

# Mark Scheme (Results) January 2011

GCE

GCE Chemistry (6CH07/01)

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| Question Number | Acceptable Answers                                                                                                                                                                         | Reject                                          | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------|
| 1 (a) (i)       | Sodium hydroxide (solution) / NaOH(aq) / NaOH<br>Potassium hydroxide (solution) / KOH(aq) / KOH<br><br>Allow calcium hydroxide (solution) / Ca(OH) <sub>2</sub> (aq) / Ca(OH) <sub>2</sub> | Alkali<br>Aqueous ammonia<br>Ammonium hydroxide | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Reject                                                                                                           | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------|
| 1 (a) (ii)      | <b>Observation:</b> White precipitate (or ppt or ppte)<br>Allow white solid / suspension (1)<br><br><b>Inference:</b> any two valid ions gain both marks<br><br>Sulfate or sulfate(VI) or sulphate or sulphate(VI) or SO <sub>4</sub> <sup>2-</sup> (1)<br><br>Carbonate or CO <sub>3</sub> <sup>2-</sup> (1)<br><br>Allow hydrogensulfate / hydrogensulfate(VI) / hydrogensulphate / hydrogensulphate(VI) / HSO <sub>4</sub> <sup>-</sup><br><br>Allow hydrogencarbonate / HCO <sub>3</sub> <sup>-</sup><br><br>If a formula is used charge must be correct<br>Ignore 'barium' | (solution) goes cloudy<br><br>Incorrect oxidation number if used<br><br>hydrogensulfite (or hydrogensulfate(IV)) | 3    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                                                                                                                                                                 | Reject                                                                                              | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------|
| 1 (a) (iii)     | (Gas evolved) was pungent / acrid or turned (orange) potassium dichromate / dichromate(VI) / K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> green / blue<br>Allow dichromate (etc) ions / Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> or decolorized potassium manganate(VII) / permanganate (allow potassium manganate) / KMnO <sub>4</sub><br>Allow manganate(VII) (etc) ions / MnO <sub>4</sub> <sup>-</sup><br><br>Allow turns blue litmus red | Steamy fumes<br>Was acidic / sulfur dioxide / SO <sub>2</sub><br>Incorrect oxidation number if used | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                             | Reject                             | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------|
| 1 (a) (iv)      | With HCl(g) (allow HCl) / conc HCl on a glass rod or stopper or open bottle (1)<br>White fumes / smoke (1)<br>Observation mark <b>not</b> stand alone but award for a near miss (e.g. 'add (conc.) HCl(aq)')<br>No TE on a forbidden test (indicators / smell) | Add conc HCl<br><br>Steamy / misty | 2    |

| Question Number | Acceptable Answers                      | Reject             | Mark |
|-----------------|-----------------------------------------|--------------------|------|
| 1 (b) (i)       | Calcium (ion) or $\text{Ca}^{2+}$ (ion) | Ca / $\text{Ca}^+$ | 1    |

| Question Number | Acceptable Answers          | Reject | Mark |
|-----------------|-----------------------------|--------|------|
| 1 (b) (ii)      | Pink<br>Allow red or purple |        | 1    |

| Question Number | Acceptable Answers                                                                                                 | Reject                             | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------|------------------------------------|------|
| 1 (b) (iii)     | Nitrogen dioxide or or nitrogen(IV) oxide or $\text{NO}_2$<br>Allow dinitrogen tetroxide or $\text{N}_2\text{O}_4$ | Incorrect oxidation number if used | 1    |

| Question Number | Acceptable Answers     | Reject | Mark |
|-----------------|------------------------|--------|------|
| 1 (b) (iv)      | Oxygen or $\text{O}_2$ | O      | 1    |

| Question Number | Acceptable Answers                       | Reject                                                      | Mark |
|-----------------|------------------------------------------|-------------------------------------------------------------|------|
| 1 (b) (v)       | Nitrate or nitrate(V) or $\text{NO}_3^-$ | Incorrect oxidation number if used<br>Incorrect / no charge | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                       | Reject                                                             | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------|
| 1 (b) (vi)      | $\text{Ca}(\text{NO}_3)_2$ (1)<br>$\text{H}_2\text{O}$ (1) or $\text{Ca}(\text{NO}_3)_2 \cdot \text{H}_2\text{O}$ (2)<br>If this formula is correct, ignore incorrect formula / charge in 1(b)(v)<br>TE on a name or <b>correct</b> formula from 1(b)(v) | Name<br>$\text{H}_2\text{O}$ with no attempt at a compound formula | 2    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Reject                                                                                                      | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------|
| 2 (a)           | <p><b>Test</b><br/>Add <math>\text{PCl}_5</math> or phosphorus pentachloride or phosphorus(V) chloride (1) Ignore heat</p> <p><b>Result</b><br/>Steamy or misty fumes or fumes which turn litmus or UI red (1)<br/>Allow white fumes</p> <p><b>OR</b></p> <p><b>Test</b><br/>Add sodium (1)</p> <p><b>Result</b><br/>Effervescence / gas which pops with a lighted splint (1)</p> <p><b>OR</b></p> <p><b>Test</b><br/>Add named carboxylic acid and sulfuric / hydrochloric acid (1)</p> <p><b>Result</b><br/>Sweet / pear drops / glue smell (1)</p> <p>Observation marks <b>not</b> stand alone</p> <p>Allow oxidizing agents (max 1)</p> <p><b>Test</b><br/>Add acidified (potassium) dichromate / dichromate(VI)</p> <p><b>Result</b><br/>orange to / turns green/blue</p> <p><b>OR</b></p> <p><b>Test</b><br/>Add acidified (potassium) manganate(VII) or permanganate<br/>Allow acidified potassium manganate</p> <p><b>Result</b><br/>Purple to / turns colourless or decolorized</p> | <p><math>\text{PCl}_3</math><br/><math>\text{PCl}_5</math> solution</p> <p>White smoke<br/>HCl observed</p> | 2    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reject | Mark |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| 2 (b)           | <p>Elimination (1)<br/>Allow dehydration</p> <p><b>Test</b><br/>Bromine (water /organic solvent) (1)<br/><b>Result</b><br/>(Orange or red-brown or brown or yellow to) /turns colourless or decolorized (1)<br/>Ignore clear</p> <p><b>Test</b><br/>Acidified potassium manganate (VII) or permanganate (1)<br/>Allow acidified potassium manganate<br/><b>Result</b><br/>(Purple to) /turns colourless or decolorized (1)</p> <p><b>Test</b><br/>Alkaline potassium manganate (VII) or permanganate (1)<br/>Allow acidified potassium manganate<br/><b>Result</b><br/>(Purple to) brown (ppt) or turns green (1)</p> |        | 3    |

| Question Number  | Acceptable Answers                                                                                                                                                                                                                                                          | Reject | Mark     |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|
| <b>3 (a) (i)</b> | Gas syringe <b>(2)</b> (cylinder & plunger reasonably distinct)<br>or<br>Collection over water <b>(1)</b> <b>graduated</b> collection vessel <b>(1)</b><br>Max (1) if gaps in apparatus or if delivery tube goes straight through the walls of trough and collection vessel |        | <b>2</b> |

| Question Number  | Acceptable Answers                                                                                                     | Reject | Mark     |
|------------------|------------------------------------------------------------------------------------------------------------------------|--------|----------|
| <b>3 (b) (i)</b> | 5 points correctly plotted <b>(1)</b><br>8 or 9 points correctly plotted <b>(2)</b><br>Smooth best fit line <b>(1)</b> |        | <b>3</b> |

| Question Number   | Acceptable Answers                                                                                                   | Reject | Mark     |
|-------------------|----------------------------------------------------------------------------------------------------------------------|--------|----------|
| <b>3 (b) (ii)</b> | 29.0/20 (= 1.45)<br>= 1.5 <b>(1)</b> cm <sup>3</sup> s <sup>-1</sup> or cm <sup>3</sup> /s <b>(1)</b><br>(2 SF only) |        | <b>2</b> |

| Question Number    | Acceptable Answers                                                                             | Reject | Mark     |
|--------------------|------------------------------------------------------------------------------------------------|--------|----------|
| <b>3 (b) (iii)</b> | Initial rate faster / higher / line steeper <b>(1)</b><br>Final gas volume the same <b>(1)</b> |        | <b>2</b> |

| Question Number   | Acceptable Answers                                                                                                                                                                                                                                                                                                        | Reject                                                                                 | Mark     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------|
| <b>3 (b) (iv)</b> | Amount of H <sub>2</sub> O <sub>2</sub> & therefore volume /amount of O <sub>2</sub> remains the same <b>(1)</b> (both points needed)<br>Greater surface area (of MnO <sub>2</sub> ) <b>(1)</b><br>Results in more (frequent) collisions (between H <sub>2</sub> O <sub>2</sub> molecules & MnO <sub>2</sub> ) <b>(1)</b> | No consequential marking<br>'smaller pieces' or fine powder (for greater surface area) | <b>3</b> |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                 | Reject               | Mark     |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------|
| <b>3 (c)</b>    | Weigh <b>(1)</b> filter <b>(1)</b> dry <b>(1)</b> and re-weigh <b>(1)</b> the catalyst<br>Allow evaporation of H <sub>2</sub> O <sub>2</sub> / H <sub>2</sub> O for filter mark<br>Repeat experiment using fresh H <sub>2</sub> O <sub>2</sub> <b>(1)</b><br>Rate is the same / similar <b>(1)</b> | Just 'mass constant' | <b>4</b> |

| Question Number | Acceptable Answers                           | Reject             | Mark |
|-----------------|----------------------------------------------|--------------------|------|
| 4 (a)           | Burette or pipette<br>Allow volumetric flask | Measuring cylinder | 1    |

| Question Number | Acceptable Answers                                                                                                | Reject | Mark |
|-----------------|-------------------------------------------------------------------------------------------------------------------|--------|------|
| 4 (b)           | Bromine volatile or low boiling point or evaporates easily<br>Or<br>To ensure that the bromine does not evaporate |        | 1    |

| Question Number | Acceptable Answers                                                    | Reject           | Mark |
|-----------------|-----------------------------------------------------------------------|------------------|------|
| 4 (c)           | Reaction is exothermic or gives off heat (allow reaction is vigorous) | Reaction is fast | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                       | Reject | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| 4 (d)           | Round or pear-shaped flask with some attempt at a vertical condenser (1)<br>Correct <b>vertical</b> condenser (1)<br>Working reflux apparatus (heat, correct water flow, no stopper, no gaps, apparatus not one piece) (1)<br>Ignore use of a Bunsen burner<br><u>Fully</u> correct distillation (1) max |        | 3    |

| Question Number | Acceptable Answers                                                                                                                                                                                                       | Reject | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| 4 (e)           | Product / bromoethane is volatile or has a low boiling point or evaporates easily<br>Allow<br>To prevent evaporation of the bromoethane<br>Or<br>Bromoethane boils at 38.4 (°C)<br>Or<br>To ensure bromoethane is liquid |        | 1    |

| Question Number | Acceptable Answers                                                                                                      | Reject | Mark |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|--------|------|
| 4 (f) (i)       | Neutralize the (phosphoric) <b>acid</b> / <b>bromine</b><br>Allow react with or remove the <b>acid</b> / <b>bromine</b> |        | 1    |

| Question Number | Acceptable Answers              | Reject      | Mark |
|-----------------|---------------------------------|-------------|------|
| 4 (f) (ii)      | Drying agent or to remove water | Dehydration | 1    |

| Question Number | Acceptable Answers                                       | Reject               | Mark |
|-----------------|----------------------------------------------------------|----------------------|------|
| 4 (g)           | From: 35, 36, 37 or 38 (°C)<br>To: 39, 40, 41 or 42 (°C) | Fractions of degrees | 1    |

| Question Number | Acceptable Answers                                                   | Reject             | Mark |
|-----------------|----------------------------------------------------------------------|--------------------|------|
| 4 (h) (i)       | $10 \times 0.789 / 46 (=0.17152) = 0.172$<br>(ignore sf except 1 sf) | incorrect rounding | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                      | Reject | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| 4 (h) (ii)      | $0.17152 \times 109 = 18.6959 = 18.7$ (g)<br>$0.172 \times 109 = 18.748 = 18.7$ (g)<br>$0.17 \times 109 = 18.53 = 18.5$ (g)<br><br>ECF on 4 (h)(i)<br>Allow use of 108.9 (from periodic table)<br>If $M_r$ values transposed in 4hi) and 4hii) (mass = 3.33 g) penalise once<br>(ignore sf except 1 sf) |        | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                                                                                                                                               | Reject        | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|
| 4 (h) (iii)     | $100 \times 13.3 / 18.7 = 71.123 = 71.1$ (%)<br>$100 \times 13.3 / 18.5 = 71.8919 = 71.9$ (%)<br><br>Or using moles:<br>Moles of $C_2H_5Br$ formed = $13.3 / 109 = 0.12202$<br>Yield = $100 \times 0.12202 / 0.17152 = 71.123 = 71.1$ (%)<br><br>Final answer = 71.1% if all values in calculator<br>ECF on 4 (h)(ii)<br>(ignore sf except 1 sf) | Yield > 100 % | 1    |

| Question Number | Acceptable Answers                                    | Reject                   | Mark |
|-----------------|-------------------------------------------------------|--------------------------|------|
| 4 (h) (iv)      | Bromine is in excess or<br>All the ethanol is used up | Ethanol limiting reagent | 1    |

| Question Number | Acceptable Answers                                                                                                                                                                                                              | Reject                                                                                                                                                                | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4 (h)(v)        | Transfer losses or handling losses or specific examples of these (e.g. some product remains in the aqueous layer during separation or in the flask during distillation.<br>Reaction incomplete or<br>Side / competing reactions | Just 'lost'<br>Handling errors<br>Evaporation<br>Equilibrium<br><u>Named</u> other products of this reaction formed (i.e. phosphoric acid or water)<br>Waste products | 1    |

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