TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY (BTAC 14S/15S2)

ACH 4210: COMPARATIVE STUDIES OF S&P BLOCK ELEMENTS

SERIES: sept 2017

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

THIS PAPER CONSISTS OF FIVE QUESTIONS

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE

Explain briefly, the following observations or facts

a) Li, Be, and B have a greater tendency of forming covalent compounds. **[4mks]**

b) K and Ca are poor complexing agents as compared to members of the d- block elements like Fe **[3mks]**

c)

i. In aqueous solution, the chemistry of Be^{2+} ions is restricted to $\mathbf{[Be(H_2O)_4]^{+2}}$ while Ca^{2+} ions can extend to $\mathbf{[Ca(H_2O)_6]^{+2}}$ yet they are in the same group. [2**mks]**

ii. Using valence bond theory predict the shapes and magnetic properties of the hydrated ions in question (c) (i) above. **[5mks]**

d) Ca metal is harder to cut it using a knife than K metal **[2mks]**

e) Group I metals form anhydrous salt **[2mks]**

f) The covalent radius of Al is roughly 1.4Å, while that of Ga is 1.23Å yet Ga is below Al on the periodic table **[2mks]**

g) $NaNO_3$ is thermally more stable than $\mathbf{Ca(NO_3)_2}$. **[2mks]**

h) Group I elements are stored under liquid hydrocarbons or in a sealed container **[2mks]**

i) Down the group 3 members the formula of halides changes from $\mathbf{MX_3}$ to **MX** **[3mks]**

j) LiO_2 does not exist, but **Li_2O** exist **[2mks]**

k) The only binary compounds of noble gases are fluorides and oxides. **[1mk]**

QUESTION TWO

a)

i. What is meant by the term diagonal relationship? **[2mks]**

ii. Using stoichiometric equations state three diagonal relationships between Li and Mg. **[6mks]**

b)

i. State the main ore of aluminum **[1mk]**

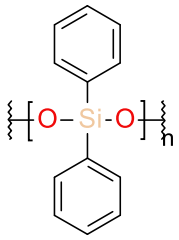
ii. Using chemical equations explain how Al is recovered from its ore. **[6mks]**

iii. Explain why molar mass of $AlCl_3$ increases above room temperature **[1mks]**

iv. State four economic importance of Al metal **[4mks]**

QUESTION THREE

(a) Starting with SiX_4 (X = halide), illustrate how silicone of an aryl derivative can be prepared. **[6mks]**



(b) State any three uses of silicones **[3mks]**

(c) The table below represents some properties of the hydrides of group 6 elements. Use the information contained in the table to answer the questions that follow.

Hydride	ΔH of formation	Bond angle	Boiling point ◦C
H_2O	-242	H-O-H, 104°28’	100
H_2S	-20	H-S-H, 92°	- 60
H_2Se	+81	H-Se-H, 91°	- 42
H_2Te	+154	H-Te-H, 89°	- 2.3

Explain the trends in;

i. Stability of the hydrides. **[4mks]**

ii. Bond angle **[3mks]**

iii. Boiling point **[4mks]**

QUESTION FOUR

(a)

(i) Suggest reasons for and against inclusion of H in the main group elements. **[6mks]**

(ii) What is meant by 'hydrogen gap'? How does it a rise **[2mks]**

(iii) Write down the general chemical equations for the reaction between hydrides of group I and group II with water **[2mks]**

(b) Give the other name for 'inorganic benzene,' how is it different from benzene **[2mks]**

(c) Starting with Na $[BH_4]$, explain how you can prepare $B(OH)_3$ **[4mks]**

(d) By the use of equations explain the causes of temporary hardness of water and how it is removed **[4mks]**

QUESTION FIVE

(a) Compare and contrast the formulas and stabilities of the oxidation states of the common nitrogen chlorides and phosphorous chlorides. **[3mks]**

(b) What is meant by contact process? **[1mk]**

(c) State the raw material and the condition required for contact process **[5mks]**

d) Give an account for large scale manufacture of H_2SO_4 **[8mks]**

e) State any three economic importance of sulphuric acid **[3mks]**