



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

**A. M. E. C. E. A**

**MAIN EXAMINATION**

**SEPTEMBER –DECEMBER 2021**

**FACULTY OF SCIENCE**

**DEPARTMENT OF CHEMISTRY**

**REGULAR PROGRAMME**

**CHEM 200: CHEMISTRY OF S AND P BLOCK ELEMENTS**

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**Date: DECEMBER 2021**

**Duration: 2 Hours**

**INSTRUCTIONS: Answer Question ONE and any TWO Questions**

## **QUESTION ONE (COMPULSORY 30 MARKS)**

**Q1.**

- a. Elements A and B have atomic numbers of 12 and 36 respectively. Use your knowledge of chemical periodicity to answer the following questions.
- i. Write the electronic configuration of the elements **(2 Mark)**
  - ii. Identify the periodic block of each element **(2 Mark)**
  - iii. What is the principal oxidation number of each element? **(2 Mark)**
  - iv. Write the probable formula of oxide(s) of each element. **(2 Mark)**
- b. Explain the trend in ionization energy (i) in a period (ii) in a group. **(2 marks)**
- c. Explain the following observations:
- i. Magnesium atom is bigger than chlorine atom. **(2 marks)**
  - ii. Carbon forms very many hydrides compared with the other elements in group IV. **(2 marks)**
  - iii. Hydride of oxygen is a liquid while the hydride of sulphur is a gas at room temperature. **(1 mark)**

- iv.  $\text{NCl}_5$  is not known while  $\text{PCl}_5$  is a known compound (1 mark)
- v.  $\text{HClO}_4$  is a stronger acid than  $\text{HClO}$  (2 marks)
- vi. Draw a diagram to show the electronic structure of diborane.

(2

marks)

- d. Write equations for major chemical reactions that occur in different chambers during the large scale production of sulphuric acid by contact process. (4 marks)
- e. Give three similarities between beryllium and aluminium. (3 marks)

Q2. Discuss the chemistry of group 13 elements. In your discussion show the main similarities and differences between the first element and the rest of the elements in group 13. In your discussion include the following:

- i. Trends in the physical properties (minimum of three). (3 marks)
- ii. Occurrence and extraction of second member of the family (5
- marks)
- iii. Chemical properties (Hydrides, oxides, hydroxides, reaction with acids, bases and water (8 marks)
- iv. Anomalous behavior of the smallest member (Minimum of 4 points).

(4 marks)

Q3. Discuss the chemistry of group 15 elements. In your discussion show the main similarities and differences between the first element and the rest of the elements in group 15. In your discussion include the following:

- i. Trends in the physical properties (minimum of three). (3 marks)
- ii. Occurrence and extraction of second member of the family (5
- marks)
- iii. Chemical properties (Hydrides, halides, oxides, hydroxides, reaction with acids, bases and water (8 marks)
- iv. Anomalous behavior of the smallest member (Minimum of 4 points).

(4

marks)

Q4. Discuss the chemistry of group 17 elements. In your discussion show the main similarities and differences between the first element and the rest of the elements in group 17. In your discussion include the following:

- i. Trends in ionization energy, electronegativity and ionic size. **(3 marks)**
- ii. Occurrence and extraction of second member of the family **(5 marks)**
- iii. Chemical properties (Formation of :Hydrides, halides, oxides, hydroxides, reaction with acids, bases and water **(8 marks)**
- iv. Anomalous behavior of the smallest member (Minimum of 4 differences). **(4 marks)**

Q5. Discuss the chemistry of group 1 elements. In your discussion show the main similarities and differences between the first element and the rest of the elements in group 2. In your discussion include the following:

- i. Trends in electropositivity, ionic size and metallic strength. **(3 marks)**
- ii. Occurrence and extraction of second member of the family **(5 marks)**
- iii. Chemical properties (Formation of :Hydrides, halides, oxides, hydroxides, reaction with acids, bases and water **(8 marks)**
- iv. Differences between the smallest member of the family and other members of the group. (Minimum of 4 differences). **(4 marks)**

**\*END\***