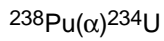


(16.8) A cardiac pacemaker contains 150 mg of  $^{238}\text{Pu}$ . What is its heat output? Use data from the isotope chart.



First known data, constants, and units:

$$1 \text{ MeV} := 1.6021773 \cdot 10^{-13} \cdot \text{joule}$$

$$N_A := 6.022137 \cdot 10^{23} \cdot \text{mole}^{-1}$$

$$M_{^{238}\text{Pu}} := 238 \cdot \text{gm} \cdot \text{mole}^{-1}$$

$$M_{^{234}\text{U}} := 234 \cdot \text{gm} \cdot \text{mole}^{-1}$$

$$E_\alpha := 5.499 \cdot \text{MeV}$$

From Fig. 16.1.

$$t_{\text{half}} := 87.7 \cdot \text{yr}$$

$$\lambda := \frac{\ln(2)}{t_{\text{half}}}$$

Data given in the text:

$$m_{\text{Pu}} := 150 \cdot \text{mg}$$

Calculations:

$$A_{\text{Pu}} := \frac{m_{\text{Pu}}}{M_{^{238}\text{Pu}}} \cdot N_A \cdot \lambda \quad \text{Eqn. (4.40b)}$$

$$Q_\alpha := E_\alpha \cdot \frac{M_{^{238}\text{Pu}}}{M_{^{234}\text{U}}} \quad \text{Eqn. (4.16)}$$

$$P_{\text{tot}} := Q_\alpha \cdot A_{\text{Pu}}$$

$$P_{\text{tot}} = 0.085 \cdot \text{watt}$$