***FORM 4 chemistryP2 MARKING SCHEME***

1. (a) Define an electrolyte. **(1mark)**

*An electrolyte is a substance which when molten or dissolved in water conducts an electric current and gets decomposed by the current.*🗸1

b II) Mobile ions in molten form

 Penalise free ions

 iii) A anode ½

 B Cathode ½

**iii heat**

**iv solid lead iodide melts/contains molten ions**

**v purple vapour**

**vi 2I I2 (g) +2e-**

 **Pb2+ + 2e Pb (s)**

**Total =10mks**

 2. a) Draw the structural formula of: **(3 marks)**

1. 2,3-dimethylpentane
2. C

 C-C-C-C-C

 C

1. Pent-2-yne

H HH

H C CCCC H ***🗸1***

H HH

1. 2,3-dimethylbutane

HH CH3H

 (iii)H-C-C-C-C-H***🗸1***

 H CH3H H

(b)Study the reaction scheme below and answer the questions that follow.

Glucose

Step I

Ethanol

Conc.H2SO4

H2 (g)/Nickel

**J**

Step II

Acidified KMnO4

 Step III

Ethene

 **K**

1. Name the process in step I **(1 mark)**

 ***Fermentation🗸1***

1. Give the two conditions necessary in step II **(2 marks)**

***Excess concentrated sulphuric (VI) acid🗸1***

***Temperature: 160oC-180oC🗸1 (any value in range)***

1. State the observation made in step III. **(1 mark)**

***Colour of acidified potassium manganate (VII) changes from purple to colourless🗸1***

1. Name compound J. **(1 mark)**

 ***Ethane🗸1***

1. Draw the structural formula of compound K. **(1 mark)**

 H H

 H C C H ***🗸1***

 OH OH

(c) Water is added dropwise to calcium carbide in a conical flask.

 (i)Identify the gas produced. **(1 mark)**

***Ethyne***🗸1

(ii)Write a chemical equation for the reaction that occurs. **(1 mark)**

 **CaC2(s) +2H2O (l) Ca (OH) 2(aq) + C2H2 (g)**🗸1

 (d)Part of a polymer is required below.

 H HHH

 C C CC

 H CH3H CH3

1. Draw the structural formula of the monomer of this polymer.  **(1 mark)**

 H H

 C C🗸1

 H CH3

1. State one use of this polymer. **(1 mark)**

 To make;

 ***Plastic crates and boxes, carpets and plastic bottles. (Any one =****🗸1)*

TOTAL= 13 MARKS

3. The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbols of the elements.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| Y | R |  |  |  |  | Q | X |  |
|  | V |  | W |  |  | **J**🗸1 |  | U |
|  |  |  |  |  |  |  |  |  |

 (a)Select an element whose oxide is amphoteric.**(1 mark)**

 **W**🗸1

(b)On the grid indicate with letter J the position of element J which is in period 3 and forms a stable ion J2**-. (1 mark)**

 **(See diagram)**

(c)Draw a dot-cross diagram to show bonding in the compound consisting of elements V and X only. **(2 marks)**

 **+**

**-**

2++++++++++++

 2

🗸2

(d)Write an equation to show the formation of an ion by R. **(1 mark)**

 **R R2+ +2e-**🗸1

 (e)Which is the least reactive element? Give a reason for your answer. **(2 marks)**

 **U**🗸1;

***It*** *has a completely filled outermost energy level🗸1 therefore neither gains nor*

*loseselectrons//OR has stable electron arrangement.*

 (f)Write an equation for the reaction that occurs when element Y is placed in water.

**(1 mark)**

***2Y(s) + 2H2O (l) 2YOH (aq) + H2 (g)****🗸1*

(g)How does the atomic radius of W compare with that of V? Explain. **(2 marks)**

 **Atomic radius of W is smaller than that of V.** *🗸1This is because nuclear charge attraction in W is stronger than in V* ***🗸 ½while both have same number of occupied energy levels🗸 ½***

(h)Name the chemical family to which elements R and V belong. **(1 mark)**

***Alkaline earth metals****🗸1*

 ***TOTAL= 11MARKS***

4. a) Use the chart below to answer the questions that follow.

 **Iron**

**Gas N**

**Solid P**

**Lead (II) oxide /heat**

**Solid M**

**Liquid L**

**Steam**

**+**

**+**

Identify:

Gas **N** ***Hydrogen //H2***(g) *🗸***½**  **(½ mark)**

Solid **P*Tri-iron tetraoxide //*** ***Fe3O4***(s)*🗸***½**  **(½ mark)**

Solid **M*Lead*** // ***Pb***(s)*🗸***½** **(½ mark)**

Liquid **L*Water //H2O*** *🗸***½** **(½ mark)**

b) Name the method that can be used to extract oil from castor oil seeds. **(1 mark)**

***Solvent extraction****🗸1*

c) i) In the method named above, state the property of oil that enables the extraction to take place. **(1 mark**)

***Oil dissolves in an organic solvent****🗸1*

ii) Describe an experimental procedure that can be used to obtain oil from the seeds.**(3 marks)**

***Crush****🗸***½*the seeds in a mortar using a pestle****🗸***½.*Continue crushing and addpropanone a little at a time****🗸***½*.Decant*** *🗸***½the mixture into an evaporating dish. Leave the mixture of oil and propanone in the sunlight for propanone to evaporate leaving the oil behind***🗸***1**

d) How is phosphorus stored in the laboratory? Explain your answer. **(1 mark)**

***Under water****🗸****½ it smoulders when left in the air.****🗸****½***

e) i) In the fractional distillation of liquid air some substances must be removed, name two substances removed. **(1 mark)**

 ***Dust particles, Carbon (IV) oxide, water vapor (*any two*=****🗸***1)**

ii) Why must the substances named in (i) above be removed? **(1 mark)**

***To prevent blocking the pipes in the rest of the system****🗸***1**

iii) State the processes involved in fractional distillation of liquid air. **(2 marks)**

 Removal of dust particles by passing through filters or by electrostatic pptn*🗸****½,removal of carbon (IV)oxide by passing the remaining gases through conc.sodium hydroxide****🗸****½,cooling the remaining part of air to -25oC to remove water vapour,repeated compression and expansion to cool the air to liquid at -200oC****🗸****½,boiling the liquid mixture in a fractionating column to obtain the fractions.****🗸****½***

***TOTAL =12 MARKS***

5. Study the flow chart below showing the Solvay process and use it to answer the questions that follow.

Brine

Ammonia absorber

Limestone

CO2(g)

Carbonator

Heat

NH4Cl (aq)

CaO(s)

Process Y

NaHCO3(S)

X

NH3 recovery/heat

Slaker

Process T

Ca(OH)2

Na2CO3(s)

a) Write the equation for the reaction producing substance X.**(1 mark)**

heat

***NH4Cl(aq) + Ca(OH)2 (aq) CaCl2(s) + 2NH3(g) + 2H2O(g)/(l)****🗸***1**

b) Name processes Y and T. **(1 mark)**

 **Y *Filtration****🗸****½***

 **T *Heating/Thermal decomposition****🗸****½***

 c) In the carbonator, two reactions take place. Write the two equations for the reactions. **(2 marks)**

***NH3(g) + CO2(g) + H2O(l) NH4HCO3 (s)****🗸****1***

 ***NH4HCO3(s) + NaCl(aq) NH4Cl(aq) + NaHCO3(s)****🗸****1***

d) Explain why the Solvay process is said to be one of the most efficient industrial process. **(1 mark)**

 ***Ammonia and carbon (IV) oxide are recycled****🗸****½ thus minimizing cost****🗸****½***

 e) 16.8g of sodium hydrogen carbonate are completely decomposed by heating. Calculate;

heat

***2NaHCO3(s) Na2CO3(s) + CO2 (g) +H2O (l)****🗸****1***

 168g of NaHCO3 yield106 g of Na2CO3

 16.8 g would yield (16.8/168) ×106*🗸****½***=10.6 g of Na2CO3*🗸****½***

 ii) the volume in litres of the gas produced at s.t.p **(2 marks)** (Molar Gas Volume at s.t.p =22400 cm3, Na=23.0, C=12.0, H= 1.0, O=16.0)

1mole of CO2 at s.t.poccupies 22.4 litres

 168g of NaHCO3 evolve 22.4 litres of the gas*🗸****½***

 16.8 g of NaHCO3  would evolve (16.8/168) ×22.4*🗸****½***=2.24 litres*🗸****½***

 f) Give two industrial uses of sodium carbonate. **(2 marks)**

Softening of hard water*🗸****1***

 Manufacture of glass*🗸****1***

***TOTAL = 11 MARKS***

6 solubility increases with increase in temperature

a)solvent molecules move further apart creating more space between molecules

b i) Scale 1mk

 ii) plot ½

 curve1/2

 plot2 ½

 curve2 ½

iii) i correct from graph

 ii correct from graph

 iii correct from graph

iv) solubility of K2SO4 from graph

mass in 100cm3 = (c.v \* 1000)/100 1/2

 = ANS 1/2MK

Molar mass 174

 Ans above /174 1/2

 =ans 1/2mk

 filter crystals of K2SO4 1/2 and dry between filter papers1/2

v) 40c

vi) add 80g of KNO3 in 100g of water

 heat to about 90c then cool to 80c

***TOTAL =14 MARKS***

7.a)wood charcoal is

 Bulk

 Has low heating value

 Its incomplete combustion produce poisonous gases

b)water accepts a proton in the forward reaction

ii) Strong acid one that dissociates fully in water to give hygrogen ions

 weak acid one that dissociates in water partially to give few hydrogen ions

 c) i) Point of complete neutralisation 1

 ii) Heat was produced during neutralisation hence increase in temperature 1

 iii) When methanoic acid is used, there would be a lower 1 temperature rise since some heat is absorbed½ to completely ionise methanoic acid½ before neutralisation occurs.

**TOTAL 9 MARKS**