 3 3b |

| Question Number | Answer                                                                                            | Additional guidance                                                                                                                                                               | Mark          |
|-----------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 10(a)(iii)      | <p>Final answer of 7308 with or without working scores 2</p> <p>210 x 34.8 (1)<br/>= 7308 (1)</p> | <p>Allow 1 for 210 x (any temp change) <b>correctly evaluated with working</b> e.g. 210 x 82.4 = 17304 (1)</p> <p>Allow 7300, 7310; Do not allow 7000</p> <p>Ignore any units</p> | (2)<br>AO 2 1 |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                   | Additional guidance                                                                                                                                                                                                                                                                                       | Mark          |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 10(b)           | <p>Any three of the following</p> <ul style="list-style-type: none"> <li>all have –OH group/ hydroxyl group / same functional group (1)</li> <li>same <b>general formula</b>/ <math>C_nH_{2n+1}OH</math> (1)</li> <li>formulae differ by <math>CH_2</math> units (1)</li> <li>react similarly with oxygen/all burn to form carbon dioxide and water (1)</li> <li>trend in physical properties</li> </ul> | <p>Ignore 'all alcohols'</p> <p>Do not allow 'hydroxide'</p> <p>Allow similar chemical reactions/ chemical properties/ a specified reaction</p> <p>Allow any sensible physical property e.g. increase in boiling point</p> <p>Ignore reference to containing C,H,O or single bonds or no double bonds</p> | (3)<br>AO 2 1 |

| Question Number | Answer                                                                                                                                                                                       | Additional guidance                                                                                                                                                                                                                                                 | Mark                     |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 10(c)(i)        | propanol + oxygen → propanoic acid + water (2)<br><br>allow $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{CH}_2\text{COOH} + \text{H}_2\text{O}$ (2) | Allow 1 mark for any three correctly named substances<br><br>Air is not acceptable for oxygen<br><br>If a mixture of words and symbols, ignore all of the symbols<br><br>If 5 substances in equation, remove 1 mark<br>If 6 or more substances in equation, score 0 | <b>(2)</b><br><br>AO 2 1 |

| Question Number | Answer                                                                                                                                                                                                                                                                    | Mark                 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 10(c)(ii)       | <b>C</b> -COOH<br><br><b>The only correct answer is C</b><br><br><i>A is not correct because this is functional group of alcohols</i><br><br><i>B is not correct because this is a methyl group</i><br><br><i>D is not correct because this is not a functional group</i> | <b>(1)</b><br>AO 1 1 |

**(Total for Question 10 = 11 marks)**

