

CHEMISTRY PAPER 233/1 K.C.S.E 1998
MARKING SCHEME

1. (a) - $^{234}\text{U} \rightarrow ^{230}\text{Th} + 4\text{He}$
(b) - Gamma rays will penetrate through the walls of the container and causes damage

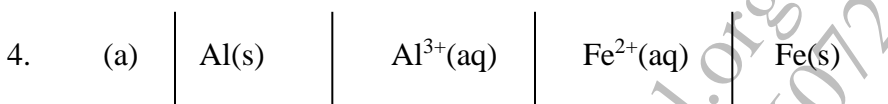
2. - Add water to the solid mixture A dissolves while B does Not
- Filter the mixture
- Evaporate the filtrate to dryness

3. Advantage

- Prevents knocking engines
- Prevent premature ignition
- Increase the Octane rating (Number)

Disadvantage

- Poisonous lead or lead compounds are released into the environment/ pollutes the atmospheres



$$\text{EMF} = E^{\circ}_{\text{R}} - E^{\circ}_{\text{O}}$$

$$= (-0.44) - (-1.66) = 1.22\text{V}$$

- (b) - It is always on the left cell rep
- Correspond on iron/ element lower in E.C.S of the two
- Has less negative

5. (a) -D

- (b) -E

6. ALT 1

$$\begin{array}{l} \text{CxHy} + \text{O}_2 \rightarrow \text{x CO}_2 + \frac{\text{y}}{2} \text{H}_2\text{O} \\ \text{XCO}_2 \qquad \qquad \frac{\text{y}}{2} \text{H}_2\text{O} \\ 3:52 \qquad \qquad 1:44 \\ \text{r:} \frac{3.52}{44} = 0.08 \qquad \frac{1.44}{44} = 0.08 \end{array}$$

$$= \frac{0.08}{0.08} = 1 \qquad \frac{0.08}{0.08} = 1$$

$$\begin{array}{l} \text{X} = 1 \quad \frac{\text{y}}{2} = 1 \\ \Rightarrow \text{E.F} = \text{CH}_2 \quad \text{y} = 2 \\ \text{E.F.M} = 14 \\ \text{N} = \frac{56}{14} = 4 \end{array}$$

M.F. (CH₂)₄ = C₄H₈

Mass of C = $12 \times \frac{3.52}{44} = 0.96$

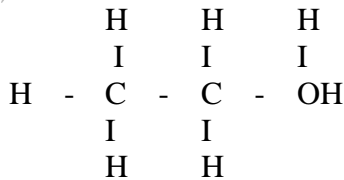
Mass of H = $2 \times \frac{1.44}{18} = 0.16\text{g}$

Moles of C = 0.96 = 0.08

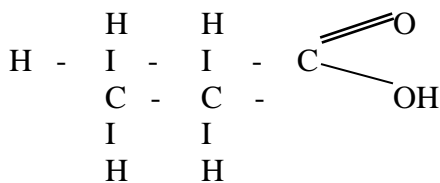
Moles of H = $\frac{0.16}{12} = 0.0133$

Ratio 0.08 : 0.0133
0.08 : 0.08
1 : 2
EF : CH₂
N : 4
MF = (CH₂)₄ = C₄ H₈

7. (a) SO₅²⁻
NH₄⁺
(Acc. Sulphate ions, ammonia ions)
- (b) From ammonia and sulphate based fertilizer
1. FeCl₂ oxidation No. of Fe increase from +2 to +3
Or oxidation No. of Cl₂ decreases from 0 to -1
 2. (a) – Rxn where the rates of forward and backward rxns are the same
(b) – The mixture becomes more yellow reasons: The equilibrium Position Shifts/ moves to the right since more OH⁻ ions have been added
 3. 16N
15P
 4. (a) In Diamond all the C- atoms are joined together by covalent in a three dimensions (3 -D) structure/ Tetrahedral structure thus very hard
(a) The C- atoms in graphite are bonded in layers/ hexagonal strata's, those thus slide over one another easily.
 5. Strong acid - one which is fully dissociated when in water e.g HCl, HI, HBr
Weak Acid: one which is partially dissociated when in water e.g. CH₃COOH
 6. (a) Because concentration of Cu²⁺ is high at the beginning and decreases as the ions are discharged during electrolysis
(b) Cu²⁺ (aq) + 2e = Cu(s)
 7. (a) Ethanol

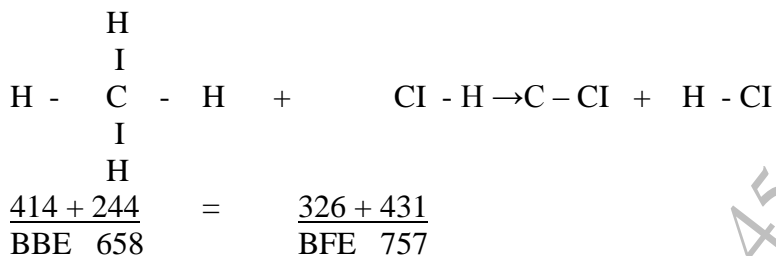


(b) Propanoic



(c) – Ethylpropanoate

8. (a) (i) - F
(ii) - I
(b)



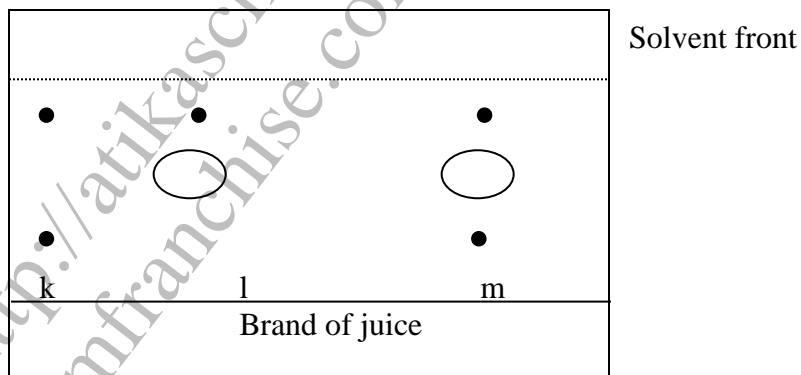
$\Delta\text{Hd} = \text{BBE} - \text{BFE} = 658 - 758 = -99\text{KJ}$

ALT2

$4(414) + 244 = 3(414) + 326 + 431$

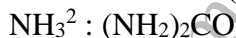
$\text{BBE } 1900 - 1999 = -99\text{KJ}$

10.



11. ALT 1

$\text{RMM of } (\text{NH}_2)_2\text{CO} = 28 - 4 + 16 = 60$



$2 \times 17\text{kg} \quad 60\text{kg}$

$680 \text{ kg} = \frac{60 \text{ kg} \times 680}{2 \times 17} = 1200\text{kg}$

ALT 2

Moles: $\frac{680000\text{g}}{17} = 40,000 \text{ moles}, 40,000 = 20,000 \text{ moles}$

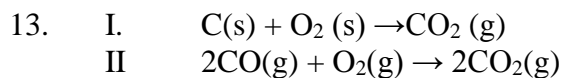
$\text{Mg} = n \times \text{R.F.M}$
 $20,000 \times 60$

1200000g

1200kg

12. **ALT 1**

- Add dilute HNO₃ to the carbonate
- Allow the rxn to go to completion
- Add excess dilute HCl to the mixture
- Filter



14. (a) Polystyrene or polyphenylethene

15. (a) Zinc/Zn

(b) Zn(NH₃)₄²⁺

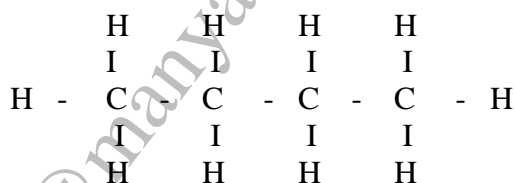
16. P₁ + P₂ Vol is constant
T₁
 $\frac{760}{273} = \frac{P_2}{373}$ P₂ = $\frac{760 \times 373}{273} = 1038 \pm \text{mmHg}$

17. Sting from a bee contains an acid which causes irritation NaHCO₃ being alkaline neutralizes the acid

18. R- Melting/ fusion
V- Boiling/ vaporization
W - Condensation/ liquefaction
U- Freezing/ solidification

19. IV, II, I, III

20. Butane



21. (i) The Ca⁺, Mg²⁺ ions in water are exchanged with Na⁺ ions in the permutit
(ii) By passing a solution of Conc. Sodium chloride through the Column
(iii) Provides Ca²⁺ required for teeth and bones formation
It coats lead pipes insides hence preventing lead poisoning

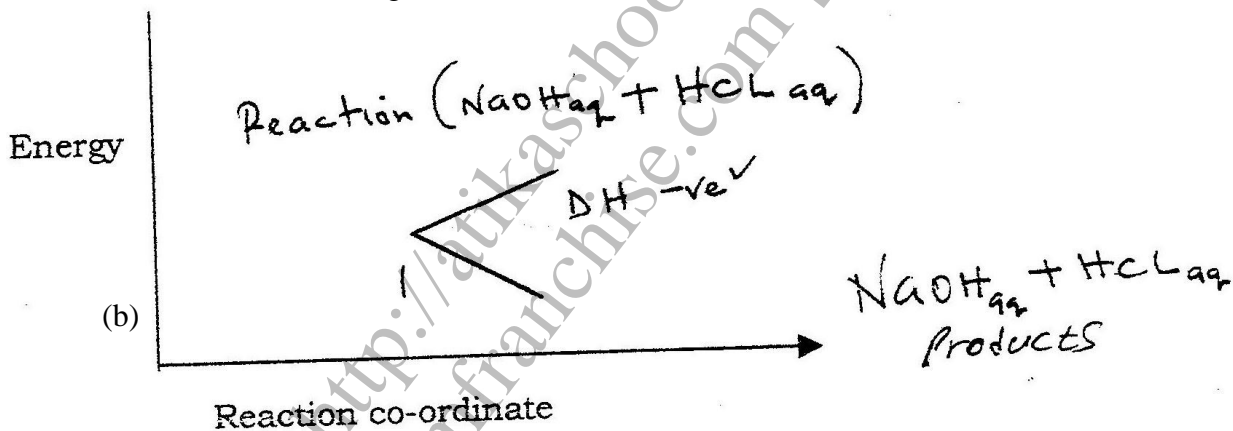
22. x + 4(-2) = -1
x - 8 = -1
x = 7

CHEMISTRY PAPER 233/ 2 K.C.S.E – 1998
MARKING SCHEME

1. (a) – To a sample of the ore add dilute sulphuric acid or hydrochloric acid (I) and warm (½)
- Filter the mixture (½)
 - To a portion of the filtrate, add sodium hydroxide or ammonium hydroxide drop wise until in excess (½)
 - Formation of the dirty green precipitate (½) OR
 - To a portion of the filtrate, add sodium hydroxide or ammonia hydroxide drop wise until in excess (I) formation of brown precipitate (½) shows presence of Fe^{3+} (½)
- (b) (i) Mass of oxygen = $13.30 - 12.66 = 0.64(g)$ (½)
 Mass of iron = $12.66 - 10.98 = 1.68 (g)$ (½)
 $\frac{1.68}{56} = 0.03$ $\frac{0.64}{16} = 0.04$
 Rate of moles Fe: O = 3:4 (½)
 Molecules formula = $Fe_3O_4(I)$
- (ii) $Fe_3O_4(S) + 4CO(s) \rightarrow 3Fe(s) + 4CO_2(g)$
- (c) (i) Oxygen (½), water (½)
 (ii) Galvanizing, painting, electroplating e.t.c
- (d) Seawater contains ions (I), which accelerate the rate of corrosion
2. (a) (i). Polymerization
 (ii) Substitution (I) (accept chlorination)
- (b) (i) distillation
 (ii) – Sodium metal disappears/ dissolves/ clarts around (½)
- Bubbles of a colourless gas/ effervescence (½) beaker become warm
 - Sodium metal reacts with ethanol to produce hydrogen gas (I)
 - The reaction is exothermic/ heat is evolved
- (iii) Fuel/gasoline
- Solvent
 - Starting material for manufacture of P.V.C, etheneglycol e.t.c
 - Skin disinfect/ antiseptic
 - In thermometer/ in making alcohol thermometers
- (c) (i) Name: Propane
 Structural formula
- (ii) Bromine water is decolourised (I) because is unsaturated (I) or has a double bond
- (iii) $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$
3. (a) (i) Fractional distillation
 (ii) Neutralization
- (b) - Electrolysis of brine

- (c) - High pressure brings the molecules closer/ increases the concentration of gas molecules (I) The pressure shifts the equilibrium to the right hence the yield of ammonia (product) increases.
- (d) $2\text{NH}_3(\text{g}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
- (e) Platinum or Rhodium
 Reagent
 Water ($\frac{1}{2}$), Oxygen ($\frac{1}{2}$)
- (f) Ammonium nitrate / NH_4NO_3
- (g) Fertilizer
4. (a) Remove oxygen (I) which could react with the element to form an oxide
 (b) absorb excess chloride
 - Absorb moisture from the atmosphere
 (c) Sodium chloride has a high melting point (I) and the burner flame
 Temperature is not able to vaporize sodium chloride
 (d) Calcium oxide OR quick lime/ CaO
 (e) $2\text{P}(\text{s}) + 3\text{Cl}_2(\text{g}) \rightarrow 2\text{PCl}_3(\text{g})$ $\text{P}_4 + 6\text{Cl}_2(\text{g}) \rightarrow 4\text{PCl}_3(\text{l})$
 (f) – Heat the mixture
 - Aluminium chloride sublimes
 - Cool to obtain aluminium chloride
 - Sodium chloride is left in the vessel.
5. (a) (i) - Scale (I)
 - Plotting all points correctly (I)
 - Curve (shape)
- (ii) $0.188 - 0.12 = 0.068 \text{ mol (I)}$
 Therefore mass of hydrated copper (II) sulphate
 $= 0.68 \times 250 = 17\text{g}$
- (b) (i) Moles of $\text{AgNO}_3 = \frac{0.1 \times 24.1}{1000} = 2.41 \times 10^{-3}$
- (ii) Moles of $\text{NaCl} = \text{Moles of AgNO}_3$
 $= 2.41 \times 10^{-3}$
- (iii) Moles of NaCl in $250\text{cm}^3 = \frac{2.41 \times 10^{-3} \times 250}{25}$
 $= 2.41 \times 10^{-2}$
- (iv) R.F.M $\text{NaCl} = 23 + 35.5 = 58.5$
 Mass of NaCl in $5\text{cm}^3 = 2.41 \times 10^{-2} \times 58.5$
 $= 1.41\text{g}$
- (v) Mass of water = $5.35 - 1.41$
 $= 3.94\text{g}$
- (vi) 3.94 of water contains 1.41g of NaCl
 100g of water = 1.41×100
 $\frac{3.94}{3.94} = 35.7$

6. (a) (i) To get uniform mixing of the reagents hence uniform distribution of heat
- (ii) $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$ OR
 $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
- (iii) I. Complete neutralization takes place
 II. Y_1 and Y_2 reactions is taking place producing heat
 Y_3 and Y_4 reaction has come to an end, the reaction mixture is cooling/loss of heat to environment
- (iv) I.
 $T = 30.9 - 24.5 = 6.4^\circ\text{C}$
 $H = 200 \times 6.4 \times 4.2 = 5376 \text{ joules}$
 II. moles of NaOH = $\frac{100 \times 1}{1000} = 0.1 \text{ moles}$
 $0.1 \text{ moles} = 5376 \text{ joules}$
 therefore $1 \text{ mole} = \frac{5376}{0.1 \times 1000}$
 $= 53.76 \text{ KJ mol}^{-1}$
- (v) Lower (I), ethanoic acid is partially ionized. Some energy is used to change the un ionized molecule into ions.



7. (a) (i) S and W
 (ii) T, U, V
- (b) (i) V(I) it is the only element whose boiling point is below 298K
 (ii) V
- (c) (i) $\text{T}(\text{NO}_3)_3$
 (ii) $2\text{S} + \text{U} \rightarrow \text{S}_2\text{U}$
- (d) Ionic (I) T. Is a metal while U is a non-metal ($\frac{1}{2}$). Therefore T loses electrons to U. T is electropositive while U electronegative. ($\frac{1}{2}$)
- (e) (i) Cathode
 Hydrogen (I)
 (ii) Anode
 Oxygen (I)