Answer on Question #84474 Physics / Other

Compute the total binding energy and the binding energy per nucleon for Lithium-7.

Solution:

The total binding energy by definition

$$\mathrm{BE} = \Delta m \cdot c^2 = \Delta m(\mathrm{u}) \cdot 931.494\ \mathrm{MeV}$$

where Δm is a mass defect, that is given by relationship

$$\Delta m = Z m_p + (A - Z) m_n - M_{\mathrm{nuclide}}$$

Since

$$m_p = 1.007825\ \mathrm{u}, \qquad m_n = 1.008665\ \mathrm{u}$$

and for Lithium-7 $\left({}^{A}_{Z}X = {}^{7}_{3}Li\right)$

$$Z = 3, \qquad A = 7, \qquad M_{\mathrm{nuclide}} = 7.016004\ \mathrm{u}$$

we obtain

$$\Delta m = 3 \times (1.007825\ \mathrm{u}) + 4 \times (1.008665\ \mathrm{u}) - 7.016004\ \mathrm{u}$$

$$= 0.042131\ \mathrm{u}$$

So, the total nuclear binding energy for Lithium-7

$$\mathrm{BE} = (0.042131\ \mathrm{u}) \cdot 931.494\ \mathrm{MeV} = 39.245\ \mathrm{MeV}$$

The total nuclear binding energy per nucleon for Lithium-7

$$\frac{\mathrm{BE}}{A} = \frac{39.245\ \mathrm{MeV}}{7} = 5.606\ \mathrm{MeV}$$

Answer: 39.245 MeV, 5.606 MeV