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**Chemistry 30: Unit 6 Hand In Assignment #1**

*This assignment includes material covered in sections 6.1-6.4.*

1. Which of the following is a correct acid-base conjugate pair? (1 mark)

a) $HNO_3$, $NO_3^-$ b) $HClO_4$, $ClO^-$ c) $H_2PO_4^-$, $PO_4^{3-}$ d) $H_2SO_4$, $H_2SO_3$

2. In each of the following equations, identify the conjugate acid-base pairs (3 marks).

a) $HSO_4^-$ + $H_2O$ ↔ $SO_4^{2-}$ + $H_3O^+$
Pair #1:
Pair #2:

b) $CH_3NH_2$ + HCl ↔ $CH_3NH_3^+$ + $Cl^-$
Pair #1:
Pair #2:

c) $CH_3COO^-$ + $H_2O$ ↔ $CH_3COOH$ + $OH^-$
Pair #1:
Pair #2:

3. Classify each of the following as either an acid or a base (5 marks):

a. The substance has a bitter taste ____
b. $H_2SO_4$____
c. $HNO_3$____
d. litmus paper dipped in this turns red____
e. reacts with active metals to produce hydrogen gas____
f. KOH____
g. $NH_3$____
h. has a slippery feel____
i. has a sour taste____
j. a proton acceptor____

4. Write balanced equations for each of the following. Show the states and charges in the products (2 marks each):

a. The dissociation of potassium hydroxide.

b. The ionization of formic acid, HCOOH (showing water in the equation)

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c. The ionization of nitric acid (showing water in the equation)

5. For each of the following categories, write the compounds in order of increasing strength (4 marks).

| | **Bases** | | **Acids** |
|---|---|---|---|
| a. | $I^-$ | e. | $HClO_4$ |
| b. | $SO_3^{2-}$ | f. | $H_2S$ |
| c. | $PO_4^{3-}$ | g. | $HCO_3^{1-}$ |
| d. | $C_2H_3O_2^{1-}$ | h. | $HNO_2$ |

6. Predict the products of the following acid-base reaction; show states. There is only one substance here that will act like an acid. Choose wisely. (2 marks)

$NH_2^-{}_{(aq)} + H_2O_{(l)} \rightarrow$

7. The following substances will get mixed together. One will act as a Bronsted-Lowry acid and the other will act as the Bronsted-Lowry base.
   i) Write the equilibrium reaction that will occur when they are mixed. (2 marks)
   ii) Label the acid and base in the reactant side (1 mark)
   iii) Label the conjugate acid and conjugate base in the product side (1 mark)

a. HCN and $F^-$

b. $HPO_4^{2-}$ and $SO_4^{2-}$

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8. What is [$H_3O^+$] for a 0.500 M solution of hydrochloric acid? Make sure you include the ionization equation. (2 marks)

9. If 2.50g of the strong base lithium hydroxide is dissolved in 1.50 L of solution, what is the concentration of hydroxide ions? Make sure you include the dissociation equation. (3 marks)?

10. What is [$H_3O^+$] for a 0.200 M solution of hydrofluoric acid? Make sure you include the ionization equation. (4 marks)

11. Calculate [$OH^-$] ions in a 0.125 M solution of nitrous acid. Is this solution acidic or basic; how do you know? Make sure you include the ionization equation. (6 marks)

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12. Calculate the $[H_3O^+]$ in a 2.00 L solution of NaOH, a strong base, if it contains 0.800 g of solute. Is this solution acidic or basic; how do you know? Make sure you include the dissociation equation. (6 marks)

13. If 23 grams of formic acid, HCOOH, are dissolved in 10L of water at 25°C, the $[H^+]$ is found to be $3.0 \times 10^{-3}$ M. Determine the $K_a$ for HCOOH. Hint: think ICE BOX. (6 marks)