

(11.6) The total kinetic energy of the fragments from thermal fission of  $^{239}\text{Pu}$  is 177.7 MeV and the average fragment masses are 100.34 and 139.66 u respectively. What are the kinetic energies of the average light and heavy mass fragments?

Momentum:  $m_1 v_1 = m_2 v_2$ , square, multiply by 1/2, and factor out  $E$  as  $(1/2)mv^2$ .

$$\text{MeV} := 1.6021773 \cdot 10^{-19+6} \cdot \text{joule}$$

$$M_{\text{light}} := 100.34 \cdot \frac{\text{gm}}{\text{mole}} \quad M_{\text{heavy}} := 139.66 \cdot \frac{\text{gm}}{\text{mole}} \quad E_{\text{tot}} := 177.7 \cdot \text{MeV}$$

$$E_{\text{light}} := \frac{E_{\text{tot}}}{\left(\frac{M_{\text{light}}}{M_{\text{heavy}}} + 1\right)} \quad E_{\text{light}} = 103.407 \cdot \text{MeV}$$

$$E_{\text{heavy}} := \frac{E_{\text{tot}}}{\left(\frac{M_{\text{heavy}}}{M_{\text{light}}} + 1\right)} \quad E_{\text{heavy}} = 74.293 \cdot \text{MeV}$$

Check: results

$$E_{\text{light}} + E_{\text{heavy}} = 177.7 \cdot \text{MeV}$$