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

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

(b) β-particle: $q_\beta = -1e$, $m_\beta = m_e = 9.1\times10^{-31}\,kg$, ~ a few meter. ${}^0_{-1}e$

$E = (E_k + E_{excite})$

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

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

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

2. Radioactive Disintegration

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

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

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

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

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