

Mass difference and binding energy

A.C. NORMAN

anorman@bishopheber.cheshire.sch.uk

Where necessary, take $1 \text{ u} = 931.3 \text{ MeV}$, and $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$.

In each question, calculate the mass differences in u and energies in MeV unless told differently.

1. Explain the meaning of the terms

- (a) mass difference
- (b) binding energy

2. Calculate

- (a) the mass difference
- (b) the binding energy

of lithium-6. [Atomic mass of lithium-6 = 6.015124]

3. What is the atomic mass of carbon-12 to 4 decimal places.

4. Calculate

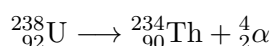
- (a) the mass difference
- (b) the binding energy

of carbon-12.

5. The atomic masses of two stable isotopes of iron are $56.935\,39 \text{ u}$ (^{57}Fe) and $57.933\,27 \text{ u}$ (^{58}Fe)

- (a) Calculate the binding energy for each isotope.
- (b) Suggest which isotope may be the more stable, giving a reason.

6. Alpha-particle emission from U-238 may be written as

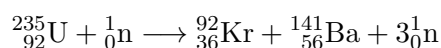


Calculate the energy of the alpha-particle in

- (a) MeV
- (b) J
- (c) Calculate the velocity of the alpha particle, assuming there is no recoil from the nucleus.

[Atomic masses are 238.0509 u and 234.0436 u for the isotopes.]

7. Nuclear fission occurs when a heavy nucleus absorbs a neutron, and splits into two small nuclei with the emission of some neutrons. One possible fission reaction is



Calculate the energy released in this fission.

[Atomic masses are 235.0439 u , 91.8976 u and 140.9136 u .]



Except where otherwise noted, this work is licensed under
<http://creativecommons.org/licenses/by-nc-sa/3.0/>