CH302 Practice Quiz 5 on Complex Equilibria

1. Na_2SO_3 is the basic salt of sulfurous acid which is a weak diprotic acid. If $K_{a1} = 1.5 \times 10^{-2}$ and $K_{a2} = 1.2 \times 10^{-7}$, what is the $[H_3O^+]$ concentration in a sulfite ($SO_3^=$) solution that is 0.025M?

1. 9.6 M **correct**
2. 4.4 M
3. 10.1 M
4. 9.0 M

2. What is the pH of a 0.5M solution of an acid with $K_a = 1.2 \times 10^{-1}$?
1. 0.71 **correct**
2. 3.05
3. 6.8
4. 11.08

3. What is the pH of 0:15 M Na_2HPO_4(aq) if $K_{a1} = 7.6 \times 10^{-3}$, $K_{a2} = 6.2 \times 10^{-8}$ and $K_{a3} = 2.1 \times 10^{-13}$?

1. 9.93 **correct**
2. 8:31
3. 7.82
4. 6.92
5. 3.02

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4. Write the charge balance equation for a dilute aqueous solution of $HClO_2$.
1. $[ClO_2^-] = [OH^-] + [H_3O^+]$
2. $[H_3O^+] = [OH^-]$
3. $[H_3O^+] = [ClO_2^-]$
4. $[H_3O^+] = [ClO_2^-] + [OH^-]$ **correct**
5. $[HClO_2]_{initial} = [ClO_2^-]$
5. $[HClO_2]_{initial} = [HClO_2] + [ClO_2^-]$

5 For a solution labeled 0.10 M Na_2S(aq),"
1. $[S^=] > 0.10$ M.
2. $[S^=] > [HS^-]$ correct
3. $[S^=] = [HS^-]$
4. [OH-] = 0.10 M.
5. [OH-] > 0.10 M.

6 A weakly basic solution with a pH near 7 is formed when a solution of 1×10^{-7} moles of NH_3 is added to 1 liter of water. How many equations must be solved in order to accurately calculate all the unknown concentrations formed at equilibrium in solution?

1. 1
2. 2
3. 3
4. 4 **correct**
5. 5
6. 6
7. 7

7. What is the concentration of HSO_4^- in 0.1 M H_2SO_4? K_{a1} is strong and K_{a2} = 1:2 a 10^{-2}.
1. 9.8×10^{-3} M **correct**
2. $1:2 \times 10^{-3}$ M
3. $4:0 \times 10^{-2}$ M
4. $1:0 \times 10^{-3}$ M
5. $4:0 \times 10^{-2}$ M

8. There are three sources of protons to be considered in calculating the pH of a solution formed when equal volumes of 1×10^{-9} M HCl and 1×10^{-9} M acetic acid (HAc) are added to water. Assume a K_a of $1:8 \times 10^{-5}$ for acetic acid. Rank from most to least, the concentration of protons contributed at equilibrium from HCl, HAc and H2O.

1. HCl, HAc, H_2O
2. HAc, HCl, H_2O
3. HAc, H_2O, HCl
4. H_2O, HCl, HAc **correct**
5. HCl, H_2O, HAc