

Syllabus 1036
Science: Chemistry
Paper 4H

MARK SCHEME - Summer 1999

1. (a) (i) calcium carbonate; 1
(ii) calcium sulphate; 1
(iii) calcium hydrogencarbonate; 1
(iv) calcium carbonate; 1
- (b) (i) points plotted correctly - 2 marks
smooth curve - 1 mark 3
- (ii) A description to include:
1. solubility increases then decreases;
2. mention of approximate temperature
at which changeover takes place; 2
- (c) (i) 2.07 – 2.08 (g); 1
(ii) 1.04 (g) i.e. half the answer to part (c)(i); 1
(iii) A description to include two from:
1. cloudy/white suspension;
2. some calcium sulphate has dissolved/eq;
3. solution is saturated;
[Allow (permanent) hard water is formed for 1 mark] 2

Total 13 marks

2. (a) (i) Na^+ ; 1
(ii) Cl^- ; 1
(iii) Cu^{2+} ; 1

(b) (i)

Name of ion	Colour of flame
potassium	lilac
sodium;	yellow
calcium	red;

2

(ii)

Name of ion in solution	Reagent added to the solution	Positive result
copper (II)	sodium hydroxide (solution);	light blue precipitate
chloride/Cl ⁻ ;	dilute nitric acid + silver nitrate solution	white precipitate
sulphate	(dilute) hydrochloric/nitric acid; + barium chloride/nitrate (solution);	white precipitate;

5

(c) A description to include:

1. warm;
2. with named alkali/sodium hydroxide;
3. ammonia gas evolved;
4. gas turns red litmus blue/has pungent smell/eq;

4

Total 14 marks

3. (a) (i) 180 g glucose;
forms 2×46 (g) = 92 (g) ethanol;
9 g glucose will form 4.6 (g) ethanol; 3
- (ii) 180 g glucose forms $2 \times 24\,000 / 48\,000$ cm³ carbon dioxide;
9 g 2400 cm³; 2
- (b) fractional;
distillation;
[fractionation scores 2] 2
- (c) (i) $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$
correct formulae;
balanced; 2
- (ii) equal/same volume;
[Reject similar] 1
- (iii) line (labelled products) below that labelled reactants; 1

Total 11 marks

4. (a) $\text{Na}_2\text{CO}_3 = 106$;
 1000 cm^3 of 0.1 M requires 10.6 g /
 250 cm^3 of 1 M requires 26.5 g;
 250 cm^3 of 0.1 M requires 2.65 g; [Allow ecf] 3
- (b) (i) $\text{CO}_3^{2-} + 2\text{H}^+ \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$ 2
 LHS correct - 1 mark RHS correct - 1 mark
 [Allow fully correct but with spectator ions for 1 mark]
- (ii) **Either** $\text{Na}_2\text{CO}_3 \quad \frac{25}{1000} \times 0.1 = 0.0025 \text{ mol};$
 $\text{HCl} \quad 2 \times 0.0025 = 0.005 \text{ mol};$
 $\text{HCl} \quad 0.005 \times \frac{1000}{20} = 0.25 \text{ mol dm}^{-3};$
or $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2};$
 $\frac{0.1 \times 25}{1} = \frac{M_2 \times 20}{2};$
 $M_2 = 0.25 \text{ mol/dm}^3;$
 [Allow $M_2 = 0.125 \text{ mol/dm}^3$ for 2 marks] 3
- (iii) 1 mol NaCl = 58.5 (g);
 NaCl 0.005 mol (same as HCl / $2 \times \text{Na}_2\text{CO}_3$);
 NaCl 0.005×58.5 (g) = 0.29 (g); 3

Total 11 marks

5. (a) Stage 1:
 $\text{S} + \text{O}_2 \longrightarrow \text{SO}_2$;
 burn sulphur in air/oxygen;
- Stage 2:
 $2\text{SO}_2 + \text{O}_2 \longrightarrow 2\text{SO}_3$;
 temperature 350-550 °C;
 pressure between 1 and 10 atmospheres;
 vanadium(V) oxide catalyst;
- Stage 3:
 $\text{SO}_3 + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{SO}_4$;
 $\text{SO}_3 + \text{H}_2\text{SO}_4 \longrightarrow \text{H}_2\text{S}_2\text{O}_7$;
 dissolve sulphur trioxide in concentrated sulphuric acid;
 $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \longrightarrow 2\text{H}_2\text{SO}_4$;
 then add water;
 valid comment about mixing sulphur trioxide and water; **max 8**
- (b) An explanation to include:
 1. sulphuric acid used widely in many industries/
 sulphuric acid used to make many different compounds;
 2/3. two examples of use of the acid/ its derivatives;;
 e.g. anodising/batteries/detergents/dyes/fertilisers/
 paints/pickling metals/plastics/eq 3

Total 11 marks

TOTAL MARKS 60