**Chemistry**

 **02/07/ 2021 08.30 AM - 11.30 AM**

 

S2 END OF YEAR EXAM, 2020/2021

SUBJECT: CHEMISTRY

DURATION: 3 HOURS

**Instructions:**

1. There are 2 sections in this paper:

 **Section A (70 marks**): Attempt all questions in this section

 **Section B (30 marks)**: Attempt 3 questions in this section.

1. Do not use periodic tables
2. Non-programmable calculators may be used
3. Answers should be written on blank papers provided
4. Use a blue or black pen only

**SECTION A: Attempt all questions in this section (70 marks)**

1 a) The atomic number of magnesium and chlorine are 12 and 17 respectively. Explain the formation of:

 a) A magnesium ion from magnesium atom. **(2 marks)**

 b) A chloride ion from chlorine atom. **(2 marks)**

2 a) Explain the difference between the formation of covalent and ionic bonds.

 **(2 marks)**

 b) Give 2 differences between ionic and covalent compounds basing on their physical properties. **(2 marks)**

3) The atomic number of silicon is 14 and that of fluorine is 9. State the type of bond formed between silicon and fluorine and explains why that bond is of that nature. **(3 marks)**

4) The atomic number of element A is 11 and that of B is 8.

 a) Determine the formula of the compound formed between element A

 and B. **(3 marks)**

 b) Write 2 physical properties of the compound formed between element A and B. **(2 marks)**

5) a) The atomic number of magnesium Mg is 12 and that of calcium, Ca is 20.

 (i) Identify the element between Mg and Ca that is more reactive.

 **(1 mark)**

 (ii) Explain why the element stated in 5.a)i) above is more reactive.**(2 marks)**

 b) The atomic number of sulphur, S is 16 and that of chlorine, Cl is 17.

 (i) Identify the element between S and Cl that is more reactive. **(1 mark)**

 (ii) Explain why the element stated in 5.b)i) above is more reactive. **(2 marks)**

6 a) What do you understand by the term “neutralization reaction”? (**2marks)**

 b) Copy and complete the missing substance formula in the table given below: **(3marks)**

|  |  |  |
| --- | --- | --- |
| **ACID** | **BASE** | **SALT** |
| HNO3 |  | Ca(NO3)2 |
|  | KOH | K2SO4 |
|  |  | NaCl |
|  |  | (NH4)3PO4 |

7) State the required reagents to prepare a sample of crystals of sodium nitrate, NaNO3 nitrate and describe the steps involved. **(4marks)**

8) A sample of copper (II) sulphate, CuSO4.5H2O crystals can be prepared in the laboratory by reacting excess copper (II) oxide, CuO with dilute sulphuric acid, H2SO4.

 a) Write the chemical equation of the reaction between sulphuric acid and copper (II) oxide. (**2marks)**

 b) Explain why excess copper (II) oxide is used. **(1mark)**

 c) State what is observed during this reaction. **(1mark)**

9) A scientist suspected that drinking water was contaminated with Aluminium sulphate, Al2(SO4)3.

 State a chemical reagent a scientist can use to show that the water contains the ions given below and describe the observable changes for a positive test in each case:

 a) Aluminium ions, Al3+? **(2 marks)**

 b) Sulphate ions, SO42-? **(2 marks)**

10) A gas measures 80 ml at 2.5 atmospheres pressure and at the temperature of 27°C.

 Calculate its volume at standard conditions of temperature and pressure. **(3 marks)**

11) Pentane is an alkane with five carbon atoms.

 a)Write the molecular formula for pentane. **(1 mark)**

 b) Identify the physical state (solid, liquid or gas) of pentane at room

 temperature. **(1 mark)**

c)Write an equation for the complete combustion of pentane. **(2 marks)**

12. You are provided with some term names below in the table. You are required to copy the sentences (a) to (e) and fill in the blank spaces using the word in the list of term names below. You may use the words once, more than once or not at all. **(5 marks)**

|  |
| --- |
| **List of term names** |
| (i) A non –electrolyte |
| (ii) A non-conductor |
| (iii) An electron |
| (iv) A metal |
| (v) A conductor |
| (vi) An ion |
| (vii) An electrolyte |
| (viii) A non metal |

1. A substance that will conduct electricity when molten and/or in aqueous solution is called...............
2. A compound that does not conduct electricity whether in the solid, molten or aqueous solution is called..............?
3. A solid substance that conducts electricity but does not contain ion is called...............................................
4. A particle that carries electric current in a solid conductor is called...................
5. A compound that does not conduct electricity when solid but does so when molten or in solution so called..............................

13) An alkane X has 6 carbon atoms.

 a) Write the molecular formula of alkane X. **(2 marks)**

 b) State the name of alkane X compound. **(2 marks)**

 c) Draw the structural formulae of 2 isomers of alkane X compound and name them. **(2 marks)**

14 a) Chlorophyll, the green colouring matter of plants contains 2.68% ofmagnesium by mass. Calculate the number of magnesium moles in 5.0 g of chlorophyll. (Mg=24). **( 3marks)**

 b) Determine the formula of a lead compound, given that 4.14 g of leadcombines with 0.64 g of sulphur and 1.28 of oxygen to form themlead compound. (Atomic mass: Pb= 207; S=32 and O=16).

 **(4 marks)**

15) On the basis of acid-base nature, oxides can be classified into four groups.

1. Classify each of the following oxide compound into the 4 types of oxides. **(4marks)**

|  |  |
| --- | --- |
| **Compound** | **Type of oxide** |
| i) K2O |  |
| ii) H2O |  |
| iii) SO2 |  |
| iv) Al2O3 |  |
| v) ZnO |  |
| vi) CO |  |
| vii) MgO |  |
| viii) NO2 |  |

 b)Write the ionic equation for the reactions below: **(2 marks)**

 CaCO3(s) + 2 HCl(aq) → CaCl2(aq) + CO2(g)+ H2O(l)

**SECTION B: Attempt three questions in this section (30 marks)**

16a) Describe the term ‘waste management’. **(2marks)**

 b) Write 3 steps which can be taken to achieve effective waste

 management. **(3 marks)**

 c) Discuss the benefits of waste recycling. **(2 marks)**

 d) State 2 dangers of the materials that do not decay (rot) when they are

 dumped in composts. **(2 marks)**

 e) Burning is one of the ways of managing wastes. Identify a negative

 consequence of this practice on the environment. **(1 mark)**

17 a) (i)Explain why metals are good conductors of electricity. **(2 marks)**

 (ii) Give 2 differences between metals and of non-metals in terms of

 chemical properties. **(2 marks)**

 (iii) State two uses of non-metals in daily life. **(2 marks)**

 b) (i)Describe any one danger associated with water pollution. **(2 marks)**

 (ii) Discuss the role of education and awareness campaign in

 preventing water pollution. **(2 marks)**

18 a) Calculate the number of moles of sodium, Na present in 4.6 g of the metal. (Molar mass of Na = 23g/ mole). **(2 marks)**

 b)Calculate the number of magnesium atoms present in a magnesium foil of mass 72 g. **(3 marks)**

(Avogadro number (N) is 6.02 x1023; Mg = 24)

 c) Calculate the mass in grams of 3.5x 1025 $10^{24}$atoms of silver, Ag. (Atomic mass: Ag = 108 ) **(3 marks)**

 d) Calculate the number of molecules in 6.8 g of gaseous hydrogen H2. **(2 marks)**

 (Atomic mass: H = 1)

19 a) Give the general formula of alkanes and the name of one alkane molecule. **(2marks)**

 b) State any two differences between organic and inorganic compounds. **(2 marks)**

 c) State the IUPAC name of the alkane with the molecular formula C5H12. **(1 mark)**

 d) The thermal cracking of decane, C10H22 gives C2H4 and alkane **B**. Give the IUPAC name and the molecular formula of **B**. **(2 marks)**

1. Discuss the socio-economic importance of alkanes in our society. **(3 marks)**

**MARKING SCHEME: CHEMISTRY (S2)**

**End of Year Examination: (100 marks)**

**End of Year Examination: 2020**

**SECTION A: (70 marks)**

**SECTION A: Attempt all questions in this section (70 marks)**

1. a) A magnesium ion from magnesium atom. **(2 marks)**

Magnesium possesses 2 electrons in the outermost shell. Therefore Mg atom loses the 2 valency electrons to form Mg2+ ion.

 b) Chlorine atom possesses 7 electrons in the outermost shell. Therefore, Cl atom gains 1 electron to become a Cl- ion. **(2 marks)**

2.a) A covalent bond is formed by **sharing of valency electrons** between 2 atoms whereas an ionic bond is formed by **the electrostatic attraction** between 2 ions of opposite charges. **(2 marks)**

**(Give 1 mark for each underlined statement)**

 (b) -Ionic compounds have a **high melting point** but covalent compounds **have low melting points**.

-Ionic compounds **conduct electricity** when they are in molten form but covalent compounds **do not conduct electricity**. **(2 marks)**

3. -Type of bond: Covalent bond. **(1 mark)**

-The bond is of that nature because each of the two atoms contributes one electron to form a covalent bond. **(2 marks)**

4. a) The formula of the compound formed between element A and B:

A ionizes by losing 1 electron and B ionizes by gaining 2 eletrons to achieve the rare gas electron configuration. **(2 marks)**

So we obtain A+ and B2- ions. The formula of the compound formed is: A2B **(1 mark)** b) 2 physical properties of the compound formed between element A and B. **(2 marks)**

-The compound conducts electricity.

-The compound formed has a high melting point.

**(Give 1 mark for each answer)**

**(Accept other correct answers)**

5. a) The atomic number of magnesium Mg is 12 and that of calcium, Ca is 20.

i) Ca is more reactive. **(1 mark)**

ii) Ca is more reactive than Mg because its outermost shell electrons are further away from the nucleus than for Mg. So this makes it possible for Ca to lose the valency electrons more easily than for Mg. **(2 marks)**

 b) i) Cl is more reactive than S. **(1 mark)**

ii) Cl is more reactive than S because being in the same period Cl has a higher nuclear charge than S and therefore Cl is more electronegative which makes it to be more reactive than S. **(2 marks)**

6.a) Neutralization reaction is a chemical reaction that happens when an acid (H+) and a base (OH-) react to form water and a salt. (**2marks)**

 b) Completed substance formulae in the table: **(3marks)**

|  |  |  |
| --- | --- | --- |
| **ACID** | **BASE** | **SALT** |
| HNO3 | **Ca(OH)2** | Ca(NO3)2 |
| **H2SO4** | KOH | K2SO4 |
| **HCl** | **NaOH** | NaCl |
| **NH4OH** | **H3PO4** | (NH4)3PO4 |

 **(Give 0.5 mark for each answer in bold in the table)**

7. Required reagents: NaOH and HNO3 **(1 mark)**

Steps involved: Concentrated NaOH and HNO3 are added in a beaker, the resultant mixture is heated until all the water evaporates to leave NaNO3 crystals in the beaker. **(3 marks)**

8. a) Chemical equation of the reaction between sulphuric acid and copper (II) oxide.

 H2SO4 + CuO → CuSO4 + H2O (**2marks)**

**(Give 1 mark for unbalanced equation)**

b) Excess copper (II) oxide used to make sure that all the H2SO4 is used up to obtain a neutral solution.. **(1mark)**

c) The black solid of CuO turns into a blue solution. **(1mark)**

9. a) -Chemical reagent: Aluminon and NH3 solution.

-Observation: Adding aluminon to Al3+ ions in NH3 solution form a red lake and a colourless solution. **(2 marks)**

**(Give 1 mark for the reagent and 1 mark for the observation)**

b) Reagent: Barium nitrate

Observation: Adding barium nitrate solution to SO42- solution forms a white precipitate. **(2 marks)**

**(Give 1 mark for the reagent and 1 mark for the observation)**

10. The volume at standard conditions of temperature and pressure.

$\frac{P1V1}{T1}$ = $\frac{P2V2}{T2}$

$\frac{2.5 X 80}{300}$ = $\frac{1 X V2}{273}$

**V2= 182 ml** **(3 marks)**

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

11.Pentane is an alkane with five carbon atoms.

a) The molecular formula for pentane.

C5H12 **(1 mark)**

b) The physical state of pentane at room temperature: It is liquid. **(1 mark)**

c) The equation for the complete combustion of pentane:

 C5H12(l) + 8O2(g) → 5CO2(g) + 6H2O(l) **(2 marks)**

**(Give 1mark for unbalanced equation)**

12. a) A substance that will conduct electricity when molten and/or in aqueous solution is called **an electrolyte**. **(1 mark)**

b)A compound that does not conduct electricity whether in the solid, molten or aqueous solution is called a **non-electrolyte**. **(1 mark)**

c)A solid substance that conducts electricity but does not contain ions is called **a metal**. **(1 mark)**

d)A particle that carries electric current in a solid conductor is called **an electron**. **(1 mark)**

e)A compound that does not conduct electricity when solid but does so when molten or in solution so called **an electrolyte**. **(1 mark)**

13.An alkane X has 6 carbon atoms.

a) The molecular formula of alkane X: C6H14. **(2 marks)**

b) The name of alkane X compound: Hexane  **(2 marks)**

c) The structural formulae of 2 isomers of alkane X compound and their names.

  **(2 marks)**

**(Give 0.5 mark for each structural formula and 0.5 mark for each name)**

14. a) Number of moles = $\frac{5}{24}$

Number of moles = **0.2083 mole** **( 3marks)**

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

b) The formula of a lead compound:

Pb : S : O

$\frac{4.14}{207}$ : $\frac{0.64}{32}$ : $\frac{1.28}{16}$

 0.02 : 0.02 : 0.08

Dividing each figure by 0.02 we obtain the lead compound formula:

 PbSO4 **(4 marks)**

**(Give 3 marks for the working method and 1 mark for the final answer)**

15. a) The 4 types of oxides. **(4marks)**

|  |  |
| --- | --- |
| **Compound** | **Type of oxide** |
| i) K2O | Neutral oxide |
| ii) H2O | Neutral oxide |
| iii) SO2 | Acidic oxide |
| iv) Al2O3 | Amphoteric oxide |
| v) ZnO | Amphoteric oxide |
| vi) CO | Neutral oxide |
| vii) MgO | Basic oxide |
| viii) NO2 | Acidic oxide |

**(Give 0.5 mark for each answer)**

c)The ionic equation for the reactions below: **(2 marks)**

 CO32-(aq) + 2 H+(aq) → CO2(g)+ H2O(l)

**SECTION B: Attempt three questions in this section (30 marks)**

16**.**a) Waste management includes the activities and actions required to manage waste from its inception to its final disposal. **(2marks)**

 b) 3 steps which can be taken to achieve effective waste management.

-Source reduction

-Recycling

-Composting. **(3 marks)**

**(Accept other correct answers)**

 c) The major benefits of waste recycling include:

-Keeps the environment clean and fresh.

-Saves the earth and conserves energy.

-Reduces environmental pollution.

-Waste management will help you earn money.

- Waste management creates employment. **(2 marks)**

 d) The materials that do not decay:

-They block the drains.

-They harm animals. **(2 marks)**

 e) A negative consequence of burning materials:

-Burning causes emission of carbon dioxide gas into the atmosphere which in eventually causes global warming. **(1 mark)**

17.a) i) Why metals are good conductors of electricity: **(2 marks)**

-Metals have free mobile electrons that can move under the influence of potential difference.

ii) 2 differences between metals and of non-metals in terms of chemical properties.

-Metals can lose electrons to give cations whereas non-metals gain electrons to become anions.

-Metals combine with non-metals to produce ionic compounds whereas non-metals react with other non-metals to produce covalent compounds. **(2 marks)**

iii) Two uses of non-metals in daily life: **(2 marks)**

-They are used as fuel.

-They are used as clothes.

**(Give 1 mark for each correct answer)**

**(Accept other correct answers)**

b) i) One danger associated with water pollution:

-Water pollution can cause the death of marine animals such as fish due to toxic substances in water. **(2 marks)**

ii) The role of education and awareness campaign in preventing water pollution:

Education awareness campaign helps to explain the benefits of clean water and the dangers of polluted water to people and to animals so that they can put in place preventive measures of water pollution in their communities and the surrounding areas. **(2 marks)**

**(Accept other correct answers)**

18.a) Number of moles of Na = $\frac{4.6}{23}$

Number of moles of Na = **0.2 mole** **(2 marks)**

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

b) The number of magnesium atoms present in a magnesium foil of mass 72 g.

Number of moles of Mg = $\frac{72}{24}$ = 3 moles

Number of atoms = 6.02 x1023 X 3

Number of moles of Mg = $\frac{72}{24}$ = 3 moles

**Number of atoms = 18.06 X 1023 atoms** **(3 marks)**

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

c) The mass in grams of 3.5x 1025 atoms of silver, Ag:

Number of moles = $\frac{3.5X10^{25}}{6.02X10^{23}}$ = 0.5813X 102 moles = **58.13 moles**

The mass of Ag = 58.13 X 108

**The mass of Ag = 6278.04g (3 marks)**

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

d) The number of molecules in 6.8 g of gaseous hydrogen H2:

Number of moles = 6.8/2

Number of moles = 3.4 moles

Number of molecules = 6.02 X1023 X 3.4

**Number of molecules = 20.468 X 1023 molecules. (2 marks)**

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

19.a) The general formula of alkanes: **CnH2n+2** **(1mark)**

The name of one alkane molecule: **Pentane**  **(1mark)**

b) Differences between organic and inorganic compounds:

-Organic compounds contain carbon, hydrogen and oxygen while inorganic compounds generally do not contain carbon atoms.

-Organic compounds are insoluble in water while inorganic compounds are soluble in water. **(2 marks)**

c) The IUPAC name of the alkane with the molecular formula C5H12:

Name: Pentane

 **( 1 mark)**

d) The IUPAC name: Octane **(1 mark)**

**The molecular formula of B: C8H18** **(1 mark)**

e) The socio-economic importance of alkanes in our society:  **(3 marks)**

Alkanes are used for combustion in domestic kitchens and in vehicle engines.

Alkanes such as biogas produced after decay of domestic compost can generate money (income).

Alkanes can be used to produce alkenes that are used to make plastic materials.

**(Give 1 mark for each point)**

**(Accept other correct answers)**

……………………………………………………………………………………

 

**Chemistry**

 **24/06/ 2021 08.30 AM - 11.30 AM**

**S2 END OF YEAR EXAM, 2020/2021**

**SUBJECT: ALTERNATIVE TO PRACTICAL EXAM**

**INSTRUCTIONS:**

1. Please read carefully before you start.
2. This paper has one question.
3. Answer the questions appropriately.

**Experiment to identify the cation and anion in sample X**

Study the data in the table given below and answer the questions that follow:

|  |  |  |
| --- | --- | --- |
| **Sample + reagent** | **Observations** | **Conclusion** |
| i) X solution +NaOH(aq) | Brown precipitate formed |  |
| ii) X solution + Na2CO3(aq) | Brown precipitate formed and a colourless gas that turns moist blue litmus paper to red  |  |
| iii) X solution + Zinc metal | Green solution formed |  |
| iv) X solution + KSCN(aq) | Red solution formed |  |
| v) X (solid) + heat | Brown gas evolved which turns blue litmus paper to red.  |  |

a) Write the symbol/symbols of possible ion/ions in each row of the **conclusion**.

i) ………………………………………………………..**(2 marks)**

ii) ………………………………………………………..**(4 marks)**

iii) ………………………………………………..……..**(2 marks)**

iv) ……………………………………………….……...(**2 marks)**

v) ………………………………………………………..**(2 marks)**

b) The cation in sample X is:…………………………… **(1 mark)**

c) The anion in sample X is:……………………………. **(1 mark)**

d) The formula of compound X is:……………………… **(1 mark)**

**MARKING SCHEME CHEMISTRY (ALTERNATIVE)**

 **S2: ADVANCED LEVEL EXAMINATION 2020/2021**

**SUBJECT: CHEMISTRY**

**DURATION: 1 HOUR 30 MINUTES**

**INSTRUCTIONS:**

1. Please read carefully before you start.
2. This paper has one question.
3. Answer the questions appropriately.

**Experiment to identify the cation and anion in sample X**

Study the data in the table given below and answer the questions that follow:

|  |  |  |
| --- | --- | --- |
| **Sample + reagent** | **Observations** | **Conclusion** |
| i) X solution +NaOH(aq) | Brown precipitate formed | Fe3+ions suspected |
| ii) X solution + Na2CO3(aq) | Brown precipitate formed and a colourless gas that turns moist blue litmus paper to red  | Fe3+ions suspected.The X solution is acidic. |
| iii) X solution + Zinc metal | Green solution formed | Fe3+ions reduced to green Fe2+ ions. |
| iv) X solution + KSCN(aq) | Red solution formed | Fe3+ions confirmed |
| v) X (solid) + heat | Brown gas evolved which turns blue litmus paper to red.  | Acidic NO2 gas given off. So the anion present is NO3- |

a) Write the symbol/symbols of possible ion/ions in each row of the **conclusion**.

i) NO3-………………………………………………..**(2 marks)**

ii) Fe3+ , H+ ………………………………....………..**(4 marks)**

iii) Fe3+ .………………………………………..……..**(2 marks)**

iv) Fe3+ .……………………………………….……...(**2 marks)**

v) NO3- ………………………………………………..**(2 marks)**

b) The cation in sample X is: Fe3+ …………………… **(1 mark)**

c) The anion in sample X is: NO3- ..…………………. **(1 mark)**

d) The formula of compound X is: Fe(NO3)3………… **(1 mark)**