



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

INORGANIC CHEMISTRY I

SCH 1101

First Semester Examination Paper

December 2014

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Periodic Table

Examiner's Name: DR H. Chiririwa

INSTRUCTIONS

1. Answer all four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
TOTAL	100

Copyright: National University of Science and Technology, 2014

SCH 1101

1. (a) Based on its position in the periodic table, Draw the condensed electron configuration for (i) Bi, (element 83),
(ii) Co, (element 27),
(iii) Te, (element 52). [9 marks]
- (b) How many unpaired electrons does a bismuth atom have? [2 marks]
- (c) Which family of elements is characterized by an ns^2np^2 electron configuration in the outermost occupied shell? [2 marks]
- (d) Define Hund's first rule and Pauli's exclusion principle. [6 marks]
- (e) Specify the set of quantum numbers used to describe an orbital and state what values of each are possible. [6 marks]
2. (a) What determines the shape of a molecule? [3 marks]
- (b) What is the Valence-Shell Electron-Pair Repulsion Theory (VSEPR) [3 marks]
- (c) Use the VSEPR model to predict the molecular geometry of:
(i) PCl_5
(ii) SF_4 ,
(ii) ClF_3 . [6 marks]
- (d) Indicate the orbital hybridization around the central atom in NH_2^- [6 marks]
- (e) Describe the bonding in the nitrate ion, NO_3^- . Does this ion have delocalized bonds? [7 marks]
3. (a) Draw the Lewis symbols for nitrogen and fluorine and use them to predict the formula of the stable binary compound formed when nitrogen reacts with fluorine and draw its Lewis structure. [7 marks]

Copyright: National University of Science and Technology, 2014

(b) Compare the Lewis symbol for neon with the Lewis structure for methane

In what important way are the electron arrangements about neon and carbon alike? In what important way are they different?

[8 marks]

(c) Which of the following bonds is most polar: S—Cl, S—Br, Se—Cl, or Se—Br? Explain

[4 marks]

(d) Draw the Lewis structure for:

(i) PCl_3 .

(ii) HCN

(iii) XeF_2

[6 marks]

4. (a) Name the three (3) reaction types and give an example of each.

[6 marks]

(b) What is a formula weight?

[2 marks]

(c) What is a limiting reactant?

[2 marks]

(d) What is theoretical yield?

[2 marks]

(e) Calculate the formula weight of:

(i) Sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (table sugar),

(ii) Calcium nitrate, $\text{Ca}(\text{NO}_3)_2$

(iii) Aluminium hydroxide $\text{Al}(\text{OH})_3$ and

(iv) Methanol CH_3OH

[8 marks]

(f) Calculate the percentage of carbon, hydrogen, and oxygen (by mass) in $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

[3 marks]

(g) Calculate the number of moles of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in 5.380 g of $\text{C}_6\text{H}_{12}\text{O}_6$.

[2 marks]