

(4.5) When a neutron is captured in a nucleus, the mass number of the isotope increases one unit. In the following table mass excess values are given for three important isotope pairs:

$$eV := 1.60217733 \cdot 10^{-19} \cdot \text{joule}$$

$$MeV := 10^6 \cdot eV$$

$$\delta_{235U} := 40915 \cdot 10^3 \cdot eV$$

$$\delta_{236U} := 42441 \cdot 10^3 \cdot eV$$

$$\delta_{238U} := 47306 \cdot 10^3 \cdot eV$$

$$\delta_{239U} := 50571 \cdot 10^3 \cdot eV$$

$$\delta_{239Pu} := 48585 \cdot 10^3 \cdot eV$$

$$\delta_{240Pu} := 50122 \cdot 10^3 \cdot eV$$

$$\delta_n := 8665 \cdot 10^{-6} \cdot 931.5 \cdot 10^6 \cdot eV \quad \text{from Table 4.1}$$

If the average nucleon binding energy in this region is 7.57 MeV one can calculate the difference between this average binding energy and the one really observed in the formation of ^{236}U , ^{239}U , and ^{240}Pu . Calculate this difference.

$$EBA_{aver} := 7.57 \cdot 10^6 \cdot eV$$

$$Q1 := -\delta_{236U} + \delta_{235U} + \delta_n \quad Q1 = 6.545 \cdot MeV \quad Q1 - EBA_{aver} = -1.02 \cdot MeV$$

$$Q2 := -\delta_{239U} + \delta_{238U} + \delta_n \quad Q2 = 4.806 \cdot MeV \quad Q2 - EBA_{aver} = -2.76 \cdot MeV$$

$$Q3 := -\delta_{240Pu} + \delta_{239Pu} + \delta_n \quad Q3 = 6.534 \cdot MeV \quad Q3 - EBA_{aver} = -1.04 \cdot MeV$$