NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
SUPPLEMENTARY EXAMINATIONS – AUGUST 2010
INORGANIC CHEMISTRY II – SCH 1201
TIME: (3) THREE HOURS

INSTRUCTIONS TO CANDIDATES

MATERIAL
Periodic table.

INSTRUCTIONS TO STUDENTS
Answer All questions in section A and Any Three questions in Section B.
Answer each question on a FRESH page.

SECTION A *Answer ALL questions. Each question carries 10 marks*

1. (a) What do you understand by the terms: Outer-coordination sphere and Inner-coordination sphere? [4 marks]

   (b) Draw the structure of the following complex:

   Bis(ethylenediamine)cobalt(III)-μ-amido-μ-superoxobis(ethylenediamine)cobalt(III) [2 marks]

   (c) Name three common geometries associated with the six-coordination. Draw the structure of one of them [4 marks]

2 .(a) Use chemical reactions to illustrate the four systems of defining acids and bases. In your equations, indicate the acids and the bases. [8 marks]

   (b) State any two major properties of solvents that are considered when selecting a solvent. [2 marks]

3. (a) What do you understand by the term *trans-metal*? [2 marks]

   (b) Name any four metals that are part of the Platinum group metals. [4 marks]

   (c) Carbon forms both discrete polyatomic molecules, extended and giant structures
   (i) Name one discrete polyatomic molecule of carbon.
   (ii) What is *catenation*? [4 marks]

4. (a) With the aid of a d-orbital spitting diagrams, show which d^n electron configurations are capable of giving both low spin and high spin configurations in an octahedral ligand field [8 marks]

(b) Bonding. What is metal-to-ligand bonding? What is the other type of bonding? [2 marks]

SECTION B

Answer ONLY THREE questions from this section.

5. (a) Calculate, in units of Δ_0, the LFSEs of the following high-spin ions in their octahedral complexes V^{3+}, Cr^{2+}, Cu^{2+}, Zn^{2+} , Sc^{3+}, Ni^{2+} [12 marks]

(b) Draw the metal atom or ion orbitals that are able to take part in pi-bonding in complexes [8 marks]

6. (a) Substitution reactions of Octahedral complexes. There are four main mechanisms that have been established for these reactions. Name these four mechanisms and use the substitution of ligand X by ligand Y in the ML_5X complex to illustrate each. [8 marks]

(b) Name the following complex compounds and ions:
(i) $[Pt(NH_3)_5Cl]Cl_3$, (ii) $Mg[Ni(CN)_4]$, (iii) $Fe(H_2O)_3Cl_3$,
(iv) $[Fe(CO)_6]Cl_3$ [6 marks]

(c) Write the appropriate formula for the named complex:
(i) Potassium pentacyanonitrosylferrate(III)
(ii) Sodium tetrachloroferrate(II) dehydrate
(iii) Pentaamminecobalt(III) pentacyanoaquaferrate(II) [6 marks]

7. (a) In discussing solubility of solutes in solvents there are three main cases. State these cases, and briefly explain them. [10 marks]

(b) HCl, HNO_3, and H_2SO_4 are acids. How can these acids be distinguished according to acid strength? [3 marks]

(c) What is a superacid? Give two important uses of superacids. [3 marks]

(d) Sulphuric acid is one of the most common protic acids. The equilibria of pure sulphuric acid is known to be complex, write down its self-ionization reaction and any three hydration-dehydration equilibrium reactions. [4 marks]

END OF QUESTION PAPER!!!