4.6 CHEMISTRY (233)

4.6.1 Chemistry Paper 1 (233/1)

1. Increasing the size of the air hole/increase the amount of air/open air holes competely. (1)

2. (a) HSO_3^- (1)

   (b) $HSO_{3\,aq)}^{-1} + H^+_{(aq)} \longrightarrow H_2O_{(l)} + SO_{2(g)}$

   or

   $NaHSO_{3(s)} + H^+_{(aq)} \longrightarrow Na^+_{(aq)} + H_2O_{(l)} + SO_{2(g)}$

3. (a) • The anhydrous copper (II) Sulphate turns from white to blue. (1)

   • A grey solid is formed/droplets of a colourless liquid condense at cool part.(1)

   (b) Reducing property.(1)

4. • Add soluble carbonate/Add soluble hydroxide. (1)
   • Filter out the zinc carbonate/filter the zinc hydroxide. (1)
   • Heat strongly the $ZnCO_3$ to decompose it to form ZnO/Heat strongly the $Zn(OH)_2$ to decompose it to form ZnO. (1)

   OR

   - Heat to evaporate the water. (1)
   - Heat $ZnSO_4$ solid to decompose (1) to form ZnO/yellow solid. (1)

5. (a) delocalised electrons. (1)

   (b) ions in the melt. (1)

6. $\frac{T_1}{T_2} = \sqrt{\frac{M_1}{M_2}}$ (½) Ethane (C_2H_6) = 30 (½)

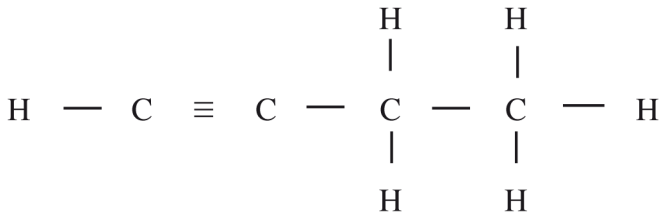
   $\left(\frac{121}{100}\right) = \sqrt{\frac{Q}{30}}$ (1)

   $\left(\frac{121}{100}\right)^2 = \frac{Q}{30}$

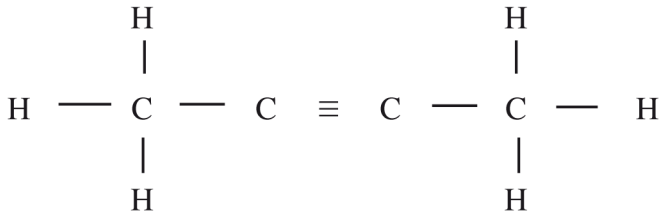
   $\left(\frac{121}{100}\right)^2 x\ 30 = Q$

   43.923 = Q
   44 = Q (1)

7. (a)



but-l-yne (1)



but-2-yne (1)

(b) Used in packaging - cushions electronics in boxes/insulation/models/ceiling strips/ crates or binding. (1)

8. (a) $^{226}_{88}Q \rightarrow {}^{222}_{86}P + {}^{4}_{2}He$ (1)

(b) (i) Cobalt 60 is used to detect the activity of the thyroid gland. (1)

(ii) To sterise equipment/treatment of cancer/radio active Na for disorders in blood circulation/Barium meal for ulcers/detect fractures in bones. (1)

9. The molecules of ethanoic acid interact through strong hydrogen bonding (1) forming a dimer while molecules of pentane have weak van der waals forces. (1) NB/ Ethanoic acid has hydrogen bonds while pentane does not have.

10. (a) Roast ore in air/heat in air. (1)

$2CuFeS_{2(s)} + 4O_{2(g)} \longrightarrow Cu_2S_{(s)} + 2FeO_{(g)} + 3SO_{2(g)}$

(b) • Acid rain that corrodes stone work on buildings/land gulleys/dust pollution. (1)

• SO2 when breathed in causes bronchitis/chlorosis in plants. (1)

11. Z is SO_2 / sulphur (IV) oxide. (1)

M is H_2SO_3/ sulphuric (IV) acid. (1)

12. A (1) and D (1)
A is acidic it will neutralise $Pb(OH)_{2(aq)}$ to form salt and water, ($^1/_2$)
D is a strong base it will react with $Pb(OH)_{2(aq)}$ to form a complex ion. ($^1/_2$)
Lead (II) hydroxide is amphoteric.

13. Moles of NaOH $\frac{18}{1000} \times 0.1 = 0.0018$ $(\frac{1}{2})$

Moles of acid $\frac{18}{1000} \times 0.1 \times \frac{1}{2} = 0.0009$ $(\frac{1}{2})$

Moles in 100 cm^3

$$\frac{18}{1000} \times 0.1 \times \frac{1}{\cancel{2}} \times \frac{\cancel{100}^{\cancel{4}}}{25}{}^{2} = 0.0036 \text{ moles} \quad / \quad 0.0036 \times \frac{100}{25} \qquad (\tfrac{1}{2})$$

Ratio of acid : Carbonate

1 : 1

Original moles of acid $= \frac{100}{1000} \times 0.05$

$= 0.005$ /0.53g $(\frac{1}{2})$

0.005 - 0.0036 = 0.0014 moles / 0.3816g $(\frac{1}{2})$

Mass of Na_2CO_3 = 0.0014 × 106 / 0.53 - 0.3816

= 0.1484 g = 0.1484 g $(\frac{1}{2})$

14. (a) Total volume of solution = 40 cm^3 / 40 g $(\frac{1}{2})$

$\Delta H = 40 \times 6.7 \times 4.2$ $(\frac{1}{2})$

= 1125.6/1000

= 1.1256 KJ

Moles of acid $\frac{20}{1000} \times 1 = 0.02$ *moles* $\frac{1125.6}{0.02}$ $(\frac{1}{2})$

0.02 moles = 0.1256 KJ

1 mole = $\frac{1.1256}{0.02}$ $(\frac{1}{2})$ -56280 j/mol $(\frac{1}{2})$

= -56.28 KJ / mol $(\frac{1}{2})$

(b) Some energy is used to ionise the weak acid first before it can neutralise. So not all energy is used in neutralisation. (1)

15. (a) $3CuO_{(s)} + 2NH_{3(g)} \longrightarrow 3Cu_{(s)} + N_{2(g)} + 3H_2O_{(l)}$ (1)

(b) It changed purple (1)

The excess ammonia makes solution basic which turns purple with universal indicator. (1)

16. (a) (i) It turned brown /blue/violet/green. (1)

(ii) The water level rose up the gas jar/occupy space left by reacted O_2. (1)

(b) The brown colour would be more since the salt accelerates rusting/rust faster. (1)

17. (a) Rate increases. (1)

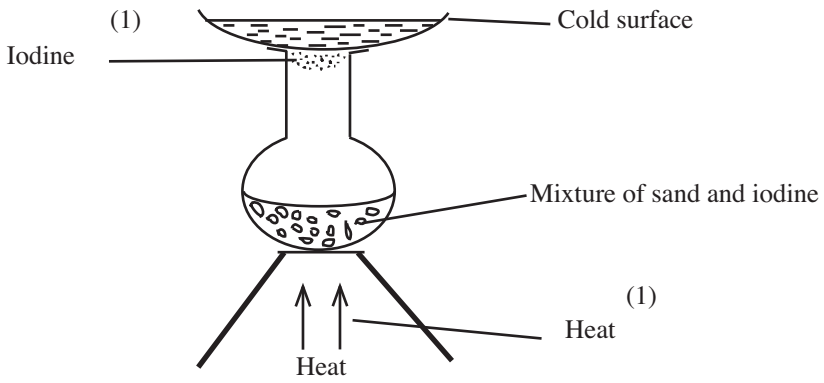
(b) Temperature increases the kinetic energy (1) of the particles increasing the number of collisions. (1)

18. (a) N (1)

(b) R (1)

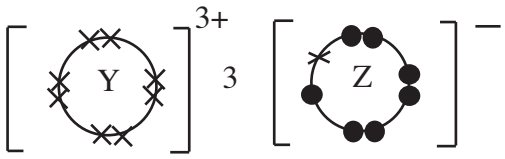
(c) M_3N_2 (1)

19.



20. Vanadium (V) oxide is cheaper (1) and is not easily poisoned by impurities. (1)

21. Y = 2.8.3 Z = 2.7 (1)



(1)

22. (a) Condensation of alcohol with higher boiling point so that it runs back to the flask as the alcohol with lower boiling point distills over. (1)

(b) Methanol. (1) It has a lower boiling point due to the size of carbon chain when compared with propanol. (1)

23. (a) Step 1 is neutralisation. (1)

(b) Step II is soda lime/ mixture of NaOH and CaO. (1)

(c) Fuel/making ethene/making hydrogen gas. (1)

24. (a) Anode - Oxygen /O_2 (1)

Cathode - Hydrogen / H_2 (1)

(b) $2Cl^-_{aq)} \longrightarrow Cl_{2(g)} + 2e$

25.

	C	H	Cl	
Mass(g)	37.21	7.75	55.04	$(\frac{1}{2})$
	37.21	7.75	55.04	$(\frac{1}{2})$
	12	1	35.5	
Moles	3.10	7.75	1.55	$(\frac{1}{2})$
	1.55	1.55	1.55	
Ratio	2 :	5 :	1	

Empirical formula C_2H_5Cl $(\frac{1}{2})$

Empirical mass = 2 x 12 + 5 + 35.5 = 64.5

64.5n = 65

n = 65/64.5

n = 1 $(\frac{1}{2})$

∴ molecular formula = C_2H_5Cl $(\frac{1}{2})$

26. Natural polymers are biodegradable (1) and are expensive. (1)
Affected by acids/Not easily recyled.

27. (a) Acetone / ethanol / propanone / propanol. (1)

(b) The solvent dissolves the organic compound indicator present in the flowers / it is an organic solvent. (1)

28. (a) It absorbs carbon (IV) oxide present in the air. (1)

(b) Copper /$Cu_{(s)}$ (1)

(c) It has rare noble gases which have not been removed / Argon. (1)

29. (a) A radical is a compound formed when elements combine to form ions / free unstable atoms or molecules / a group of free unstable atoms exist in a compound /group of atoms with a common charge. (1)

(b)

Element	**N**	**S**
H	NH_4^+	
O	NO_2^- NO_3^- (1)	SO_3^{2-}; $S_2O_3^{2-}$ SO_4^{2-}; $S_2O_7^{2-}$ (1)

30. (a) A colourless gas is formed /chlorine water decompose to give oxygen $(\frac{1}{2})$
The colour of solution changes from green to colourless / chlorine water becomes hydrochloric acid. $(\frac{1}{2})$
The level of solution in the gas jar drops oxgen formed occupies space pushing water downwards. $(\frac{1}{2})$

(choose any 2)

(b) $6KOH_{(aq)} + 3Cl_{2(g)} \longrightarrow KClO_{3(aq)} + 5KCl_{(aq)} + 3H_2O_{(l)}$ (1)

4.6.2 Chemistry Paper 2 (233/2)

1. (a) (i) Sodium chloride / potassium chloride /rock salt. (1 mark)

(ii) Concentrated sulphuric (VI) acid (1 mark)

(iii) Grey solid turns green (1 mark)

(iv) $Fe_{(s)} + 2\ HCl_{(g)} \longrightarrow FeCl_{2(s)} + H_{2(g)}$. (1 mark)

(v) To avoid explosion. (1 mark)

(b) (i) I The gas reacts with silver nitrate to form insoluble silver chloride. (1 mark)

II Both gases form ammonium chloride which is white. (1 mark)

(ii)
- To make hydrochloric acid.
- Manufacture of ammonium chloride.
- Manufacture of PVC.
- Making chloroethene /vynil chloride (1 mark)

(c) (i) Q is $Ca(OH)_2$ (aq) /calcium chloride (1 mark)

(ii) Presence of Ca^{2+} which make water hard / forms scum. (1 mark)

2. (a) (i) K - Has largest atomic radius / it most readily loses its outermost electron.

(ii) B /N (1 mark)

(iii) D / Mg (1 mark)

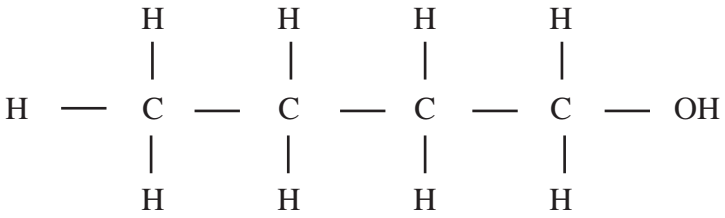
(iv) A (1) It has the smallest/smaller atomic radius/ its outermost electron is more/most strongly held by nucleus.(1) (2 marks)

(v) P^H is seven (7). The chlorides of group 1 elements are neutral salts. (2 marks)

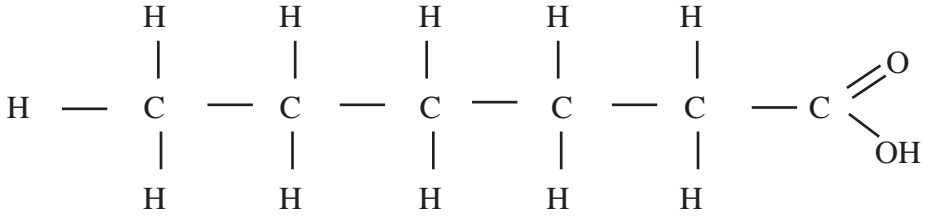
(b) (i) Both $CaCl_2$ and $MgCl_2$ have mobile ions in molten state (1) while both CCl_4 and $SiCl_4$ are molecular compounds with no mobile ions (1).

(ii) Neon has molar mass of 20 while Flourine has a molar mass of 38 (1). Therefore Neon diffuses faster. (1) Since it has a lower molecular mass the faster the rate of diffusion.

3. (a) (i)



(1 mark)



(1 mark)

(b) (i) Yeast/enzymes/zymase/temperature of 35 - 40 ^{o}C. (2 marks)

(ii) Acidified $KMnO_4$ or $K_2Cr_2O_7$ (1 mark)

(iii) P = Ethene / C_2H_4 (1 mark)

T = Methane / CH_4 (1 mark)

(iv) Addition of CaO or NaOH (1 mark)

(v) Converting oils into fats. (1 mark)
Manufacture of mangarine /hardening oils.

(c) $CH_3 CH_2 OH \longrightarrow$ 1370 kJ$^{(1)}$

R.M.M. of CH3CH2OH $46^{(\frac{1}{2})}$

1 litre (780g) = $\frac{1370 \times 780}{46}$ (1)

= 23,230.43 kj $^{(\frac{1}{2})}$

(d) Fuel
Solvent
Anti-septic
Manufacture of synthetic fibres
Manufacture of gasohol

Manufacture of ethanoic acid/vinegar
Used in themometers
Manufacture of other organic compounds.
Any 2 (2 marks)

4. (a)
- Pressure
- Concentration
- Catalyst
- Particle size/surface area
- Light intensity (1 mark)

(b) (i) Draw a tangent to the graph at 12 min. (1)
Determine change in volume $(\frac{1}{2})$ /Calculate gradient.
Determine change in time. $(\frac{1}{2})$
Divide change in volume by change in time (1)

(ii) AB Low production of gas(1) while BC the rate is very high because catalyst B was added. (1)

(iii) $2H_2O_{2(aq)} \longrightarrow O_{2(g)} + 2H_2O_{(l)}$ (1)

(c) (i) Lowering the temperature shifts the equilibrium to the right /favours the forward reaction. (1) Hence more SO_3 will be produced. (1)

(ii) Platinum or Vanadium pentoxide/vanadium (v) oxide / V_2O_5/ platinised asbestos
any (1 mark)

5. (a) (i) Cation present in solution **D** is H^+ (1 mark)

(ii) $Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow BaSo_{4(s)}$ (1)

(iii) Zinc disappears /zinc dissolves.
Blue colour disappears and brown solid is deposited.(1)
Zinc being more reactive than copper displaces /Cu^{2+} ions from solution, copper which is brown is formed.(1)
Apparatus feels warm/reaction is exothermic.

(iv) The reaction forms $CaSO_4$ which is insoluble (1) the insoluble $CaSO_4$ coats the surface of calcium preventing further reaction. (1)

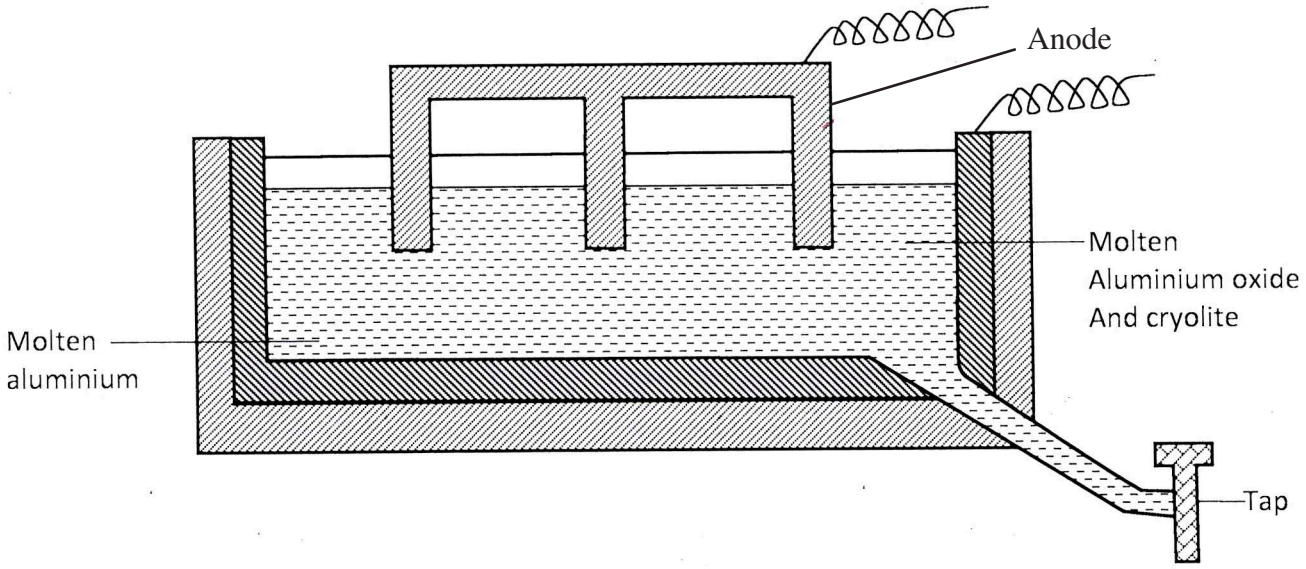
(v) Making plaster of paris / making plaster. (1)

(b) Dissolve sodium chloride in distilled water. ($\frac{1}{2}$) Add aqueous lead nitrate. (1)
Filter the mixture, ($\frac{1}{2}$) wash residue with distilled water. ($\frac{1}{2}$)
Dry residue in oven at controlled temperatures/ between filter papers.($\frac{1}{2}$)

(c) (i) It absorbs moisture/water. / deliquescent / hygroscopic (1)

(ii) Conc. H_2SO_4 (1) / $H_2SO_{4(l)}$ / concentrated sulphuric (VI) acid/

6.



(a) On the diagram (1)

(b) $2O^{2-}_{(l)} \longrightarrow O_{2(g)} + 4e$ (1)

(c) Below 950 °C, the electrolyte is not in molten state.(1)

(d) Aluminium is more reactive than carbon (coke)(1) therefore the reduction process is not possible / carbon / carbon (II) oxide / coke cannot reduce Al_2O_3.

(e) - Aluminium is less reactive than Sodium (1) ∴ It is preferentially discharged.

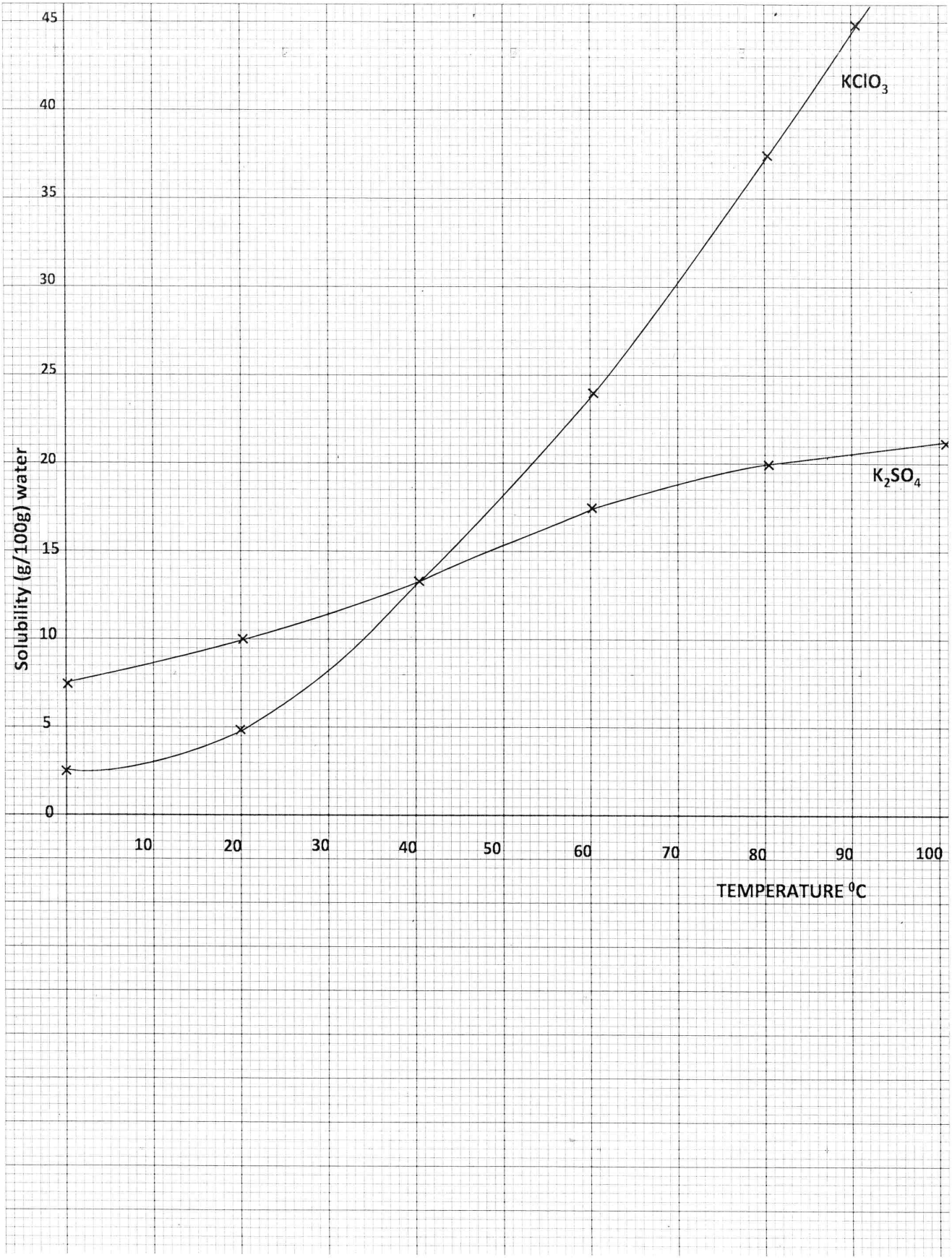
- Al^{3+} ions are in higher concentration than Na^+.(1)

(g) - Global warming due to production of CO_2 / F_2 pollution. (1)

- Creation of gullies during excavation. (1)

(f) - Light (1)

- Strong (1)


45
40
35
30
25
20
15
10
5
0
Solubility (g/100g) water
10
20
30
40
50
60
70
80
90
100
TEMPERATURE ^{0}C
$KClO_3$
K_2SO_4

7. (a) Solvent molecules move further apart hence more solid particles dissolve / creating more space for solid particles (1)
∴ The solubility increases. (1)

(b) (i) (3 marks)

(ii) (I) Value read from the graph (1)

(II) 10.5 g (value read) (1)

(iii) Salt identified from the graph (1)

(iv) Solubility of K_2SO_4 = 12.8 ($\frac{1}{2}$) g/100 g

Mass of K_2SO_4 in 100 cm^3 = $\frac{12.8 \times 1000}{100}$ ($\frac{1}{2}$)

= 128 g($\frac{1}{2}$)

Molar mass of K_2SO_4 = 174g ($\frac{1}{2}$)

Conc of K_2SO_4 = $\frac{128}{174}$ ($\frac{1}{2}$) = 0.7356M ($\frac{1}{2}$)

(v)

Filter crystals of K_2SO_4 ($\frac{1}{2}$)
Dry between filter papers. $\frac{1}{2}$)

4.6.3 Chemistry Practical Paper 3 (233/3)

1. **Table 1**

	I	II	III
Final burette reading	41.20	19.20	38.00
Initial burette reading	22.00	0.10	19.00
Volume of solution K used (cm^3)	19.20	19.10	19.00

(3 marks)

(i) Average $\frac{19.2 + 19.1 + 19.0}{3} = 19.10\ cm^3$

(1 mark)

(ii) Moles of Sodium thiosulphate $= \frac{19.1 \times 0.1}{1000}$ (1)

$= 0.00191$ (1)

$\therefore$ Moles of Copper ions in 25 cm^3 $= 0.00191$

Moles in 250 cm^3 $= 0.00191 \times 10$

$= 0.0191$ (1)

Concentration of Copper ions $= \frac{0.0191 \times 1000}{25}$ (1)

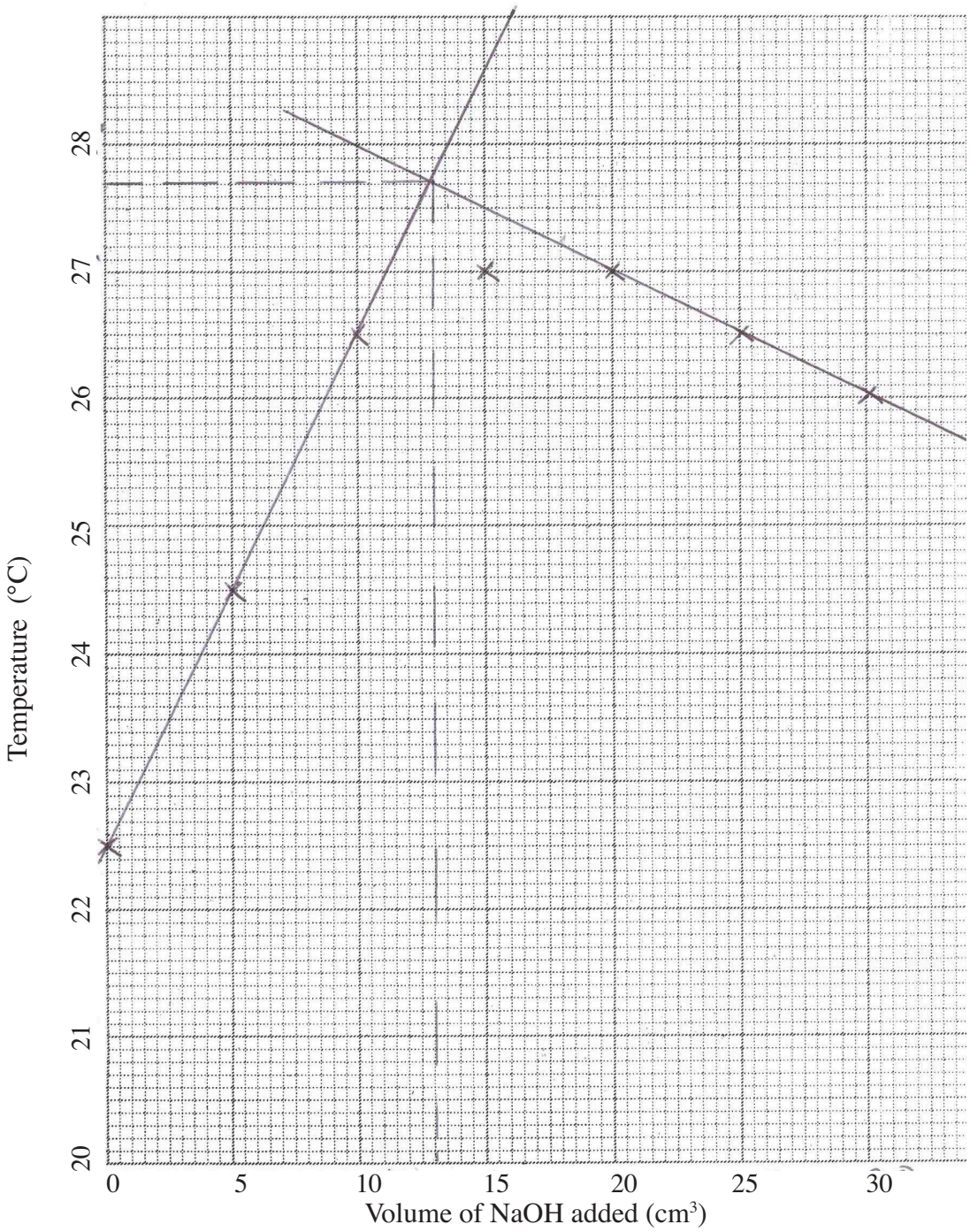
$= 0.764$ M (½)

2. **Table 2**

Volume of NaOH added (cm^3)	0	5	10	15	20	25	30
Maximum Temperature (°C)	22.5	24.5	26.5	27.0	27.0	26.5	26.0

(3½ marks)

(i) Graph



(3 marks)

(ii) I 13.0 ± 0.2 1 mark for working

1 mark for value

II $\triangle T = 5.2\,^{\circ}C \pm 0.1$ 1 mark

(ii) $\triangle H = 33 \times 5.2 \times 4.2$

$= 720.72$ J (1)

Moles of $Cu^{2+} = \frac{20 \times 0.764}{1000}$

$= 0.01528$ (½)

1 mole $= \frac{720.721}{0.01528}$ (1)

$= -47.2\ KJMol^{-1}$ (½)

2. (a) White crystalline substance. (1 mark)

(b)

Observations	**Inferences**
Colourless liquid condenses on the cool parts of T-Tube leaving behind a white solid	Hydrated salt or salt contains water of crystallisation
(1 mark)	(1 mark)

(c)

Solid dissolves to form colourless solution.	P is soluble in water No coloured ions
(1 mark)	(1 mark)

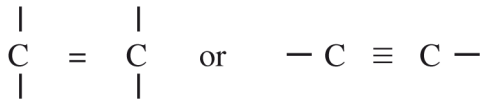
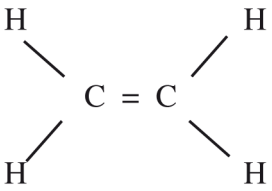
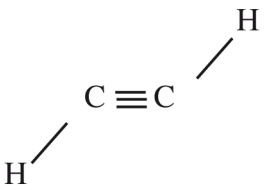
(d)

(i) White PPt formed	SO_4^{2-}, SO_3^{2-} or CO_3^{2-} present
(1 mark)	(2 marks)
(ii) No effervescence or no bubbles	SO_4^{2-}, present or SO_3^{2-} or CO_3^{2-} absent
(1 mark)	(1 mark)
(iii) White PPt	Mg^{2+} present
(1 mark)	(1 mark)

(e)

Cation	Mg^{2+} or Magnesium ions	(½)
anion	SO_4^{2-} or Sulphate ions	(½)

3. (a)

	Observations	**Inferences**
	Burns with a yellow sooty flame or luminous flame.	 Organic compound with high C:H ration aromatic compound, long chain organic compound.
	(1 mark)	(1 mark)
(b)	(i) Efferescence observed	Has a - COOH group or carboxylic/alkanoic acid.
	(1 mark)	(1 mark)
	(ii) Decolourised	Could be an alcohol or has  or 
	(1 mark)	(1 mark)