February 2025 Wk 08 • 048-317

17 Monday

MOLECULAR COLLISION

A molecular collision happens when two or more molecules come into contact with each other - that is when they physically bump or interact in space.

These collisions are the foundation of chemical reactions - because for a reaction to occur, reactant molecules must collide.

Types of molecular collisions

1) Elastic collision

* The molecules bounce off each other without any change in their internal energy.

* Total kinetic energy is conserved.

Example - Gas molecules colliding in an ideal gas.

Important Calls ✓ | Things to Do ✓ | Meetings ✓

2) Inelastic collisions →

* Part of the kinetic energy is converted into potential energy or internal energy.

* These can lead to chemical reactions if enough energy is transferred.

conditions for a chemical reaction (Effective collision theory) →

Not all collisions lead to reactions - only effective collisions do.

For a collision to be effective, it must satisfy two conditions:

1) Proper orientation →

• Molecules must collide in a specific way so that the reactive parts are aligned

Example - In the reaction

$H + Cl_2 \longrightarrow HCl + Cl$

2) Sufficient Energy →

Molecules must collide with at least the activation energy - the minimum energy required to break bonds in the reactants and form new bonds in the products.

Energy and collision Frequency →

collision Frequency (z) →

The number of collisions per second per unit volume.

It increases with temperature and concentration.

* Fraction of effective collisions!

only a small fraction of total collisions have energy ≥ E_a

This idea is captured in the Arrhenius equation

$$K = Ae^{-E_a/RT}$$

9.00

K = Rate constant

10.00

A = Frequency factor

11.00

Ea = Activation energy

12.00

R = Gas constant

1.00

T = Temperature

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2.00

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