**Class Assignment 6 (Organometallic Chemistry)** 4/15/2021

Name: Max Shi

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**Questions (20 pts):**

**Q1. Which of the following obey 18 electron rule?**

1. Fe(CO)5
2. [Rh(bipy)2Cl]+

CO – 5 x 2 e- = 10 e-  
Fe(3d8) – 8 e- = 8 e-

Total = 18 e-

Obeys electron rule

Bipy – 2 x 4 e- = 8 e-

Cl – 2 e- = 2e-

Rh2+ (4d7) = 7e-

Total = 17e-

Does not obey 18 electron rule.

**Q2. On the basis of 18-electron rule. Identify the first-row transition metal for each of the following:**

1. [M(CO)7]+

CO – 7 x 2e- = 14 e-  
M+ should have 4 more electrons to obey 18 electron rule, so configuration has 5 electrons. This is consistent with vanadium.

**Q3. On the basis of 18-electron rule, determine the expected charge on the following:**

[Co(CO)3]X

CO – 3 x 2e- = 6 e-

Co(4s2 3d7) – 9 e- = 9 e-

Total = 15 e-

To complete the 18 electrons, this complex must have a charge of 3-.

**Q4. Which of the following square-planar complexes have 16-electron valence configuration?**

1. Ir(CO)Cl(PPh3)2

CO – 1 x 2 e- = 2e-  
Cl – 1 x 2 e- = 2e-  
PPh3 – 2 x 2 e- = 4e-  
Ir+ (5d8) – 8 e-  
Total = 16 e-  
Has 16 electron valence configuration.

1. [RhCl(PPh3)3]

PPh3 – 3 x 2 e- = 6 e-  
Cl – 1 x 2 e- = 2 e-  
Rh+ (4d8) – 8 e- = 8 e-  
Total = 16 e-  
Has 16 valence electron configuration.

**Q5. Which of the following complexes is inert or labile?**

1. Hexaiodomaganate(IV)  
   MnI6 – Mn has +4 charge, so its configuration is (3d3), which is d3, and inert.
2. Hexacyanoferrate(III)  
   Iron has a +3 charge, so its configuration is (3d5), which is d5, and due to the CN ion, it is low spin. Therefore, it is inert.
3. [Cr(H2O)6]2+Water is neutral, which means Cr has a 2+ charge. This means its configuration is 3d4, or d4. Because water is a weak field ligand, this is a high spin complex, which means it is labile.
4. Cr(CN)6]4-CN contributes a -1 charge, which means Cr has a 2+ charge. This means its configuration is d4. Due to the strong field ligand CN, this is a low spin complex, making the complex inert.

**Q6. (a)** Classify the following 5 reactions as

**oxidative addition or reductive elimination or migratory insertion or ligand association or ligand dissociation.**

**Note: you may use above options as more than once or may not use at all**



Pd(II)

1. Oxidative addition
2. Isomerization
3. Substitution
4. Isomerization
5. Reductive elimination