Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Honors Chemistry Practice Test 14, 15, 18.3

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Acetic acid is found in
a. lemons.
b. vinegar.
c. sour milk.
d. apples.

____ 2. Aqueous solutions of acids
a. contain only two different elements.
b. carry electricity.
c. have very high boiling points.
d. cannot be prepared.

____ 3. Bases taste
a. soapy.
b. sour.
c. sweet.
d. bitter.

____ 4. Bases react with
a. acids to produce salts and water.
b. salts to produce acids and water.
c. water to produce acids and salts.
d. neither acids, salts, nor water.

____ 5. An Arrhenius acid contains
a. hydrogen that does not ionize.
b. hydrogen that ionizes to form hydrogen ions.
c. oxygen that ionizes to form hydroxide ions.
d. oxygen that ionizes to form oxygen ions.

____ 6. Arrhenius theorized that an acid is a chemical compound that
a. increases the concentration of hydrogen ions when dissolved in water.
b. increases the concentration of hydroxide ions when dissolved in water.
c. decreases the concentration of hydrogen ions when dissolved in water.
d. decreases the concentration of hydroxide ions when dissolved in water.

____ 7. Which statement about Arrhenius bases is *false*?
a. Some are ionic hydroxides.
b. They dissociate in solution to release hydroxide ions into the solution.
c. They increase the concentration of hydrogen ions in aqueous solution.
d. Some react with water and remove a hydrogen ion, leaving hydroxide ions.

____ 8. Which of the following is a strong acid?
a. HSO_4^-
b. H_2SO_4
c. CH_3COOH
d. H_3PO_4

____ 9. Which of the following is a weak base?
a. NH_3
b. KOH
c. NaOH
d. $Ba(OH)_2$

____ 10. Which of the following is a strong base?
a. KOH
b. H_2
c. NH_3
d. HCl

____ 11. Which of the following is a triprotic acid?
a. H_2SO_4
b. CH_3COOH
c. HCl
d. H_3PO_4

____ 12. Whose definition of acids and bases emphasizes the role of protons?
a. Brønsted and Lowry
b. Lewis
c. Arrhenius
d. Bohr

____ 13. A Brønsted-Lowry acid is a(n)
a. electron-pair acceptor.
b. electron-pair donor.
c. proton acceptor.
d. proton donor.

____ 14. In the equation $HCl(g) + H_2O(l) \rightarrow H_3O^+(aq) + Cl^-(aq)$, which species is a Brønsted-Lowry acid?
a. HCl
b. H_2O
c. Cl^-
d. None of the above

____ 15. A Lewis base is a(n)
a. producer of OH^- ions.
b. proton acceptor.
c. electron-pair donor.
d. electron-pair acceptor.

____ 16. A species that remains when an acid has lost a proton is a
a. conjugate base.
b. conjugate acid.
c. strong base.
d. strong acid.

____ 17. A species that is formed when a base gains a proton is a
a. conjugate base.
b. conjugate acid.
c. strong base.
d. strong acid.

____ 18. How many conjugate acid-base pairs participate in a Brønsted-Lowry acid-base reaction?
a. none
b. one
c. two
d. four

____ 19. The members of a conjugate acid-base pair
a. appear on the same side of the chemical equation.
b. appear on opposite sides of the chemical equation.
c. might appear on the same side or on opposite sides of the equation.
d. are not included in the chemical equation.

____ 20. In the reaction represented by the equation $HF + H_2O \rightleftarrows H_3O^+ + F^-$, a conjugate acid-base pair is
a. F^- and H_2O.
b. HF and F^-.
c. H_3O^+ and HF.
d. HF and H_2O.

____ 21. In the reaction represented by the equation $HClO_3 + NH_3 \rightleftarrows NH_4^+ + ClO_3^-$ the conjugate acid of NH_3 is
a. $HClO_3$.
b. ClO_3^-.
c. NH_4^+.
d. not shown.

____ 22. In the reaction represented by the equation $CH_3COOH + H_2O \rightleftarrows H_3O^+ + CH_3COO^-$, the conjugate acid of CH_3COO^- is
a. H_2O.
b. CH_3COOH.
c. H_3O^+.
d. not shown.

____ 23. In the reaction represented by the equation $CH_3COOH + H_2O \rightleftarrows H_3O^+ + CH_3COO^-$, the conjugate base of H_3O^+ is
a. H_2O.
b. CH_3COOH.
c. CH_3COO^-.
d. not shown.

____ 24. The conjugate of a strong acid is a
a. strong acid.
b. weak acid.
c. strong base.
d. weak base.

____ 25. In the reaction represented by the equation $H_3PO_4 + H_2O \rightleftarrows H_3O^+ + H_2PO_4^-$, the ion $H_2PO_4^-$ acts as a(n)
a. acid.
b. base.
c. spectator species.
d. salt.

____ 26. In the reaction represented by the equation $H_3PO_4 + H_2O \rightleftarrows H_3O^+ + H_2PO_4^-$, the molecule H_2O acts as a(n)
a. acid.
b. base.
c. spectator species.
d. salt.

____ 27. Which compound is produced by a neutralization?
a. $H_2O(l)$
b. $HNO_3(aq)$
c. $Ca(OH)_2(s)$
d. $H_3PO_4(aq)$

____ 28. Pure water partially breaks down into charged particles in a process called
a. hydration.
b. hydrolysis.
c. self-ionization.
d. dissociation.

____ 29. What is the concentration of OH^- ions in pure water?
a. 10^{-7} M
b. 0.7 M
c. 55.4 M
d. 10^7 M

____ 30. What is the product of H_3O^+ ion and OH^- ion concentrations in water?
a. 10^{-28}
b. 10^{-14}
c. 10^{-7}
d. 55.4

____ 31. Which expression represents the pH of a solution?
a. $\log[H_3O^+]$
b. $-\log[H_3O^+]$
c. $\log[OH^-]$
d. $-\log[OH^-]$

____ 32. If $[H_3O^+]$ of a solution is greater than $[OH^-]$, the solution
a. is always acidic.
b. is always basic.
c. is always neutral.
d. might be acidic, basic, or neutral.

____ 33. If $[H_3O^+]$ of a solution is less than $[OH^-]$, the solution
a. is always acidic.
b. is always basic.
c. is always neutral.
d. might be acidic, basic, or neutral.

____ 34. The pH of an acidic solution is
a. less than 0.
b. less than 7.
c. greater than 7.
d. greater than 14.

____ 35. If $[H_3O^+] = 1.7 \times 10^{-3}$ M, what is the pH of the solution?
a. 1.81
b. 2.13
c. 2.42
d. 2.77

____ 36. If $[H_3O^+] = 8.26 \times 10^{-5}$ M, what is the pH of the solution?
a. 2.161
b. 3.912
c. 4.083
d. 8.024

____ 37. What is the pH of a 0.027 M KOH solution?
a. 6.47
b. 12.43
c. 12.92
d. 14.11

____ 38. What is the pH of a 0.001 62 M NaOH solution?
a. 3.841
b. 5.332
c. 9.923
d. 11.210

____ 39. The pH of a solution is 9.0. What is its H_3O^+ concentration?
a. 1×10^{-9} M
b. 1×10^{-7} M
c. 1×10^{-5} M
d. 9 M

____ 40. What is the hydronium ion concentration of a solution whose pH is 7.30?
a. 1.4×10^{-11} M
b. 3.8×10^{-8} M
c. 5.0×10^{-8} M
d. 7.1×10^{-6} M

____ 41. The pH of a solution is 10.00. What is its OH^- concentration?
a. 1.0×10^{-10} M
b. 1.0×10^{-7} M
c. 1.0×10^{-4} M
d. 10 M

____ 42. What process measures the amount of a solution of known concentration required to react with a measured amount of a solution of unknown concentration?
a. autoprotolysis
b. hydrolysis
c. neutralization
d. titration

____ 43. An acid-base titration is carried out by monitoring
a. temperature.
b. pH.
c. pressure.
d. density.

____ 44. In an acid-base titration, equivalent quantities of hydronium ions and hydroxide ions are present
a. at the beginning point.
b. at the midpoint.
c. at the end point.
d. throughout the titration.

____ 45. A standard solution always contains
a. a known concentration of solute.
b. an acid.
c. a base.
d. a primary standard.

____ 46. When titrating a strong acid with a strong base, the equivalence point
a. will be below a pH of 7.0.
b. will be above a pH of 7.0.
c. will be at a pH of 7.0.
d. will be either above or below a pH of 7.0.

____ 47. When titrating a weak acid with a strong base, the equivalence point
a. will be below a pH of 7.0.
b. will be above a pH of 7.0.
c. will be at a pH of 7.0.
d. cannot be determined by pH.

____ 48. What is the molarity of an HCl solution if 50.0 mL is neutralized in a titration by 40.0 mL of 0.400 M NaOH?
a. 0.200 M
b. 0.280 M
c. 0.320 M
d. 0.500 M

____ 49. What is the molarity of an HCl solution if 125 mL is neutralized in a titration by 76.0 mL of 1.22 M KOH?
a. 0.371 M
b. 0.455 M
c. 0.617 M
d. 0.742 M

____ 50. What is the molarity of an NaOH solution if 4.37 mL is titrated by 11.1 mL of 0.0904 M HNO_3?
a. 0.230 M
b. 0.355 M
c. 0.460 M
d. 0.620 M

____ 51. Calculate the molarity of a $Ba(OH)_2$ solution if 1900 mL is completely titrated by 261 mL of 0.505 M HNO_3.
a. 0.0173 M
b. 0.0254 M
c. 0.0322 M
d. 0.0347 M

____ 52. What is the acid-ionization expression for the ionization of acetic acid, shown in the reaction represented by the equation $CH_3COOH(aq) + H_2O(l) \rightleftarrows H_3O^+(aq) + CH_3COOH^-(aq)$?
a. $[H_3O^+]\,[CH_3COOH^-]$
b. $\dfrac{\left[H_3O^+\right]\left[CH_3COO^-\right]}{\left[CH_3COOH\right]\left[H_2O\right]}$
c. $\dfrac{\left[H_3O^+\right]\left[CH_3COO^-\right]}{\left[CH_3COOH\right]}$
d. $\dfrac{\left[CH_3COOH\right]}{\left[H_3O^+\right]\left[CH_3COO^-\right]}$

____ 53. To what degree does water ionize?
a. completely
b. to a large extent
c. slightly
d. not at all

____ 54. What is the symbol for the ion-product constant for water?
a. K_w
b. K_a
c. K
d. K_{sp}

____ 55. When small amounts of acids or bases are added to a solution of a weak acid and its salt, the pH
a. always increases considerably.
b. always decreases considerably.
c. either increases or decreases considerably.
d. remains nearly constant.

____ 56. If a base is added to a solution of a weak acid and its salt,
a. more of the nonionized weak acid forms.
b. more of the nonionized acid ionizes.
c. precipitation occurs.
d. the hydronium ion concentration decreases.

____ 57. If a base is added to a solution of a weak base and its salt,
a. the hydronium ion concentration increases.
b. more of the weak base ionizes.
c. more hydroxide ions form.
d. more water and nonionized base forms.

____ 58. If an acid is added to a solution of a weak base and its salt,
a. more water forms and more weak base ionizes.
b. the hydronium ion concentration decreases.
c. more hydroxide ions form.
d. more nonionized weak base forms.

____ 59. Which solutions resist changes in pH?
a. buffered
b. equilibrium
c. neutral
d. stable

____ 60. An example of a good buffer is
a. HCl and NaCl.
b. HNO_3 and NaCl.
c. HNO_2 and $NaNO_2$
d. CH_3COOH and NaC.

____ 61. What type of reaction occurs in an aqueous solution of the salt of a weak acid and a strong base?
a. cation hydrolysis
b. anion hydrolysis
c. both cation and anion hydrolysis
d. buffer hydrolysis

____ 62. The cation of the salt of a strong acid and a weak base is the
a. hydronium ion.
b. hydroxide ion.
c. conjugate acid of the weak base.
d. conjugate base of the strong acid.

____ 63. Basic solutions are generally formed by hydrolysis of anions of salts of
a. weak acids and weak bases.
b. weak acids and strong bases.
c. strong acids and weak bases.
d. strong acids and strong bases.

____ 64. Acidic solutions are generally formed by hydrolysis of cations of salts of
a. weak acids and weak bases.
b. weak acids and strong bases.
c. strong acids and weak bases.
d. strong acids and strong bases.

Problem

65. What is the pH of a solution that has a hydronium ion concentration of 8.26×10^{-5} M?

66. What is the pH of a 0.067 0 M KOH solution?

67. What is the hydroxide ion concentration of a solution that has a pH of 8.570?

68. What is the hydronium ion concentration of a solution that has a pOH of 4.120?

Honors Chemistry Practice Test 14, 15, 18.3
Answer Section

MULTIPLE CHOICE

1.	ANS: B	PTS: 1	DIF: I	REF: 1	OBJ: 1		
2.	ANS: B	PTS: 1	DIF: I	REF: 1	OBJ: 1		
3.	ANS: D	PTS: 1	DIF: I	REF: 1	OBJ: 1		
4.	ANS: A	PTS: 1	DIF: I	REF: 1	OBJ: 1		
5.	ANS: B	PTS: 1	DIF: I	REF: 1	OBJ: 4		
6.	ANS: A	PTS: 1	DIF: I	REF: 1	OBJ: 4		
7.	ANS: C	PTS: 1	DIF: I	REF: 1	OBJ: 4		
8.	ANS: B	PTS: 1	DIF: II	REF: 1	OBJ: 5		
9.	ANS: A	PTS: 1	DIF: I	REF: 1	OBJ: 5		
10.	ANS: A	PTS: 1	DIF: II	REF: 1	OBJ: 5		
11.	ANS: D	PTS: 1	DIF: II	REF: 1	OBJ: 5		
12.	ANS: A	PTS: 1	DIF: I	REF: 2	OBJ: 1		
13.	ANS: D	PTS: 1	DIF: I	REF: 2	OBJ: 1		
14.	ANS: A	PTS: 1	DIF: II	REF: 2	OBJ: 1		
15.	ANS: C	PTS: 1	DIF: I	REF: 2	OBJ: 2		
16.	ANS: A	PTS: 1	DIF: I	REF: 3	OBJ: 1		
17.	ANS: B	PTS: 1	DIF: I	REF: 3	OBJ: 1		
18.	ANS: C	PTS: 1	DIF: I	REF: 3	OBJ: 1		
19.	ANS: B	PTS: 1	DIF: I	REF: 3	OBJ: 1		
20.	ANS: B	PTS: 1	DIF: II	REF: 3	OBJ: 1		
21.	ANS: C	PTS: 1	DIF: II	REF: 3	OBJ: 1		

22. ANS: B PTS: 1 DIF: II REF: 3
OBJ: 1
23. ANS: A PTS: 1 DIF: II REF: 3
OBJ: 1
24. ANS: D PTS: 1 DIF: I REF: 3
OBJ: 1
25. ANS: B PTS: 1 DIF: II REF: 3
OBJ: 1
26. ANS: B PTS: 1 DIF: II REF: 3
OBJ: 1
27. ANS: A PTS: 1 DIF: I REF: 3
OBJ: 2
28. ANS: C PTS: 1 DIF: I REF: 1
OBJ: 1
29. ANS: A PTS: 1 DIF: I REF: 1
OBJ: 1
30. ANS: B PTS: 1 DIF: I REF: 1
OBJ: 1
31. ANS: B PTS: 1 DIF: I REF: 1
OBJ: 2
32. ANS: A PTS: 1 DIF: I REF: 1
OBJ: 2
33. ANS: B PTS: 1 DIF: I REF: 1
OBJ: 2
34. ANS: B PTS: 1 DIF: I REF: 1
OBJ: 3
35. ANS: D
Solution:

$$\text{pH} = -\log\left[\text{H}_3\text{O}^+\right] = -\log 1.7 \times 10^{-3} = 2.77$$

PTS: 1 DIF: III REF: 1 OBJ: 4
36. ANS: C
Solution:

$$\text{pH} = -\log\left[\text{H}_3\text{O}^+\right] = -\log 8.26 \times 10^{-5} = 4.083$$

PTS: 1 DIF: III REF: 1 OBJ: 4
37. ANS: B
Solution:

$$\left[\text{H}_3\text{O}^+\right] = \frac{1.00 \times 10^{-14}}{\left[\text{OH}^-\right]} = \frac{1.00 \times 10^{-14}}{\left[2.7 \times 10^{-2}\right]} = 3.707 \times 10^{-13}\ \text{M}$$

$$\text{pH} = -\log\left[\text{H}_3\text{O}^+\right] = -\log 3.707 \times 10^{-13} = 12.43$$

PTS: 1 DIF: III REF: 1 OBJ: 4

38. ANS: D
Solution:

$$\left[H_3O^+\right] = \frac{1.00 \times 10^{-14}}{\left[OH^-\right]} = \frac{1.00 \times 10^{-14}}{\left[1.62 \times 10^{-3}\right]} = 6.173 \times 10^{-12} \text{ M}$$

$$\text{pH} = -\log\left[H_3O^+\right] = -\log\ 6.173 \times 10^{-12} = 11.210$$

PTS: 1 DIF: III REF: 1 OBJ: 4

39. ANS: A
Solution:

$$\left[H_3O^+\right] = 10^{-ph} = 10^{-9.0} = 1 \times 10^{-9} \text{ M}$$

PTS: 1 DIF: II REF: 1 OBJ: 5

40. ANS: C
Solution:

$$\left[H_3O^+\right] = 10^{-ph} = 10^{-7.30} = 5.012 \times 10^{-8} \text{ or } 5.0 \times 10^{-8}\text{M}$$

PTS: 1 DIF: III REF: 1 OBJ: 5

41. ANS: C
Solution:

$$\left[H_3O^+\right] = 10^{-ph} = 10^{-10.00} = 1.0 \times 10^{-10} \text{ M}$$

$$\left[OH^-\right] = \frac{1.00 \times 10^{-14}}{\left[H_3O^+\right]} = \frac{1.00 \times 10^{-14}}{\left[1.0 \times 10^{-10}\right]} = 1.0 \times 10^{-4} \text{ M}$$

PTS: 1 DIF: III REF: 1 OBJ: 5

42. ANS: D PTS: 1 DIF: I REF: 2
OBJ: 2

43. ANS: B PTS: 1 DIF: I REF: 2
OBJ: 2

44. ANS: C PTS: 1 DIF: I REF: 2
OBJ: 2

45. ANS: A PTS: 1 DIF: I REF: 2
OBJ: 2

46. ANS: C PTS: 1 DIF: II REF: 2
OBJ: 2

47. ANS: B PTS: 1 DIF: II REF: 2
OBJ: 2

48. ANS: C
Solution:
$M_{OH^-}V_{OH^-} = M_{H_3O^+}V_{H_3O^+}$

$$M_{H_3O^+} = \frac{M_{OH^-}V_{OH^-}}{V_{H_3O^+}} = \frac{(0.400\text{ M})(40.0\text{ mL})}{50.0\text{ mL}} = 0.320\text{ M HCl}$$

PTS: 1 DIF: III REF: 2 OBJ: 3

49. ANS: D
Solution:
$M_{OH^-}V_{OH^-} = M_{H_3O^+}V_{H_3O^+}$

$$M_{H_3O^+} = \frac{M_{OH^-}V_{OH^-}}{V_{H_3O^+}} = \frac{(1.22\text{ M})(76.0\text{ mL})}{125\text{ mL}} = 0.742\text{ M HCl}$$

PTS: 1 DIF: III REF: 2 OBJ: 3

50. ANS: A
Solution:
$M_{OH^-}V_{OH^-} = M_{H_3O^+}V_{H_3O^+}$

$$M_{OH^-} = \frac{M_{H_3O^+}V_{H_3O^+}}{V_{OH^-}} = \frac{(0.0904\text{ M})(11.1\text{ mL})}{4.37\text{ mL}} = 0.230\text{ M NaOH}$$

PTS: 1 DIF: III REF: 2 OBJ: 3

51. ANS: D
Solution:
$M_{OH^-}V_{OH^-} = M_{H_3O^+}V_{H_3O^+}$

$$M_{OH^-} = \frac{M_{H_3O^+}V_{H_3O^+}}{V_{OH^-}} = \frac{(0.505\text{ M})(261\text{ mL})}{1900\text{ mL}} = 0.06937\text{ M}$$

$$M\,\text{Ba(OH)}_2 = \frac{1}{2}(M_{OH^-}) = \frac{1}{2} \times 0.06937\text{ M} = 0.0347\text{ M Ba(OH)}_2$$

PTS: 1 DIF: III REF: 2 OBJ: 3

52. ANS: C PTS: 1 DIF: II REF: 3
OBJ: 1

53. ANS: C PTS: 1 DIF: I REF: 3
OBJ: 2

54. ANS: A PTS: 1 DIF: I REF: 3
OBJ: 2

55. ANS: D PTS: 1 DIF: I REF: 3
OBJ: 3

56. ANS: B PTS: 1 DIF: I REF: 3
OBJ: 3

57. ANS: D PTS: 1 DIF: I REF: 3
OBJ: 3

58. ANS: A PTS: 1 DIF: I REF: 3
OBJ: 3
59. ANS: A PTS: 1 DIF: I REF: 3
OBJ: 3
60. ANS: C PTS: 1 DIF: II REF: 3
OBJ: 3
61. ANS: B PTS: 1 DIF: I REF: 3
OBJ: 4
62. ANS: C PTS: 1 DIF: I REF: 3
OBJ: 4
63. ANS: B PTS: 1 DIF: I REF: 3
OBJ: 4
64. ANS: C PTS: 1 DIF: I REF: 3
OBJ: 4

PROBLEM

65. ANS:
4.083
Solution:
pH= $-\log\left[\mathrm{H_3O^+}\right] = -\log(8.26\times10^{-5}) = 4.083$

PTS: 1 DIF: II REF: 1 OBJ: 4
66. ANS:
12.826
Solution:
$\left[\mathrm{H_3O^+}\right] = \dfrac{K_w}{\left[\mathrm{OH^-}\right]} = \dfrac{1.00\times10^{-14}}{6.70\times10^{-2}} = 1.49\times10^{-13}\ \mathrm{M}$

pH = $-\log\left[\mathrm{H_3O^+}\right] = -\log(1.49\times10^{-13}) = 12.826$

PTS: 1 DIF: III REF: 1 OBJ: 4
67. ANS:
3.72×10^{-6} M
Solution:
$\left[\mathrm{H_3O^+}\right] = 10^{-\mathrm{pH}} = 10^{-8.57} = 2.69\times10^{-9}\ \mathrm{M}$

$\left[\mathrm{OH^-}\right] = \dfrac{K_w}{\mathrm{H_3O^+}} = \dfrac{1.00\times10^{-14}}{2.69\times10^{-9}} = 3.72\times10^{-6}\ \mathrm{M}$

PTS: 1 DIF: III REF: 1 OBJ: 5

68. ANS:
1.32×10^{-10} M
Solution:
$\left[OH^-\right] = 14 - pOH = 14 - 4.12 = 9.88$

$\left[H_3O^+\right] = 10^{-ph} = 10^{-9.88} = 1.32 \times 10^{-10}$ M

PTS: 1 DIF: III REF: 1 OBJ: 5

Honors Chemistry Practice Test 14, 15, 18.3 [Answer Strip] **ID: A**

B 1.

B 2.

D 3.

A 4.

B 5.

A 6.

C 7.

B 8.

A 9.

A 10.

D 11.

A 12.

D 13.

A 14.

C 15.

A 16.

B 17.

C 18.

B 19.

B 20.

C 21.

B 22.

A 23.

D 24.

B 25.

B 26.

A 27.

C 28.

A 29.

B 30.

B 31.

A 32.

B 33.

B 34.

D 35.

C 36.

B 37.

D 38.

A 39.

C 40.

C 41.

D 42.

B 43.

C 44.

A 45.

C 46.

B 47.

C 48.

D 49.

A 50.

D 51.

C 52.

C 53.

A 54.

D 55.

B 56.

D 57.

__A__ 58.

__A__ 59.

__C__ 60.

__B__ 61.

__C__ 62.

__B__ 63.

__C__ 64.