



# Mark Scheme (Results)

January 2018

Pearson Edexcel International GCSE  
In Chemistry (4CH0) Paper 2C

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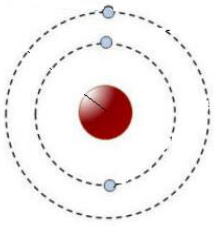
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## **General Marking Guidance**

- 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.

| Question number | Answer                                                        | Notes | Marks |
|-----------------|---------------------------------------------------------------|-------|-------|
| 1 (a)           | P beaker<br>Q (filter) funnel<br>R conical flask<br>S pipette |       | 4     |
| (b)             | D red                                                         |       | 1     |
| (c)             | A blue                                                        |       | 1     |

Total 6 marks

| Question number | Answer                                                                            | Notes                                                                                                                | Marks  |
|-----------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------|
| 2 (a)           | electron(s)                                                                       |                                                                                                                      | 1      |
| (b)             | nucleus                                                                           |                                                                                                                      | 1      |
| (c)             | <b>M1</b> proton(s)<br><b>M2</b> neutron(s)                                       | in either order                                                                                                      | 1<br>1 |
| (d) (i)         | isotope(s)                                                                        |                                                                                                                      | 1      |
| (ii)            |  | ALLOW other symbols for electrons<br><br>do not need to show nucleus<br><br>REJECT any diagram showing a lithium ion | 1      |
| (e)             | <b>M1</b> $[(92.5 \times 7) + (7.5 \times 6)]/100$<br><b>M2</b> = 6.9             | <b>ACCEPT</b> 6.925 and 6.93<br><b>REJECT</b> 7<br>Incorrect rounding e.g. 6.92<br>scores 1<br><b>IGNORE</b> units   | 2      |

Total 8 marks

| Question number    | Answer                                                                                                                                                                                                                                                                                | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 3 (a)              | <b>B</b> neutralisation                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1     |                    |      |              |       |                                                                                                                                                                                           |   |
| (b) (i)            | <table><tr><td>after adding acid</td><td>26.30</td></tr><tr><td>before adding acid</td><td>1.75</td></tr><tr><td>volume added</td><td>24.55</td></tr></table><br><b>M1</b> 26.30<br><br><b>M2</b> 1.75<br><br><b>M3</b> 24.55                                                         | after adding acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 26.30 | before adding acid | 1.75 | volume added | 24.55 | If readings are correct but in wrong order, award 1 mark for M1 and M2<br><br><br><br><br><br><br><br><br><br><b>M3</b> ECF from (M1 - M2)<br><br>Penalise an answer not to 2dp once only | 3 |
| after adding acid  | 26.30                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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| volume added       | 24.55                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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| (ii)               | Any two from<br><br><b>M1</b> to obtain (two) concordant results/titres<br><br><br><br><br><br><br><br><br><br><b>M2</b> to identify anomalous results/first result may be anomalous<br><br><br><br><br><br><br><br><br><br><b>M3</b> to obtain a mean (of concordant results/titres) | <br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>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|       |                    |      |              |       |                                                                                                                                                                                           |   |

Total 6 marks

| Question number | Answer                                                                                                                                                                                                                       | Notes                                                                                                                                                                                                                         | Marks |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4 (a) (i)       | $C_3H_8O$                                                                                                                                                                                                                    | Penalise incorrect use of lowercase letters and subscripts<br><br>ALLOW symbols in any order e.g. $C_3OH_8$<br>REJECT $C_3H_7OH$                                                                                              | 1     |
| (ii)            | <b>M1</b> (correct as X) only contains single bonds<br><br><b>M2</b> (not correct as X) contains oxygen/O<br><br><b>M3</b> hydrocarbon contains hydrogen/H and carbon/C only                                                 | ALLOW no double bonds<br><br>REJECT if they say it is unsaturated<br><br>IGNORE $O_2$<br><br>ALLOW (not correct as X) is an alcohol<br><br>REJECT if they say it is a hydrocarbon<br><br>REJECT hydrogen and carbon molecules | 3     |
| (b)             | Any one from: <ul style="list-style-type: none"> <li>• have a general formula</li> <li>• successive members differ by <math>CH_2</math></li> <li>• trends in physical properties</li> <li>• same functional group</li> </ul> | IGNORE reference to chemical properties                                                                                                                                                                                       | 1     |

| Question number | Answer                                                                                                                                                                                                                                                                                      | Notes                                                                                                                                          | Marks |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4 (c) (i)       | catalyst                                                                                                                                                                                                                                                                                    | ALLOW description of effect of catalyst<br>e.g. to speed up the reaction/ to lower the activation energy<br><br>IGNORE to dehydrate compound X | 1     |
| (ii)            | insoluble (in water)                                                                                                                                                                                                                                                                        | IGNORE reference to density<br>ALLOW (only) slightly soluble in water                                                                          | 1     |
| (iii)           | contains air                                                                                                                                                                                                                                                                                | ALLOW contains oxygen<br>IGNORE contains other gases                                                                                           | 1     |
| (iv)            | <div style="text-align: center;"> <math display="block">  \begin{array}{c}  \text{H} &amp; &amp; \text{H} \\    &amp; &amp;   \\  \text{C} = &amp; \text{C} - &amp; \text{C} - \text{H} \\    &amp;   &amp;   \\  \text{H} &amp; \text{H} &amp; \text{H}  \end{array}  </math> </div><br>M1 | <br>IGNORE bond angles<br><br>ALLOW H-O-H                                                                                                      | 2     |
| (v)             | M2 H <sub>2</sub> O<br><br>propene                                                                                                                                                                                                                                                          |                                                                                                                                                | 1     |

Total 11 marks

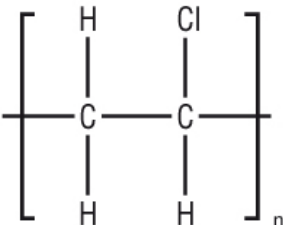
| Question number | Answer                                                                                                                                                                                                                                | Notes                                                                                                                                                                                                           | Marks |    |          |   |        |                                 |   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----|----------|---|--------|---------------------------------|---|
| 5 (a)           | <table><tr><td>Fe</td><td>iron</td></tr><tr><td>Cr</td><td>chromium</td></tr><tr><td>O</td><td>oxygen</td></tr></table>                                                                                                               | Fe                                                                                                                                                                                                              | iron  | Cr | chromium | O | oxygen | All three names must be correct | 1 |
| Fe              | iron                                                                                                                                                                                                                                  |                                                                                                                                                                                                                 |       |    |          |   |        |                                 |   |
| Cr              | chromium                                                                                                                                                                                                                              |                                                                                                                                                                                                                 |       |    |          |   |        |                                 |   |
| O               | oxygen                                                                                                                                                                                                                                |                                                                                                                                                                                                                 |       |    |          |   |        |                                 |   |
| (b) (i)         | $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$<br>M1 $\text{Al}_2\text{O}_3$<br>M2 completely correct equation                                                                                   |                                                                                                                                                                                                                 | 2     |    |          |   |        |                                 |   |
| (ii)            | M1 aluminium more reactive (than chromium)<br><br>M2 as aluminium displaces chromium                                                                                                                                                  | ORA<br>ALLOW aluminium higher in the reactivity series (than chromium)<br><br>ALLOW aluminium removes the oxygen from chromium                                                                                  | 2     |    |          |   |        |                                 |   |
| (iii)           | Any two from<br><br>M1 (redox means both) reduction and oxidation taking place (at same time)<br><br>M2 chromium reduced and aluminium oxidised<br><br>M3 chromium (reduced as) loses oxygen and aluminium (oxidised as) gains oxygen | ACCEPT chromium oxide<br><br>ACCEPT chromium oxide<br><br>ACCEPT chromium ions gain electrons (so reduced) and aluminium loses electrons (so oxidised)<br><br>ALLOW answer in terms of oxidation number changes | 2     |    |          |   |        |                                 |   |

| Question number | Answer                                                                                                                                                                                                                                                                                                                                                                                                            | Notes                                                                                                                                                                                             | Marks |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5 (c) (i)       | <p><b>M1</b> <math>\text{mol (Cr)} = 0.13/52 = 0.0025</math></p> <p><b>M2</b> <math>\text{vol H}_2 = \text{answer to M1} \times 24 =</math></p> <p><b>M3</b> <math>0.06(0) \text{ dm}^3</math></p>                                                                                                                                                                                                                | <p>accept <math>60 \text{ cm}^3</math></p> <p>If incorrect moles of <math>\text{H}_2</math> e.g. 0.0025 has been multiplied or divided by 2, ECF to M3, i.e. 0.03 or 0.12 would score 2 marks</p> | 3     |
| (ii)            | <p>Any two from</p> <p><b>M1</b> (sample of) chromium impure</p> <p><b>M2</b> gas leakage (from apparatus)/some gas escaped (before the bung was inserted)</p> <p><b>M3</b> not enough/less than 0.13g chromium used/did not use excess acid</p> <p><b>M4</b> reaction not allowed to go to completion/the volume was measured before reaction ended</p> <p><b>M5</b> some gas dissolved in the acid/solution</p> |                                                                                                                                                                                                   | 2     |

Total 12 marks

| Question number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Notes                                                                                                                                                                                         | Marks |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6 (a) (i)       | $(24 + 16) = 40$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                               | 1     |
| (ii)            | $\text{Li}^+$ and $\text{F}^-$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | both needed                                                                                                                                                                                   | 1     |
| (b)             | <p>Any four from</p> <p><b>M1</b> strong (electrostatic) forces/attraction</p> <p><b>M2</b> between oppositely charged ions</p> <p><b>M3</b> a large amount of energy needed to overcome attraction / break down lattice/break bonds</p> <p><b>M4</b> (MgO higher melting point as) greater charge on <math>\text{Mg}^{2+}</math> (than <math>\text{Li}^+</math>) / greater charge on <math>\text{O}^{2-}</math> (than <math>\text{F}^-</math>)</p> <p><b>M5</b><br/>EITHER<br/>so stronger attraction/forces/bonds (in MgO)</p> <p>OR<br/>more (thermal/heat) energy required to overcome attraction / break down lattice/break the bonds (in MgO)/ORA</p> | <p>ACCEPT strong (ionic) bonds</p> <p>Must be a comparison to gain M5</p> <p>MAX 2 if any reference to intermolecular forces/covalent bonding/electron sharing/molecules/metallic bonding</p> | 4     |
| (c)             | <p><b>M1</b> (when) solid ions in fixed positions/don't move/only vibrate</p> <p><b>M2</b> (when) molten or in solution ions can move/mobile</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>IGNORE electrons<br/>ALLOW atoms</p> <p>REJECT electrons/atoms</p> <p>MAX 1 if mention of sharing of electrons/covalent bonding</p>                                                        | 2     |

Total 8 marks

| Question number | Answer                                                                                                                                                                                    | Notes                                                                                                                                                                  | Marks |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 7 (a) (i)       | <p><b>M1</b> oxidation is loss of electrons</p> <p><b>M2</b> chloride ions/<math>\text{Cl}^-</math> lose electrons (so oxidised)</p>                                                      | <p>REJECT chlorine/<math>\text{Cl}/\text{Cl}_2</math> loses electrons</p> <p>ALLOW chloride loses electrons</p>                                                        | 2     |
| (ii)            | <p><math>2\text{H}_2\text{O} + 2\text{e}^- \rightarrow 2\text{OH}^- + \text{H}_2</math></p> <p><b>M1</b> all correct species</p> <p><b>M2</b> correctly balancing</p> <p>M2 dep on M1</p> | ACCEPT multiples                                                                                                                                                       | 2     |
| (b)             | $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$                                                                                                  | ACCEPT multiples                                                                                                                                                       | 1     |
| (c) (i)         | <p><b>M1</b> monomers join together/ double bonds broken (in monomers)</p> <p><b>M2</b> to form a long chain (molecule)/large molecule</p>                                                | ALLOW link/add in place of join                                                                                                                                        | 2     |
| (ii)            |  <p><b>M1</b> correct repeat structure</p> <p><b>M2</b> brackets and continuation bonds and n</p>      | <p>No M1 if more than 1 repeat unit shown</p> <p>ACCEPT n anywhere after the brackets but not before</p> <p>REJECT any structure with a double bond for both marks</p> | 2     |

Total 9 marks

Paper Total 60 marks

