

(6.1) In paragraph 6.3 two equations are given for calculating the range of alpha-particles in air and other material from the particle energy as well as a curve for the range in aluminium. How different are the values from the equations and from the curve for a 5 MeV alpha?

Given:

$$E_{\alpha} := 5 \quad \text{MeV} \quad A_Z := 27 \quad (\text{aluminum is monoisotopic})$$

Calculated:

$$R_{air} := 0.40 \cdot E_{\alpha}^{\frac{3}{2}} \quad \text{mg/cm}^2 \quad \text{Eqn. (6.10)} \quad R_{air} = 4.472 \quad \text{mg/cm}^2$$

$$R_Z := 0.173 \cdot E_{\alpha}^{\frac{3}{2}} \cdot A_Z^{\frac{1}{3}} \quad \text{mg/cm}^2 \quad \text{Eqn. (6.11)} \quad R_Z = 5.803 \quad \text{mg/cm}^2$$

From Figure 6.6 the range in Al of a 5 MeV a particle can be estimated to 6 mg/cm².

$$\text{Difference: } \frac{6 - R_Z}{6} \cdot 100 = 3.29 \quad \%, \quad \text{which is within the read-off uncertainty in Figure 6.6.}$$