

KINETICS

AT A GLANCE

COLLISION THEORY

- Particles must collide before a reaction can take place.
- Not all collisions lead to a reaction.
- Reactants must possess a minimum amount of energy ... this is known as the Activation Energy (E_a).

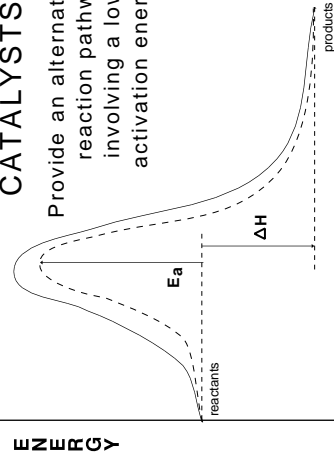
TO INCREASE THE RATE OF A REACTION YOU NEED . . .

more frequent collisions - *increase speed of particles or have more particles present*
 more successful collisions - *give particles more energy or lower the activation energy*

- INCREASED RATE BY
- Increasing pressure
 - Increasing surface area
 - Increasing temperature
 - Adding a catalyst
 - Using a light source
 - Increasing concentration

CATALYSTS

Provide an alternative reaction pathway involving a lower activation energy.



REACTION CO-ORDINATE

THE RATE EQUATION

ORDER WITH RESPECT TO A = 1
 ORDER WITH RESPECT TO B = 2

$$\text{rate} = k [A] [B]^2$$

RATE CONSTANT

CONCENTRATIONS OF SPECIES WHICH AFFECT THE RATE

RATE units of conc / time e.g. $\text{mol dm}^{-3} \text{s}^{-1}$

RATE CONSTANT units depend on overall order . . .

e.g. 1st order sec^{-1}
 2nd order $\text{dm}^3 \text{mol}^{-1} \text{sec}^{-1}$
 3rd order $\text{dm}^6 \text{mol}^{-2} \text{sec}^{-1}$

ORDER individual or overall - sum of individual orders

In the above rate equation . . .

the order wrt A = 1 rate \propto [A]

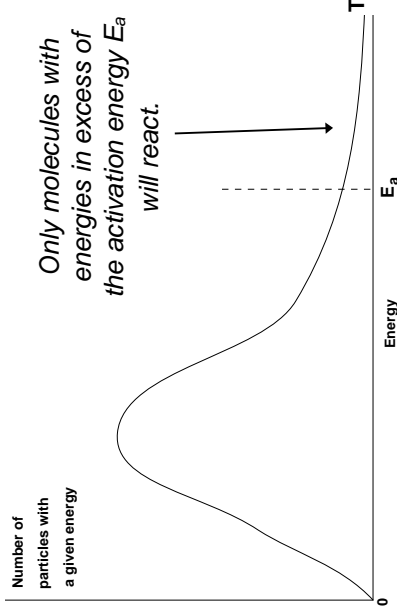
e.g. tripling [A] will triple the rate

the order wrt B = 2 rate \propto [B]²

e.g. tripling [B] will increase rate x 9 (3²)

Overall order = 1 + 2 = 3

* [wrt = with respect to]



Only molecules with energies in excess of the activation energy E_a will react.

MAXWELL-BOLTZMANN DISTRIBUTION OF MOLECULAR ENERGIES

Increasing the temperature . . .

- moves the curve to higher energies (more molecules have energies greater than E_a)
- increases the spread (curve gets broader and flatter)
- keeps same area under the curve