

Name _____

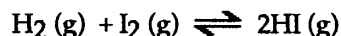
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following expressions is the correct equilibrium-constant expression for the equilibrium between dinitrogen tetroxide and nitrogen dioxide?



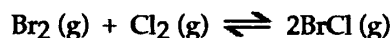
- A) $\frac{[\text{NO}_2]}{[\text{N}_2\text{O}_4]}$
 B) $[\text{NO}_2]^2[\text{N}_2\text{O}_4]$
 C) $\frac{[\text{NO}_2]}{[\text{N}_2\text{O}_4]^2}$
 D) $\frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$
 E) $[\text{NO}_2][\text{N}_2\text{O}_4]$

- 2) Consider the following chemical reaction:



At equilibrium in a particular experiment, the concentrations of H_2 , I_2 , and HI were 0.15 M, 0.033 M, and 0.55 M, respectively. The value of K_{eq} for this reaction is _____.

- A) 111 B) 9.0×10^{-3} C) 6.1 D) 61 E) 23
- 3) At 400 K, the equilibrium constant for the reaction



is $K_{\text{eq}} = 7.0$. A closed vessel at 400 K is charged with 1.00 atm of $\text{Br}_2 (\text{g})$, 1.00 atm of $\text{Cl}_2 (\text{g})$, and 2.00 atm of $\text{BrCl} (\text{g})$. Use Q to determine which of the statements below is true.

- A) The equilibrium partial pressure of Br_2 will be greater than 1.00 atm.
 B) The equilibrium partial pressures of Br_2 , Cl_2 , and BrCl will be the same as the initial values.
 C) The reaction will go to completion since there are equal amounts of Br_2 and Cl_2 .
 D) The equilibrium partial pressure of $\text{BrCl} (\text{g})$ will be greater than 2.00 atm.
 E) At equilibrium, the total pressure in the vessel will be less than the initial total pressure.

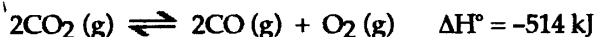
4) The equilibrium constant for the interconversion of PCl_5 and PCl_3 is 0.0121:



A vessel is charged with PCl_5 , giving an initial pressure of 0.123 atm. At equilibrium, the partial pressure of PCl_3 is _____ atm.

- A) 0.045 B) 0.033 C) 0.078 D) 0.123 E) 0.090

5) Consider the following reaction at equilibrium:



Le Châtelier's principle predicts that adding $\text{O}_2(\text{g})$ to the reaction container will _____.

- A) increase the partial pressure of $\text{CO}_2(\text{g})$ at equilibrium
B) decrease the value of the equilibrium constant
C) decrease the partial pressure of $\text{CO}_2(\text{g})$ at equilibrium
D) increase the value of the equilibrium constant
E) increase the partial pressure of $\text{CO}(\text{g})$ at equilibrium

6) The effect of a catalyst on an equilibrium is to _____.

- A) increase the rate at which equilibrium is achieved without changing the composition of the equilibrium mixture
B) shift the equilibrium to the right
C) increase the rate of the forward reaction only
D) increase the equilibrium constant so that products are favored
E) slow the reverse reaction only

7) A Brønsted-Lowry base is defined as a substance that _____.

- A) increases $[\text{H}^+]$ when placed in H_2O
B) acts as a proton acceptor
C) increases $[\text{OH}^-]$ when placed in H_2O
D) acts as a proton donor
E) decreases $[\text{H}^+]$ when placed in H_2O

8) The conjugate base of HSO_4^- is

- A) H_2SO_4 B) SO_4^{2-} C) H_3SO_4^+ D) HSO_4^+ E) OH^-

9) The concentration of water in pure water is approximately _____ M.

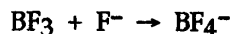
- A) 0.100 B) 18 C) 83 D) 100 E) 55

10) What is the pH of an aqueous solution at 25°C in which $[\text{H}^+]$ is 0.0025 M?

- A) -3.40 B) +2.25 C) +2.60 D) +3.40 E) -2.60

- 11) Which solution below has the highest concentration of hydroxide ions?
 A) pH = 9.82 B) pH = 3.21 C) pH = 7.00 D) pH = 12.59 E) pH = 7.93
- 12) Of the following acids, _____ is not a strong acid.
 A) HCl B) HNO₃ C) H₂SO₄ D) HClO₄ E) HNO₂
- 13) Which one of the following is the weakest acid?
 A) HNO₂ ($K_a = 4.5 \times 10^{-4}$)
 B) Acetic acid ($K_a = 1.8 \times 10^{-5}$)
 C) HClO ($K_a = 3.0 \times 10^{-8}$)
 D) HF ($K_a = 6.8 \times 10^{-4}$)
 E) HCN ($K_a = 4.9 \times 10^{-10}$)
- 14) 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) 2.1×10^{-5} B) 0.14 C) 1.4×10^{-3} D) 14 E) 4.5×10^{-8}
- 15) The acid-dissociation constants of sulfurous acid (H₂SO₃) are $K_{a1} = 1.7 \times 10^{-2}$ and $K_{a2} = 6.4 \times 10^{-8}$ at 25°C. Calculate the pH of a 0.163-M aqueous solution of sulfurous acid.
 A) 1.35 B) 1.77 C) 7.19 D) 1.28 E) 4.48
- 16) B is a weak base. Which equilibrium corresponds to the equilibrium constant K_a for HB⁺?
 A) $\text{HB}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightleftharpoons \text{B}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 B) $\text{HB}^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{B}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 C) $\text{B}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}) \rightleftharpoons \text{HB}^+(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 D) $\text{HB}^+(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}) \rightleftharpoons \text{H}_2\text{B}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 E) $\text{B}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HB}^+(\text{aq}) + \text{OH}^-(\text{aq})$
- 17) Classify the following compounds as weak acids (W) or strong acids (S):
 nitrous acid hydrochloric acid hydrofluoric acid
 A) S W W B) W W W C) W S W D) S S S E) W S S
- 18) Of the following, which is the strongest acid?
 A) HIO
 B) HIO₂
 C) HIO₄
 D) HIO₃
 E) The acid strength of all of the above is nearly the same.

19) In the reaction



BF_3 acts as a(n) _____ acid.

- A) Lewis
B) Arrhenius, Brønsted-Lowry, and Lewis
C) Arrhenius and Brønsted-Lowry
D) Arrhenius
E) Brønsted-Lowry
- 20) 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 0.080 M sodium cyanide (NaCN)?
A) 2.89 B) 11.11 C) 1.3×10^{-3} D) 7.8×10^{-12} E) 3.9×10^{-11}
- 21) The pH of a solution that contains 0.818 M acetic acid ($K_a = 1.76 \times 10^{-5}$) and 0.172 M sodium acetate is _____. The K_a of acetic acid is 1.76×10^{-5} .
A) 9.922 B) 5.432 C) 8.568 D) 8.370 E) 4.077
- 22) A solution containing which one of the following pairs of substances will be a buffer solution?
A) RbCl, HCl
B) KBr, HBr
C) NaI, HI
D) CsF, HF
E) none of the above
- 23) Consider a solution containing 0.100 M fluoride ions and 0.126 M hydrogen fluoride. The concentration of fluoride ions after the addition of 5.00 mL of 0.0100 M HCl to 25.0 mL of this solution is _____ M.
A) 0.00253 B) 0.0850 C) 0.0817 D) 0.00167 E) 0.0980
- 24) The K_b of ammonia is 1.8×10^{-5} . The pH of a buffer prepared by combining 50.0 mL of 1.00 M ammonia and 50.0 mL of 1.00 M ammonium nitrate is _____.
A) 4.74 B) 4.63 C) 9.37 D) 7.00 E) 9.26
- 25) A 25.0-mL sample of an acetic acid solution is titrated with a 0.175 M NaOH solution. The equivalence point is reached when 37.5 mL of the base is added. The concentration of acetic acid is _____ M.
A) 0.263 B) 0.119 C) 0.175 D) 0.365 E) 1.83×10^{-4}

Answer Key

Testname: PRACTICE_TEST_3.TST

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

- 1) D
- 2) D
- 3) D
- 4) B
- 5) A
- 6) A
- 7) B
- 8) B
- 9) E
- 10) C
- 11) D
- 12) E
- 13) E
- 14) B
- 15) A
- 16) B
- 17) C
- 18) C
- 19) A
- 20) B
- 21) E
- 22) D
- 23) C
- 24) E
- 25) A