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 ${}^{4}_{2}He$ (He^{2+})

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

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

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

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

2. Radioactive Disintegration

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

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

${}^{1}_{0}n \rightarrow {}^{1}_{1}H + {}^{0}_{-1}e$

(c) γ-radiation ${}^{A}_{Z}X \rightarrow {}^{A}_{Z}X + \gamma + E$

Conservation (i) ; (i) mass-energy
(ii)
(iii)

Quantum Theory of Radiation

de Broglie's Theory

Matter Wave

$$\lambda_d = \frac{h}{p} = \frac{h}{mv}$$

Wavelength of Electron

$$\lambda_d = \frac{h}{mv} = \frac{h}{\sqrt{2eVm}} = \frac{h}{\sqrt{2E_k m}}$$

Photoelectric Effect

Photon

$$E = hf = \frac{hc}{\lambda}$$

$$p = \frac{hf}{c} = \frac{h}{\lambda}$$

Energy of Photoelectron

$$E_{K_{max}} = hf - W_0$$

$$\frac{1}{2}mv_{max}^2 = hf - W_0$$

$$W_0 = hf_0 = \frac{hc}{\lambda_0}$$

Stopping Potential

$$V_s = \frac{hf}{e} - \frac{W_0}{e}$$

$$I_{sat} = \frac{Ne}{t}$$

Compton Effect

$$\lambda' = \lambda + \frac{h}{m_e c}(1 - \cos\varphi)$$

$$\Delta\lambda = \frac{h}{m_e c}(1 - \cos\varphi)$$