General Chemistry II

RR # 7
Summer 2022

1. **. Given that the K_a for acetic acid, CH_3COOH, is 1.8×10^{-5}, calculate the pH of a 0.20 mol/L solution. Assume x is negligibly small compared to the original concentration of acetic acid.**

2. **A student prepares a 0.45 M solution of a monoprotic weak acid and determines the pH to be 3.68. What is the K_a of this weak acid? . Assume x is negligibly small compared to the original concentration of acid.**

3. The value of K_w depends on temperature. At body temperature (37ºC), K_w =

2.4×10^{-14}

a. What is the $[H_3O+]$ of pure water at body temperature?

b. What is the [OH-] of pure water at body temperature?

c. What is the pH of pure water at body temperature?

d. What is the pOH of pure water at body temperature?

4. Calculate [H+] for each of the following solutions, and indicate whether the solution is acidic, basic, or neutral:

a. [OH-] = 0.00045 M

b. [OH-] = 8.8×10^{-9} M

c. A solution in which [OH-] is 100 times greater than [H+]

MCAT Style Questions

5. By what factor does [H+] change for a pH change of 2.00 units?

- **a. 2**
- **b. 100**
- **c. 200**
- **d. 2000**

6. The conjugate acid of the $H_2SiO_4^{2-}$ (dihydrogen orthosilicate) anion is: a. $H_2SiO_4^{2-}$

- **b. $H_3SiO_4^-$**
- **c. H_4SiO_4**
- **d. H_3O^+**

7. The first step of a nitration reaction involves using a mixture of sulfuric acid and nitric acid to form an NO_2^+ electrophile, as shown below.

$H_2SO_4 + HNO_3$ $HSO_4^- + H_2NO_3^+$ $HSO_4^- + H_2O + NO_2^+$

In the forward reaction of the equilibrium, which of the following molecules acts as a Bronsted-Lowry base?

- **a. H_2SO_4**
- **b. HNO_3**
- **c. HSO_4^-**
- **d. $H_2NO_3^+$**

8. Hypochlorous acid dissociates in water to create hydronium ions and hypochlorite ions: $HOCl + H_2O$ $H_3O^+ + OCl^-$. Suppose that additional hypochlorite ions are added to the solution. Which of the following correctly describes the resultant effect on the concentration of HOCl?

- **a. It depends on the number of hydronium ions**
- **b. It remains the same**
- **c. It increases**

d. It decreases

9. Suppose a large organic molecule X is classified as a Lewis acid, while another large molecule Y is classified as a Bronsted-Lowry acid. Which of the following most accurately describes a similarity in their behaviors in solution?

a. Both molecules will tend to acquire a net positive charge

b. Both molecules will release hydroxide ions

c. Both molecules will release hydrogen gas

d. Both molecules will tend to acquire a net negative charge

10. Suppose an equilibrated, dilute solution containing an acid HA with $K_a = 10^{-4}$ is measured to have pH = 6 and [HA] = 10^{-8} M. Which of the following gives the best estimate of $[A^-]$?

a. 10^{-4}

b. 10^{-6}

c. 10^{-14}

d. 10^{-16}