CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015
233/1 CHEMISTRY PAPER 1 MARKING SCHEME

1. (i) Take 2 tablets after every 8 hours. ✓1
   (ii) Produced when the air hole is open. ✓1

2. (a) - Difference in densities. ✓1
   - They are immiscible. ✓1

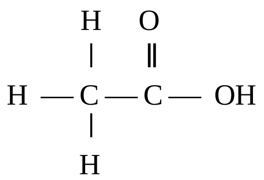
3. - Heat to sublime NH_4Cl. ✓½
   - Add water ✓½ to dissolve NaCl. ✓½
   - Filter ✓½ the residue is $PbCl_2$ ✓½
   - Evaporate ✓½ the filtrate (NaCl solution) to obtain NaCl solid.

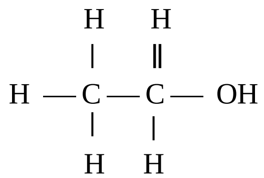
4. (i) 2.8 ✓1
   (ii) Group II ✓1

5. (a) Hydrogen ✓1
   (b) Copper would not react with steam. ✓1
   (c) $Mg_{(S)} + H_2O_{(g)} \rightarrow MgO_{(S)} + H_{2(g)}$ ✓1 $\left(\begin{array}{l} \textit{Balanced equation} - \tfrac{1}{2} \\ \textit{Correct state symbols} - \tfrac{1}{2} \end{array}\right)$

6. $M_m =$ $\quad$ $M_{Fe} = 0.1M$
   $V_m = 24.15cm^3$ $\quad$ $V_{Fe} = 25cm^3$
   Mole of Fe^{2+} = 0.1 mol → $1000cm^3$ ✓½
   ← 25
   Mole ratio 1: 5✓½ = 0.0025 moles ✓½
   Moles of MnO_4 $= \dfrac{0.0025}{5} = 0.0005\ moles$ ✓½
   0.005 moles → $24.15cm^3$
   ← $1000cm^3$ ✓½ $= \dfrac{0.005 \times 1000}{24.15} = 0.0207\ moles$ ✓½

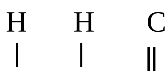
7. (a) Protect the hot iron from being re-oxidised. ✓1
   (b) Used to preheat the air blown in at the base of the furnace. ✓1
   (c) - Decomposes to calcium oxide which combines with unwanted silica forming slag. ✓1

8. (a) P —  ✓1

   Q —  ✓1

   (b) Sodium ethoxide. ✓1

9. (a) Esters ✓1
   (b) Propanoic acid ✓½ $\quad$ Methanol ✓½



10. (a) - Neutron – Proton ratio $\left({}^{n}\!/_{p}\right)$ ratio ✓1
- Amount of energy released when neutrons collide with protons in the nucleus
(Any 1)

(b) 216 = 208 + 4m + 0
4m = 216 – 208
4m = 8
$m = {}^{8}\!/_{4} = 2$ ✓1
90 = 82 + 2m + -n
4 = -n
n = 4 ✓1

(c) $1 \rightarrow {}^{1}\!/_{2} \rightarrow {}^{1}\!/_{4} \rightarrow {}^{1}\!/_{8} \rightarrow {}^{1}\!/_{16}$
4 half-life's = 112 days
1 half life = ??
$= \frac{1 \times 112}{4}$ ✓½ = 28 days ✓½

11. (a) $M_{(g)} - 3e^{-} \rightarrow M^{3+}_{(g)}$ ✓1
(b) MCl_3 ✓1

12. - Withdraw of ammonia formed, ✓½ decrease in concentration of $NH_{3(g)}$ favours forward reaction. ✓½
- Use of low temperatures – Reaction is exothermic and decrease in temperature favours forward reaction.
- Addition of hydrogen/nitrogen; increase in concentration of reactants favours forward reaction. (Any one)

13. Moles of HCl used $= \frac{1 \times 20}{1000}$ ✓½
= 0.02 moles ✓½
$CaCO_3$: HCl
1: 2
Moles of $CaCO_3$ used = ½ x 0.02 moles
= 0.01 moles ✓½
0.01 moles → 1g
1 mole → ??
$= \frac{1 \times 1}{0.01} = 100g$ ✓½
Ca + 12 + 16 x 3 =100
Ca = 100 – 40

Ca = 40 ✓1

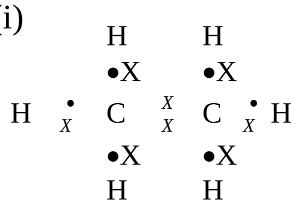
14. 100g of water $\rightarrow$ 25g

112g of water $= \frac{112 \times 25}{100}$ ✓½ = 28g ✓½

Undissolved salt = (8 + 55) – 28 ✓½

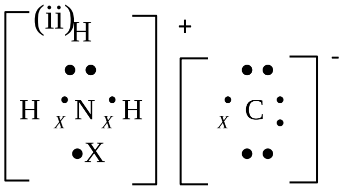
= 35g ✓½

15. (a) (i)



✓1

(ii)



✓1

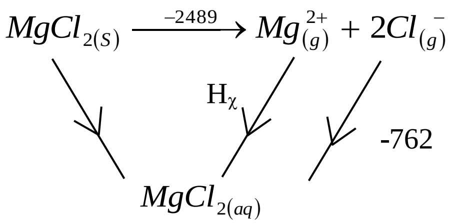
(b) Dative covalent. ✓1

16. (a) Enthalpy change of a reaction is the same regardless of the route followed as long as the reactants and products are the same. ✓1

(b) H_1 – Lattice energy ✓1

H_2 – Hydration energy of $MgCl_2$ ✓1

(c)



✓1

$-5142 = -2489 + H_\chi + -762$

$-5142 + 2489 + 769 = H_\chi$

H_χ = -189/kJ/mol ✓1

17. (a) - Denser than air ✓½

- Does not support combustion ✓1

(b) - Reacts with $NaHCO_3$ to produce CO_2 which makes the dough to rise ✓1

- Reacts with Na_2CO_3 formed when $NaHCO_3$ is heated hence neutralizes Na_2CO_3in the dough. ✓1

18. (a) Q = 1t

= 0.5 x 1930 sec

= 965C ✓1

(b) $J^{\chi+}_{(l)} + \chi C \rightarrow J_{(S)}$

44g

965C $\rightarrow$ 0.44g

$\leftarrow$ 44g

$= \frac{44 \times 965}{0.44}$ ✓½ = 96500C ✓½

$\chi \times \frac{96500}{96500} = \frac{965500}{96500}$ ✓½

$\chi = 1$

Charge = 1+ ✓½

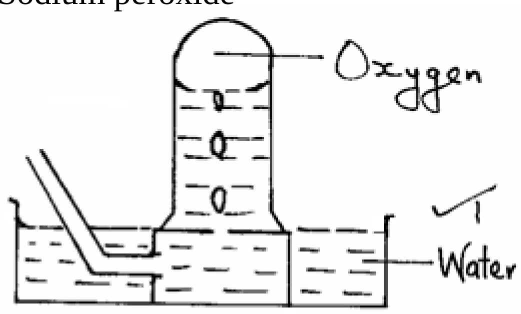
19. (a) It is the number of replaceable hydrogen atoms in an acid. ✓1

(b) - Mix/react 50cm³ of 0.5M H_2SO_4 or 25cm³ of 1M H_2SO_4 solution to obtain a neutral solution of K_2SO_4. ✓1

- Heat to evaporate some water. ✓1
- Cool slowly to crystallize the salt. ✓1

20. (a) Sodium peroxide ✓1

(b)



(c) $2Na_2O_{2(S)} + 2H_2O_{(l)} \rightarrow 4NaOH_{(aq)} + O_{2(g)}$

21. (a) R/14.0 ✓1

(b) P/1.5 ✓1

(c) S/8.0 ✓1

22. (a) Yellow solid is formed. ✓1

SO_2 gas is reduced by H_2S to sulphur. ✓1

(b) - Jars should be moist. ✓1

- The jar with the denser gas should be placed on top of the jar with the light gas. ✓1

23. (a) $2KMnO_{4(S)} + 16HCl_{(aq)} \rightarrow 2KCl_{(aq)} + 2MnCl_{2(aq)} + 8H_2O_{(l)} + 5Cl_{2(g)}$ ✓1

(b) MnO_2 ✓1

(c) $Cl_{2(g)} + \text{dye} + H_2O_{(l)} \rightarrow 2HCl_{(aq)} + (\text{dye} - O)$ ✓1

24. - Ionisation energy is the energy required to remove an electron ✓½ (S) from a gaseous atom. ✓½

- Electron affinity is the energy required to add an electron ✓½ to a gaseous atom. ✓½

25. $RN_2 = \frac{280}{70} =$ ✓½ 4cm³/sec; $RCO_2 = \frac{400}{t}$ ✓½

$\frac{4}{\frac{400}{t}} = \sqrt{\frac{44}{28}}$ ✓½

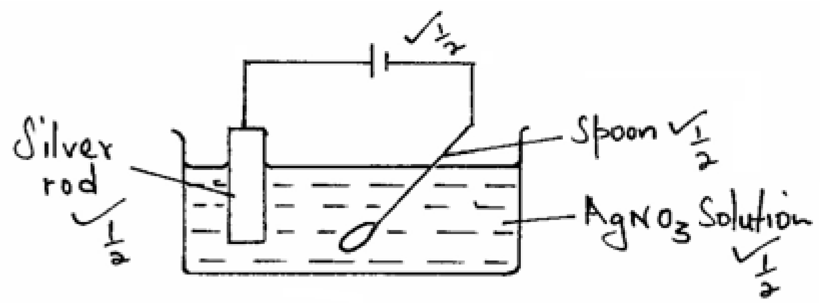
$4 \times \frac{t}{400} = \sqrt{\frac{44}{28}}$

$\frac{t}{100} = \sqrt{\frac{44}{28}}$ ✓½

$t = \sqrt{\frac{44}{28}} \times 100$ ✓½

= 125.36 sec ✓½

26.

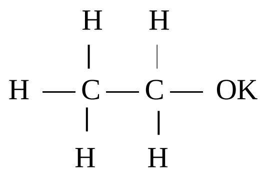


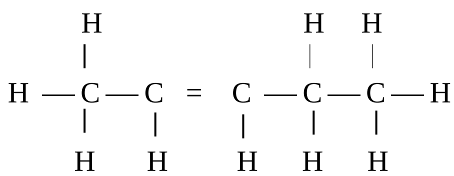
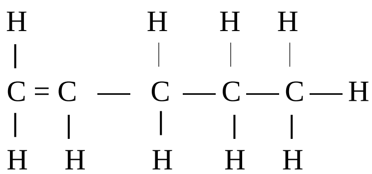
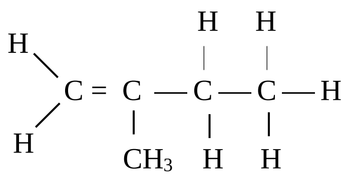
27. (a) $2NaNO_{3(S)} \rightarrow 2NaNO_{2(S)} + O_{2(g)}$

(b) $2Cu(NO_3)_{2(S)} \rightarrow 2CuO_{(S)} + 4NO_{2(g)} + O_{2(g)}$

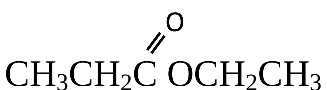
CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015
233/2 CHEMISTRY PAPER 2 MARKING SCHEME

1. (a) (i) C = 2.8 ✓½
F = 2.8.8 ✓½
(ii) Period 3 ✓½
Group II ✓½
(b) B has a giant metallic structure ✓½ with strong metallic bonds ✓½ hence B.P very high compared to F which has molecular structure ✓½ with weak van der waal forces ✓½ between the molecules hence low B.P.
(c) BG_2 ✓1
(d) Chloride of A is ionic has strong ionic ✓½ bonds hence high B.P. While C has molecular ✓½ structure with weak van der waal forces ✓½ hence low B.P.
(e) A_2O ✓½ C_2O_3 ✓½ DO_2 ✓½ G_2O_7 ✓½/G_2O
(f) C_2O_3 ✓½ its amphoteric ✓½
(g) +4 ✓1

2. (a) (i) A – Ethene
B – Ethane
C – 1, 2 – dichloroethane
D – Hydrogen
K – Ethanol
(ii)

(iii) W – Fermentation
X – Esterification
Y – Dehydration

(iv)




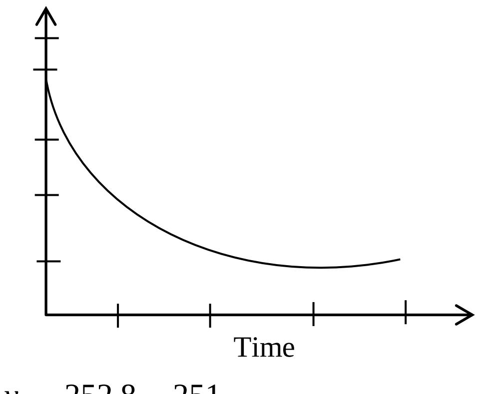
(c) Manufacture of polythene.
Manufacture of ethanol.



(d)

3. (a) To avoid poisoning the catalyst ✓1
(b) A: Air ✓½
B: Ammonia gas ✓½
(c) D: Catalytic chamber ✓1
E: Cooling chamber ✓1
F: Absorption tower ✓1
(d) (i) $4NH_3 + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$ ✓1
(ii) $4NO_{2(g)} + O2_{(g)} + 2H_2O_{(l)} \rightarrow 4HNO_{3(aq)}$ ✓1
(e) Pressure: 9atm ✓1/Catalyst : Platinum-rhodium ✓1
(f) Fractional distillation. ✓1
(g) Manufacture of nitrogenous fertilizers ✓1/AOC.
(h) There is production of $NO_{(g)}$ which is oxidized by air to $NO_{2(g)}$ which is brown. ✓1

4. (a) $Zn_{(S)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$
(b) It decreases with time until it becomes constant.
(c) Colourless solution/Brown solid.
(d) (i) Graph paper provided



Plotting – (1mk)
Scale - (1mk)
Curve - (1mk)

(ii) $\frac{\Delta y}{\Delta \chi} = \frac{252.8 - 251}{30 - 20} = 0.09 \pm 0.01$
(iii) Rate would increase.
Increase in temperature increases kinetic energy and lowers activation energy.

5. (a) (i) Q;✓½ Has the highest negative ✓½ E^θ hence highest tendency to lose electrons.

(ii) $B_{(S)} \rightarrow B^{2+}_{(aq)} + 2e^-$ +1.14
$D^{2+} + 2e \rightarrow D_{(aq)}$ +0.80 ✓½
e.m.f = +1.94V ✓½
(or)

e.m.f = $E^{\theta}_{Reduced}$ - $E^{\theta}_{Oxidised}$ = +0.80 - -1.14 ✓½
= +1.94V ✓½

(iii) $Q_{(S)} \rightarrow 2C^{2+}_{(aq)} \rightarrow Q^{2+}_{(aq)} + 2C_{(S)}$ ✓1

(iv) 3B → $3B^+$ + 3e +1.14V
Fe^{3+} + 3e- → Fe -1.66V
emf = -0.52V
∴ Cannot occur because emf is negative.
(or) Fe is a stronger reducing agent hence B cannot reduce Fe^{3+}.

(b) To prevent rusting ✓1/corroding of iron pipe; magnesium is more reactive than iron, so it is attacked as a sacrificial metal. ✓1 (2 marks)

(c) (i) B ✓1
(ii) $4OH^-_{(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-$ ✓1
(iv) A brown ✓1 deposit, Cu^{2+} migrate to cathode and are reduced to copper metal.
(v) Becomes acidic/PH reduces because hydrogen ion concentration increases as OH^- ions are discharged.

(d) Anode dissolves: $Cu_{(S)} \rightarrow Cu^{2+}_{(aq)} + 2e^-$ ✓1
Cathode: $Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(S)}$ ✓1
(v) Purification of copper. ✓1

6. (a) (i) I: $Zn(OH)_2$ ✓1
II: $ZnCl_2$ ✓1
III: ZnO ✓1
(ii) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_{2\,(S)}$ ✓1
(iii) White precipitate soluble in excess. ✓1

(b) Ammonia gas is polar and ionizes ✓1 in water which is polar. While it does not ionize in methylbenzene which is non polar.

(c) (i) Calcium carbonate/magnesium carbonate.
(ii) Passing a solution of dilute hydrochloric acid or nitric (V) acid in the boiler. (1mk)

(d) $[Zn(OH)_4]^{2-}$

7. (a) $2ZnS_{(S)} + 3O_{2(g)} \rightarrow 2ZnO_{(S)} + 2SO_{2(g)}$ ✓1

(b) L: Sulphur (IV) oxide M: Zinc oxide
T: Lead Z: Zinc/Zinc vapour (Each ½mk)

(c) It produced in vapour state/form. ✓1

(d) Sulphuric (VI) acid manufacturing plant. ✓1
To utilize the sulphur (IV) oxide by product. ✓1

(e)
- Galvanization of iron sheets to prevent corrosion/rusting.
- Making brass, an alloy of copper and zinc.
- Making outer casing of dry batteries.
- Zinc cyanide is used for refining silver and gold. (any 1mk)

(f) (i) R.F.M ZnS = 97

$Moles\ \frac{2.91}{97} = 0.03\ moles$ ✓½

Sulphuric acid H_2SO_4

0.2 mole = 1000cm³

? = 100cm³

$\frac{100 \times 0.2}{1000} = 0.02$ mole ✓½

Zinc sulphide ✓1 is excess by 0.01 mole.

(ii) 0.02 mole x 24000 ✓1 = <u>480cm³</u> ✓1

233/3 CHEMISTRY PAPER 3 MARKING SCHEME

Question 1

Table 1

1. (i) Complete table. (5mks)

Conditions
- 3 titrations (1mk)
- 2 titrations (½mk)
- 1 titration (0mk)

Penalties
- Wrong arithmetic/subtraction
- Inverted table
- Burette reading beyond $50cm^3$ or below $1cm^3$.

Penalize ½mk for each penalty upto a max of. (½mk)

(ii) Decimals.

Conditions
- Accept 1 or 2d.p used consistently.
- Where 2d.p used 2nd d.p must be 0.5 or 5

Penalize fully if any conditions are not met

(iii) Accuracy (1mk)

Compare candidates titre with school value.

Conditions.
- If any is within $\pm 0.1cm^3$ SV (½mk)
- If none within $\pm 0.2cm^3$ SV (0mk)

(iv) Averaging
- Values averaged must be shown and be consistent within $\pm 0.2cm^3$ of each other.

Conditions
- If 3 consistent averaged. (1mk)
- If 3 titration done and two possible averaged (1mk)
- If only two titrations done, consistent and averaged (1mk)
- If only two titrations done, inconsistent yet averaged (1mk)
- If 3 titrations done, all are possible yet only two averaged (0mk)
- If 3 inconsistent values averaged. (0mk)

Final/answer

Compare final answer with SV (School value)
- If within $\pm 0.1cm^3$ of SV (1mk)
- If within $\pm 0.2cm^3$ of SV (1mk)
- If outside $\pm 0.2cm^3$ of SV (0mk)

(a) (ii) $\frac{5.88 \times 4}{392}$ ✓1 = 0.05M ✓1 (2mks)

(iii) $Moles = \frac{25}{1000} \times 0.06$ ✓1

= 0.0015 ✓1 (2mks)

(b) (i) Mole ratio = y: χ

= 5: 1

Moles of $A = \frac{1}{5} \times 0.0015$ ✓½

= 0.0003 ✓½ (1mk)

(ii) Concentration in mole dm^{-3}

$= \frac{1000 \times moles\ in\ b(i)}{Answer\ in\ a(i)}$ ✓1

= Correct answer ✓1 (2mks)

<u>Question 2</u>

- Complete table (1mk)
- Trend in temperature (1mk)
- Trend in time (1mk)

Accuracy: Time (1mk)

Temperature (1mk)

Calculation of $\frac{1}{Time}$ (2mks)

Temp. before mixing (°C)	60.0	55.0	50.0	45.0
Temp. when solution become colourless (°C)	52.0	48.0	44.0	39.0
Time (sec)	25	35	48	70
$\frac{1}{t}$ (S^{-1})	4.000 x 10^{-2}	2.8571 x 10^{-2}	2.0853 x 10^{-2}	1.4285 x 10^{-2}

4 values – 2mks 3 values – 1mk 2 values – 0mk

Values of time should be whole number

Values of temperature with one decimals – The decimal should be 0 or 5

(Should decrease; if not) (0mk)

(Should increase; if not) (0mk)

(Must be within ± 5 sec of SV)

(Must be within ± 2°C of SV)

(Must have 4d.p 4 → Correct values – (1mk) 3 values – (½mk) 2 values – (0mk)

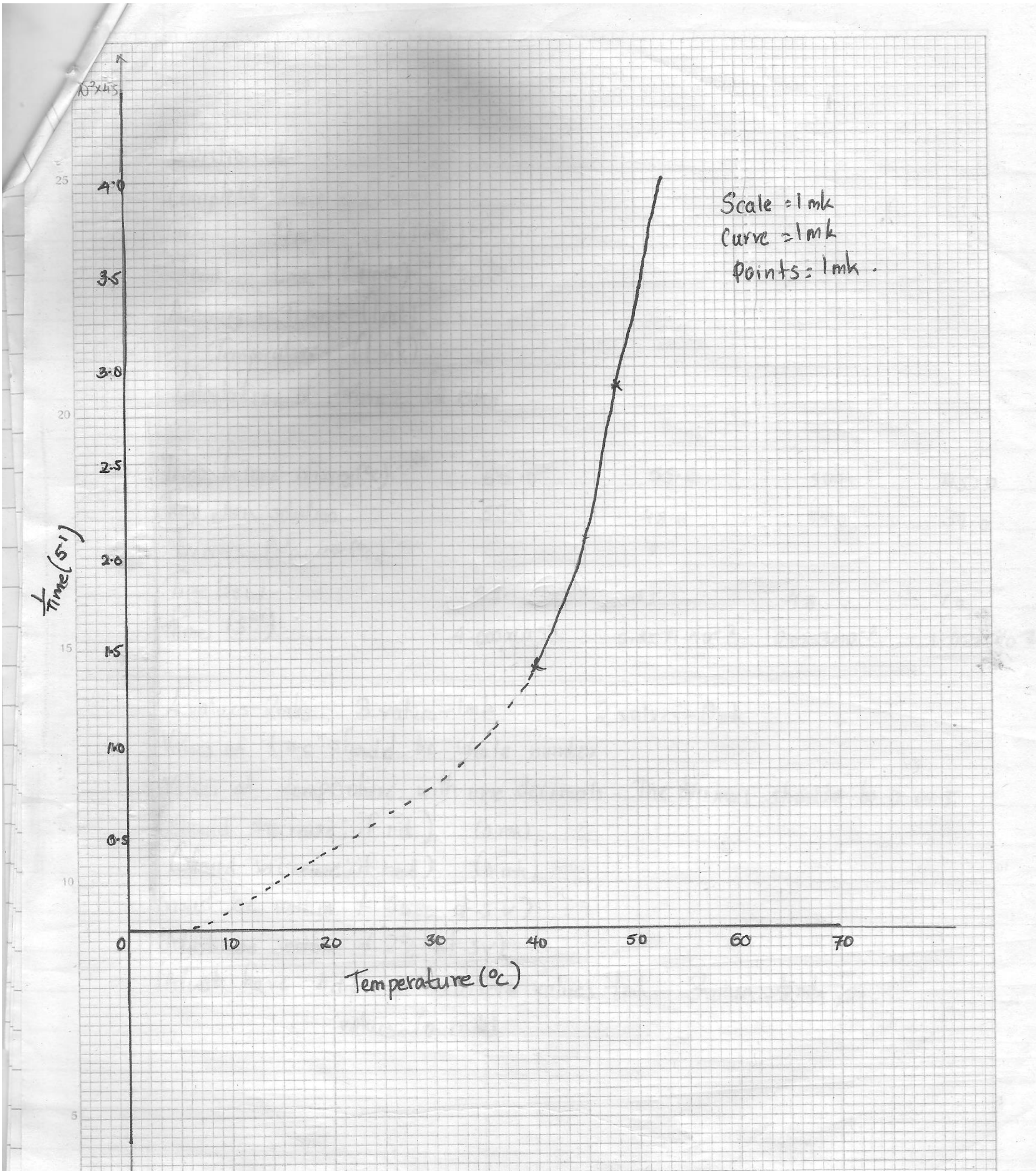
(b) $\frac{1}{Time} = 2.25 \times 10^{-2}\ S^{-1}$

$Time = \frac{1}{2.25} \times 10^{2}\ Sec$

Time = 44 secs. ✓1

(Shown on the graph – (1mk) not shown (0mk) Total marks – (2mks)

(c) The rate of reaction increases with increase in temperature.


Scale = 1 mk
Curve = 1mk
Points = 1mk .
1/time (s⁻¹)
Temperature (°C)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40
50
60
70

2.

(a)	(i)	OBSERVATION	INFERENCES
		Blue turns red ✓½ Red remains red ✓½ Yellow residue when hot ✓½ White when cold ✓½ Colourless liquid on cooler ✓½ Parts of test tube ✓½	- Acidic gas ✓½ - ZnO ✓½ - Hydrated salt ✓½
	(ii)	- Colourless filtrate ✓½ - White residue ✓½	- Soluble✓½/Insoluble salt ✓½
	(iii)	White ppt soluble in excess ✓1	Al^{3+}, Pb^{2+}, Zn^{2+} present ✓1
	(iv)	White ppt soluble in excess ✓1	Zn^{2+} present ✓½
	(v)	White ppt formed ✓½ dissolves on warming ✓½	 Cl^- present ✓½
	(vi)	Bubbles produced ✓½	CO_3^{2-} present ✓½
	(vii)	White ppt soluble in excess ✓1	Zn^{2+} present ✓½

3.

(i)	OBSERVATION	INFERENCES
	Burns with aluminous sooty flame ✓1	- C ≡ C - ✓½ or – C = C - ✓½ Present Reject alkyne/alkenes in words
(ii)	Partially soluble ✓½	Organic substance with a high molecular mass ✓½
(iii)	$K_2Cr_2O_7/H+$ turns from orange to green ✓1	- C ≡ C - ✓½ , – C = C - ✓½ Present
(iv)	Effervescence occurs ✓½	RCOOH present Reject H^+/H_3O^+ ✓½
(v)	PH = 4.0 ✓½	Weakly acidic ✓½ RCOOH present Reject H^+/H_3O^+