CHEMICAL EQUILIBRIUM SELF-QUIZ

For each question, write the word, phrase, or expression that completes each statement.

1. For a reversible reaction, a state of equilibrium exists when the forward and reverse reactions are proceeding under the same conditions at the same _____.

2. For a given reaction, the value of the equilibrium constant will change when the _____ is changed.

3. The mass-action expression for the reaction whose balanced equation is

   $2\,A \leftrightarrows B + C$ is _____.

4. For the reaction $A + B \leftrightarrows C + D + 50\ kJ$, the equilibrium will shift to the _____ when the temperature is increased.

5. If the pressure on the reaction $2\,N_2\,(g) + 5\,O_2\,(g) \leftrightarrows 2\,N_2O_5\,(g)$ is decreased, the equilibrium will shift to the _____.

Base your answers to questions 6-8 on the equation below for the HABER PROCESS.

$$N_2\,(g) + 3\,H_2\,(g) \leftrightarrows 2\,NH_3\,(g) + 91.8\ kJ$$

6. When a catalyst is added to the reacting mixture, the equilibrium point

   a) shifts to the right b) shifts to the left c) remains the same

7. If the pressure is increased, the number of moles of NH_3 molecules formed will

   a) increase b) decrease c) remain the same

8. Lowering the temperature will favor

   a) the exothermic reaction b) the endothermic reaction c) both reactions

9. If the concentration of N_2 is increased, the concentration of NH_3

   a) increase b) decrease c) remain the same

10. If the temperature is raised, the rate of

    a) the forward reaction increases b) the backward reaction increases

    c) both reactions increases

Find the answer to the following problems:

11. For the reaction $2\ H_2\ (g) + S_2\ (g) \leftrightarrow 2\ H_2S\ (g)$ at equilibrium, the concentration of H_2 is 0.010 mole/liter, and the concentration of H_2S is 0.15 mole/liter. If the equilibrium constant is 44, what is the concentration, in moles/liter of S_2 ?

12. The equilibrium $H_2\ (g) + I_2\ (g) \leftrightarrow 2\ HI\ (g)$ is established in a container into which H_2 and I_2 are placed. If the equilibrium concentrations are 0.040 M for both H_2 & I_2 and 0.320 M for HI, what is the equilibrium constant?

Key

CHEMICAL EQUILIBRIUM SELF-QUIZ

For each question, write the word, phrase, or expression that completes each statement.

1. For a reversible reaction, a state of equilibrium exists when the forward and reverse reactions are proceeding under the same conditions at the same rate.

2. For a given reaction, the value of the equilibrium constant will change when the temp. is changed.

3. The mass-action expression for the reaction whose balanced equation is $2A \leftrightarrows B + C$ is $\frac{[B][C]}{[A]^2}$.

4. For the reaction $A + B \leftrightarrows C + D + 50\ kJ$, the equilibrium will shift to the left when the temperature is increased.

5. If the pressure on the reaction $2 N_2 (g) + 5 O_2 (g) \leftrightarrows 2 N_2O_5 (g)$ is decreased, the equilibrium will shift to the left.

Base your answers to questions 6-8 on the equation below for the HABER PROCESS.

$$N_2 (g) + 3 H_2 (g) \leftrightarrows 2 NH_3 (g) + 91.8\ kJ$$

6. When a catalyst is added to the reacting mixture, the equilibrium point

   a) shifts to the right b) shifts to the left c) remains the same

   catalyst ↑ rate forward = reverse equally.

7. If the pressure is increased, the number of moles of NH_3 molecules formed will

   (favor less moles) →

   a) increase b) decrease c) remain the same

   Shifts R

8. Lowering the temperature will favor

   a) the exothermic reaction b) the endothermic reaction c) both reactions

9. If the concentration of N_2 is increased, the concentration of NH_3

   a) increase b) decrease c) remain the same

10. If the temperature is raised, the rate of

    a) the forward reaction increases b) the backward reaction increases

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Find the answer to the following problems:

11. For the reaction $2\ H_2\ (g) + S_2\ (g) \leftrightarrow 2\ H_2S\ (g)$ at equilibrium, the concentration of H_2 is 0.010 mole/liter, and the concentration of H_2S is 0.15 mole/liter. If the equilibrium constant is 44, what is the concentration, in moles/liter of S_2 ?

$X = 5.11$

$$K_{eq} = \frac{[H_2S]^2}{[H_2]^2[S_2]} \qquad 44 = \frac{[.15]^2}{[.01]^2[x]}$$

$$44 = \frac{[.15]^2}{[.001]x} \qquad \frac{.0044x}{.0044} = \frac{.0225}{.0044}$$

12. The equilibrium $H_2\ (g) + I_2\ (g) \leftrightarrow 2\ HI\ (g)$ is established in a container into which H_2 and I_2 are placed. If the equilibrium concentrations are 0.040 M for both H_2 & I_2 and 0.320 M for HI, what is the equilibrium constant?

$$\frac{[HI]^2}{[H_2][I_2]} = K_{eq} \qquad \frac{[.320]^2}{[.040][.040]} = K_{eq}$$

$K_{eq} = 64$