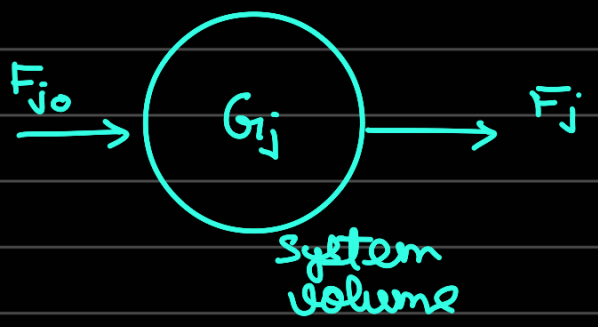
Day-17



mole balance :

$$F_{j,0} - F_j + G_j = \frac{dN_j}{dt}$$

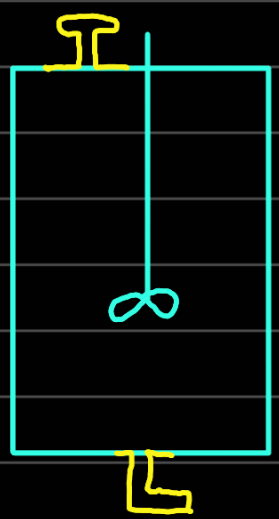
- $F_{j,0}$: Flow rate into the system ($mol\ s^{-1}$)
- F_j : Flow rate out of the system ($mol\ s^{-1}$)
- G_j : Generation rate of j in the system ($mol\ s^{-1}$) *
- $\frac{dN_j}{dt}$: Accumulation rate of j within the system ($mol\ s^{-1}$)

$$G_j = \int_V r_j \, dV$$

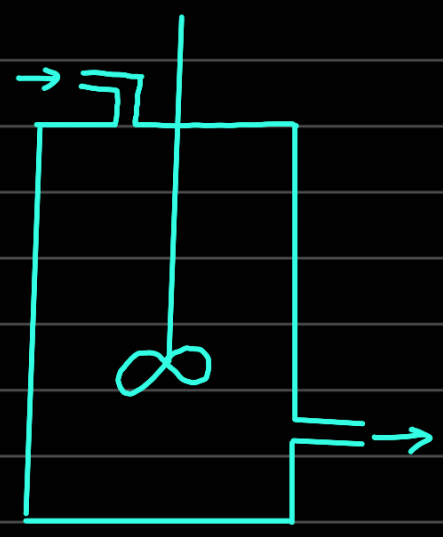
↳ Formation rate of species j.

* Design eqⁿ of various industrial reactors

→ Batch reactor :



→ CSTR :



→ PFR :

→ Batch reactor (some math?) –

$$F_{j0} - F_j + \int_V r_j \, dV = \frac{dN_j}{dt}$$

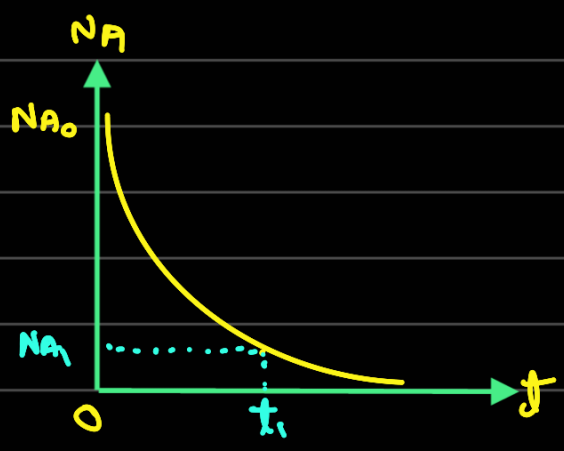
$F_{j0} - F_j = 0$ ⇒

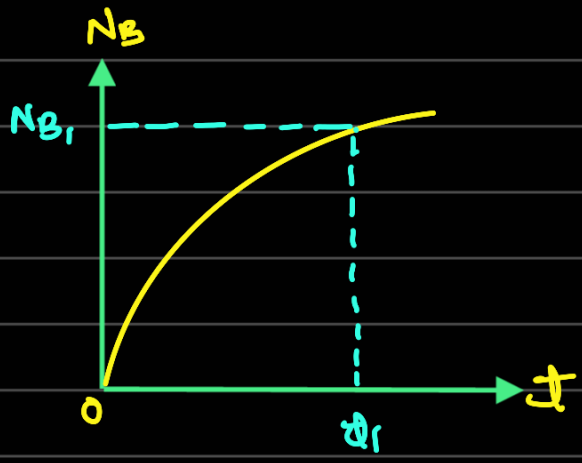
$$\boxed{\int_V r_j \, dV = \frac{dN_j}{dt}}$$

If the reaction mixture is perfectly mixed so that there is no variation in the reaction rate throughout the reaction volume,

$$\frac{dN_j}{dt} = r_j V$$

$A \longrightarrow B$





$$\frac{dN_A}{dt} = \vartheta_A V$$

$$\Rightarrow \int_0^{t_1} dt = \int_{N_{A_0}}^{N_{A_1}} \frac{dN_A}{\vartheta_A V} = \int_{N_{A_1}}^{N_{A_0}} \frac{dN_A}{-\vartheta_A V}$$