

Chemical Equilibrium

I. What Is Equilibrium?

1. Define the term chemical equilibrium.

Chemical Equilibrium - state in which the forward and reverse reactions balance each other (take place at equal rates)

2. Write the balanced formula showing how ammonia (NH_3) can be created from H_2 and N_2 .



3. Write the formula so that the reaction is reversed.



4. Write the formula indicating that the reaction is in chemical equilibrium.



5. The total amount of reactants and products remain constant in chemical equilibrium.

(Circle One) : True False

6. Most reactants and products react in a state of chemical equilibrium.

(Circle One) : True False

Ex. People traveling between two buildings in a connecting hallway.

II. Equilibrium Expressions

1. A majority of equilibrium reactions occur with some reactants unconsumed.

(Circle One) : True False

2. Define the term law of chemical equilibrium.

Law Of Chemical Equilibrium - a state in which a particular ratio of reactants + products have a constant value at a given temperature

3. Write the Equilibrium Constant expression from the general equation for equilibrium.

$$K_{eq} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

$[A]$, $[B]$ = Molar Concentrations of Reactants

$[C]$, $[D]$ = Molar Concentrations of Products

a, b, c, d = Coefficients in Balanced Equation

4. Define the term equilibrium constant.

Equilibrium Constant - (K_{eq}) - numerical value of the ratio of product concentration to reactant concentration (at specific temperatures)

Ammonia
- Animal
grains
- Fertilizer

5. What do each of the following equilibrium constants represent?

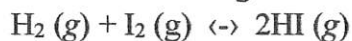
$K_{eq} > 1 =$ More products than reactants (at equilibrium)

$K_{eq} < 1 =$ More reactants than products (at equilibrium)

6. Define the term homogeneous equilibrium.

Homogeneous Equilibrium - equilibrium in which all the reactants + products are in the same physical state

7. Determine the homogeneous equilibrium constant for the following equation :



$$K_{eq} = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$

Add Coefficients

8. No units are used to label equilibrium constant expressions.

(Circle One) : True False

9. Define the term heterogeneous equilibrium.

Heterogeneous Equilibrium - equilibrium in which reactants + products are in more than one physical state

10. Using ethanol, determine the heterogeneous equilibrium constant for the equation :



Step 1 : Form ratio constant (K) of product to reactant

$$K = \frac{[\text{C}_2\text{H}_5\text{OH}(\text{g})]}{[\text{C}_2\text{H}_5\text{OH}(\text{l})]}$$

Step 2 : Omit liquid and solid substances (constant densities)

$$\frac{[\text{C}_2\text{H}_5\text{OH}(\text{g})]}{[\text{C}_2\text{H}_5\text{OH}(\text{l})]} \times [\text{C}_2\text{H}_5\text{OH}(\text{l})] \rightarrow K [\text{C}_2\text{H}_5\text{OH}(\text{l})] = [\text{C}_2\text{H}_5\text{OH}(\text{g})] = K_{eq}$$

Step 3 : Determine K_{eq} by gaseous state

$$K_{eq} = [\text{C}_2\text{H}_5\text{OH}(\text{g})]$$

III. Equilibrium Constants

1. Which of the following statements is false concerning equilibrium?

a. Temperature must remain constant during equilibrium.

b. Equilibrium must take place in closed open systems.

c. The amount of reactants and products remain constant in equilibrium.

d. An unlimited number of temperature positions can create equilibrium.