Equilibrium Constant Quiz Questions and Answers PDF

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For the reaction N2(g) + 3H2(g) ⇌ 2NH3(g), what is the expression for Kc?

- ◯ **[NH3]^2 / [N2][H2]^3 ✓**
- ◯ [N2][H2]^3 / [NH3]^2
- ◯ [NH3]^2 / [N2]^2[H2]^3
- ◯ [N2][H2]^3 / [NH3]

> The equilibrium constant expression Kc for the reaction N2(g) + 3H2(g) ⇌ 2NH3(g) is derived from the concentrations of the products and reactants. It is given by Kc = [NH3]^2 / ([N2][H2]^3).

Which of the following are characteristics of a system at equilibrium? (Select all that apply)

- ☐ **Forward and reverse reactions occur at the same rate ✓**
- ☐ Concentrations of reactants and products are equal
- ☐ The system is static
- ☐ **The macroscopic properties are constant ✓**

> A system at equilibrium exhibits characteristics such as constant concentrations of reactants and products, and no net change in the system over time. Additionally, the rates of the forward and reverse reactions are equal.

Explain how temperature affects the equilibrium constant of an exothermic reaction.

> **For an exothermic reaction, increasing the temperature shifts the equilibrium position to the left, resulting in a decrease in the equilibrium constant (K).**

In the context of equilibrium, what does a large K value indicate?

- ◯ The reaction is fast
- ◯ The reaction is slow
- ◯ **Products are heavily favored ✓**
- ◯ Reactants are heavily favored

> A large K value indicates that the equilibrium position of a reaction favors the formation of products over reactants, suggesting that the reaction proceeds nearly to completion.

If Kc > 1 for a reaction, what does this indicate about the reaction at equilibrium?

- ◯ Reactants are favored
- ◯ **Products are favored ✓**
- ◯ The reaction is at its midpoint
- ◯ The reaction is not at equilibrium

> A Kc value greater than 1 indicates that at equilibrium, the concentration of products is greater than that of reactants, favorably shifting the reaction towards the products side.

What conditions can change the value of the equilibrium constant (K)? (Select all that apply)

- ☐ **Temperature ✓**
- ☐ Pressure
- ☐ Concentration
- ☐ Catalyst presence

> The value of the equilibrium constant (K) can change with temperature, but it remains constant with changes in concentration, pressure, or the presence of catalysts. Therefore, the only condition that affects K is temperature.

What is the unit of Kc for the reaction $2A(g) + B(g) \rightleftharpoons 3C(g)$?

- ◯ M^2
- ◯ M^-1
- ◯ **M^-2 ✓**
- ◯ Unitless

> The unit of Kc for the reaction 2A(g) + B(g) ⇌ 3C(g) is mol/L, raised to the power of the change in moles of gas, which is (3 - 2 - 1) = 0. Therefore, Kc is dimensionless.

Which of the following statements is true regarding the reaction quotient (Q)?

- ◯ Q is always equal to K at equilibrium
- ◯ **Q can predict the direction of the reaction shift ✓**
- ◯ Q is only calculated at equilibrium
- ◯ Q is independent of reactant concentrations

> The reaction quotient (Q) is a measure of the relative concentrations of products and reactants at any point in a reaction, and it helps predict the direction in which the reaction will proceed to reach equilibrium.

In an ICE table, what does the 'C' stand for? (Select all that apply)

- ☐ **Change ✓**
- ☐ Concentration
- ☐ Constant
- ☐ Coefficient

> In an ICE table, the 'C' stands for 'Change', which represents the change in concentration or pressure of reactants and products as the reaction progresses. It is used to calculate the equilibrium concentrations based on initial amounts and the changes that occur during the reaction.

What is the significance of a reaction having an equilibrium constant (K) close to 1?

> **The significance of a reaction having an equilibrium constant (K) close to 1 is that it implies the reaction reaches a state where the concentrations of reactants and products are similar, indicating a balance between the forward and reverse reactions.**

Which of the following are true for a reaction with Kc < 1? (Select all that apply)

- [x] **The reaction favors reactants ✓**
- [ ] The reaction favors products
- [ ] The forward reaction is predominant
- [x] **The reverse reaction is predominant ✓**

> For a reaction with Kc < 1, it indicates that the reactants are favored at equilibrium, meaning the concentration of products is lower than that of reactants. This suggests that the reaction does not proceed significantly towards the formation of products under standard conditions.

Provide an example of an industrial process that utilizes the concept of equilibrium constant and explain its importance.

> **An example of an industrial process that utilizes the concept of equilibrium constant is the Haber process, which synthesizes ammonia (NH3) from nitrogen (N2) and hydrogen (H2) gases. The equilibrium constant helps in determining the optimal conditions (temperature, pressure, and concentration) to maximize ammonia yield.**

Which of the following statements are true about K p? (Select all that apply)

- [x] **K p is used for reactions involving gases ✓**
- [ ] K p is always equal to K c
- [x] **K p depends on the change in moles of gas ✓**
- [x] **K p is affected by changes in pressure ✓**

> K p, or the equilibrium constant for a reaction, is a measure of the ratio of the concentrations of products to reactants at equilibrium. It is temperature-dependent and provides insight into the favorability of a reaction.

How does Le Chatelier's Principle help predict the effect of pressure changes on a gaseous equilibrium?

Le Chatelier's Principle helps predict that increasing pressure will shift the equilibrium towards the side with fewer moles of gas, while decreasing pressure will shift it towards the side with more moles of gas.

What can be deduced if Q < K for a reaction? (Select all that apply)

- [x] **The reaction will shift to the right ✓**
- [ ] The reaction will shift to the left
- [x] **More products will form ✓**
- [ ] More reactants will form

If Q < K for a reaction, it indicates that the reaction will proceed in the forward direction to reach equilibrium, favorably producing more products until Q equals K.

Which of the following is true about the equilibrium constant (K) when a reaction is at equilibrium?

- ○ K is always equal to 1
- ○ K is greater than 1
- ○ K is less than 1
- ○ **K is constant at a given temperature ✓**

The equilibrium constant (K) is a ratio of the concentrations of products to reactants at equilibrium, and it remains constant at a given temperature regardless of the initial concentrations of the reactants and products.

What does the equilibrium constant (K) represent in a chemical reaction?

- ○ The speed of the reaction
- ○ **The ratio of products to reactants at equilibrium ✓**
- ○ The amount of energy released
- ○ The initial concentration of reactants

The equilibrium constant (K) quantifies the ratio of the concentrations of products to reactants at equilibrium for a given chemical reaction. It indicates the extent to which a reaction favors the formation

of products over reactants at equilibrium.

Discuss why the equilibrium constant does not provide information about the speed of a reaction.

The equilibrium constant does not provide information about the speed of a reaction because it only indicates the ratio of products to reactants at equilibrium, while the rate of reaction depends on kinetic factors such as activation energy and reaction mechanisms.

Describe the process of setting up an ICE table for a reaction and its purpose.

To set up an ICE table, first identify the balanced chemical equation for the reaction. Then, create a table with three rows labeled 'Initial', 'Change', and 'Equilibrium', and fill in the initial concentrations of reactants and products, the changes that occur as the reaction progresses, and finally calculate the equilibrium concentrations based on the changes.

Which factor does NOT affect the value of the equilibrium constant?

- ◯ Temperature
- ◯ Concentration of reactants
- ◯ Pressure
- ◯ **Catalysts ✓**

The value of the equilibrium constant is not affected by changes in concentration, pressure, or temperature of the reactants and products at equilibrium. It is solely dependent on the temperature of the system.