

## Problems of Nuclear mass and binding energy

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1) The isotope calcium-42 has 20 protons and a mass of 41.9586183 u. Determine:

- Mass defect in atomic mass units (u).
- Nuclear binding energy in MeV.
- Binding energy per nucleon in MeV/nucleon.

*Data:* Proton mass:  $m_p = 1.007\,276\,467$  u. Neutron mass:  $m_n = 1.008\,664\,916$  u  
 $1\text{ eV} = 1.602\,176\,621 \times 10^{-19}$  J,  $1\text{ u} = 1.660\,539\,04 \times 10^{-27}$  kg,  $c = 299\,792\,458$  m/s

*Answer:* a) 0.3775392 u b) 351.676 MeV c) 8.37323 MeV/nucleon

2) The isotope  $^{202}_{80}\text{Hg}$  has a mass of 201.970626 u. Determine:

- Mass defect in atomic mass units (u).
- Nuclear binding energy in MeV.
- Binding energy per nucleon in MeV/nucleon.

*Data:* Proton mass:  $m_p = 1.007\,276\,467$  u. Neutron mass:  $m_n = 1.008\,664\,916$  u  
 $1\text{ eV} = 1.602\,176\,621 \times 10^{-19}$  J,  $1\text{ u} = 1.660\,539\,04 \times 10^{-27}$  kg,  $c = 299\,792\,458$  m/s

*Answer:* a) 1.668611 u b) 1554.3 MeV c) 7.69456 MeV/nucleon

3) The isotope silicon-29 has 14 protons and a mass of 28.9764947 u. Find out:

- Mass defect in atomic mass units (u).
- Nuclear binding energy in MeV.
- Binding energy per nucleon in MeV/nucleon.

*Data:* Proton mass:  $m_p = 1.007\,276\,467$  u. Neutron mass:  $m_n = 1.008\,664\,916$  u  
 $1\text{ eV} = 1.602\,176\,621 \times 10^{-19}$  J,  $1\text{ u} = 1.660\,539\,04 \times 10^{-27}$  kg,  $c = 299\,792\,458$  m/s

*Answer:* a) 0.2553496 u b) 237.857 MeV c) 8.20195 MeV/nucleon

4) The isotope copper-63 has 29 protons and a mass of 62.9296011 u. Find out:

- Mass defect in atomic mass units (u).
- Nuclear binding energy in MeV.
- Binding energy per nucleon in MeV/nucleon.

*Data:* Proton mass:  $m_p = 1.007\,276\,467$  u. Neutron mass:  $m_n = 1.008\,664\,916$  u  
 $1\text{ eV} = 1.602\,176\,621 \times 10^{-19}$  J,  $1\text{ u} = 1.660\,539\,04 \times 10^{-27}$  kg,  $c = 299\,792\,458$  m/s

*Answer:* a) 0.5760236 u b) 536.563 MeV c) 8.51687 MeV/nucleon