

**CHEMISTRY PAPER 233/ 1 K.C.S.E 1999**  
**MARKING SCHEME**

1.
  - Does not corrode easily
  - Light or low density
  - Cheap
  - Ductile
2.
  - a)
    - i) Dilute nitric acid
    - ii) Lead (II) sulphate or lead sulphate
  - b)
 
$$\text{Pb (OH)}_2 \text{ (S)} + 2\text{OH} \longrightarrow (\text{pb(OH)}_2)_{-4} \text{ (aq)}$$

$$\text{Pb (OH)}_2 \text{ (S)} + 2\text{OH} \longrightarrow \text{pbO}^{2-}_2 \text{ (aq)} + 2\text{H}_2\text{O}$$
3. The blue crystals turn into a white powder, concentrated H<sub>2</sub>SO<sub>4</sub> removes water of crystallization or is dehydrating agent.
 
$$\text{CuSO}_4 \cdot \text{H}_2\text{O (s)} \longrightarrow \text{CuSO}_4 \text{ (s)} + 5\text{H}_2\text{O}$$

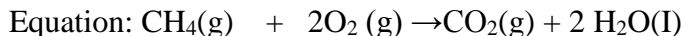
Blue hydrated                      White powder                      (explanation not tied to observation)
4. Relative formula, mass of N<sub>2</sub> = 28  
 Relative formula mass of NH<sub>3</sub> = 17  
 Moles of B<sub>2</sub> =  $\frac{4.76}{28} = 0.17$   
 Moles of NH<sub>3</sub> =  $\frac{4.76}{17} = 0.28$   
 Therefore moles of ammonia are more hence under the same temperature and pressure ammonia occupies greater volume.
5.
  - (i)
 
$$\begin{array}{ccccccc} \text{SO}_2(\text{g}) & + & \text{NO}_2(\text{g}) & \rightarrow & \text{SO}_3(\text{g}) & + & \text{NO}(\text{g}) \\ +4 & & +4 & & +6 & & +2 \end{array}$$

Oxidation number of sulphur increases/ oxidation number of nitrogen decreases
  - (ii) Sulphur dioxide Or SO<sub>2</sub> is the reducing reagent
6. Li= 2:1 F= 2:7  
 Ionic bond  
 Bond is formed between a metal and a non- metal Or Lithium loses electrons while fluorine gains
7. C=2:3 Valency C<sub>2</sub>S<sub>3</sub> Or C<sub>2</sub>S<sub>5</sub>  
 Accept B<sub>2</sub>S<sub>3</sub> or B<sub>2</sub>S<sub>5</sub> if the candidate identifies C as Boron (B)
8. Precipitation occurs because the solubility of the salt decreases with an increase in temperature
9. Pentane: \_\_\_\_\_ + Sodium No effervescence  
 Pentanol: \_\_\_\_\_ + sodium effervescence – colourless colour produced
10. Moles of nitric acid =  $\frac{50 \times 2}{1000} = 0.1$   
 Moles of KOH in 50cm<sup>3</sup> = 0.1 ½  
 Moles of KOH in 100cm<sup>3</sup> = 0.2 ½  
 Mass of D = 0.2 x 56  
 11.2 g

11. Sulphuric acid reacts with Barium sulphite to give  $\text{SO}_2$  (g) but it also reacts with  $\text{Ba}^{2+}$  to form insoluble Barium Sulphate which covers the sulphate and stops the reaction.
12. (b) Curve concentration of F increases with time  
(c) After time 't' concentration does not change because equilibrium has been Established
13. (a)  $2\text{Cr}(\text{s}) + 3\text{Fe}^{3+}(\text{aq}) \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{Fe}(\text{s})$   
(b)  $0.44 - E^\theta \text{Cr}(\text{s}) / \text{Cr}^{3+}(\text{aq}) = 0.30\text{V}$   
 $E^\theta = 0.44 - 0.30 = 0.74\text{V}$
14. (a) A brown ring was formed  
(b)  $2\text{KNO}_3(\text{s}) \rightarrow 2\text{KNO}_2(\text{s}) + \text{O}_2$
15.  $H_p$  (products) –  $H_r$  ( reactants)  
(i)  $1207 - (-394 - 365) = -1207 + 394 - 635 = 178\text{kJ}$   
2 mks with –ve sign but 1 without  
OR  
 $394 + 635 = 1029$   
 $= 1207 + 1029$   
 $= -1207 + 1029$   
 $= -178\text{kJ}$  for any other acceptable method
16. Yield increases. It is endothermic reaction. Increase in temperature equilibrium to the right
17. Change was greatest with magnesium. Both react with oxygen to form oxides but magnesium reacts with nitrogen to form a nitride.
18. Molar heats of vaporization increase down the group with increase in van der waals forces of attraction as the number of electrons increase/increases in size/ volume/ mass/energy levels/ density/ No. of protons (atomic number)
19. (a) (i) Concentrated hydrochloric acid or Conc.  $\text{HCl}$  or  $\text{HCl}(\text{aq})$   
(ii) Conc. Sulphuric acid or Conc.  $\text{H}_2\text{SO}_4$  or  $\text{H}_2\text{SO}_4(\text{l})$   
(a) Heavier or more dense than air (l) OR Air is lighter / less dense than  $\text{Cl}_2$
20. With gas M there is reduction, in pressure in the porous pot because air moves out faster than gas M enters  $\frac{1}{2} \text{M}$  is denser than air / Air is less dense than M with gas N there is increase in pressure, inside the porous because gas N enters the porous pot faster than air comes out, gas B is less dense than air/ air is less dense than N.
21. On boiling hard water deposits  $\text{CaCO}_3$  which form a fur/ scales in the boiler. This reduces conductivity.
22.  $\begin{array}{ccccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{Br} & & \text{H} \\ & | & & | & & | & & | & & | \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & | & & | & & | & & | & & | \\ & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} \end{array}$
23. (a)  $\text{Pb}(\text{s}) + \text{CO}(\text{g}) \rightarrow \text{Pb}(\text{s}) + \text{CO}_2(\text{g})$   
(b) Silvery white or grey metal/ shiny grey metal

(c) Hydrogen gas / ammonia

24. Name: Methane / CH<sub>4</sub>



25. HCl is covalent and dissolves in methylbenzene but does not ionize/ dissociate. Addition of water causes HCl to ionize/ dissociate. H<sup>+</sup> ions reacts with the carbonate to produce carbon dioxide gas.

26. (a) t<sub>1/2</sub> is 8 days

(b) 10 → 5 → 2.5 → 1.25 → 0.625

(proper division of the isotope be Xg

Number of t<sub>1/2</sub> = 32 / 8 = 4

X/10 = [ 1/2 ]<sup>4</sup>

X = 0.625

27. (a) III

(b) I and IV. Al<sub>2</sub>O<sub>3</sub> is amphoteric. It dissolves in acidic and alkaline media

If only one solution is given plus correct explanation max 1 1/2 mks

If explanations is Al<sub>2</sub>O<sub>3</sub> is basic and Al<sub>2</sub>O<sub>3</sub> is acidic

28. (a) U.V light

Accept sunlight/ high temperature

180 – 250°C/ heating strongly

(b) Bonds broken C – Br and H

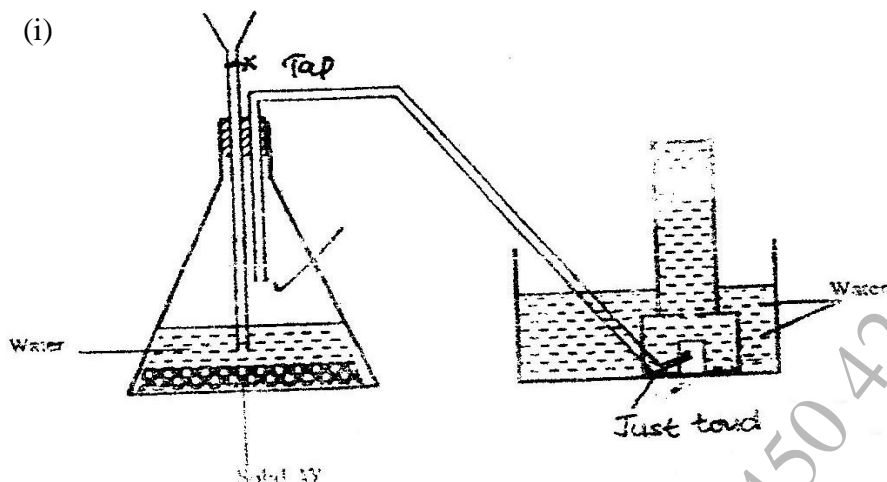
## CHEMISTRY PAPER 233/2 K.C.S.E 1999

### MARKING SCHEME

1. (a)  $\text{Mg(s)} + 2\text{HCl(g)} \rightarrow \text{MgCl}_2 + \text{H}_2(\text{g})$  - ½ mk if states are missing
- (b)
- (c) (i)  $300\text{cm}^3$  ( $10\text{cm}^3$ ) depending on the scale  
Must read from the graph
- (i)  $25\text{cm}^3$  ( $0.5$  or  $5\text{cm}^3$ )  
Must be read from the graph
- (d) (i) Rate is lowered (i) w.t.t.e. (slow only) magnesium ribbon has a smaller surface area (½) than the powder contact or collision (½) between magnesium and hydrochloric acid is reduced
- (ii) Rate is increased (i), Number of particles of HCl is higher (½) or concentration is increased (½)
- (e) Moles of hydrogen gas =  $\frac{600}{24000} = 0.025$  (½)
- Mole Mg = 0.025  
R.M of Mg = 0.6 (I) = 24 (½)  
0.025  
OR consequential to (ii) above  
Moles of HCl =  $\frac{25 \times 2}{1000} = 0.025$  (I)  
Moles of Mg =  $\frac{0.05}{2} = 0.025$  (½)  
Moles of Mg =  $\frac{0.6}{24} = 0.025$  (½)
2. (i) Platinum / graphic ( carbon)
- (ii)  $\text{SO}_4^{2-}(\text{aq})$   $\text{OH}(\text{aq})$
- (iii)  $\text{Mg}^{2+}(\text{aq})$   $\text{H}(\text{aq})$  ( $\text{H}^3\text{O}^4$ )
- (iv)  $4\text{OH}(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}(\text{g}) + 4\text{e}$
- (v) The concentration of aqueous magnesium sulphate is increased (I) because water molecules are broken down into hydrogen and oxygen.
- (vi)  $Q = 4 \times 2 \times 60 \times 60$  (½)  
 $= 28000\text{C}$  (½)  
 $4 \times 96500\text{C} = 24000 \times 28800 = 1790.67\text{cm}^3$  (½)  
 $4(\frac{1}{2}) \times 96.500$  (½) accept  $1791\text{cm}^3$
- (vii) Process where a thin layer of metal is deposited on another metal (I) by the use of electrolysis
- Preventing of rusting corrosion (I)
  - Decoration purpose w.t.t.e
  - Increases strength and durability
3. (a) M – 2.8  
Q 2.8.8
- (b) (i) Q

- (ii) Q ( or N)
- (c) 4, (four)
- (d) R has a larger atomic radius than L ( water). (I) its outermost Electron is not tightening held by the nucleus
- (e) 1 mark for labeling N and Q  
1 mark for showing correct electronic distribution
- (f) The metallic bond in M is stronger than L (I) because m has more valence electrons(I)
- (g)  $2L(s) + 2 H_2O (l) = 2 LOH (aq) + H_2 (g)$
- (h) Add water to the mixture C stir / shake the mixture (  $\frac{1}{2}$  ) filter mixture (  $\frac{1}{2}$  ). Dry the mixture to obtain lead (II) sulphate (  $\frac{1}{2}$  )  
Evaporate or crystallize the filter to obtain the sulphate of R. (I)
4. (a) (i) Chlorine  
Condition  
Heat
- (ii) I. Iron (III) Oxide ( $Fe_2O_3$ )  
II. Iron (II) Sulphide ( $FeS$ )  
I. Coke or carbon (C)
- (ii) Green  $Fe^{2+}(aq)$  is oxidized by hydrogen peroxide to yellow  $Fe^{3+}(aq)$
- (iii)  $Fe_2 + 3OH(aq) = Fe(OH)_3(s)$  (  $\frac{1}{2}$  ) for states
- (iv) Ammonia solution ( ammonia hydroxide) ( $KOH_{aq}$ )
- (b)  $Fe(s) + Cu (aq) = Fe_2 + Cu (s)$   
Moles of  $Fe(s) = \frac{3.36}{56} = 0.06$  (  $\frac{1}{2}$  )  
Moles of  $Cu = 0.06$   
Mass of  $Cu = 0.06 \times 63.5$  (I) = 3.81 (  $\frac{1}{2}$  )  
Mark consequently from caption given (  $\frac{1}{2}$  ) for units
5. (a) (i) Propanoic acid  
(ii) Esters
- (b) The colour of the solution changes from orange yellow to green (I) because is reduced to Cr while ethanol is oxidized to ethanol acid (I)
- (c) (i) Soap/ soapy detergent  
(ii) Sodium chloride  
(iii) To make soap float ( w.t.t.e)  
(iv) A molecule of the cleansing agent has polar and non polar parts (  $\frac{1}{2}$  ) non – polar parts dissolves in oil (  $\frac{1}{2}$  ) and the polar part (  $\frac{1}{2}$  ) dissolves in water when the mixtures is agitated (  $\frac{1}{2}$  ) the oil droplets coagulate and can be washed away with water.

6. (a) (i)



(ii) sodium peroxide  $\text{Na}_2\text{O}_2$

(b) (i)  $4\text{P} + 5\text{O}_2(\text{g}) = 2\text{P}_2\text{O}_5(\text{s})$   
Or  $4\text{P}_2$

(ii) It dissolves in water (I) a strong (I) to form acid

(c) A firm oxide  $\text{Al}_2\text{O}_3$  (I) layer is formed on the surface of the metal. The oxide protects the metal from further attack. (I)

(d)  $2\text{SO}(\text{aq}) + \text{O}_2(\text{g}) = 2\text{SO}_3(\text{g})$

(i) A reaction where heat is lost to the surroundings

(ii) Lower (I) through by the principal, the yield is expected to increase, the rate of reaction is lower (I) because the reacting molecules have lower kinetic energy (I).

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