1. Radioactive radiations (without any external aids (spontaneous")

(a) α-particle : $q_\alpha = +2e$, $m_\alpha = 2(m_p + m_n)$, $(E_k)_\alpha$ – 5cm ^4_2He (He^{2+})

(b) β-particle : $q_\beta = -1e$, $m_\beta = m_e = 9.1 \times 10^{-31}$ kg , – a few meter , $^0_{-1}e$ $E = (E_k + E_{nuclear})$

(c) γ-rays : photon $q_\gamma = 0$, $m_\gamma = 0$ ~ 200 km γ

penetrating power : $\gamma > \beta > \alpha$
(E_k)

ionization power : $\alpha > \beta > \gamma$
(mass)

2. Radioactive Disintegration

(a) α-decay $^A_ZX \rightarrow {}^{A-4}_{Z-2}Y + {}^4_2He + E$

(b) β-decay $^A_ZX \rightarrow {}^A_{Z+1}Y + {}^0_{-1}e + E$

$^1_0n \rightarrow {}^1_1H + {}^0_{-1}e$

(c) γ-radiation $^A_ZX \rightarrow {}^A_ZX + \gamma + E$

Conservation (i) ; (iv) mass – energy
(ii)
(iii)

- **Quantum Theory of Radiation**
  - **de Broglie's Theory**
    - **Matter Wave**
      - $\lambda_d = \dfrac{h}{p} = \dfrac{h}{mv}$
    - **Wavelength of Electron**
      - $\lambda_d = \dfrac{h}{mv} = \dfrac{h}{\sqrt{2eVm}} = \dfrac{h}{\sqrt{2E_k m}}$
  - **Photoelectric Effect**
    - **Photon**
      - $E = hf = \dfrac{hc}{\lambda}$
      - $p = \dfrac{hf}{c} = \dfrac{h}{\lambda}$
    - **Energy of Photoelectron**
      - $E_{K_{max}} = hf - W_0$
      - $\dfrac{1}{2}mv_{max}^2 = hf - W_0$
      - $W_0 = hf_0 = \dfrac{hc}{\lambda_0}$
    - **Stopping Potential**
      - $V_s = \dfrac{hf}{e} - \dfrac{W_0}{e}$
      - $I_{sat} = \dfrac{Ne}{t}$
    - **Compton Effect**
      - $\lambda' = \lambda + \dfrac{h}{m_e c}(1 - \cos\varphi)$
      - $\Delta\lambda = \dfrac{h}{m_e c}(1 - \cos\varphi)$