Chem 370 - Spring, 2019
Assignment 7

Reading Assignment

We will next discuss the physical chemistry of transition metal complexes. Start by reading sections 9.1 and 9.2. Section 9.1 gives a little background on the history of coordination chemistry, and section 9.2 discusses nomenclature. I will not test you specifically on either of these topics. However, it is essential that you be familiar with the nomenclature of coordination compounds, because I will use it routinely as we cover the material in Chapters 10 through 12. Similarly, skim through all of section 9.3 on isomerism. I want you to be familiar with the terminology of isomerism and know the cases where certain types are possible, but I will not ask you, say, to list all of the isomers of some complex or specifically test you on isomerism. We will start by covering the material in Chapters 10 and 11, so you should be reading these for understanding. I will not discuss the angular overlap method (section 10.4), but we will talk about many of the topics in this section from a different perspective.

Test 2

As you will note from the course calendar, Test 2 will consist of two parts, given in the morning and afternoon meeting times on April 22nd. It will cover all the lecture material corresponding to the assigned sections in Chapters 5, 6, and 7, and a portion of the material in Chapter 10, depending on how far we progress. I will announce the exact cut-off point in class. Use the class overheads, your notes, and especially the homework assignments for preparation.

Part 1 will have a mixture of short answer or multiple choice problems, covering all of the material since the last test. Be sure you know the homonuclear diatomic MO scheme, and MO arguments like those we covered that are related to acid-base chemistry. Know the acid-base theories we covered, and be prepared to answer questions similar to the homework problems. Know the principles of crystal chemistry that we covered, and be prepared to answer questions similar to the homework problems on this material. Know the principals of crystal field theory and transition-metal MO theory to the cut-off point, to be announced.

Part 2 may start with one or two short essay questions on the covered material. I usually give several essay questions, from which you can choose the two you wish to answer. The rest of Part 2 will be devoted to a group theory problem dealing with MO theory or hybrid orbitals. I will not ask you to develop a full MO scheme from scratch. However, you may be asked to use group theory to determine symmetries of central atom AOs and pendant atom SALCs, and from that information determine what bonding/antibonding or nonbonding MOs can be formed. You might be asked to sketch some of these combinations. In the past, I have given a skeleton MO scheme and asked students to draw connecting lines between AOs, SALCs, and MOs, and to give symmetry and bond-type labels to the diagram. Alternately, you could be given a group theory problem dealing with construction of hybrid orbitals. See the posted exams from last year for a better idea of the coverage of the two parts of Exam 2.

Homework Assignment

This homework assignment will be discussed during our regular class time on Friday, April 5th.

Do the following problems from Chapter 6 in your text (4th edition equivalents in parentheses): [6.1], 6.3 (6.3), [6.4], 6.22 (6.15), 6.36 (6.29), 6.37 (6.30), 6.39 (6.32). Problems 6.1 and 6.4 are similar to problems 6.1 and 6.7 in the 4th edition, but the new problems have different compounds. The new problems are reproduced below.

In chapter 7, do problems 7.3, 7.5 (The pictured structures, from left to right, are NaCl, CsCl, and CaF_2.), 7.11, 7.16, and 7.19 (Use the Born-Mayer equation to calculate U with $\rho =$ 30 and $e^2/4\pi\varepsilon_0 = 2.307 \times 10^{-28}$ J·m). The problem numbering is the same in the 4th edition.

Problems New to the 5th edition

6.1 For each of the following reactions, identify the the acid and the base. Also indicate which acid-base definition (Lewis, Brønsted-Lowry) applies. In some cases, more than one definition may apply.

a. $AlBr_3 + Br^- \rightarrow AlBr_4^-$
b. $HClO_4 + CH_3CN \rightarrow CH_3CNH^+ + ClO_4^-$
c. $Ni^{2+} + 6\ NH_3 \rightarrow [Ni(NH_3)_6]^{2+}$
d. $NH_3 + ClF \rightarrow H_3N\cdots ClF$
e. $2\ ClO_3^- + SO_2 \rightarrow 2\ ClO_2 + SO_4^{2-}$
f. $C_3H_7COOH + 2\ HF \rightarrow [C_3H_7C(OH)_2]^+ + HF_2^-$

6.4 The conductivity of BrF_3 is increased by adding KF. Explain this increase, using appropriate chemical equations.