

Unit 7

NAME

Class Work

2/27/14

## 7.3 Le Chatelier's Principle

### SPARK

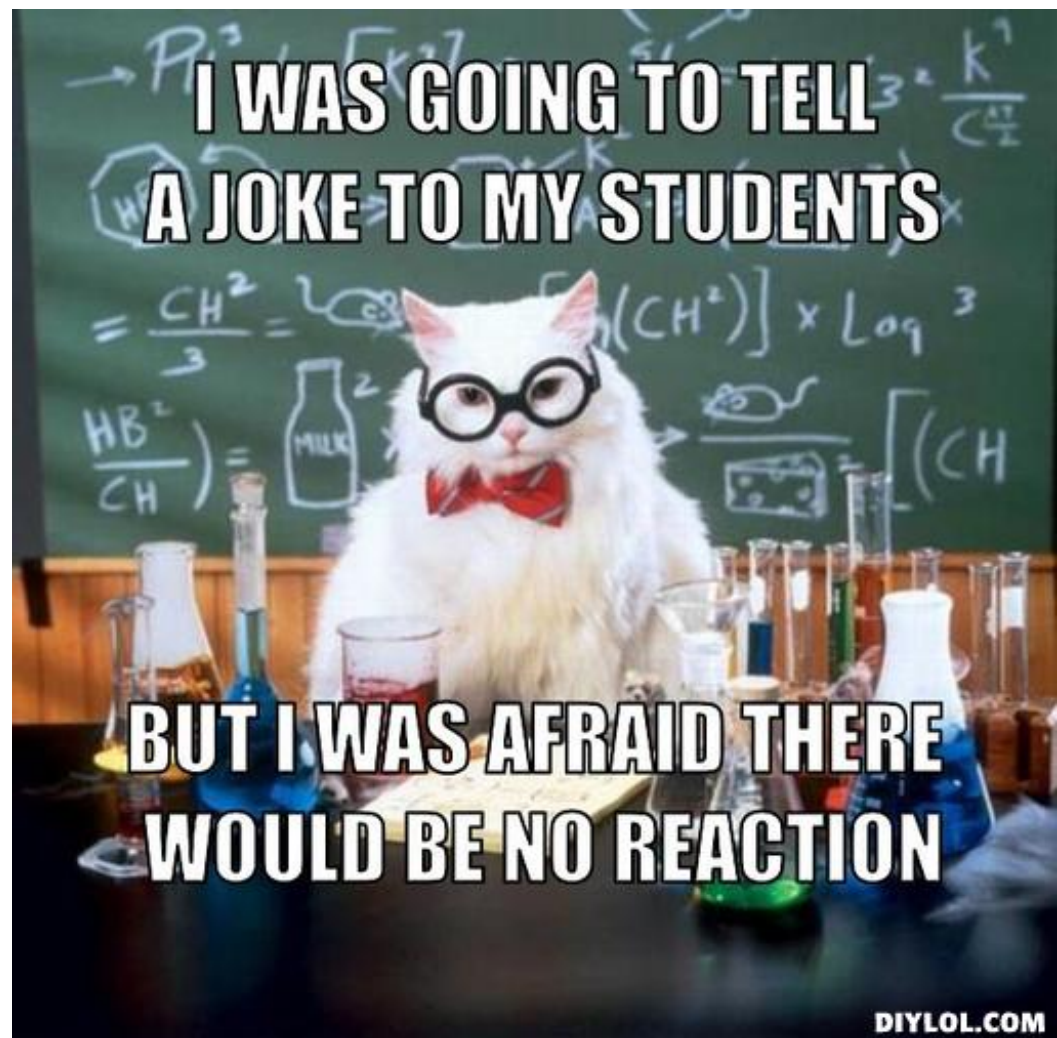
1. During chemical equilibrium, the rate of the forward and reverse reactions are \_\_\_\_\_.
2. What is constant during equilibrium?

## Objective

SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Agenda:

- SPARK/Objective
- Notes
- Practice
- Homework



Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

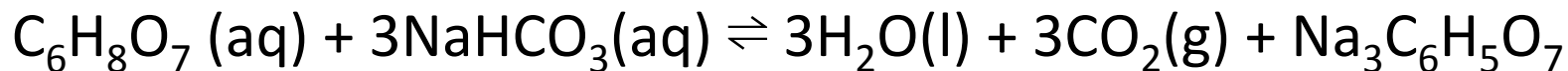
# Notes

- Any change in **PRESSURE**, **CONCENTRATION**, or **TEMPERATURE** on an equilibrium system is called a STRESS.
- LeChatelier's Principle explains how a reaction system at equilibrium responds or **SHIFTS** to **RELIEVE** the stress.

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Concentration Change:

Consider the following reaction:

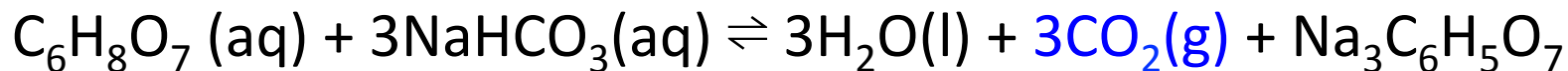


- When we add more reactants ( $\text{C}_6\text{H}_8\text{O}_7$  and  $\text{NaHCO}_3$ ), we created a **STRESS** on the system.
- Reaction went to the **RIGHT**: The rate of the **FORWARD** rxn increase and more **PRODUCT** formed

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Concentration Change:

Consider the following reaction:



◆ What would happen if we added more  $\text{CO}_2 (\text{g})$ ?

Reaction will go to the **LEFT**: The rate of the **REVERSE** rxn will increase and more **REACTANT** will form.

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Example:

*The following example shows how a change in concentration affects equilibrium. A plus sign (+) means the concentration increases, and a minus sign (-) means that the concentration decreases.*



Stress: More  $\text{NH}_3 (\text{g})$  is added

\*\*\*Response:



Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Example:

*The following example shows how a change in concentration affects equilibrium. A plus sign (+) means the concentration increases, and a minus sign (-) means that the concentration decreases.*



**Stress:** More  $\text{H}_2\text{O}$  is added

**\*\*\*Response:**



Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Example:

*The following example shows how a change in concentration affects equilibrium. A plus sign (+) means the concentration increases, and a minus sign (-) means that the concentration decreases.*



**Stress:**  $\text{O}_2 (\text{g})$  is removed

**\*\*\*Response:**

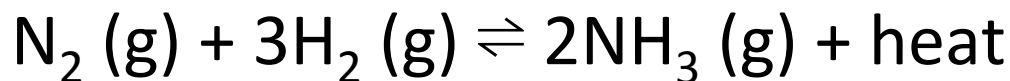


Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.



# Temperature Change:

Consider the production of ammonia:



Is heat on the product side or the reactant side? \_\_\_\_\_

- If we add more heat (raising temperature), the reaction will go to the **LEFT** and more **REACTANTS** will form.
- If we release heat (lowering temperature), the reaction will go to the **RIGHT** and more **PRODUCTS** will form.

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Temperature Example

*Given the following balanced equation:*



Stress: Raise temperature

•Response:



Stress: Lower temperature

•Response:



Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Temperature Example – Your Turn

*Given the following balanced equation: (notice that heat is on the reactant side now)*



- **Stress:** Raise temperature

- **Response:**  $A + B + \text{heat} \rightarrow C$

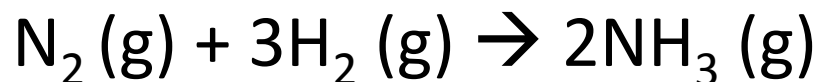
- **Stress:** Lower temperature

- **Response:**  $A + B + \text{heat} \rightarrow C$

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Pressure

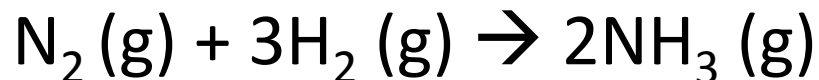
- An increase in pressure will favor the reaction toward the side with the fewer **PARTICLES** (less **MOLES** = fewer **SUM OF COEFFICIENTS**)



- Step 1: What is the total number of moles of reactants? (hint: add the coefficient together on the left side) \_\_\_\_\_
- Step 2: What is the total number of moles of products? (hint: add the coefficient together on the right side) \_\_\_\_\_

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Pressure



- 4 moles on LEFT – 2 moles on RIGHT

If pressure is increased, which way will the reaction go?

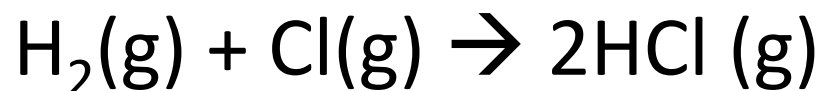
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If pressure is decreased, which way will the reaction go? \_\_\_\_\_

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# Pressure Example

*Consider the following balanced equation:*



- If pressure is increased, which way will the reaction go?
- 

- If pressure is decreased, which way will the reaction go?
- 

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# NOTE

- Decrease in **VOLUME**= **INCREASE** in PRESSURE
- Increase in **VOLUME**= **DECREASE** in PRESSURE

# Classwork

- When you answer Le Chatelier questions... use the format:
  - The equilibrium will shift \_\_\_\_\_ (and \_\_\_\_\_ will increase/decrease.)
  - Example: The equilibrium will shift to the right OR  
The equilibrium will shift to the right and the concentration of A will increase

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.



# Exit Ticket

- Complete your 7.3 exit ticket!

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.

# HOMEWORK

Read pages 562-565 in your textbook and answer questions 1 and 5

Objective: SWBAT explain Le Chatelier's Principle and determine the effect of stress on a chemical system in equilibrium.