

**Problem of the Day 36    CHEM 1252**

1. The mineral azurite is partly composed of copper (II) carbonate,  $\text{CuCO}_{3(s)}$ , and was found in the upper peninsula of Michigan. The slight solubility is characterized by its  $K_{sp} = 2.3 \times 10^{-10}$ .

a) Write out the chemical equation that represents the solubility of  $\text{CuCO}_{3(s)}$  in water. Make sure you include the physical states.

4

b) Write out the solubility product expression,  $K_{sp}$ , for  $\text{CuCO}_{3(s)}$ .

3

c) Determine the molar solubility of  $\text{CuCO}_3$ . You must show all work.

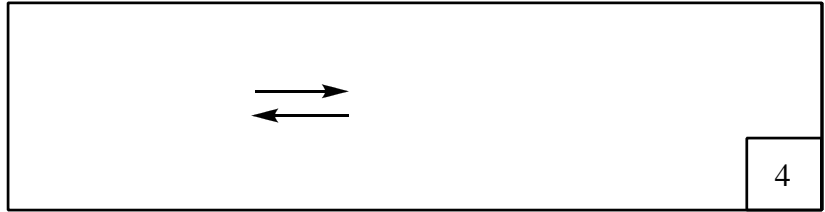
8

d) Would the molar solubility of  $\text{CuCO}_3$  increase, decrease, or stay the same if a strong acid was added to the aqueous solution of  $\text{CuCO}_3$ ? You must justify your answer and it must include a balanced chemical equation.

<p><i>Circle One</i></p> <p>increase</p> <p>decrease</p> <p>stay the same</p>	<p><i>Justification</i></p>
2	4

2. Magnesia (MgO) is only marginally soluble in water. When it does dissolve, however, it forms magnesium hydroxide, Mg(OH)<sub>2</sub>, also known as "milk of magnesia."

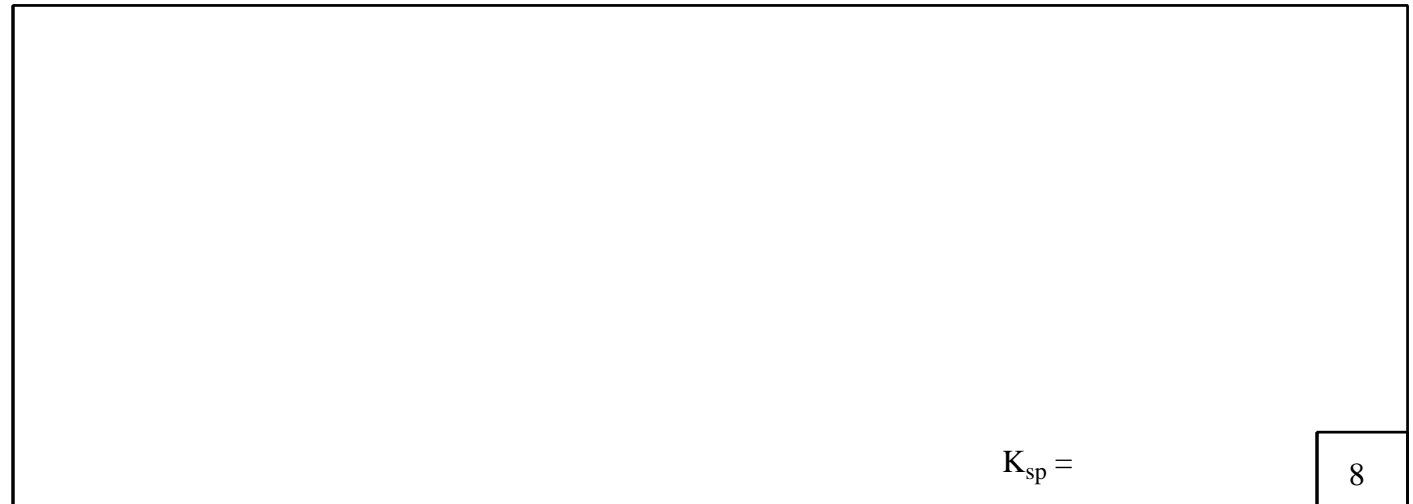
a). Write the reaction representing solid magnesium hydroxide dissolving in water to form magnesium ions and hydroxide ions. Make sure you include the physical states.



b). Write the solubility product equilibrium expression for your answer in part (a).



c) Calculate  $K_{sp}$  for Mg(OH)<sub>2</sub> if a saturated solution in water has a pH of 10.53?



$K_{sp} =$

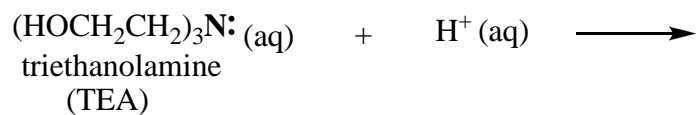
3. A titration of 25.00 mL of 0.0400 M triethanolamine, (HOCH<sub>2</sub>CH<sub>2</sub>)<sub>3</sub>N, was performed with 0.0500 M HCl. Triethanolamine is a weak base with  $K_b = 5.78 \times 10^{-7}$ .

a) What is the pH of the solution before any acid is added? You may use TEA as the abbreviation for triethanolamine and TEAH<sup>+</sup> as its conjugate acid. ***You must justify any assumptions made!***



3 con'd.

b) Complete the titration reaction. Include physical states. *Note: There is a lone pair of electrons shown on the nitrogen atom.*



2

c) What is the pH of the solution after 10.00 mL of HCl has been added?

pH =

8

d) What is the pH at the equivalence point? *You must justify any assumptions made!*

pH =

12

e) What is the pH after 22.00 mL of HCl has been added?

pH =

4