Acids and Bases Review

1. Consider the following equilibrium:

$$HOI + F^- \leftrightarrow OI^- + HF$$
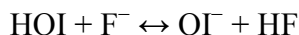
   Reactants are favored in this equilibrium. Which of the following describes the relative strengths of the acids and the bases?

Stronger Acid	Stronger Base
A) HF	F^-
B) HF	OI^-
C) HOI	F^-
D) HOI	OI^-

2. The pH of a 0.10 mol/L HCl is about 1.0 and the pH of a 0.10 mol/L H_3PO_4 is about 1.6. Which of the following best explains the difference?
   A) HCl is more ionized than H_3PO_4
   B) HCl is a weaker acid than H_3PO_4.
   C) H_3PO_4 is amphoteric (amphiprotic) in water.
   D) H_3PO_4 has more hydrogen atoms.

3. The K_a of a weak acid, HNO_2 is 5.1 x 10^{-4}. What is the $[H_3O^+]$ of a 0.10 mol/L solution of this acid?

4. What is the pH of a 0.015 mol/L aqueous solution of HCl (hydrochloric acid)?

5. The initial concentration of the acid HX is 0.16 mol/L. If the equilibrium concentration of the H_3O^+ is 5.0 x 10^{-3} mol/L, what is the percent dissociation?

6. Which statement is **TRUE** for the following reaction?

$$HCN(aq) + H_2O \ (l) \rightarrow CN^- \ (aq) + H_3O^+(aq)$$
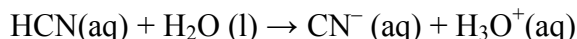
   A) $HCN(aq)$ is an acid and $CN^-(aq)$ is its conjugate base
   B) $HCN(aq)$ is an acid and $H_2O(l)$ is its conjugate base
   C) $H_2O(l)$ is an acid and $HCN(aq)$ is its conjugate base
   D) $H_2O(l)$ is an acid and $H_3O^+(aq)$ is its conjugate base.

7. The equilibrium constants for the weak acids HOCl, HCN and HF are 3.5 x 10^{-8}, 6.2 x 10^{-10} and 7.2 x 10^{-4} respectively. Which of the following is the correct order of increasing conjugate base strength?
   A) OCl^-, CN^-, F^-, H_2O, NO_3^-
   B) CN^-, OCl^-, F^-, H_2O, NO_3^-
   C) NO_3^-, F^-, OCl^-, CN^-, H_2O
   D) NO_3^-, H_2O, F^-, OCl^-, CN^-

8. In a titration experiment, 20.0 mL of HBr was needed to completely neutralize 40.0 mL of 0.10 mol/L KOH. What was the concentration of the acid?

9. What is the $[H_3O^+]$ in a 0.2 mol/L NaOH(aq) solution?

10. What happens to the concentration of the hydroxide ion if the pH decreases from 11.5 to 8.5 during a reaction?
    A) It decreases by a factor of 3.
    B) It decreases by a factor of 1000.
    C) It increases by a factor of 3.
    D) It increases by a factor of 1000.

11. Which of the following salts has an aqueous solution with a pH less than 7.00?
    A) NaCl   B) LiOH
    C) NH_4NO_3 D) $KC_2H_3O_2$

12. Boric acid, $HBrO_3$, is weak acid sometimes used as a detergent. At 25°C, 0.1 mol/L $HBrO_3$ solution has a pH of 3.56. Calculate the K_a for boric acid.

13. Calculate the pH of a 0.25 mol/L solution of $NaHCO_3$, a basic salt.

14. Which of the following are strong acid and which are weak acids?
    a. HCl(aq)
    b. HF(aq)
    c. HCN(aq)
    d. $HClO_4$(aq)
    e. HBr(aq)
    f. HNO_3(aq)
    g. H_3PO_4(aq)

15. Write the expression for the acid dissociation constant, K_a, of acetic acid.

16. What is the pH of the following solutions:
    a. 0.01 mol/L $HClO_4$
    b. 0.01 mol/L NaOH
    c. Pure water

17. Calculate the pH of 0.50 mol/L KF.

18. What is the pH of a 0.0150 mol/L HNO_2 solution? $K_a = 4.5 \times 10^{-4}$.

19. A solution has an $[OH^-]$ of 2.0 mol/L. What is the pH? Is this an acidic or basic solution?

20. What is the concentration of OH^- ions in a 1 mol/L solution of a strong monoprotic (only has one hydrogen) acid?