Equilibrium Practice Test
Chemistry

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

1) What is the correct form for the equilibrium constant for this reaction?

$H_2\,(g) + F_2\,(g) = 2\,HF\,(g)$

A) $\frac{[H_2][F_2]}{[HF]^2}$ B) $\frac{[HF]^2}{[H_2][F_2]}$

C) $\frac{[H_2][F_2]}{[HF]}$ D) $\frac{[H_2][F_2]}{2[HF]}$

2) When a reaction is at equilibrium,
A) the products and reactants have the same energy content.
B) the forward and reverse reactions occur at the same rate.
C) all reaction stops.
D) the reaction is no longer reversible.
E) no more reactants are converted to products.

3) What is the correct form of the equilibrium constant for the reaction of hydrogen and oxygen to form water? The equation is:

$2H_2(g) + O_2(g) = 2\,H_2O(g)$

A) $K_c = \frac{[H_2O]}{[O_2]\,[H_2^2]}$

B) $K_c = \frac{[H_2O]^2}{[O_2]\,[H_2]^2}$

C) $K_c = \frac{[H_2O]}{[O_2]\,[2H_2]}$

D) $K_c = \frac{[H_2O]}{[O_2]\,[H_2]}$

4) In the following reaction, what is the effect on the direction of the reaction if more SO_3 is added to the reaction mixture?

$2SO_2\,(g) + O_2\,(g) = 2SO_3\,(g)$

A) The position of the equilibrium remains unchanged.
B) The equilibrium shifts to produce more reactants.
C) The equilibrium shifts to produce more products.
D) The rate of formation of products is increased.
E) The catalyst for the reaction is used up.

5) In the reaction of nitrogen gas with oxygen gas to produce nitrogen oxide, what is the effect of adding more oxygen gas to the initial reaction mixture? The reaction is shown below.

$N_2(g) + O_2(g) = 2NO(g)$

A) The equilibrium shifts to produce more N_2.
B) The equilibrium shifts to produce more NO.
C) The temperature of the reaction mixture is raised.
D) Extra catalyst is required to reach equilibrium.
E) The equilibrium is not affected.

6) Which of the changes listed below has *no effect* on the equilibrium for the following reversible reaction?

$SrCO_3(s) \rightleftarrows Sr^{2+}(aq) + CO_3^{2-}(aq)$

A) add solid Na_2CO_3
B) add solid $NaNO_3$
C) increase $[CO_3^{2-}]$
D) increase $[Sr^{2+}]$
E) add solid $Sr(NO_3)_2$

7) Which of the changes listed below will shift the equilibrium to the *right* for the following reversible reaction?
$C(s) + H_2O(g) \rightleftarrows CO(g) + H_2(g) + \text{heat}$
A) decrease $[H_2]$
B) increase $[H_2O]$
C) increase volume
D) decrease temperature
E) all of the above

8) Which of the changes listed below will shift the equilibrium to the *left* for the following reversible reaction?
$C(s) + H_2O(g) \rightleftarrows CO(g) + H_2(g) + \text{heat}$
A) increase $[H_2O]$
B) decrease volume
C) decrease temperature
D) decrease $[H_2]$

9) An industrial process for producing carbon monoxide is to pass carbon dioxide gas over hot charcoal (carbon). Which set of conditions listed below favors the *maximum yield* of carbon monoxide?
$C(s) + CO_2(g) + \text{heat} \rightleftarrows 2\,CO(g)$
A) high temperature and low pressure
B) high temperature and high pressure
C) low temperature and low pressure
D) low temperature and high pressure

10) Which reaction below is endothermic?
A) $PCl_3 + Cl_2 \longrightarrow PCl_5 + \text{heat}$
B) $NH_3 + hr \longrightarrow NH4Br + \text{heat}$
C) $CH_4 + N_2 + \text{heat} \longrightarrow hn + NH_3$
D) $2NO2 \longrightarrow N_2 + 2O2 + \text{heat}$

11) When the position of an equilibrium is described as being "far to the left" it means that:
A) very few reactant molecules are present in the equilibrium mixture
B) the rate of the reverse reaction is greater than that of the forward reaction
C) very few product molecules are present in the equilibrium mixture
D) significant amounts of both products and reactants are present in the equilibrium mixture

12) The expression for the equilibrium constant, K_{eq}, for the reaction below is:
$4\,NH_3(g) + 5\,O_2(g) \rightleftarrows 4\,NO(g) + 6\,H_2O(g)$
A) $K_{eq} = \dfrac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5}$
B) $K_{eq} = \dfrac{[NO][H_2O]}{[NH_3][O_2]}$
C) $K_{eq} = \dfrac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$
D) $K_{eq} = \dfrac{[NH_3][O_2]}{[NO][H_2O]}$

13) Which of the following is the correct equilibrium expression for the reaction
$CS_2(g) + 4\,H_2(g) \rightleftarrows CH_4(g) + 2\,H_2S(g)$
A) $K_{eq} = \dfrac{[CS_2][H_2]^4}{[CH_4][H_2S]^2}$
B) $K_{eq} = \dfrac{[CH_4][H_2S]^2}{[CS_2][H_2]^4}$
C) $K_{eq} = \dfrac{[CS_2][H_2]^4}{[CH_4][H_2S]^2}$
D) $K_{eq} = \dfrac{[CH_4][H_2S]^2}{[CS_2][H_2]}$

14) Which one of the following will change the value of an equilibrium constant?
A) varying the initial concentrations of products
B) varying the initial concentrations of reactants
C) adding other substances that do not react with any of the species involved in the equilibrium
D) changing temperature

15) If the K eq = 2.2×10^{12} then which of the following statements is true?
A) mostly reactants are present
B) mostly products are present
C) some of both reactants and products are present
D) none of the above

16) According to Le Chatelier's principle, which of the following changes will shift to the left the position of the equilibrium to the left of the following reaction?

N_2 (g) + 3 H_2 (g) $\rightleftarrows$ 2 NH_3 (g) + Heat

A) Decrease the temperature.
B) Increase the concentration of H_2.
C) Decrease the pressure on the system.
D) Increase the concentration of N_2.

17) The following reaction is *exothermic*. Which of the following will drive the reaction to the right (towards products)?

CH_4 (g)+ 2 O_2 (g)$\rightleftarrows$ CO_2(g)+ 2 H_2O(g)

A) a decrease in temperature
B) the removal of CH_4
C) the addition of CO_2
D) an increase in temperature

18) What is the equilibrium constant value if at equilibrium the concentrations are $[NH_3]$= 0.40 M, $[H_2]$= 0.12 M and $[N_2]$ = 0.040 M at a certain temperature?

2 NH_3 (g) $\rightleftarrows$ 2 (g) + 3 H_2 (g)

A) 6.8×10^{-9}
B) 7.2×10^{15}
C) 4.8×10^{-2}
D) 4.3×10^{-4}

19) The following reaction is endothermic:

$CaCO_3$ (s) $\rightleftarrows$ CaO (s) + CO_2 (g).

Which of the following will cause the reaction to shift towards making more carbon dioxide gas?

A) decreasing the temperature of the reaction
B) increasing the pressure and decreasing the temperature of the system
C) increasing the pressure of the system
D) increasing the temperature of the reaction

20) Consider the following system at equilibrium:

N_2 (g) + 3 H_2 (g) $\rightleftarrows$ 2 NH_3 (g) + 93 kJ

Which of the following changes will shift the equilibrium to the *right*?

1. Increasing the temperature
2. Decreasing the temperature
3. Increasing the volume
4. Decreasing the volume
5. Removing some NH_3
6. Adding some NH_3
7. Removing some N_2
8. Adding some N_2.

A) 1, 4, 6, 7
B) 2, 4, 5, 8
C) 1, 6, 8
D) 2, 3, 5, 8

Answer Key
Testname: CHEM EQUILIBRIUM PRACTICE EXAM

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