

初南函. 2020011219

1. $D = \phi \cdot S/\rho$

$$\frac{S}{\rho} = \left(\frac{Z}{Z_p}\right)^2 \left(\frac{S}{\rho}\right)_e = Z^2 \left(\frac{S}{\rho}\right)_e. \quad e = \frac{M_p}{m_e} E = 1 \text{ MeV} \rightarrow \left(\frac{S}{\rho}\right)_e = 229.41 \text{ MeV} \cdot \text{cm}^2/\text{g}$$

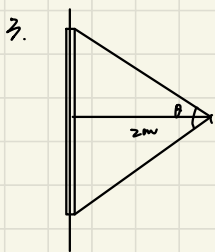
$$= 917.64 \text{ MeV} \cdot \text{cm}^2/\text{g} = 1.468224 \times 10^{-11} \text{ J} \cdot \text{m}^2/\text{kg}$$

$$\rightarrow D \approx 1.468 \times 10^{-8} \text{ J} \cdot \text{s}^{-1} \cdot \text{kg}^{-1}$$

2. $(R_{\beta \max})_{pb} = \frac{(Z/M_A)_{A1} \cdot \rho_{A1}}{(Z/M_A)_{pb} \cdot \rho_{pb}} (R_{\beta \max})_{A1}$

$$(R_{\beta \max})_{A1} = 1.23 \text{ g/cm}^2. \quad (Z/M_A)_{A1} = \frac{13}{27}. \quad (Z/M_A)_{pb} = \frac{82}{207}. \quad \rho_{A1} = 2.7 \text{ g/cm}^3 \quad \rho_{pb} = 11.3 \text{ g/cm}^3$$

$$\rightarrow (R_{\beta \max})_{pb} \approx 0.353 \text{ g/cm}^2$$



$$\dot{X} = \frac{T \times A_L \times \theta}{h}, \quad h = 2 \text{ m}, \quad T = 2.503 \times 10^{-18} \text{ C} \cdot \text{m}^2 \cdot \text{kg}^{-1} \cdot \text{Bg}^{-1} \cdot \text{s}^{-1},$$

$$A_L = 2.1 \times 10^9 \text{ Bg/cm}^3 \times 1 \text{ cm}^2 = 2.1 \times 10^9 \text{ Bg/cm} = 2.1 \times 10^{11} \text{ Bg} \cdot \text{m}^{-1}$$

$$\theta \approx 0.4636$$

$$\rightarrow \dot{X} \approx 1.219 \times 10^{-7} \text{ C} \cdot \text{kg}^{-1} \cdot \text{s}^{-1}$$

$$K = \dot{X} \cdot \frac{\Gamma_K}{T} \approx 4.22 \times 10^{-6} \text{ Gy} \cdot \text{s}^{-1}$$

4. $E_\beta = 545.914 \text{ KeV}$

\rightarrow 有机玻璃厚度约为 0.1524 cm

$$\dot{D} = 4.59 \times 10^{-8} \text{ AB} \left(\frac{\mu_{en}}{\rho}\right)_\beta \left(\frac{E_\beta}{R}\right)^2 e^{-\mu R}, \quad A = 3.7 \times 10^{11} \text{ Bq}, \quad Z = 6.3, \quad \left(\frac{\mu_{en}}{\rho}\right)_\beta \approx 2.6 \times 10^{-2} \text{ cm}^2/\text{g}, \quad R = 2 \text{ m}$$

$$\approx 0.207 \text{ mGy/h}$$

$$D_0 = 5 \mu\text{Cy/h}$$

$$K = \frac{D}{D_0} \approx 41.4$$

\rightarrow 铅厚度 $d \approx 2.4 \text{ cm}$

若颠倒, 所需有机玻璃厚度增加, 以阻挡 β 射线逃逸.

铅厚度可减少, 因为不再需要阻挡 γ 射线.

$$5. d = \frac{1}{\Sigma} \ln \left(\frac{\xi \cdot B_n \cdot q}{4\pi r^2 \cdot \varphi_L} \right) , \quad \Sigma_1 = 0.118 \text{ cm}^{-1}, \quad \xi = AY = 5 \times 10^7 \text{ s}^{-1}, \quad \varphi_L = 5.88 \text{ cm}^2 \text{ s}^{-1}$$

$$B_n = 5, q = 1$$

$$\rightarrow d \approx 49.4 \text{ cm}$$

$$6. \dot{H} = \frac{1 \text{ mSV}}{4 \text{ h}} = 250 \mu\text{SV/h}$$

$$\dot{X} = \frac{\tau A}{R^2} = 0.13 \text{ C/kg/h}, \quad \tau = 6.312 \times 10^{19} \text{ C} \cdot \text{m}^2 \cdot \text{kg}^{-1} \cdot \text{Bq}^{-1} \cdot \text{s}^{-1}, \quad R = 0.3 \text{ m}$$

$$= 3.611 \times 10^{-5} \text{ C} \cdot \text{kg}^{-1} \cdot \text{s}^{-1}$$

$$\rightarrow A = 5.149 \times 10^{12} \text{ Bq}$$

$$K \geq \frac{1.4 \times 10^5 \text{ A} \Gamma \text{ a}}{H \cdot r^2} = 455$$

$$d \approx 5.86 \text{ cm}$$