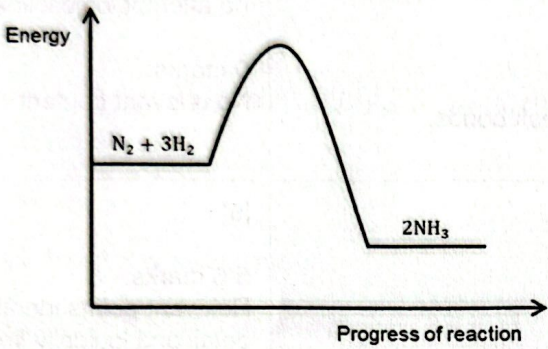
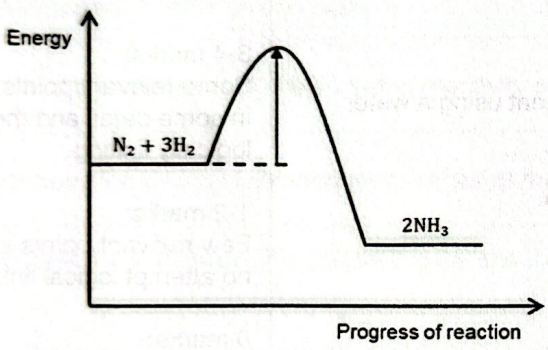
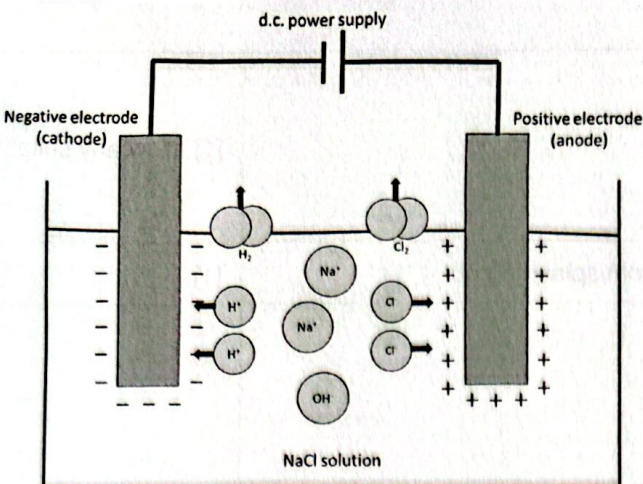


**SOLUTIONS: Chemistry Paper 1H**

|              |                                                                                                                                                                                                                       |                                             |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>0 1.1</b> | To reduce energy/heat lost to the surroundings                                                                                                                                                                        | [1]                                         |
| <b>0 1.2</b> | Any 2 from: <ul style="list-style-type: none"><li>• 25 cm<sup>3</sup>/amount of sodium hydroxide solution</li><li>• Concentration of sodium hydroxide solution</li><li>• Concentration of hydrochloric acid</li></ul> | [2] 1 mark per point                        |
| <b>0 1.3</b> | Highest temperature = 20.2 + 4.0                                                                                                                                                                                      | [1]                                         |
|              | 24.2 (°C)                                                                                                                                                                                                             | [1] an answer of 24.2 scores 2 marks        |
| <b>0 1.4</b> | $X = \frac{10.1+10.6+10.3+10.6}{4}$                                                                                                                                                                                   | [1]                                         |
|              | X = 10.4 (°C)                                                                                                                                                                                                         | [1] an answer of 10.4 scores 2 marks        |
| <b>0 1.5</b> | As the volume of hydrochloric acid increases, the temperature change increases.                                                                                                                                       | [1]                                         |
| <b>0 1.6</b> | Exothermic                                                                                                                                                                                                            | [1]                                         |
|              | The temperature change is positive<br>or<br>The temperature goes up / increases                                                                                                                                       | [1] allow they are neutralisation reactions |
| <b>0 1.7</b> | Use metal instead of hydrochloric acid                                                                                                                                                                                | [1]                                         |
|              | Repeat using different metals shown in the reactivity series                                                                                                                                                          | [1]                                         |
|              | Compare/order the (mean) temperature changes of the metals                                                                                                                                                            | [1]                                         |
|              | The more reactive the metal, the greater the temperature change<br>or<br>The metals with the greater temperature change are more reactive                                                                             | [1]                                         |
| <b>0 2.1</b> | Water, methane                                                                                                                                                                                                        | [1] lose mark if more boxes ticked          |
| <b>0 2.2</b> | Delocalised electrons                                                                                                                                                                                                 | [1]                                         |
|              | Carry electrical charge through structure                                                                                                                                                                             | [1]                                         |
| <b>0 2.3</b> | A mixture of 2 (or more) metals<br>or<br>A mixture of a metal and another element                                                                                                                                     | [1]                                         |
| <b>0 2.4</b> | An alloy would be harder / pure iron is soft                                                                                                                                                                          | [1]                                         |
| <b>0 2.5</b> | $\frac{9}{10} \times 100$                                                                                                                                                                                             | [1]                                         |
|              | 90 (%)                                                                                                                                                                                                                | [1] an answer of 90 scores 2 marks          |
|              |                                                                                                                                                                                                                       |                                             |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                           |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 2.6 | <p>Indicative content:</p> <p>Water:</p> <ul style="list-style-type: none"> <li>• Exists as simple molecules.</li> <li>• Weak intermolecular forces between molecules.</li> <li>• Small amount of energy needed to overcome forces.</li> <li>• So lowers melting point.</li> </ul> <p>Sodium chloride:</p> <ul style="list-style-type: none"> <li>• Sodium chloride is a giant ionic lattice.</li> <li>• Electrostatic forces of attraction between oppositely charged ions.</li> <li>• Many strong ionic bonds.</li> <li>• Large amount of energy required to break bonds/forces.</li> <li>• So middle melting point.</li> </ul> <p>Diamond:</p> <ul style="list-style-type: none"> <li>• Diamond exists as giant molecules.</li> <li>• Many strong covalent bonds between atoms.</li> <li>• A very large amount of energy required to break bonds.</li> <li>• So highest melting point.</li> </ul> | <p>[6]</p> <p>5-6 marks:<br/>Relevant points identified, given in detail and logically linked</p> <p>3-4 marks:<br/>Some relevant points identified, given in some detail and there are attempts at logically linking</p> <p>1-2 marks:<br/>Few relevant points simply stated, with no attempt logical linking</p> <p>0 marks:<br/>No relevant content</p>                |
| 0 3.1 | <p>Indicative content:</p> <ul style="list-style-type: none"> <li>• Place hydrochloric acid in a beaker.</li> <li>• Add copper oxide one spatula at a time.</li> <li>• Until no more reacts / base is in excess.</li> <li>• Filter excess copper oxide to get salt solution.</li> <li>• Filter using filter paper and funnel.</li> <li>• Pour solution into an evaporating basin and heat using a water bath.</li> <li>• Stop heating when crystals start to form.</li> <li>• Allow water to evaporate until crystals remain.</li> <li>• Dry crystals using warm oven / paper towels.</li> </ul> <p>Safety:</p> <ul style="list-style-type: none"> <li>• Wear eye protection.</li> </ul>                                                                                                                                                                                                             | <p>[6]</p> <p>5-6 marks:<br/>Relevant points identified, given in detail and logically linked. Safety required for top of bracket.</p> <p>3-4 marks:<br/>Some relevant points identified, given in some detail and there are attempts at logically linking.</p> <p>1-2 marks:<br/>Few relevant points simply stated, with no attempt logical linking.</p> <p>0 marks:</p> |
| 0 3.2 | Strength is the proportion of the acid molecules that ionise in water                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [1]                                                                                                                                                                                                                                                                                                                                                                       |
|       | Concentration is the total number of dissolved acid molecules (per unit volume)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | [1]                                                                                                                                                                                                                                                                                                                                                                       |
| 0 4.1 | Ammonia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [1]                                                                                                                                                                                                                                                                                                                                                                       |
| 0 4.2 | <p>Bonds broken:</p> <p>1 × (N ≡ N)</p> <p>3 × (H – H)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [1]                                                                                                                                                                                                                                                                                                                                                                       |
|       | <p>Bonds formed:</p> <p>6 × (N – H)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [1]                                                                                                                                                                                                                                                                                                                                                                       |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                           |

|       |                                                                                          |                                                                                                                                                      |
|-------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 4.3 | Energy required to break original bonds:<br>$941 + 3 \times 436 = 2249 \text{ (kJ/mol)}$ | [1]                                                                                                                                                  |
|       | Energy required to make new bonds:<br>$6 \times 391 = 2346 \text{ (kJ/mol)}$             | [1]                                                                                                                                                  |
|       | Energy change = $2249 - 2346 = -97 \text{ (kJ/mol)}$                                     | [1] negative sign required for mark or indication of direction, e.g. less An answer of $-97$ scores 3 marks                                          |
| 0 4.4 | Exothermic                                                                               | [1]                                                                                                                                                  |
|       | (because) the energy change is negative                                                  | [1] allow more energy when making bonds than breaking                                                                                                |
| 0 4.5 |         | [3] 1 mark for correct axes<br>1 mark for correct energy levels of reactants and products<br>1 mark for correct shape linking reactants and products |
| 0 4.6 |        | [1]                                                                                                                                                  |
| 0 5.1 | A liquid or solution                                                                     | [1]                                                                                                                                                  |
|       | That can conduct electricity / contains freely moving ions                               | [1] allow molten/dissolved ionic compound for 2 marks                                                                                                |
| 0 5.2 | So they don't react with the electrolyte                                                 | [1]                                                                                                                                                  |
| 0 5.3 | (because) sodium is more reactive than hydrogen                                          | [1]                                                                                                                                                  |
| 0 5.4 | $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$                                       | [1]                                                                                                                                                  |
|       | $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$                                     | [1]                                                                                                                                                  |
|       |                                                                                          |                                                                                                                                                      |

|       |                                                                                  |                                                                                                                                                                                                                                                                                                                                                              |
|-------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 5.5 |  | <p>[4]</p> <p>1 mark for diagram showing d.c. supply (with correct orientation) connected to electrodes</p> <p>1 mark for electrodes named or labelled with – and + symbols respectively</p> <p>1 mark for H<sup>+</sup>, H<sub>2</sub>, Cl<sup>–</sup> and Cl<sub>2</sub> shown in correct position</p> <p>1 mark for Na<sup>+</sup> and OH<sup>–</sup></p> |
| 0 6.1 | carbon dioxide                                                                   | [1]                                                                                                                                                                                                                                                                                                                                                          |
| 0 6.2 | $\frac{800 - 400}{2.5 - 1.25}$                                                   | [1] calculation of gradient                                                                                                                                                                                                                                                                                                                                  |
|       | 320                                                                              | [1] allow answer in range 315 – 335 for 2 marks                                                                                                                                                                                                                                                                                                              |
|       | cm <sup>3</sup> /g or cm <sup>3</sup> g <sup>–1</sup>                            | [1]                                                                                                                                                                                                                                                                                                                                                          |
| 0 6.3 | 0.75 g at 240 cm <sup>3</sup>                                                    | [1] mass found from reading off graph (allow any suitable reading)                                                                                                                                                                                                                                                                                           |
|       | 24 dm <sup>3</sup> = 24000 cm <sup>3</sup><br>24000 ÷ 240 = 100 times            | [1] conversion and calculation to find multiplier                                                                                                                                                                                                                                                                                                            |
|       | 0.75 × 100                                                                       | [1]                                                                                                                                                                                                                                                                                                                                                          |
|       | 75                                                                               | [1] allow answer in range 70 – 80 for 4 marks<br>Accept method using answer from 0 6.2                                                                                                                                                                                                                                                                       |
| 0 6.4 | M <sub>r</sub> of K <sub>2</sub> O = (39 × 2) + 16 = 94                          | [1]                                                                                                                                                                                                                                                                                                                                                          |
|       | (K) $\frac{117}{39} = 3$ moles                                                   | [1]                                                                                                                                                                                                                                                                                                                                                          |
|       | (K <sub>2</sub> O) $\frac{2}{4} \times 3 = 1.5$ moles                            | [1]                                                                                                                                                                                                                                                                                                                                                          |
|       | mass of K <sub>2</sub> O = 1.5 × 94                                              | [1]                                                                                                                                                                                                                                                                                                                                                          |
|       | 141 (g)                                                                          | [1] an answer of 141 scores 5 marks<br>Accept alternative methods of arriving at correct answer                                                                                                                                                                                                                                                              |
|       |                                                                                  |                                                                                                                                                                                                                                                                                                                                                              |