Name _____ AP Chemistry

Chapter 15 HW 2: Due 12/6/19 Circle and write the correct answer on the line in front of the question.

1._____ A monoprotic acid was titrated with a solution of NaOH. For 55.0 mL of the acid, 37.0 milliliters of a 0.450 M solution of NaOH was required to reach the equivalence point. Which of the following expressions is equal to the initial concentration of the monoprotic acid?

a. $\frac{(0.450)(0.037)}{(0.055)}$ M b. $\frac{(0.450)(0.055)}{(0.055)}$ M c. $\frac{(0.055)}{(0.450)(0.037)}$ M

d. $\frac{(0.037)}{(0.450)(0.055)}$ M e. (0.450)(0.055)(0.037) M

2. _____ Which of the following can function as both a Brønsted-Lowry acid and Brønsted-Lowry base?
a. HCl b. H_2SO_4 c. HSO_3^- d. SO_4^{2-} e. H^+

3. _____ The acid dissociation constant for HClO is 3.0×10^{-8}. What is the hydrogen ion concentration in 0.12 M solution of HClO?
a. 3.6×10^{-9} M b. 3.6×10^{-8} M c. 6.0×10^{-8} M d. 2.0×10^{-5} M e. 6.0×10^{-5} M

4. _____ Which of the following will produce a buffered solution?
I. Equal volumes of 1 M NH_3 and 1 M NH_4Cl solutions are mixed.
II. Equal volumes of 1 M H_2CO_3 and 1 M $NaHCO_3$ solutions are mixed.
III. Equal volumes of 1 M NH_3 and 1 M H_2CO_3 solutions are mixed.

a. I only b. III only c. I and II only d. II and III only e. I, II and III

5. _____ When 0.250 mol of NaOH is added to 1.00 L of 0.100 M H_3PO_4, the solution will contain:
a. HPO_4^{2-} b. $H_2PO_4^-$ c. PO_4^{3-} d. A and B e. A and C

6. _____ $HSO_4^- + H_2O \leftarrow \rightarrow H_3O^+ + SO_4^{2-}$
In the equilibrium represented above, the species that act as bases include which of the following?
I. HSO_4^- II. H_2O III. SO_4^{2-}

a. II only b. III only c. I and II d. I and III e. II and III

7. _____ pH is equal to pK_a:
a. when [acid] = [conjugate base] b. at the endpoint of a titration
c. in the buffer region d. in the Henderson-Hasselbach equation
e. at equilibrium

8. _____ How many milliliters of water must be added to 10 milliliters of an HCl solution with a pH of 1 to produce a solution with a pH of 2?
a. 10 mL b. 90 mL c. 100 mL d. 990 mL e. 1000 mL

9. _____ Which of the following statements is correct?
a. $HClO_2$ is a stronger acid than $HClO_3$ b. HI is a weaker acid than HCl
c. H_3PO_4 is a stronger acid than $HClO_4$ d. HNO_3 is a stronger acid than HNO_2
e. CH_3COOH is a stronger acid than $CH_2BrCOOH$

10. _____ A 100 mL sample of 0.10 M NaOH was added to 100 mL of a 0.10 M $H_3C_6H_5O_7$. After equilibrium was established, which of the ions listed below was present in the greatest concentration?
a. $H_2C_6H_5O_7^-$ b. $HC_6H_5O_7^{2-}$ c. $C_6H_5O_7^{3-}$ d. OH^- e. H^+

11. _____ Which of the following procedures will produce a buffered solution?
I. Equal volumes of 0.5 M NaOH and 1 M HCl
II. Equal volumes of 0.5 M NaOH and 1 M $HC_2H_3O_2$ solutions are mixed.
III. Equal volumes of 1 M $NaC_2H_3O_2$ and 1 M $HC_2H_3O_2$ solutions are mixed.

a. I only b. III only c. I and II only d. II & III only e. I, II & III

12. _____ What is the conjugate base of HSO_4^-?

a. H^+ b. H_2SO_4 c. OH^- d. SO_4^{2-} e. H_3O^+

13. _____ 50.0 mL of a 0.0200 M HCl solution is mixed with 25.0 mL of a 0.0100 M NaOH solution. What is the pH of the final mixture?

a. 3.36 b. 0.43 c. 2.00 d. 11.00 e. 7.00

14. _____ Which of the following is the acid anhydride of a monoprotic acid?

a. CaO b. SO_3 c. FeO d. CO_2 e. N_2O_5

15. _____ In aqueous solution the amphiprotic substance is:

a. H_2O b. Cl^- c. NH_4^+ d. $Cr_2O_7^{2-}$ e. CH_3CH_2COOH

16. _____ A buffer at pH 5.32 is prepared from a weak acid with a $pK_a = 5.15$. If 100 mL of this buffer is diluted to 200 mL with distilled water, the pH of the dilute solution is:

a. 5.62 b. 5.02 c. 5.32

d. The identity of the acid is needed to answer this question.

e. The concentrations of the acid and the salt are needed to answer the question.

17. _____ K_a of hydrocyanic acid, HCN, is 5.0×10^{-10}. What is the pH of 0.050 M HCN(aq)?

a. below 3.5 b. between 3.5 and 4.5 c. between 5.0 and 5.5

d. between 9.0 and 9.5 e. between 10.5 and 11.0

18. _____ The K_a for hydrofluoric acid is 6.8×10^{-4}. What percentage of HF is dissociated in a 0.080 M solution where the hydronium ion concentration is 7.4×10^{-3} M?

a. 12.3% b. 4.25% c. 9.2 % d. 1.12% e. 23.6%

19. _____ A 50.0 mL sample of HCl with an unknown concentration is titrated with 0.125 molar NaOH.

a. The volume of NaOH used will be less than 50.0 mL.

b. The endpoint will be at a pH greater than 7.

c. The color change of the indicator will be from colorless to pink.

d. The reaction must be standardized by adding KHP.

e. The equivalence point will have a pH of exactly 7.

20. _____ A laboratory technician wishes to create a buffered solution with a pH of 5. Which of the following acids would be the best choice for the buffer?

a. $H_2C_2O_4$, $K_a = 5.9 \times 10^{-2}$ b. H_3AsO_4, $K_a = 5.6 \times 10^{-3}$ c. $HC_2H_3O_2$, $K_a = 1.8 \times 10^{-5}$

d. HOCl, $K_a = 3.0 \times 10^{-8}$ e. HCN, $K_a = 4.9 \times 10^{-10}$

21. _____ It takes 40.0 mL of 0.100 M NaOH to titrate 488 mg of a solid monoprotic acid to the phenolphthalein endpoint. What is the molecular mass of the acid?

a. 221 b. 122 c. 68 d. 1.2×10^5 e. 1.2×10^{-1}

22. _____ Which has the highest pH?

a. the endpoint of a strong acid titrated with a strong base

b. the endpoint of a weak acid titrated with a strong base

c. the endpoint of a weak base titrated with a strong acid

d. the endpoint of a strong base titrated with a strong acid

e. the endpoint of a weak acid titrated with a weaker base

23. _____ Which of the following is not a conjugate acid-base pair?

a. H_2SO_4 and SO_4^{2-} b. HCl and Cl^- c. NH_3 and NH_2^-

d. HPO_4^{2-} and PO_4^{3-} e. H_2S and HS^-

24. _____ The pH of 0.01 M acetic acid ($K_a = 1.8 \times 10^{-5}$) is closest to:

a. 1 b. 2 c. 3 d. 7 e. 11

25. _____ What is the volume of 0.05 molar HCl that is required to neutralize 50 mL of a 0.10 molar $Mg(OH)_2$ solution?

a. 100 mL b. 200 mL c. 300 mL d. 400 mL e. 500 mL