Chem1109 **Sample Quiz 3** **Last update: 9/10/11**

Questions 1 & 2 refer to the solubility of lead chromate, $PbCrO_4$:

$$PbCrO_4(s) \rightleftharpoons Pb^{2+}(aq) + CrO_4^{2-}(aq)$$

1. The K_{sp} for $PbCrO_4$ is 2.0×10^{-16} at 25 °C. What is the solubility of $PbCrO_4$ in mol L^{-1}?

a) 1.4×10^{-8} b) 2.8×10^{-8} c) 2.0×10^{-16} d) 7.1×10^{7} e) 5.0×10^{15}

2. If 5.0 mL of 1.0×10^{-5} M $Pb(NO_3)_2$ is added to 5.0 mL of a solution of 1.0×10^{-10} M K_2CrO_4, which statement is correct?

a) The ionic product is 1.0×10^{-15} and $PbCrO_4(s)$ precipitates.

b) The ionic product is 2.5×10^{-16} and $PbCrO_4(s)$ does not precipitate.

c) The ionic product is 1.0×10^{-15} and $PbCrO_4(s)$ does not precipitate.

d) The ionic product is 2.5×10^{-16} and $PbCrO_4(s)$ precipitates.

e) none of the above

3. The K_{sp} for nickel(II) hydroxide is 6×10^{-16} at 25 °C. What is the solubility of nickel(II) hydroxide (in mol L^{-1}) in a solution buffered at pH 10.5?

a) 6×10^{-5} b) 4×10^{-7} c) 6×10^{-9} d) 2×10^{-12} e) 1×10^{-14}

4. What is the concentration of $Zn^{2+}(aq)$ ions in the solution made by adding water to zinc nitrate (0.10 mol) and ammonia (3.0 mol) so that the final volume of solution is 1.5 L?
The K_{stab} of $[Zn(NH_3)_4]^{2+}$ is 7.8×10^{8}

a) 4.9×10^{-11} M

b) 9.5×10^{-12} M

c) 6.1×10^{-12} M

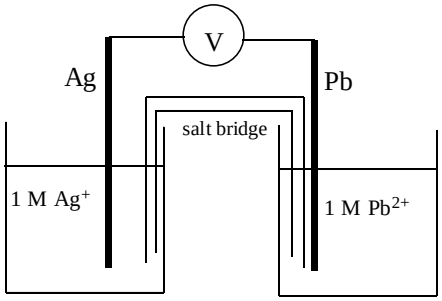
d) 2.8×10^{-12} M

e) 2.3×10^{-13} M

5. How many different stereoisomers (*i.e.* geometrical and optical isomers) of the complex $[Co(en)_3]^{3+}$ are possible? en = ethane-1,2-diamine = ethylenediamine = $NH_2CH_2CH_2NH_2$

a) 1 b) 2 c) 3 d) 4 e) 5

6. Consider the following galvanic cell and standard reduction potentials:



$Ag^+(aq) + e^- \rightarrow Ag(s)$ $\quad E^o = 0.80$ V

$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$ $\quad E^o = -0.13$ V

Which one of the following statements is TRUE?

a) The cell on the left containing $Ag^+(aq)$ is the anode.

b) The initial reading on the voltmeter would be 0.67 V.

c) Oxidation occurs in the cell on the right containing $Pb^{2+}(aq)$.

d) Negative charges will flow through the salt bridge from right to left.

e) The silver electrode dissolves as the reaction proceeds.

7. Consider the following equation. Relevant standard reduction potentials are given in Q6.

$$2Ag^+ + Pb \rightleftharpoons 2Ag + Pb^{2+}$$

Which of the following is nearest to the equilibrium constant, *K*, at 298 K for this reaction?

a) 9.8×10^5 b) 8.6×10^6 c) 5.4×10^{15} d) 1.1×10^{22} e) 2.9×10^{31}

8. How much gold is deposited in 4.00 hours by the electrolysis of a solution of $Na[AuCl_4]$ by a constant current of 0.37A?

a) 10.9 g b) 5.44 g c) 3.63 g d) 2.72 g e) 2.18 g

9. Given the initial rate data below, what is the rate law for the following reaction?

$$2ClO_2(aq) + 2OH^-(aq) \rightarrow ClO_3^-(aq) + ClO_2^-(aq) + H_2O$$

$[ClO_2]_0$ (mol L^{-1})	$[OH^-]_0$ (mol L^{-1})	Initial rate (mol L^{-1} s^{-1})
0.100	0.100	0.23
0.200	0.050	0.46
0.200	0.100	0.92

a) rate = $k[ClO_2][OH^-]^2$ b) rate = $k[ClO_2]^2[OH^-]$ c) rate = $k[ClO_2]^2[OH^-]^2$
d) rate = $k[ClO_2][OH^-]$ e) rate = $k[ClO_2]^3$

10. Given the proposed mechanism below, what is the rate law for the following reaction?

$$2H_2O_2(aq) + 2I^-(aq) + 2H^+(aq) \rightarrow I_2(aq) + H_2O(l)$$

Mechanism:

$HOOH(aq) + I^-(aq) \rightarrow HOI(aq) + OH^-(aq)$ slow

$HOI(aq) + I^-(aq) \rightarrow I_2(aq) + OH^-(aq)$ fast

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ fast

a) rate = $k[H_2O_2(aq)][I^-(aq)]$ b) rate = $k[H_2O_2(aq)]^2$ c) rate = $k[HOI(aq)][I^-(aq)]$
d) rate = $k[H_2O_2(aq)]^2[I^-(aq)]^2$ e) rate = $k[H_2O_2(aq)^2[I^-(aq)]^2[H^+(aq)]^2$

Correct answers: 1A, 2D, 3C, 4B, 5B, 6C, 7E, 8C, 9B, 10A