Competitive Exams: Chemistry MCQs (Practice_Test 6 of 31)

1. Hypochlorite ion (OCl-) is the conjugate base of hypochlorous acid (HOCl, Ka = 3.5 × 10 − 8) . What is the value of the base ionization equilibrium constant, Kb, for hypochlorite ion?

   a. 3.5 × 10 − 22

   b. 3.5 × 10 − 8

   c. 2.9 × 10 − 7

   d. 2.9 × 107

   e. 4.7 × 109

2. Calculate the pH of an aqueous solution prepared to contain 1.3 × 10 − 3 M sodium nitrite (NaNO2) if the acid dissociation equilibrium constant, Ka, for nitrous acid (HNO2) is 5.1 × 10 − 4.

   a. 3.1

   b. 5.1

   c. 7.0

   d. 7.3

   e. 10.9

3. Calculate the carbonate ion concentration in a 0.10 M solution of the weak acid, carbonic acid (H2CO3) . The stepwise dissociation constants of carbonic acid are Ka1 = 4.5 × 10 − 7 and Ka2 = 4.7 × 10 − 11.

   a. 4.7 × 10 − 11 M

   b. 1.0 × 10 − 7 M

   c. 4.5 × 10 − 7 M

   d. 2.1 × 10 − 4 M

e. 3.5 × 10 − 3 M

4. The very first disinfectant used by Joseph Lister was called “carbolic acid” This substance is now known as phenol (PhOH) . What is the H3O + ion concentration in a 0.10 M solution of phenol? [PhOH: Ka = 1.0 × 10 − 10]

   a. 1.0 × 10 − 11

   b. 3.2 × 10 − 5

   c. 5.0 × 10 − 12

   d. 3.2 × 10 − 6

5. The sweetener, saccharin, is a weak monoprotic acid with Ka = 2.1 × 10 − 12. Calculate the H3O + concentration in a solution that contains 1.0 × 10 − 2 mole of saccharin in 1.00 L of otherwise pure water.

   a. 1.4 × 10 − 7

   b. 1.8 × 10 − 7

   c. 2.1 × 10 − 12

   d. 2.1 × 10 − 14

6. When would the pH of a solution prepared by adding sodium formate to formic acid be equal to the pKa of formic acid, HCO2H?

   a. when [HCO2H] < [HCO2-]

   b. when [HCO2H] = [HCO2-]

   c. when [HCO2H] > [HCO2-]

   d. the pH of this buffer will never equal the pKa of formic acid.

7. Calculate the pH of a buffer prepared by mixing 0.10 mol of sodium formate and 0.05 mol of formic acid in 1.0 L of solution. [HCO2H: Ka = 1.8 × 10 − 4]

   a. 1.8 × 10 − 4

   b. 3.44

   c. 4.05

   d. 5.31

   e. none of these

8. For a weak diprotic acid, H2A, for which Ka1 = 2.1 × 10 − 7 and Ka2 = 4.3 × 10 − 13, the A2-ion concentration at equilibrium will be:

   a. approximately equal to the initial concentration of H2A.

   b. roughly equal to Ka2.

c. roughly equal to the HA-concentration.

d. much larger than the HA-concentration.

e. approximately equal to the H3O + concentration.

9. Many insects discharge sprays containing weak acids as a means of defense. For example, some ants discharge a spray that contains the weak acid, formic acid (HCO2H) . Calculate the pH of a 0.14 M solution of formic acid. Ka (HCO2H) = 1.8 × 10 − 4.

a. N/A

b. N/A

c. N/A

d. N/A

10. Calculate the pH of a solution prepared by dissolving 0.20 moles of benzoic acid (abbreviated HOBz) and 0.15 moles of sodium benzoate (abbreviated NaOBz) in enough water to make 1.0 L of solution. The acid-dissociation equilibrium constant for benzoic acid is Ka = 6.3 × 10 − 5.

a. N/A

b. N/A

c. N/A

d. N/A

11. Consider an aqueous solution of a weak acid. Explain why the contribution of hydronium ion from the dissociation of water (i.e.. . [H3O +] water) to the total hydronium ion concentration is not equal to that for pure water (i.e.. . 1.0 × 10 − 7 M) .

a. N/A

b. N/A

c. N/A

d. N/A

12. Calculate the [OH-] (in M) for an acetic acid solution (Ka = 1.8 × 10 − 5) having a pH of 6.32.

a. N/A

b. N/A

c. N/A

d. N/A

13. Ascorbic acid is also known as Vitamin C. In a 0.10 M solution of ascorbic acid 2.8 % of the ascorbic acid will dissociate. Consider the pH you would measure for a 0.25 M solution of ascorbic acid. Which of the following statements is true?
    a. The pH would show that the %-dissociation would be the same in both ascorbic acid solutions.
    b. The pH would show that the %-dissociation would be twice as much in the more concentrated acid solutions.
    c. The pH of the more concentrated solution would be lower.
    d. You must know the Ka value for ascorbic acid before determining which of the above selections is true.
14. A buffer can be prepared by mixing:
    a. a strong acid and its conjugate base.
    b. a strong base and its conjugate acid.
    c. a weak acid and its conjugate base.
    d. a weak acid and a strong acid.
    e. all responses above are correct.
15. Calculate the pH of a solution containing 0.1 M formic acid (a monoprotic weak acid with Ka = $1.8 \times 10 - 4$) and 0.1 M sodium formate.
    a. N/A
    b. N/A
    c. N/A
    d. N/A