

Practice**Exam 3****Show all work and set ups in an organized way. See last page for constants.**

1) A particular complex ion absorbs light at a wavelength of 520 nm. What is the frequency of this light? What is the energy in joules? What color of light is observed? Is the ligand most likely a weak field ligand or strong field ligand?

Answer: Energy _____ Observed Color _____
Frequency _____ Type of Ligand _____

2) Complete and balance the following equation and use the appropriate values of K_{sp} and K_f to find the equilibrium constant for the following reaction:
 $\text{FeS}(s) + _ \text{CN}^-(aq) \rightleftharpoons$

Answer _____

3.) Find the solubility of CuI in 0.67M HCN solution. The K_{sp} of CuI is 1.1×10^{-12} . Show balanced equation.

Answer _____

4. For the following complex ion draw the valence bond theory diagram and the crystal field theory diagram. Label the diagrams as shown in lecture. Label all orbitals.



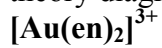
a. Valence bond diagram:

b. Crystal Field diagram

c. Is the species high spin or low spin	
d. Is the species paramagnetic or diamagnetic	
e. State the hybridization	
f. State the shape	
g. Which is greater crystal field splitting energy or pairing energy?	
h. Is(are) the ligand(s) weak field or strong field	
i. Coordination number	
j. Name the species	

Draw all of the isomers of $[\text{ZnBrClFH}_2\text{O}]^{2-}$. Label the isomers as cis/trans, fac/mer etc. where appropriate.

5. For the following complex ion draw the valence bond theory diagram and the crystal field theory diagram. Label the diagrams as shown in lecture. Label all orbitals.

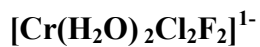


a. Valence bond diagram:

b. Crystal Field diagram

c. Is the species high spin or low spin	
d. Is the species paramagnetic or diamagnetic	
e. State the hybridization	
f. State the shape	
g. Which is greater crystal field splitting energy or pairing energy?	
h. Is(are) the ligand(s) weak field or strong field	
i. Coordination number	
j. Name the species	

6. For the following complex ion draw the valence bond theory diagram and the crystal field theory diagram. Label the diagrams as shown in lecture. Label all orbitals.

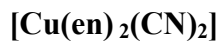


a. Valence bond diagram:

b. Crystal Field diagram

c. Is the species high spin or low spin	
d. Is the species paramagnetic or diamagnetic	
e. State the hybridization	
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g. Which is greater crystal field splitting energy or pairing energy?	
h. Is(are) the ligand(s) weak field or strong field	
i. Coordination number	
j. Name the species	

7. For the following complex ion draw the valence bond theory diagram and the crystal field theory diagram. Label the diagrams as shown in lecture. Label all orbitals.

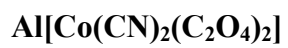


a. Valence bond diagram:

b. Crystal Field diagram

c. Is the species high spin or low spin	
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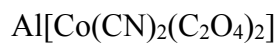
8. Draw two linkage isomers of



Name the compound $\text{Al}[\text{Co}(\text{CN})_2(\text{C}_2\text{O}_4)_2]$ _____

What type of bond exists between the aluminum and the complex ion? _____

9. Draw two enantiomers of



10. The complex ion $[\text{NiCl}_4]^{2-}$ has two unpaired electrons whereas $\text{Ni}(\text{CN})_4^{2-}$ is diamagnetic. Draw structures of these two complex ions that explain the magnetism. Give a brief explanation.

11. $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is violet. Another chromium complex is green. Would that compound most likely be $[\text{Cr}(\text{CN})_6]^{4-}$ or $[\text{Cr}(\text{Cl})_6]^{4-}$ Draw and label the CF diagrams and give a brief explanation for your claim.

TEAR THIS SHEET OFF
THIS IS YOUR REFERENCE SHEET

Weaker field-----> Stronger Field

Color	Wavelength
Violet	400-430
blue	430-480
green	480-560
yellow	560-590
orange	590-630
red	630-750

Plank's Constant = 6.626×10^{-34} J (sec)

K formation for complex ions	
Complex Ion	K _f
Ag(CN) ₂ ⁻	3.0 x 10 ²⁰
AgCl ₂ ⁻	1.0 x 10 ⁻⁵
Fe(CN) ₆ ⁴⁻	3.0 x 10 ³⁵
Fe(CN) ₆ ³⁻	4.0 x 10 ⁴³
Hg(CN) ₄ ²⁻	9.3 x 10 ³⁸
Zn(CN) ₄ ²⁻	4.2 x 10 ¹⁹
AlF ₆ ³⁻	4 x 10 ¹⁹
Cd(NH ₃) ₄ ²⁺	1.3 x 10 ⁷
Cd(CN) ₄ ²⁻	7.7 x 10 ¹⁶
CdI ₄ ²⁻	1 x 10 ⁶
Ag(NH ₃) ₂ ⁺	1.7 x 10 ⁷
Cu(NH ₃) ₄ ²⁺	5.6 x 10 ¹¹
Zn(NH ₃) ₄ ²⁺	7.8 x 10 ⁸
Al(OH) ₄ ⁻	3 x 10 ³³
Be(OH) ₄ ²⁻	4 x 10 ¹⁸
Co(OH) ₄ ²⁻	5 x 10 ⁹
Ni(OH) ₄ ²⁻	2 x 10 ²⁸
Pb(OH) ₃ ⁻	8 x 10 ¹³
Sn(OH) ₃ ⁻	3 x 10 ²⁵
Zn(OH) ₄ ²⁻	3 x 10 ¹⁵
Ag(S ₂ O ₃) ₂ ³⁻	4.7 x 10 ¹³