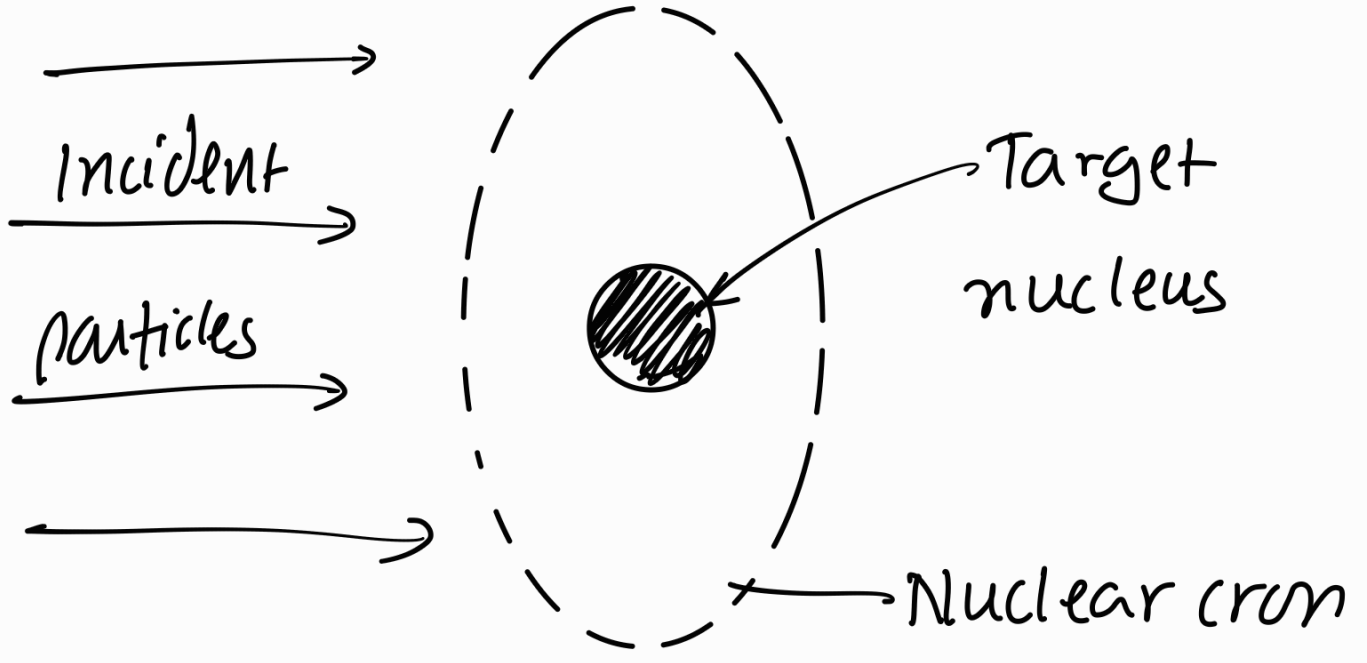
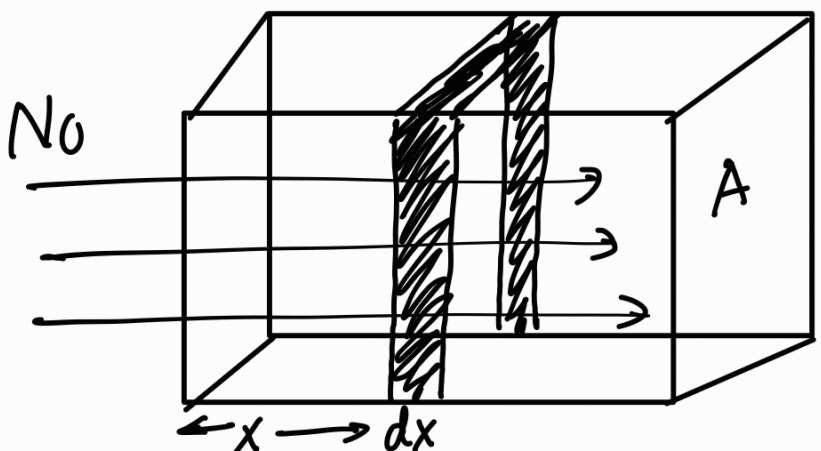
$N(x)$ = No. of incident particles at distance x

dN = Decrease in no of incident particles
(= number of interaction / nuclear reactions)

$\sigma \equiv$ Nuclear cross section





$N(x)$ at x

$N(x) - dN$ at $x + dx$

n = number density

No. of target nuclei in dx

$= n A dx$

Area of cross section $= n A dx \sigma$

$$\frac{\text{No. of interactions}}{\text{Total incident particles}} = \frac{\text{Total nuclear c.s}}{\text{Area of c.s of slab}}$$

$$\Rightarrow \int_{N_0}^{N} \frac{dN}{N} = \frac{n\sigma A dx}{A} = -\int_{x=0}^{x} n\sigma dx$$

'$-$' indicates change in no. of particles is $-ve$.

$$\ln \frac{N}{N_0} = -n\sigma x.$$

$$\therefore N(x) = N_0 e^{-n\sigma x}$$

N_0 = No. of particles that survives a dist x