Marwari college Darbhanga

Subject---physics (Hons)

Class--- B. Sc. Part 3

Paper –06 ; Group—A

Topic--- Properties of Nuclei

Lecture series –55

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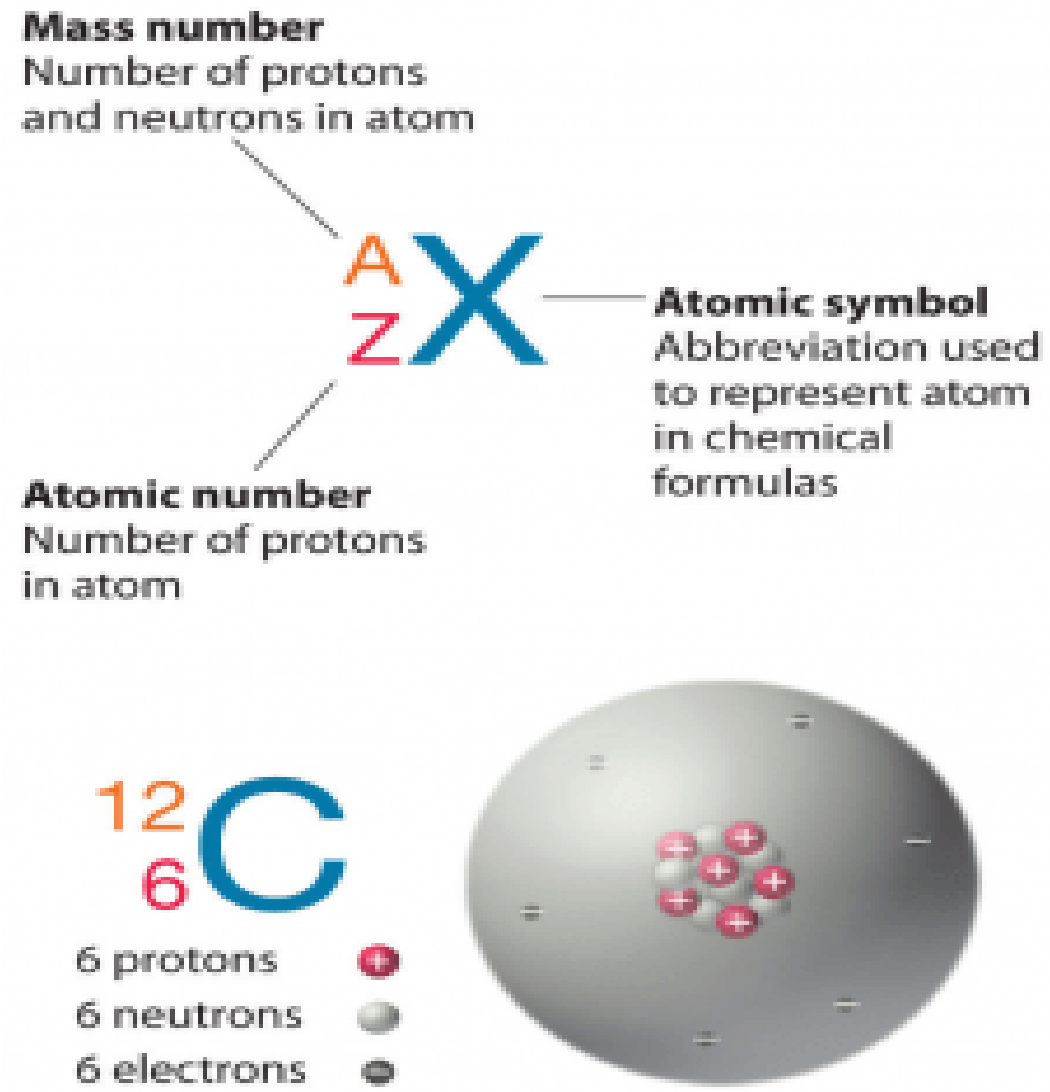
Properties of Nuclei

There are many properties of Nuclei

(1) Mass of nucleus
(2) Radius of nucleus
(3) Angular momentum of nucleus
(4) Spin
(5) Magnetic moment
(6) Stability
(7) Binding Energy

Mass of Nucleus



As was written, almost all of the mass of an atom is located in the nucleus, with a very small contribution from the electron cloud. The mass of the nucleus is associated with the atomic mass number, which is the total number of protons and neutrons in the

nucleus of an atom. The mass number is different for each different isotope of a chemical element. The mass number is
The size and mass of atoms are so small that the use of normal measuring written either after the element name or as a superscript to the left of an element's symbol. For example, the most common isotope of carbon is carbon-12, or ^{12}C.

units, while possible, is often inconvenient. Units of measure have been defined for mass and energy on the atomic scale to make measurements more convenient to express. The unit of measure for mass is the atomic mass unit (amu). One atomic mass unit is equal to 1.66×10^{-24} grams .
Beside the standard kilogram, it is a second mass standard. It is the carbon-12 atom, which, by international agreement, has been assigned a mass of 12 atomic mass units (u). The relation between the two units is one atomic mass unit is equal:
$1u = 1.66 \times 10^{-24}$ grams.

One unified atomic mass unit is approximately the mass of one nucleon (either a single proton or neutron) and is numerically equivalent to 1 g/mol.
For ^{12}C the atomic mass is exactly 12u, since the atomic mass unit is defined from it. For other isotopes, the isotopic mass usually differs and is usually within 0.1 u of the mass number. For example, **^{63}Cu** (29 protons and 34 neutrons) has a mass number of 63 and an isotopic mass in its nuclear ground state is 62.91367 u.

There are two reasons for the difference between mass number and isotopic mass, known as the mass defect:

1. The neutron **is** slightly heavier than the proton. This increases the mass of nuclei with more neutrons than protons relative to the atomic mass unit scale based on ^{12}C with equal numbers of protons and neutrons.

2. The nuclear binding energy varies between nuclei. A nucleus with greater binding energy has a lower total energy, and therefore a lower mass according to Einstein's mass-energy equivalence relation $E = mc^2$. For **^{63}Cu** the atomic mass is less than 63 so this must be the dominant factor.

Note that, it was found the rest mass of an atomic nucleus **i**s measurably smaller than the sum of the rest masses of its constituent protons, neutrons and electrons. Mass was no longer considered unchangeable in the closed system. The difference is a measure of the nuclear binding energy which holds the nucleus together. According to the Einstein relationship ($E=mc^2$), this binding energy is proportional to this **mass difference** and it is known as the **mass defect**.