



# MASEÑO UNIVERSITY

## UNIVERSITY EXAMINATIONS 2012/2013

SECOND YEAR SECOND SEMESTER EXAMINATIONS  
FOR THE DEGREE OF BACHELOR OF SCIENCE AND  
BACHELOR OF EDUCATION (SCIENCE) WITH  
INFORMATION TECHNOLOGY  
(MAIN CAMPUS)

### SCH 205: INORGANIC CHEMISTRY II

*Date: 19<sup>th</sup> July, 2013*

*Time: 11.00 a.m.- 1.00 a.m.*

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**SCH205 INORGANIC CHEMISTRY II**

**ANSWER ANY FIVE QUESTIONS**

**QUESTION ONE**

- (a) When an alkali metal dissolves in liquid ammonia the solution acquires a blue colour. On standing the, colour changes to bronze colour. Explain these colour changes. [3 mks]
- (b) Why is  $\text{Li}_2\text{CO}_3$  decomposed at a lower temperature whereas  $\text{Na}_2\text{CO}_3$  at higher temperature? [2 mks]
- (c) Lithium resembles magnesium in some of its properties.
- (i) Mention two such properties. [2 mks]
  - (ii) What name is given to the resemblance in c(i) above? [1 mk]
  - (iii) Give the reason for the resemblance in c(i) above. [1 mks]
- (d) Why are alkali metals never found in free state in nature? [1 mk]
- (e) What is an oxo-acid? [1 mk]
- (f) Hydrogen can form compounds with other elements in three ways. State and explain each of these three ways. [3 mks]

**QUESTION TWO**

- (a) Draw the structure of (i)  $\text{BeCl}_2$  (vapour) (ii)  $\text{BeCl}_2$  (solid). [2 mks]

(b) When water is added to compound (A) of calcium, solution of compound (B) is formed. When carbon dioxide is passed into the solution, a white precipitate (compound C) is formed. If excess of carbon dioxide is passed into the solution containing C, the white precipitate disappears due to the formation of compound (D).

(i) Identify the compounds A, B, C and D. [4 mks]

(ii) Explain why the white precipitate disappears in the last step. [1 mk]

(c) Explain why alkali metals and their salts impart characteristic colour to an oxidizing flame while beryllium and magnesium do not. [2 mks]

(d) Give the three classifications of binary hydrides of hydrogen. [1.5 mks]

(e) Indicate the type of elements that combine with hydrogen to give each of the binary hydrides in (2e) above. [1.5 mks]

(f) Explain why  $D_2O$  does not support life and is actually toxic if administered to mammals in large amounts unlike  $H_2O$ . [1 mk]

(g) Water bodies that have no outlet, such as Lake Nakuru, have significantly higher concentrations of deuterated water than does those with at least an outlet. Explain. [1 mk]

3. (a) Impurities in bauxite are gotten rid off during production of Al from impure aluminium oxide. Briefly with the aid of chemical equations show the behaviour of  $Al_2O_{3(s)}$  and the impurities  $Fe_2O_{3(s)}$  and  $SiO_{2(s)}$  in the presence of concentrated  $NaOH_{(aq)}$ . [3 mks]

(b) Carbon exhibits allotropy in its existence.

(i) What is meant by the term allotropy as applied to an element? (1 mk)

(ii) Give sketches of the structures of the common allotropes of carbon. (2mks)

(c) Explain the differences in the following properties between the common allotropes of carbon.

I. Electrical conductivity

II. Relative chemical reactivity

(4 mks)

(d) Inert pair effect is first experienced in Group III or 13 of the s and p block elements. The effect is more pronounced in Groups 14 and 15.

(i) Explain the meaning of inert pair effect. (2 mks)

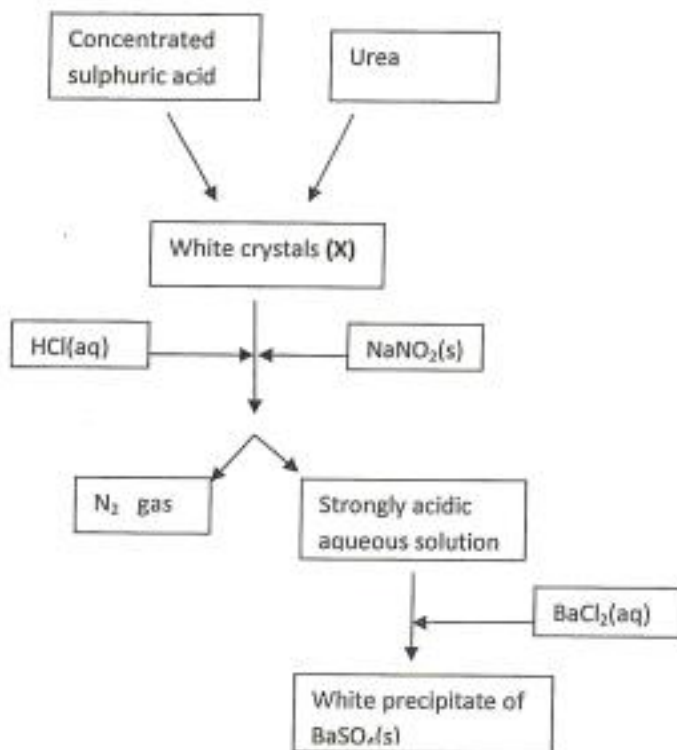
(ii) Explain the cause of the inert pair effect. (2 mks)

4. (a) State one major source for each of the elements nitrogen and phosphorus. Briefly describe how these two elements are extracted from the sources? (4 mks)

(b) The element arsenic (As) easily do form 5-covalent compounds while the 5-covalent compounds are not possible for nitrogen. Explain. (N= 7, As = 33)

(3 mks)

- (c) Nitrogen can form a number of oxides with oxygen. Give the chemical formulae of these oxides and for each case state the oxidation state of nitrogen in the molecule. (5 mks)
- (d) With the aid of appropriate chemical equations, show how bismuth (Bi) is extracted from bismuth sulphide ( $\text{Bi}_2\text{S}_3$ ). (2mks)
5. (a) The action of concentrated sulphuric acid on urea results in the production of a white crystalline solid X of formula  $\text{H}_3\text{NO}_3\text{S}$ . This is a monobasic acid. On treatment with sodium nitrite and dilute hydrochloric acid at  $0^\circ\text{C}$  it liberates one mole of  $\text{N}_2$  per mole of X and on addition of aqueous barium chloride the resulting solution yields one mole of  $\text{BaSO}_4$  per mole of X taken. Study the scheme below and;



(i) Deduce the structure and name of X. [4 marks]

(ii) Write chemical equations to depict the reactions taking place at each step. [3 marks]

5. (b) Hydrogen peroxide decomposes easily, especially if exposed to light or contaminated with traces of transition metals. The decomposition



can occur explosively in the case of the pure liquid.

(i) Why is hydrogen peroxide rather unstable? [2 marks]

- (ii) Indicate the oxidation state of each oxygen species in the above reaction. [3 marks]
- (iii) Mention two uses of hydrogen peroxide. [2 marks]
6. (a) Since bromine was discovered, various bromine compounds have been put to important use. Explain briefly how bromine compounds are used in;
- (i) Water purification,
  - (ii) Agriculture,
  - (iii) Healthcare,
  - (iv) Photography. [8 marks]
6. (b) Several alkali fluoride complexes with  $\text{XeOF}_4$  are known. In these compounds  $\text{XeOF}_4$  behaves as a fluoride ion acceptor:
- (i) Draw the molecular structure of  $\text{XeOF}_4$ . [2 marks]
  - (ii) Write balanced chemical equations for the reactions of  $\text{XeOF}_4$  with  $\text{N}(\text{CH}_3)_4\text{F}$  and  $\text{CsF}$  in each case. [4 marks]

*The end*