

## Section 18.2 Factors Affecting Chemical Equilibrium

In your textbook, read about Le Châtelier's Principle.

Answer the following questions.

1. What does Le Châtelier's Principle say?

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2. What are three kinds of stresses that can be placed on a system?

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For each reaction below, state the direction, left or right, in which the equilibrium will shift when the indicated substance is added. Identify one other way in which the reaction could be shifted in the same direction you indicated. (Hint: There may be more than one way to do this.)

3. Reaction:  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ ;  $\text{NH}_3$  added

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4. Reaction:  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ ;  $\text{H}_2$  added

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5. Reaction:  $\text{CO}(\text{g}) + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$ ;  $\text{H}_2\text{O}$  added

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6. Reaction:  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ ;  $\text{SO}_3$  added

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7. Reaction:  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ ;  $\text{SO}_2$  added

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8. Reaction:  $2\text{NCl}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{Cl}_2(\text{g})$ ;  $\text{NCl}_3$  added

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**Section 18.2** *continued*

In your textbook, read about factors affecting chemical equilibrium.

Use each of the terms below just once to complete the passage.

right	exothermic	increase	stress	catalyst	energy
smallest	change	reverse	constant	forward	

When you decrease the volume of a reaction vessel, you **(9)** \_\_\_\_\_ the pressure. This causes a reaction at equilibrium to shift to the side with the **(10)** \_\_\_\_\_ number of moles. If the reaction has an equal number of moles of reactants and products, changing the volume of the reaction vessel causes no **(11)** \_\_\_\_\_ in the equilibrium.

Changing the temperature of a reaction at equilibrium alters both the equilibrium **(12)** \_\_\_\_\_ and the equilibrium position. When a reaction is **(13)** \_\_\_\_\_, which means it releases energy, lowering the temperature shifts the equilibrium to the **(14)** \_\_\_\_\_ because the forward reaction liberates heat and removes the **(15)** \_\_\_\_\_.

A **(16)** \_\_\_\_\_ speeds up a reaction by lowering the **(17)** \_\_\_\_\_ requirements for the reaction, but it does so equally in both the **(18)** \_\_\_\_\_ and the **(19)** \_\_\_\_\_ directions. The reaction will reach equilibrium more quickly, but with no change in the amount of product formed.

For each reaction below, indicate in which direction the equilibrium shifts when the stated stress is applied to the system. Write *R* if the reaction shifts to the right, *L* if it shifts to the left, or *NC* if there is no change.

Reaction	Stress
_____ <b>20.</b> $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) + \text{heat}$	temperature increase
_____ <b>21.</b> $\text{CO}(\text{g}) + \text{Fe}_3\text{O}_4(\text{s}) \rightleftharpoons \text{CO}_2(\text{g}) + 3\text{FeO}(\text{s})$	volume increase
_____ <b>22.</b> $\text{C}_2\text{H}_2(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CH}_3\text{CHO}(\text{g}) + \text{heat}$	temperature decrease
_____ <b>23.</b> $2\text{NO}(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}(\text{g}) + \text{H}_2\text{O}(\text{g}) + \text{heat}$	volume decrease
_____ <b>24.</b> $\text{Heat} + \text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$	temperature decrease
_____ <b>25.</b> $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{HCl}(\text{g}) + \text{heat}$	volume decrease