

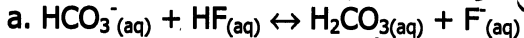
AP Chemistry: Acid-Base Worksheet

AP Chemistry Acid-Base WS 0809.doc

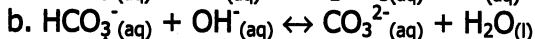
Name: Key Date: _____ Per: _____

1. In the following equations, label each species as an acid or a base. Show the conjugate acid-base pairs.

base acid conj acid conj base



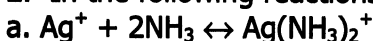
Bronsted Acid = proton donor



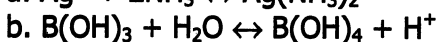
Bronsted Base = proton acceptor

acid base conj base conj acid

2. In the following reactions, identify the Lewis acid and the Lewis base.



Ag⁺ is the Lewis acid / NH₃ = Lewis Base

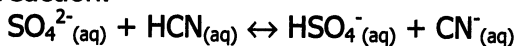


Lewis acid = electron pair acceptor

base = electron pair donor

B(OH)₃ = Lewis acid H₂O = Lewis Base acceptor site → B.

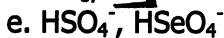
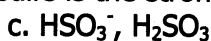
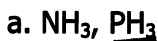
3. For the following reaction, decide which species (reactants or products) are favored at the completion of the reaction.



Reactants are favored

HSO₄⁻ is a stronger acid & CN⁻ is a stronger base than their conjugates.

4. Which member of each of the following pairs is the stronger acid?



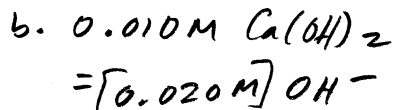
*Acid strength increases to the right and down
Acid strength increases w/ # of attached oxygens*

5. Calculate the concentrations of hydronium ion and hydroxide ion at 25°C in



a. *HNO₃ = strong acid*

$$\text{H}^+_{\text{ion}} = [0.15\text{M}] \quad \text{OH}^- = \frac{1.00 \times 10^{-14}}{0.15} = [6.67 \times 10^{-14}]$$



$$\frac{1.00 \times 10^{-14}}{0.020} = [5.0 \times 10^{-13}] = \text{H}^+$$

6. A sample of orange juice has a hydronium-ion concentration of $2.9 \times 10^{-4}\text{M}$. What is the pH? Is the solution acidic?

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log [2.9 \times 10^{-4}\text{M}] = \boxed{3.54}$$

yes. The solution is acidic (pH < 7)

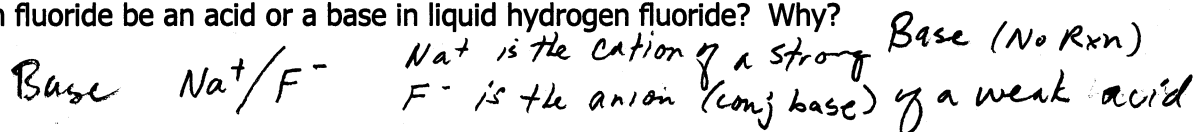
7. The pH of human arterial blood is 7.40. What is the hydronium ion concentration?

$$[\text{H}_3\text{O}^+] = 10^{-7.40} = [3.98 \times 10^{-8}\text{M}]$$

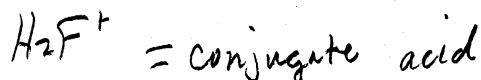
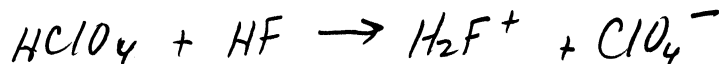
8. Pure liquid hydrogen fluoride ionizes in a way similar to that of water.
 a. Write the equilibrium reaction for the self-ionization of liquid hydrogen fluoride.



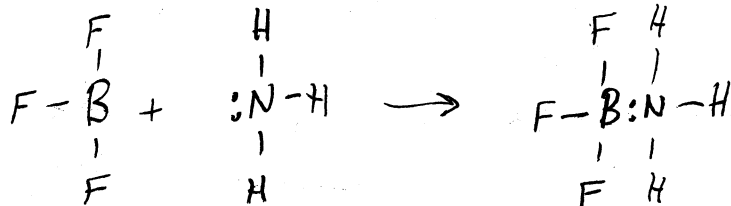
- b. Will sodium fluoride be an acid or a base in liquid hydrogen fluoride? Why?



- c. Perchloric acid is a strong acid in liquid hydrogen fluoride. Write the chemical equation for the ionization reaction. What is the conjugate acid in this medium?



9. Boron trifluoride, BF_3 , and ammonia, NH_3 , react to produce $\text{BF}_3 \cdot \text{NH}_3$. A coordinate covalent bond is formed between the boron atom on BF_3 and the nitrogen atom on NH_3 . Write the equation for this reaction, using Lewis electron-dot formulas. Label the Lewis acid and the Lewis base. Determine how many grams of $\text{BF}_3 \cdot \text{NH}_3$ are formed when 10.0g of each are placed in a reaction vessel, assuming that the reaction goes to completion.



$\text{BF}_3 = 67.81 \text{ g/ml}$
 $\text{NH}_3 = 17.03 \text{ g/ml}$
 $10.0 \text{ g} / 67.81 \text{ g/ml} = .147 \text{ ml } \text{BF}_3$
 $10.0 \text{ g} / 17.03 \text{ g/ml} = .587 \text{ ml}$
 1:1 ml ratio .147 ml (84.84 g/ml $\text{BF}_3 \cdot \text{NH}_3$)

BF_3 is the Lewis acid & NH_3 is the Lewis base (electron pair donor)
 = 12.5g

10. The following shows ball and stick models of the reactants in a Lewis acid-base reaction. Write the complete equation for the reaction, including the product. Identify each reactant as a Lewis acid or a Lewis base.

