# FORM FOUR CLUSTER KCSE MODEL 6

# CHEMISTRY PAPER 1 ANSWERS

**1.**

(a) It is one which does not form lather easily with soap. √(1mk)

(b) $Ca(HCO_3)_{(aq)} \xrightarrow{heat} CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$ √(1mk)

OR $Mg(HCO_3)_{2(aq)} \xrightarrow{heat} MgCO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$ (1 mk)

(c) -It contains calcium necessary for strong bones and teeth. √(1mk)

OR –It does not react with lead pipes hence No lead poisoning. √

2.

(a) The volume of a fixed mass of a gas is directly proportional to the absolute temperature if pressure is kept constant. √(1mk)

(b)

$P_1 = P_2$

$V_1 = 22.4dm^3$

$T_1 = 273K$

$T_2 = 546\ K$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$P_1 = P_2$

$hence\ \frac{V_1}{T_1} = \frac{V_2}{T_2}$ (√½)

$\frac{22.4}{273} = \frac{V_2}{546}$ (√½)

$V_2 = \frac{22.4 \times 546}{273}$ (√½)

$= 44.8\,dm^3$ (√½)

(2)

3.

Effervescence occurs. √ (1mk)

$AlCl_3$ hydrolyses in water form an acidic solution $(H^+)$ that reacts with $Na_2CO_3$ to form $CO_{(g)}$ √(1mk)

$Na_2CO_{3(s)} + H^+(aq) \rightarrow 2Na^+(aq) + H_2O_{(l)} + CO_{2(g)}$ √(1mk)

4.

(a) The rate of diffusion of a gases is inversely proportional to the square root of its density if pressure and temperature are kept constant.

(b) $CH_4 = 12 + 4 = 16$ √½ $R_{CH_4} = 1$

$x = ?$

$\frac{R_1}{R_2} = \sqrt{\frac{RMM_2}{RMM_1}}$

$R_X = \frac{1}{1314} = \frac{1}{\left(\frac{7}{4}\right)} = \frac{4}{7}$ (√½)

$\frac{R_{CH_4}}{R\times} = \sqrt{\frac{x}{16}}$ √½

$\frac{1}{\left(\frac{4}{7}\right)} = \sqrt{\frac{x}{16}}$ (½)

$\frac{7}{4} = \frac{\sqrt{x}}{4}$

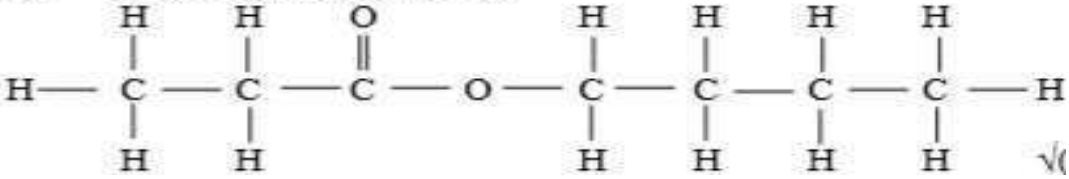
$\sqrt{x} = 7$

$x = 79$ √½ (2 mks)

5.

(a) Heptyne. √(1mk)

(b) Butylpropanoate. √(1mk)



6.

(a) (i) Nonmetals. √(½) Their ionic radius is larger than atomic radius.½

(ii) P. √½

Reactivity of nonmetals increase with decrease in atomic radius. √½

(b) Sodium. √½

Atomic radius decrease across the period √as the effective nuclear charge increases.½

7.

(a) Add water to each one of them in a test-tube separately √ and stir.

To 2ml of each solution add acidified $AgNO_3$ √ if a white precipitate forms them it is $NaCl$ √½

To 2ml of each solution add acidified $BaCl_2$ √½ solution or $Ba(NO_3)_2$ .If a white precipitate is formed, then it is $Na_2SO_4$ √½

(b) Add 2 drops of $Na_2SO_4$ *or* $Na_2CO_3$ to each one of them. √½

If a white precipitate is formed then it is $Ca(OH)_2$ ,with $NaOH$ a white ppt does NOT. √½

8.

(a) $4Fe_{(s)} + 3O_{2(g)} \rightarrow 2Fe_2O_{3(s)}$ √1

(b) The green solution turns yellow √ or red brown. √1
$H_2O_2$ oxidizes the green $Fe^{2+}$ ions to form the yellow $Fe^{3+}$ ions. √1

9.

Add water to the mixture. √½
Pour in a separating funnel. √½
Drain the lower layer (Ethanol) in a beaker. √½
Drain the upper layer (pentane) in a separate beaker. √½

10.

The orange solution turns green. √1
$H_2S$ is a reducing agent. √It reduces the orange $K_2Cr_2O_7$ into $Cr^{3+}$ ions which are green. √1

11.

(a) $2NaOH_{(aq)} + H_2A_{(aq)} \rightarrow Na_2A_{(aq)} + H_2O_{(l)}$ √
$25\ cm^3$ $18.7cm^3$
$1000cm^3 = 0.1$ moles of NaOH. √1
$25cm^3 = \frac{25 \times 0.1}{1000} = 0.0025\ moles\ of\ NaOH.$ √1

(b) Moles of $H_2A$ used = ½ *moles of NaOH*
$= ½ \times 0.0025 = 0.00125\ moles\ of\ H_2A$ √1
$18.7\ cm^3 = 0.00125$ moles of $H_2A$ ½

$1000cm^3 = \frac{1000 \times 0.00125}{18.7}$ √½=0.06684 moles hence 0.06684 √½ molar $H_2A$.

12.

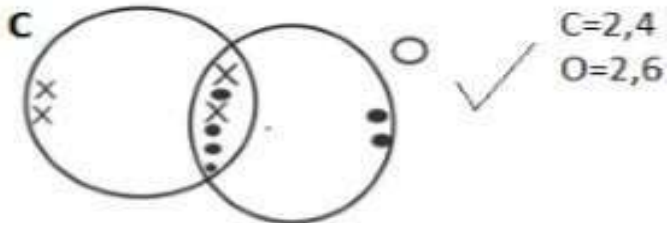
(a) They destroy the ozone layer √½ causing global warming. √½
(b) When subjected to high temperature it produces $SO_2$ that cause acid rain √1 which destroy buildings (roofs) and destroy plants. √1

13.

(a) (i) Dinitrogentetraoxide. √1
(ii) Oxygen. √1
(b) Thermal decomposition. √1

14.

(i) CO let x be an $e^-$ from c and • be an electron from O.




15.

(a) Solubility is the mass in grams of a substance which dissolves in 100g of water at a particular temperature. √1

(b) $\frac{70}{2} - \frac{38}{2} = 35 - 19 = 16g$ √1

16.

. A deliquescent substance absorbs water vapour from the atmosphere and dissolves in it to form a solution. √ 1

A hydroscopic substance absorbs water vapour from the atmosphere and becomes wet it does becomes wet it does not dissolve in it. √½ 1

17.

. (i) Q. √1
Its mpt is less than $25^0$ C but its Bpt is greater than $25^0$C. √1

(ii) P has Giant covalent structure (or Giant atomic) √½
R has Giant metallic structure. √½

(iii) R √1 because it has high Mpt and Bpt and conducts electricity in solid state. √1

18.

(i) It is denser than air. √1
It does not support burning. √1

(ii) Solid $CO_2$ does not leave any residue behind. √1
Normal ice leave water as a residue causing inconvenience. √1

19.

. (a) -An acid is a proton ($H^+$) donor. √1
-An acid is a substance which liberates $H^+$ ions $(or\ H_3O^+ ions)$ as the only positively charged ions in aqueous solution.

(b) A strong acid is one which ionizes completely in aqueous solution. √ 1concentrated acid is one in which the acid units exceeds the water molecules. √1

20.

Heat copper in air to form CuO. √½
Add the excess CuO to dilute $H_2SO_4$ in a beaker and stir. √½
Filter to remove the unreacted (excess) $H_2SO_4$ acid. √½
Heat the filtrate to saturate it √and cover with a paper with holes leave it cool slowly to form crystals. √½
Decant to get crystals and dry in the sun/between filter paper. √½

21.

Ethanol is polar hence soluble in water. √1
Ethanol is an organic compound hence soluble in organic solvents e.g. acetone etc. √1

22.

(a) Cation $Zn^{2+}$ √ or Zinc ions. √1
Anion $Cl^-$ √ or Chloride ions. √1

(b) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_{2(s)}$ √1

(c) $[Zn(NH_3)_4]^{2+}$ √

23.

(a) The black copper (II) oxide turns brown (red brown). √1

(b) $3Fe_{(s)} + 4H_2O_{(g)} \rightarrow Fe_3O_{4(s)} + 4H_{2(g)}$ √1

(c) $H_2$ is explosive when it burns in air. √1 (to avoid an explosion)

24.

(a) Addition polymerization. √1

(b)

(c)

$(8\times12)+(8\times1)_n = 20,800$ √½

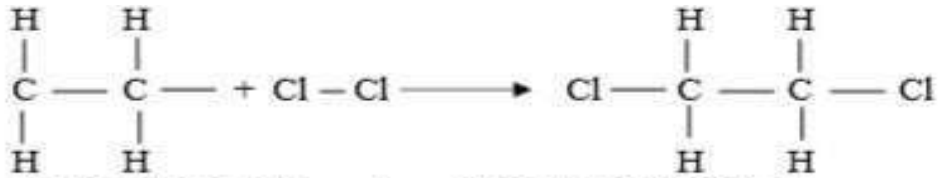
$(96+8)_n = 20800$

$104n = 20800$

$n = \frac{20,800}{104} = n = 200$ ½

25.

(a)



4(413)+612+242√½ | (413)4+348+2(338) √½
1,652+612+242 | 1,652+348+676
=2506 √½ | -2676. √½

$\Delta H = (2{,}506 + -2676)$ kJ√½
=-170kJ√½

(b) A fuel is a substance which burns in air to release heat energy. √1

26.

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)} \surd$$

6.25g | 50cm³
$CaCO_3$ 0.065 moles√ 1 | 0.1 mole √1
40+12+45
100g

Hence all the $CalCO_3$ is used up while HCl is excess
1 mole of $CaCo_3$ ≡ 24 litres of $CO_2$ (1 mole of $CO_2$)

$$0.0625 \text{ moles of } CaCO_3 = \frac{0.0625 \times 24}{1} \surd ½$$
$$= 1.5\,dm^3 \surd ½$$

27.

(a) (i) $\Delta H_1 = Molar\ heat\ of\ solution$ √1
(ii) $\Delta H_2 = Activation\ energy$. √1
(b) *Endothermic reaction*. √1