Chemical Equilibrium Quiz Answer Key PDF

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What is the definition of chemical equilibrium?

A. A state where reactants are completely converted to products.

C. A dynamic state where the rate of the forward reaction equals the rate of the reverse reaction. ✓

D. A state where the reaction has stopped completely.

C. A state where the concentrations of reactants and products are equal.

Which of the following is a characteristic of a system at equilibrium?

A. The reaction has stopped.

C. The concentrations of reactants and products are changing.

D. The system is open to the environment.

C. The forward and reverse reactions occur at the same rate. ✓

In the context of Le Chatelier's Principle, which actions will shift the equilibrium of a reaction to the right?

A. Adding more reactants ✓

C. Removing products ✓

D. Increasing pressure for a reaction with fewer moles of gas on the product side ✓

C. Decreasing temperature for an endothermic reaction

In a homogeneous equilibrium, what is true about the phases of reactants and products?

A. They are in different phases.

C. They must be gases.

D. They must be liquids.

C. They are in the same phase. ✓

Which factors can affect the position of equilibrium in a chemical reaction?

A. Concentration of reactants ✓
C. Temperature ✓
D. Pressure ✓
C. Catalyst

What does the equilibrium constant (K) express?

A. The speed of the reaction.
C. The temperature at which equilibrium is achieved.
D. The pressure of the system.
C. The ratio of product concentrations to reactant concentrations at equilibrium. ✓

Which of the following changes can shift the equilibrium of an exothermic reaction to the left?

A. Increasing temperature ✓
C. Decreasing temperature
D. Increasing concentration of products ✓
C. Decreasing concentration of reactants ✓

Which statement is true about Le Chatelier's Principle?

A. It predicts the speed of a reaction.
C. It only applies to temperature changes.
D. It is not applicable to chemical equilibria.
C. It predicts how a system at equilibrium responds to external changes. ✓

What is the effect of a catalyst on a system at equilibrium?

A. It increases the concentration of products.
C. It decreases the concentration of reactants.
D. It shifts the equilibrium position.
C. It speeds up both the forward and reverse reactions equally. ✓

In the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, what happens if the pressure is increased?

A. The equilibrium shifts to the left.

C. The equilibrium remains unchanged.

D. The reaction stops.

C. The equilibrium shifts to the right. ✓

Discuss the industrial significance of chemical equilibrium, using the Haber process as an example.

The industrial significance of chemical equilibrium is highlighted in the Haber process, where the equilibrium between nitrogen and hydrogen gases is manipulated to maximize ammonia production, crucial for agricultural fertilizers.

How does the concept of dynamic equilibrium apply to biological systems, such as oxygen transport in the blood?

Dynamic equilibrium applies to oxygen transport in the blood by maintaining a balance between oxygen uptake in the lungs and oxygen release to tissues, ensuring stable oxygen levels despite continuous movement.

Why is it important to consider both Kc and K p when analyzing gaseous equilibria?

It is important to consider both Kc and K p because Kc relates to concentrations of reactants and products, while K p relates to their partial pressures, allowing for a complete analysis of the equilibrium state in gaseous systems.

How does the presence of a catalyst affect the time taken to reach equilibrium, and why does it not affect the equilibrium position?

A catalyst decreases the time taken to reach equilibrium by increasing the rate of both the forward and reverse reactions, but it does not affect the equilibrium position.

Explain how Le Chatelier's Principle can be used to predict the effect of temperature changes on an equilibrium system.

Le Chatelier's Principle can be used to predict that increasing the temperature of an equilibrium system will shift the equilibrium position towards the endothermic direction, while decreasing the temperature will shift it towards the exothermic direction.

What are the characteristics of a system at chemical equilibrium?

A. The reaction rates of the forward and reverse reactions are equal. ✓

C. The concentrations of reactants and products are constant. ✓

D. The system is static and unchanging.

C. The system is closed. ✓

Which of the following changes will shift the equilibrium position of a gaseous reaction?

A. Adding a catalyst.

C. Increasing the volume of the container.

D. Adding an inert gas at constant volume.

C. Increasing the temperature. ✓

Which of the following statements about equilibrium constants are true?

A. Kc is used for reactions in solution. ✓

C. K p is used for reactions involving gases. ✓

D. The value of K changes with temperature. ✓

C. A large K value indicates a fast reaction.

Which of the following are examples of reversible reactions?

A. Combustions of methane

C. Dissolution of salt in water

D. The synthesis of ammonia ✓

C. The reaction between hydrogen and iodine to form hydrogen iodide ✓

Describe the process of using an ICE table to calculate equilibrium concentrations in a chemical reaction.

To use an ICE table, first list the reactants and products of the reaction. Then, fill in the initial concentrations (I), the changes in concentrations (C) as the reaction proceeds to equilibrium, and finally, the equilibrium concentrations (E) by applying the stoichiometric coefficients from the balanced equation.