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1 (a) (i) propanol (1) [1]
   (ii) catalyst/speeds up reaction (1) [1]
   (iii) displayed formula of propene (1) [1]

   (b) (aqueous) bromine (1)
       (turns) colourless/decolourises (1) [2]

   (c) (i) carbon dioxide (1)
       limewater turns milky/limewater forms a white precipitate (1) [2]
   (ii) \(2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O\)
       species (1) balancing (1) [2]

[Total: 9]

2 (a) hydrogen (1)
   lighted splint pops/pops in a flame (1) [2]

   (b) (i) chlorine (1) [1]
   (ii) \(2Cl^- \rightarrow Cl_2 + 2e^-\) or \(2Cl^- - 2e^- \rightarrow Cl_2\) (1) [1]

   (c) (i) oxygen (1)
       glowing splint relights (1) [2]
   (ii) \(4OH^- \rightarrow 2H_2O + O_2 + 4e^-\) or \(4OH^- - 4e^- \rightarrow 2H_2O + O_2\) (1) [1]

[Total: 7]

3 (b) [Total: 1]

4 (b) [Total: 1]

5 (d) [Total: 1]
6 (a) 3.43 (g) (1)

(b) volumetric flask/standard flask/graduated flask (1)

(c) (i) pipette (1)

(ii) purple/pink (1)

(d) 27.3 37.9 42.7 one mark for each correct row or column

0.0 10.0 15.6 to the benefit of the candidate (3)

27.3 27.9 27.1

average volume = 27.2(cm³) (1) [4]

(e) 0.000544 (mol) (1)

(f) 0.00136 (mol) (1)

(g) 0.0272 (mol) (1)

(h) 126 (1)

(i) \( M_r \) of \( \text{H}_2\text{C}_2\text{O}_4 \) = 90

\[
126 - 90 = 36
\]

\[
36/126 \times 100 = 28.6\text{%}
\]

[Total: 14]

7 (a) transition metal present/transition element present/

\( Z \) is a compound of a transition metal/\( Z \) is a compound of a transition element (1)

(b) (i) blue precipitate (1)

(ii) insoluble in excess (1) [2]

(c) (i) blue precipitate (1)

(ii) deep/dark blue solution formed (1) [2]

(d) (dilute/aqueous) nitric acid (1)

(aqueous) silver nitrate (1)

white precipitate (1) [3]
(e) CuCl₂ (1)

8 (a) to reach room temperature/steady temperature (1)

(b) exothermic (1)

(c) all sodium hydroxide has reacted/reaction is complete (1)

(d) all points plotted correctly (1)
   one mark each for two intersecting straight lines (2)

(e) (i) 26.0 (cm³) (1)
   (ii) 31.8 (°C) (1)

(f) (i) \(2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}\) (1)
   (ii) 0.05 moles of NaOH react with 0.025 moles of \(\text{H}_2\text{SO}_4\) (1)
        concentration of \(\text{H}_2\text{SO}_4\) = 0.96 (mol/dm³) (1)

(g) (i) 7.6 (°C) (1)
   (ii) 76 (cm³) (1)
   (iii) moles of \(\text{NaOH}\) = 0.05 (1)
        \(\Delta H = 48.5\) (kJ/mol) (1)

(h) heat or evaporate/warm or boil/leave in sun (1)
   to crystallisation point/saturation point/leave some of water/leave (solution) to cool/leave (solution) to crystallise/leave a concentrated solution (1)
   wash and dry crystals (1)

[Total: 18]