

# IGCSE Chemistry 4437 / 5H

## Mark Scheme (Final)

### November 2007

IGCSE

## IGCSE Chemistry (4437/5H)

| Question Number | Question           |        |
|-----------------|--------------------|--------|
| 1               | (a)                |        |
|                 | Acceptable Answers | Reject |
|                 | (i) C / F          |        |
|                 | (ii) A and B       |        |
|                 | (iii) E            |        |
|                 | Notes              |        |
|                 |                    | Mark   |
|                 |                    | (1)    |
|                 |                    | (1)    |
|                 |                    | (1)    |

| Question Number | Question  |   |
|-----------------|---|---|
| 1               | (b)   |   |
|                 | Acceptable Answers  | Reject                                  |
|                 | Poly((ethene)).   |   |
|                 | Accept polythene/Polyethylene   |   |
|                 | correct repeat unit   |   |
|                 | $\begin{array}{c} \text{H} \\   \\ -\text{C}- \\   \\ \text{H} \end{array}$ | Or any multiple length<br>(2 + carbons) |
|                 | continuation bonds ____ or .....  |   |
|                 | ..... (only if first mark awarded)  |   |
|                 | Notes   |   |
|                 | Ignore 'brackets' and 'n' or other subscripts                               |   |
|                 |   | Mark                                    |
|                 |   | (1)                                     |
|                 |   | (1)                                     |
|                 |   | (1)                                     |

Total 6 marks

| Question Number | Question  |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|-----------------|---|-----------------|---------------|-----------------|----------|--|----|--|------------------|--|---------|--|---------|--------|---|--|------------|
| 2               | (a)   |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 | Acceptable Answers  | Reject          |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 | <table border="1"> <thead> <tr> <th>Particle</th> <th>Relative mass</th> <th>Relative charge</th> </tr> </thead> <tbody> <tr> <td>Electron</td> <td><math>\frac{1}{1840}</math> <math>\frac{1}{2000}</math> <math>\frac{1}{1850}</math></td> <td>-1</td> </tr> <tr> <td></td> <td><math>\frac{1}{1836}</math></td> <td></td> </tr> <tr> <td>Neutron</td> <td></td> <td>0 / nil</td> </tr> <tr> <td>Proton</td> <td>1</td> <td></td> </tr> </tbody> </table> | Particle        | Relative mass | Relative charge | Electron | $\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$ | -1 |  | $\frac{1}{1836}$ |  | Neutron |  | 0 / nil | Proton | 1 |  | 0 for mass |
| Particle        | Relative mass   | Relative charge |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
| Electron        | $\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$  | -1              |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 | $\frac{1}{1836}$  |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
| Neutron         |   | 0 / nil         |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
| Proton          | 1   |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 | Notes   |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 | Ignore negligible   |                 |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 |   | Mark            |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |
|                 |   | (4)             |               |                 |          |  |    |  |                  |  |         |  |         |        |   |  |            |

| Question Number | Question   |        |      |
|-----------------|--|--------|------|
| 2               | (b)  |        |      |
|                 | Acceptable Answers   | Reject | Mark |
|                 | (i) helium / carbon / nitrogen / oxygen / neon / magnesium / silicon / sulphur / calcium |        | (1)  |
|                 | (ii) silicon   |        | (1)  |
|                 | (iii) hydrogen   |        | (1)  |
|                 | <b>Notes</b><br>Max penalty 1 if give symbols for all 3 rather than names                |        |      |

| Question Number | Question           |        |      |
|-----------------|--------------------|--------|------|
| 2               | (c)                |        |      |
|                 | Acceptable Answers | Reject | Mark |
|                 | 7                  |        |      |
|                 | <b>Notes</b>       |        | (1)  |

| Question Number | Question                                       |        |      |
|-----------------|--|--------|------|
| 2               | (d)  |        |      |
|                 | Acceptable Answers                             | Reject | Mark |
|                 | (i) full / complete<br>ignore saturated        |        | (1)  |
|                 | (ii) unreactive/inert/do not undergo reactions |        | (1)  |
|                 | <b>Notes</b>                                   |        |      |

**Total 10 marks**

| Question Number | Question   |                            |      |
|-----------------|--|----------------------------|------|
| 3               | (a)  |                            |      |
|                 | Acceptable Answers   | Reject                     | Mark |
|                 | zinc is less reactive than magnesium<br>Magnesium is more reactive than Zinc<br><b>Notes</b><br>Or correct reference to positions in reactivity series | <u>It</u> is more reactive | (1)  |

| Question Number | Question  |        |            |
|-----------------|---|--------|------------|
| 3               | (b)   |        |            |
|                 | Acceptable Answers  | Reject | Mark       |
|                 | (i) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$<br>reagents<br>products<br><br><b>Notes</b><br>incorrect balancing = -1<br>be generous with cases |        | (1)<br>(1) |
|                 | (ii) (dark) grey (1) to pink-brown (1)<br>blue (1) to green (1)<br><br><b>Notes</b><br>Ignore additional information  |        | (2)<br>(2) |

| Question Number | Question  |                         |            |
|-----------------|---|-------------------------|------------|
| 3               | (c)   |                         |            |
|                 | Acceptable Answers  | Reject                  | Mark       |
|                 | hydrogen more reactive than copper<br>hydrogen less reactive than iron<br><br><b>Notes</b><br>Hydrogen between Fe + Cu for both marks | Iron(II) or Copper (II) | (1)<br>(1) |

**Total 9 marks**

| Question Number | Question  |        |            |
|-----------------|---|--------|------------|
| 4               | (a)   |        |            |
|                 | Acceptable Answers  | Reject | Mark       |
|                 | (i) shared electron pair<br>all other electrons correct (ignore inner shells even if wrong) |        | (1)<br>(1) |
|                 | (ii) bottom box crossed<br><br><b>Notes</b>   |        | (1)        |

| Question Number | Question  |        |      |
|-----------------|---|--------|------|
| 4               | (b)   |        |      |
|                 | Acceptable Answers  | Reject | Mark |
|                 | same number of electrons / same electronic configurations<br>'Same protons' negates<br><b>Notes</b> |        | (1)  |

| Question Number | Question  |  |                       |
|-----------------|---|--|-----------------------|
| 4               | (c)   |  |                       |
|                 | Acceptable Answers  | Reject                                       | Mark                  |
|                 | add sodium hydroxide (solution)/ammonia solution/ ammonium hydroxide<br>green ppt/solid/suspension<br>Orange/brown/orange-brown/foxy<br>brown/rusty brown/red-brown ppt/<br>solid/suspension<br><b>Notes</b><br>If miss out ppt then give 1 mark for 2 correct colours<br>result marks only given if test correct | Powder/crystals/bits<br><br>Orange/rusty/red | (1)<br><br>(1)<br>(1) |

**Total 7 marks**

| Question Number | Question  |        |                   |
|-----------------|---|--------|-------------------|
| 5               | (a)   |        |                   |
|                 | Acceptable Answers  | Reject | Mark              |
|                 | (X) chlorine / Cl <sub>2</sub><br>(Y) sodium / Na<br>(Z) aluminium / Al<br><br><b>Notes</b> |        | (1)<br>(1)<br>(1) |

| Question Number | Question                                |        |      |
|-----------------|---|--------|------|
| 5               | (b)                                     |        |      |
|                 | Acceptable Answers                      | Reject | Mark |
|                 | Y and Z / Na and Al<br><br><b>Notes</b> |        | (1)  |

| Question Number | Question                   |        |      |
|-----------------|----------------------------|--------|------|
| 5               | (c)                        |        |      |
|                 | Acceptable Answers         | Reject | Mark |
|                 | yellow<br><br><b>Notes</b> |        | (1)  |

| Question Number | Question                 |        |
|-----------------|--------------------------|--------|
| 5               | (d)                      |        |
|                 | Acceptable Answers       | Reject |
|                 | burns with a squeaky pop |        |
|                 | Notes                    |        |
|                 |                          | (1)    |

| Question Number | Question                        |        |
|-----------------|---------------------------------|--------|
| 5               | (e)                             |        |
|                 | Acceptable Answers              | Reject |
|                 | (products) $Z_2(SO_4)_3 + H_2O$ |        |
|                 | (balancing) - 3 - 3             |        |
|                 | Notes                           |        |
|                 |                                 | (1)    |
|                 |                                 | (1)    |

Total 8 marks

| Question Number | Question           |        |
|-----------------|--------------------|--------|
| 6               | (a)                |        |
|                 | Acceptable Answers | Reject |
|                 | $C_nH_{2n+2}$      |        |
|                 | Notes              |        |
|                 |                    | (1)    |

| Question Number | Question   |        |
|-----------------|--|--------|
| 6               | (b)  |        |
|                 | Acceptable Answers   | Reject |
|                 | similar chemical properties / same functional group<br>gradation in physical properties<br>neighbouring members differ by $CH_2$ |        |
|                 | Notes<br>Max 2   |        |
|                 |  | (2)    |

| Question Number | Question                            |        |
|-----------------|-------------------------------------|--------|
| 6               | (c)                                 |        |
|                 | Acceptable Answers                  | Reject |
|                 | no double bonds / only single bonds |        |
|                 | Notes                               |        |
|                 |                                     | (1)    |

| Question Number | Question                                       |        |
|-----------------|--|--------|
| 6               | (d)  |        |
|                 | Acceptable Answers                             | Reject |
|                 | contains oxygen / not just carbon and hydrogen |        |
|                 | Notes  | (1)    |

| Question Number | Question   |      |
|-----------------|--|------|
| 6               | (e)  |      |
|                 | Acceptable Answers   | Mark |
|                 | $  \begin{array}{ccccccccc}  & \text{H} & \text{H} & & \text{H} & \text{H} & & \text{H} & \text{H} \\  &   &   & &   &   & &   &   \\  \text{H} & - \text{C} & - \text{C} & - & \text{C} & - \text{C} & - & \text{C} & - \text{H} \\  &   &   & &   &   & &   &   \\  & \text{H} & \text{H} & & \text{H} & \text{H} & & \text{H} & \text{H}  \end{array}  $ <p style="text-align: right;">pentane</p><br>$  \begin{array}{ccccccc}  & \text{H} & \text{H} & & \text{H} & & \text{H} \\  &   &   & &   & &   \\  \text{H} & - \text{C} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  &   &   & &   & &   \\  & \text{H} & \text{CH}_3 & & \text{H} & & \text{H}  \end{array}  $ <p style="text-align: right;">(2-)methylbutane</p><br>$  \begin{array}{ccccccc}  & \text{H} & & \text{CH}_3 & & \text{H} & \\  &   & &   & &   & \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  &   & &   & &   & \\  & \text{H} & & \text{CH}_3 & & \text{H} &   \end{array}  $ <p style="text-align: right;">(2,2-)dimethylpropane</p><br>Notes<br>(any two structures and matching names for 1 each) | (4)  |

Total 9 marks

| Question Number | Question                     |            |
|-----------------|------------------------------|------------|
| 7               | (a)                          |            |
|                 | Acceptable Answers           | Reject     |
|                 | ammonia<br>hydrogen chloride |            |
|                 | Notes                        | (1)<br>(1) |

| Question Number | Question  |        |
|-----------------|---|--------|
| 7               | (b)   |        |
|                 | Acceptable Answers  | Reject |
|                 | (i) ammonia   |        |
|                 | (ii) $\text{NH}_4^+$  |        |
|                 | (iii) $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$ |        |
|                 | reactants   |        |
|                 | products  |        |
|                 | Notes   |        |
|                 |   | Mark   |
|                 |   | (1)    |
|                 |   | (1)    |
|                 |   | (1)    |
|                 |   | (1)    |

| Question Number | Question                                       |        |
|-----------------|--|--------|
| 7               | (c)  |        |
|                 | Acceptable Answers                             | Reject |
|                 | (i) silver chloride                            |        |
|                 | (ii) $\text{Cl}^-$                             |        |
|                 | (iii) (products)                               |        |
|                 | (state symbols)      aq      aq      s      aq |        |
|                 |  |        |
|                 | Notes  |        |
|                 |  | Mark   |
|                 |  | (1)    |
|                 |  | (1)    |
|                 |  | (1)    |
|                 |  | (1)    |

Total 10 marks

| Question Number | Question           |        |
|-----------------|--------------------|--------|
| 8               | (a)                |        |
|                 | Acceptable Answers | Reject |
|                 | 2,7                |        |
|                 | 2.8                |        |
|                 | Notes              |        |
|                 |                    | Mark   |
|                 |                    | (1)    |
|                 |                    | (1)    |

| Question Number | Question                              |        |
|-----------------|---------------------------------------|--------|
| 8               | (b)                                   |        |
|                 | Acceptable Answers                    | Reject |
|                 | (ion) 2 and 8 • or × shown on diagram |        |
|                 | 2+ shown                              |        |
|                 | Notes                                 |        |
|                 |                                       | Mark   |
|                 |                                       | (1)    |
|                 |                                       | (1)    |



| Question Number | Question                                  |        |            |
|-----------------|---|--------|------------|
| <b>8</b>        | <b>(c)</b>                                |        |            |
|                 | Acceptable Answers                        | Reject | Mark       |
|                 | F <sub>2</sub> / fluorine gains electrons |        | (1)<br>(1) |
|                 | <b>Notes</b>                              |        |            |

| Question Number | Question   |        |      |
|-----------------|--|--------|------|
| <b>8</b>        | <b>(d)</b>   |        |      |
|                 | Acceptable Answers                                   | Reject | Mark |
|                 | positive and negative ions / oppositely charged ions |        | (1)  |
|                 | <b>Notes</b>   |        |      |

| Question Number | Question  |        |            |
|-----------------|---|--------|------------|
| <b>8</b>        | <b>(e)</b>  |        |            |
|                 | Acceptable Answers  | Reject | Mark       |
|                 | fluorine (molecules) attracted by (weak) intermolecular forces which are (much) weaker than ionic bonds/bonds in MgF <sub>2</sub> |        | (1)<br>(1) |
|                 | <b>Notes</b>  |        |            |

| Question Number | Question  |        |            |
|-----------------|---|--------|------------|
| <b>8</b>        | <b>(f)</b>  |        |            |
|                 | Acceptable Answers  | Reject | Mark       |
|                 | (i) $100 - (78.6 + 10.1) = 11.3$  |        | (1)        |
|                 | (ii) $(24 \times 0.786) + (25 \times 0.101) + (26 \times .113)$<br>$= 24.3$ |        | (1)<br>(1) |
|                 | <b>Notes</b>  |        |            |

**Total 12 marks**

| Question Number | Question   |        |
|-----------------|--|--------|
| 9               | (a)  |        |
|                 | Acceptable Answers   | Reject |
|                 | decreases                      increases<br>increases                      no change |        |
|                 | <b>Notes</b>   |        |
|                 |  | (4)    |

| Question Number | Question   |   |
|-----------------|--|---|
| 9               | (b)  |   |
|                 | Acceptable Answers   | Reject                                      |
|                 | rate increases<br>(reactant) particles closer together/more particles in given volume<br>molecules/particles collide more frequently/ more collisions per second | Rate same/rate decreases = 0/3<br><br>atoms |
|                 | <b>Notes</b><br>If no mention of particles/molecules<br>max 1 for explanation  | (1)<br>(1)<br>(1)                           |

| Question Number | Question                         |            |
|-----------------|----------------------------------|------------|
| 9               | (c)                              |            |
|                 | Acceptable Answers               | Reject     |
|                 | recycled / put back into reactor | Used again |
|                 | <b>Notes</b>                     | (1)        |

| Question Number | Question   |                   |
|-----------------|--|-------------------|
| 9               | (d)  |                   |
|                 | Acceptable Answers   | Reject            |
|                 | (i) oxidation / redox/ accept exothermic   |                   |
|                 | (ii) $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$<br>all formulae correct<br>balancing | (1)<br>(1)<br>(1) |
|                 | <b>Notes</b>   |                   |

| Question Number | Question                        |        |            |
|-----------------|---------------------------------|--------|------------|
| <b>9</b>        | <b>(e)</b>                      |        |            |
|                 | Acceptable Answers              | Reject | Mark       |
|                 | NH <sub>4</sub> NO <sub>3</sub> |        | <b>(1)</b> |
|                 | <b>Notes</b>                    |        |            |

| Question Number | Question                |           |                          |
|-----------------|-------------------------|-----------|--------------------------|
| <b>9</b>        | <b>(f)</b>              |           |                          |
|                 | Acceptable Answers      | Reject    | Mark                     |
|                 | phosphorus<br>potassium | Phosphate | <b>(1)</b><br><b>(1)</b> |
|                 | <b>Notes</b>            |           |                          |

**Total 14 marks**

| Question Number | Question   |        |            |
|-----------------|--|--------|------------|
| <b>10</b>       | <b>(a)</b>   |        |            |
|                 | Acceptable Answers   | Reject | Mark       |
|                 | nitric acid<br>$\text{KOH} + \text{HNO}_3 \rightarrow \text{KNO}_3 + \text{H}_2\text{O}$ |        | (1)<br>(1) |
|                 | Notes  |        |            |

| Question Number | Question  |        |            |
|-----------------|---|--------|------------|
| <b>10</b>       | <b>(b)</b>  |        |            |
|                 | Acceptable Answers  | Reject | Mark       |
|                 | (i) $(\text{K}_2\text{O}) \quad M_r = 94$<br>$(\text{KOH}) \quad M_r = 56$  |        | (1)<br>(1) |
|                 | (ii) $(18.8 \div 94 = 0.20 \text{ mol})$<br>$(0.20 \times 2 \times 56 =) 22(.4) \text{ (g)}$<br>(answer of 11(.2) scores 1) |        | (1)<br>(1) |
|                 | Notes   |        |            |

| Question Number | Question  |        |      |
|-----------------|---|--------|------|
| <b>10</b>       | <b>(c)</b>  |        |      |
|                 | Acceptable Answers  | Reject | Mark |
|                 | $\text{RbOH} + \text{HCl} \rightarrow \text{RbCl} + \text{H}_2\text{O}$ |        | (1)  |
|                 | Notes   |        |      |

**Total 7 marks**

**Paper total 90 marks**