CHEM1212K Test 2 Spring 2013

Name: Student ID:

1. Which one of the following will change the value of an equilibrium constant?

A) changing temperature

B) adding other substances that do not react with any of the species involved in the equilibrium

C) varying the initial concentrations of reactants

D) varying the initial concentrations of products

E) changing the volume of the reaction vessel

2. Which of the following expressions is the correct equilibrium-constant expression for the following reaction?

CO2 (g) + 2H2 (g)  CH3OH (g)

A) 

B) 

C) 

D) 

E) 

3. The equilibrium constant for reaction 1 is K. The equilibrium constant for reaction 2 is \_\_\_\_\_\_\_\_\_\_.

(1) SO2 (g) + (1/2) O2 (g)  SO3 (g)

(2) 2SO3 (g)  2SO2 (g) + O2 (g)

A) K2 B) 2K

C) 1/2K D) 1/K2

E) -K2

4. The Keq for the equilibrium below is 7.52 × 10-2 at 480.0°C.

2Cl2 (g) + 2H2O (g)  4HCl (g) + O2 (g)

What is the value of Keq at this temperature for the following reaction?

2HCl (g) + O2 (g)  Cl2 (g) + H2O (g)

A) 13.3 B) 3.65

C) -0.0376 D) 5.66 × 10-3

E) 0.274

5. Which of the following expressions is the correct equilibrium-constant expression for the reaction below?

HF (aq) + H2O (l)  H3O+ (aq) + F- (aq)

A) [HF][H2O] / [H3O+][F-]

B) 1 / [HF]

C) [H3O+][F-] / [HF][H2O]

D) [H3O+][F-] / [HF]

E) [F-] / [HF]

6. The equilibrium constant for the gas phase reaction

2NH3 (g)  N2 (g) + 3H2 (g)

is Keq = 230 at 300°C. At equilibrium, \_\_\_\_\_\_\_\_\_\_.

A) products predominate

B) reactants predominate

C) roughly equal amounts of products and reactants are present

D) only products are present

E) only reactants are present

7. At 400 K, the equilibrium constant for the reaction

Br2 (g) + Cl2 (g)  2BrCl (g)

is Kp = 7.0. A closed vessel at 400 K is charged with 1.00 atm of Br2 (g), 1.00 atm of Cl2 (g), and 2.00 atm of BrCl (g). Use Q to determine which of the statements below is true.

A) The equilibrium partial pressures of Br2, Cl2, and BrCl will be the same as the initial values.

B) The equilibrium partial pressure of Br2 will be greater than 1.00 atm.

C) At equilibrium, the total pressure in the vessel will be less than the initial total pressure.

D) The equilibrium partial pressure of BrCl (g) will be greater than 2.00 atm.

E) The reaction will go to completion since there are equal amounts of Br2 and Cl2.

8. The reaction below is exothermic:

2SO2 (g) + O2 (g)  2SO3 (g)

Le Châtelier's Principle predicts that \_\_\_\_\_\_\_\_\_\_ will result in an increase in the number of moles of SO3 (g) in the reaction container.

A) increasing the pressure B) decreasing the pressure

C) increasing the temperature D) removing some oxygen

E) increasing the volume of the container

9. For the endothermic reaction

CaCO3 (s)  CaO (s) + CO2 (g)

Le Châtelier's principle predicts that \_\_\_\_\_\_\_\_\_\_ will result in an increase in the number of moles of CO2.

A) increasing the temperature B) decreasing the temperature

C) increasing the pressure D) removing some of the CaCO3 (s)

E) none of the above

10. Given the following reaction:

CO (g) + 2H2(g)  CH3OH (g)

In an experiment, 0.42 mol of CO and 0.42 mol of H2 were placed in a 1.00-L reaction vessel. At equilibrium, there were 0.29 mol of CO remaining. Keq at the temperature of the experiment is \_\_\_\_\_\_\_\_\_\_.

A) 2.80 B) 0.357

C) 14.5 D) 17.5

11. A BrØnsted-Lowry base is defined as a substance that \_\_\_\_\_\_\_\_\_\_.

A) increases [H+] when placed in H2O

B) decreases [H+] when placed in H2O

C) increases [OH-] when placed in H2O

D) acts as a proton acceptor

E) acts as a proton donor

12. Which one of the following is a BrØnsted -Lowry acid?

A) (CH3)3NH+ B) CH3COOH

C) HF D) HNO2

E) all of the above

13. The molar concentration of hydroxide ion in pure water at 25°C is \_\_\_\_\_\_\_\_\_\_.

A) 1.00 B) 0.00

C) 1.0 ×10-14 D) 1.0 × 10-7

E) 7.00

14. The magnitude of Kw indicates that \_\_\_\_\_\_\_\_\_\_.

A) water autoionizes very slowly

B) water autoionizes very quickly

C) water autoionizes only to a very small extent

D) the autoionization of water is exothermic

15. In basic solution, \_\_\_\_\_\_\_\_\_\_.

A) [H3O+] = [OH-] B) [H3O+] > [OH-]

C) [H3O+] < [OH-] D) [H3O+] = 0 M

E) [OH-] > 7.00

16. 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 \_\_\_\_\_\_\_\_\_\_.

A) H3O+ (aq) B) OH- (aq) + H2 (g)

C) OH- (aq) + 2H+ (aq) D) no reaction occurs

E) H2O2 (aq)

17. In which of the following aqueous solutions does the weak acid exhibit the lowest percentage ionization?

A) 0.01 M HC2H3O2 (Ka = 1.8 × 10-5)

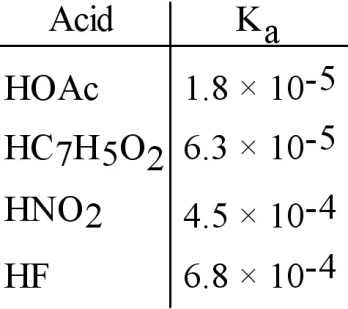
B) 0.01 M HNO2 (Ka = 4.5 × 10-4)

C) 0.01 M HF (Ka = 6.8 × 10-4)

D) 0.01 M HClO (Ka = 3.0 × 10-8)

E) These will all exhibit the same percentage ionization.

18. Using the data in the table, which of the conjugate bases below is the strongest base?



A) OAc- B) C7H5O2-

C) NO2- D) F-

E) OAc- and C7H5O2-

19. A 0.1 M aqueous solution of \_\_\_\_\_\_\_\_\_\_ will have a pH of 7.0 at 25.0°C.

NaOCl KCl NH4Cl Ca(OAc)2

A) NaOCl B) KCl

C) NH4Cl D) Ca(OAc)2

E) KCl and NH4Cl

20. What is the pH of an aqueous solution at 25.0 °C that contains 3.98 × 10-9 M hydronium ion?

A) 8.400 B) 5.600

C) 9.000 D) 3.980

E) 7.000

21. Place the following in order of increasing acid strength.

HBrO2 HBrO3 HBrO HBrO4

A) HBrO2 < HBrO4 < HBrO < HBrO3

B) HBrO < HBrO2 < HBrO3 < HBrO4

C) HBrO2 < HBrO3 < HBrO4 < HBrO

D) HBrO4 < HBrO2 < HBrO3 < HBrO

E) HBrO < HBrO4 < HBrO3 < HBrO2

22. What is the Kw of pure water at 50.0°C, if the pH is 6.630?

A) 2.34 × 10-7 B) 5.50 × 10-14

C) 2.13 × 10-14 D) 1.00 × 10-14

E) There is not enough information to calculate the Kw.

23) Which of the following statements is FALSE?

A) When K >> 1, the forward reaction is favored and essentially goes to completion.

B) When K << 1, the reverse reaction is favored and the forward reaction does not proceed to a great extent.

C) When K ≈ 1, neither the forward or reverse reaction is strongly favored, and about the same amount of reactants and products exist at equilibrium.

D) K >> 1 implies that the reaction is very fast at producing products.

E) None of the above.

24) Express the equilibrium constant for the following reaction.

P4(s) + 5 O2(g) ⇌ P4O10(s)

A) K = 

B) K = 

C) K = [O2]-5

D) K = [O2]5

E) K = 

25. Which of the following statements is TRUE?

A) If Q < K, it means the reverse reaction will proceed to form more reactants.

B) If Q > K, it means the forward reaction will proceed to form more products.

C) If Q = K, it means the reaction is at equilibrium.

D) All of the above are true.

E) None of the above are true.