**Name:……………………………………………………………………………………………Signature:………………….**

**P525/1**

**CHEMISTRY**

**Paper 1**

**August 2023**

**Uganda Advanced Certificate of Education**

**END OF TERM TWO EXAMINATIONS**

**S.5 CHEMISTRY**

**Paper 1**

2 hours 45 minutes

**INSTRUCTIONS:**

Answer **all** questions in this section **A** and **six** questions in section **B**.

**All**answers must be written in the spaces provided.

Mathematical tables (3-figure tables) are adequate or non-programmable scientific electronic calculators may be used.

Illustrate your answers, with equations where applicable.

Where necessary, use the following;

Molar gas constant, R=8.31 JK-1mol-1.

Molar volume of a gas at s.t.p is 22.4 litres. Standard temperature = 273K.

Standard pressure = 101325Nm-2

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | |  | **For Teachers’ Use Only** | | | | | | | |  |  |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | **Total** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**SECTION A (46 MARKS)**

Answer **all** questions in this section.

1. (a) Complete the following equations.

1. 2713𝐴𝑙 + 10𝑛 𝛽 + … … … (01 mark)
2. 411𝐻 42𝐻𝑒 + … … … (01 mark)
3. (iii) 23992 𝑈 23991𝑈 + … … … (01 mark)

b) The half-life of a radioactive element **Z** is 36 years. After how many years will the substance take to decay to 25%. (02 marks)

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1. An organic compound, **R** has the structure;

𝐶𝐻3𝐶𝐻 = 𝐶𝐻𝐶*H2OH*

* 1. Name the functional groups present in **R**. (01 mark)

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* 1. Write equation for the reaction between **R** and:
  2. alkaline potassium manganate(vii) solution. (01 mark)

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(ii) bromine water. (01 mark)

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(c) State what would be observed in (b) (i) and (ii) (02 marks)

(i)

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(ii)

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1. (a) Write an equation for the reaction between each of the following pairs of chemical reactants.
2. Aluminium metal and concentrated sodium hydroxide solution. (1 ½ marks)

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(ii) Magnesium nitride and water (1 ½ marks)

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(iii) Methylbenzene and excess chlorine gas in Ultraviolet light. (1 ½ marks)

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(iv) Beryllium carbide and water (1 ½ marks)

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4. (a) What is meant by relative abundance? (01 mark) ……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………..............................................................

(b) Brominehas two naturally occurring isotopes with isotopic masses and relative abundances as shown below.

|  |  |
| --- | --- |
| **Isotopic mass** | **Relative abundance** |
| 79 | 50.5 |
| 81 | 49.3 |

1. Bromine has two isotopes, **Br-79** and **Br-81**. Write the ion formed on the mass spectrum when the two isotopes combine

. (01 mark)

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1. Calculate the average atomic mass of **bromine**. (03marks)

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1. Complete the following organic reactions and name the major organic product in each case.

* 1. + 𝐻𝐵𝑟  …………… .. (1 ½ marks)

**Name of product**

………………………………………………………………………………………………………………………………………

CH3

* 1. 𝐶𝑙2 / 𝑢𝑣 𝑙𝑖𝑔ℎ 𝑡   ……………… (1½ marks)

**Name of product**

………………………………………………………………………………………………………………………………………

* 1. 𝐶𝐻3𝐶𝐻 = 𝐶𝐻2 Br2, CCl4 ……………………… (1½ marks)

**Name of product**

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1. (a) Define diagonal relationship (01 mark)

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(i) State two properties in which beryllium resembles aluminium.

(02 marks)

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(ii)State two reasons why beryllium resembles aluminium. (02 marks)

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b) State any other pair of elements on a periodic table that exhibit

diagonal relationship. (01 mark)

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7. Draw the structures and name the shapes of the following molecules or

ions. (04½ marks)

|  |  |  |
| --- | --- | --- |
| Molecules/ions | Structure | shape |
| CO32- |  |  |
| H2S |  |  |
| H2SO4 |  |  |

8. Complete the following reactions and suggest the possible mechanism for each reaction.

a). CH3CHCHCH3 CH3CH2ONa (03 marks)

Heat

Br Br

…………………………………………………………………………………………………………………………………

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b) CH3CH2CCH  CH3CH2Br (02marks)

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9. (a) State Dalton’s law of partial pressure of gases (01 mark)

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(b) What is meant by the following terms;

(i) Partial pressure of a gas (01 mark)

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(ii) Mole fraction of a gas (01 mark)

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(b) 12.0g of nitrogen, 0.4g of hydrogen and 9.0 g of oxygen were put in a 1litre vessel at pressure of 22.4atm. Calculate the partial pressure of the respective gases present in the vessel. (06 marks)

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**SECTION B: (54 MARKS)**

Answer any **six** questions from this section.

1. (a) State what is meant by the term **freezing point constant** of a substance. (01 mark)

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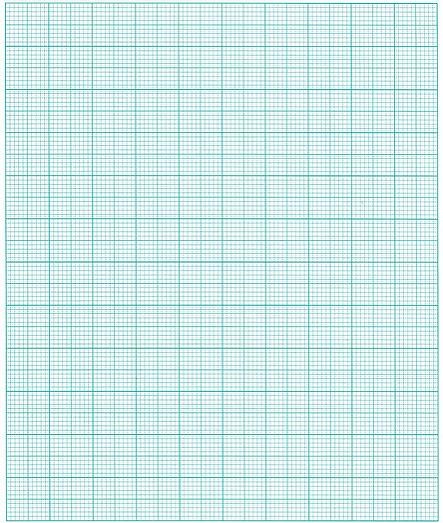
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* 1. The table below shows the freezing points of various concentrations of a non-volatile solute Q in water at 760mmHg.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Concentration of Q (𝑔𝑑𝑚−3) | 0 | 30 | 60 | 90 | 120 | 150 |
| Freezing point°𝐶) | 0 | -0.16 | -0.32 | -0.49 | -0.65 | -0.81 |

Plot a graph of freezing point depression against concentration of Q

(05 marks)



* 1. Determine the :
     1. slope of the graph you have drawn in (b). (1 mark)

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* + 1. relative molecular mass of Q. (𝐾𝑓 𝑜𝑓 𝑤𝑎𝑡𝑒𝑟 𝑖𝑠 1.86°𝐶𝑘𝑔−1𝑚𝑜𝑙)

(2 marks)

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1. Write equations to show how the following compounds can be synthesised. Indicate the condition(s) for the reaction(s).

(a) Ethyne from Calcium Oxide (02marks)

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(b) Benzene from Ethene gas (03 marks)

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(c) Propanone from 1,2-Dibromopropane (02marks)

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(d) Hexane from propene (02 marks)

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1. The table below shows chlorides of group 11 elements of the Periodic table and their melting points.
   1. For each chloride, state the type of bonding and name the structure of the chloride. (05 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| **Chloride** | **Melting point/0C** | **Bonding** | **Structure** |
| BeCl2 | 405 |  |  |
| MgCl2 | 714 |  |  |
| CaCl2 | 782 |  |  |
| SrCl2 | 875 |  |  |
| BaCl2 | 962 |  |  |

* 1. Write equation for the reaction that takes place leading to the formation of chloride of;
     + 1. Magnesium chloride (1 mark)

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(c) Explain the trend in variation of the melting points shown above. (3marks)

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1. (a) What is meant by the following terms
   * + - 1. Hydration energy (01 mark)

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* + - * 1. Lattice energy (01 mark)

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* + - * 1. Enthalpy of solution (01 mark)

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(b) State two factors which can affect the magnitude of lattice energy

(01 mark)

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c) The lattice hydration energies of salts **RX** and **TX** are given in the table below

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| **Salt** | Lattice energy(kjmol-1) | Hydration energy (kjmol-1) |
| RX | 880 | 860 |
| TX | 790 | 800 |

(c) Calculate the enthalpy of solution of each salt

1. **RX** (02 marks)

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1. **TX** (02 marks)

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1. Which one of the two salts is more soluble in water at a given

temperature? Give a reason for your answer (01 mark)

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14. A hydrocarbon **Y** contains 85.7% carbon and has a density of 2.5gl at s.t.p.

(a) Calculate the empirical formula of Y (02 marks)

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(b)(i) Determine the molecular formula of Y (02 marks)

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(ii)Write the structural formulae and IUPAC names of all the possible open chain isomers of Y. (03 marks)

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(c) Ozonolysis of Y and subsequent hydrolysis gives only one compound.

(i) Identify Y (01 mark)

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(ii­) Write an equation to show how Y can be synthesised from butan-1-ol

(01 mark)

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15. (a)(i) What is meant by the term first ionisation energy? (01mark)

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(ii)Write an equation for the first ionisation energy of aluminium (01 mark)

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(iii)State two factors that can affect the value of first ionisation energy

(02 marks)

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(b)State and explain how first ionisation energy varies

(i) Down a group. (03 marks)

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(i)Across a given period. (02 mark)

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16. (a) State two factors affecting stability of a nucleus of an atom. (02 marks)

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(b) Below is a graph of number of neutrons against number of protons for different nuclei.

Identify (i) region S……………………………………………………………………………………………(01 mark)

(ii) line A………………………………………………………………………………………………..(01 mark)

(c) State how the following nuclide can gain stability.

(i) Q (01 mark)

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(ii) R (01 mark)

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(iii) P (01 mark)

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(d) State two properties of a stable nuclide. (02 marks)

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1. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case state what would be observed if each member of the pair is treated with the named reagent.

(a) But-2-yne and Butane

**Reagent**. (01 mark)

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**Observations.** (02 marks)

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(b) Propane and propene

**Reagent**. (01 mark)

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**Observations.** (02 marks)

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(c) But-2-yne and But-1-yne

**Reagent**. (01 mark)

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**Observations.** (02 marks)

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**END.**

