



WELCOME

NUCLEAR PHYSICS



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DEFINITION



☞ Nuclear Physics is the field of physics that studies the building blocks and interaction of atomic nuclei.

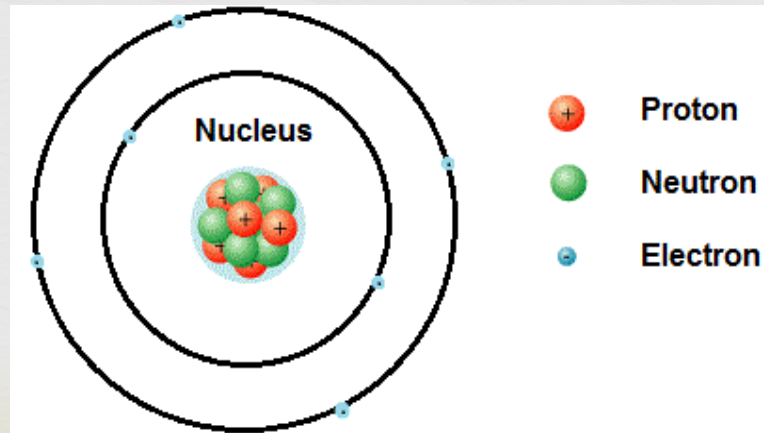
☞ It includes the study of,

1. The general properties of nucleus.
2. The particles contained in the nucleus.
3. The interaction between these particles.
4. Radioactivity and nuclear reaction.

NUCLEUS



- ☞ Every atom contains a Centre, an extremely dense, positively charged nucleus.
- ☞ The nucleus is made of protons and neutrons.
- ☞ Protons have positive electric charge.
- ☞ Neutrons have no electrical charge.



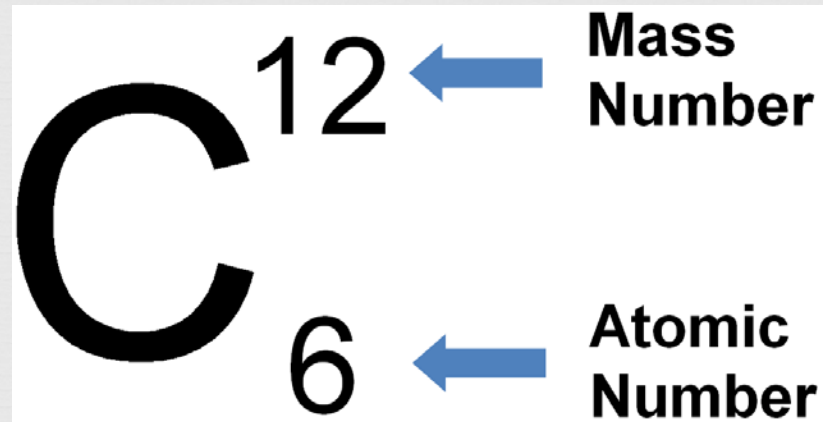
NUCLEUS



∞ Mass Number(A): Total number of nucleon.

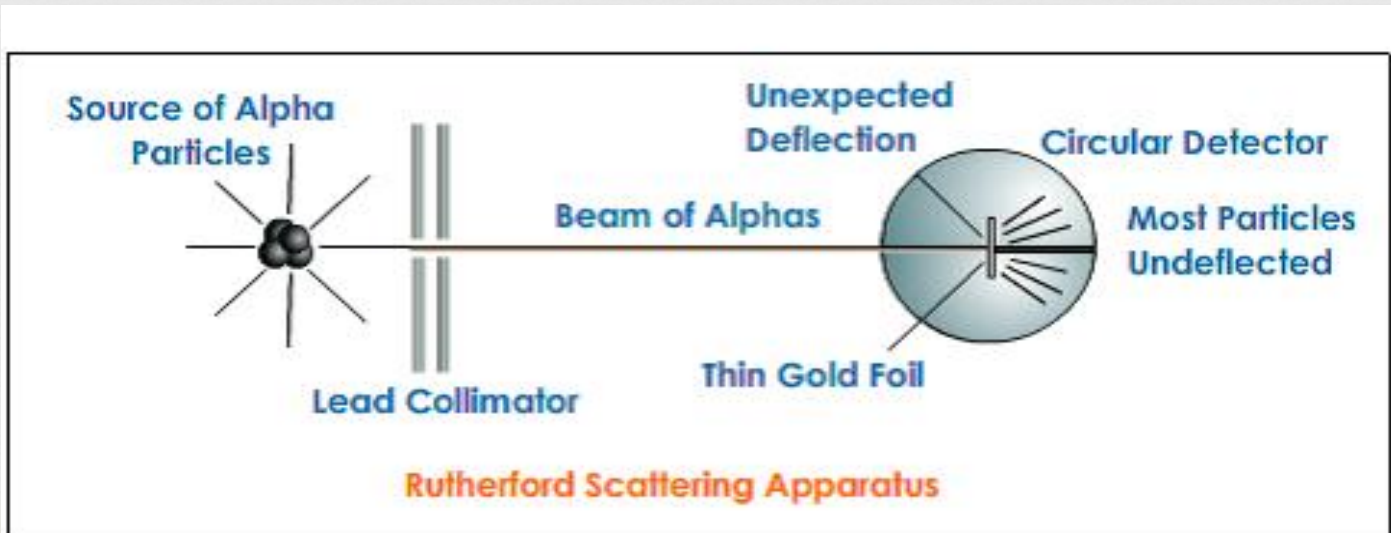
$$A = Z(\text{protons}) + N(\text{neutrons}).$$

∞ Atomic Number(Z): Number of protons.



α -Ray Scattering Experiments

- It was done by E. Rutherford.
- From angular distribution of rescattered α - particles.
- Rutherford concluded existence of positively charged core of atom, then called nucleus.
- The size of the nucleus was much smaller than size of the atom.



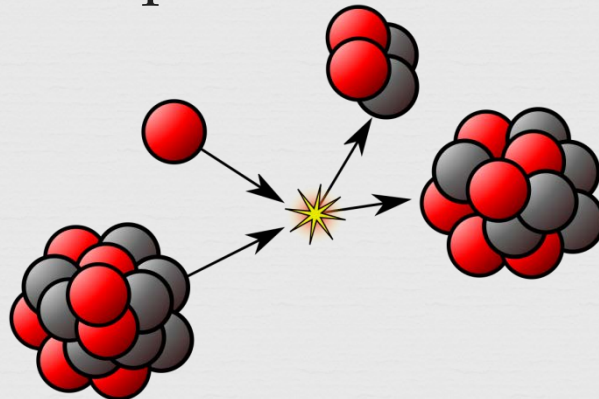
THE NUCLEAR FORCE



- ∞ The force binds together protons and neutrons inside the nucleus is called the Nuclear Force.
- ∞ Some characteristics of the nuclear force are:
 1. It does not depend on charge.
 2. It is very short range.
 3. It is much stronger than the electric force.

NUCLEAR BINDING ENERGY

- ❧ Nuclear binding energy is the energy required to split a nucleus of an atom into its component parts: protons and neutrons, or, collectively, the nucleons.
- ❧ The **binding energy** of nuclei is always a positive number, since all nuclei require net energy to separate them into individual protons and neutrons.



NUCLEAR REACTION



- ∞ A nuclear reaction is rearrangement of nuclear components induced by particle bombardment.
 1. Fusion
 2. Fission
- ∞ Nuclear reaction subject to the following conservation laws:
 1. Charge
 2. Momentum and angular momentum
 3. Energy
 4. Total number of nucleons

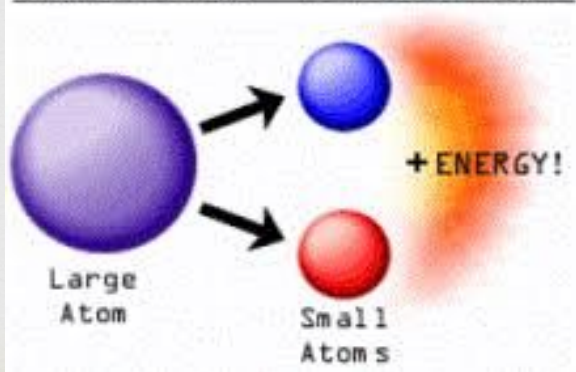
FISSION AND FUSION

∞ Fission

Fission is the splitting of an atomic nucleus into two or more lighter nuclei accompanied by **energy** release.

The original heavy atom is termed the parent nucleus and the lighter nuclei are daughter nuclei.

Nuclear Fission

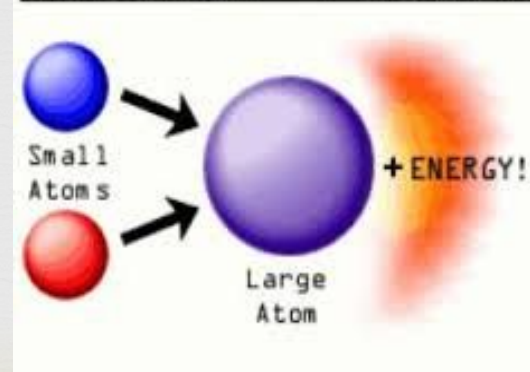


∞ FUSION

Nuclear fusion is the process of making a single heavy nucleus (part of an atom) from two lighter nuclei. This process is called a **nuclear** reaction.

It releases a large amount of energy. The nucleus made by **fusion** is heavier than either of the starting nuclei.

Nuclear Fusion





FISSION

- ❧ Splitting a large mass nucleus into two medium mass nucleus.
- ❧ Energy released per nucleon is less
- ❧ It can be controlled
- ❧ Heat is not needed

FUSION

- ❧ Joining two low mass nuclei into a larger mass nucleus
- ❧ Energy produced per nucleon is large
- ❧ It cannot be controlled
- ❧ Extreme heat is needed



THANK YOU