K.C.S.E 2008 CHEMISTRY PAPER 1
MARKING SCHEME

1. - Crystal dissolves, purple colour spreads in the water
   - The crystal break into smaller particles of potassium manganate (VII) which moves in all directions
   Crystals dissolves through diffusion. Purple colour of KM spread uniformly throughout the water
   $KMnO_4$ diffused from the area of high concentration.

2. Mass of hydrated salt = (33.111 – 30.296) = 2.815g
   Mass of anhydrous salt = (32.781 – 30.296) = 2.485g
   C.F. = $CaSO_4$

$$\begin{array}{r} 33.111\text{g} \\ -\ 32.781\text{g} \\ \hline 0.330\text{g} \end{array}$$

Mass of water = (2.815 – 2.485) = 0.330g

$CaSO_4 \longrightarrow XH_2O$

Mass 2.485 $\longrightarrow$ 0.320

Moles 2.485 = 0.0183 $\longrightarrow \frac{0.330}{18} = 0.0183$

Ration $\frac{0.0183}{0.0183} = \frac{0.0183}{0.0183}$

$= 1$

ALTERNATIVE

$CaSO_4 \cdot XH_2O \longrightarrow CaSO_4 + XH_2O$

$\frac{2.815\text{g}}{CaSO_4 \cdot XH_2O} = \frac{2.485\text{g}}{136}$

$= \frac{2.815}{2.485} \times 136 = 154$

$CaSO_4\ XH_2O = 154$

$136 + 18X = 154$

$18X = 154 - 136 = 18$

$X = \frac{18}{18} = 1$

3.

No	Gas	Test	Observation
I	Chlorine		The red litmus paper turns white/the litmus paper is bleached.
II	Acidified must be there	Put a filter paper dipped in acidified potassium dichromate(VI) into the gas.	
III			The bromine water is decolourised

4. a) $C_{13}H_{27}COO—Na^+$ Regardless of charges i.e. $C_{13}H_{27}COONa$
   b) Soapy detergent/Soaps
   c) $(C_{13}H_{27}COO\text{-})_2\ Ca$

5. RFM of $Ca_3(PO_4)_2$

$$\begin{array}{lcll} Ca & = & 40 \times 3 & = 120 \\ P & = & 31 \times 2 & = 62 \\ O & = & 16 \times 8 & = \underline{128} \\ & & & 310 \end{array}$$

$H = 1 \times 3 = 3$
$P = 31 \times 1 = 31$
$O = 16 \times 4 = \frac{64}{98}$

1 mole $CO_3(PO_4)_2$ gives 2 moles of H_3PO_4
310g $CO_3(PO_4)_2$ gives 2×98 g
155×100g $CO_3(PO_4)_2$ gives $\frac{2 \times 98 \times 155 \times 100}{310}$
$= 98000$g
$= 98$kg

6. Propanol Propan-i-ol
Butanoic acid
Are elements with the same atomic number but different mass number.
Are different elements with the same atomic number but different mass number.

7. a) Atoms of the same element having different masses or atoms of the same element having different number of neutrons.
b) $18 - 8 = 10$ neutrons

8. a) A black solid
b) $FeS_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_{2(aq)} + H_2S_{(g)}$
c) The powder has a larger surface area than the iron fillings hence the reaction is faster.

9. $Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$
$Zn_{(s)} + 2H_2SO_{4(l)} \longrightarrow ZnSO_{4(aq)} + SO_{2(g)} + 2H_2O_{(l)}$

10. Magnesium burns in air to form MgO and Mg_3N_2, Mg_2N_2 reacts with water to liberate ammonia gas
$Mg_3N_{2(s)} + 6H_2O_{(l)} \longrightarrow 2NH_{3(g)} + 3\ Mg\ (OH)_{2\ (aq)}$

11. a) Ionic /electrovalent
b) Has 7 electrons in its outermost energy level and hence easily gains an electron to complete the octet or it is most electronegative.

12. a) Oxygen; O_2
b) The pH decreases
HOCl decomposes to give more HCl in the mixture
$2HOCl_{(aq)} \longrightarrow 2HCl_{(aq)} + O_{2(g)}$

13. Pass product E over anhydrous copper (II) sulphate which turns from white to blue or use anhydrous cobalt chloride which turns from blue to pink.

14. a) H
b) A_1 using baseline

15. J – The solubility of the substance decreases with increase with temperature.
It dissolves more in cold water than in hot water.

16. - Heat the metal in air to form the oxide CuO.
- Add excess dilute HCl to the oxide to get $CuCl_2$.
- Concentrate the filtrate and leave to crystallize.
- Filter and dry the crystals at room temperature between pieces of filter paper.
- Add excess Cu to nitric acid (dilute concentrate) $K_2CO_3/NH_4(CO_3)$.
- Filter to remove unreacted copper. Add Na_2CO_3 to the filtrate to ppt $CuCO_3$ filter and add dilute HCl to residue to obtain $CuCl_2$.
- Add nitric acid to obtain $Cu(NO_3)_2$. Filter to remove excess Cu.
- Add NaOH.

17. a) Amphoteric
b) lead (II), Zinc and Aluminium *(any two)*

18. a) Position fersilicon

b) U

c) $Q_{(s)} + T_{2(g)} \longrightarrow QT_{2(s)}$

$Mg_{(s)} + Cl_{2(g)} \longrightarrow MgCl_{2(s)}$

19. a) $Zn_{(s)} / Zn^{2+}_{(aq)} // Ag^{+}_{(aq)} / Ag_{(s)}$

$Zn / Zn^{2+} // Ag^{+} / Ag_{(s)}$

b) The solution changes to blue because Cu metal is corroded dissolves to form Cu.
Metal silver is deposited on the sides of beaker BCO_3 silver is deposited on the sides of beaker

$Cu_{(s)} + Ag^{+}_{(aq)} \longrightarrow Cu_{2(aq)} + 2Ag_{(s)}$

20. a) At constant temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density.

b) $\sqrt{\frac{RW}{RX}} \quad \sqrt{\frac{RMMX}{MMWE}} \quad \sqrt{\frac{44}{16}}$

$\frac{12.0}{RX} = \frac{\sqrt{44}}{4}$; $\frac{12.0 \times 4}{\sqrt{44}} = \frac{48}{6.63}$

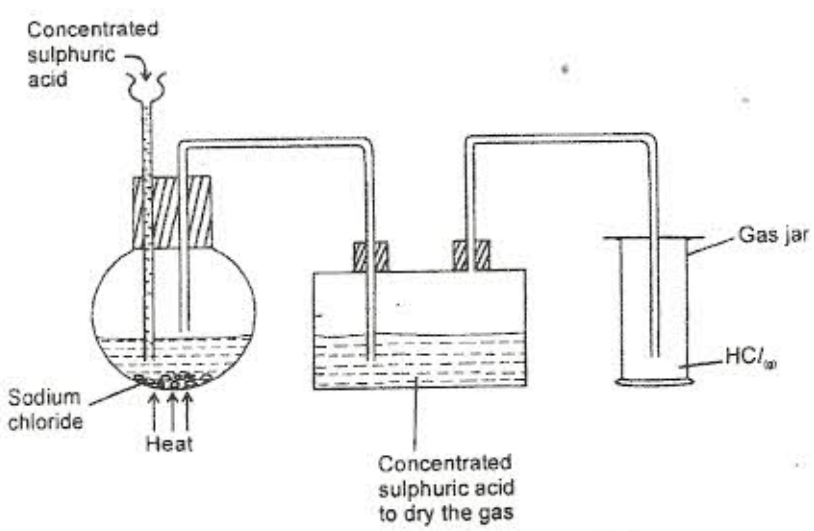
$= 7.24$ cm

21. a) CU^{2+} moving towards the cathode

b) $4OH^{-}_{(aq)} - 4e^{-} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$

$4OH^{-}_{(aq)} \longrightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^{-}$

22.



23. The brown colour of the mixture intensifies /increases and the green colour of the mixture fades/decreases or the yellow deposit /sulphur decreases.
Iron (II) is converted to Fe^{3+}

24. a) $^{4}_{2}He$ $^{4}_{2}He^{+}$ (reject He)

b). i) $Z_1 = 235$ $Z_2 = 54$

ii) Nuclear fission (accept fission)

25. a) cooling
b) latent heat of fusion

26. a) I Pb^{2+}
II CO_3^{2-}

b) $PbO_{(s)} + 2H^+_{(aq)} \longrightarrow Pb^{2+}_{(aq)} + H_2O_{(l)}$

27. a) $Mg(OH)_{2(aq)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(l)}$

Mole ration (1 : 2)

No of moles of acid = $\frac{0.1 \times 23}{1000} = 0.0023$

No of moles of $Mg(OH)_2 = \frac{\frac{1}{2} \times 0.1 \times 23}{1000} = 0.00115$

Mass of $Mg(OH)_2$ in anti acid = $0.001'_{,}5 = 0.067g$

b) % of $Mg(OH)_2$ in anti-acid

$Mg(OH)_2 = \frac{0.67 \times 100}{0.50} = 13.34\%$

28. a) i) Cryolite
ii) Electrolysis

b)
- Good conductor does not rust
- Malleable
- Light
- High m.p
- Does not corrode easily

29. a) Gas syringe/ graduated gas cylinder measuring cylinder.

b) i) The molecules of the reactants have higher energy marking points.
ii) The reaction is faster / are more effective collusions.

30. It burns to form SO_2/SO_3 which is a pollutant.
Accept any other effect e.g. acid rain, corrosion of buildings, irritation of respiratory systems, yellowing of leaves of plants.

31. a) Neutralization

b) i) Calcium hydrogen carbonate
ii) drying agent
Extraction of sodium metal