Ch. 16 MC Review Solutions

3. $K_a\ (CH_3COOH) = 1.8\times10^{-5} < K_a\ (HNO_2) = 4.5\times10^{-4}$

4. $$\text{pH} = \text{p}K_a + \log\frac{[A^-]}{[HA]};\ 4.00 = -\log(1.8\times10^{-5}) + \log\frac{[A^-]}{[HA]} = 4.74 + \log\frac{[A^-]}{[HA]}$$
$$\log\frac{[HA]}{[A^-]} = 4.74 - 4.00 = 0.74;\ \frac{[HA]}{[A^-]} = 10^{0.74} = 5.50$$

7. $$\text{p}K_a(NH_4^+) = -\log(5.6\times10^{-10}) = 9.25$$

11. $$[Pb^{2+}]_0 = \frac{(3.0\times10^{-2}\ M)(100\ \text{mL})}{500\ \text{mL}} = 6.0\times10^{-3}\ M$$
$$[Cl^-]_0 = \frac{(9.0\times10^{-2}\ M)(400\ \text{mL})}{500\ \text{mL}} = 7.2\times10^{-2}\ M$$
$$Q_{sp} = [Pb^{2+}]_0[Cl^-]_0^2 = (6.0\times10^{-3})(7.2\times10^{-2})^2 = 3.1\times10^{-5} < K_{sp}$$

12. $MgCO_3$: $s = 1.8\times10^{-4}\ M$; $K_{sp} = s^2 = (1.8\times10^{-4})^2 = 3.2\times10^{-8}$

13. $BaSO_4$: $K_{sp} = 1.1\times10^{-11} = s^2$; $s = 1.1\times10^{-5}\ M$

15. $$[Pb^{2+}]_0 = \frac{(1.2\times10^{-3}\ M)(50.0\ \text{mL})}{100.0\ \text{mL}} = 6.0\times10^{-4}\ M$$
$$[S^{2-}]_0 = \frac{(2.0\times10^{-4}\ M)(50.0\ \text{mL})}{100.0\ \text{mL}} = 1.0\times10^{-4}\ M$$
$$Q_{sp} = [Pb^{2+}]_0[S^{2-}]_0 = (6.0\times10^{-4})(1.0\times10^{-4}) = 6.0\times10^{-8} \gg K_{sp} = 3.4\times10^{-28}$$