

Day-11

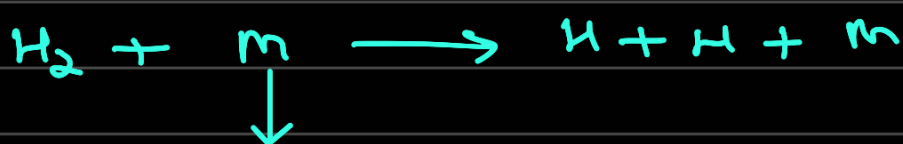
Chemical Kinetics

→ Global reaction:



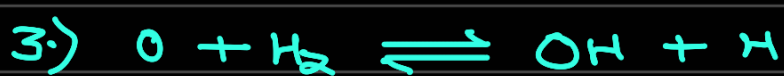
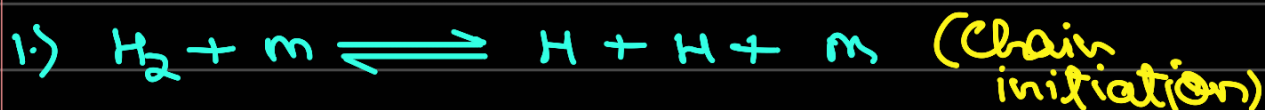
This doesn't happen in a single step!

→ Elementary reaction:

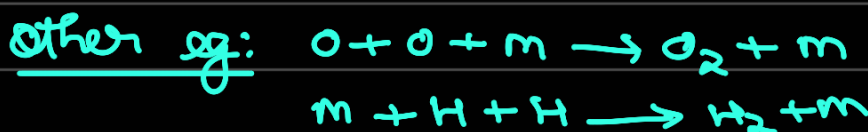
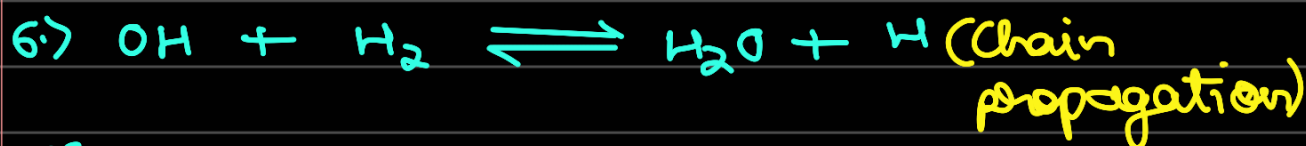


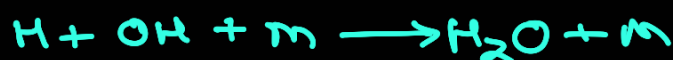
3rd molecule: energy carrier.

→ $\text{H}_2 - \text{O}_2$ system:



} Chain branching





All these are chain termination/recombination reactions.

→ $1 \text{ cm}^3 \rightarrow$ Initially 1 chain molecule.
 (= 1 free radical per cm^3).
 $N = 10^{19}$ molecules/ cm^3 , avg. collision rate is 10^9 collision/s. It is chain prop.
 reacⁿ (1 free rad. \rightarrow 1 free rad.)

a.) $\text{Time} = \frac{10^{19}}{10^9} \text{ s} = 10^{10} \text{ s} \approx 317 \text{ yrs}$

b.) Time (chain branching)

$$= \frac{\log_2(10^{19})}{10^9} = \frac{63.1166}{10^9} \text{ s}$$

$$= 63.1166 \text{ ns}$$

c.) 1% chain branching, then? (rest 99% nothing).

$$\Rightarrow 1 + 1.01 + 1.01^2 + \dots + 1.01^N = 10^{19}$$

$$\Rightarrow \frac{(1.01)^{N+1} - 1}{0.01} \approx 10^{19}$$

$$\Rightarrow (1.01)^{N+1} \approx 10^{17}$$

$$\Rightarrow N \approx 17 \log_{1.01} 10 \approx 3933.9342$$

$$t = \frac{3933.9342}{10^9} \approx 3.93 \text{ } \mu\text{s}$$

→ Law of mass Action:

$aA + bB \longrightarrow cC + dD$
 a, b, c, d are stoichiometric
coeff., elementary reaction.

$$\frac{1}{-a} \frac{d[A]}{dt} = k [A]^a [B]^b$$

$$\frac{1}{-b} \frac{d[B]}{dt} = k [A]^a [B]^b$$

$$\frac{1}{c} \frac{d[C]}{dt} = k [A]^a [B]^b$$

$$\frac{1}{d} \frac{d[D]}{dt} = k [A]^a [B]^b$$

$k \rightarrow$ Rate constant / Arrhenius constant