Session #41 - Modern Physics III

Radioactivity (RA Equilibrium & Simultaneous Decay)

① RA Equilibrium → $A_1 \xrightarrow{\lambda_1} A_2 \xrightarrow{\lambda_2} A_3 \xrightarrow{\lambda_3} A_4 \cdots$

	A_1	A_2	A_3	A_4
@t=0	N_0	0	0	0
@t=t	N_1	N_2	N_3	N_4

$\boxed{\lambda_1 > \lambda_2 > \lambda_3}$

$$-\frac{dN_1}{dt} = \lambda_1 N_1$$

rate of accumulation of A_2

= rate of prod^n A_2 − rate of decay of A_2

rate of prod^n of A_2 = rate of decay of A_1

$= \lambda_1 N_1$

rate of decay of $A_2 = -\frac{dN_2}{dt} = \lambda_2 N_2$

rate of accumulation of A_2

$= \lambda_1 N_1 - \lambda_2 N_2$

@ RA equilibrium,

rate of accumulation of $A_2 = 0$

$\Rightarrow \lambda_1 N_1 - \lambda_2 N_2 = 0$

$$\Rightarrow \boxed{\frac{N_1}{N_2} = \frac{\lambda_2}{\lambda_1} = \frac{T_{1/2}^1}{T_{1/2}^2} = \frac{T_m^1}{T_m^2}}$$

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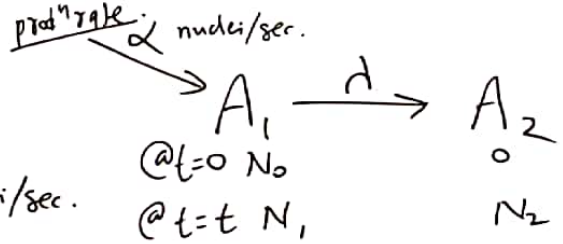
① RA Equilibrium →



A_1 is getting produced @ α nuclei/sec.

For RA. equilibrium.

$$-\frac{dN_1}{dt} = \lambda N_1$$

rate of accumulation of $A_1 = \alpha - \lambda N_1$

@ Equilibrium, $\alpha - \lambda N_1 = 0$

$$\Rightarrow \boxed{N_1 = \alpha/\lambda}$$

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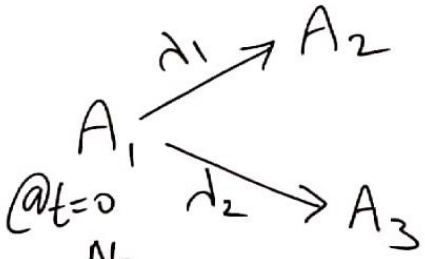
(2) Simultaneous Decay →



$$-\frac{dN_1}{dt} = \lambda_1 N_1 + \lambda_2 N_1$$

$$-\frac{dN_1}{dt} = (\lambda_1 + \lambda_2) N_1$$

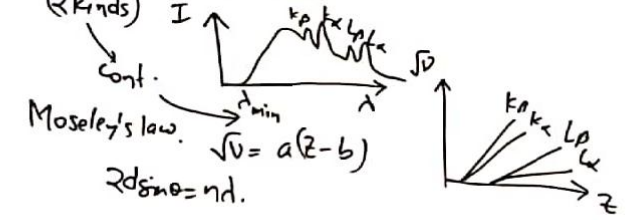
$$\boxed{\lambda_{eff} = \lambda_1 + \lambda_2} \Rightarrow \boxed{\frac{1}{T_{1/2}^{eff}} = \frac{1}{T_{1/2}^{1}} + \frac{1}{T_{1/2}^{2}}}$$

Session #41 - Modern Physics - Review - Micronotes - PMA

Strategy → Shortest to shorter to short

personalized

1. Dual nature of light - (particle & wave)
2. story of light →
3. Photo electric effect
4. Radiation force & press. -
5. DeBroglie's Hypothesis (5 formulae)
6. Davisson-Germer Expt.
7. Atomic Models
   - Thomson model
   - Lenard's model
   - Rutherford's model → α- scattering Expt.
     - → Stability
     - → H-spectrum
     - → Nuclear Atomic model.
   - H-Spectrum - Rydberg's formula
8. X-rays → ch. xray
   (2 kinds)
   - Cont.
   - Moseley's law. $\sqrt{\nu} = a(Z-b)$
   - $2d\sin\theta = n\lambda$.



9. Nuclear Physics → ① Nuclear Constitution →
   ② classification → similarity
   → Stability