

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) According to the Arrhenius concept, an acid is a substance that _____.
 - A) causes an increase in the concentration of H^+ in aqueous solutions
 - B) can accept a pair of electrons to form a coordinate covalent bond
 - C) is capable of donating one or more H^+
 - D) reacts with the solvent to form the cation formed by autoionization of that solvent
 - E) tastes bitter
- 2) A Brønsted-Lowry base is defined as a substance that _____.
 - A) acts as a proton acceptor
 - B) increases $[H^+]$ when placed in H_2O
 - C) decreases $[H^+]$ when placed in H_2O
 - D) increases $[OH^-]$ when placed in H_2O
 - E) acts as a proton donor
- 3) A substance that is capable of acting as both an acid and as a base is _____.
 - A) miscible
 - B) conjugated
 - C) amphoteric
 - D) autocratic
 - E) autosomal
- 4) What is the conjugate acid of NH_3 ?
 - A) NH_4OH
 - B) NH_3^+
 - C) NH_4^+
 - D) NH_2^+
 - E) NH_3
- 5) The conjugate base of HSO_4^- is
 - A) SO_4^{2-}
 - B) $H_3SO_4^+$
 - C) H_2SO_4
 - D) OH^-
 - E) HSO_4^+
- 6) The molar concentration of hydronium ion in pure water at $25^\circ C$ is _____.
 - A) 1.00
 - B) 7.00
 - C) 0.00
 - D) 1.0×10^{-7}
 - E) 1.0×10^{-14}
- 7) The magnitude of K_w indicates that _____.
 - A) water autoionizes very slowly
 - B) the autoionization of water is exothermic
 - C) water autoionizes only to a very small extent
 - D) the autoionization of water is endothermic
 - E) water autoionizes very quickly

- 8) In basic solution, _____.
- $[\text{H}_3\text{O}^+] > [\text{OH}^-]$
 - $[\text{H}_3\text{O}^+] < [\text{OH}^-]$
 - $[\text{OH}^-] > 7.00$
 - $[\text{H}_3\text{O}^+] = 0 \text{ M}$
 - $[\text{H}_3\text{O}^+] = [\text{OH}^-]$
- 9) What is the pH of an aqueous solution at 25°C in which $[\text{H}^+]$ is 0.0025 M ?
- 2.60
 - 3.40
 - +2.60
 - +3.40
 - +2.25
- 10) What is the pH of an aqueous solution at 25°C in which $[\text{OH}^-]$ is 0.0025 M ?
- +2.60
 - 2.60
 - +11.40
 - 11.40
 - 2.25
- 11) What is the concentration (in M) of hydronium ions in a solution at 25°C with $\text{pH} = 4.282$?
- 9.71
 - 1.66×10^4
 - 4.28
 - 1.92×10^{-10}
 - 5.22×10^{-5}
- 12) What is the concentration (in M) of hydroxide ions in a solution at 25°C with $\text{pH} = 4.282$?
- 9.72
 - 1.91×10^{-10}
 - 1.66×10^4
 - 5.22×10^{-5}
 - 4.28
- 13) Calculate the pOH of a solution at 25°C that contains $1.94 \times 10^{-10} \text{ M}$ hydronium ions.
- 1.940
 - 14.000
 - 7.000
 - 4.288
 - 9.712
- 14) Which solution below has the highest concentration of hydroxide ions?
- $\text{pH} = 12.59$
 - $\text{pH} = 7.00$
 - $\text{pH} = 9.82$
 - $\text{pH} = 7.93$
 - $\text{pH} = 3.21$
- 15) The hydride ion, H^- , is a stronger base than the hydroxide ion, OH^- . The product(s) of the reaction of hydride ion with water is/ are _____.
- $\text{H}_3\text{O}^+ (\text{aq})$
 - $\text{OH}^- (\text{aq}) + 2\text{H}^+ (\text{aq})$
 - $\text{H}_2\text{O}_2 (\text{aq})$
 - $\text{OH}^- (\text{aq}) + \text{H}_2 (\text{g})$
 - no reaction occurs
- 16) What is the pH of a 0.015-M aqueous solution of barium hydroxide?
- 10.35
 - 12.48
 - 1.52
 - 12.18
 - 1.82
- 17) Sodium hydroxide is a strong base. This means that _____.
- NaOH cannot be neutralized by ordinary means
 - NaOH cannot be neutralized by a weak acid
 - NaOH does not dissociate at all when it is dissolved in water
 - aqueous solutions of NaOH contain equal concentrations of $\text{H}^+ (\text{aq})$ and $\text{OH}^- (\text{aq})$
 - NaOH dissociates completely to $\text{Na}^+(\text{aq})$ and $\text{OH}^-(\text{aq})$ when it dissolves in water

- 18) An aqueous solution contains 0.10 M NaOH at 25°C. The pH of the solution is _____.
 A) 0.10 B) -1.00 C) 7.00 D) 1.00 E) 13.00
- 19) Of the following acids, _____ is not a strong acid.
 A) H₂SO₄ B) HCl C) HClO₄ D) HNO₃ E) HNO₂

- 20) Which one of the following is the weakest acid?

- A) HCN ($K_a = 4.9 \times 10^{-10}$)
 B) HF ($K_a = 6.8 \times 10^{-4}$)
 C) Acetic acid ($K_a = 1.8 \times 10^{-5}$)
 D) HClO ($K_a = 3.0 \times 10^{-8}$)
 E) HNO₂ ($K_a = 4.5 \times 10^{-4}$)

- 21) HZ is a weak acid. An aqueous solution of HZ is prepared by dissolving 0.020 mol of HZ in sufficient water to yield 1.00 L of solution. The pH of the solution was 4.93 at 25°C. The K_a of HZ is _____.

- A) 6.9×10^{-9} B) 9.9×10^{-2} C) 1.2×10^{-5} D) 2.8×10^{-12} E) 1.4×10^{-10}

- 22) Of the acids in the table below, _____ is the strongest acid.

Acid	K_a
HOAc	1.8×10^{-5}
HCHO ₂	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

- A) HOAc
 B) HOAc and HCHO₂
 C) HClO
 D) HF
 E) HCHO₂

- 23) The K_a of hypochlorous acid (HClO) is 3.0×10^{-8} at 25°C. What is the % ionization of hypochlorous acid in a 0.015-M aqueous solution of HClO at 25°C?

- A) 14 B) 2.1×10^{-5} C) 0.14 D) 4.5×10^{-8} E) 1.4×10^{-3}

- 24) The pH of a 0.55-M aqueous solution of hypobromous acid, HBrO, at 25°C is 4.48. What is the value of K_a for HBrO?

- A) 3.0×10^4 B) 6.0×10^{-5} C) 1.1×10^{-9} D) 3.3×10^{-5} E) 2.0×10^{-9}

- 25) The K_a of hypochlorous acid (HClO) is 3.0×10^{-8} at 25°C. Calculate the pH of a 0.0385-M hypochlorous acid solution.

- A) 8.94 B) 1.41 C) 4.47 D) -1.41 E) 7.52

- 26) In which of the following aqueous solutions does the weak acid exhibit the highest percentage ionization?
- A) 0.01 M HF ($K_a = 6.8 \times 10^{-4}$)
 B) 0.01 M HNO_2 ($K_a = 4.5 \times 10^{-4}$)
 C) 0.01 M $\text{HC}_2\text{H}_3\text{O}_2$ ($K_a = 1.8 \times 10^{-5}$)
 D) 0.01 M HClO ($K_a = 3.0 \times 10^{-8}$)
 E) These will all exhibit the same percentage ionization.
- 27) The acid-dissociation constants of phosphoric acid (H_3PO_4) are $K_{a1} = 7.5 \times 10^{-3}$, $K_{a2} = 6.2 \times 10^{-8}$, and $K_{a3} = 4.2 \times 10^{-13}$ at 25°C . What is the pH of a 2.5-M aqueous solution of phosphoric acid?
- A) 0.87 B) 0.13 C) 1.8 D) 2.5 E) 0.40
- 28) Classify the following compounds as weak acids (W) or strong acids (S):
- hypochlorous acid perchloric acid chloric acid
- A) S W W B) W W W C) W S W D) S S S E) W S S
- 29) Ammonia is a _____.
- A) weak acid B) salt C) strong acid D) strong base E) weak base
- 30) The pH of a 0.10-M solution of a weak base is 9.82. What is the K_b for this base?
- A) 2.1×10^{-4} B) 4.3×10^{-8} C) 6.6×10^{-4} D) 2.0×10^{-5} E) 8.8×10^{-8}
- 31) Calculate the pH of a 0.50-M aqueous solution of NH_3 . The K_b of NH_3 is 1.8×10^{-5} .
- A) 11.48 B) 2.52 C) 5.05 D) 3.01 E) 8.95
- 32) Determine the pH of a 0.35-M aqueous solution of CH_3NH_2 (methylamine). The K_b of methylamine is 4.4×10^{-4} .
- A) 10.19 B) 12.55 C) 1.91 D) 3.81 E) 12.09
- 33) An aqueous solution contains 0.050 M of methylamine. The concentration of hydroxide ion in this solution is _____M. K_b for methylamine is 4.4×10^{-4} .
- A) 4.7×10^{-3} B) 2.2×10^{-5} C) 4.5×10^{-3} D) 0.050 E) -4.9×10^{-3}

34) Using the data in the table, which of the conjugate bases below is the strongest base?

Acid	K_a
HOAc	1.8×10^{-5}
HCHO ₂	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

- A) F⁻
- B) OAc⁻
- C) CHO₂⁻
- D) ClO⁻
- E) OAc⁻ and CHO₂⁻

35) The base-dissociation constant, K_b , for pyridine, C₅H₅N, is 1.4×10^{-9} . The acid-dissociation constant, K_a , for the pyridinium ion, C₅H₅NH⁺, is _____.

- A) 1.4×10^{-23}
- B) 7.1×10^{-6}
- C) 1.4×10^{-5}
- D) 1.0×10^{-7}
- E) 7.1×10^{-4}

36) Which of the following ions will act as a weak base in water?

- A) ClO⁻
- B) Cl⁻
- C) NO₃⁻
- D) OH⁻
- E) None of the above will act as a weak base in water.

37) Calculate the pOH of a 0.0827-M aqueous sodium cyanide solution at 25°C. K_b for CN⁻ is 4.9×10^{-10} .

- A) 8.80
- B) 5.20
- C) 1.08
- D) 10.39
- E) 9.31

38) Which of the following aqueous solutions has the highest [OH⁻]?

- A) a solution with a pOH of 12.0
- B) a 1×10^{-3} M solution of NH₄Cl
- C) a 1×10^{-4} M solution of HNO₃
- D) a solution with a pH of 3.0
- E) pure water

39) Determine the pH of a 0.15-M aqueous solution of KF. For hydrofluoric acid, $K_a = 7.0 \times 10^{-4}$.

- A) 2.33
- B) 6.59
- C) 12.01
- D) 5.83
- E) 8.16

40) K_b for NH₃ is 1.8×10^{-5} . What is the pH of a 0.35-M aqueous solution of NH₄Cl at 25°C?

- A) 9.71
- B) 4.86
- C) 9.14
- D) 11.40
- E) 4.29

41) Of the following substances, an aqueous solution of _____ will form basic solutions.

NH_4Cl $\text{Cu}(\text{NO}_3)_2$ K_2CO_3 NaF

- A) K_2CO_3 , NH_4Cl
- B) NaF only
- C) NH_4Cl only
- D) NaF , K_2CO_3
- E) NH_4Cl , $\text{Cu}(\text{NO}_3)_2$

42) A 0.1-M aqueous solution of _____ will have a pH of 7.0 at 25.0°C.

NaOCl KCl NH_4Cl $\text{Ca}(\text{OAc})_2$

- A) NaOCl
- B) KCl
- C) NH_4Cl
- D) $\text{Ca}(\text{OAc})_2$
- E) KCl and NH_4Cl

43) Of the compounds below, a 0.1-M aqueous solution of _____ will have the highest pH.

- A) NaOAc , K_a of $\text{HOAc} = 1.8 \times 10^{-5}$
- B) NaClO , K_a of $\text{HClO} = 3.2 \times 10^{-8}$
- C) NH_4NO_3 , K_b of $\text{NH}_3 = 1.8 \times 10^{-5}$
- D) KCN , K_a of $\text{HCN} = 4.0 \times 10^{-10}$
- E) NaHS , K_b of $\text{HS}^- = 1.8 \times 10^{-7}$

44) The pH of a 0.15-M aqueous solution of NaZ (the sodium salt of HZ) is 10.70. What is the K_a for HZ ?

- A) 6.0×10^{-9} B) 3.3×10^{-8} C) 1.6×10^{-6} D) 8.9×10^{-4} E) 1.3×10^{-12}

45) Of the following, which is the strongest acid?

- A) HIO_4
- B) HIO_2
- C) HIO_3
- D) HIO
- E) The acid strength of all of the above is nearly the same.

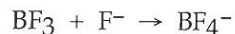
46) Of the following, which is the strongest acid?

- A) HClO B) HI C) HBr D) HF E) HCl

47) Which one of the following cannot act as a Lewis base?

- A) NH_3 B) H_2O C) CN^- D) BF_3 E) Cl^-

48) In the reaction



BF_3 acts as a(n) _____ acid.

- A) Arrhenius
- B) Lewis
- C) Arrhenius and Brønsted-Lowry
- D) Brønsted-Lowry
- E) Arrhenius, Brønsted-Lowry, and Lewis

49) A 0.200 M aqueous solution of HI at 25°C has a pH of _____.

- A) 0.699
- B) 5.00×10^{-13}
- C) 13.301
- D) 13.800
- E) 2.00×10^{-15}

50) A 7.0×10^{-3} M aqueous solution of $\text{Ca}(\text{OH})_2$ at 25°C has a pH of _____.

- A) 11.85
- B) 1.85
- C) 1.4×10^{-2}
- D) 7.1×10^{-13}
- E) 12.15

51) The base-dissociation constant of ethylamine ($\text{C}_2\text{H}_5\text{NH}_2$) is 6.4×10^{-4} at 25°C. The of $[\text{H}^+]$ in a 1.6×10^{-2} M solution of ethylamine is _____ M.

- A) 11.46
- B) 2.9×10^{-3}
- C) 3.5×10^{-12}
- D) 3.2×10^{-3}
- E) 3.1×10^{-12}

52) The acid-dissociation constant of hydrocyanic acid (HCN) at 25°C is 4.9×10^{-10} . What is the pH of an aqueous solution of 0.010 M sodium cyanide (NaCN)?

- A) 10.65
- B) 4.9×10^{-12}
- C) 2.2×10^{-11}
- D) 3.35
- E) 4.5×10^{-4}

Answer Key

Testname: PRACTICE 14.TST

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- | | |
|-------|-------|
| 1) A | |
| 2) A | |
| 3) C | 49) A |
| 4) C | 50) E |
| 5) A | 51) C |
| 6) D | 52) A |
| 7) C | |
| 8) B | |
| 9) C | |
| 10) C | |
| 11) E | |
| 12) B | |
| 13) D | |
| 14) A | |
| 15) D | |
| 16) B | |
| 17) E | |
| 18) E | |
| 19) E | |
| 20) A | |
| 21) A | |
| 22) D | |
| 23) C | |
| 24) E | |
| 25) C | |
| 26) A | |
| 27) A | |
| 28) E | |
| 29) E | |
| 30) B | |
| 31) A | |
| 32) E | |
| 33) C | |
| 34) D | |
| 35) B | |
| 36) A | |
| 37) B | |
| 38) E | |
| 39) E | |
| 40) B | |
| 41) D | |
| 42) B | |
| 43) D | |
| 44) A | |
| 45) A | |
| 46) B | |
| 47) D | |
| 48) B | |