11.0 CHEMISTRY (233)

11.1 Chemistry Paper 1 (233/1)

1. (a) Fermentation. (1 mark)

   (b) Ethane remains in molecular form while ethanol forms hydrogen bonds with water. (2 marks)

2. (a) $^{0}_{-1}e$ (1 mark)

   (b) $50g \longrightarrow 25g \longrightarrow 12.5g \longrightarrow 6.25 \longrightarrow 3.125 \longrightarrow 1.5625g.$ (1 mark)

   (c) Instant death, or gene mutation, induce cancer. √ (1 mark)

3. • Heat the mixture to sublime the ammonium chloride. √ (1 mark)

   • Add water to dissolve the sodium chloride √½; copper (ii) oxide does not dissolve (1 mark)

   • Filter √½ and evaporate the filtrate to obtain sodium chloride. √½ (1 mark)

4. (a) • Oxygen is used up. ½

5. (a) • 2.8 (1 mark)

   (b) $3V + Q_2 \longrightarrow V_3Q_2$ (1 mark)

   OR

   $3Mg + N_2 \longrightarrow Mg_3N_2$

   (c) T has a lower ionisation energy than M. √½
   T has an extra energy level and hence electrons is less attracted by the positive nuc (1 mark)

6. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ √½

   $V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2} = \frac{98,658.5 \times 150 \times 273}{293 \times 101,325}$ √1

   $V_2 = 0.136\ dm^3$ √½ (2 mark)

7. (a) $2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$ (1 mark)
   (s) (s) (g) (g)

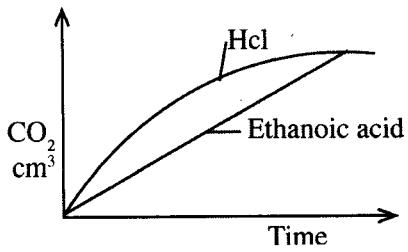
(b) Moles of brown gas (NO_2) $= \frac{0.29}{24} = 0.012$ √½

Moles of lead (II) nitrate $= \frac{1}{2} \times \frac{0.29}{24} = 0.006$√½ (2 marks)

Mass of lead (II) nitrate $= 0.006 \times 331$√½
$= 1.9998$ g √½

8. (a) Strong acid ionises fully. (1 mark)

(b)



(2 marks)

9. (a) Hydrogen is expensive.
Hydrogen is explosive. (2 marks)

10. (a)
- Green colour of chlorine disappears.
- Brown gas is produced or black solid is deposited. (1 mark)

(b) $Cl_2 + I^- \longrightarrow 2Cl^- + I$ (1 mark)
(g) (aq) (aq) (s)
Explanation: Iodine oxidation state changes from -1 to 0 hence oxidation while chlorine oxidation state changes from 0 to -1 hence reduction. (1 mark)

11. (a) Carbon (II) oxide is formed in the internal combustion engines when fuel burns under limited oxygen. (1 mark)

(b) Pollutant gas - Carbon (IV) oxide, Nitrogen (IV) oxide and Sulphur (IV) oxide.
(Any two) (2 marks)

12. (a)
- Small piece of sodium metal (pea size) with alot of water.
- Perform the experiment wearing goggles. (1 mark)

(b) Electrolysis. (1 mark)

(c) Manufacture of soap. (1 mark)

13. Deliquescent substance absorbs water from the atmosphere to form a solution, while a fluorescent substance loses water of crystallisation to the atmosphere. (2 marks)

14. P is in alkanol R - OH. The alkanol reacts with sodium metal to produce the colourless gas. (2 marks)

15. (a) $Ca(st)_2$ or $Mg(st)_2$ (1 mark)

$Ca^{2+}_{(aq)} + CO_3^{2-}_{(aq)} \longrightarrow CaCO_{3(s)}$ (1 mark)

OR

$Mg^{2+}\ CO_3^{2-} \longrightarrow MgCO_{3(s)}$

16. By adding Conc. H_2SO_4 as a catalyst. (1 mark)

17. (a) (i) Black solid is deposited. (1 mark)

(ii) The indicator turns red. (1 mark)

(b) The experiment should be done in fume chamber or in open air. (1 mark)

18. (a) Cold ½ and dilute sodium hydroxide. ½ (1 mark)

(b)
- Used in sterilising of water. (1)
- Used as a bleaching agent. (1) (2 marks)

19. Plot A

Percentage of Nitrogen in $(NH_4)_2SO_4$

$= \frac{21}{132} \times 100 = 21.2\%$

Amount Nitrogen in 50 kg $(NH_4)_2SO_4 = \frac{21.2}{100} \times 50$

$= 10.6\ kg\sqrt{}½$

Plot B

Percentage of Nitrogen in urea $= \frac{28}{60} \times 100 = 46.7\%^{½}$

The amount of Nitrogen in 30 kg $= \frac{46.7}{100} \times 30$

$= 14.01\ kg\sqrt{}½$

∴ Plot B $\sqrt{}½$ is more enriched with nitrgen since if has higher amount of nitrogen than plot A $\sqrt{}½$. (3 marks)

20.
- Add water $\sqrt{}½$ to dissolve the anti-acid powder.
- Add universal $\sqrt{}½$ indicator and match the colour of solution with pH chart $\sqrt{}½$ and read the value. $\sqrt{}½$ $\sqrt{}½$ (2 marks)

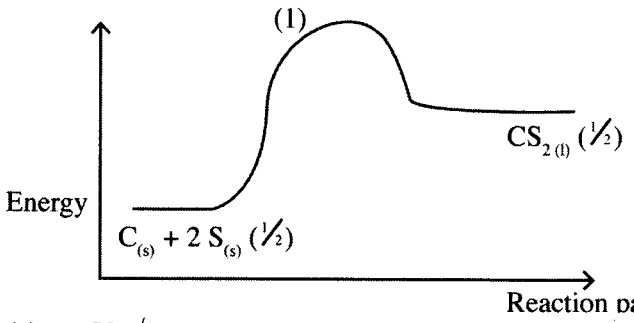
21. (a) Sulphur or phosphorus. (1 mark)

(b) Carbon atoms in graphite are arranged in layers of hexagons which are held by weak van der waal forces. The layers slide over each other when some force is applied on them; hence suitable in making pencil leads. (3 marks)

22. (a)
- Bromine
- At room temperature (25°C), Bromine is liquid since its MP and bP is between -7 and 59.

(b)
- Atomic mass of iodine is higher than that of chlorine.
- Van der waal's forces are stronger in iodine than chlorine hence iodine's bP is higher than that of chlorine. (3 marks)

23.



(2 marks)

24. (a) Y

(b) Y and Z
They have the same number of protons (8) but different atomic masses. (3 marks)

25. (a) When gases combine together at constant temperature and pressure they do so in volumes which bear a simple ratio to each other, and to the volumes of the products if gaseous.

(b) $C_2H_x + 3O_2 \longrightarrow 2CO_2 + 2H_2O_{(g)}$

Vol.	10	:	30	20	20
Mole ratio	1	:	3	2	2

$\therefore X = 4$ (3 marks)

26. (a) (i) Mass of oxygen = 10.400 - 10.352 = 0.048 g

(ii) Mass of M powder = 10.352 - 10.24 = 0.118 g

	M	O
Mole ratio	$\frac{0.112}{56}$	$\frac{0.48}{16}$
	0.0020	0.0030 (1)
Simplest ratio	2	3

Empirical formula M_2O_3 (1) (3 marks)

27. (a) Zinc blende or calamite √1

(b) $ZnO_{(s)} + C_{(s)} \longrightarrow Zn_{(s)} + CO_{(g)}$ √1

(c) Use of Zinc metal:
- dry cells; √½
- galvanising iron sheet. √½
- as electrodes. (3 marks)

28. (a)
- Single covalent bonding √½
- Dative (coordinate) bonding √½ (2 marks)

(b) 7 bonds x 2 = 14 electrons.√1

29. (a) Mg metals have mobile delocalised electrons which carry the current √1

(b) Molten magnesium chloride has Mg^{2+} and Cl^- ions which are free to move √1 (2 marks)

30. Add aqueous ammonia to fill √½ in excess.
A formation of white precipitate which dissolves in excess shows presence of zinc ions. ½
√1
Add aqeous actified Barium Nitrate
(3 marks)

Formation of a white precipitate shows

Presence of sulphate ions

31. Alkaline earth metals. (1 mark)

11.2 Chemistry Paper 2 (233/2)

1. (a) Purify to remove (½) dust, bubble in NaOH or KOH to remove (½) CO_2, reduce tem perature to remove water as (½) ice, compress to liquify the remaining air then fraction ally (½) distill to obtain Oxygen at −183°C. (1) (3 marks)

(b) (i) 98% concentrated sulphuric (VI) acid (1) (1 mark)

(ii) $SO_3(g) + H_2SO_4$ (1) $H_2S_2O_7$ (1) (1 mark)

(c) (i) Platinum or platinised asbestos (1 mark)

(ii) It is cheap and not easily poisoned. (2 marks)

(d) They turn from blue to (½) white and form a powder (½). (1 mark)

The sulphuric (VI) acid dehydrates the copper (II) (1) sulphate crystals forming copper (II) sulphate powder. (1 mark)

(e) H_2SO_4 is less- volatile (1) (1 mark)

(f)
- Manufacture fertilizers eg. Super phosphate
- Production of rayon fibres
- Car batteries as electrolyte
- Sulphur detergents
- Cleaning of metals (Pickling)
- Paints etc.

any four (½) mark each (2 marks)

2. (a) (i) $Cu^{2+}(aq) + 2e$ $Cu(s)$ (1) (1 mark)

(ii) It decreases (1). The anode is not inert so it dissolves.(1) (2 marks)

(iii) Chlorine gas (1). Use moist blue litmus paper (1). It will change from blue to pink then to white or is bleached. (1) (3 marks)

(b) Quantity of electricity = 0.45 x 72 x 60 (½)
= 1944 coulombs (½).

0.6 g require 1944
59 require ?

$\frac{1944 \times 59}{0.6}$ (1)

$\triangleq$ 191116 Q

1 Faraday = 96,500 Q
? = 191160 Q

Number of Faradays/Charge = $\frac{191160}{96500}$ $\triangleq$ 1.98 $\triangleq$ 2 (½)

∴ B^{2+} (1) (3 marks)

(c) From the electrode potentials, zinc is more reactive than cadmium.(1) Therefore zinc will displace cadmium ions from solution hence the metal container will dissolve. (1)
(2 marks)

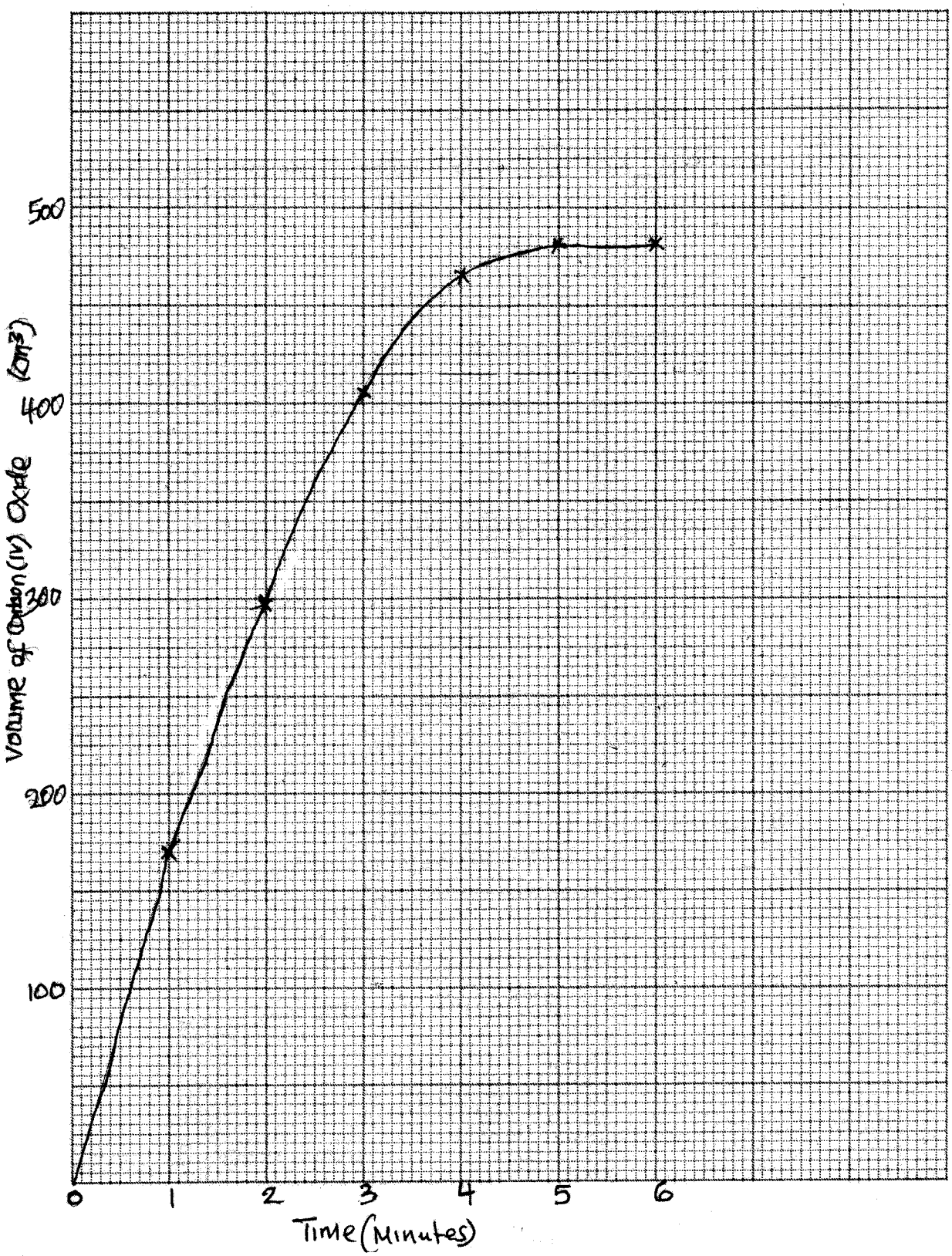
3. (a) Increase or change in amount of reagent either reactants or products. (Concentration). (1 mark)

(b) (i) Exothermic (1) increase in temperature from 250 - 350 (½) at constant pressure (½) the amount of ethanol formed at equilibrium decreases. (1)
(3 marks

(ii) I Advantage - it would increase the yield of ethanol (½); since increase in pressure will favour side with less moles i.e. the products. (1)
(1 (½) marks)

II Disadvantage - it would mean investment in equipment to withstand the high pressure(1) and would be expensive . (1 (½) marks)

(c) (i) See graph drawn. (3) (3 marks)



(ii) Drawing tangent (½)
Rate = $\frac{525 - 414}{6 - 2.3}$ (½) $= \frac{111}{3.7}$ = 30 cm^3/min (½) (2 marks)

4. (a) (i)
- $Ca(s) + Cu(NO_3)_2(aq) \rightarrow Ca(NO_3)_2(aq) + Cu(s)$ (1)
- $Ca(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

(2 marks)

(ii) Sodium metal is more reactive than calcium (½). Reaction between sodium and copper nitrate will be explosive (½) as it reacts with water evolving hydrogen gas. (1) (2 marks)

(b) $Ca(s) + Cu(NO_3)_2(aq) \rightarrow Ca(NO_3)_2(aq) + Cu(s)$
1 : 1
moles of copper nitrate $\frac{50}{1000} \times 2 = 0.1$ moles (1)
Ratio 1:1
Moles of Ca = 0.1
Mass of Ca = 0.1 x 40 = 4 g (1) (2 marks)

(c) A white precipitate is formed which is insoluble in excess. (1) (1 mark)

(d) (i) Add dilute nitric (V) acid to calcium oxide to form the soluble salt (½) calcium nitrate. Add sodium (½) carbonate (another soluble salt) to form insoluable. Calcium Carbonate and sodium nitrate (½). Filter out (½) the calcium carbonate, wash it (½) with distilled water to remove traces of sodium nitrate and dry between filter papers (½) (3 marks)

(ii) Manufacture of cement
Manufacture of sodium carbonate. (1 mark)

5. (a) - electron has $\frac{1}{1840}$ mass while proton has mass of one mass unit.
- proton is positively charged while electron is negatively charged.
(2 marks)

(b) (i) F (1 mark)

(ii) 27 (1 mark)

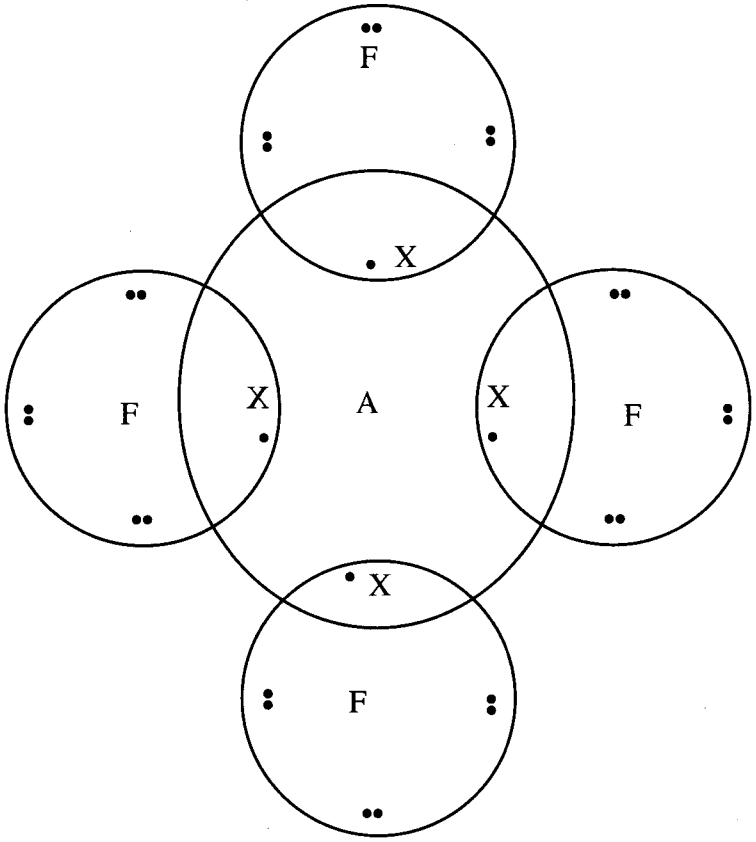
(iii) E_2G_3 (1) (1 mark)

(iv) Ionic bond (1) or electrostatic (1 mark)

(v) E has a smaller atomic radius than C (1)

E has more protons than C :. nucleur attraction stronger. (1) (2 marks)

(vi)



(vii) Particle B is inert with a stable electronic configuration :. will not react. (1)

(1 mark)

6. (a) (i) I The potasium permanganate is decolurised or changes from purple to colourless. (1) (1 mark)

II C is a ethanoic acid (carboxylic acid)
Add sodium carbonate, you will see effervescence, test gas evolved with lime water, it will form a white precipitate. (2) (2 marks)

(ii) I Polyethene (1)

II Substance D - sodium ethoxide (1) (2 marks)

(iii) Substance B - CH_2BrCH_2Br. (1) or $C_2H_4Br_2$. (1 mark)

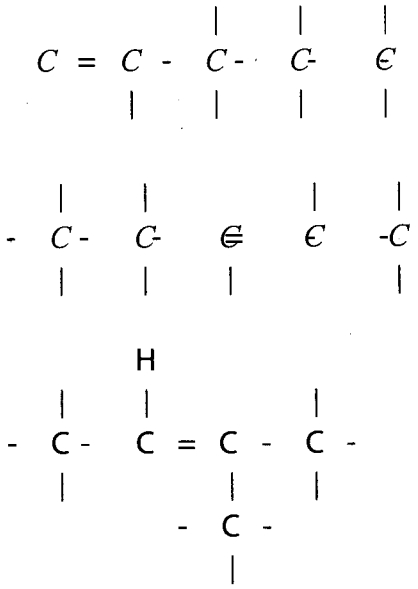
(iv) I Step II - dehydration (1)

II Step IV - hydrogenation. (1) (1 mark)

(v) Reagent: Methanoic acid (1)
Conditions: Concentrated sulphuric (VI)acid & (1) warm. (2 marks)

(b) (i) Hexan - 1 - 01 (1 mark)

(ii)



(1 mark

7. (a) The amount of heat liberated when one mole of a substance is burnt in excess oxygen. (1 mark

(b) The heat evolved ar absorbed in a chemical change is the same whether the change occurs in one step or through many steps. (1 mark

(c) (i) $3C_{(3)} + 4H_{2(g)}$ $C_3H_{8(g)}$ (1 mark

$3C_{(s)} + 4H_{2(g)}$ $C_3H_{8(g)}$

(1) (1) $\Delta H_c(c_3H_8)$

(1)

$$3CO_{2(g)} + 4\ H_2O_{(l)}$$ (3 mark

(iii) $-104 = 3 \times -393 + 4 \times -286 - \Delta H_c\ (C_3H_8)^{(1)}$

$\Delta H_c\ (C_3H_8) = 104 + (-1179) + -1144)\ (½)$

$= -2219\ kJ\ mol^{-1}\ (½)$

(2 mark

(d) - cost
- effect on environment
- availability
- storage (1 mark

(e) Ethanoic acid is a weak acid therefore heat is used to ionise it before neutralization occurs (1). It value is therefore lower than that of hydrochloric acid which is fully ionised(1). (2 mark

11.3 Chemistry Paper 3 (233/3)

1. Table 1

	I	II	III
Final burette reading	29.70	33.40	44.60
Initial burette reading	0.00	4.00	15.30
Volume of solution **A** used (cm^3)	29.70	29.40	29.30

(4 marks)

(i) average volume $= \frac{29.4 + 29.3}{2}$

$= 29.35cm^3$ (½ mark)

(ii) concentration of the dibasic acid **A**; (2 marks)

$conc = \frac{1.6}{126} = 0.01269$; $0.01269 \times 4 = 0.05M$

(iii) moles of the dibasic acid used;

$= \frac{29.35}{1000} \times 0.05$

$= 0.0014675$ moles

(1 mark)

(iv) moles of NaOH in $25.0cm^3$.

$= (0.0014657 \times 2) = 0.002935$ moles

(1 mark)

(v) The concentration of NaOH in moles per litre.

$= 25.0\ cm^3$ of NaOH 0.002935

$1000cm^3 = 0.1174$ M

(2 marks)

2. Table II

	1st conical flask	2nd conical flask
Final burette (cm^3)	21.20	33.60
Initial burette (cm^3)	9.70	22.20
Volume of solution **A** used (cm^3)	11.50	11.40

(3 marks)

(i) average volume; $= \frac{11.4 + 11.5}{2}$

$= 11.45\ cm^3$ (½ mark)

(ii) moles of the dibasic acid $= \frac{0.05 \times 11.45}{1000}$

$= 0.0005725$ moles (1 mark

(iii) moles of NaOH that reacted with the dibasic acid.

$= (0.0005725 \times 2)$

$= 0.001145$ moles

(1 mark

(iv) moles of NaOH that reacted with 25.0cm^3 of salt **B** in solution **B**;

$= 0.0029314 - 0.001145$

$= 0.0017864$ moles

(2 marks

(v)

I. moles of salt **B** in 25.0cm^3 of solution **B**;

$0.0017884 \times \frac{1}{2}$

6 $= 0.00089$ moles

(1 mark

II. concentration in moles per litre of salt **B** in solution **B**; (1 mark

$= 0.00089 \times \frac{1000}{25}$

$= 0.0357$ M (1 mark

III. relative molecular mass of salt **B**;

$= \frac{4.73}{0.0357}$

$= 133.0$ (1 mark)

2 (a)

(i)

Observations	**Inferences**
- Gas which turns red litmus paper blue - Brown solid formed	NH_4^+ present
(2 marks)	(1 mark)

(3 marks

(ii)

Observations	**Inferences**
- Yellow / brown solution - Brown ppt	Fe^{3+} formed
(1 mark)	(1 mark)

(2 marks)

(b) (i)

Observations	**Inferences**
- White ppt formed (1 mark)	CO_3^{2-}, SO_3^{2-}, SO_4^{2-} (2 marks)

(3 marks)

(ii)

Observations	**Inferences**
I White ppt dissolved/disappears Effervescence occurs (1 mark)	SO_3^{2-}, CO_3^{2-} (1 mark)
II Changes from orange to green (1 mark)	SO_3^{2-} present (1 mark)

(2 marks)

(2 marks)

3 (a)

Observations	**Inferences**
- Burns with a blue flame (1 mark)	Saturated compound or Short-chain hydrocarbon (1 mark)

(2 marks)

(b)

Observations	**Inferences**
- No effervescence (1 mark)	Not acidic (1 mark)

(2 marks)

(c)

Observations	**Inferences**
- colour changes from orange to green (1 mark)	R - OH present (1 mark)

(2 marks)