1. WHAT IS DYNAMIC EQUILIBRIUM?

UNIT 4 – CHEMICAL EQUILIBRIUM

CH40S *MR. WIEBE*

1

WARM-UP

The Apple Store in Polo Park Mall has a total of 75 people in it at lunch time. Predict the number of people in the store if the following situations occur:

People Entering	People Leaving	People in Store
25	0	
10	30	
15	15	

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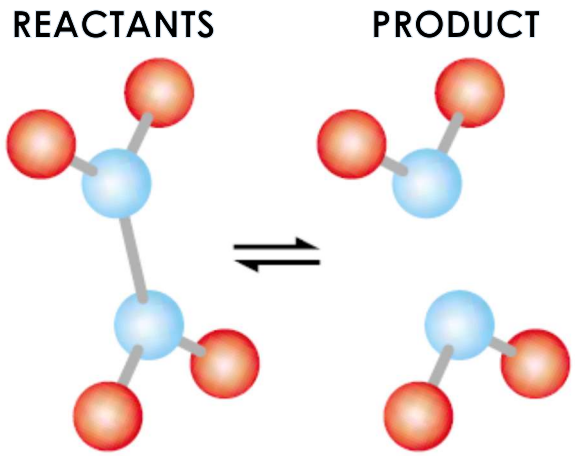
REACTIONS CAN BE REVERSIBLE



reversible reaction a chemical reaction that proceeds in both the forward and reverse directions, setting up an equilibrium in a closed system

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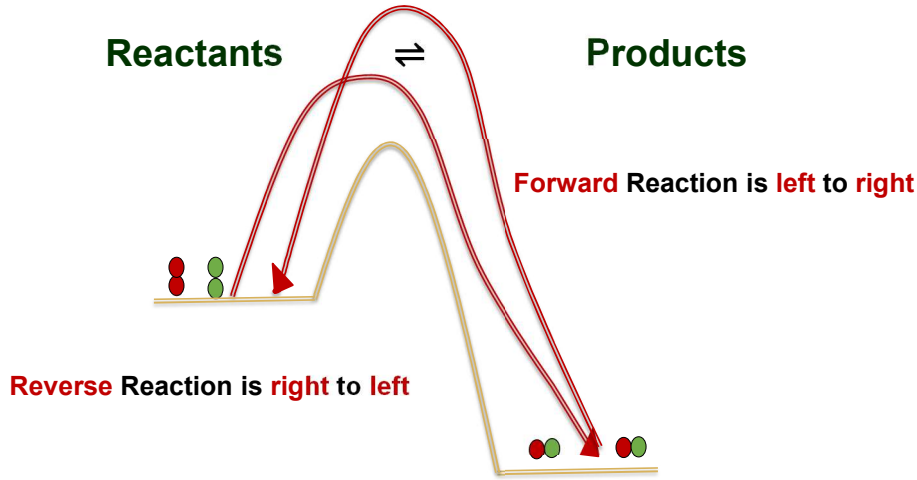
CHEMICAL EQUILIBRIUM

Chemical reactions are **reversible** if the activation energy is low.



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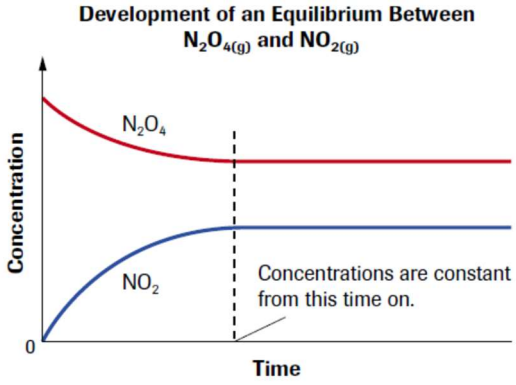
A SYSTEM AT EQUILIBRIUM REQUIRES:

1. The Forward rate = Reverse rate
2. The Reactant and Product concentrations to be constant
3. The Macroscopic (observable) properties to be constant
4. The system to be Dynamic (the forward and reverse reactions continue).

chemical equilibrium the state of a reaction in which all reactants and products have reached constant concentrations in a closed system



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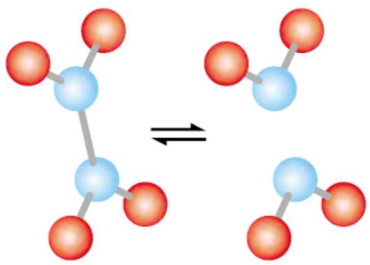
REACHING EQUILIBRIUM

Table 1 Changes in Concentrations of $NO_2(g)$ and $N_2O_4(g)$ by the Forward or Reverse Reactions

	Initial concentrations (mol/L)		Final concentrations (mol/L)	
	$N_2O_4(g)$	$NO_2(g)$	$N_2O_4(g)$	$NO_2(g)$
Experiment 1	0.750	0	0.721	0.0580



$$N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$$

The **equilibrium** can be **reached** by starting with **all reactants** and forming **products**, or…

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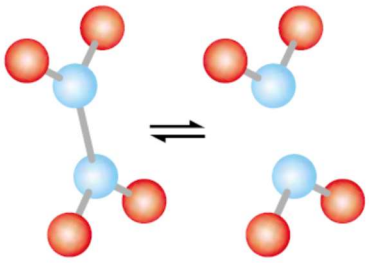
REACHING EQUILIBRIUM

Table 1 Changes in Concentrations of $NO_2(g)$ and $N_2O_4(g)$ by the Forward or Reverse Reactions

	Initial concentrations (mol/L)		Final concentrations (mol/L)	
	$N_2O_4(g)$	$NO_2(g)$	$N_2O_4(g)$	$NO_2(g)$
Experiment 1	0.750	0	0.721	0.0580
Experiment 2	0	1.50	0.721	0.0580



$$N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$$

…the **equilibrium** can be **reached** by starting with **all products** and **no reactants**

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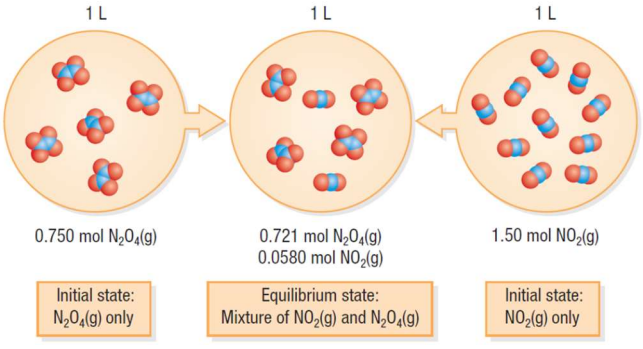
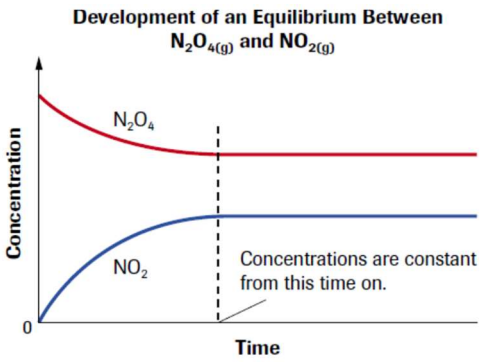
REACHING EQUILIBRIUM





For a closed chemical equilibrium system in constant environmental conditions, the same equilibrium concentrations are reached regardless of the direction by which equilibrium was reached.

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EXAMPLE 1

The balanced chemical equation for the synthesis of hydrogen fluoride gas from its elements is given below. Initially, the concentration of each reactant is 2.00 mol/L, and no product is present. At equilibrium, the $[F_2(g)]$ is 0.48 mol/L. What would the equilibrium concentrations of the remaining substances be?

$$H_2(g) + F_2(g) \leftrightarrow 2\,HF(g)$$

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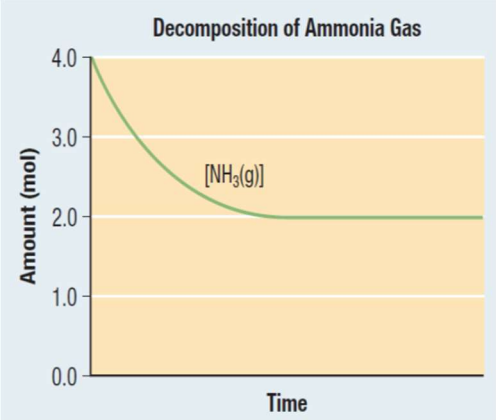
EXAMPLE 2

The balanced chemical equation for the decomposition of ammonia into its elements is given below. Initially, 4.0 mol of ammonia are added to a 2.0 L container and allowed to react. Determine the equilibrium concentrations of the products.

$$2\,NH_3(g) \rightarrow N_2(g) + 3\,H_2(g)$$



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