Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

BTAC

ACH 4210 : COMPARATIVE STUDY OF S AND P BLOCK ELEMENTS

SPECIAL/SUPPLEMENTARY EXAMINATION

OCTOBER 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

a) (i) Write the chemical equations for the reaction between the following oxides and water, and name the products: Na_2O, P_4O_{10}, SO_3 Cl_2O_7. **(6marks)**

(ii) Comment on the nature of the above oxides in view of their reactions with water.

(2marks)

b) Explain the following :-

(i) $MgSO_4$ is readily soluble in water, while $BaSO_4$ is virtually insoluble. **(7marks)**

(ii) LiBr is only sparingly soluble in water, but very soluble in methanol. **(3marks)**

c) (i) Explain the trend of acid strength of aqueous hydrogen halides. **(4marks)**

(ii) Give FOUR factors to which the differences between the chemistry of fluorine and the other halogens can be attributed. **(4marks)**

(iii) State FOUR applications of the Group II elements and their compounds.

(4marks)

Question TWO

a) (i) Explain the trends in crystallographic and hydrated radii of the alkali metal ions in the following table.

Metal ion	Li^+	Na^+	K^+	Rb^+	Cs^+
Crystal radii (A˚)	0.85	1.10	1.40	1.55	1.82
Hydrate radii(A˚)	3.40	2.75	2.30	2.25	2.22

(5marks)

(ii) State any FIVE applications of the alkali metals and their compounds. **(5marks)**

b) (i) Give the structure of diborane and explain the concept of three-centre two-electron bonds in the bridges **(6marks)**

(ii) Outline TWO synthetic applications of diborane. **(4marks)**

Question THREE

a) Elemental oxygen occurs in two allotropic forms oxygen molecule and ozone.

(i) Write the Lewis structures of the two allotropes. **(4marks)**

(ii) Explain the order of reactivity of the allotropes. **(3marks)**

(iii) State THREE common applications of oxygen and ONE of ozone. **(4marks)**

b) Explain the variation in the boiling points of the Group VI hydrides in the following table

Hydride	H_2O	H_2S	H_2Se	H_2Te
Boiling point (˚C)	100	-61	-42	-2

(5marks)

c) Thallium (Group III) forms both $TICl_3$ and TlCl, the latter being more stable than the former. Explain. **(4marks)**

Question FOUR

a) (i) Explain the trend of basicity of the oxides of group III elements **(8marks)**

(ii) Give THREE applications of aluminium or its compounds, explaining the property exploited in each case. **(6marks)**

b) Boiling points of the halogens and hydrogen halides are given in the following table.

Elements, X		F	Cl	Br	I
Boiling point (˚C)	X	-188	-34	59	183
	HX	+20	-85	-67	-35

Explain the trend of:

(i) The boiling point of the halogens **(2marks)**

(ii) The boiling point of the hydrogen halides **(4marks)**

Question FIVE

a) Explain the following observations

(i) In group IV, carbon (1^{st} row element) has a stronger tendency to catenation than its homologues, while in group VI, sulphur (2^{nd} row element) has a stronger tendency to catenation relative to the other group members. **(5marks)**

(ii) The O-O and O-F bonds are much weaker than S-S and S-F bonds, while O-H and O-C bonds are much stronger than S-H and S-C bonds. **(5marks)**

b) (i) Explain why the solubility products of the carbonates of Group II elements decrease, while those of the fluorides increase down the series . **(7marks)**

(ii) State THREE applications of Group III elements and their compounds. **(3marks)**