30.6.1 Chemistry Paper 1 (233/1)

1. (a) Deliquescent - a substance that absorbs water from the atmosphere and changes into a solution. (1)

   Hygroscopic – a substance that absorbs water from the atmosphere but just becomes wet. (1)

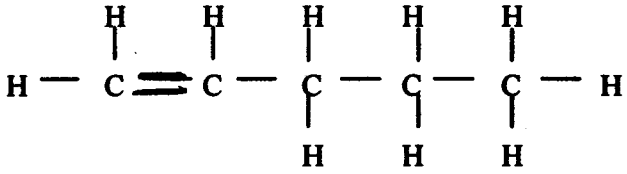
   (b) drying agent. (1) (3 marks)

2. (a) (i) Element – substance that consists of one type of atoms. (1)
   (ii) Atomic number – number of protons in an atom. (1)

   (b) $Ti_3(SO_4)_2$ (1) (3 marks)

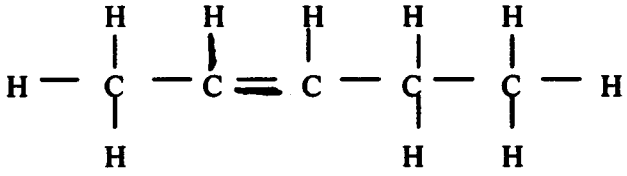
3. (a) ductility. (1)
   (b) activation energy. (1)
   (c) vander waals force. (1) (3 marks)

4.



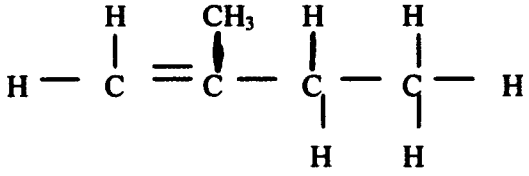
(1)

pent-1-ene



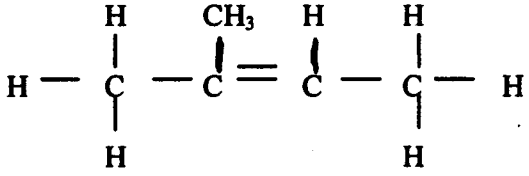
(1)

Pent-2-ene



(1)

2-methylbut-1-ene



2-methylbut-2-ene

5. (a) Heat the hydrated salt in a sealed container (1). The pink substance changes to blue (½). Allow the pink substance to cool (1) it changes to a pink substance (½). (3 marks)

6. (a) $Al_2O_3(s) + 6HCl(aq) \longrightarrow 2AlCl_3(aq) + 3H_20\ (l)$

(b) $Al_20_3 = 2(27) + 3(16) = 102$

Moles of $Al_2O_3 = \frac{153}{102}$ (1)

Moles of $HCl = \frac{152}{102} \times 6$ (½) = 9 moles (½) (3 marks)

7.

Electrolyte	Anode	Cathode
Aqueous sodium sulphate using (½) insert electrodes	Oxygen	Hydrogen (½)
Copper(II) sulphate using copper electrode	Copper ions (1)	Copper metal (1)

(3 marks)

8. (a)

$$\frac{P_1V_1}{T_1} = \frac{p_2V_2}{T_2}$$

$$\frac{1.0\times10^7 \times 1}{77} = \frac{1.0\times10^5 \times V_2}{298} \quad (½)$$

$$V_2 = \frac{1.0\times10^7 \times 298}{1.0\times10^5 \times 77} \quad (½)$$

$$V_2 = 387.0dm^3 \quad (½)$$

(b) No. of moles of

$$N_2 = \frac{387.0}{24.0} = 16.1 \text{ moles} \quad (½)$$

$\therefore$ mass of N_2 = 28 × 16.1 (½)
= 450.8 g (½) (3 marks)

9. (a) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ (1 mark)

(b) (i) 5.6×10^3 years (1 mark)
(ii) 78% (1 mark)

10. (a) Enthalpy of formation of hydrogen peroxide (1) (1 mark)

(b)

$$\Delta H_1 + \Delta H_3 = \Delta H_2$$
$$= \Delta H_2 + \Delta H_1$$
$$= 187.8 - 285.8\ (1)$$
$$= -98\,kJmol^{-1}\ (1)$$

(2 marks)

11. (a) Iron (II) Sulphide
Hydrochloric acid (1)

(b) Reducing agent, hydrogen sulphide (½)
The sulphur changes from -2 to zero (½)

(c) Vulcanisation of rubber (1)
Manufacture of sulphur drugs (3 marks)

12. (a) $Cu^{2+}_{(aq)} + Fe_{(s)} \longrightarrow Cu_{(s)} + Fe^{2+}_{(aq)}$ (1)

(b)

$$\Delta H = MC\Delta T$$
$$= 75.0 \times 4.2 \times 5.6 \quad (½)$$
$$= {}^{-}1764J$$

$$\text{Moles of Cu} = \frac{5.83}{63.5} = 0.0918 \quad (½)$$

$$\Delta H/\text{mol} = \frac{1764}{0.0918} \quad (½)$$

$$= {}^{-}19215.7J$$
$$= {}^{-}19.2kJ\,mol \quad (½)$$

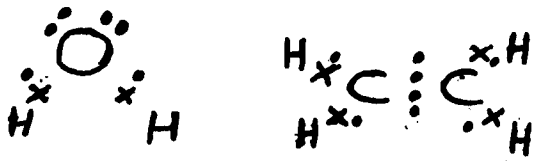
(3 marks)

13. (a)

Reagents	Conditions
Hydrogen (1)	High temperature (½) High pressure Nickel catalyst (½)

(b) Soap = Sodium hydroxide (½) Heating (½) (3 marks)

14. (a)



(b) Dative covalent bond (1) (3 marks)

15. (a) gas has no colour and smell. (1)

(b) Carbon (II) oxide has high affinity for iron in the haemoglobin in the blood, or displaces oxygen from haemoglobin, (1) the body tissues are deprived of oxygen. (1)

(3 marks)

16. (a) Add a few drops of NaOH to an aqueous solution of the fertilizer. Forms white ppt insoluble in excess. (1)

Add a few drops of aqueous sulphuric (VI) acid to another portion of aqueous solution of fertilizer. Forms a white ppt insoluble in excess. (1)

(b) Heat the sample fertilizer in a test tube, and test gas evolved with damp red litmus paper, turn blue. (1)

Or add NaOH to the sample fertilizer and heat the mixture; test gas evolved using damp red litmus paper, turn blue. (3 marks)

17. (a)

	C	H	O	
%	69.42	4.13	26.45	(½)
	$\frac{69.42}{12} = 5.785$	$\frac{4.13}{1} = 4.13$	$\frac{26.45}{16} = 1.653$	(½)
Simplification	$\frac{5.785}{1.653} = 3.5$	$\frac{4.13}{1.653} = 2.5$	$\frac{1.653}{1.653} = 1$	(½)
Whole no.	7	5	2	(½)

Empirical formula $C_7H_5O_2$ (½)

(3 marks)

(b) Empirical mass $7(12) + 5(1) + 2(16)$ (½)
$= 121$

$(C_7H_5O_2)n = 242$
$(121)n = 242$
$n = \frac{242}{121} = 2$

Molecular formula is $C_{14}H_{10}O_4$ (½) (3 marks)

18. (a) $X = H_2$ gas (1 mark)
(b) Increase surface area for faster reaction. (1 mark)
(c) Pickling of metals. (1 marks)

19. (a) $2H_2 + O_2 \rightleftharpoons 2H_2O$ (1 mark)

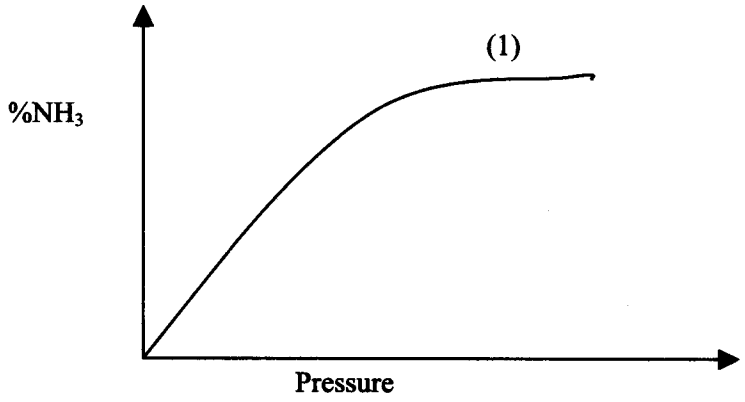
(b) e.m.f. = 0.40 ⁻ ¯0.83 = 1.23V per cell.
For ten cells = 10 x 1.23 = 12.3V (1)

(c) Water formed can be used.
Water is not a pollutant. (1) (3 marks)

20. (a) $NH_4NO_3(s) \longrightarrow N_2O_{(g)} + 2H_2O_{(g)}$ (1)
(b) Downward displacement of warm water because it is fairly soluble in cold water (1)
(c) Both red and blue litmus will not change colour. (1) (3 marks)

21. (a) Chlorofluorocarbon (1)
(b) When ozone is depleted, high energy UV radiations reach the earth, which may cause skin cancer to human beings. (1)
(c) Global warmings (1), /green house effect. (3 marks)

22. (a) Forward reaction is exothermic, (1) therefore increase in temperature shifts position of equilibrium to the left direction in (1) which heat is absorbed.
(b)



(3 marks)

23. Hydrochloric acid is a strong acid which is fully ionised in water (1) while ethanoic acid is a weak acid, partially ionised in water. (1) (2 marks)

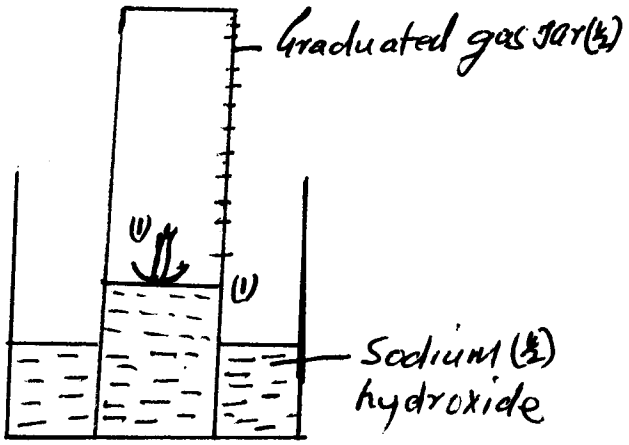
24. React ion metal with sulphuric acid to form Iron (II) sulphate. (1)
React aqueous ammonia with sulphuric acid to form Ammonium Sulphate. ½
Mix the two solutions iron (II) Sulphate and ammonium sulphate ½ to form a solution of ammonium iron (II) sulphate evaporate, ½ until crystallization ½ starts then filter.½
(3 marks)

25.

	Inference	
1st portion	water hard	(1)
2nd portion	permanent hardness of water	(1)
3rd portion	Na_2CO_3 removed the hardness	(1)

(3 marks)

26.



27. (a) 2.8.8 (1)
(b) $K^+ < S^{2-} < P^{3-}$ (1)
Potassium has 19 protons attracting 18 electrons, sulphur has 16 protons attracting 18 electrons and phosphorous has 15 protons attracting 18 electrons.
Therefore the electrons in potassium ions are attracted more strongly making it the smallest ion (1)
(3 marks)

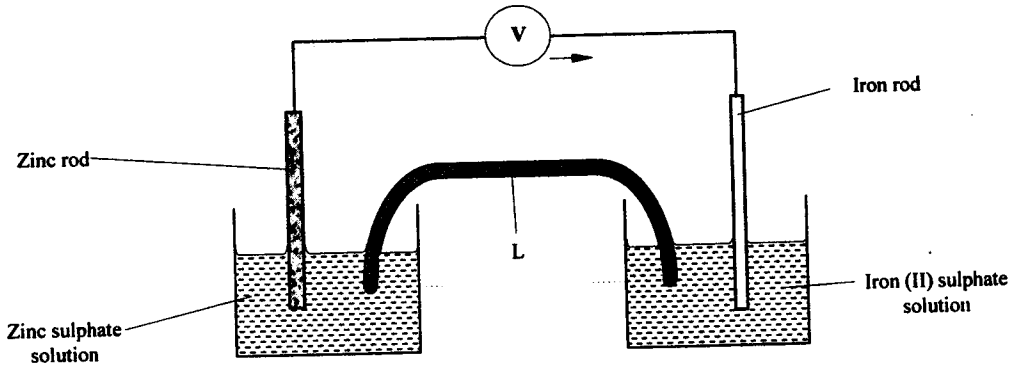
30.6.2 Chemistry Paper 2 (233/2)

1. (a) Ammonia (½) and Copper (II) chloride (½).
This is because they form ions or ionise when they dissolve in water (1)

(2 marks)

(b) (i)

(1 mark)



(ii) Potassium nitrate solution, potassium chloride solution
Any soluble salt of potassium or sodium. Salt. (2 marks)
½ mark for mentioning the salt without the taste.

(c) (i) To improve its appearance/make it attractive
To prevent it from rusting/corrosion (2 marks)

(ii) Q = It

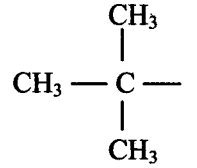
$$Mass = \frac{R.A.M. \times It}{nF} \quad \text{(1 mark)}$$

$$= \frac{108 \times 0.5 \times 60 \times 60}{1 \times 96500} \quad \text{(1 mark)}$$

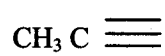
$$= 2.01 \text{ g} \quad \text{(1 mark)}$$

2. (a) (i) 2, 2 - dimethyl propane/dimethylpropane (1 mark)
(ii) pent - 2 - yne (1 mark)

(b) Add acidified Potassium Manganate (VII) or bromine
to each of the compounds in separate test tubes. (1 mark)

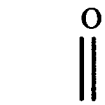


does not decolourise the reagents/ (½ mark)
Purple colour remains/
reddish brown/yellow colour remains/
Burns with a blue/non-luminous flame

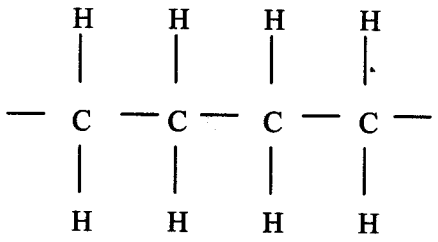


Decolourises the reagents. (½ mark)
Burns with a yellow/sooty/luminous flame

(c) (i)

I		Ethylethanoate	(1 mark)
II	CH_3CH_3	Ethane	(1 mark)

(ii)

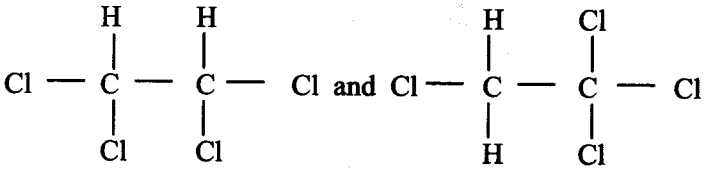


(1 mark)

(iii) Water/steam and Conc. Sulphuric (VI) acid catalyst (1 mark)
Phosphoric acid, conditions. Heat, pressure 60-80,
temperature 300^0 C.

(iv) I - Esterification/condensation (1 mark)
II - Substitution (1 mark)

(d)



(2 marks)

3. (a) (i) Metallic bonds in S are stronger than in R. (1 mark)

(ii) V is monoatomic (independent) hence weaker (1)
van der waals forces while U is diatomic hence stronger van der waals forces
V has less van der waals forces while U has more van der waal forces
(2 marks)

(b) w reacts more vigorously/more reactive/reacts faster (1 mark)
- reactivity of group 1 elements increases down the group/
Ionisation energy is less than that of R
- easier to lose outer electron in W than in R
W is more electropositive than R (1 mark)

(c) $4T(s) + 5O_2(g) \longrightarrow 2T_2O_5(s)/T_4O_{10\,(g)}$ (1 mark)

(d) $2R(s) + 2H_2O(l) \longrightarrow 2ROH(aq) + H_2(g)$ (1 mark)

Moles of gas $= \frac{600}{24000} = 0.025$ Moles (½ mark)

Moles of R = 2 x 0.025 moles = 0.05 moles (½ mark)

R.A.M. of R $= \frac{1.15}{0.05} = 23$ (1 mark)

(e) Used in fluorescent tubes/bulbs/lamps (1 mark)
∴ used in arch welding/fire extinguisher/preservatives in
museums

4. (a) (i) B A Copper and C (1)

B has the highest ΔT (1)
C cannot displace the ions of Cu from solution
there is no reaction (1)
A is more reactive than Cu because it displaces
its ions from solution (3 marks)

(ii) Blue colour of solution disappeared brown deposit is formed
(1 mark)

(b) (i) $C(s) + 2H_2(g) + \frac{1}{2}O_2(g) \longrightarrow CH_3OH(g) \Delta H = -239 kJmol^{-1}$
(1 mark)

(ii) I Yield increases/ will be higher
∴ Equilibrium shifts to the right/forward rxn is formed
(2 marks)

II $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2\ (\frac{1}{2}) = -283\ kJmol^{-1}$

$2H_2 + O_2(g) \longrightarrow 2H_2O(l)\ (1) = -572\ kJmol^{-1}$

$CO_2 + 2H_2O\ (l) \longrightarrow CH_3OH(l) + \frac{3}{2}O_2\ (1) = 715\ kJmol^{-1}$

Change in energy = 715 – 283 – 572 = -140 (½) $kJmol^{-1}$
(3 marks)

(iii) DH_j of CO was not included (1 mark)

5. (a) (i) Flask is slanting upwards
Water will condense into the hot flask and crack it
Method of collection is wrong
Ammonia is less dense than air
Moist reactants should not be used
The gas will be reabsorbed by water (3 marks)

(ii) CaO (1 mark)

(iii) $2NH_4CL(s) + Ca(OH)_2(s) \longrightarrow 2NH_3(g) + 2H_2O(l)\ (1) + CaCl_2(g)$
(1 mark)

(iv) Pass dry HCl through ammonia/take a glass rod/ pass
it over a jar of ammonia and dip it in conc. HCl and white
fumes are formed (½)
Mixture forms white fumes (½) (1 mark)

(b) (i) Unit 1 (1 mark)

(ii) A = NO (½)
B = NO_2 (½) (1 mark)

(iii) Nitrogen in (NH_3) has oxidation
State of -3 while it has oxidation state of +5 in HNO_3 (1)

Increase in oxidation state is oxidation (1) (2 marks

(iv) $NH_3(g) + HNO_3(aq) \longrightarrow NH_4NO_3(aq)$ (½)

Molar mass of NH_4NO_3 (½) = 80 g

Moles of NH_4NO_3 $= \frac{1000 \times 1000}{80}$ (½)

Moles of HNO_3 $= \frac{1000 \times 1000}{80}$ (½)

Molar mass of HNO_3 = 63

$\therefore$ mass of HNO_3 $= \frac{1000 \times 1000}{80} \times 63$ (½)

= 787.5 kg (½) (3 marks)

6. (a) (i) Zn S

(ii) So as to obtain ZnO which is easily reduced by CO to Zn(1 mark)

$2ZnS(s) + 3O_2(g) \longrightarrow 2Zn(s)+2SO_2(g)$ (1)

(2 marks)

(b) (i) - Coke/carbon
- Limestone/$CaCO_3$ (1 mark)

(ii) $2C(s) + O_2(g) \longrightarrow 2CO(g)$ (1)

$CO_2(g) + C(s) \longrightarrow 2CO(g)$ (1) (2 marks)

(iii) Vapour/gas, temperature is above boiling point of Zinc. (1 mark)

(iv) 600° C it is condensing/temperature is below boiling point of Zinc (1 mark)

(v) Formation of gullies (1) due to scooping of soil containing the ore/ CO2 leading to global warming (1). (2 marks)

(vi) - making brass
- Making –ve terminal in dry cells
Galvanization of iron sheets (1 mark)

7. (a) Curve I (1)

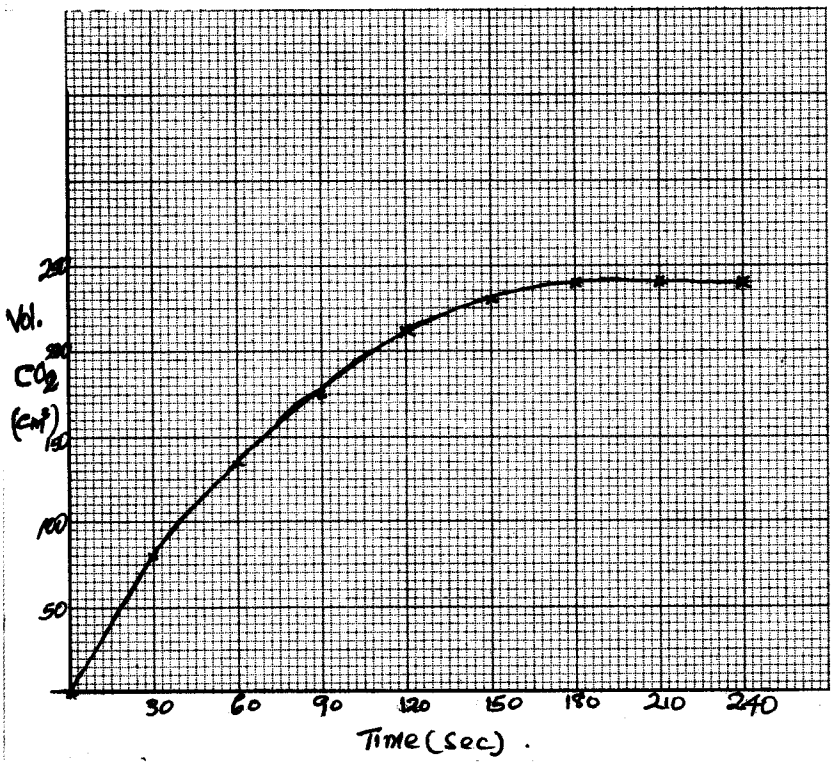
The concentration of products are increasing
The rate of rxn is increasing. (1) (2 marks)

At time x equilibrium has been established, the rate of forward reaction is equal to the rate of reverse reaction (1) and this has a value of Y. (1) (2 marks)

(b) (i) Increasing pressure increases rate of reaction. (1)
Molecules are brought closer, more collision of gases

particles. (1) (2 marks)

(ii) Increasing pressure has no effect on liquids. (1 mark)



(c) Graph

(i) Labelling axes (1 mark)
Showing points correctly (1 mark)
Smooth curve through the points (1 mark)

(ii) I at 15s, (tangent drawn and used correctly) (1 mark)
II at 120s, (tangent drawn and used correctly) (1 mark)
III amount of $BaCO_3$ is decreasing with time
at 15s the value is higher than at 120s. (1 mark)

30.6.3 Chemistry Paper 3 (233/3)

1. **Table 1**

	I	II	III
Final burette reading	13.80	27.80	40.70
Initial burette reading	0.00	13.80	27.30
Volume of solution used (cm^3)	13.80	13.50	13.40

(4 marks)

Average volume used $\frac{13.50+13.40}{2} = 13.45cm^3$ (1 mark)

Mava = MbVb
2 x 25 = 250 x Vb

$\frac{2\times 25}{250}$ = Vb = 0.20M (1 mark)

Moles of NaOH used = $0.2\times\frac{25}{1000} = 0.005$ moles

Moles of acid used = $\frac{1}{3}\times 0.0005$

Concentration of acid = $\frac{0.005\times 100}{13.45\times 3} = 0.12$ M (1 mark)

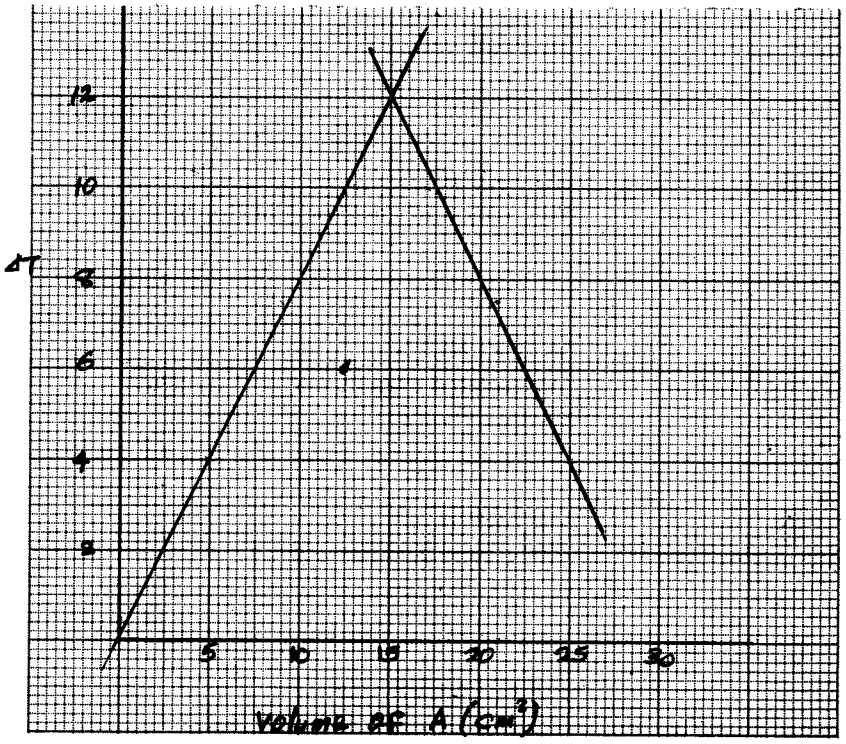
Molar mass of acid = $\frac{25}{0.12} = 208.3$ (1 mark)

Table 2

Volume of solution A (cm^3)	5	9	13	17	21	25
Volume of solution B (cm^3)	25	21	17	13	9	5
Maximum temperature (°C)	30.5	34.0	36.5	36.5	34.0	30.5
Initial temperature (°C)	26.5	26.5	26.5	26.5	26.5	26.5
ΔT change in temperature	4.0	7.5	10.0	10.0	7.5	4.0

(6 marks)

(a)



(b) $15\ cm^3$ (1 mark)

(c) $30 - 15 = 15\ cm^3$ (1 mark)

(d) (i) $15 : 15 = 1 : 1$ (1 mark)

(ii) $MaVa = MbVb$

$$\frac{Ma \times 15}{2 \times 15} = \frac{1}{1}$$

$$Ma = \frac{2 \times 15}{15} = 2$$

$$Ma = 2M$$

(1 mark)

Question 2

(a) (i)

OBSERVATIONS	INFERENCES
White PPt formed (½) No effervescence (½)	CO_3^{2-} and SO_3^{2} ions absent (1) Probably Pb^{2+}, Ba^{2+} or Ca^{2+}, may be present (1)

(3 marks)

(ii)

OBSERVATIONS	INFERENCES
White PPt which (½) Dissolves in excess (½)	Pb^{2+} present (1)

(2 marks)

(iii)

OBSERVATIONS	INFERENCES
White PPt formed (1)	Insoluble cpd of Pb^{2+} is formed (1)

(2 marks)

(iv)

OBSERVATIONS	INFERENCES
Yellow PPt (1)	Pb^{2+} ions confirmed or PbI_2 formed (1)

(2 marks)

(b) (i)

OBSERVATIONS	INFERENCES
Burns with a smoky flame (1)	Unsaturated organic cpd or long chain Hydrocarbon (1)

(2 marks)

(ii)

OBSERVATIONS	INFERENCES
Colourless solution, turns red P^H 1 – 2 (1)	Carboxylic acid present (1)

(2 marks)

(iii)

OBSERVATIONS	INFERENCES
- Effervescence colourless gas evolved - Odourless gas (1)	Confirm G was acid and F was a carbonate (1)

(2 marks)

I

OBSERVATIONS	INFERENCES
Decolourised $KMnO_4$ (1)	Unsaturated alkene or alcohol present (1)

(2 marks)

II

OBSERVATIONS	INFERENCES
Bromine water decolourised (1)	Unsaturated alkene present or alkyne (1)

(2 marks)