**MINISTRY OF EDUCATION**

**RUHANGO DISTRICT**

**CHEMISTRY EXAM OF THE THIRD TERM 2021 FOR SENIOR THREE.**

**DURATION: 3 HOURS**

**INSTRUCTIONS:**

 - Attempt **all** questions in section A**/55Marks.**

 -Attempt **any three** questions in section B**/30marks.**

 -Attempt **any one** question in section C **/15Marks**

 - Periodic table is not allowed.

**SECTION A: ATTEMPT ALL QUESTIONS /70MARKS**

I.Multiple choice questions: Answer these questions by choosing the best alternative represented by letters from A, B, C and D. /10 marks

**1**. Metals lose electrons from their lattice to become

 A. positive ions

 B. negative ions,

 C. alkalis,

 D. non- metals A

**2**. Metals are good conductors due to

 A. ionic lattices,

 Crystalline lumps,

 C. mostly solids,

 D. delocalized electrons.

**3**. Which of the following is NOT a type of chemical bond?

 A. Covalent

 B. Metallic

 C. Valence

 D. Ionic

**4**. When two or more metal elements are combined they form an...

 A. bronze

 B. alloy

 C. Covalent bond

 D. Brass.

**5**.Sulphur is a solid non-metallic element at room temperature, so it is?

 A. A good conductor of heat

 B. A substance with a low melting point,

 C. Easily bent into shape

 D. A good conductor of electricity.

**6.** Sodium chloride has a high melting point because it has?

 A. Many ions strongly attracted together

 B. Strong covalent double bonds

 C. A giant covalent 3-dimentional structure

 D. Molecules packed tightly together.

**7**. A nonmetal that exists as a liquid at room temperature is:

 A. aluminum

 B. mercury

 C. hydrogen

 D. bromine

**8**. Which action should be taken immediately after concentrated sulphuric acid spilled on the skin?

 A It should be rinsed off with large quantities of running water.

 B It should be neutralized with solid CaCO3

 C It should be neutralized with concentrated NaOH.

 D The affected area should be wrapped tightly and shown to a medical health provider.

 E It should be neutralized with concentrated KOH.

**9**. Which of the following compounds contains only two elements?

 A Magnesium hydroxide

 B Magnesium nitride

 C Magnesium phosphate

 D Magnesium sulphite.

**10**. An atom has 26 protons, 26 electrons and 30 neutrons. The atom has

 A atomic number 26, mass number 52

 B atomic number 56, mass number 30

 C atomic number 30, mass number 82

 D atomic number 26, mass number 56

**OPEN QUESTIONS/50MARKS.**

**11**. a. Name two aqueous solutions which will react to form a precipitate of silver chloride, AgCl  **/2Marks**
b. Write an ionic equation, including state symbols, for the reaction in a. **/2Marks**
c. Describe how you would obtain a pure, dry sample of silver chloride precipitate from the mixture in a**./ /2Marks**

**12**. Ozone occurs in the upper atmosphere.
a. why is ozone in the upper atmosphere important? **/2Marks**
b. state one type of compound that is responsible for ozone depletion **//2Marks**

**13**. Fluorine and Sodium have atomic numbers 9 and 11 respectively.
a. Draw a dot-and-cross diagram to show the bonding in
 i. sodium fluoride, Na F **/2Marks**
 ii. fluorine, F2 **/2Marks**
Your diagrams must show all electrons
b. Explain why sodium fluoride has a higher melting point than fluorine. **/2Marks**

**14**.When iron is heated in a steam of dry chlorine, it produces a chloride that contains 34.5% by mass of iron.
a. calculate the empirical formula of this chloride **/2Marks**
b. the relative molecular mass of this chloride (Mr) is 325.
i. what is the molecular formula of this chloride? **/2Marks**
ii. hence construct an equation, including state symbols, for the reaction of iron with chlorine. **/2Marks**

**Given Relative atomic masses :Fe=56, Cl=35.5**

**15.**Complete the table by naming the products formed when the following liquids are electrolysed using inert electrodes.**/5marks.**

|  |  |  |
| --- | --- | --- |
| liquid | product formed at cathode | product formed at anode |
| dilute sulphuric acid |  | oxygen |
| molten calcium bromide |  |  |
| concentrated aqueous sodium chloride |  |  |

**16** a) When concentrated aqueous sodium chloride is electrolysed using graphite electrodes, hydrogen is collected at the cathode and chlorine at the anode. When concentrated aqueous sodium chloride is electrolysed using iron electrodes, hydrogen is again collected at the cathode but much less chlorine is collected at the anode.
 i. Give the equations for the electrode reactions by which hydrogen and chlorine are formed / **2 Marks**
 ii. Explain why much less chlorine is collected when iron electrodes are used./ **2 Marks**
 iii. Name the product, other than hydrogen and chlorine, which is manufactured by the electrolysis of concentrated aqueous sodium chloride. Give a major use of this product / **2 Marks**
 b) Why is the electrolysis of concentrated hydrochloric acid not used for the manufacture of chlorine?**/2 Marks.**
**17**.a. Aqueous sodium chloride can be prepared by titrating aqueous sodium hydroxide with dilute hydrochloric acid. The equation for this reaction is shown below.
 NaOH (aq) + HCl (aq) ➝ NaCl (aq) + H2O (l)
 i. name the two pieces of apparatus used to measure accurately the volumes of the solutions in this titration /**2 Marks**
 ii. name a suitable indicator for this titration. give the expected colour change of this indicator. /**2 Marks**
 iii. explain the meaning of the symbols (aq) and (l) in this equation. **/2 Marks.**

**18.** Name a process that is used to separate a mixture of

 a. three water-soluble dyes **1 Mark**

 b. insoluble solid and water **1 Mark**

 c. two liquids (ethanol and water) **1 Mark**

 d. water and a dissolved salt **/1Mark**

**SECTION B: ATTEMPT ANY 3 QUESTIONS/30MARKS**

**19.** a)A student adds dilute sulphuric acid to a beaker containing calcium chloride solution. He obtains a mixture containing a solid (remaining solid which fails to dissolve) of calcium sulphate in a solution of hydrochloric acid.

1. Write the balanced equation for this reaction by inserting state symbols. **/4 )**

b)The student uses this apparatus to separate the mixture into a residue and a filtrat



 -Draw a diagram to show how he/she should assemble the apparatus for the filtration. **2Marks**

 -Define the term **filtrate / 2Marks**

 c)State what will be the **filtrate** and **residue** in this experiment. **/2mks**

**20.** The following diagram shows ammonium chloride being heated in a test tube.



a) Write the formula of ammonium chloride**/1mk**

.b) How many different elements are there in ammonium chloride? (**2Marks)**

c) Identify the two gases in mixture A? **2mks)**

d) Identify the white solid B? **1mks)**

e)Ammonium chloride can sublime, what do you mean by sublimation? **1mk**.

 give other two more substances that can sublime. **1mk**.

f)Place crosses (X) in two boxes to identify the processes that occur in the test tube? **2mks)**



**21.**a. For each salt, suggest the name of the missing reagent and briefly describe how to obtain the solid product from the reaction mixture.
i. salt to be made: lithium chloride
reagent 1: dilute hydrochloric acid
reagent 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 I could obtain solid lithium chloride by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
ii. salt to be made: barium sulphate
reagent 1: aqueous potassium sulphate
reagent 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 I could obtain solid barium sulphate crystals by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
iii. salt to be made: blue copper(II) sulphate crystals
reagent 1: dilute sulphuric acid
reagent 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 I could obtain blue copper(II) sulphate crystals by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
b. Ammonium sulphate can be made by reacting aqueous ammonia with dilute sulphuric acid.
2NH3 (aq) + H2SO4 (aq) ➝ (NH4)2SO4 (aq)
Calculate the mass of ammonium sulphate that can be made from 51 g of ammonia./**10marks.**

 2**2**.The table shows the atomic structure of six particles, represented by the letters L to Q. The particles are atoms or ions. The letters are not the symbols of the elements.

|  |  |  |  |
| --- | --- | --- | --- |
| Particles | Electrons | Protons | Neutrons. |
| L | 6 | 6 | 6 |
| M | 2 | 2 | 2 |
| N | 12 | 12 | 11 |
| O | 10 | 12 | 12 |
| P | 6 | 8 | 8 |
| Q | 13 | 13 | 14 |

Use the letters L to Q to answer the following questions.
a. Which 2 particles are ions? /2Marks
b. Which particle is a atom of a noble gas? /2Marks
c. Which 2 particles are an atom and an ion of the same element? /2Marks
d. Which 2 particles are isotopes of the same element? /2Marks
e. Which particle has the highest atomic mass?/2Marks

 **23**.Dilute sulphuric acid will conduct an electric current.
a. Give the formulae of all of the ions present in dilute sulphuric acid
b. Name the gaseous products which you would expect to be formed during the electrolysis of aqueous potassium sulphate using inert electrodes
at the anode:\_\_\_\_\_ ,at the cathode:\_\_\_\_\_\_
c. Name a metal which is used to electroplate
i. bicycle handlebars ii. teaspoon
d. Explain why a metal such as aluminium can conduct an electric current but a non-metal such as sulphur cannot conduct a current**/10marks**.

**SECTION C: Attempt only one question**

 **24**.A mixture of iron and iron oxide were reacted with excess sulphuric acid. 500 cm3 of hydrogen gas was produced (measured at room temperature and pressure). If the mixture had a mass of 3 g and only iron (Fe) reacted with the acid to produce H2 gas.

Determine:

a) The number of moles of H2 gas produced. **(3 marks)**

b) The number of moles of iron, Fe that reacted with the acid. **(3 mark)**

c) The mass of iron, Fe in the mixture. **(3 marks)**

d) The mass of Fe2O3 present in the mixture. **(3 marks)**

e) The percentage composition of Fe2O3 by mass in the mixture. **(3 marks)**

Equation:

Fe(s) + H2SO4(aq) → FeSO4(aq) + H2(g)

(Atomic mass: Fe=56, O=16)

(1 mole of a gas occupies 24000 cm3 at room temperature and pressure)

**25.** a) State Graham’s law of diffusion of ideal gases. **(4 marks)**

b) A certain gaseous fluoride of phosphorous has a formula PFx .

 Under similar conditions, fluorine F2 diffuses 1.82 times faster than the gaseous PFx

i) Find the molecular mass of PFx (**6 marks)**

ii) Find the value of x in the formula PFx **(5 marks)**

(Atomic mass: F =19, P =31)

!!!!!!!!!!!!!!!!!!END!!!!!!!!!!!!!!!!

**MARKING GUIDES**

MINEDUC **Date 2/7/2021**

SOUTHERN PROVINCE **Duration: 3hours**

RUHANGO DISTRICT

**CHEMISTRY DISTRICT EXAMINATION S3IIIRD TERM/2020-2021.**

 **MARKING GUIDE/100MARKS.**

**SECTION A.**

**MULTIPLE CHOICE QUESTIONS/20MARKS.**

**1.A 2.D 3.C 4.B 5.B 6.A 7.D 8.A 9.B 10.D**

**OPENED QUESTIONS/50MARKS.**

11.a. sodium chloride and silver nitrate
b. Ag+ (aq) + Cl- (aq) -->AgCl (s)
c. Mix the two solutions. Filter the resulting mixture. AgCl is obtained as the residue. Wash the residue with water and then dry the solid in an oven.

12.a. The ozone layer acts as a barrier that absorbs harmful UV rays from the sun, preventing it from reaching earth.
b. chlorofluorocarbons.

13.a.i.



a.ii.



b. In NaF, the ionic bonds are very strong. In F2, the forces of attraction between F2 molecules are very weak. A lot of energy is required to break the strong ionic bonds. Hence, NaF has a higher melting point than F2.

14.a. molar ratio of Fe : Cl = 34.5/56 : (100 - 34.5)/35.5
                                             =   0.616   : 1.845
                                             =        1       :   3
Hence empirical formula is FeCl3
b.i. let the molecular formula be (FeCl3)n
n x (56 + 3 x 35.5) = 325
--> n = 2
Hence molecular formula is Fe2Cl6
b.ii. 2Fe (s) + 3Cl2 (g) --> Fe2Cl6 (s).
4800cm3 of gas is formed

15.

|  |  |  |
| --- | --- | --- |
| liquid | product formed at cathode | product formed at anode |
| dilute sulphuric acid | hydrogen | oxygen |
| molten calcium bromide | Calcium | bromine |
| concentrated aqueous sodium chloride | hydrogen | chlorine |

16a)i.2H+ (aq) + 2e-  ----->  H2 (g)
2Cl- (aq) -----> Cl2 (g) + 2e-
ii. When iron anode is used, some oxygen gas is produced at the same time. Some of the electrical energy is used to liberate oxygen. So less Cl2 is produced.
iii. Sodium hydroxide. It is used to manufacture soap
b. because concentrated HCl is not a cheaply and readily available raw material. It is also a volatile acid. A lot of HCl gas will be emitted.

17. i. pipette and burette
ii. phenolphthalein. from pink to colorless
iii. (aq) : aqueous solution , (l) : liquid state.

18.a. paper chromatography ,b. filtration , c.fractional distillation , d. crystallization

**SECTION B: ATTEMPT ANY 3 QUESTIONS/30MARKS.**

19) a)i)H2SO4(aq) + CaCl2(aq)CaSO4(aq + 2HCl(aq)

b)-The student can draw the set up of filtration.

-Filtrate: The liquid which passes through the filter paper into the filter funnel.

Filtrate is a solution of hydrochloric acid while the residue is the solid calcium sulphate.

20)a)NH4Cl

b)3 elements

c)Ammonia and hydrogen chloride gas

d)White solid is ammonium chloride

e)Sublimation is the change from solid to gas

Example: Dry ice and Iodine.

f)crosses will be on decomposition and neutralization

21a.i. reagent 2: aqueous lithium hydroxide
Evaporating the salt solution to dryness to obtain lithium chloride crystals
a.ii. reagent 2: aqueous barium chloride
Filtration
a.iii. reagent 2: solid copper(II) oxide
Crystallisation
2.b.Mr of NH3 = 17
Mr of (NH4)2SO4 = 132
no. of moles of NH3 = 51/17 = 3
no. of moles of (NH4)2SO4 = 1.5

22. a. O and Q (because O is an ion with a 2+ charge while Q is an ion with a 3+ charge)
b. M
c. N and O (N and O have the same number of protons but different number of electrons
d. L and P have the same number of protons but different number of neutrons
e. Q. (13 + 14 =27)

23 a) H+, OH-, SO42-
 b) cathode: Hydrogen
anode: Oxygen
c.i.chromium
.ii. silver
d. Aluminium consists of positively charged particles in a sea of electrons. The electrons are able to move freely and thus electricity can flow. In sulphur, the atomic arrangement is fixed, so there is no movement of electrons. When electricity is passed through sulphur, electricity will not be able to flow.

**SECTION C Any one question**.

24 a)The number of moles of H2 gas produced= $\frac{500}{24000}$= **0.0208 mole(3 marks)**

**(Give 1 mark for the working method and 2 marks for the final answer)**

b) The number of moles of iron, Fe that reacted with the acid= **0.0208 mole(3 mark)**

c) The mass of iron, Fe in the mixture = 0.0208 x 56 = **1.1648 g(3 marks)**

**(Give 1 mark for the working method and 1 mark for the final answer)**

d) The mass of Fe2O3 present in the mixture =3-1.1648 =**1.8352 g(3 marks)**

**(Give 1 mark for the working method and 1 mark for the final answer)**

e) The percentage composition of Fe2O3 by mass in the mixture: **(3 marks)**

 % =(Mass of Fe2O3/ Total mass)X 100%

% Fe2O3 =$\frac{1.8352}{3}$X 100%

% of = **61.17 %**

**(Give 2 marks for the working method and 1 mark for the final answer)**

25.a) Graham”s law of diffusion of ideal gases states that the rate of diffusion of a gas is inversely proportional to the square root of its density. **(2 marks)**

b) A certain gaseous fluoride of phosphorous has a formula PFx . Under similar conditions, fluorine F2 diffuses 1.82 times faster than the gaseous PFx

i) The molecular mass of PFx :**(3 marks)**

$\frac{Rate F\_{2}}{Rate PF\_{x}}$ =$\frac{\sqrt{Molar mass of PF\_{x}}}{\sqrt{Molar mass of F\_{2}}}$

$1.82$ = $\frac{\sqrt{Molar mass of PF\_{x}}}{\sqrt{38}}$

$1.82X 6.164$ = $\sqrt{PF\_{x}}$

$11.218$ = $\sqrt{PF\_{x}}$

$Molecular mass of PF\_{x}$**= 125**

**(Give 2 marks for the working method and 1 mark for the final answer)**

ii) The value of x in the formula PFx .**(3 marks)**

31+19x=125

19x=125-31 = 94

X = 4.947

**X = 5**

**(Also accept X=4.947 as the answer)**