LETTURE 21

1. Using the values of $K_b$ provided, calculate the pH and $[OH^-]$ for each of the solutions below:
   
   (a) 0.30 M ammonia ($K_b = 1.8 \times 10^{-5}$)
   (b) 0.54 M hydroxylamine ($K_b = 1.1 \times 10^{-8}$)

   (a) $[OH^-] = 2.3 \times 10^{-3}$ M; \(pH = 11.36\) (or 11.37)
   (b) $[OH^-] = 7.7 \times 10^{-5}$ M; \(pH = 9.89\)

2. The following reactions are important for buffer creation in biological chemistry labs. Identify the conjugate acid-base pairs.

   (a) $C_4H_9(OH)_2NH_2 (aq) + H_2O (l) \rightleftharpoons C_4H_9(OH)_3NH^+ (aq) + OH^- (aq)$
   (b) $HPO_4^{2-} (aq) + HCl (aq) \rightleftharpoons H_2PO_4^- (aq) + Cl^- (aq)$
   (c) $CH_3COOH (aq) + H_2O (aq) \rightleftharpoons CH_3COO^- (aq) + H_3O^+ (aq)$

   (a) As written, $C_4H_9(OH)_2NH_2$ is the base and $C_4H_9(OH)_3NH^+$ (aq) is its conjugate acid. $H_2O$ is the acid and $OH^-$ is its conjugate base.
   (b) As written, $HPO_4^{2-}$ is the base and $H_2PO_4^-$ is its conjugate acid. $HCl$ is the acid and $Cl^-$ is its conjugate base.
   (c) As written, $CH_3COOH$ is the acid and $CH_3COO^-$ is its conjugate base. $H_2O$ is the base and $H_3O^+$ is its conjugate acid.

3. Ketoacidosis is a serious medical condition caused by a build up of ketone bodies. A 0.50 M solution of one of those ketone bodies, acetoacetic acid, is found to have a pH of 1.95. Determine the $K_a$ of acetoacetic acid.

   $2.6 \times 10^{-4}$