Chemistry 448/548 Name: _____
Test 3
Fall 2014

Very Short Answer Questions: (3 points each)

1/2. B_5H_9 is called _____ and has a(n) _____ structure.

3. $B_2H_6 + xH_2O \rightarrow$ _____

4. A defect caused by missing ions from the lattice is called a(n) _____defect.

5. A(n) _____ semiconductor conducts electricity when heated.

6. Surface tension is _____ proportional to the strength of intermolecular forces.

7. Those elements that hydrogen bond do so because of a combination of two factors: their _____ size and high _____.

8. The tetrahedral ligand field stabilization energy for a d^1 metal is _____ Δ_T.

9. The *d*-electron configuration in $V(CO)_6$ is _____.

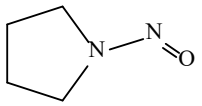
10. What is the minimum number of electrons a stable, octahedral transition metal complex can be expected to have? _____

Discussion Questions: (You must show work to receive credit!)

1. What is doping in the context of seminconductors (be as specific as you can)? What kind of semiconductor is gallium doped into germanium? (6 points)

2. Why is graphite a good conductor, while diamond is not? $(BN)_x$ forms a structure similar to graphite. What kind of conductor would it be and why? (10 points)

3. Crystals of the bis(N-nitrosopyrrolidine)hydrogen cation are typically prepared by evaporationg a solution of N-nitrosopyrrolidine and hexaflurophosporic acid (HPF_6). Explain why HPF_6 is employed as the acid instead of HF. (5 points)



4. List the intermolecular forces <u>from strongest to weakest</u> and provide the proportionalities/ratios for each (how the strength of each changes as a function of charge and distance). Explain why the one typically viewed as weakest may be considerably stronger than expected. (10 points)

5. What is the electroneutrality principle and discuss the physical processes that account for it? (10 points)

6. The bulk formulae of hydrates and clathrates on the surface look the same (e.g. $CaSO_4 \cdot 2H_2O$). In fact, there are two kinds of hydrates. One kind is a subset of clathrates (i.e. clathrates with water as opposed to other molecules). An example of the other kind would be the coordination compound $[Cr(H_2O)_6]Cl_2$. How are they chemically different and why do clathrates form? (5 points)

7. Which of the following would have the larger crystal field splitting energy (Δ_O)? Justify your answer. (10 points)
   a) $PtCl_4$ (square planar) or $[PtCl_6]^{2-}$

   b) $[Co(H_2O)_6]^{2+}$ or $[Co(H_2O)_6]^{3+}$

8. Identify each element. (*Note*: Only 10 of the 11 elements are used.) (1½ point each)

   ___ It has the highest melting and boiling points of the first-row transition metals.

   ___ The high luster of this metal is noteworthy as is the colorful nature of its coordination compounds.

   ___ Its oxide has been used as both white paint pigment and smoke screen for ships.

   ___ A good electrical and thermal conductor that forms two historically important alloys.

   ___ Exhibits the widest range of oxidation states (11 in all) of any element and is the colorant in amethyst.

   ___ Corrosion resistant, ferromagnetic element that forms many industrially important alloys (e.g. Monel)

   ___ Bluish metal which frequently forms coordination compounds.

   ___ It is found naturally in the minerals haematite and magnetite, among others.

   ___ Very dense; pyrophoric when finely divided.

   ___ Chemically very similar to aluminum. It has only one chemically important oxidation state.