

NAME: _____

CHEM 315 "INORGANIC CHEMISTRY"

FALL, 2000

Professor Kenneth S. Suslick

Hour Exam #3

Friday, December 8, 9:00 - 9:50 am

12 Questions on 8 Pages, including this one.

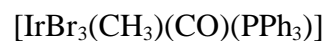
Plus one page, two-sided handout.

200 points as indicated.

Mark all answers directly on the test itself.

3. a. When should the 18 electron rule apply? How do exceptions to it arise? Use at least one diagram to explain. (12 pts)

b. Give the electron count, the oxidation state of metal, and the expected stability for each of the following compounds: (16 pts.)



4. For 5 points each, give an example of a ligand that
- is a strong σ donor but not a π donor or acceptor.
 - is bidentate.
 - is a weak field ligand.
 - is a strong field ligand.
5. Provide an electron count for each metal in the following molecules or fragments: (18 pts)
- $\text{Fe}_3(\text{CO})_{12}$
 - $\text{Co}[\text{PPh}_3]_2\text{Cl}$
 - $\text{CpFe}(\text{CO})_2$
6. The isolobal, or equivalent group concept is very useful in cluster chemistry. For each of the following organometallic fragments, give the equivalent $\text{CH}_n^{+x/-x}$ groups. (12 pts.)

a. CpFe

b. $\text{Co}(\text{CO})_3$

c. $\text{Mn}(\text{CO})_5$

7. Draw the organometallic product of the following reactions and give a name to each reaction. (18 pts.)

a. $\text{Mn}(\text{CO})_5(\text{C}_2\text{H}_5) + \text{CO}$

b. $\text{Rh}(\text{PR}_3)_3(\text{Cl}) + \text{H}_3\text{Cl}$

c. $\text{Fe}(\text{CO})_5 + \text{Na}$

8. Define the following terms: (4 pts each)

a) homogeneous catalyst

b) heterogeneous catalyst

c) turnover frequency

d) catalyst selectivity

e) Volcano plot (draw one)

9. Zeolites are an important class of inorganic materials.

a. What elements are present in zeolites? (6 pts.)

b. Where does the name come from? (4 pts.)

c. Give one technological application of zeolites and describe the function of the zeolite. (6 pts.)

10. a. Thermodynamic and kinetic trends often correlate. Whose postulate is this? Graphically describe the relationship between energy and reaction coordinate that explains this. (8 pts.)

b. What is the inverted region in electron transfer theory? Explain its origins graphically. Whose idea was this? (8 pts.)

11. In our discussions of bioinorganic chemistry, heme proteins were prominent. It was noted that one role of the protein in myoglobin was to provide *site isolation*. Write out the reactions that prevent reversible O₂ binding in simple iron porphyrins (8 pts.)

12. Draw the general structure of the three types of iron-sulfur protein active sites. (16 pts)