

(13.10) A cyclotron can accelerate ${}^4\text{He}^{2+}$ -ions to 35 MeV. (a) What is its K -value? To what energy would it accelerate (b) ${}^{16}\text{O}^{6+}$ and (c) ${}^{18}\text{O}^{8+}$ ions?

Constants and units:

$$\text{MeV} := 1.60217733 \cdot 10^{-13} \cdot \text{joule} \quad A_{\text{He}} := 4 \quad E_{\text{He}} := 35 \cdot \text{MeV} \quad z_{\text{He}} := 2$$

Calculations:

$$K_{\text{cyclo}} := \frac{E_{\text{He}}}{A_{\text{He}}} \cdot \left(\frac{A_{\text{He}}}{z_{\text{He}}} \right)^2 \quad \text{From eqn. (13.7)}$$

$$\text{(a)} \quad K_{\text{cyclo}} = 35 \cdot \text{MeV}$$

$$\text{(b)} \quad A_{\text{O}} := 16 \quad z_{\text{O}} := 6 \quad E_{\text{O}} := A_{\text{O}} \cdot K_{\text{cyclo}} \cdot \left(\frac{z_{\text{O}}}{A_{\text{O}}} \right)^2 \quad E_{\text{O}} = 78.75 \cdot \text{MeV}$$

$$\text{(c)} \quad A_{\text{O}} := 18 \quad z_{\text{O}} := 8 \quad E_{\text{O}} := A_{\text{O}} \cdot K_{\text{cyclo}} \cdot \left(\frac{z_{\text{O}}}{A_{\text{O}}} \right)^2 \quad E_{\text{O}} = 124.4 \cdot \text{MeV}$$