Atomic mass unit:

The unit in which atomic and nuclear masses are measured is called atomic mass unit (a.m.u).

One amu is defined as $\frac{1}{12}^{th}$ of the mass of an atom of ${}_6C^{12}$.

It is denoted by 'u'.

As, mass of 6.023×10^{23} atoms of carbon= 12 gm

So, mass of 1 atom of carbon= $\frac{12}{6.023 \times 10^{23}}$ gm

By definition $1\ amu = \frac{1}{12} \times mass\ of\ one\ atom\ of\ C^{12}$

or, $1\ amu = \frac{1}{12} \times \frac{12}{6.023\ x\ 10^{23}}\ gm$

or, $1\ amu = 1.66 \times 10 - 24\ gm$

$\therefore$ $\mathbf{1\ a.m.u = 1.66 \times 10 - 27\ Kg}$

In terms of amu

Mass of an electron (m_e) = 0.00055 u

Mass of a Proton (m_p) = 1.0073 u

Mass of a neutron (m_n) =1.0086 u

Mass number and atomic mass (WEIGHT):

The atomic weight of an element is the weighted average of the masses of all its isotopes.

For example, neon has two isotopes of masses 20 and 22 which occur in the ratio 9:1.

$\therefore$ Average atomic weight of neon $= \frac{20 \times 9 + 22 \times 1}{(9+1)}$

$= 20.2$

Neon has two isotopes:

$10Ne^{20}$ and $10Ne^{22}$

90% of Neon is: $10Ne^{20}$

10% of Neon is: $10Ne^{22}$

But mass number is always represented by an integer as it represents the number of nucleons in the nucleus.

Electron volt (eV):

It is the small unit of energy. One electron volt is the energy gained by an electron, when accelerated through a potential difference of one volt.

$Energy = Work\ done = charge \times Potential\ difference$

Or, 1 eV= $1.602 \times 10^{-19} \times 1$

Or, 1 eV = 1.602×10^{-19} Joule

Einstein's mass-energy relation:

In 1905, Einstein explained the interrelationship between mass & energy in his special theory of relativity. According to this theory, mass & energy are interchangeable i.e. mass can be converted into energy & vice- versa.

According to Einstein, the energy equivalent to a mass (Δm) is,

$E = \Delta \boldsymbol{mc^2}$,

Where, $c = 3x10^8 m/s$, is speed of light in vacuum.

This equation represents Einstein's mass-energy relation. This relation explains the unification law of conservation of mass & law of conservation of energy into a single law called law of mass-energy conservation.

So, this relation is also known as mass- energy equivalence.

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1. The mass of an electron is about $9.1 \times 10^{-31}\ Kg$. What would be the energy equivalent of the electronic mass? $[\mathbf{8.2 \times 10^{-14} J}]$