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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) \[2Cl^- \rightarrow Cl_2 + 2e^-\text{ or } 2Cl^- - 2e^- \rightarrow Cl_2\] (1) [1]

(c) (i) oxygen (1)
(glowing splint relights (1) [2]
(ii) \[4OH^- \rightarrow 2H_2O + O_2 + 4e^-\text{ or } 4OH^- - 4e^- \rightarrow 2H_2O + O_2\] (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 (cm$^3$) (1)

(e) 0.000544 (mol) (1)

(f) 0.00136 (mol) (1)

(g) 0.0272 (mol) (1)

(h) 126 (1)

(i) $M_r$ of $H_2C_2O_4 = 90$

$126 - 90 = 36$ (1)

$36/126 \times 100 = 28.6\%$ (1)

[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)

(c) (i) blue precipitate (1)

(ii) deep / dark blue solution formed (1)

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

(aqueous) silver nitrate (1)

white precipitate (1)

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(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 H₂SO₄ (1)
        concentration of H₂SO₄ = 0.96 (mol/dm³) (1)

(g) (i) 7.6 (°C) (1)
   (ii) 76 (cm³) (1)
   (iii) moles of 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: 9]

[Total: 18]