Chemistry

Answers to Chapter 16 Study Questions

1.

	$[H^+]$	$[OH^-]$	pH	acid, base or neutral?
a)	*1.0 x 10^{-4} M*	1.0 x 10^{-10} M	4.0	acid
b)	1.0 x 10^{-7} M	*1.0 x 10^{-7} M*	7.0	neutral
c)	1.0 x 10^{-12} M	1.0 x 10^{-2} M	*12.0*	base
d)	1.0 x 10^{-3} M	*1.0 x 10^{-11} M*	3.0	acid

2. a) strong acid, $HNO_3(aq) \rightarrow H^+(aq) + NO_3^-(aq)$
   b) weak acid, $HF(aq) \rightleftharpoons H^+(aq) + F^-(aq)$
   c) weak base, $F^-(aq) + H_2O \rightleftharpoons HF(aq) + OH^-(aq)$
   d) neutral, $NaNO_3(aq) \rightarrow Na^+(aq) + NO_3^-(aq)$
   e) strong base, $KOH(s) \rightarrow K^+(aq) + OH^-(aq)$

3. a) HCl = strong acid; $[H^+] = \frac{0.010\ mol}{10.0\ L} = 1.0 \times 10^{-3}$ M; pH = 3.0

   b) NaOH = strong base; $[NaOH] = \frac{6.0\ g\ NaOH}{15.0\ L} x \frac{1\ mol\ NaOH}{40.0\ g\ NaOH} = 0.010$ mol/L =

   $[OH^-] = [NaOH] = 1.0 \times 10^{-2}$ M; $[H^+] = 1.0 \times 10^{-12}$ M; pH = 12.0

   c) HBr = strong acid; 5.0 mL = 5.0 x 10^{-3} L; $V_1 \times M_1 = V_2 \times M_2$
   (5.0 x 10^{-3} L) x (0.40 M) = (20 L) x M_2; M_2 = (5.0 x 10^{-3} L) x (0.40 M)/(20 L)
   $M_2 = 1.0 \times 10^{-4}$ M = $[H^+]$; pH = 4.0

4. a) It can be an H^+ acceptor. b) CH_3COOH
   c) $CH_3COO^-(aq) + H_2O \rightleftharpoons CH_3COOH(aq) + OH^-(aq)$

5. a) $H^+(aq) + OH^-(aq) \rightarrow H_2O$
   b) $HNO_2(aq) + OH^-(aq) \rightarrow NO_2^-(aq) + H_2O$
   c) $H^+(aq) + HCO_3^-(aq) \rightarrow H_2CO_3(aq)$

6. acids: HNO_2 and H_2O; bases: OH^- and NO_2^-

7. $V_b \times M_b = V_a \times M_a$; V_b x 2.0 M = 12.5 mL x 0.080 M;
   $V_b = \frac{12.5\ mL \times 0.080\ M}{2.0\ M} = 0.50$ mL

8. weakest acid → strongest acid: $HCN < CH_3COOH < HF < HCl$

9. a) $NaHCO_3$ used: $1.26\ g\ NaHCO_3 \times \frac{1\ mol\ NaHCO_3}{84.0\ g\ NaHCO_3} = 0.0150$ moles

b) 0.0150 moles

c) 26.1 mL - 2.1 mL = 24.0 mL = 0.0240 L

d) molarity = $\frac{moles}{liters} = \frac{0.0150\ mol}{0.0240\ L}$ = 0.625 M