

Rates of Reaction

Q-1) What is rate of reaction?

- > Rate of reaction is how fast the reactants are converted into products.

$$\text{rate} = \frac{\text{change in amount of reactants/products}}{\text{time}}$$

Q-2) Collision theory?

- > Collision theory states that the particles must collide with correct orientation and sufficient energy for reactions to occur. These will result in **effective collisions**.

The rate of reaction will speed up if:

- * Frequency of collisions increases.
- * Proportion of particles with greater energy than activation energy increases.

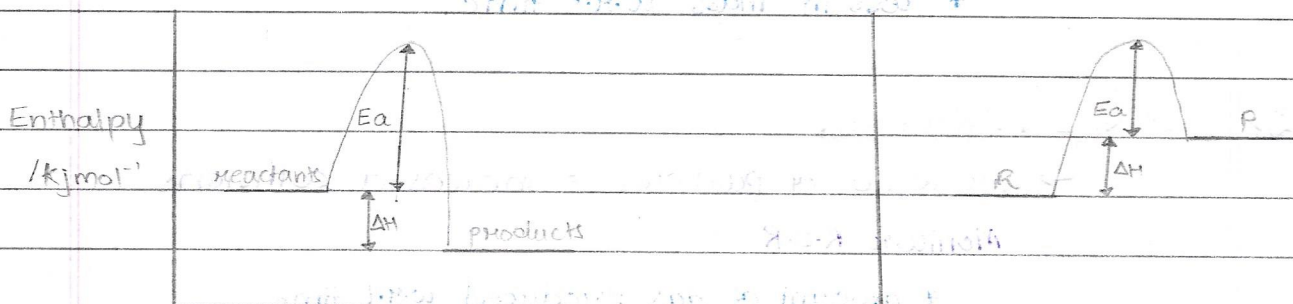
Q-3) What is the activation energy?

- > Activation energy is the minimum energy required for (the particles to have successful collisions) reactions to take place.

Transition theory

Enthalpy diagrams

Exothermic Endothermic



Reaction pathway $E_a \Rightarrow$ activation energy

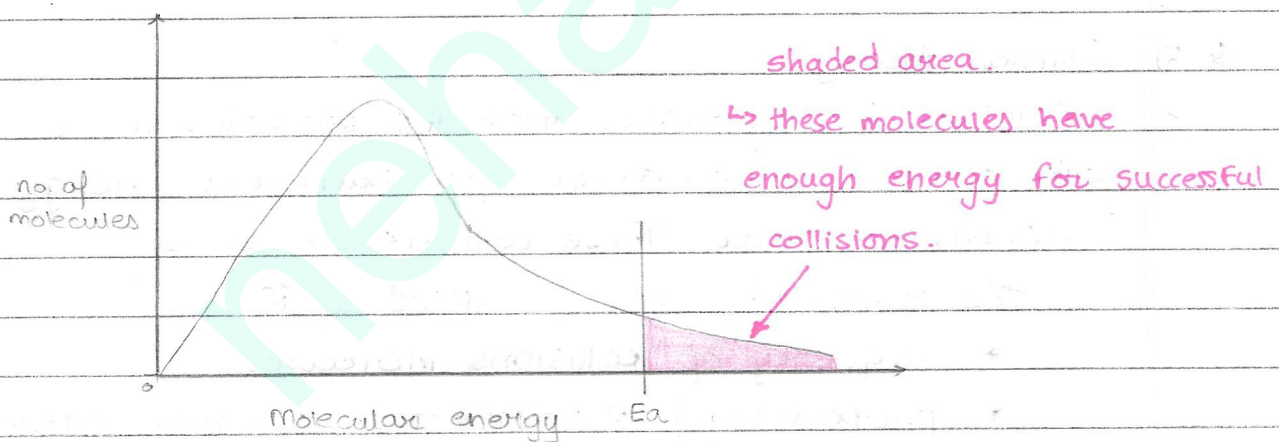
$\Delta H \Rightarrow$ change in enthalpy

$$\Delta H = H_p - H_R$$

ΔH negative -ve = exothermic

ΔH positive +ve = endothermic

Not all particles have the same amount of energy. It can be shown by the Boltzmann distribution graph.



Q-4) Factors affecting rate of reaction.

① **SURFACE AREA** (solids)

→ use ^{powder} ~~lumps~~ rather than ^{lumps} ~~powder~~ so surface area is increased ∴ R.O.R increases.

Monitor R.O.R

* amount of gas evolved w.r.t time

* less in mass w.r.t time

② **CONCENTRATION**

→ more no. of particles = increased collisions

Monitor R.O.R

* amount of gas produced w.r.t time

* precipitate (print on paper disappears) w.r.t time

③ > **TEMPERATURE**

→ higher temperature; particles have more kinetic energy
 ∴ more successful collisions.

④ > **PRESSURE** (gases)

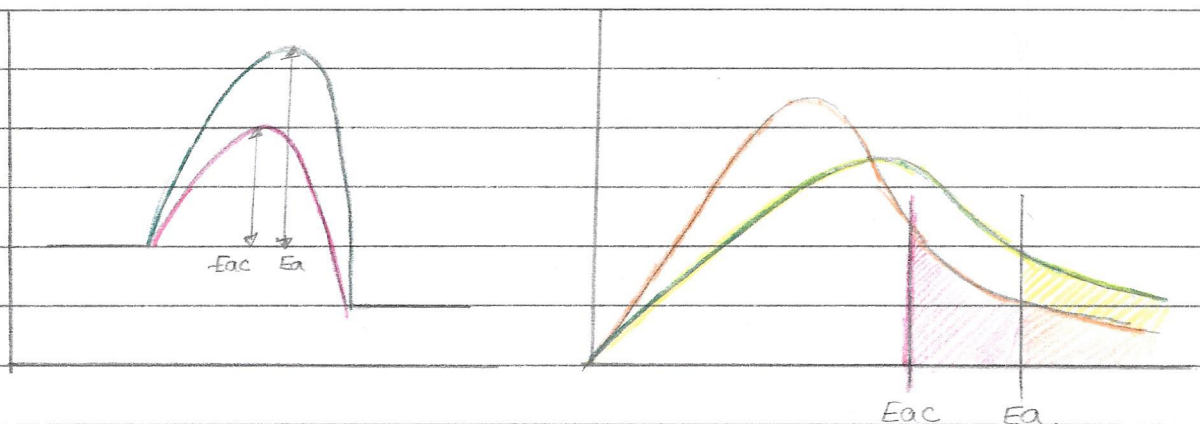
→ higher pressure; the particles are closer together -
 more particles per unit volume ∴ no. of successful
 collisions increases.

⑤ > **CATALYST**

Catalyst is a substance that increases the rate of
 reaction by reducing activation energy, but is not used up
 in the reaction itself.

⑥ > **LIGHT**

→ photosynthesis
 → film development in photography
 → alkane + halogen $\xrightarrow{\text{u.v.}}$ halo-alkane.



- normal
- higher temperature
- with catalyst.

Q-5) Ways to monitor rate of reaction.

>

- ① volume of gas evolved per unit time
- ② mass of solid formed per unit time
- ③ intensity of colour per unit time
↳ (colorimeter or spectrophotometer / spectrometer)
- ④ change in pH per unit time
- ⑤ change in temperature per unit time
- ⑥ change in pressure per unit time
- ⑦ conductivity.