4.7 CHEMISTRY (233)

4.7.1 Chemistry Paper 1 (233/1)

1. (a) Ethene (1 mark)

(b) Add water to each compound.
Add Na_2CO_3 or $NaHCO_3$ to a soluble salt of each sample (1 mark)

$C_4H_{10}O$ no effervescence $\frac{1}{2}$ mark

$C_4H_6O_2$ effervescence $\frac{1}{2}$ mark

or add acidified potassium dichromate (VI) and warm

$C_4H_{10}O$- turns from orange to green

$C_4H_6O_2$ - no change

Or add acidified Potassium Manganate (VII)

$C_4H_{10}O$ - will be decolourised

$C_4H_6O_2$ - no change

2. (a) Brine (NaCl) (1 mark)

(b) - Sodium is very reactive (use electrolysis) (1 mark)

- More reactive than carbon.

(c) Uses

Sodium lamps, coolant in nuclear reactors (1 mark)
Sodium cyanide, sodium amalgam
Na_2O_2, Extraction of titanium, etc.

3. (a) Enthalpy change, when one mole of crystal lattice is broken into its ions in gaseous state. (1 mark)

(b) Endothermic reaction (process) (1 mark)

4. (a) Boyle's law: The volume of a fixed mass of a gas is inversely proportional to its pressure or the product of pressure and volume is constant at a fixed temperature. (1 mark)

(b) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\left(\frac{1}{2}\right)$

$\frac{100,000 \times 500 \times 273}{101325 \times (273+27)}$ (1)

$= 449\ cm^3$ $\left(\frac{1}{2}\right)$

(2 marks)

5. Equation

$ZnO_{(s)} + 2HNO_3 \longrightarrow Zn(NO_3)_{2(aq)} + H_2O$ (1) (1 mark)

RFM $HNO_3 = 63$ $\left(\frac{1}{2}\right)$

Moles of $HNO_3 = \frac{12.6}{63}$ $\left(\frac{1}{2}\right)$

Moles of Zinc Oxide $= \frac{1}{2} \times 0.2$

$= 0.1$ m $\left(\frac{1}{2}\right)$

Mass of $ZnO = 81$

Mass of ZnO that reacted $= 0.1 \times 81$

$= 8.1$ g $\left(\frac{1}{2}\right)$

6. Add Na_2CO_3 $\left(\frac{1}{2}\right)$ to water. (1) Ca^{2+} and Mg^{2+} ions precipitate as carbonates (insoluble)

7. (a) Equation: $NaCl_{(s)} + H_2SO_{4(l)} \longrightarrow NaHSO_{4(s)} + HCl_{(g)}$ (1 mark)

(b) - Chemical properties of HCl - (1 mark)

(i) - Forms white fumes with ammonia gas (NH_4Cl)

(ii) - Forms $FeCl_2$ with Fe metal (green solution)

- Forms white precipitate with Ag^+/Pb^{2+} ions

(c) - Uses:

- Pickling metals
- Forms chlorides with metals
- Analysis of lab chemicals
- Manufacture of $HCl_{(aq)}$
- Manufacture vinyl Chloride (PVC) used in chloroethene

(1 mark)

8. (a) Type of reaction: Reversible reaction/temporary reaction. (1 mark)

(b) - Copper (II) Sulphate salt (Crystals) (1 mark)
- Copper (II) Chloride hydrated.
Any other hydrated salts e.g. Cobalt (II) Chloride

9. (a) Substance A - Calcium Oxide (1 mark)
- fused calcium chloride
- Accept any other answer

(b) Black Copper (II) Oxide (Solid) changes to brown (1 mark)

Colourless liquid formed on the cooler part of the combustion tube.

(c) Copper (II) Oxide is reduced to Copper metal. (1 mark)

10. (a) 2.8.8 (1 mark)

(b) T_2O_3 / T_2O_5 or P_2O_3 / P_2O_5 (1 mark)

11. Product at the anode = Oxygen and water (1 mark)

Reasons

OH^- ions are preferentially discharged to form oxygen (1 mark)

12. (a) Equation $Na_2S_2O_{3(aq)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + SO_{2(g)} + H_2O_{(aq)} + S_{(s)}$ (1 mark)

(b) Explain:

- As the temperature increases, the time taken for the reaction to take place decreases.

Explanation

- Increase in temperature, leads to increase (1) in kinetic $\left(\frac{1}{2}\right)$ energy, thus increasing the frequency of fruitful /successful collision, hence decrease in time $\frac{1}{2}$ taken for the reaction to take place. (2 marks)

13. (a) The purpose of the glass wool. It spreads the oxygen evenly/increase surface area. or enriches the air with oxygen.

(1 mark)

(b) Forms NO, Nitrogen $\frac{1}{2}$ (II) Oxide and steam $\frac{1}{2}$ (1 mark)

14. (a) Reactivity series starting with the most reactive

X R Z Y (2 marks)

(b) X could be potassium $\frac{1}{2}$
Y could be copper $\frac{1}{2}$

Accept any other metal

15. (a) Universal indicator / litmus paper (1)

(b) Acid, base, neutral. (3 marks)

16. Reagent R - Sodium hydroxide / KOH (1 mark)

Reagent Q Cl_2
or HCl (1 mark)

Step V $2Al_{(s)} + 3H_2SO_{4(aq)} \longrightarrow Al_2(SO_4)_3 + 3H_{2(g)}$ (1 mark)

17. (a) Monoclinic sulphur /Beta sulphur/ Prismatic sulphur (1)

(b) (i) Dehydrating property (1)
(ii) Oxidising property (1)

18. (a) Calcium (1)

(b) No observable change (1) silver is below copper in the reactivity series so it cannot displace it. (1)

19. (a) No. of half-lives $= \frac{1900}{380} = 5$ (1)

480 ___ 240 ___ 120 ___ 60 ___ 30 ___ 15 (1)

(b) - Sterilising surgical instruments $\left(\frac{1}{2}\right)$

- Detecting diseases like goitre $\left(\frac{1}{2}\right)$
- Detecting ulcers
- Treating cancer
- Detecting fracture/flaw

20. Formula of Iodine I_2 (l)
Weak Van der Waals (1)
Antiseptic (1)

21. Heat $\frac{1}{2}$ the mixture and collect
$AlCl_3$ as sublimate $\frac{1}{2}$
Add water $\frac{1}{2}$ to the remaining sodium chloride dissolves $\frac{1}{2}$
Filter to obtain Lead (II) Sulphate as residue $\frac{1}{2}$. Evaporate filtrate to obtain sodium chloride. $\frac{1}{2}$

22. Process T - Fermentation (1)

W - CH_3COONa (1)

Uses of X - Making polythene (1)
- Manufacture of ethanoic acid

23. (a) Element stored under paraffin G (1 mark)

(b) E is smaller than I (1). E has two energy levels while I has 3 energy levels. (1)

24. The molecules of water are

(a) Loosing heat (1). The kinetic energy decreases and the molecules move closer to each other (1)

(b) Solid state (1)

25. Add a soluble carbonate (1)
Filter the mixture $\left(\frac{1}{2}\right)$
Wash residue with distilled (1) water and dry residue $\left(\frac{1}{2}\right)$

26. H = 14.5

$C = (100 - 14.5 = 85.5\%)$ $\left(\frac{1}{2}\right)$

	C	:	4
Moles	$\frac{85.5}{12}$	:	$\frac{14.5}{1}$ $\left(\frac{1}{2}\right)$
	7.12	:	14.5
	$\frac{7.12}{7.12}$	:	$\frac{14.5}{7.12}$
	:2.03		

Ratio 1 : 2 $\left(\frac{1}{2}\right)$

EF CH_2 $\left(\frac{1}{2}\right)$

MF $= (CH_2)_n = 56$

$14n = 56$

$n = 4$ $\left(\frac{1}{2}\right)$

MF $= C_4H_8$ $\left(\frac{1}{2}\right)$

(3 marks)

27. (a) Bubble the gases in calcium hydroxide solution.(1) Carbon (II) Oxide does not react $\left(\frac{1}{2}\right)$ while Carbon (IV) Oxide forms a white precipitate. $\left(\frac{1}{2}\right)$

(b) Carbon (IV) Oxide cuts the supply of oxygen. (1)

28. (a) Sources of alkanes

- crude oil/petroleum
- natural gas/biogas

(b) (i) The brown/red/orange/yellow colour of bromine is discharged/discoloured

29. (a) B (1)

(b) A (1)

(c) C (1)

4.7.2 Chemistry Paper 2 (233/2)

1. (a) (i) It acts as a preservative $(\frac{1}{2})$.
It gives it taste/adds flavour/sweetens $(\frac{1}{2})$.

(ii) Effervescence/ fizzing/bubbles/sound (1) CO2 is dissolved under pressure in the soft drink. On opening, the pressure is released the pressure is decreased (1).

(iii) H_2CO_3 (1)

(b) (i) $2Zn(NO_3)_{2(s)} \longrightarrow 2ZnO_{(s)} + 4NO_{2(g)} + O_{2(g)}$ (1)

(ii) $\text{Moles of } Zn(NO_3)_2 = \frac{5.76}{189.4} = 0.03 \text{ moles}$ (1)

$\text{Moles of } NO_2 = 2 \times 0.03$
$= 0.06(\frac{1}{2})$

$\text{Moles of } O_2 = \frac{0.03}{2}$

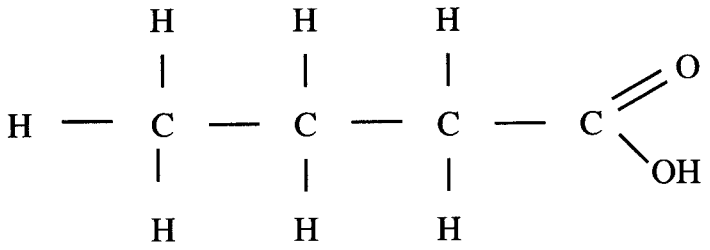
$= 0.015\ (\frac{1}{2})$

Total no. of moles of gases = 0.06 + 0.015
= 0.075 (1)

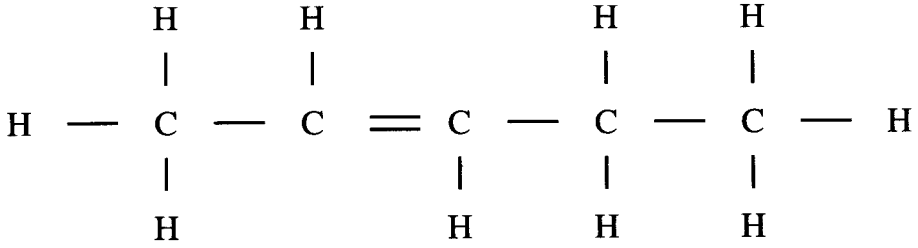
Volume of gases = 0.075 x 24 = 1.8 dm^3 (1)

(iii) Nitrogen (1). Its oxidation state decreases/oxidation state changes from +5 to +4.

2. (a) (i)



(ii)



(b) Propan - 1 - ol dissolves in water because it is polar v Prop-l-ene is non-polar.

(c) The purple colour would be decolourised (1) because oil from nuts is unsaturated (1) / contains a $\dot{C} = \dot{C}$ double bonds..

(d) Hydrogenation (1).

(e) Add NaOH /KOH to the oil (1), stir $(\frac{1}{2})$, boil the mixture $(\frac{1}{2})$. Add NaCl solution (1), skim off or filter $(\frac{1}{2})$.

(f) $$\text{Moles of KOH} = \frac{62.5 \times 0.08}{1000}$$

$$= 0.005 \text{ moles (1)}$$

$$\frac{0.44}{\text{R.M.M}} = 0.005 (\tfrac{1}{2})$$

$$\text{R.M.M} = 0.44 (\tfrac{1}{2})$$

3. (a) Sublimation (1 mark)

(b) Add ethanol to the mixture $(\frac{1}{2})$. Filter $(\frac{1}{2})$ and evaporate filtrate to obtain red dye $(\frac{1}{2})$. Add water to the residue $(\frac{1}{2})$. Filter to obtain sunflower flour $(\frac{1}{2})$. Evaporate filtrate to obtain salt $(\frac{1}{2})$.

Add H_20 to mixture $(\frac{1}{2})$, filter $(\frac{1}{2})$, residue is sunflower $(\frac{1}{2})$, evaporate the water $(\frac{1}{2})$; add ethanol to the residue $(\frac{1}{2})$ filter $(\frac{1}{2})$. The filtrate is red dye.

(3 marks)

(c) (i) W accepts electrons more readily than X. W has small atomic radius/ W has less energy levels than X/ W has less screening effect than X/ W has greater effective nuclear attraction than X. W is more electro negative than X.

(ii) T has a lower melting point than R (1) because it exists in simple molecular form with weak Van der Waals forces $(\frac{1}{2})$ while R has strong metallic bonds $(\frac{1}{2})$.

(iii) I Q ($\frac{1}{2}$ mark)

II N ($\frac{1}{2}$ mark)

(d) I.

Elements	Compounds
iodine	Water (1)
diamond	Candle wax

- making drilling bits/making glass cutters (1 mark)
- Jewellery

4. (a) (i) I F (1)

II G (1)

(ii) - Manganese (IV) oxide oxidises hydrogen to water /depolariser (1).

- It increases the surface area of the electrolyte (1).

(b) (i) Cathode J (1).

(ii) $Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e^{(1)}$.

(iii) Slag /impurity / sludge $^{(1)}$.

(iv) Q = It

Quantity of electricity = 60 x 2

Q = 0.6 x 60 x 60 x 2

$Cu \rightarrow Cu^{2+} + 2e^-$

IF = 96500 x 2

0.6 x 60 x 60 - ?

$\frac{0.6 \times 60 \times 60}{96500 \times 2} = 0.01119$ x2

½

Mass = 0.02238 x 63.5 = 1.42 g (3 marks)

(v) Uses of copper metal - soldering bits / wires

- Electrical cables and alloys - coins, ornaments/lightening arrestors/ diodes/
- calorimeters. (1 mark)

5. (a) (i) Chlorine

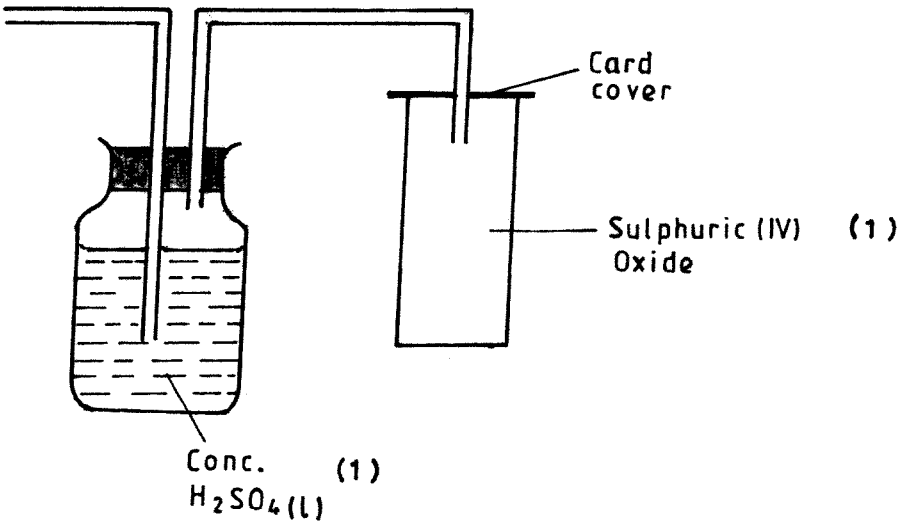
Solid N - Potassium manganate (VII). $\frac{1}{2}$

M - Conc HCl. $\frac{1}{2}$

SO_2 - N is sodium sulphite / Potasium sulphite $\frac{1}{2}$

M is dilute HCl / H_2SO_4 $\frac{1}{2}$

(ii)



(3 marks)

(b) Presence of SO_2
- Use of acidified potassium dichromate (VI)(1) which turns from orange to green $\frac{1}{2}$.
- Bubble gas through acidified potassium manganate (VII)(1) which decolourises $\frac{1}{2}$ / changes i.e from purple to colourless.
- Iron (III) sulphate solution - yellow/brown changes to green
- Bromine water colour changes from yellow/brown / orange to colourless

(c)
- Fumigation (1)
- Preservative (1).
- Antioxidant
- Bleaching agent
- Disinfectant

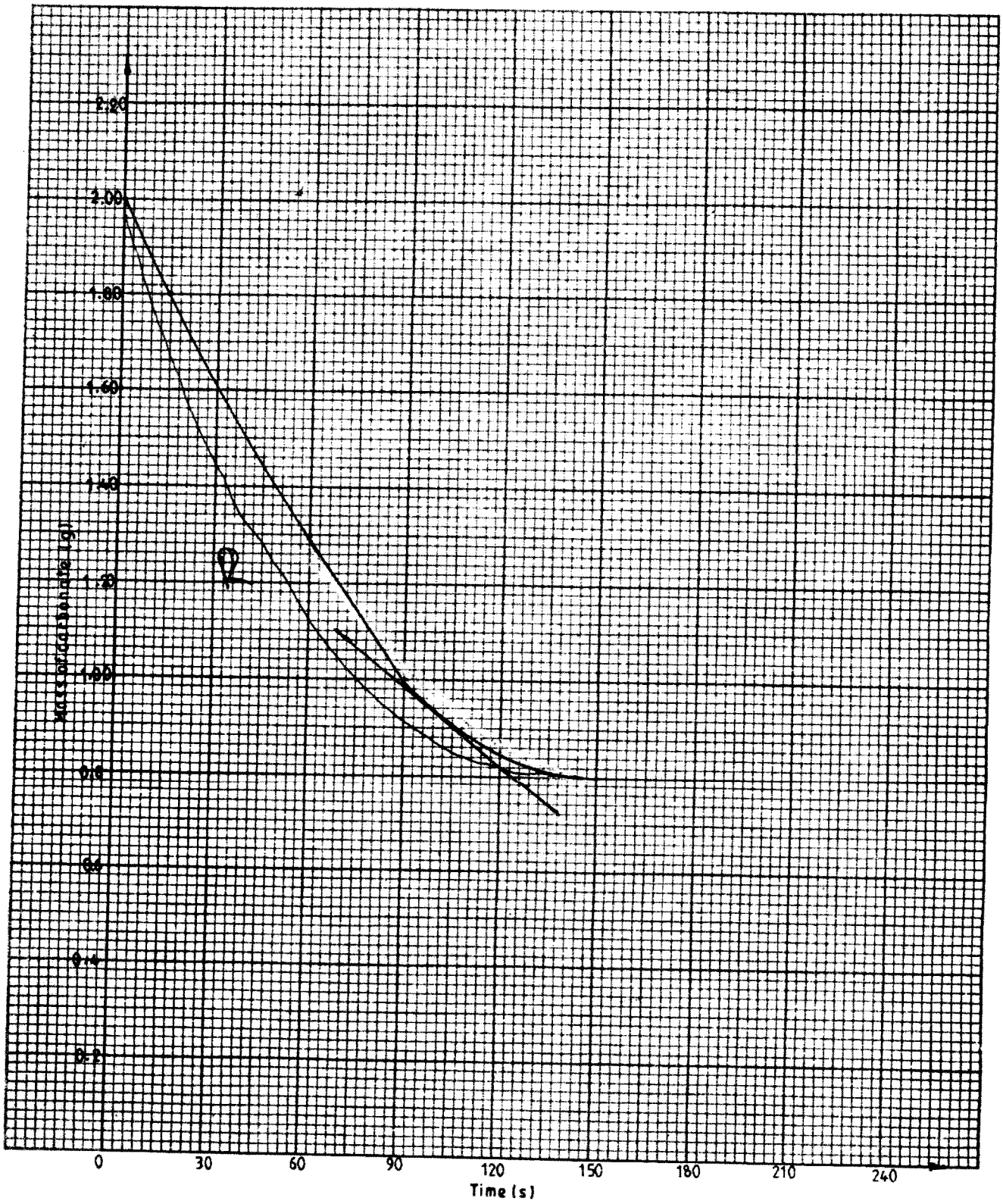
6. (a) Factors, temperature, catalyst, surface area, particle size, pressure, light intensity.

(2 marks)

(b) (i) Equation: $CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$ (1 mark)

(ii) Graph
- plotting
- scale
- curve - which levels towards the end

(3 marks)



(c) Determine the rate of reaction at 105 sec. (Use the graph) (3 marks)
Draw a tangent at 105

(d) Curve levels off, because all the acid has been used up. (1 mark)

(e) Sketching a curve. (2 marks)

7. (a) $\%\ ^{26}Mg = 78.6 + 10.0$
$= 88.6$
$100 - 88.6$
$= 11.4\%$ (1)

$$\text{RAM for Mg} = \frac{24 \times 78.6 + 10 \times 25 + 11.4 \times 26}{100}$$

$$\frac{1886.4 + 250 + 296.4}{100}$$

RAM of Mg = 24.3 (1)

(b) (i) White solid = Magnesium oxide (1 mark)

Ammonia. (1 mark)

(ii) Making ammonium fertilizers /manufacture of Na_2CO_3/laundry/refregirant.. (1 mark)

(c) (i) - Water sample with temporary hardness is I
- It uses less soap after boiling

(ii) On filtering there is still soluble cations of Ca^{2+} and Mg^{2+} present which contribute to water hardness. Distilling, the Ca^{2+} and Mg^{2+} ions are left behind as insoluble salts.
Filterning does not remove hardness in water/does not remove Ca^{2+} and Mg^{2+} ions. Distillation removes hardness in H_2O/ removes Ca^{2+} and Mg^{2+}.

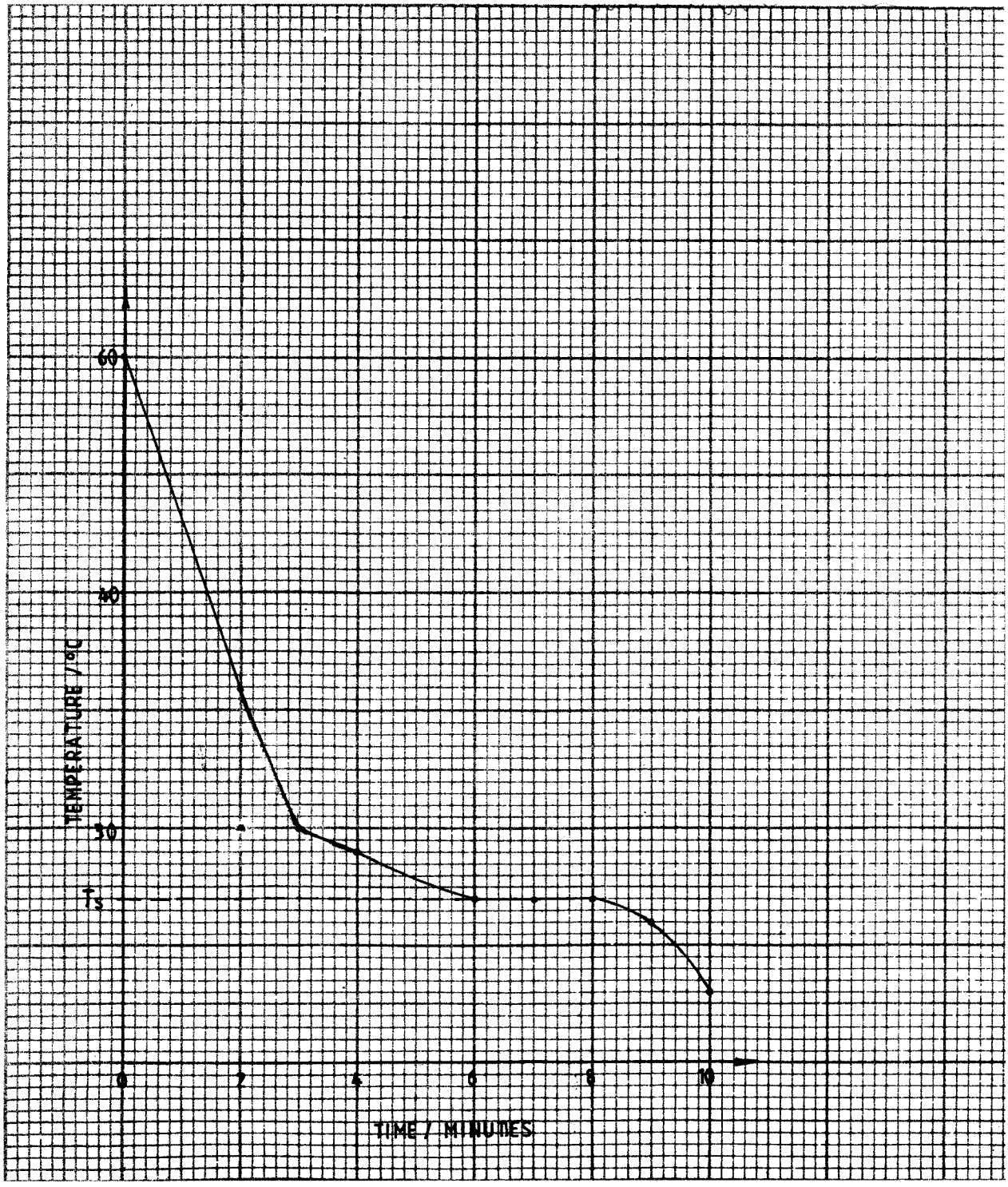
(iii) Clogs water pipes, waste soap formation of scum/ Boiler scales
Dirty marks/stains on clothes.

4.7.3 Chemistry Practical Paper 3 (233/3)

1. (a)

Time (minutes)	0	2	3	4	5	6	7	8	9	10
Temperature (°C)	60.0	36.0	30.0	29.0	27.5	27.0	27.0	27.0	26.0	23.0

(5 marks)



(a) Ts is 27(°C).(1) (3 marks)

(b) Solubility at Ts.(1)
2 g of A in 10 cm^3 of H_2O
? 100 cm^3 of H_2O

$$\frac{2\times100}{10}=20\,g$$ (1)

Table 2

	I	II	III
Final burette reading	30.80	38.70	30.70
Initial burette reading	0.00	8.00	0.00
Volume of solution **A** (cm^3) used	30.80	30.70	30.70

(3 marks)

(a) (i) Average volume of solution A.

$$\frac{30.7+30.7}{2}=30.7\,cm^3$$ (1 mark)

(ii) $\frac{25}{1000}\times0.05=1.25\times10^{-3}$ moles (1 mark)

(b) (i) Acid: substance A
2 : 1
$$=\frac{1.25\times10^{-3}}{2}=6.25\times10^{-4}$$ (1 mark)

(ii) 6.25×10^{-4} moles in 30.7
? moles in 1000

$$\frac{6.25\times10^{-4}\times10^{3}}{30.7}=0.02\text{ m}$$

(iii) Molarity - $\frac{Conc\ g/L}{RAM}$

2g - 250
? - 1000
$$\frac{2\times1000}{250}=8\,g/L$$ (1 mark)

(iv) RFM = $\frac{\text{conc g/L}}{\text{molarity}}$

$$=\frac{8}{0.02}$$

$$=400$$ (1 mark)

2. (a)

Observations	Inferences
White precipitate insoluble in excess	Probably Ca^{2+}, Mg^{2+} present (Accept names of ions)
(1 mark)	(2 marks)

(b)

Observations	Inferences
No white precipitate No observable change	Calcium ions present (Ca^{2+})
(1 mark)	(1 mark)

(c)

Observations	Inferences
White precipitate	Calcium ions (Ca^{2+})
(1 mark)	(1 mark)

(d)

Observations	Inferences
No effervescence	CO_3^{2-}/SO_3^{2-} absent
(1 mark)	(1 mark)

(e)

Observations	Inferences
No white precipitate	SO_4^{2-}(absent)
(1 mark)	(1 mark)

(f)

Observations	Inferences
White precipitate	Cl^- present
(1 mark)	(1 mark)

3 (a)

Observations	Inferences
It is not decolourised	L must be saturated
(1 mark)	(1 mark)

(b)

Observations	Inferences
Orange colour persists	alcohol absent or R-OH absent
(1 mark)	(1 mark)

(c)

Observations	Inferences
Effervescence and colourless gas evolved	L is acidic or carboxylicacid present H^+, H_3O^+, R-COOH
(1 mark)	(1 mark)

(d)

Observations	Inferences
Effervescence and colourless gas evolved	H^+, H_3O^+, R-COOH confirmed.
(1 mark)	(1 mark)