

Name: _____

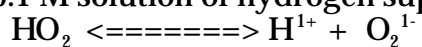
Ionic Equilibria Test #4

1. What species, both molecular and ionic, are present in a solution of sulfuric acid (H_2SO_4)? (Hint: consider all possible modes of ionization of sulfuric acid and water. There are more than five species present.)

2. Determine the pH of each of the following solutions:

a) 0.001 M solution of the very strong acid HI, $K_a = 3.2 \times 10^9$.

b) 0.1 M solution of hydrogen superoxide, HO_2 .



$$K_a = 6.3 \times 10^{-3}$$

3. Determine the $\text{p}K_a$ of each of the acids listed in question 2 above.

a) $\text{p}K_a =$ _____;

b) $\text{p}K_a =$ _____

4. When an X-ray picture of the stomach or intestines is taken barium sulfate is given to “enhance” the picture. Barium ions are extremely poisonous, but the patient is “protected” by the very low solubility of barium sulfate. Determine the concentration of barium ions in a saturated solution of barium sulfate ($K_{sp}=8.7 \times 10^{-11}$).
5. Calcium propanoate, $\text{Ca}(\text{C}_3\text{H}_5\text{O}_2)_2$, is sometimes used as preservative for bread. In a water solution this salt will undergo hydrolysis. What would be the pH of a 0.02 M solution of calcium propanoate. (K_a of propanoic acid, $\text{HC}_3\text{H}_5\text{O}_2$, = 1.3×10^{-5}).
6. In venous blood the following equilibrium is set up by dissolved carbon dioxide:
 $\text{CO}_2 + 2 \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^{1+} + \text{HCO}_3^{1-}$
 The pH of the blood is normally quite constant at 7.35. What would the ratio of HCO_3^{1-} to CO_2 have to be at this pH? The $\text{p}K_a$ of H_2CO_3 is 4.3×10^{-7} . You can consider a water solution of carbon dioxide to be H_2CO_3 .

One step beyond (Extra Credit#1) [2 pts]

If abominable snowmen were to exist in the world in the same proportion to humans as do hydrogen ions to water molecules in pure water, how many abominable snowmen would there be in the world? Assume a world population of 6 billion people.

Twilight Zone (Extra Credit #2) [5 pts].

One liter of a 0.1 M solution of hydroselenic acid, H_2Se , was prepared and allowed to come to equilibrium. Afterwards 1.25 G of Na_2Se , 1.57 G of K_2Se , 6.6 G of NaCl , and 7.8 G of KNO_3 were added. What would be the final pH of the solution? (You may assume that the volume of the solution remained at 1 L.) The pKa of hydroselenic acid is 3.8.