

(14.7) Calculate the kinetic energy of the ${}^4\text{He}$ ion formed through thermal neutron capture in ${}^{10}\text{B}$.

Constants, units, and known values:

$$\text{MeV} := 1.60217733 \cdot 10^{-13} \cdot \text{joule} \quad \text{amu} := 1.6605402 \cdot 10^{-27} \cdot \text{kg} \quad M_n := 1.008665 \cdot \text{amu}$$

$$M_{{}^4\text{He}} := 4.002603 \cdot \text{amu} \quad M_{{}^7\text{Li}} := 7.016003 \cdot \text{amu}$$

$$M_{{}^{10}\text{B}} := 10.012937 \cdot \text{amu} \quad M_{{}^{11}\text{B}} := 11.009305 \cdot \text{amu}$$

Reaction: ${}^{10}\text{B} + n = {}^{11}\text{B}^* = {}^4\text{He} + {}^7\text{Li}$ Neglect the n-energy and the n-capture recoil energy.

Calculations:

$$Q := -931.5 \cdot \frac{\text{MeV}}{\text{amu}} \cdot (M_{{}^4\text{He}} + M_{{}^7\text{Li}} - M_{{}^{10}\text{B}} - M_n) \quad Q = 2.791 \cdot \text{MeV}$$

$$E_\alpha := Q \cdot \frac{M_{{}^7\text{Li}}}{M_{{}^{11}\text{B}}} \quad \text{From eqn. (4.16)} \quad E_\alpha = 1.78 \cdot \text{MeV}$$