

**CHEMISTRY PAPER 233/1 K.C.S.E 2003**  
**MARKING SCHEME**

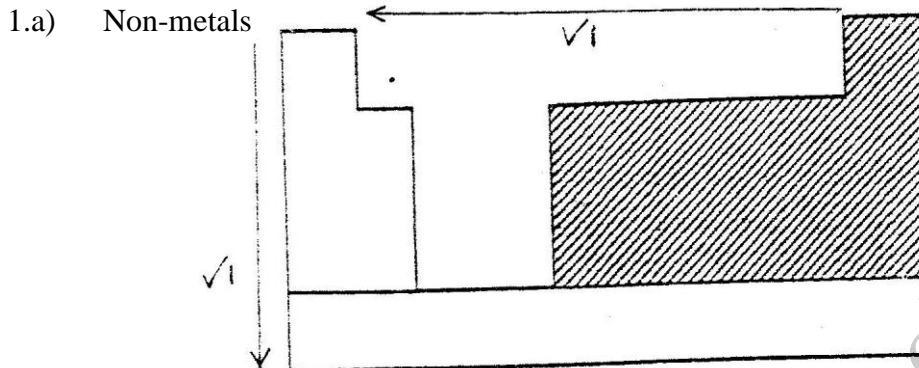
1. Add water to the mixture (1) Sodium chloride dissolves(1/2 ) while Copper (II) oxide does not (1/2 ) filter (1/2) and heat the filtrate to dryness to obtain Sodium chloride(1/2).
2.  $K^+$  has three energy levels while  $Na^+$  has only two (1)  
 $Mg^{2+}$  nucleus has 12 protons attracting 10  $e^-$  (1)  $Na^+$  has 11 protons attracting 10 $e^-$  hence  $Mg^{2+}$  radius shrinks more (1) Or  $Mg^{2+}$  has higher nucleous charge (1) shrinking the ions(1)
3.  $2Al_{(s)} + 3/2 O_2 \longrightarrow Al_2O_3, \Delta H = - 1673.6 KJmol^{-1}(i)$   
 $Fe_2 O_3 + Fe_2 O_3(s) \longrightarrow 2Fe + 3/2 O_2, \Delta H = 836.8KJ mol -$
4. a) Rhombic  $\longrightarrow$  Octahedral Or Monoclinic – B – Prismatic  
b) - Vulcanisation  
- Manufacture of sulphuric acid /  $SO_2$   
- Gun powder  
- Preparation of  $Ca(HSO_3)_2$   
- Drugs  
- Fungicides  
- Match sticks head
5.  $H \longrightarrow H^+ + e^{-} (1/2) \Delta H \text{ is } +ve (1/2)$   
 $H + e^{-} \longrightarrow H^{-} (1/2) \Delta H \text{ is } -ve (1/2)$
6.  $Na_2SO_3(s) + 2 HCl (aq) \longrightarrow 2NaCl (aq) + SO_2 (g) + H_2O(l)$   
Moles of  $SO_2 = 160 / 2400$  Mass of  $NaSO_3$   
=0.04  $0.04 \times 126$   
Moles ratio 1:1  $=5.04 \text{ gm}$   
Moles of  $NaSO_3 = 0.04$
7.  $HCl$  is a strong acid hence fully ionizes. Ethanoic acid is a weak acid hence partially ionized.
8. a) The heat absorbed by a substance as it changes from liquid state to gaseous state at constant temperature.  
b) Boiling point increases with increase in molecular mass / c- atoms / c- bonds
9. a) A condenser/ lie big condenser  
b) To show when vapour fractions are distilling off.  
c) C
10. a)  $+5 / 5$   
b)  $5 / V$
11. The yellow phosphorous form liquid  $PCl_3$ , The  $PCl_3$  is hydrolysed in air to form  $HCl$  which fumes.
12. a)  $H_2O (g) + C(s) \longrightarrow CO(g) + H_2$   
b) Reducing agents, Fuel / methanol, synthetic petrol.
13. They combine with water vapour to form acid rain which corrode building, pollute/poisonous / bad smell / Nitrating / Acidifying sort.
14. The entire Soln turns pink/ purple; Potassium permanganate particles have diffused into water molecules or color spreads.
15. a) Add water to the oluem carefully

- b) - Making  $\text{NH}_4\text{SO}_4$  fertilizer  
 - Paints manufacture  
 - Manufacture of detergents  
 - Esters  
 - Explosives  
 - HCl acid  
 - Dehydration  
 - Drying gases
16. a)  $3\text{mg (S)} + \text{N}_2 (\text{g}) \longrightarrow \text{Mg}_3\text{N}_2(\text{S})$   
 b) Argon / Neon (name of a rare gas)  
 Because they are inert and not likely to have reacted with any of the reagents.
17. **Chemical method** – Insert a glowing splint into a gas jar of gas G and find it absorbed it is not  $\text{N}_2\text{O}$  inverting in air, if it doesn't turn brown it's  $\text{N}_2\text{O}$   
**Physical** – Invert gas G over cold water if the level rises the gas is  $\text{N}_2\text{O}$  (laughing gas, nitrous oxide or sweet sickly smell).
18. a)  $\text{SO}_4^{2-}$ , Sulphate ion  
 b)  $\text{Ba}^{2+} (\text{aq}) + \text{SO}_4^{2+} \longrightarrow \text{BaSO}_4(\text{s})$   
 c)  $\text{Zn} (\text{NH}_3)_4^{2+}$
19. a) The high yield of ammonia decreases. At high temperatures ammonia decomposes and moves to the left OR shifts to the left. (Forward rxn is exothermic)  
 b) - Manufacture of fertilizer  
 - Softening temporary  $\text{H}_2\text{O}$   
 - Solvay process  
 - Removal of stains  
 - Smelting salts / manufacture.
20. - Door handles  
 - Coinage  
 - Soldering bits  
 - Padlocks  
 - Musical instruments  
 - Ornaments  
 - Making plumbing joints  
 - Cartridges for bullets and bombs.
21. a) 
$$\begin{array}{ccccccccccc} & & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \\ & & | & & | & & | & & | & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{CH} \\ & & | & & | & & | & & | & & \\ & & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \end{array}$$
  
 b) Alkanols / Alcohols.  
 c)  $2\text{C}_4\text{H}_9\text{OH} (\text{l}) + 2\text{k} (\text{s}) \longrightarrow 2\text{C}_4\text{H}_9\text{OK}(\text{s}) + \text{H}_2(\text{g})$   
 $\text{C}_4\text{H}_9\text{OH}(\text{l}) + \text{K}(\text{s}) \longrightarrow \text{C}_4\text{H}_9\text{OK}(\text{s}) + \frac{1}{2} \text{H}_2(\text{g})$
22. a)  $\text{FeCl}_2$  or Iron (II) chloride.  
 b) The solution was basic / alkaline hence PH of 14.0 Excess HCl neutralized all the alkali and then the solution became acidic as HCl is acidic.

23. a) Bromine is decolorized (colorless)  
 b) 1, 2 –dibromopentane or 2, 3 dibromopentane.
24. Group 7 elements react by gaining electrons. A small atom has a high e- affinity. This trend decreases down the group.
25. a) At a constant temperature the volume is inversely proportional to pressure OR  $V \propto 1/p$ ,  $V = K/p$   
 b)  $3x1 = 2x V_2$   
 $V_2 = 3/2 \text{ litres /dm}^3 \text{ or } 15000\text{cm}^3$
26. a) Ammonia being basic dissolves in water to form a basic solution  
 b) To prevent sucking back as ammonia is very soluble.
27.  $63.5g = 2 \times 96500$   $1.48\text{gm} = 1.48 \times 2 \times 96500$   
 $1\text{gm} = 2 \times 96500$   $\frac{63.5}{63.5}$   
 $1 \times 2.5 \times 60 \times 60 \times 60 \times 1 = 1.48 \times 2 \times 96500$   $q = 2.5 \times 60 \times 1$   
 I =  $\frac{2 \times 1.48 \times 96500}{63.5 \times 2.5 \times 60 \times 60}$   $I = 0.4998\text{A or } 0.5\text{a}$

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b) i) KB/KF/KI/KA

- ii) - Ionic /electrovalent bonding  
 - K loses an electron to form K<sup>+</sup> ions  
 - A gains electrons to form A<sup>-</sup> ions  
 - The ions combine to form KA

c) starting with aqueous magnesium sulphate, describe how you would obtain a sample of magnesium oxide. (3 marks)

Add an alkali solution to precipitate Mg(OH)<sub>2</sub>, Filter; heat the residue to obtain MgO  
 OR

Add Na or K carbonate or hydrogen carbonate to form MgCO<sub>3</sub> ppt filter, heat the residue to obtain MgO

d) Both must be present and correct, do not accept one



iii) Average rate in b (i) is higher than in b (ii). There are more particles between 0 and 2 mins than 6-8 mins hence the frequency of collision is higher.



d) - Heating/ warming/increasing the temperature.

- Increase in concentration of HCL

- Crushing the marble chips into small pieces using powdered CaCO<sub>3</sub>/ Stirring

e) - It becomes wet/ damp/ mass increased

-The substance absorbs water from the atmosphere

f) i) Calcium sulphate

ii) I Making plaster for building

II Preparation of CO<sub>2</sub>

- III Manufacturer of ammonium sulphate (fertilizer)  
 IV Manufacture of cement  
 V Manufacture of plaster (with oil)  
 VI filter material for paper (with oil)
- 2 a) i) On the diagram, show with a (+) sign the positive terminal  
 ii)  $\text{Zn(s)} \longrightarrow \text{Zn}^{2+} + 2\text{e}^-$   
 iii) -The cell does not produce any current// Bulb will not light // No light // ions are not mobile // the solid is a non-electrolyte.  
 iv) advantage disadvantage  
 - Portable -Not rechargeable  
 - Cheap - Cannot produce continuous supply of elec.  
 - Convenient to use -Environmental pollution
- b) i) Purple /violet fumes are produced// Iodine is produced //
- $2\text{I}^- \longrightarrow \text{I}_2 + 2\text{e}^-$
- ii) quantity of electricity = It  
 $= 0.5 \times 2 \times 60 \times 60$   
 $= 3600$   
 Mass of Pb  $= \frac{3600 \times 207}{1.2 \times 96500}$   
 $= 3.861\text{g}$
3. a) Chemical reaction Nuclear reaction  
 Involves valency electrons Involves the nucleus (P and N)  
 Rate of chemical reaction is Reaction's independent of external  
 Dependent on temp and pressure factors (external conditions)  
 No huge amount of energy involved Huge amount of energy involved.  
 No change in mass There is mass change.
- b) (i) I alpha particle  
 III Beta particle  
 (ii)  ${}_{84}^{210}\text{Po} \longrightarrow {}_{82}^{206}\text{Pb} + {}_2^4\text{He}$
- Conventional way of writing
- c) I 20 minutes (value to be read from graph +2)  
 II % value at 70 min from graph 9 % +2  
 $\text{Mass} = \frac{0.16 \times 100}{9}$   
 (value must be read from the graph +2)
- d) -Treatment of cancer  
 - sterilization of surgical equipment  
 -Regulation of heart pace makers  
 - detection of uptake of iodine 131 in kidneys.
4. a) Carbon dioxide is lost/produced/evolved
- b) (i)  $\frac{1.8-0}{2} = 0.9 \text{ g/min}$

$$(ii) \quad \frac{-2.95}{2} = 0.125 \text{ g/min}$$

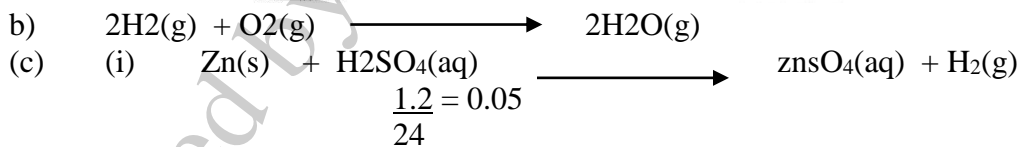
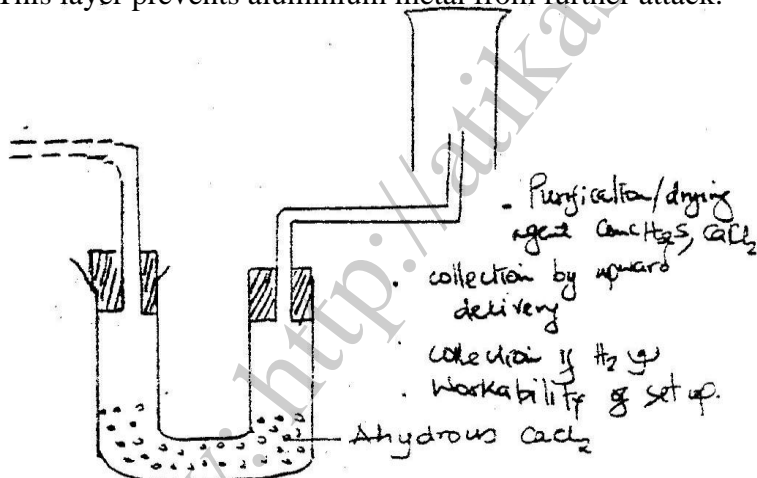
- 5
- Electrolysis // Hall/ Heroult cell
  - $\text{Al}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O} / \text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
  - Iron (iii) Oxide  $\text{Fe}_2\text{O}_3$  silica

Silica  $\text{SiO}_2$

- Add hot conc.  $\text{NaOH} / \text{KOH}$ , silica and  $\text{AlO}_3$  dissolves. Filter iron(iii) oxide. Bubble  $\text{CO}_2$  through filtrate/ add water/ add  $\text{Al}(\text{OH})_3$  to precipitate.  $\text{Al}(\text{OH})_3$ . Filter  $\text{Al}(\text{OH})_3$  / silica remain in solution.

- Lower melting point of Aluminum oxide/Acts as an electrolyte.
- The oxide ion ( $\text{O}^{2-}$ ) is discharged at the graphite to form carbon dioxide
- The reaction of aluminium with oxygen forms a firm layer of aluminium oxide. This layer prevents aluminium metal from further attack.

6. a)



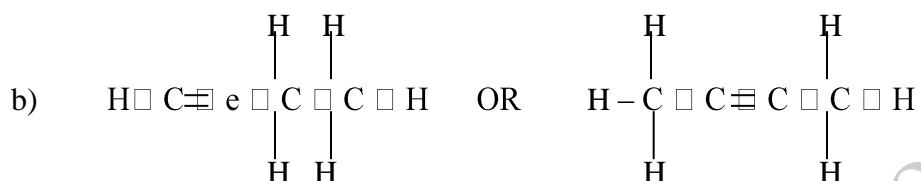
Moles of Zn = 0.05

0.05 moles of zn = 0.05 moles

R.A. M  $\frac{3.27}{0.05} = 65.4$  (NO units)

- Manufacture of ammonia
  - Extraction of tungstein
  - Synthesis of HCL (acid) or HCL (gas)
  - Filling weather balloons
  - Making oxy-hydrogen flame for welding
  - Hardening of oil/manufacture of margarine.

7. a) Ethane burns with a pale blue flame while ethane burns with a yellow flame. Ethane is saturated while ethyne is unsaturated. OR Ethane burns with a non smoky flame while ethyne burns with a Smokey/sooty flame.



- c) (i) I Oxidation  
II B -Ethane  
C - Sodium ethanoate.



(iii) to bring the reacting particles in close contact for the reaction to occur.

(iv) -Fuel

- Manufacturer of carbon black used in making paint and paint ink
- Manufacture of hydrogen gas
- Manufacture of carbon disulphide
- Manufacture of chloromethane, tetra chloromethane
- Manufacture of hydrogen used in manufacture of ammonia
- Manufacture of hydrogen cyanide
- Manufacture of ethyne.