



CHEMICAL KINETICS

INTRODUCTION OF CHEMICAL KINETICS

CHEMICAL KINETICS

CHEMICAL REACTION

It depends on three factors

FEASIBILITY

Chemical Thermodynamics

EXTENT

Chemical Equilibrium

SPEED

?

CHEMICAL



The Greek word 'kinesis' means movement.

is a branch of chemistry which deals with the study of **reaction rates** & their mechanism.

1. Chemical kinetics deals with the _____ of reaction

a) spontaneity

 b) rate

c) extent

d) None of these

TYPES OF REACTION

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Types of reactions

1) Very fast reaction

2) Slow reaction

3) Moderate reaction

Very fast reaction

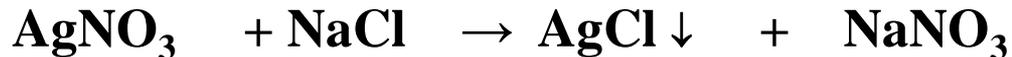
- which takes place within microseconds or instantaneously.
- These include **all ionic reactions**, **all precipitation reactions** and **all neutralization reactions** and **combustion reactions**.

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Very fast reaction

Example

Precipitation of **silver chloride** occurs by mixing of aqueous solutions of silver nitrate and sodium chloride.



**Very fast
reaction**

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Very slow reaction

- which may take days or months or even years

Example

Rusting of iron



Rusted Iron

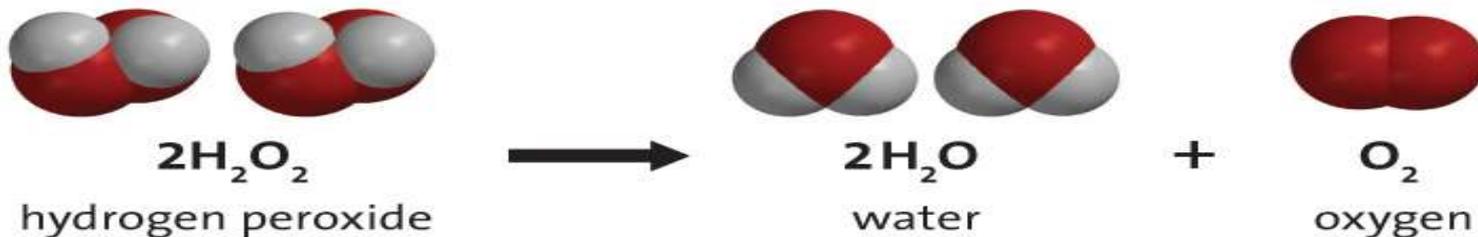
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Moderate reaction

- Reactions which are neither slow nor fast but take place at **moderate speeds or rates**.

Example

Decomposition of hydrogen peroxide



CHEMICAL KINETICS

Moderate reaction

- Reactions which are neither slow nor fast but take place at **moderate speeds or rates**.

Example

Inversion of cane sugar to give glucose and fructose



CHEMICAL KINETICS

Moderate reaction

- Reactions which are neither slow nor fast but take place at **moderate speeds or rates**.

Example

Decomposition of nitrogen pentoxide



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Moderate reaction

In chemical kinetics, we mainly study moderate speed reaction

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Question

The enthalpies of formation of Al_2O_3 and B_2O_3 are -1676 and 1274 kJmol^{-1} respectively. Can this data help us to know the rate of oxidation of aluminium and boron.

Answer:

No, thermodynamic data are not related to rate of reaction

1. Which of the following reactions occurs most rapidly at room temperature.



2. Speed of the reaction can be...

a) moderate

b) very fast

c) very slow

d)  all of these

3. Chemical Kinetics deals with those reactions which occur at _____.

a) slow speed

 b) moderate speed

c) fast speed

d) all of these

**RATE/SPEED/
VELOCITY OF REACTION**

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Rate/Speed/Velocity of reaction

R Reactant

P Product

Rate of chemical reaction is expressed as

Change in Concentration

Rate =

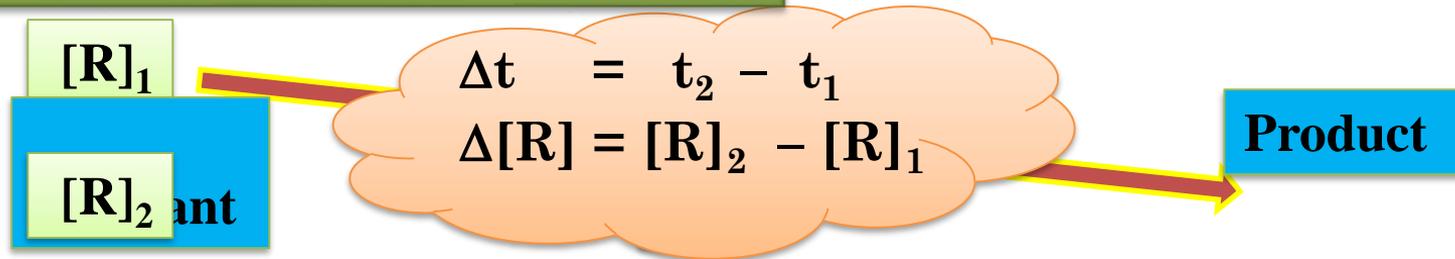
Time taken

Definition :

Rate of reaction may be defined as a change in concentration of any one of the reactants or products per unit time

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Representing Rate of Reaction

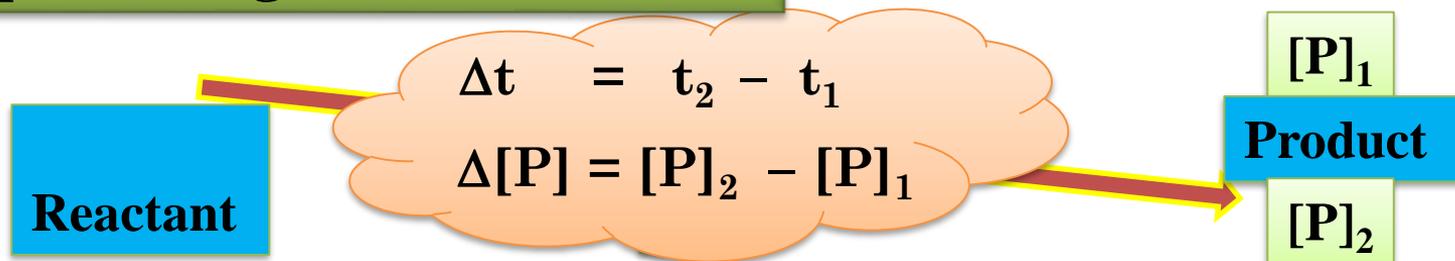


i) The rate of disappearance of R (reactants) :

$$\begin{aligned} \text{Rate of reaction} &= \frac{\text{Decrease in concentration of R}}{\text{Time taken}} \\ &= - \frac{\Delta[R]}{\Delta t} \end{aligned}$$

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Representing Rate of Reaction

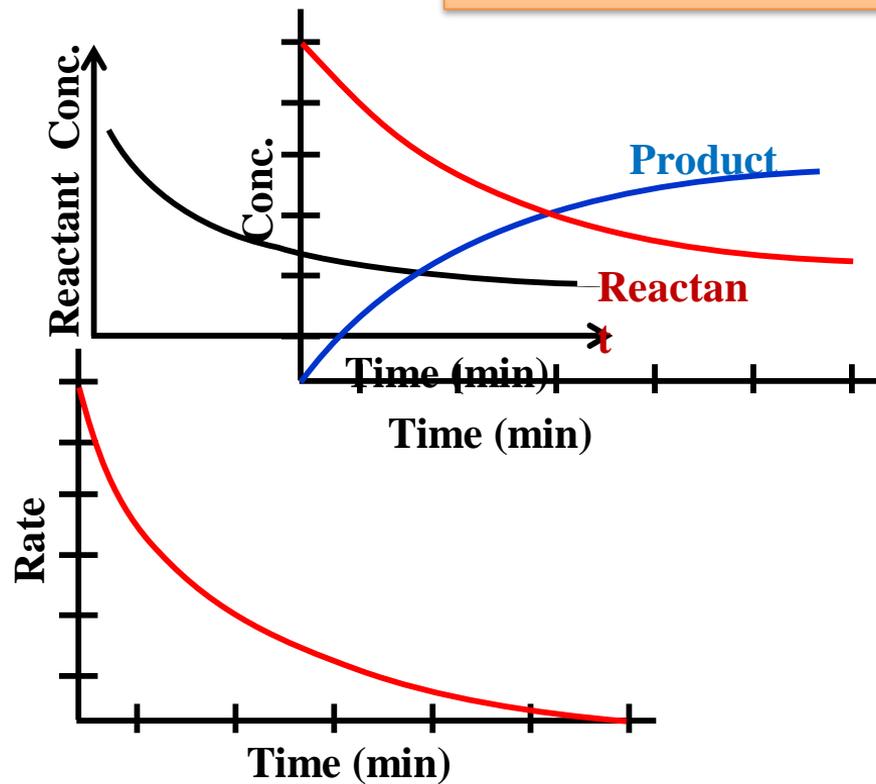


ii) The rate of appearance of P (Products) :

$$\begin{aligned} \text{Rate of reaction} &= \frac{\text{Increase in concentration of P}}{\text{Time taken}} \\ &= + \frac{\Delta[P]}{\Delta t} \end{aligned}$$

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Graphical representation



Product Conc.

Rate depends on concentration of reactant

Time (min)

Units of Rate of Reaction

$$\text{Units} = \frac{\text{Concentration}}{\text{Time}}$$

M sec⁻¹

mole lit⁻¹ sec⁻¹

mole lit⁻¹ min⁻¹

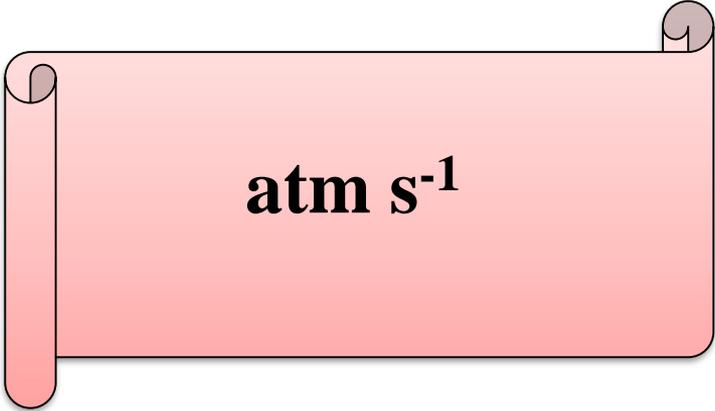
mole dm⁻³ min⁻¹

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Units of Rate of Reaction

In gaseous reaction

$$\text{Units} = \frac{\text{Partial pressure}}{\text{Time}}$$



atm s⁻¹

1. Units of rate of a reaction involving gases can be expressed as _____.

a) mole

b) mole lit⁻¹ sec⁻¹

 c) atm sec⁻¹

d) all of these

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2. Concentration of reactant _____ with time.

a) increases

 b) decreases

c) both a & b

d) none of these

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3. Concentration of product _____ with time.

a) remains same

 b) increases

c) both a & b

d) none of these

