

Chem 103 Practice problems week 5

- 1) What is the molar solubility of cadmium hydroxide ( $\text{Cd}(\text{OH})_2$ ,  $K_{\text{sp}} = 1.2 \times 10^{-14}$ ) in a solution buffered (i.e. fixed!) at pH 10.00? [ $1.2 \times 10^{-6}$ ]
- 2) Consider the separation of oil and water to form 2 distinct layers after you vigorously shake an oil-water mixture and let it stand. Explain in words why it is spontaneous (product-favored). Your explanation should be given in the context of the 2 factors that determine if a process is spontaneous or not. [ $\Delta S > 0$  but why?]
- 3) Suppose that we add  $\text{Cu}^+$  ions dropwise to a solution containing 0.100 M  $\text{Br}^-$  and 0.200 M  $\text{Cl}^-$ . What is the %  $\text{Br}^-$  that will be precipitated before  $\text{Cl}^-$  starts to precipitate? The  $K_{\text{sp}}$  of  $\text{CuBr} = 5.3 \times 10^{-9}$  and that of  $\text{CuCl} = 1.9 \times 10^{-7}$ . [94.4%]
- 4) Estimate the pH of  $5 \times 10^{-8} \text{M}$  NaOH (use ICE) ? [7.18]
- 5) What is the molar concentration of free copper(I) ion,  $[\text{Cu}^+]_{\text{free}}$ , in a 0.145 M aqueous solution of  $\text{KCu}(\text{CN})_2$  if its  $K_f = 1.0 \times 10^{16}$  ? [ $1.5 \times 10^{-6}$  ]  
What is the concentration of free  $\text{CN}^-$  ? [ $3.0 \times 10^{-6} \text{M}$ ]
- 6) An experiment found that 0.401 mg of manganese hydroxide ( $\text{Mn}(\text{OH})_2$ , 88.9g/mol) dissolved in 200. mL of a saturated aqueous solution. A) Calculate the pH of the solution. [12.65 ]  
B) calculate the  $K_{\text{sp}}$  of  $\text{Mn}(\text{OH})_2$ . [  $4.57 \times 10^{-5}$  ]
- 7) What is the formation constant for the complex  $[\text{Ag}(\text{NH}_3)_2]^+$  if the concentration of free silver,  $[\text{Ag}^+]_{\text{free}}$  in a 0.100 M  $\text{Ag}(\text{NH}_3)_2\text{Cl}$  solution is  $1.2 \times 10^{-3} \text{M}$ ? [ $1.5 \times 10^7$ ]