

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF
DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY, INDUSTRIAL CHEMISTRY,
BIOLOGY & BE.D SCIENCE**

CHEM 212: COMPARATIVE STUDY OF S AND P BLOCK ELEMENTS

**STREAMS: BSC CHEMISTRY, BSC.INDUSTRIAL CHEMISTRY, BSC.BIOLOGY
& BE.D SCIENCE**

TIME: 2 HOURS

DAY/DATE: TUESDAY 6 /07/ 2021

8.30 AM – 10.30 AM

INSTRUCTIONS:

- Answer Question ONE and any other TWO Questions.
- Do not write on the question paper

QUESTION ONE (30 MARKS)

- a) Define the following terms (5marks)
- Radial distribution function
 - Pauli Exclusion Principle
 - Aufbau Principle
 - Modern Periodic law
 - Isoelectronic ion
- b) i) Define a nodal surface (1 mark)
- ii) How many nodal surfaces does a 4s orbital have (2marks)
- c) Using an equation explain the effective nuclear charge and explain how it varies from left right across the periodic table (3marks)

d) Calculate the effective nuclear charge of one of the 2p electrons in the carbon atom

(3marks)

e) Give four characteristics of metals and nonmetals (2marks)

f) Briefly explain why potassium and calcium have electrons in 4s orbital instead of being in 3d orbital (3marks)

g) i) Define ionization energy (1 mark)

ii) Give two factors that influence ionization energy (2 marks)

iii) Briefly explain why the second ionization for Na, the third ionization energy for Mg and the 4th ionization energy for Al are all very large compared to the preceding number

(3marks)

h) Give two reasons for the anomalous behavior of lithium (2 marks)

i) Using a diagram explain why the structure of diborane (B_2H_6) differs from that of ethane (3 marks)

QUESTION TWO (20 MARKS)

a) Explain why the ionization energy of Al is lower than that of Mg even though the nuclear charge of Al is higher than that of Mg (2marks)

b) Explain the general periodic trends of the following and give the reasons for their trends (6marks)

i) Atomic radius

ii) Ionic radius

iii) Electron affinity

c) i) Briefly explain diagonal relationships (2marks)

ii) Give two similarities between Lithium and Magnesium (2marks)

d) i) Define the Inert Pair Effect (1 mark)

ii) Give two causes of Inert Pair Effect (2marks)

- e) Using suitable equations give three steps in the large scale extraction of boron from borax (5marks)

QUESTION THREE (20 MARKS)

- a) Explain why hydrogen can be placed in either Group 1 or 17 of the periodic table (3 marks)
- b) Define the following terms i) Electronegativity (1 mark) ii) Cohesive energy (1 mark)
- c) i) Using a suitable equation give the industrial synthesis of borane (4mks)
ii) Give two characteristics of borane (2marks)
- d) Distinguish between isotopes and allotropes (2marks)
- e) Explain why nitrogen forms only a trifluoride (NF_3), whereas phosphorous and arsenic form two common fluorides, the pentafluoride (PF_5) and the trifluoride (PF_3) (3marks)
- f) Using a suitable equation give the Ostwald's process for manufacture of HNO_3 acid. (4marks)

QUESTION FOUR (20 MARKS)

- a) Explain why graphite is a better electrical conductor than diamond and why its conductivity depends on direction (3marks)
- b) Explain briefly two anomalous behavior of carbon (4 marks)
- c) Explain why PH_3 has lower boiling point than NH_3 (2 marks)
- d) Using a suitable equation show how ammonia can be prepared in the laboratory (2marks)
- e) Give reasons why electron gain enthalpy of fluorine is less negative as compared to chlorine and fluorine is a stronger oxidizing agent than chlorine (3marks)
- f) Account for the fact that xenon forms stable compounds with fluorine whereas argon does not (2marks)

- g) Give two uses of Group 18 elements (1 mark)
- h) Compare the reactivity's of the halogens with water. Write chemical equations in each case. Which halogen is quite different? (3marks)

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