

(21.10) Calculate the natural radiotoxicity value In_w of 1 km³ of land (density 2 600 kg m⁻³) containing 3 weight ppm ²³⁸U with daughter products. Only ²²⁶Ra has to be considered.

$$\rho := 2600 \cdot \text{kg} \cdot \text{m}^{-3} \quad \text{Volume} := 1 \cdot \text{km}^3 \quad m_{tot} := \text{Volume} \cdot \rho \quad N_A := 6.022137 \cdot 10^{23} \cdot \text{mole}^{-1}$$

$$t_{half} := 4.468 \cdot 10^9 \cdot \text{yr} \quad \lambda_U := \frac{\ln(2)}{t_{half}} \quad \text{Equilibrium U-Ra assumed.}$$

$$M_U := 238.03 \cdot \text{gm} \cdot \text{mole}^{-1} \quad C_U := 3 \cdot 10^{-6} \quad Bq := \text{sec}^{-1}$$

ALI for ²²⁶Ra is found in Table 18.12.

$$R_U := m_{tot} \frac{C_U}{M_U} \cdot N_A \cdot \lambda_U \quad R_U = 8.138 \cdot 10^{20} \cdot \text{sec}^{-1} \quad ALI_{Ra} := 9 \cdot 10^4 \cdot Bq$$

$$In_w := \frac{R_U}{ALI_{Ra}} \quad In_w = 9.04 \cdot 10^{15}$$