

# ANSWERS CHEMISTRY PAPER 2012

## 1. (a) Carbon (IV) Oxide and Carbon (II) Oxide

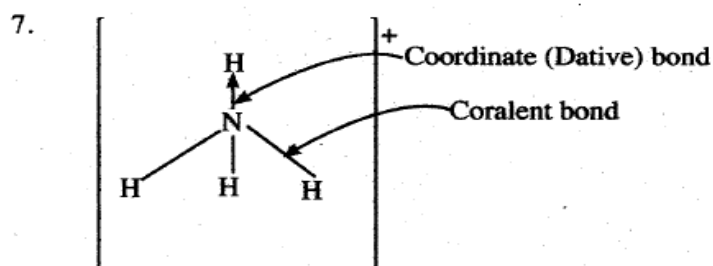
- (b)  $\text{CO}_2$  - Fire extinguishers  
 - Fizzy drinks  
 - Food preservative  
 - Solvay process

Choose 1

- $\text{CO}$  - Manufacture of fuel (water gas)  
 - Reduction in the extraction of metals  
 - Manufacture of methanol

Choose 1

2. Add water to dissolve  $\text{CuSO}_4$  while  $\text{Fe}_2\text{O}_3$  does not. Filter out the undissolved  $\text{Fe}_2\text{O}_3$ . Wash residue with plenty of distilled water to remove traces of the filtrate. Dry the residue between filter papers.
3. Grey Solid deposited  $\text{PbO}$  has been reduced to lead metal. A colourless liquid condenses on the cooler parts of the combustion tube. The hydrogen has been oxidised to water.
4. (a) BDAC  
 Across the period the atomic radius decreases.
- (b) D  
 Across the period the conductivity increase due to increase in delocalised electrons.
5. The water must contain impurities. The presence of impurities elevates the boiling point.
6. (i) Copper (II) Sulphate; at  $40^\circ\text{C}$  only 28g is soluble leaving undissolved  $\text{CuSO}_4$   
 $\text{Pb}(\text{NO}_3)_2$  all dissolves.
- (ii)  $35 - 28 = 7\text{g}$



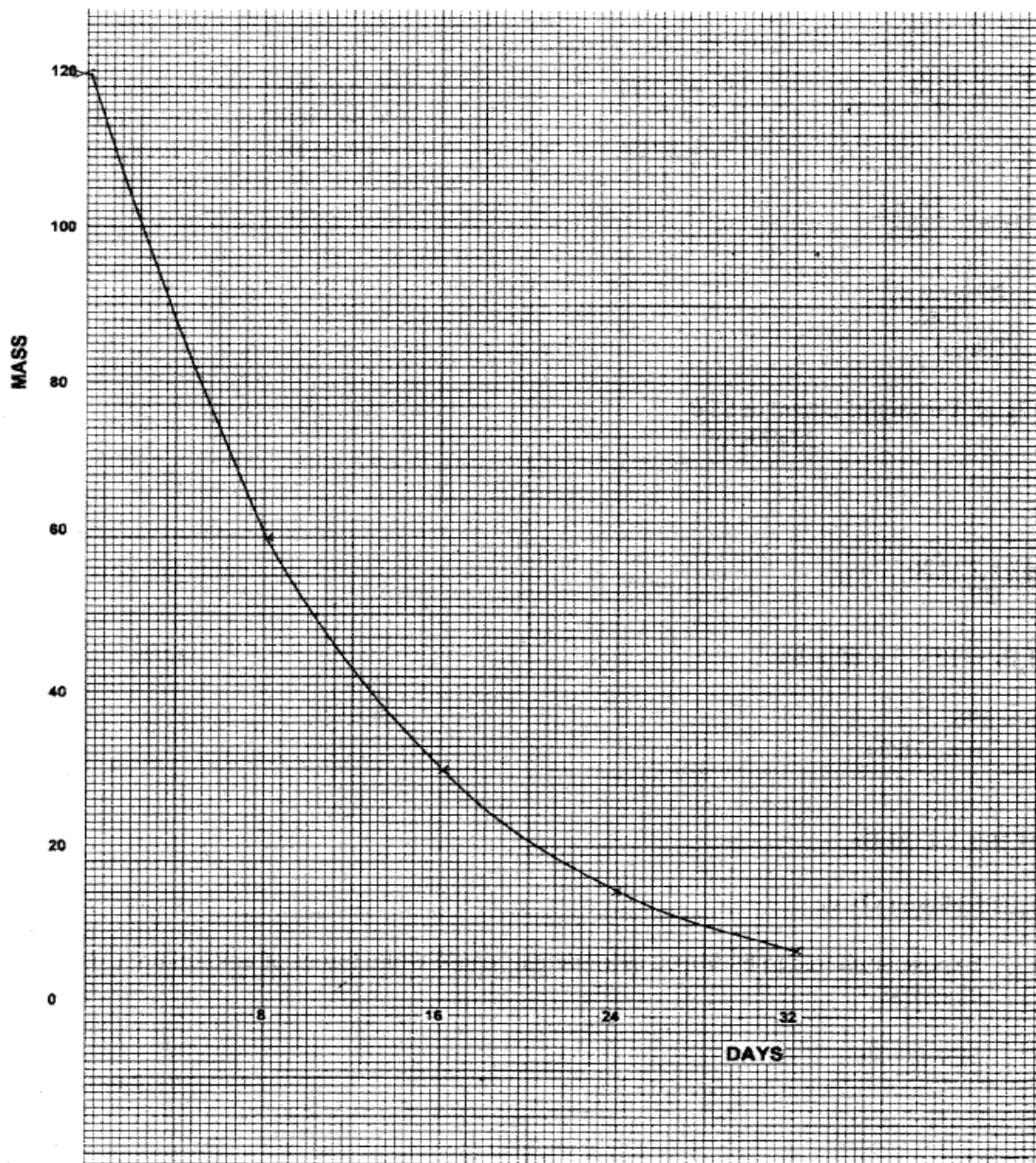
8.  $\text{H}_2\text{SO}_{4(aq)} + 2\text{NaOH}_{(aq)} \rightarrow \text{Na}_2\text{SO}_{4(aq)} + \text{H}_2\text{O}(l)$
- Moles of  $\text{NaOH} = \frac{36}{1000} \times 0.1 = 0.0036$

$$\text{Moles of acid in } 100 \text{ cm}^3 = \frac{100 \times 0.0018}{10} = 0.018$$

$$\text{R.M.M. of } \text{H}_2\text{SO}_4 = 98 \left(\frac{1}{2}\right)$$

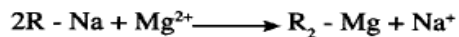
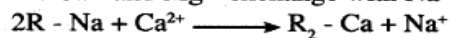
$$0.0018 \times 98 = 0.1764\text{g} \left(\frac{1}{2}\right)$$

9.



10. (a)  $\text{Mg}^{2+}, \text{Ca}^{2+}$

(b) The  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  exchange with  $\text{Na}^+$  on the ions exchange resin.<sup>(1)</sup>



11.  $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$$P_2 = 1 \text{ litre}$$

$$V_2 = ?$$

$$T_2 = 273\text{K}$$

$$P_1 = 1 \text{ atm}$$

$$V_1 = 56\text{cm}^3$$

$$T_1 = 546\text{K}$$

$$\frac{1 \times V_1}{273} = \frac{56 \times 1}{546}$$

$$V_1 = \frac{56 \times 1 \times 273}{546}$$

$$V_1 = 28\text{cm}^3$$

0.47g of A occupies  $28\text{cm}^3$  at STP

?  $22400\text{cm}^3$

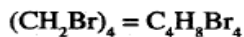
$$\frac{0.47 \times 22400}{28} = 376$$

$$\text{CH}_2\text{Br} = 12 + 2 + 80 = 94$$

$$94n = 376$$

$$n = 376/94$$

$$n = 4$$



12. (a) Calcium Oxide

(b) Expose ammonia to hydrogen chloride gas, dense white fumes of ammonium chloride are observed.

(c) Steam/water

13. The catalyst has no effect on the position of equilibrium.  
The catalyst will increase the rate of forward and backward reactions to the same extent.

14. Ionisation energy

This is the energy required to remove an electron from an atom in its gaseous state.

Electron affinity:

This is the energy change that results in the formation of an ion when an atom gains an electron.

15. (a) Represents salt bridge.

- (b)  $EMF = E^{\ominus}_{\text{gaining}} - E^{\ominus}_{\text{losing}}$

$$= +0.80 - (-0.13)$$

$$= +0.93V$$

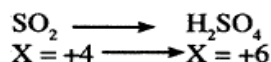
16. (a) S, H, V, T (2) - If only 1st and last letters are correct

- (b)  $T(s) + V^{2+}(aq) \longrightarrow T^{2+}(aq) + V(s)$

17. (a) Heat of reaction

- (b) Using a catalyst  
Catalyst reduce activation energy.

18. (a) Sulphur (IV) Oxide is oxidised  
The change in Oxidation state for

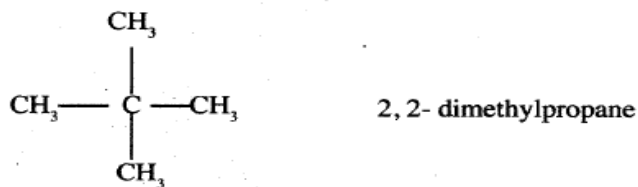
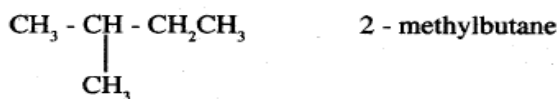


Since it is increasing, this is oxidation.

- (b)
- Preservative for Jams and fruits
  - Bleaching in the paper industry
  - Fumigant
  - Disinfectant

19. The level of water in glass tube would go down this is because hydrogen gas being less dense than air diffuses through the porous bag, forcing the level of water in the glass tube to go down while the level of water in the beaker rises slightly.

20.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  Pentane

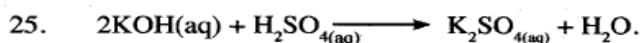


21. - Plastic bottles  
- Packaging of materials  
- Tooth brush handles.  
Any 1 (1)

22. (a) (i) Maleable - Can be hammed into sheets  
(ii) Ductile - Can be drawn into wires  
(b) (i) Saucepans  
(ii) Electrical transmission lines

23. • Weigh copper carbonate  
• Heat  $\text{CuCO}_3$  to constant mass in a combustion tube  
• Reduce  $\text{CuO}$  using dry  $\text{H}_2/\text{NH}_3$  or  $\text{CO}$   
• Allow to cool and reweigh to get mass of copper  
•  $\% = \frac{\text{Mass of Cu}}{\text{Mass of CuCO}_3} \times 100$

24. (a) No air due to boiling.  
(b) • Aluminium being very reactive forms a layer of  $\text{Al}_2\text{O}_3$  on the metal making it impervious to moisture.  
• Aluminium being more reactive than iron protects the iron through sacrificial protection/ cathodic protection.



$$\text{Moles of KOH } \frac{200}{1000} \times 2 = 0.4 \text{ moles}$$

$$\text{Moles of } \text{H}_2\text{SO}_4 = \frac{0.4}{2} = 0.2 \text{ moles}$$

$$x = 100\text{cm}^3$$

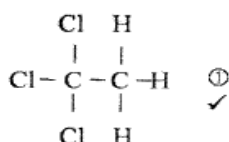
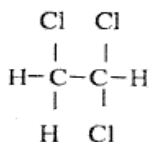


Mix  $200\text{cm}^3$  of  $2\text{M KOH}$  with  $100\text{cm}^3$  of  $2\text{M H}_2\text{SO}_4$ . Concentrate the mixture to drive off excess water, crystallise using a water bath, then dry crystals between filter papers.

- 26.
- Add  $\text{Na}_2\text{CO}_3$  or  $\text{NaHCO}_3$  to each, with ethanoic acid there will be effervescence, no reaction with ethanol.
  - Add acidified potassium dichromate (VI) or acidified potassium manganate (VII) ethanol will decolourise acidified potassium manganate (VII) and change acidified potassium dichromate (VI) from orange to green. Ethanoic acid has no reaction with the reagent.
- 27.
- (a) Group is 5  
Period is 3
- (b)
- (i) Noble gases/inert gases
  - (ii) Used in fluorescence lamps, x-rays tubes
- 28.
- (a)  $2\text{Cl}^-_{(\text{aq})} \longrightarrow \text{Cl}_{2(\text{g})} + 2\text{e}^-$
- (b) Oxygen
- There will be a higher concentration of the hydroxide ion in the dilute solution.  
The hydroxide ion being higher in the electromotive series than the chloride ion will then be preferentially discharged.
- 29.
- (a) No change or no effect  
Presence of water is necessary to form  $\text{H}^+$  and  $\text{OCl}^-$  ions which change the litmus paper
- (b) Add dilute hydrochloric acid to each of the salts.  $\text{BaSO}_3$  gives effervescence and the salt dissolves. There is no effervescence or effect on  $\text{BaSO}_4$ .

## 5.4.2 Chemistry Paper 2 (233/2)

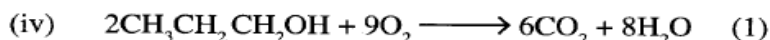
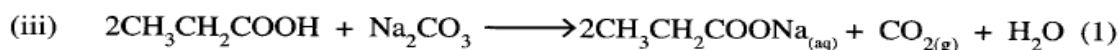
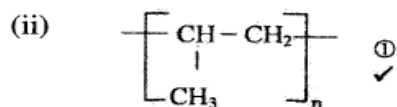
1. (a)



- (b)
- Bubble each through acidified potassium dichromate (VI)  $\sqrt{1}$  with ethene the solution changes from orange to green  $\sqrt{1/2}$  while in ethane the solution remains orange.  $\sqrt{1/2}$
  - Bubble each through acidified Potassium manganate(VII)  $\sqrt{1}$  with ethene the solution changes from purple to  $\sqrt{1/2}$  colourless while in ethane the solution remains purple.  $\sqrt{1/2}$
  - Add a few drops of bromine water  $\sqrt{1}$  with ethene the solution changes from orange/ brown  $\sqrt{1/2}$  to colourless, while in ethane the solution remains orange / brown.  $\sqrt{1/2}$
  - Ethene burns with yellow or sooty flame.  
Ethane burns with non-luminous or blue flame.

Choose any 2

- (c) (i) Concentrated sulphuric (VI) acid or  $\text{Al}_2\text{O}_3$  or  $\text{H}_3\text{PO}_4$ .  $\sqrt{1}$



$$\text{Moles of CO}_2 = \frac{18}{24} \quad (1/2)$$

$$\text{Moles of CH}_3\text{CH}_2\text{CH}_2\text{OH} = \frac{18}{24} \times \frac{1}{3} \quad (1/2)$$

$$\text{R.M.M. of CH}_3\text{CH}_2\text{CH}_2\text{OH} = 60 \quad (1/2)$$

$$\text{Mass} = \frac{18}{24} \times \frac{1}{3} \times 60 = 15 \text{ g} \quad (1/2)$$

2. (a) C  $\sqrt{1}$  (1) has the smallest atomic radius and is the most electronegative element in the periodic table.  $\sqrt{1}$  / as one traverses the period number of protons increases hence the nuclear attraction increases.

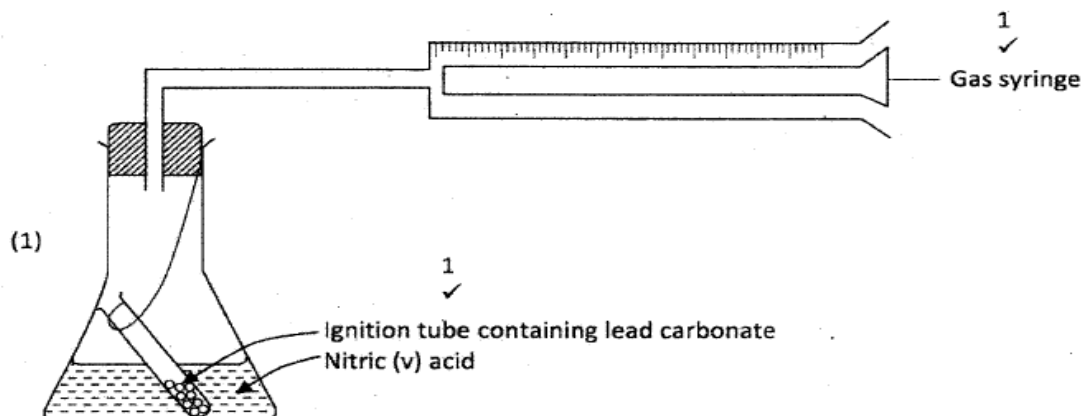
- (b) (i)  $\text{AB}_2/\text{AB}/\text{CO}_2$  or  $\text{CO}$   $\sqrt{1}$   
(ii) Covalent bond  $\sqrt{1}$

3. (a) (i) Concentrated  $\sqrt{1}$  sulphuric (VI) acid.
- (ii) Potassium nitrate  $\sqrt{1}$
- (iii) To condense the fumes or vapour of nitric (V) acid into liquid  $\sqrt{1}$
- (b) (i) Nitric acid (V) will corrode the rubber  $\sqrt{1}$
- (ii) The reaction produces nitrogen monoxide (colourless)  $\sqrt{1/2}$  which is oxidised by oxygen from the air to form nitrogen(IV) oxide.  $\sqrt{1/2}$
- (c) (i) 

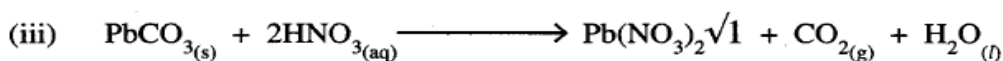
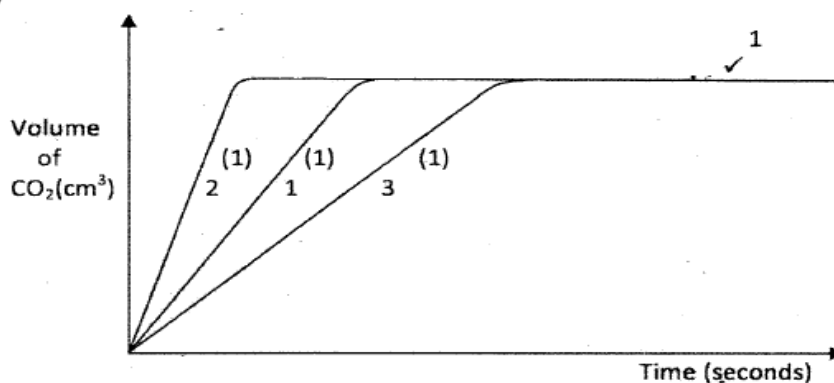
•	Water	$\sqrt{2}$	}	any 2
•	Alkanes			
•	Biogas			
•	Water gas			
- (ii)  $\text{NH}_3 + \text{HNO}_3 \longrightarrow \text{NH}_4\text{NO}_3$   $\sqrt{1}$
- Mass of  $\text{NH}_4\text{NO}_3 = 80 \sqrt{1/2}$
- either
- Moles of  $\text{NH}_4\text{NO}_3 = \frac{4800}{80} \times 10^3 = 6 \times 10^4$
- Moles of  $\text{NH}_3 = 6 \times 10^4 \sqrt{1/2}$
- Mass of  $\text{NH}_3 = \frac{6 \times 17 \times 10^4}{1000}$
- $= 1020 \text{ kg}$
- (iii) Explosives eg. T.N.T.  $\sqrt{2}$
- Production of polymers (terylene)
- Textile dyes.
- Manufacture of drugs
- } any 2



4. (a) Surface area/particle size  $\sqrt{1}$ .  
 (b) (i)



(ii)



- (c) With hydrochloric acid an insoluble lead chloride is formed,  $\sqrt{1/2}$  which coats the lead carbonate  $\sqrt{1/2}$  preventing the reaction between the acid and the carbonate from proceeding.  $\sqrt{1}$
- (d) The reaction would shift to the left changing the solution from colourless to yellow/orange  $\sqrt{1}$ . Addition of HCl creates excess  $\text{H}^+$  which disturbs the equilibrium so it shifts to the left to get rid of the excess  $\text{H}^+$  ions.  $\sqrt{1}$

5. (a) (i) The anode is X.  $\sqrt{1}$  Since hydrogen is liberated at the cathode which is Y.  $\sqrt{1}$
- (ii) 
$$4\text{OH}^-_{(aq)} \longrightarrow 2\text{H}_2\text{O}_{(l)} + \text{O}_{2(g)} + 4\text{e}^-$$
  $\sqrt{1}$
- (iii) The hydrogen ions and hydroxide ions which form water (1) are discharged at the electrodes leaving  $\text{MgSO}_4$  concentrated. The amount of water electrolysed is more than the amount of water formed at the anode.  $\sqrt{1}$

(iv) Blue litmus remains  $\checkmark\frac{1}{2}$  blue while the red litmus remains red  $\checkmark\frac{1}{2}$ . Indicating that the solution is neutral.  $\checkmark 1$

(b) Quantity of electricity =  $0.3 \times 30 \times 60$   
 $= 540 \checkmark 1$

Oxygen requires 4 Faradays  $\checkmark\frac{1}{2}$  of electricity

$$24 \text{ dm}^3 = 4 \times 96500 \checkmark\frac{1}{2}$$

$$? = 540$$

$$\frac{24 \times 540}{4 \times 96500} = 0.32 \text{ dm}^3$$

(c) Electroplating  
 Purification of metals

6. (a) (i)  $\text{Cu}^{2+} \checkmark 1$

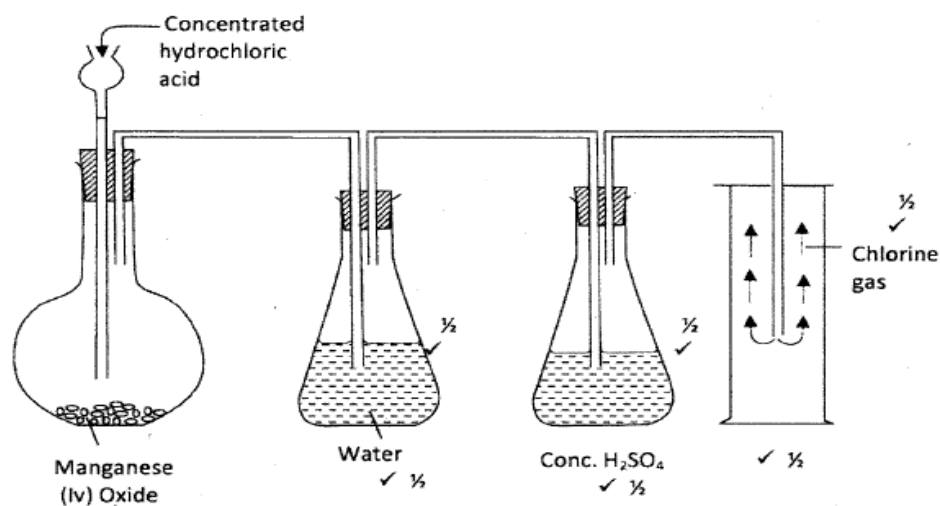
(ii)  $\text{CuCO}_3 \checkmark 1 / \text{ZnSO}_4 \checkmark 1$

(b)  $\text{Ba}^{2+}_{(\text{aq})} + \text{SO}_4^{2-}_{(\text{aq})} \longrightarrow \text{BaSO}_{4(\text{s})} \checkmark 1$

(c) The solution changes from blue to colourless  $\checkmark 1$  and a brown solid is formed.  $\checkmark 1$   
 The magnesium which is above copper in the reactivity series displaces the copper ions  $\checkmark 1$  from the solution. Apparatus become warm. The reaction is exothermic.

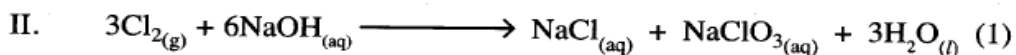
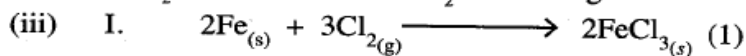
(d) (i) Add nitric (V) acid to  $\checkmark\frac{1}{2}$  lead oxide, filter  $\checkmark\frac{1}{2}$ , add a soluble sulphate/ sulphuric acid to the filtrate  $\checkmark\frac{1}{2}$ . Filter  $\checkmark\frac{1}{2}$ , and wash residue with distilled water  $\checkmark\frac{1}{2}$  to remove traces of the filtrate, then dry residue between  $\checkmark\frac{1}{2}$  filter papers /oven.  
 (ii) Determine the melting  $\checkmark 1$  point, if it is pure the melting point will be constant.  $\checkmark 1$

7. (a) (i)



(ii) Potassium Manganate (VII)  $\checkmark^{1/2}$  and remove heat  $\checkmark^{1/2}$ .

$\text{PbO}_2$  and heat OR  $\text{CaOCl}_2$  No heating.



(b)

	Cl	O
Mass	0.07	1.12
RAM	35.5	16
Moles	$\frac{0.07}{35.5}$	$\frac{1.12}{16}$
	0.02	0.07
	0.02	0.02
	1	$\frac{7}{2}$
	2	7

Empirical formula  $\text{Cl}_2\text{O}_7 \checkmark^1$

- (c) Sterilising drinking water supplies  $\checkmark$   
Manufacture of hydrochloric acid  $\checkmark$   
Manufacture of plastics  $\checkmark$   
Manufacture of chloroform  $\checkmark$   
Manufacture of bleaching agents  $\checkmark$

(Any 2)

### 5.4.3 Chemistry Practical Paper 3 (233/3)

#### 1. Table 1

	I	II	III
Final burette reading	17.45	32.90	36.05
Initial burette reading	2.10	17.45	20.60
Volume of solution B used (cm <sup>3</sup> )	15.35	15.45	15.45

(4 marks)

(a) (i) Average volume

$$= \frac{15.35 + 15.45 + 15.45}{3}$$

$$= 15.42 \text{ cm}^3$$

(1 mark)

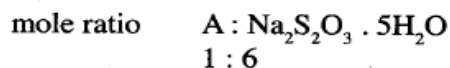
(ii) Moles of sodium thiosulphate used

$$= \frac{0.05 \times 15.42}{1000} \quad \left(\frac{1}{2}\right)$$

$$7.71 \times 10^{-4} \text{ moles} \quad \left(\frac{1}{2}\right)$$

(1 mark)

(b) (i) Number of moles of A in 25.0 cm<sup>3</sup>



$$7.71 \times 10^{-4} / 6 = 1.28 \times 10^{-4} \text{ moles}$$

(1 mark)

(ii) Concentration of solution A in mol dm<sup>3</sup>

$$1.28 \times 10^{-4} \text{ moles in } 25 \text{ cm}^3$$

$$? \text{ moles in } 1000 \text{ cm}^3$$

$$1.28 \times 10^{-4} \times 1000 / 25 \quad (1)$$

$$5.12 \times 10^{-3} \text{ moles/dm}^3 \quad (1)$$

(2 marks)

Table 2

Test tube number	1	2	3	4	5	6
Volume of distilled water (cm <sup>3</sup> )	0	2	3	5	6	7
Volume of solution A (cm <sup>3</sup> )	10	8	7	5	4	3
Time (s)	22.5	28.0	32.0	50.0	57.5	85.0
Rate = $\frac{1}{\text{Time}}$ (s <sup>-1</sup> )	0.044	0.036	0.031	0.020	0.017	0.012

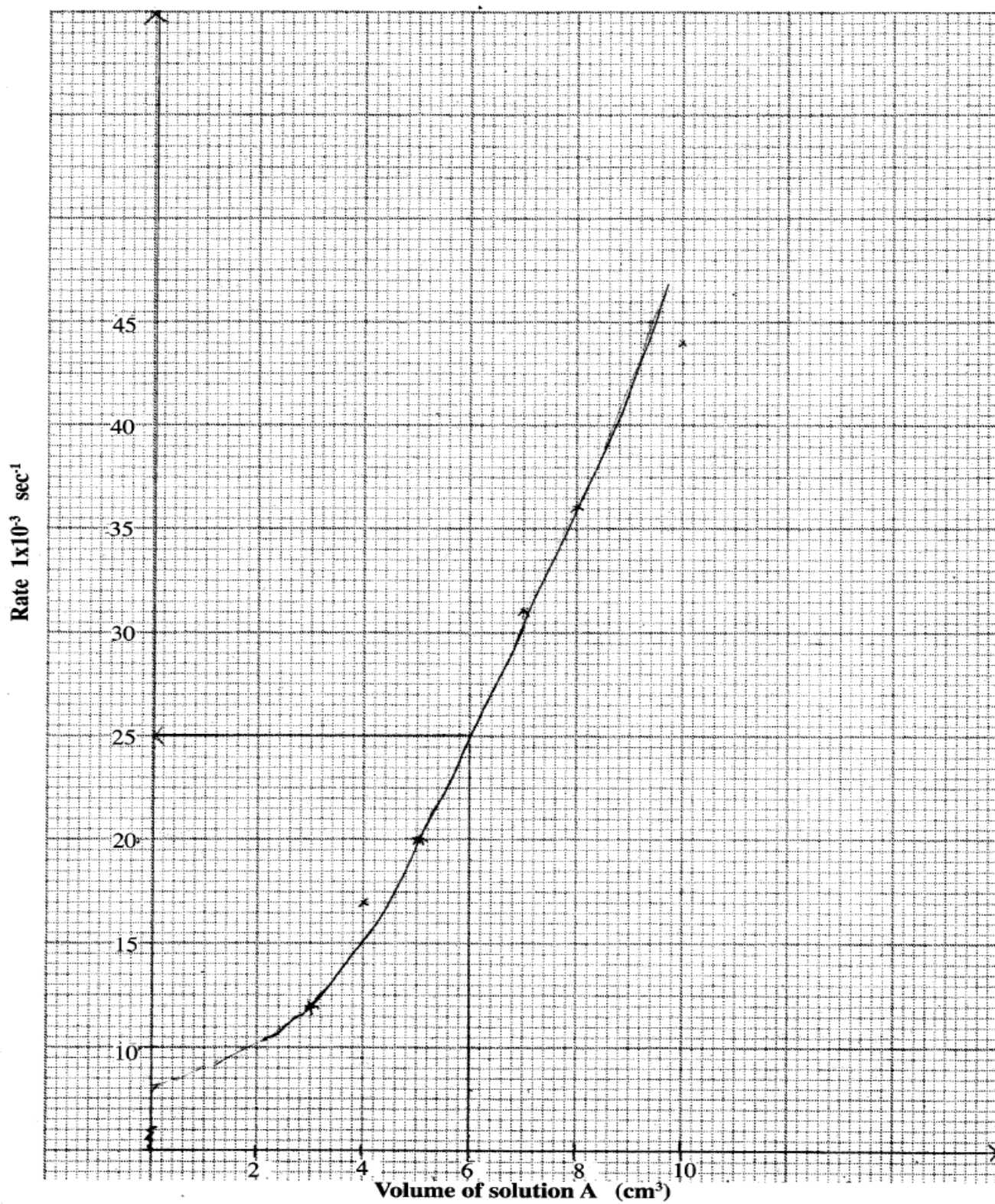
(1)      (1)      (1)      (1)      (1)      (1)

(6 marks)



(a) Graph of Rate

(3 marks)



(b) Time taken for 4cm<sup>3</sup> of distilled water.

∴ 6cm<sup>3</sup> of solution A is added.

from the graph =  $25 \times 10^{-3} \text{ sec}^{-1}$

= 40 seconds

(1)

(1)

(2 marks)

## 2. Observation

(a) (i)	(I)	A white precipitate (1)	Presence of Pb <sup>2+</sup> , Ba <sup>2+</sup> or Ca <sup>2+</sup> (1)  <i>1 mark for all the 3 ions</i> <i>½ mark for 2 correct ions</i> <i>0 mark for one or none</i>
	(II)	No white precipitate (1)	Absence of Pb <sup>2+</sup> (1)
	(III)	No white precipitate (1)	SO <sub>4</sub> <sup>2-</sup> , SO <sub>3</sub> <sup>2-</sup> , CO <sub>3</sub> <sup>2-</sup> ions absent (1)  <i>1 mark all the 3</i> <i>½ mark for 2 ions correct</i> <i>0 mark for one or none</i>
	(IV)	No white precipitate (1)	Cl <sup>-</sup> ions absent (1)
(ii)		Effervescence ½/Bubbles/Fizzing Colourless gas produced ½ Turns red litmus blue ½ Blue litmus remained blue ½ (2 marks)	NO <sub>3</sub> <sup>-</sup> present (1)
			(Total 11 marks)



3.

	Observations	Inferences
(a)	No effervescence (1)	Compound/solution F <b>not acidic</b> H <sup>+</sup> or R-COOH absent. (1)
(b) (i)	Burns with a sooty/smoky $\frac{1}{2}$ luminous/yellow flame $\frac{1}{2}$	Unsaturated cpd (1) $>C=C<$ Long chain hydrocarbon or $-C\equiv C-$
(ii)	Some white suspension/solid remains undissolved $\frac{1}{2}$	Compound slightly/partially soluble in water $\frac{1}{2}$
(c) (i)	Effervescence $\frac{1}{2}$ Colourless gas produced $\frac{1}{2}$	Mixture is acidic (1) RCOOH present
(ii)	Not decolourized (1)	$\diagup C=C \diagdown$ absent (1) $-C\equiv C-$ absent

(Total 9 marks)