Chem 142 Quiz 7 Spring 2009

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_KEY \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Instructor: Martin Larter

1. For the following,

* Give the oxidation number of the metal.
* Give the coordination number of the metal.
* Describe each ligand as monodentate, bidentate, tridentate, etc.
* If the formula is given, name it; if the name is given, write the formula.
* Draw the coordination sphere.

a. [Co(en)2Br2]+ Coordination Sphere



|  |  |
| --- | --- |
| metal oxidation number | +3 |
| coordination number | 6 |
| describe ligand(s) | en: bidentate  Br-: monodentate |

Name\_\_\_dibromo bis(ethylenediamine) cobalt (III)\_\_

b. potassium dichlorotetracyanoferrate(II) Coordination Sphere



|  |  |
| --- | --- |
| metal oxidation number | +2 |
| coordination number | 6 |
| describe ligand(s) | Cl-: monodentate  CN-: monodentate |

Formula \_\_K4[FeCl2(CN)4]\_\_\_\_

1. The electron configuration of a Cr3+ ion is: \_**\_**[Ar]3d3**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. Draw the structure of the following transition metal complexes.
3. *cis*-[Ir(PPh3)2(CO)Cl]:



1. the two linkage isomers of [Co(OH2)(SCN)Cl2]–:



1. an optically active isomer of [Co(en)(NH3)2Br2]2+:



1. Pentaamminenitrocobalt(III) ion yields a yellow compound and pentaamminenitritocobalt(III) ion yields a red compound. Give the colors and approximate wavelengths of light that are absorbed in those complexes.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **observed**  **color** | **absorbed color of light** | **approximate wavelength**  **of light absorbed** |
| Pentaamminenitrocobalt(III) | yellow | violet | 415 nm |
| pentaamminenitritocobalt(III) | red | green | 525 nm |

1. The hexaaquairon(II) ion is light blue, while the hexacyanoferrate(II) is orange.

* One of these is paramagnetic, and the other is diamagnetic.
* One of these is a high spin complex, and the other is a low spin complex.
* Which one is which? Justify (not using the spectrochemical series).

Hexaaquairon (II) ion is light blue; therefore, it absorbs orange.

Hexacyanoferrate(II) ion is orange; therefore, it absorbs blue.

Blue is a higher energy light than orange, so hexacyanoferrate (II) has a larger energy gap than hexaaquairon(II). Both are octahedral, so we’ll use the eg-t2g splitting. Iron is in a +2 state, so it is a *d6* ion.



As you can see hexaaquairon(II) is high spin and paramagnetic while hexacyanoferrate(II) is low spin and diamagnetic.



Extra credit Draw *mer*, *trans*-[Cr(NH3)3(OH2)(CN)2]+:



The spectrochemical series:

I- < Br- < S2- < SCN- < Cl- < NO3- < F- < OH- < C2O42- < H2O < NCS- < CH3CN < NH3 < en < bipy < phen < NO2- < PPh3 < CN- < CO