

LESSON NOTES

Subject: Chemistry

Year/Level: 12

Week 15

Strand	3 Quantitative Chemistry
Sub Strand	3.3 Physical Chemistry
Content Learning Outcome	To identify reactions at chemical equilibrium, discuss Le Chatelier's principle and how changes can be brought using concentration and temperature.

**Chemical Equilibrium**

- Reactions can proceed in one direction or both directions.
- Reactions which proceed in one direction go to completion while reactions which proceed in **both directions** (forward and backward) are often reversible.

\*When a system is in dynamic equilibrium, **the rate of the forward reaction is equal to the rate of the backward reaction.**

**Note:** reversible reactions can be made to go to completion by changing the position of the equilibrium and is always represented by  $\rightleftharpoons$ .

This change can be brought about by the **Le Chatelier's principle**.

\*Le Chatelier's Principle - **states that if a change is applied to a system at dynamic equilibrium, the position of the equilibrium shifts to counteract the change and re-establish equilibrium.**

Change in a system can be brought about by changes in concentration, temperature and pressure.

Factors that change the position of the equilibrium

**1. Concentration**

Consider the reaction:  $A + B \rightleftharpoons C + D$ .

- Increasing the conc of any reactants or both (A or B) at equilibrium, then **forward reaction will be favoured**. Therefore, the rate of forward reaction will increase. The equilibrium will **shift from left to right**. Hence, **more products**.
- If the **conc of the reactants is decreased**, the concentration of the products (C or D) decreases. This **favours the backward reaction**. Equilibrium shifts from right to left.
- Increase in concentration of the products (C or D), increases the reactants, and thus favours the backward reaction. Equilibrium shifts from right to left.
- Decrease in concentration of products (C or D) decreases the reactants, thus favors the forward reaction. Equilibrium shifts from left to right.

## 2. Temperature

- **An increase in temperature favours endothermic reaction (+ enthalpy change).**  
This is because the system counteracts the change made by absorbing the extra heat.
- **A decrease in temperature favours the exothermic reaction (- enthalpy change).**  
This is because the system counteracts the change made by producing more heat.

### Catalyst

Adding a catalyst will only **increase the rate of the reaction** but it will **never** affect the amount of products formed.

### Activity

1. Discuss Le Chatelier's principle.

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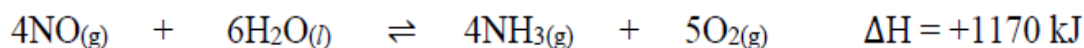
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2. Explain what do you understand by the statement that 'the system is at dynamic equilibrium'.

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3. Consider the reaction given below.



- a) State if the forward reaction will be favoured if temperature is increased with reason.

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- b) If the concentration of one of the reactants is increased, what will be the equilibrium shift? Also, explain how this will affect the products?

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- c) Will adding a catalyst have any effect on the amount of oxygen gas formed?

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