Acid Base Equilibrium Questions

1. Hydrofluoric acid can be used to etch glass. Calculate the pH of a 0.33 M HF solution.

2. The ionization constant, K_a, for propanoic acid, C_2H_5COOH, is 1.3 x 10^{-5}. What is the percent ionization in a 0.65 M solution of propanoic acid? Propanoic acid is a monoprotic acid.

3. What is the percent ionization in a 0.0500 M solution of formic acid, HCOOH?

4. A 0.0830 M solution of a monoprotic acid is known to be 1.07% ionized. What is the pH of the solution? Calculate the value of K_a for this acid.

5. A 0.055 M aqueous solution of a weak, monoprotic acid is 0.85% ionized. Calculate the value of the ionization constant, K_a, for this acid.

6. Pyridine is 0.053% ionized in 0.00500 M solution. What is the pK_b of this monobasic compound?

7. Lactic acid, $HC_3H_5O_3$(aq), is a weak acid that gives yogurt its sour taste. Calculate the pH of a 0.0010 mol/L solution of lactic acid. The K_a for lactic acid is 1.4 x 10^{-4}.

8. Methanoic acid, HCO_2H(aq), also known as formic acid, is partly responsible for the characteristic itchy rash produced by the leaves of the stinging nettle plant. Calculate the pH of 0.150 mol/L methanoic acid. The K_a for methanoic acid is 1.8 x 10^{-4}.

9. A 0.25 mol/L solution of benzoic acid, $HC_7H_5O_2$ (aq), an antiseptic also used as a food preservative, has a pH of 2.40. Calculate the K_a of benzoic acid at SATP.

10. Ascorbic acid, $HC_6H_7O_6$ (aq), is a weak organic acid, also known as vitamin C. A student prepares a 0.20 mol/L aqueous solution of ascorbic acid, and measures its pH as 2.40. Based on this evidence, what is the K_a of ascorbic acid?

11. Strychnine, $C_{21}H_{22}N_2O_2$ (aq), is a weak base but a powerful poison. Calculate the pH of a 0.001 mol/L solution of strychnine. The K_b of strychnine is 1.0 x 10^{-6}.

12. Codeine (use Cod as an abbreviated chemical symbol) has a K_b of 1.73 x 10^{-6}. Calculate the pH of a 0.020 mol/L codeine solution.

13. Ammonia, NH3, is the conjugate base of the ammonium ion, NH_4^+ (aq).
    (a) Given that the K_b for ammonia is 1.72 x 10^{-5}, write the K_b expression for the ionization of ammonia.
    (b) Given that the K_a for the ammonium ion is 5.80 x 10^{-10}, write the K_a expression for the ammonium ion.
    (c) Use the equations in (a) and (b) to show that $K_aK_b = K_w$.

14. Calculate the concentrations of H_3O^+, OH^-, $HSeO_4^-$, and SeO_4^{2-} in 0.12 M H_2SeO_4, selenic acid, solution.

15. Rust stains can be removed from painted surfaces with a solution of oxalic acid, $(COOH)_2$. Calculate the pH of a 0.050 M oxalic acid solution.

16. Calculate the pH and pOH of a carbonated soft drink that is 0.0032 mol/L carbonic acid solution. Assume that there are no other acidic or basic components.