**CHEMESTRY**

**FORM FOUR**

**233/2**

**END OF TERM II 2022**



**CEKENAS END OF TERM TWO EXAM-2022**

***Kenya Certificate of Secondary Education. (K.C.S.E)***

**MAKING SCHEME**

1. (a) Study the table below and answer the questions that follows. The symbols are not the actual symbols of the elements

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element | A | B | C | D | E | F |
| Electronic configuration of the ion | 2.8 | 2.8.8 | 2.8 | 2.8.8.8 | 2.8 | 2.8.8 |
| Valency and type of ion | Divalent cation | Divalent anion | Monovalent cation | Monovalent anion | Trivalentcation | Trivalentanion |

1. Arrange the elements A,B,C,D,E and F in terms of increasing atomic sizes (1mk)
* **D, B,F,E,A,C**
1. Name the period of the periodic table to which these elements belongs? (1mk)
* **Period 3**
1. Write an equation for the reaction between elements C and D (1mk)
* **2C(s) + D2(g) 2CD (aq)**
1. Compare the electrical conductivity of elements A and E. Explain (2mks)
* **E is better conductor than A. E has 3 delocalized electrons per atom compared to A which has one delocalized electron per atom**
1. Compare the first ionization energies of elements A and C. Explain (2mks)
* **A has lower first ionization energy than C A has a bigger/ lager atomic radius than C**
1. **vi)** Which element sit re strongest oxidizing agent (1mk)

 **Element D**

b.) Study the information below and answer the question that follow

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Formula of oxide | NaCL | MgCl2 | AlCl3 | SiCl4 | PCl3 | SCl2 |
| Melting point oC | 801 | 714 |  \_ | -70 | -91 | -80 |
| Formula of oxide | Na2O | MgO | AlO3 | SiO2 | P4O10 | SO2 |
| Melting point oC | 1190 | 3080 | 2050 | 1730 | 560 | -73 |

1. Aluminum chloride(AlCl3 ) has an unexpected body type and structure
2. State the type of bonding and the structure in AlCl3 (1mk)
* **Covalent, simple molecule structure**
1. What type of bonding would AlCl3 be expected to have? Give a reason (1mk)
* **Ionic bond, compound of a metal and a non-metal**
1. What is melting point of AlCl3 not indicted in the table above (1mk)
* **Sublimes when heated**
1. Silicon (iv) chloride get hydrolysed by water. Write a balanced equation for this reaction(1mk)
* SiCl4 (l) + 4H2 O (l) SiO2 (s) + 4HCl (aq)

2.) The following chart is an illustration of the extraction of aluminum from its ores

Residue S

Process T

 Grinders

Bauxite

Filtration containing Al(OH)4 (aq) /SiO@

Aluminum hydroxide

Aluminum oxide

Molten Aluminum Oxide

Gas

Molten

Process V

1. Give the formula of bauxite (1mk)
* **Al2 O3 . 2H2 O**

 ii.) Name the two impurities in bauxite

* **Iron (III) oxide**
* **Silicon (iv) oxide**

 iii.) Write the chemical equation for the reaction taking place during process cost – effective (1mk)

 **Al (OH) -4 (aq)  Al(OH)3 Al(OH)3 (s) + OH- (aq)**

 **OR**

**[Al (OH)4 ]- (aq) + CO2 (g)**2Al(OH)3 + CO32- (aq) + H2O (l)

(iv) The melting point of aluminum oxide is quite high. Explain what isdone to make the process (1mk)

* **Adding cryolite (Na3 ALF6** ) which lowers the melting point of aluminium, oxide from **2015 to 800o C**

**(v)** Name residue S

 **Residue S – Iron (III) Oxide**

 **Gas R – Oxygen**

(vi) Write down the half equations for the reaction at the

 **I, Anode : 6O 2- (l) 3O2 (g) + 12e-**

 **II,Cathode : 4Al 3+ (l) + 12e- 4Al (s)**

(vii) In the electrolysis stage the graphite electrode used at the anode is periodically replaced anode at regular intervals (1mk)

* **The oxygen evolved at the anode reacts carbon electrode to form carbon (iv) oxide. This corrodeS the carbon anode hence the need to replace from time to time**

(viii) Give two properties that makes aluminum and alloys suitable for making aircraft bodies (2mks)

* **Lighter**
* **Stronger**
* **More resistant to corrosion**
* **Higher tensile strength**

(3a.) A form four students carried out an experiment to extract oil from sim sim seeds. (1mk)

i.) Name two apparatus he used to crush the simsim seeds (1mk)

* **Mortar and pestle**

ii.) Name suitable solvent used (1mk)

* **Propanone**

iii.) Name the class or organ compounds in which vegetable oil belongs to (1mk)

* **Esters**

(iv) Describe the process of preparing soapy detergents using vegetable oil (3mks)

* **Place vegetable oil in a beaker**
* **Add NaoH to the oil and stir**
* **Boil the mixture while stirring**
* **Add Nacl/sodium chloride solution to the mixture to precipitate soap**
* **Filter the mixture to obtain soap as residue**

b.) Study the flow chaert below and answer the question that follow

1. State the conditions for the reaction in step 1 to occur (1mk)
* **400 o C – 700 o C, Nickel catalyst**
1. Identify substance H (1mk)
* **Ethane**
1. Give one disadvantage of the continued use of substances such as J (1mk)
* **Non – biodegradable hence pollutes the environment**
1. The relative molecular mass of J is 16800. Calculate the number of monomers that make up J (2mks)
* $\frac{16800}{28}$ **= 600**

4. Study the standard electrode potentials of the half – cells given below and answer the questions that follow. The letters do not represent the actual symbols of the elements)

 EƟ Volts

 N+ (aq) + e-  N (s) - 2.92

 J+ (aq) + e- J (S)+ 0.52 K+ (aq) + e- ½ K(S) 0.00

G+ (aq) + e-  G2(S) + 0.30

M2+ (aq) + e- M (S) + 0.44

1. Identify the strongest oxidizing agent. Give a reason for your answer (2mks)
* **G+ has the highest positive electrode potential/Greatest tendency to gain electrons**
1. Which two half- cells would produce the highest potential difference when combined (1mk)
* **N+ (aq)**+ e - N (s) , G+(aq) + e - G(s)
1. Draw an electron cell for the above. Show on the diagram flow of electrons (3mks)



1. Write three cell notation representation for the above cell (1mk)
* N (s)/ **N+ (aq)//** G + (aq)/ G(s)
1. Calculate the e.m.f of the cell above (1mk)
* **EƟ = 0.8- -2.92 = + 3.72V**
1. Give two functions of the salt bridge (2mks)
* **Complete the circuit by making contact between the electrolytes**
* **Maintain balance o charges / ions on both half cells**

 (vii) Determine the oxidation number of the halogens in 104 -  (1mk)

* **x + -8 = -1**

**x = +7**

1. Give on use f electrolysis (1mk)
* **Electroplating**
* **Extraction of reactive metals**
* **Manufacture of pure substance**
* **Purification of metals**

5. The table below shows the observations made when aqueous ammonia and sodium hydroxide solutions were added to cations of A,B,C and D

|  |  |  |
| --- | --- | --- |
| Cation of | Sodium hydroxide in excess | Ammonia solution in excess |
| A | White precipitate | Blue precipitate dissolved to form a deep blue solution |
| B | White precipitate dissolve to form a colorless solution | White precipitate dissolve to form a colourless solutuion |
| C | White precipitate dissolved to form a colourless solution | White precipitate |
| D |  |  |

1. Identify the cations present in (2mks)
* **B- Zn 2+**
* **C- Pb 2+ and Al**3+
1. Write the formula of the complex ion present in the deep blue solution of cation (1mk)
* **[ Cu (NH3 ) 4 ]2+**

iii.) Given that the cation of D ore Na + ions complete the table above (1mk)

* **No white precipitate**
* **No white precipitate**

iv.) State any one use of complex ions (1mk)

* **Softening hard water**
* **Extraction of reactive metals e.g. Al from its ore**

Step 3

Excess NaOH (aq)

Step1

NC(OH)

5b.)

Colourless Solution M

White ppt

White precipitate T

Solution K

BaCL2

White ppt

Excess NH3(aq)

Colourless solution

Step 2 Dil HCl

i.)Name precipitate L (1mk)

* **Aluminum hydroxide**

ii.) Write the ionic equation for the formation of L (1mk)

* **Al 3+ (aq) + 3OH- (aq) Al (OH) 3 (s)**

iii.) Name the type of reaction in step 2 (1mk)

* **Neutralisation**

iv.) Name any other solution that can be used in step 2 above (1mk)

* **Al (OH) 3 (s) + 3 HCl (aq) AlCl 3 (aq) + 3H2 O(l)**

v.) Name any other solution that can be used in step 2 above (1mk)

* **Dil sulphuric (VI) acid/ Nitric (v) acid**

6. The diagram below was used to prepare hydrogen chloride gas which was passed over heated iron powder

a.i.) State a pair of reagents that will produce hydrogen chloride gas in flask A (1mk)

* **Sodium chloride and concentrated sulphuric (vi) acid**

ii.) Name the substances in flask B (1mk)

* **Concentrated sulphuric (VI) acid**

iii.) State the observations made in the combustion tube (2mk)

* **Grey iron powder turns green**

iv.) Write the equation for the reaction in the combustion tube (1mk)

* **Fe (s) + 2HCl (g)  FeCl2(s) + H 2 (g)**

v.) Describe a chemical test for hydrogen chloride gas (2mks)

* **Dip a glass rod in concentrated ammonia solution and expose it to HCl(g)**
* **White dense fumes are produced**

b i.) Identify the gas that burns at the jet (1mk)

* **Hydrogen/ H2**

ii.) Explain why the gas in (b) is burnt (1mk)

* **Avoid explosion because its mixture with oxygen burns explosively when ignited**

c.) Another experiment was carried out where hydrogen chloride gas was bubbled through methylbenzene and water in separate beakers the resulting solutions were tested with blue litmus paper and marble chips

 (2mks)

|  |  |  |
| --- | --- | --- |
| Solution of hydrogen chloride gas | Blue litmus paper | Marble chips |
| Water  | * **Turns red ½**
 | * **Effervescence ½**
 |
| Methylbenzene  | * **Remains blue ½**
 | * **No effervescence**
 |

7. The thermodynamic equation for the formation of ammonia in the harber process is as follows.

 N2(g) + 3H2(g) 2NH 3 (aq) H = -92KJ/mol

1. If the system is allowed to attain equilibrium. State and explain how the following factors would affect the yield of ammonia

a.) Increase in temperature (1mk)

* **The reaction is exothermic : increase in temperature will favor an endothermic reaction/ backward reaction**

b.)Increase in pressure (1mk)

* **Increase : increase in pressure favors the side with fewer number of molecules / moles / volumes hence more NH3 will be produced**

c.) Using a more efficient catalyst (1mk)

* **No effect**

ii.) In an experiment to study the rate of reaction 1g of Magnesium ribbon was reacted with excess 2M hydrochloric acid. The results obtained were recorded as shown in the table below.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time(s) | 0 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Volume of gas produced (cm3) | 0 | 11 | 20 | 26 | 31 | 35 | 38 | 39 | 40 | 40 |

1. Give a reason why Magnesium ribbon is normally cleaned with sand paper before being put into the acid (1mk)
* **Remove the oxide layer**

b.) Write a balanced chemical equation for the reaction (1mk)

* **Mg (s) + 2 HCl (aq) Mg Cl2 (aq) + H2 (g)**

c.)On the grid provided plot a graph of volume of the gas produced against the time taken (3mk)

i)

* **Graph**

$\frac{30-7.5}{60-10}$ **= 0.45 cm3/ s**

**ii.)**$ \frac{45-36}{190-100}$ **= 0.1 cm3/ s**

iii.) From the graph determine the rate of reaction at

1. 30 seconds
2. At 120 seconds
3. Give a reason for the difference between the two values
* **Rae of reaction at 30 s higher than at 120s**
* **The concentration of reactants decreases as the reaction continues**

