

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE, BACHELOR OF EDUCATION SCIENCE**

CHEM 212: COMPARATIVE STUDY OF S AND P-BLOCK ELEMENTS**STREAMS: BED (SCI), BSC****TIME: 2 HOURS****DAY/DATE: THURSDAY 11/08/2016****8.30 AM – 10.30 AM****INSTRUCTIONS:****Answer Question One and any other Two Questions****Question One (Compulsory) – 30 Marks**

- (a) Compared with other elements in other groups, the alkali metals (Group I) i.e. Li, Na, K, Rb and CS are comparatively characterized with low Melting Point M.P., B.P., electronegativity and their compound are of high ionic character.
- (i) Give an adequate explanation for the above observations. [3 marks]
 - (ii) With the help of three examples, show how Li metal behaves anomalously from other elements in the same group. [6 marks]
 - (iii) Explain the trends in the reactivity of alkali metals towards water. [2 marks]
 - (iv) Describe the trends in terms of thermal stability and solubility in polar solvents of salts (both small and large anions) of the alkali metals down the group. [3 marks]
- (b) State three properties of lithium metal which make it suitable for use as an excellent coolant in heat exchangers. [3 marks]
- (c) Alkali metals are not known to form many complex compounds. Explain briefly the kind of the ligands and what complexes they are able to form. [3 marks]

- (d) Be^{2+} and Al^{3+} have some similarities (diagonal relations).
- (i) State three reactions in which these two elements show similarity. [3 marks]
 - (ii) Write a balanced chemical equation for the reaction between the group II (alkaline Earth metal) and carbon (C). [1 mark]
 - (iii) Write a balanced chemical equation for the hydrolysis (reaction with water) of the product formed in (ii) above. [2 marks]
- (e) Solutions of Be^{2+} and Al^{3+} salts are acidic (diagonal relations). Describe and explain with the help of relevant chemical equations why the salts are acidic in solution. [4 marks]

Question Two (20 Marks)

- (a) Mg occurs in nature both as dolomite and carnallite.
- (i) Give the chemical formulae of the two ores of Mg. [2 marks]
 - (ii) Briefly explain how Mg is obtained from dolomite. [3 marks]
 - (iii) Write a balanced chemical equation between Mg and C to form magnesium carbide. [1 mark]
 - (iv) Write a balanced equation for the hydrolysis (reaction of the carbide with water) of magnesium carbide. [2 marks]
- (b) Explain how the Grignard reagent is synthesized. [2 marks]
- (c) Explain the following:
- (i) In group III boron forms covalent compounds rather ionic compounds. [2 marks]
 - (ii) Boron is always trivalent rather than monovalent. [2 marks]
- (d) (i) Explain the term "Inert Pair Effect" as observed in group III elements (B to Tl). [3 marks]
- (ii) Describe the composition of alums commonly associated with elements in group III. [3 marks]

Question Three (20 Marks)

- (a) Catenation is associated with group IV elements. Describe what catenation is and how it varies down the group. [3 marks]

- (b) Carbon forms carbides with elements of lower or equal electronegativity.
- (i) State the three types of carbides formed. [3 marks]
 - (ii) Mention the general preparative methods for carbides of all the three types mentioned in b (i) above. [3 marks]
 - (iii) Write a balanced chemical equation for the hydrolysis of aluminium carbide (Al_4C_3) [2 marks]
- (c) Silica (SiO_2) is one of the compounds formed between oxygen and silicon;
- (i) Name two forms of pure SiO_2 in which it occurs. [2 marks]
 - (ii) Explain how silicates are formed starting with silica (SiO_2). [2 marks]
 - (iii) Give the basic structure of ortho-silicates. [2 marks]
- (d) Alumino-silicates which are formed from the three dimensional framework of ortho-silicates (SiO_2)_n by replacement of some silicon atoms by aluminium are among the most widespread, diverse and useful silicate minerals in nature.
- (i) Name the three types of these alumina-silicates. [1 ½ marks]
 - (ii) Mention three important uses of these materials which occur naturally. [1 ½ marks]

Question Four (20 Marks)

- (a) Nitrogen is the first element in group V. It reacts with more electropositive elements to nitrides.
- (i) Name the three types of nitrides formed with the elements. [3 marks]
 - (ii) Show with the help of equations under what conditions NH_3 reacts with oxygen to form N_2 and NO , respectively. [3 marks]
 - (iii) Show how the elements in the group (V) change their chemical behavior down the group. [3 marks]
- (b) Describe the interrelationships of sulphur trioxide (SO_3), Sulphuric acid and oleum. [2 marks]
- (c) Fluorine (F_2) is in group VII
- (i) Name three ores in which F_2 occurs in nature. [3 marks]

- (ii) Give the respective chemical formulae of the ores in b (i) above. [3 marks]
- (iii) Give adequate explanation for the high reactivity of F_2 . [3 marks]
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