Problem-13

Mukesh Tekwani

Calculate the binding energy per nucleon of an alpha particle from the following data:
Mass of helium nucleus = 4.001265 amu
Mass of proton = 1.007277 amu
Mass of neutron = 1.00866 amu
1 amu = 931.4812 amu

Solution:

Mass of two protons = $2 \times 1.007277 = 2.014554$ u

Mass of two neutrons = $2 \times 1.00866 = 2.017332$ u

∴ Total initial mass of 2 protons & 2 neutrons

$= 2.014554 + 2.017332$

$= 4.031886$ u

∴ Mass defect Δm = Total initial mass − actual mass

$= 4.031886 - 4.001265$

$\Delta m = 0.030621$ u

∴ Binding energy of α-particle

$= \Delta m\, c^2$

$= \Delta m \times 931.4812$

$= 0.030621 \times 931.4812$

$= 28.522$ MeV.

∴ Binding energy per nucleon $= \frac{28.522}{4}$

$= 7.10525$ MeV