**Chemistry Paper 1 SET 4**

**MARKING SCHEME**

1. **You are provided with water, lead carbonate, dilute nitric (V) acid and solid sodium chloride. Describe in very clear steps how you would prepare a sample of lead chloride.**

**(3 marks)**

* Add excess PbCO3 to dil HNO3,filter the excess PbCO3
* DissolveNaCl in water
* Add Nacl(aq) to filtrate pb(NO3)2
* Filter the ppt

1. **(i) Using ‘dots’ and crosses to represent electrons, draw the electron diagram for**

**ammonia molecule, NH3. (N = 7, H = 1) (1 marks)**

**(ii) Explain the following observations; oxygen and sulphur are in the same group of the**

**periodic table. The hydride of oxygen is liquid at rtp while that of sulphur is gaseous**

**at rtp. (2 marks)**

Both have covalent bond and weak van der waals forces but H2O has hydrogen bonds which are stronger to break.

1. **Phosphorus is in group V of the periodic table. Explain the following observations.**
2. **Phosphorus exhibits two melting points. (1 mark)**

Phosphorous has two allotropes

1. **The chloride of phosphorus forms musty fumes in damp air. (2 marks)**

Phosphorous hydrolyses to form HCl(g)

1. **Steam was passed over iron in a combustion tube as shown below. Study the diagram and answer the questions that follow.**

**Iron**

**Steam**

1. **What must be included in the diagram for Iron to react with steam?(1 mark)**

Heat

1. **Write an equation for the reaction that takes place when the correction in (i) above is made. (1 mark)**

3Fe(s) + 4H2O(g) Fe3O4(s) + 4H2(g)

1. **State and explain the precaution to be observed when carrying out the above experiment. (1 mark)**

H2 produced should be ignited to avoid explosion.

1. **A gas jar of chlorine and air were inverted over a trough containing sodium hydroxide as shown below.**

**Air chlorine**

**NaOH(aq)**

1. **(b)**
2. **In which case was there a larger change in volume of the gas jar? Explain.**

**(2 marks)**

In jar (b) chlorine gas dissolves in NaOH hence the great change.

1. **State any one important use of chlorine gas. (1 mark)**

* Treatment of water
* Manufacture of HCl et.

1. **(i) Nitric (V) acid prepared in the laboratory is yellow in colour. What causes the**

**yellow colour? (1 mark)**

Contains dissolved NO2 gas

**(ii) State any two observations that would be made when concentrated nitric (V) acid is**

**added to copper turnings. (2 marks)**

* A blue solution is formed
* A brown gas evolved

1. **(i) Give two reasons why laboratory apparatus are made of glass. (2 marks)**

* Do not react with most chemicals
* Transparent hence reactions visible
* Easy to clean (any 2)

**(ii) Name the apparatus drawn below. (1 mark)**

Thistle funnel.

1. **An organic compound contains carbon and hydrogen only. When this compound was completely burnt in excess air, it gave 9.6g of carbon (IV) Oxide and 4.9g of water vapour. The molecular mass of the hydrocarbon is 58. Determine the molecular formula. (C = 12, O = 16, H = 1) (3 marks)**

C = x 9.6 = 2.6182 C H EF = C4H10

2.6182 0.5444 (C4H10) = 58

H = x 4.9 = 0.5444 12 1

0.2182 0.5444 58n = 58

0.2182 0.2182 n = 1

1 9.98 M.F = C4H10

10

1. **An equilibrium was established between lead chloride and its ions as shown below.**

**White colourless**

1. **State and explain the observation made on the equilibrium when the mixture is heated. (2 marks)**

The mixture forms a colourless solution, Pbcl2 dissolves on warming.

1. **What happens to the position of the equilibrium if a few drops of hydrochloric acid are added tot eh equilibrium mixture. (1 mark)**

Equilibrium shift to the left due to introduction of Cl-

1. **(i) State any two observations made when calcium is placed in a trough of water?**

**(2 marks)**

* Bubbles of a colourless gas
* Sinks to the bottom of the jar.

**(ii) State any one important use of the solution formed in (i) above. (1 mark)**

Testing CO2 in the lab.

1. **The curves below were obtained when equal volumes of HCl acid of same concentration were reacted with 25.0g of Mabel chips. In one case, the acid was first warmed to a high temperature.**

**Quantity of Y**

**II I**

**Time ( min)**

1. **Which curve represents the reaction involving warm hydrochloric acid?(1 mark)**

Curve II

1. **Suppose a graph of time against volume of CO2 produced was plotted, draw on the same axes a sketch to show the graphs of the reaction above. (2 marks)**
2. **Given the following electrode potentials,**

**Eθ (V)**

**A+­(aq) + e- A(s) +0.76**

**B2+(aq) + 2e- B(s) -0.48**

**½ Q2(g) + 2e- Q2-(aq) +1.62**

1. **Determine the maximum emf that can be obtained by combining two of the given half cells. (1 mark)**

+1.62 - -0.48 = +2.1V

1. **Write the cell representation for the cell in (a) above. (1 mark)**

B(s) / // ½ Q2(g) /Q2-(aq)

1. **What would be the electrode potential of A if B was made the standard electrode. (1 mark)**

0.76 - -0.48 = +1.24V

1. **Study the flow chart below and answer the questions the follow.**

**Calcium hydroxide solution**

**CO2 (g)**

**White precipitate**

**CO2**

**Solution B**

**Heat**

**White residue + water + gas C**

**Name:**

1. **White precipitate A** calcium carbonate **(1 mark)**
2. **Solution B**  calcium hydrogen carbonate **(1 mark)**
3. **Gas C** carbon (IV) oxide **(1 mark)**
4. **Equal volumes of ammonia gas and hydrogen chloride gas were introduced into opposite ends of a tube. Explain what happened. (2 marks)**

Formation of a white ring of ammonium chloride near the hydrogen chloride and

NH3(g) + HCl(s) NH4Cl(s)

1. **A gas occupies 4 litres at 250K and 152mmHg pressure. At what pressure will its volume be halved, if the temperature then is 2270C? (3 marks)**

|  |  |  |
| --- | --- | --- |
| P1 = 152 mmHg  V1 = 4 litre  T1 = 250k | P2 = ?  T2 = 227 + 273 = 500k  V2 = 2 litres | P2 =  =  = 608 mmHg |

1. **Study the scheme below and answer the questions that follow.**

Dark viscous liquid

Amber liquid

Solid sulphur

Step I Step 2

1130C 1600C – 2500C

Step 3

4000C

Sulphur vapour

Mobile liquid

Step 4

4440C

**Explain the observations made in:**

1. **Step 1 (1 mark)**

Inter molecular forces of attraction holding sulphur eight rings are broken, sulphur melts into liquid sulphur.

1. **Step 2 (1 mark)**

Covalent bonds in the sulphur eight rings break leading to the formation of long chains of atoms. The chains entangle causing the liquid to become viscom and dark.

1. **Step 3 (1 mark)**

More of the covalent bonds break resulting into smaller molecules which are less entangles. The liquid become less viscous and thus mobile.

1. **Study the set-up below and answer the questions that follow.**

**Copper turnings**

**Gas X**

**Nitrogen( I) oxide Heat**

1. **Identify gas x. (1 mark)**

Nitrogen gas

1. **State the observations made in the combustion tube. (1 mark)**

Brown copper turnings turn to black copper (II) oxide

1. **Write an equation for the reaction in the combustion tube. (1 mark)**

N2O(g)  + Cu(s) CuO(s) + N2 (g)

1. **30cm3 of 0.06M sodium hydroxide reacted with 25cm3 of a dibasic acid HOOC(CH2)xCOOH containing 4 g/litre. Calculate the value of x. (3 marks)**

|  |  |
| --- | --- |
| 2NaoH(aq) + H2x(aq) NaX(aq) + H2O(l)  0.06 moles = 1000cm3  x = 3 cm3  x = 0.0018 moles  Ra 1 :2  Mole of acid =  = 0.009 moles  0.009 moles = 25 cm3  x moles = 1000cm3  x moles = 0.036 m | Mass of H2X = = 111.11g  Value of X  HOOC (CH2)x COOH = 111.11g  14x + 90 = 111.11g  14x = 21.11  X = 1.508  X 2 |

1. **Study the diagram below and answer the questions that follow.**

Ca (OH)2

CaC2 + X

**Step 1**

**1 mole HCl**

Gas Y

Z

**Step 2**

H H

| |

C — C |

H H 2

**1 mole H2**

**Step 3**

CH3CH3

C2H4

**2000C, High pressure H2 1500C**

**Step 5 Step 4**

1. **Identify reagent X. (1 mark)**

Water

1. **Draw the structural formula of gas Y. (1 mark)**

H – C C – H

1. **What name is given to the process that takes place in step 5? (1 mark)**

Polymerisation

1. **(a) Using equation(s) suggestion a way in which might change into**

**(1 mark)**

Hg + + ie or

Hg + Au +

**(b) The half-life of in milk was found to be 6 days. On 1st of March before boiling and freezing the mixture, the iodine in the milk had an activity of 1000 counts per second. On what date would you expect the activity to have reduced to 125 count per minute?**

**(2 marks)**

1000 5000 250 125 cpm

6 x 4 = 24 days = 25th March

1. **A student place a thermometer in molten napthalein at 900c, recorded the temperature and time until it solidified. Using the readings, the cooling curve below was obtained.**

**90**

**Temp(0C)**

**80 B C**

**70 D**

**Time(min)**

1. **What does parts B, C ad D-C signify? (2 marks)**

**B-C** freezing

**C-D** solid Napthalein cooling

1. **Sketch on the same axis a curve that would be produced if common slat was added to Naphthalene. (1 mark)**
2. **The diagram below represents paper chromatogram of three sugars K, L and M. study it and answer the questions that follow.**

**·**

**·**

**·**

X x x x

K L M Mixture

1. **On the diagram, indicate the position of baseline. ( ½ mark)**
2. **Show on the same chromatogram the plotting representing a mixture of the three sugars. (1 mark)**
3. **Other than separating colours, sate one other use of chromatography. (1 mark)**

Detecting drugs in sportsmen / women (urinalysis)

1. **State one major factor that chromatography relies on to achieve separation.**

**( ½ mark)**

Solubility (major – reject other factors)

1. **Study the flow chart below and answer the questions that follow.**

Colouress oduorless gas S

White solid R

**Dil HNO 3(aq)**

**Step I**

**H2SO4 (aq)**

White ppt T

Colourless solution

**Step II**

**Step II NaCl (aq)**

White ppt

1. **Identify solid R. ( 1 mark)**

Lead (II) carbonate / PbCO3

1. **Write a balanced equation for step II and ionic equation for step III.**

**Step II** Pb(NO3)3(g) + H2 SO4 (aq) PbSO4 (s) + 2HNO3(aq) **(1 mark)**

**Step III** Pb2+(aq) + 2 Cl-(aq) PbCl2 (s)**. (1 mark)**

1. **In one of the dry practicals assignment to analyze cation a salt, the following observations were made:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test** | **Observation** | **Inference** |
| **(i)** | **NaOH dropwise till in excess** | **White ppt formed soluble in excess** | Al3+; Zn2+, Pb2+ |
| **(ii)** | **NH3 solution dropwise till in excess.** | White ppt formed soluble in excess | **Presence of Zn2+ions confirmed.** |

1. **Fill in the blanks in the table above. (2 marks)**
2. **Give an ionic equation for the reaction that occurs in test (ii) when excess NH3 solution is added. (1 mark)**

Zu (OH)2 (s) + 4NH3 (g) [Zu (NH3)4] 2+(aq) + 2OH-(aq)

1. **(a) State three roles of chemistry in our society today. (1 ½ marks)**

* Fertilizers development in Agriculture
* Research in medicine
* Careers in chemistry e.g. Doctors, Chemists etc.

**(b) State key words in the definition of chemistry as a branch of science. (1 ½ marks)**

* Composition
* Structure
* Property / how they behave

1. **(i) Distinguish between a weak acid and a strong acid giving an example of each.**

**(2 marks)**

Weak acid – That which dissolves in water ionizing partially – ethanoic acid or any organic acid while strong acid is that which ionizes fully in water e.g. H2SO4, HCl, HNO3

**(ii) Identify an acid in the forward reaction given by the equation below: (1 mark)**

**(1 mark)**

H2O

**27 (a) Metals are said to be Ductile Malleable and corrosive in air. Explain the meaning of**

**underlined words.**

1. **Malleable (1 mark)**

Can be drawn into wires

1. **Corrosive in air (1 mark)**

Reacts with O­2 to form an oxide

**(b) Give the names and formula of one ore used in production of Iron. (1 mark)**

Iron pyrite FeS2

Siderite FeCO3

Magnetic Fe3O4