NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
SUPPLEMENTARY EXAMINATIONS – AUGUST 2011
INORGANIC CHEMISTRY I – SCH 1101
FOR SCH AND TTE STUDENTS
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

This paper comprises five (5) questions. Attempt to answer ***all*** the questions. Each question carries twenty (20) marks. Start your answer to each question on a new page.

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1. (a) Define Hund's first rule and show how it is used to specify in detail the electron configurations of the elements from Li to Ne.

(11 marks)

(b) What geometric arrangement would you expect from the following set of hybrid orbitals: dsp^2, d^2sp^3 and dsp^3? Give one example for each of the hybrid orbital.

(9 marks)

2. (a) Using VSEPR Theory, predict the geometry of the following interhalogen species:
(i) BrF_3 (ii) IF_5 (iii) IBr_2 (9 marks)

(b) Calculate the volume of hydrogen at standard temperature and pressure produced when 4.8g of magnesium is dissolved in excess hydrochloric acid. (6 marks)

(c) Write a balanced equation of the reaction between potassium hydroxide and phosphoric acid.

(5 marks)

3. (a) Define the co-ordination number of a cation and an anion in a crystal lattice

(4 marks)

(b) Which of the two cations Na^+ or Cs^+ would you expect to have a higher co-ordination number and why?

(2 marks)

(c) Draw Lewis diagrams and predict structures of dimethyl sulfide, $[CH_3]_2S$, and dimethylsulfoxide, $[CH_3]_2SO$. How will the CSC bond angles differ?

(8 marks)

(d) Indicate the type of hybridization (sp, sp2, etc) for the underlined atoms in $Cl_2\underline{C}=O$, $\underline{Mg}F_2$ and $\underline{P}Cl_6^-$

(6 marks)

4. (a) Define the following terms:
(i) electron configuration of an atom
(ii) microstate
(iii) term
(iv) multiplicity

(8 marks)

(b) Calculate the lattice energy for KI using the Born-Madelung approximation given that:

$N=6.022x10^{23}$ ion pairs/mol M (Madelung Constant) =1.74756
$Z^+=1$ $Z^-= -1$ $e=1.602x10^{-19}C$ $4\pi\epsilon_0 = 1.113x10^{-10}$
$C^2J^1m^{-1}$ $r_0 = 0.358nm$ Born Exponent n=9.5

(9 marks)

(c) Using noble gas configuration, write the electronic configuration of Meitnerium
^{109}Mt (3 marks)

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5. (a) Show with drawings the difference between cubic and hexagonal close packing in ionic compounds.

(8 marks)

(b) Deduce the geometries of the following:

(i) I_3^- (ii) ClO_3^- (iii) ClO_3^+ (iv) Fe_2SeO (v) $IO_2F_2^-$ (vi) XeO_3F_2

(12 marks)

End of question Paper!!!