**FORM 4 EXAMINATION CHEMISTRY PAPER 233/1**

**PAPER 1**

**MARKING SCHEME**

1. (a) Calcium oxide//Quickline ✓ 1 Mark
   (b) Filtration//Fractional crystallization✓ 1
   (c) - In the extraction of sodium metal
   - Pickling
   - As a drying agent
   - Anti microbial agent
   - Anti cracking agent
   (Any to correct answers award 2 mark each)

2. Rate of diffusion of methane gas = $\frac{100cm^3}{40\ sec}$ = 2.5cmsec$^{-1}$ ✓ ½ mark

   Let rate of diffusion of ozone be $\frac{90}{t}$ = R

   Molar mass of $CH_4$ = 12 + 4 = 16 ½ mark

   Molar mass of $O_3$ = 16 x 3 = 48

   $\therefore \frac{Rmethane}{ROzone} = \frac{\sqrt{MMO_3}}{\sqrt{MMCH_4}}$

   $\frac{2.5}{R} = \frac{\sqrt{48}}{\sqrt{16}}$ ✓ ½ mark

   $\therefore R = \frac{2.5\ x\ \sqrt{16}}{\sqrt{48}}$ = 1.4434cm$^3$/sec ✓ ½ mark

   $\therefore \frac{90}{t}$ = 1.4434 ✓ ½ mark

   $\therefore$ t = $\frac{90}{1.4434}$

   = 62.3528sec ✓ ½ mark

3 (a) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

   Pressures of 200 atms

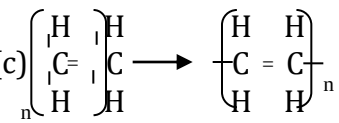
   Temperature of 450 °C to 500°C

   Finely divided iron (any two)

4(i) X – Bromo ethene ✓ 1 mark

   N – Ethyl hydrogen sulphate ✓ 1 mark

   (a) M – Bromine gas ✓ 1 mark

(c)  ✓ 1 mark

   Polyethene ✓ 1 mark

5(i) - P ✓1

   - It reacts with the carbonate faster ✓ ½ and the reaction ends earlier. ✓ ½

   (ii) The same quantities of reactants ✓ ½ have been used hence total volume of gas ✓ ½ evolved is the same.

6(i) Lowering the temperature ✓ ½

(ii) Increasing pressure ✓ ½

7(a) B 1mk - It looses 3 electrons and the remaining electrons are strongly held than before due to less repulsion. (1 Mark) total (2marks)

(b) C 1mark - It has the weakest nuclear charge among the non-metals given
(1 Mark) total 2marks

8(a) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ ✓1

(b) – Carbon (II) Oxide ✓1

(c) - Extraction of metals ✓1

9(i) To displace/drive out the air in the aspirator

(ii) A black solid (✓1 ); copper (II) oxide is formed // copper is oxidized to copper (II) oxide

10 No. of moles = m

$$= \frac{\text{R.f}}{\frac{15}{58.5}}$$

$$= 0.25641 \text{ moles}$$

Molarity $= \frac{0.25641}{0.12}$

$= 2.13675M$

11(a) Boyles law states that the volume $V_1$ of a fixed mass of a gas is inversely proportional to its pressure

$P_1$ when temperature is kept constant.

(b) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_{12}}$

$\frac{780\ X\ 400}{303} = \frac{600xV_2}{323}$

$\Rightarrow V_2 = \frac{323\ x\ 780\ x\ 400}{303\ x\ 600}$

$= 554.3234cm^3$

12 (a) Allotropy – existence of an element in more than one structural form in the same physical state.

(b) Rhombic/ ✓ 1mk
Monoclini// ✓ 1mk

(c) (i) Blue flame ✓ (1 mk)// pungent smell
(ii) Acidic ✓ (1 mk)//low pH

13. Ratio

| | M | | O |
|---|---|---|---|
| Moles | $\frac{0.254}{63.5}$ | | $\frac{0.64}{16}$ ✓ ½ |
| Ratio | 0.04 | : | 0.04 ✓ ½ |
| | 1 | : | 1 |

E.F = MO✓ 1

14 - Add water to Lead (II) nitrate to obtain Lead (II) nitrate solution. ½

- Add water to sodium carbonate to obtain sodium carbonate solution. ½
- Mix the solutions to ppt Lead (II) carbonate. ✓ 1
- Filter to obtain Lead (II) carbonate as a residue. ½
- Was the residue and dry between filter paper ½

15. Burette ✓ 1 has accuracy of 0.1 $cm^3$ ✓ 1

16. Add water to the solid mixture.

- V dissolves while W will not.
- Filter to obtain W as residue.
- Heat the filtrate to evaporate the water.

17) Bond breaking

= H - H + Cl - Cl

= 435 + 243

= +678 kJ $mol^{-1}$

Bond formation energy

= 2 × H - Cl

= 2 × 431

= -862 km $mol^{-1}$

Heat of reaction

= Bond breaking energy + Bond formation energy

= +678 + -862

= -184 kJ $mol^{-}$

18 (i) - Adding calcium ions to soil ✓

- Raise PH of soil/Neutralize soil ✓ 1

(ii) - liming

19 (a) X – 2.8.2

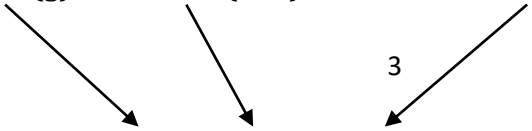
Y – 2.8.7

(b) Atomic radii of x is larger than that of y

(c) Alkaline earth metals

20) .

$4C(s) + 5H_2(g)$ ……$\Delta Hf(CH_4)$……$>C_4H_{10}(g)$



$4CO_2(g) + 5H_2O(l)$

$4(-393) + 5(-286) = \Delta Hf + (-2877)$
$\Delta Hf(CH_4) = 2877 - 1572 - 1430$
$= -125$ Kj/mol (3mks

21.(i) By putting a few drops of the liquid to anhydrous copper (II) sulphate, which would change from white to blue. Cobalt (II)chloride paper (anhydrous (II) chloride changes from blue to pink on adding the liquid. (2 mks)

(ii) By determining its boiling point, has b.p of $100^0$ at sea level/determining freezing point which is $0^0$ at sea Level / determining its density which is $1g/cm^3$. (1 mk)

22.(a) It has a low boiling point (it is volatile)

(b) Sodium nitrate (1 mark)

(c) Manufacture of fertilizer(1mark)

23. (i) X – Hydrogen bond

Y – Covalent bond

(ii) Water contain hydrogen bonds holding the molecules together which are stronger than van der waals forces whereas CH4
has only van der waals forces holding molecules together.

24.(i) In diamond all carbon atoms are joined together by covalent bonds in three dimensional structure//or

tetrahedral structure thus very hard.

(ii) The carbon atoms are bonded in layers/or hexagonal layers which are held by weak forces of
attraction// or Van der waal's forces these layers slide over one another easily.

25. (i) NO (1) Mark

- The gas is <u>less dense</u> (✓ ½ Mark) hence can't be collected by <u>downward</u> delivery.(1/2mk)

(ii) Concentrated sulphuric (VI) acid (✓ ½ Mark) Reject if "concentrated" is missing

(iii) – It's colourless ✓
- Odourless ✓
- Less dense than air ✓
*Any two for ( ½ mark) each*

26 $\frac{(92.2\ x\ 2.8)+(4.7\ x\ 29)+(3.2\ x\ 30)}{100}$ ✓ 1

$= \frac{2581.6+136.3+93.0}{100}$ ✓1

27(a) Hydrogen ✓ 1

(b) They increase the surface area over which the gas dissolves in water.

(c) Give one use of hydrochloric acid

- Treatment of water at the water works.
- Sewage treatment
- Manufacture of dyes, drugs etc
- To clean metal surfaces to remove rust

28 Place the mixture on a piece of paper and put a magnet ✓1above the mixture to attract iron filings

Heat the remaining part of the mixture for $Al_2Cl_3$ ✓1to sublime and collect sublimate.

Calcium chloride will remain at the bottom of the tube.✓1

29.A✓1-does not form scum with hard water.✓1