

**CHEMISTRY PAPER 233/1 K.C.S.E 2002**  
**MARKING SCHEME**

1. It is uncreative
2. Oxygen exists as discrete molecules ( $O_2$ ) with only weak van der Waals forces between them. While sulphur exists as  $S_8$  rings and chains which are bulky
3. A sulphur, carbon, nitrogen  
B Sodium potassium, lithium
4. (a) The hypochlorous acid decomposes to form (atomic oxygen)  
The atomic oxygen attacks and bleaches the blue flower  
(b)  $2HOCl(aq) \rightarrow O_2(g) + 2HCl(aq)$
5. (a) calcium 2.8.8.2  
Beryllium 2.2  
(b) Both elements are in the same group but the two valence electrons of calcium are further away (1) They are not strongly held by the nucleus, hence are readily released.  
(1) (3 mks)
6. (a) Oxygen (1)  
(b) Decomposition (1) (2 mks)
7. Use zinc powder (1), which has a larger surface area (1) (2 mks)
8. (a)  $C_2 = FeS, ZnS$  (1)  
(b) It is soluble in cold water (1)  
(c) it turns black (1)
9. (a) Displacement (1)  
(b) DGEF (1)  
(c)  $G(s) + 2F^+(aq)$
10. (a) Alpha or He (10)  
(b)  ${}_{81}^{210}J \rightarrow {}_{82}^{210}k + {}_{-1}^0e$   
(c) K and M
11. SO reacts with water to form  $SO_2$ / sulphurous acid (10) which then is oxidized by chlorine to  $SO_3$ / sulphuric acid (1).  $SO_3$  reacts with  $Ba^{2+}$  to form insoluble  $BaSO_4$  (1)
12. Concentrated nitric acid is a strong oxidizing agent (1/2). It oxidizes pale iron (II) (1/2) to yellow iron (III) (1/2) and it is reduced to nitrogen dioxide (1) which is brown (1/2)  
3 mks
13. (a) Lattice energy (a)  
(b) Let the heat be  $H_3$   
 $H_3 - 701 = 15$  (1)  
 $H_3 = 686 \text{ kJ mol}^{-1}$  (2 mks)
14. (a)  $Fe_2O_3, Fe_3O_4$  (1)  
(b)  $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$  (1)
15. (a)  $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$   
(b) White ppt dissolves (1) because the insoluble  $CaCO_3$  (1/2) is changed into soluble calcium hydrogen carbonate. (1/2)
16. Covalent bonds exist between two iodine atoms (1/2) in an iodine molecule (1) while Van der Waals forces exist between two or more molecules of iodine (1) covalent bonds are stronger than Van der Waals forces

17. a) Perspex(10)  
 b) As a substitute for glass in the manufacture of  
 - safety screens  
 - plastic lenses  
 - Wind screen Accept any other correct use.
18. Add excess zinc oxide (  $\frac{1}{2}$  ) to dilute HCL, HCl, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub> (  $\frac{1}{2}$  ) Filter to the filtrate, add aqueous Na<sub>2</sub>CO<sub>3</sub> K<sub>2</sub>CO<sub>3</sub>(  $\frac{1}{2}$  ) to precipitate ZnCO<sub>3</sub>(  $\frac{1}{2}$  ) filter (  $\frac{1}{2}$  )
20. I Conducts (1)  
 II Ionic (1)  
 III Covalent (1)
21. a)  $2\text{NaOH(aq)} + \text{H}_2\text{SO}_4\text{(aq)} \rightarrow \text{Na}_2\text{SO}_4\text{(aq)} + \text{H}_2\text{O(l)}$  (1) (3 marks)  
 b) Blue litmus paper turn remains red  
 (c) The acid was in excess (1)
22. a) Manganese (IV) oxide (1)  
 b) -Welding (1)  
 - Fuel in rockets  
 - Breathing aid / hospitals  
 - Steel making (3mrks)
- Accept any other correct ans
23.  $\text{Pb(XO}_3\text{(aq)} + 2\text{NaCl(aq)} + 2\text{NaNO}_3\text{(aq)(l)}$   
 R.F.M NaCl = 58.5  
 R.F.M PbCl<sub>2</sub> = 278(  $\frac{1}{2}$  )  
 Moles of PbCl<sub>2</sub> =  $\frac{2.56}{278}$   
 Moles of NaCl =  $2.56 \times 2 \left(\frac{1}{2}\right)$   
 = 278  
 Mass of NaCl =  $0.04 \times 58.5$   
 = 2.34g
24. a) Being acidic, it would react with the basic ammonia(1) (2mks)  
 b) CaO (1)
25. a) Butane (1)  
 b) Hardening of oils in the (a) manufacture of margarine (2 marks)
26. a)  $\text{Ag}^+\text{(aq)} + \text{e}^- \rightarrow \text{Ag(s)}$  (1)  
 b) Anode decreases in size/mass  
 It dissolves/ions to release electrons (1)  
 (3marks)
27. a) Pb<sup>2+</sup> or Ag<sup>+</sup> Hg<sub>2</sub><sup>2+</sup> Absent(i)  
 b) Zn<sup>2+</sup> (1)  
 c)  $\text{Zn}^{2+}\text{(aq)} + \text{CO}_3^{2-}\text{(aq)} \rightarrow \text{ZnCO}_3\text{(s)(l)}$  (3 mks)

**CHEMISTRY PAPER 233/2 K.C.S.E 2002**

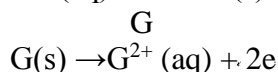
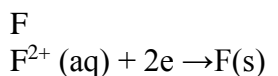
**MARKING SCHEME**

1. (a) Distillation/ Fractional distillation
- (b) (i) Add water to the mixture; sodium chloride being an ionic compound dissolves. Filter the mixture to remove sulphur as a residue. Sulphur being a molecule substitute does not dissolve. Evaporate the filtrate to obtain sodium chloride.  
(ii) Determine the melting point, If it sharp then it is pure. Narrow range/ fixed/113<sup>0</sup>C/Content/ Definite.
- (c) (i) potassium bromide/ KBr  
(ii) 60 – 55 = 5g  
(iii) Fractional crystallization  
(iv) Extraction of salts/Na<sub>2</sub>CO<sub>3</sub>/Solvay process  
Production of salts  
Solving process
2. (a) (i) Sodium hydroxide ( 1 mk)  
(ii) ethne/C<sub>2</sub>H<sub>2</sub> //H – C = C-H (1 mk)
- (b) Polymerization // Addition polymerization ( 1mk)
- (c) - making artificial leather/ rain coats/ manufacture of cromophone  
- making plastic water pipes  
- Making electrical insulators ( 1 mk)
- (d)  $2Cl^{-}(aq) \rightarrow Cl_2(g) + 2e^{-}$   
 $2Cl(aq) - 2e^{-} \rightarrow bCl_2(g)$
- (e) Deep brown solution // dark black brown solid is formed. Chlorine is more reactive than iodine, it displaces if formed.
- (f) (i)  $2NaOH(aq) + Cl_2(aq) \rightarrow NaCl(aq) + NaOCl(aq) + NaOCl(aq) + H_2O(l)$   
 $2OH^{-}(aq) + Cl_2(aq) \rightarrow OCl^{-}(aq) + Cl^{-}(aq) + H_2O(l)$
- (ii) Moles  $\frac{2 \times 15000}{1000} = 30$  or  $2 \times 15 = 30$   
R.F.M NaOCl = 23 + 16 + 35.5 = 74.5  
Molar mass = 3 + 16 + 35.5 = 74.5  
Moles of NaOCl =  $30 \times \frac{1}{2} = 15$   
Mass of NaOCl =  $\frac{15 \times 74.5}{1000} = 1.1175$   
Mass in kilograms of the sodium hypochlorite produced = 1.1175
3. (a) Exothermic reaction – heat energy given out to surrounding  
Endothermic reaction – heat energy is absorbed from the surround
- (b) (i) Vaporization// melting// evaporation// boiling  
(ii) Condensation // freezing  
Sublimation must be given with the solid that sublimes
- (c) The water is undergoing a change of state. The heat supplied is used in breaking the inter particle forces between molecules of water OR intermolecular bonds

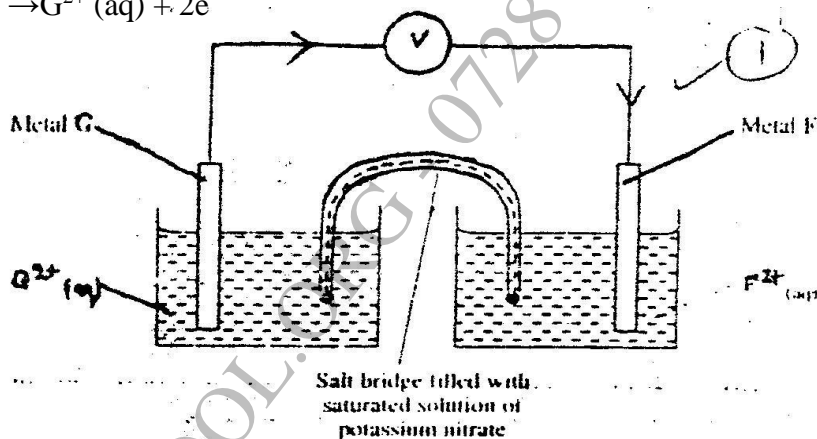
- (d) (i) Heat of formation of  $\text{FeCl}_2$   
(ii)  $\Delta H_1 + \Delta H_2$  OR  $\Delta H_1 = \Delta H_3 - \Delta H_2$  OR  $\Delta H_2 = \Delta H_3 - \Delta H_1$
- (e) Butane because more bonds are formed on combustion of butane hence more heat released OR Butane has a large molecular mass / carbon atoms OR Butane has highest percentage of carbons.

4. (a) E; its ions have the greatest tendency (+ 0.85V) to accept electrons// has reduction potential // strongest oxidizing agent

- (b) (i)

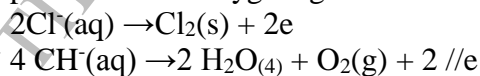


- (ii)



- (iii) To complete the circuit // maintain charge balance // Enable ions to move to cell too

- (c) (i) The blue green colour of the solution fades;  $\text{Cu}^{2+}$  are removed from the Solution  
(ii) The two gases are chloride and oxygen; initially  $\text{Cl}^-$  are at a more higher Concentration of  $\text{Cl}^-$  goes hence the  $\text{OH}^-$  is discharged reading to production of oxygen gas



- (iii) J; Negativity charged ions (aq – and not  $\text{OH}^-$  – can only move to the anode // anode is the charged hence attract  $\text{Cl}^-$  and  $\text{HO}^-$

5. (a) (i) Hydrogen // H  
(ii) carbon //C

- (b) (i) Extinguishes // put off // goes off // want out // Die;  $\text{CO}_2$  and Water vapour, which do not support combustion, accumulates around the supply of oxygen

- (ii) Mass increases; water vapour reacts with  $\text{CaO}$  and forms  $\text{Ca}(\text{OH})_2$   
 $\text{Ca}(\text{OH})_2$  reacts with  $\text{CO}_2$  to produce  $\text{CaCO}_3$   
 $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{s}) \rightarrow \text{CaO}$  reacts with moist  $\text{CO}_2$   
 $\text{Ca}(\text{OH})_2 + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}$

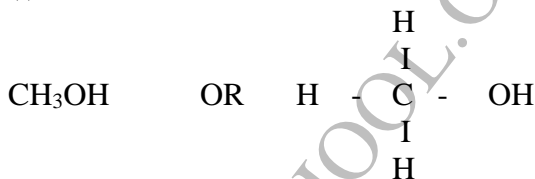
- (iii) Oxygen and Nitrogen Helium, Neon argon; Accept a name of inert gas

- (iv) To absorb excess water vapour // moisture  
 (v) Sodalime // NaOH and CaO // KOH // Caustic potash // caustic soda
6. (a) Malachite // Copper pyrites // Chalcocite // Chalcopyrite // Bornite // azurite
- (b) (i) Hydrogen sulphide // H<sub>2</sub>S  
 Reagent Q ( 1 mk)  
 Sodium Carbonate // Na<sub>2</sub>CO<sub>3</sub> // NaHCO<sub>3</sub> // Potassium carbonate //  
 Solid R  
 Copper (II) Oxide // CuO
- (ii) CuCO<sub>3</sub>(s) → CuO(s) + CO<sub>2</sub>  
 Step 4  
 - Green solid dissolves to form blue solution  
 - There is effervescence // bubbles  
 Step 7  
 - Black solid dissolves to form a blue solution
- (c) (i) Tin // Sn  
 (ii) Ornaments // medals // metal bearings in machines // jewels // spear head //  
 making coins // gear wheels // rims of car // clocks springs // electric  
 contact.

7. (a) Write the structural formula of:

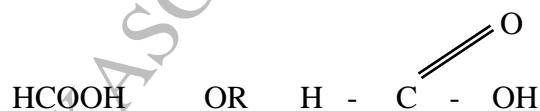
(i) Methanol

( 1 mk)

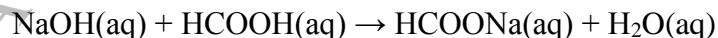


(ii) Methanoic acid

( 1 mk)



(b) Write the equation for the reaction between methanoic acid and aqueous sodium hydroxide (1 mk)



(c) (i) Name the product formed when methanol reacts with methanoic acid

Methylmethanoate // HCOOCH<sub>3</sub> // H - C - O - CH<sub>3</sub>

(ii) State one condition necessary for the reaction in © (i) above to take Place

- add conc. H<sub>2</sub>SO<sub>4</sub>
- Heat to 180<sup>0</sup>C // warm // heat

(d) (i) Describe one chemical test that can be used to distinguish between hexane and hexene

- Use a bromine water // acidified potassium permanganate
- If hexane they will be decoloured
- If hexene no decolourisation

(ii) State one use of hexane

Fuel // solvent // manufacture hexanol // hexanoic acid, hexanol

(iii) Hydrogen gas reacts with hexane form hexane. Calculate the volume or hydrogen gas required to convert 42g of hexane to hexane at S.T.P ( C = 12.0, H = 1.0, Molar gas volume at S.T.P is = 22.4 litres). ( 4 mks)

$C_6H_{12} + H_2 = C_6 H_{14}$  mole ratio = 1:1

R.MM of hexane =  $42/84 = 0.5$

Moles of hydrogen = 0.5

Volume of hydrogen =  $0.5 \times 22.4 = 11.2$  litres of  $11 \text{ dm}^3$

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