Name ______________________ Class ______________ Date ______________

Assessment

Chapter Test B

Chapter: Acid-Base Titration and pH

PART I In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

______ **1.** The pH scale generally ranges from
a. 0 to 1.
b. −1 to 1.
c. 0 to 7.
d. 0 to 14.

______ **2.** During the titration of HCl with NaOH, a very rapid change in pH occurs
a. when the first addition of known solution is made.
b. when roughly equivalent amounts of H_3O^+ ions and OH^- ions become present.
c. at several points.
d. at no point.

______ **3.** A water solution is neutral if
a. it contains no H_3O^+ ions.
b. it contains no ionized water molecules.
c. it contains no H_3O^+ ions or OH^- ions.
d. the concentrations of H_3O^+ ions and OH^- ions are equal.

______ **4.** The antilog of a number N is
a. the inverse of N.
b. the square root of N.
c. 10 raised to the power of N.
d. N raised to the 10th power.

______ **5.** Universal indicators
a. are mixtures of several indicator solutions.
b. are pure substances.
c. have very brief color-change intervals.
d. work well only for acidic solutions.

______ **6.** A useful pH range for an indicator in neutralizations involving strong acids and weak bases is
a. 1.2 to 3.0.
b. 3.1 to 4.6.
c. 6.0 to 7.6.
d. 9.5 to 11.0.

______ **7.** An acid-base titration determines the solution volumes that are
a. chemically equivalent.
b. of equal molarity.
c. of equal mass.
d. of equal molality.

______ **8.** In acidic solutions, an indicator that is a weak acid, HIn, is primarily in the form
a. In^{+}.
b. In^{-}.
c. InOH.
d. HIn.

PART II

Write the correct term (or terms) in the space provided.

9. Pure water partially breaks down into ions in a process called

______________________________.

10. If $[H_3O^{+}]$ in a solution is less than $[OH^{-}]$, the solution is

______________________________.

11. The pH range over which an indicator changes color is called the indicator's

______________________________.

12. The negative of the common logarithm of the hydronium ion concentration is called ______________________________.

13. The product of $[H_3O^{+}]$ and $[OH^{-}]$ in a water solution equals

______________________________.

14. The sum of the pH and the pOH of a neutral solution at 25°C is

______________________________.

15. As the concentration of hydronium ions increases, a solution becomes more acidic and the pH ______________________________.

16. In a titration, an indicator changes color at the

______________________________ of the titration.

17. When a weak acid is titrated with a strong base, the pH of the solution at the equivalence point is ______________________________ than 7.

18. When a strong acid is titrated with a weak base, the pH of the solution at the equivalence point is ____________ than 7.

19. A ____________ is a highly purified solid used to check the concentration of a standard solution.

20. A 1 M solution of NaOH will have a pH that is ____________ than the pH of a 1 M solution of NH_3.

In the space provided, identify each of the following values as true of *acidic* or *basic* solutions at 25°C.

21. ____________ pH = 4.0

22. ____________ $[H_3O^+] = 1 \times 10^{-2}$

23. ____________ $[OH^-] = 1 \times 10^{-8}$

24. ____________ pH = 9.0

25. ____________ $[OH^-] = 1 \times 10^{-4}$

PART III Write the answers to the following questions in the space provided.

26. How does a pH meter measure the pH of a solution?

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27. What can be observed about the rate of change in the pH of a solution during a titration?

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____

28. Write the general equilibrium expression for the dissociation of an acid-base indicator that is a weak acid, HIn, and explain how this equilibrium determines the color of the indicator at a given pH.

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PART IV

In the space provided, identify each of the following substances as *acidic*, *basic*, or *neutral*.

29. ______________________ grapefruit

30. ______________________ pure water

31. ______________________ seawater

32. ______________________ eggs

33. ______________________ blood

Calculate the $[H_3O^+]$ and $[OH^-]$ for each of the following. Write your answers in the spaces provided.

34. ______________________________ 1×10^{-4} M HCl

35. ______________________________ 1×10^{-4} M NaOH

36. ______________________________ 1×10^{-4} M $Ca(OH)_2$

37. ______________________________ 1×10^{-4} M HNO_3

38. ______________________________ 5×10^{-3} M $HClO_4$

PART V Write the answers to the following problems on the line to the left, and show your work in the space provided.

______________ **39.** What is the hydronium ion concentration of an aqueous solution that has a pH of 5.0?

______________ **40.** What is the pH of a 10^{-4} M HCl solution?

______________ **41.** What is the hydroxide ion concentration of a solution with a pH of 12.40?

______________ **42.** What is the molarity of a solution of H_2SO_4 if 49.0 mL of it are neutralized by 68.4 mL of 0.333 M NaOH solution?

______________ **43.** If 72.1 mL of 0.543 M H_2SO_4 are needed to neutralize 39.0 mL of KOH solution, what is the molarity of the KOH solution?

______________ **44.** What is the molarity of an NaOH solution if 130.0 mL of the solution are neutralized by 61.3 mL of 0.0124 M H_3PO_4?

water to produce a sulfuric acid solution that falls to the ground as rain or snow. $SO_3(g) + H_2O(l) \rightarrow H_2SO_4(aq)$

37. Have a sour taste; change the color of acid-base indicators; some react with active metals to release hydrogen gas; react with bases to produce salts and water; conduct electric current

38. $H_3PO_4(aq) + H_2O(l) \rightleftarrows H_3O^+(aq) + H_2PO_4^-(aq)$
$H_2PO_4^-(aq) + H_2O(l) \rightleftarrows H_3O^+(aq) + HPO_4^{2-}(aq)$
$HPO_4^{2-}(aq) + H_2O(l) \rightleftarrows H_3O^+(aq) + PO_4^{3-}(aq)$

15 *Acid-Base Titration and pH,* *pp. 134–143*

TEST A

1. d	**2.** c
3. b	**4.** c
5. c	**6.** c
7. b	**8.** b
9. d	**10.** b
11. c	**12.** b
13. a	**14.** d
15. d	**16.** d
17. d	**18.** a
19. c	**20.** c
21. d	**22.** b
23. c	**24.** d
25. d	

TEST B

1. d	**2.** b
3. d	**4.** c
5. a	**6.** b
7. a	**8.** d

9. self-ionization
10. basic
11. transition interval
12. pH
13. 10^{-14}
14. 14
15. decreases
16. end point
17. higher
18. lower
19. primary standard
20. higher
21. acidic
22. acidic
23. acidic
24. basic
25. basic
26. A pH meter measures the pH of a solution by measuring the voltage between the two electrodes that are placed in the solution. This works because the voltage is proportional to the hydronium ion concentration.
27. The pH changes slowly at first, then rapidly through the equivalence point, then slowly again.
28. $HIn + H_2O \rightleftarrows H_3O^+ + In^-$ or $HIn \rightleftarrows H^+ + In^-$
In acidic solutions, the H_3O^+ ions in solution drive the equation toward the nonionized form. HIn is present in largely nonionized form in acidic solutions, and In^- ions are present in largely ionized form in basic solutions. HIn is a different color than the In^- ion.
29. acidic
30. neutral
31. basic
32. basic
33. basic
34. $[H_3O^+] = 1 \times 10^{-4}$ M; $[OH^-] = 1 \times 10^{-10}$ M
35. $[H_3O^+] = 1.0 \times 10^{-10}$ M; $[OH^-] = 1.0 \times 10^{-4}$ M
36. $[H_3O^+] = 5.0 \times 10^{-11}$ M; $[OH^-] = 2.0 \times 10^{-4}$ M
37. $[H_3O^+] = 1 \times 10^{-4}$ M; $[OH^-] = 1 \times 10^{-10}$ M
38. $[H_3O^+] = 5 \times 10^{-3}$ M; $[OH^-] = 2 \times 10^{-12}$ M
39. 1×10^{-5} M
40. 4.0
41. 2.5×10^{-2} M
42. 0.232 M
43. 2.01 M
44. 0.0175 M

16 *Reaction Energy,* *pp. 144–153*

TEST A

1. d	**2.** a
3. c	**4.** a
5. b	**6.** c
7. a	**8.** a