Name _____ Test 4 (5/2)
CHEM 0211 (Adv. Inorganic) Spring 2014

1. (10 pts.) Explain how water can act as both a Brønsted-Lowry base and a Brønsted-Lowry acid. In the explanation provide examples of water acting in both ways.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

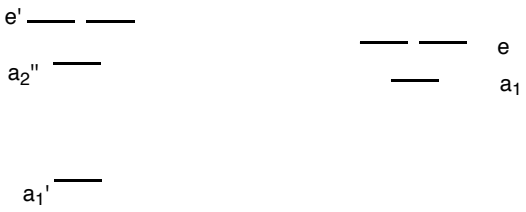
2. (10 pts.) Explain why $HClO_4$ is a stronger acid than $HClO_2$. In your explanation, remember to consider the structure of the conjugate bases.

8. _____

3. (10 pts.) In the gas phase, triethylamine is attracts H^+ more strongly than diethylamine. On the other hand, in aqueous solution the diethylamine more strongly attracts H^+. Explain these observations.

4. The following questions refer to the hypothetical formation of a Lewis acid-base adduct between ammonia and borane (BH_3).

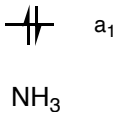
a. (3 pts.) In the reaction of BH_3 and ammonia to form H_3NBH_3, which molecule acts as the Lewis base?



b. (3 pts.) In the reaction of BH_3 and H_3N to form H_3NBH_3, which molecule acts as the Lewis acid?

c. (4 pts.) Circle and label (with acronyms) the MO's that participate in the formation of the acid-base adduct.

d. (4 pts.) Draw the new MO's that form when the adduct forms. Ignore all MO's not directly involved in adduct formation.



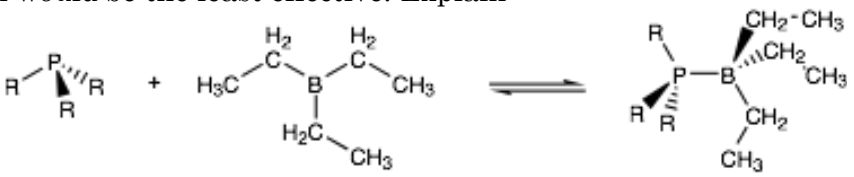
e. (4 pts.) If the only available orbital on BH_3 is higher in energy than the filled orbital on the ammonia, why do the two molecules form a Lewis acid-base adduct?

5. a. (8 pts.) Draw a reaction that shows how strongly positive metal ions like Al^{3+} cause H^+ to form when the metal ions are added to water.

b. (4 pts.) Is the metal acting as a Lewis acid or a Lewis base.

6. a. (5 pts.) Which of the phosphines below would be most effective at forming a Lewis acid-base adduct with triethylborane. Explain

b. (5 pts.) Which would be the least effective. Explain



R = Cl, or H, or CH_2CH_3

7. (10 pts.) AgI is not soluble in water; however, AgF is moderately soluble in water. Explain.

8. a. (8 pts.) Determine the oxidation numbers for the transition metals in the following coordination complexes, and

b. (8 pts.) Draw a three dimensional representation of the structures for the compounds with octahedral coordination complexes.

$[Re(CO)_3(H_2O)_3]Cl$ $Fe(CO)_5$

$K_2[MoO_4]$ $K_2[PtCl_6]$