

24.6 CHEMISTRY (233)



24.6.1 Chemistry Paper 1 (233/1)

MANYAM FRANCHISE
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- Carbon (IV) oxide. **(1 mark)**
 - A blue flame is observed. Carbon (II) oxide burns with a blue flame. **(2 marks)**
- | | | | |
|--|---|--------------------|------------------|
| Mass of acid | = | 1.05 x 15 | |
| | = | 15.75 g | |
| Molar mass of acid | = | 60 | |
| Moles of acid in 500 cm ³ of solution | = | $\frac{15.75}{60}$ | |
| | = | 0.2625 | |
| Moles of acid in a litre | = | 0.2625 x 2 | |
| | = | 0.525 M | (3 marks) |
- Elements found in group seven of the periodic table. **(1 mark)**
 - Chlorine exists in discrete gaseous molecules with negligible forces of attraction between them while iodine exists in layers held together by strong forces of attraction. **(2 marks)**
- | | | | | |
|--|----------|---|--|------------------|
| | C | = | Region of unburnt gas (colourless zone). | |
| | D | = | Yellow Zone (luminous flame). | (2 marks) |
- The nettle plant contained an acid, which was neutralised by aqueous ammonia. **(2 marks)**
- The solution changed from pale green to yellow/brown. **(1 mark)**
 - A brown precipitate was formed. **(1 mark)**
 - $Fe_{(aq)}^{3+} + 3OH_{(aq)} \rightarrow Fe(OH)_{3(s)}$ **(1 mark)**
- Salt bridge

(2 marks)
 - $-0.14 + 0.74 = 0.6V$ **(1 mark)**
- There is an increase in nuclear charge. The outermost electron is strongly attracted, therefore more energy is required to remove it. **(2 marks)**

9. (a) **Solution K:** Dilute nitric (V) acid.
 (b) **Solid L:** Silver.
 (c) **Gas M:** Oxygen. (3 marks)
10. $H_2O_{2(l)} \rightarrow H_2O_{2(g)}; \Delta H_f^\circ = 55 kJ mol^{-1}$ (2 marks)
11.
 ▪ Carbon (IV) oxide will react with calcium oxide.
 ▪ Carbon (IV) oxide is denser than air. (2 marks)
12. (a) The volume of a fixed mass of a gas is directly proportional to the absolute temperature at constant pressure. (1 mark)
- (b) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
- $$\frac{3.5 \times 10^{-2}}{291} = \frac{2.8 \times 10^{-2}}{T_2}$$
- $$T_2 = \frac{291 \times 2.8}{3.5}$$
- $$= 232.8 \text{ K}$$
- (2 marks)

13. (a) (i) Deliquescence. (1 mark)
 (ii) Esterification. (1 mark)

(b) Cracking. (1 mark)

14. (a) **Nuclear fission** is the splitting of a heavy nuclide when bombarded by a fast moving Neutron, while **Nuclear fusion** is the combination of light nuclei when they collide at high speed and a heavier nuclide is formed. (2 marks)

(b) The radioactive substance is put in thick lead blocks and buried underground. (1 mark)

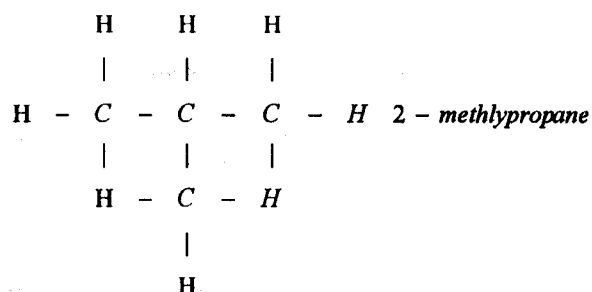
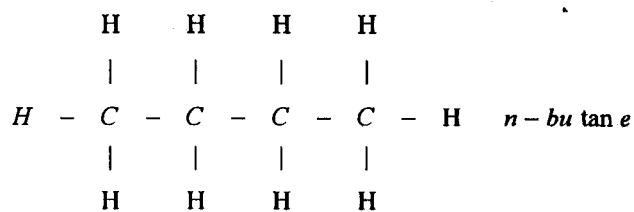
15. (a) Permanent hardness in water is caused by the presence in the water of Ca^{2+} , Mg^{2+} and SO_4^{2-} ions. The sulphate ion is not decomposed by boiling. (2 marks)

(b)
 ▪ Used in ion exchange.
 ▪ Distillation.
 ▪ Precipitation. (1 mark)

16. (a) O^{2-} (1 mark)

(b) $Zn(OH)_4^{2-}$ (1 mark)

17. $12n + 2n + 2 = 58$
 $n = 4$
 \therefore Formula = C_4H_{10}



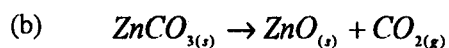
(3 marks)

18. Heat sodium metal in oxygen to form sodium oxide. Dissolve the oxide in water to form sodium hydroxide. Bubble excess carbon dioxide into the solution to form sodium hydrogen carbonate. Warm the solution to concentrate. Allow solution to cool and form crystals. Filter and dry the crystals between pieces of filter paper.

(3 marks)

19. (a) Froth floatation.

(1 mark)



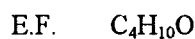
(1 mark)

- (c)

- Making brass.
- Used in batteries/dry batteries.
- Making paints.

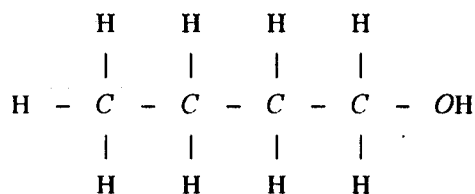
(1 mark)

20. (a)
- | C | H | O |
|-------------------------|--------------------------|--------------------------|
| $\frac{64.9}{12} = 5.4$ | $\frac{13.5}{1} = 13.5$ | $\frac{21.6}{16} = 1.35$ |
| $\frac{5.4}{1.35} = 4$ | $\frac{13.5}{1.35} = 10$ | $\frac{1.35}{1.35} = 1$ |



(2 marks)

- (b)



(1 mark)

21. (a) The concentration of the Cl^- ion is very high. The Cl^- ion is therefore discharged in preference to the OH^- .

(2 marks)

(b) Hydrogen gas. (1 mark)

22. Moles of aluminium sulphate = $\frac{6.84}{342}$
= 0.02

Concentration of aluminium sulphate = $\frac{0.02 \times 1000}{150}$

∴, Concentration of the Sulphate ion = 0.133
= 0.133×3
= 0.399 M (3 marks)

23. Hydrogen bonds exist in propan-1-ol. These require more energy to break than van der Waals forces. (2 marks)

24. Observation: white fumes.

Ammonia is ignited in / reacts with chlorine to form hydrogen chloride. The hydrogen chloride reacts with excess ammonia to form ammonium chloride. (3 marks)

25. (a) Volume would be equal in both cases because the moles of HCl are equal and zinc powder is in excess. (1 mark)

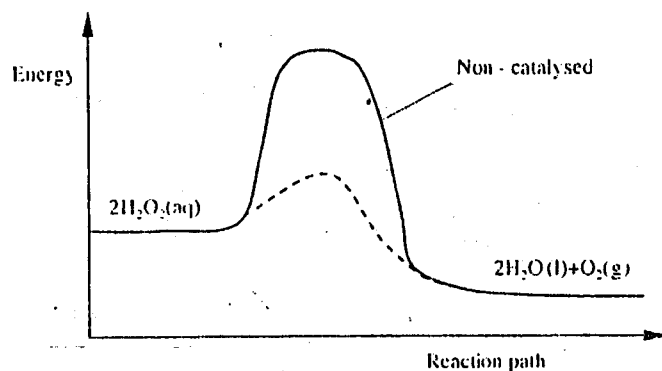
(b) It is inert / does not react. (1 mark)

26. (a) Both are metals and react by losing electrons. (1 mark)

(b) $RCO_{3(s)} \rightarrow RO_{(s)} + CO_{2(g)}$ (1 mark)

(c) Q^{3-} or Q^{+5} (1 mark)

27.



(2 marks)

28. (a) $4OH^-_{(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-$ (1 mark)

(b) Quantity of electricity = $5 \times 3 \times 60 \times 60$

(c) Moles of electricity = $\frac{5 \times 3 \times 60 \times 60}{96500} = 0.5596$

Moles of Ag = 0.5596

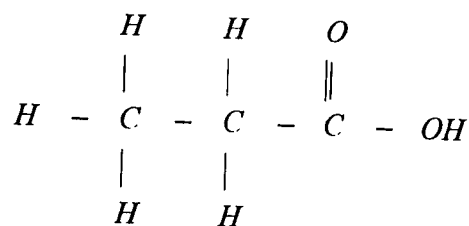
Mass of Ag = 60.4368g (2 marks)

29. (a) Metallic. (1 mark)
- (b) Group 1, because each atom loses a single electron. (2 marks)
30. The S₈ rings are broken down to form S₈ chains. These chains join together to form huge molecules of sulphur which do not flow easily. (2 marks)

24.6.2 Chemistry Paper 2 (233/2)

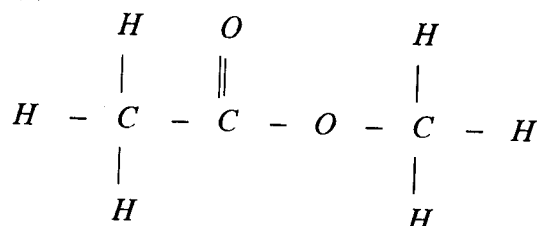
1. (a)
- Cost.
 - Availability.
 - Effects to the environment.
 - Heating value.
 - Ease of storage. (2 marks)
- (b) (i) Mass of water $450 \times 1 = 450\text{g}$
 $\Delta T = 46.5 - 25.0 = 21.5^\circ\text{C}$
 Heat evolved $= 450 \times 4.2 \times 21.5$
 $= 40635 \text{ Joules}$ (3 marks)
- (ii) Mass of ethanol used $= 125.5 - 124.0$
 $= 1.5\text{g}$
 R.M.M. of ethanol $= 46$
 1.5g of ethanol produces 40635
 Therefore, 46g of ethanol produces $\frac{40635}{1.5} \times \frac{46}{1000}$
 $= 1246.14\text{kJ mol}^{-1}$ (2 marks)
- (c) $\text{C}_2\text{H}_5\text{OH}_{(l)} + 3\text{O}_{2(g)} \rightarrow 3\text{H}_2\text{O}_{(l)} + 2\text{CO}_{2(g)}$ (1 mark)
- (d)
- Heat lost to the surroundings.
 - Error in reading the temperature or mass. (2 marks)
2. (a) (i) 2- Methyl Prop-I-ene (1 mark)
- (ii) Pentan-I-yne (1 mark)
- (b) (i) The solution changes from orange to green. (1 mark)
- (ii) A colourless odourless gas bubbles out. (1 mark)
- (c) **Step 1:** Fermentation.
Process: Glucose is mixed with yeast at about 30°C . It is changed to ethanol and CO₂ bubbles out. (1½ marks)
- Step 2:** Dehydration.
Process: Ethanol is heated to 180°C in the presence of sulphuric acid when it is dehydrated to ethene. (1½ marks)

(d) (i)



(1 mark)

(ii)



(1 mark)

(e)

- They produce poisonous gases to the environment.
- Produce gases with unpleasant smell.

(2 marks)

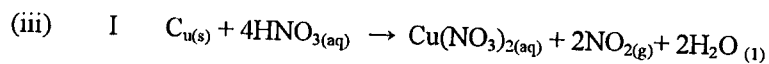
3. (a)

- (i) Brown gas.
Blue solution.

(2 marks)

- (ii) It is not an oxidising agent and therefore has no effect on copper.

(1 mark)



(1 mark)

II Moles of $Cu = \frac{0.5}{63.5} = 0.007874$

Moles of $HNO_3 = 4 \times 0.007874 = 0.03149$

$\frac{3XV}{1000} = 0.03149$

$V = \frac{0.03149 \times 1000}{3}$

$= 10.5 \text{ cm}^3$

(3 marks)

- (b) Step 4: Neutralisation.
Step 5: Displacement.

(1 mark)

(c)

- It does not corrode easily.
- It is ductile and has a high melting point.

(2 marks)

4.

- (a) (i) The rate of forward reaction is the same as that of the backward reaction or they are the same.

(1 mark)

- (ii) I Reduction in pressure shifts the equilibrium to the left hence the yield of methanol decreases.

(2 marks)

II The yield remains the same. Catalysts only change the rate of attainment of equilibrium and not the amounts of species in the equilibrium mixture.

(2 marks)

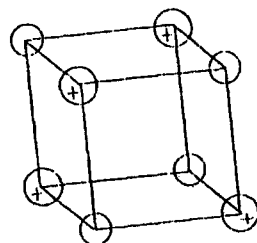
(iii) I ΔH is negative. When temperature is lowered, the system shifts in the direction in which heat is evolved, that is, towards the right. (2 marks)

II At 500k, the rate of the reaction is lower than at 700k. (1 mark)

(b) (i) Time = 60×2
= 120 sec
No of moles $\text{dm}^{-3} = 6 \times 120 \times 10^{-8}$
= $7.2 \times 10^{-6} \text{ mol dm}^{-3}$ (2 marks)

(ii) Warming. Kinetic energy increases. Therefore, frequency of high energy collisions increase hence rate increases. (2 marks)

5. (a) (i)



(2 marks)

(ii) At 25°C , sodium chloride is in solid state form; ions cannot move. Between 801°C and 1413°C , sodium chloride is in liquid state: ions are mobile. (2 marks)

(b) Both ammonia and water are polar molecules and hydrogen bonds are formed. (2 marks)

(c) $\text{N} \rightarrow \text{H}$ Co-ordinate bond. (1 mark)

(d) (i) Allotrope. (1 mark)

(ii) Add methylbenzene to soot in a beaker. Shake and filter. Warm the filtrate to concentrate it. Allow the concentrate to cool for crystals to form. Filter to obtain crystals of fullerene. (3 marks)

(iii) $\frac{720}{12} = \text{C}_{60}$ (1 mark)

6. (a) (i) Dissolve the sample in water. Add aqueous iron (II) sulphate. Then add concentrated sulphuric down the side of the test tube. Formation of a brown ring confirms presence of nitrate ion.

OR

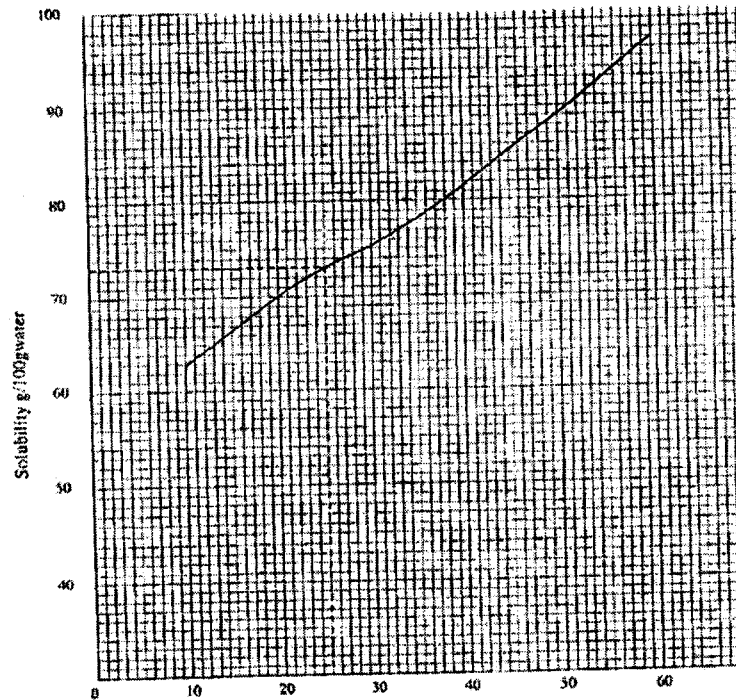
Dissolve a sample of the fertilizer in water. Add a piece of aluminium foil then a little $\text{NaOH}_{(\text{aq})}$. Warm, then test gas with red litmus paper. The paper turns blue (2 marks)

(ii) Molar mass of $(\text{NH}_4)_2\text{HPO}_4 = 132$

$$\begin{aligned} \text{Mass of Nitrogen} &= \frac{38}{132} \times 25 \\ &= 5.3\text{kg} \end{aligned}$$

(2 marks)

(b) (i)



(3 marks)

(ii) $72 \pm 1\text{g}/100\text{g water}$

(1 mark)

(iii) I A solution which contains the maximum amount of solute at that temperature.

(1 mark)

II At 25°C , 73g of AP dissolve in 100g of water.
 Therefore, 173g of saturated solution contain 73g
 Therefore, 100g of saturated solution contain $\frac{73}{173} \times 100$
 $= 42.196\text{g}$

(2 marks)

(c) (i) Add distilled water to soil and stir. Dip Universal indicator paper to the mixture and compare with pH chart.

(2 marks)

(ii) Extensive use of ammonium fertilizer (acidic fertilizers) or pollution by acid rain etc.

(1 mark)

7. (a)

- Wear gloves.
- Use safety goggles.
- Use a fume cupboard.

(2 marks)

(b)

- MnO_2
- $\text{K}_2\text{Cr}_2\text{O}_7$

(1 mark)

- (c) To displace air from the apparatus. Heated aluminium may react with oxygen to form an impurity. (Al_2O_3) **(2 marks)**
- (d) Sublimes. **(1 mark)**
- (e) (i) $2\text{Al}_{(s)} + 3\text{Cl}_{2(g)} \rightarrow 2\text{AlCl}_{3(s)}$
 $2 \times 27 \qquad \qquad \qquad 2(27 + 35.5 \times 3)$
 $54 \qquad \qquad \qquad = 267$
 $54\text{g of Al} \qquad \qquad \qquad = 267\text{ of AlCl}_3$
 Therefore 1.08 produces = $\frac{267 \times 1.08}{54}$
 $= 5.34(\text{g})$ **(3 marks)**
- (ii) % yield = $\frac{3.47}{5.34} \times 100$
 $= 65\%$ **(1 mark)**
- (f) Replace receiver with a flask in ice-cold water. **(1 mark)**

24.6.3 Chemistry Paper 3 (233/3)

1. (A)

	I	II	III
Final burette reading	21.8	21.6	43.6
Initial burette reading	0.0	0.0	22.0
Volume of D used (cm^3)	21.8	21.6	21.6

(3 marks)

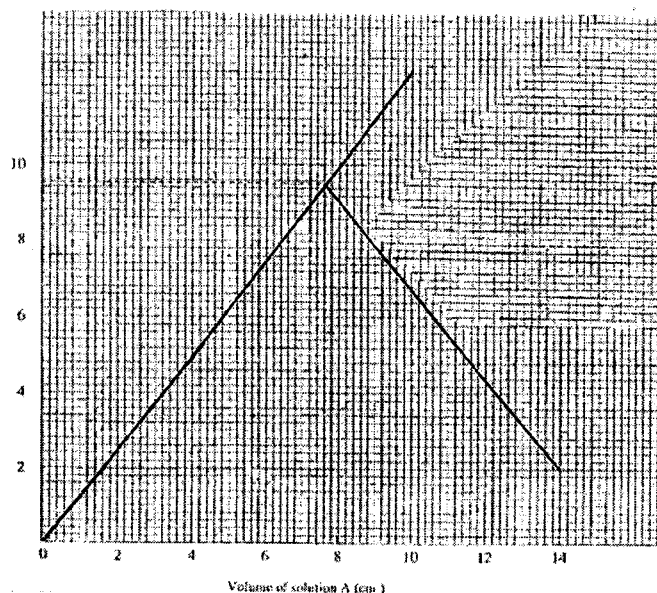
- (i) $\frac{21.6 + 21.6}{2} = 21.6\text{cm}^3$ **(1 mark)**
- (ii) R.F.M of $\text{Na}_2\text{CO}_3 = 106$
 Conc. $\frac{8}{106} = 0.075M$ **(1 mark)**
- (iii) Moles of $\text{Na}_2\text{CO}_3 = \frac{25 \times 0.075}{1000}$
 $= 0.001875$
 Moles of $\text{H}_2\text{SO}_4 = 0.001875$
 Conc. of $\text{H}_2\text{SO}_4 = \frac{0.001875}{21.6} \times 1000$
 $= 0.0868M$ **(2 marks)**
- (iv) $0.0868 \times 10 = 0.868M$ **(1 mark)**

(B)

Test-tube number	1	2	3	4	5	6
Volume of solution A (cm ³)	2	4	6	8	6	4
Volume of solution C (cm ³)	14	12	10	8	10	12
Initial temperature of solution C (°C)	20.5	20.5	20.5	20.5	20	20
Highest temperature of mixture (°C)	23	25.5	28.0	29.5	26.5	24.5
Change in temperature ΔT	2.5	5.0	7.5	9.0	6.5	4.5

(6 marks)

(ii)



(3 marks)

- (ii) I $\Delta T = 9.5 \pm 0.1^\circ\text{C}$ (1 mark)
II Maximum volume of A = $7.6 \text{ cm}^3 \pm 0.1$ (1 mark)

- (iii) I Moles of sulphuric Acid = $\frac{7.6 \times 0.868}{1000}$
= 0.0066 moles (1 mark)

- II Heat evolved $16 \times 4.2 \times 9.5$
= 638.4 joules
Molar Heat = $\frac{638.4}{0.0066}$
= 96.727272 KJ mol⁻¹ (2 marks)

2. (a)

Observations

Inferences

Gas with a pungent/irritating/choking smell.

Colourless liquid formed on cool part of test tube.

Hydrated salt.

Blue litmus paper turns red.

Acidic gas evolved.

Red litmus paper remains red.

Solid turns reddish brown.

(3 marks)

(b)

Observations

- i) Reddish brown solution.
PH 1,2,3,
- ii) Brown precipitate insoluble in excess.
- iii) Brown/Black solid formed or solution changes from yellow to brown.
- iv) White Precipitate settles at the bottom of the test tube.

Inferences

Strongly acidic.
(2 marks)
 Fe^{3+}
(2 marks)
Iodide ions oxidised to Iodine
(2 marks)
 SO_4^{2-} present.
(2 marks)

3.

(a)

Observations

- a) Clear blue flame.
- b) No separation or forms a solution
Two liquids are miscible.
- c) No effervescence.
- d) Solution changes from orange to green.

Inferences

Saturated low carbon organic compound.
(2 marks)
Mixture is miscible or polar organic compound.
(1 mark)
Liquid not acidic or absence of H^+ .
(2 marks)
F is likely to be alcohol *OR* R-OH.
(2 marks)