Nuclear Binding Energy and Mass Defect

Mass defect, total binding energy and binding energy per nucleon of a nuclide from its atomic mass, proton number and mass number.

Method: Mass-energy equivalence E = mc² with atomic masses (CODATA 2018 and AME2020 values)

Input parameters

Unit system: SI

Parameter	Value	Unit
Proton number (atomic number)	26.000	
Mass number	56.000	
Atomic mass of the neutral atom (u)	55.935	

Calculated results

Parameter	Value	Unit
Mass defect (u)	0.52846	
Binding energy	492.26	MeV
Binding energy per nucleon	8.7903	MeV
Neutron number	30.000	

Notes for this case

• B = [Z m(¹H) + N m_n − M(A, Z)] × 931.494 MeV/u with atomic masses (the electrons cancel). Iron-56 and nickel-62 sit near the peak of about 8.8 MeV per nucleon.

Formula and method

$$\Delta = Z m_H + (A - Z) m_n - M, \quad B = 931.494\,\Delta\ \mathrm{MeV}$$

Variables

Z	Proton number (atomic number)	-
A	Mass number	-
M	Atomic mass of the neutral atom (u)	-
Δ	Mass defect (u)	-
B	Binding energy	J
B/A	Binding energy per nucleon	J
N	Neutron number	-

Method and standards

Mass defect and binding energy from atomic masses.

Assumptions and limits

- Electron binding energies (eV) are neglected.

References

Mass-energy equivalence E = mc² with atomic masses (CODATA 2018 and AME2020 values)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/nuclear-power/nuclear-binding-energy

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.