



Name _____ Class _____ Date _____

- 1 Given the system at equilibrium:
- $$\text{N}_2\text{O}_4(\text{g}) + 58.1 \text{ kJ} \rightleftharpoons 2\text{NO}_2(\text{g})$$
- What will be the result of an **increase in temperature** at **constant pressure**?
- A The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
 - B The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will increase.
 - C The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
 - D The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will increase.

- 2 Which statement must be true for any **chemical reaction** at **equilibrium**?
- A The concentration of the products is greater than the concentration of the reactants.
 - B The concentration of the products is less than the concentration of the reactants.
 - C The concentration of the products and the concentration of the reactants are equal.
 - D The concentration of the products and the concentration of the reactants are constant.

- 3 As the temperature of a substance decreases, the **average kinetic energy** of its particles

- A decreases
- B increases
- C remains the same



- 4 Given the equation:
- $$\text{KNO}_3(\text{s}) \xrightarrow{\text{H}_2\text{O}(\text{l})} \text{KNO}_3(\text{aq})$$

As $\text{H}_2\text{O}(\text{l})$ is added to $\text{KNO}_3(\text{s})$ to form $\text{KNO}_3(\text{aq})$, the **entropy** of the system

- A decreases



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- C saturated
- D unsaturated



- A decreasing the pressure
- B decreasing the concentration of $\text{N}_2(\text{g})$
- C increasing the concentration of $\text{O}_2(\text{g})$
- D increasing the temperature

- 9 Which statement must be true about a **chemical system** at **equilibrium**?
- A The forward and reverse reactions stop.
 - B The concentration of reactants and products are equal.
 - C The rate of the forward reaction is equal to the rate of the reverse reaction.
 - D The number of moles of reactants is equal to the number of moles of product.

- 10 Adding a **catalyst** to a **chemical reaction** results in
- A a decrease in activation energy and a decrease in the reaction rate
 - B a decrease in activation energy and an increase in the reaction rate
 - C an increase in activation energy and a decrease in the reaction rate
 - D an increase in activation energy and an increase in the reaction rate



ANSWER KEY

Given the system at equilibrium:



What will be the result of an **increase in temperature** at **constant pressure**?

- A** The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
- B** The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will increase.
- C** The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
- D** The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will increase.

(d)

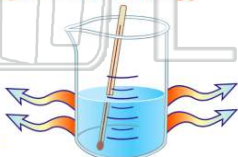
Which statement must be true for any **chemical reaction** at **equilibrium**?

- A** The concentration of the products is greater than the concentration of the reactants.
- B** The concentration of the products is less than the concentration of the reactants.
- C** The concentration of the products and the concentration of the reactants are equal.
- D** The concentration of the products and the concentration of the reactants are constant.

(d)

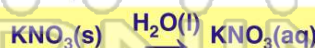
As the temperature of a substance decreases, the **average kinetic energy** of its particles

- A** decreases
- B** increases
- C** remains the same



(a)

Given the equation:



As $\text{H}_2\text{O}(\text{l})$ is added to $\text{KNO}_3(\text{s})$ to form $\text{KNO}_3(\text{aq})$, the **entropy** of the system

- A** decreases
- B** increases

(b)



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Which statement must be true about a **chemical system** at **equilibrium**?

- A** The forward and reverse reactions stop.
- B** The concentration of reactants and products are equal.
- C** The rate of the forward reaction is equal to the rate of the reverse reaction.
- D** The number of moles of reactants is equal to the number of moles of product.

(c)

Adding a **catalyst** to a **chemical reaction** results in

- A** a decrease in activation energy and a decrease in the reaction rate
- B** a decrease in activation energy and an increase in the reaction rate
- C** an increase in activation energy and a decrease in the reaction rate
- D** an increase in activation energy and an increase in the reaction rate

(b)