Marwari college Darbhanga

Subject---physics Hons

Class--- B. Sc. Part 3

Paper –06 ; Group—A

Topic--- Nuclear Reaction

Lecture series -- 74

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Nuclear Reaction

Nuclear reactions are processes in which one or more nuclides are produced from the collisions between two atomic nuclei or one atomic nucleus and a subatomic particle. The nuclides produced from nuclear reactions are different from the reacting nuclei (commonly referred to as the parent nuclei).

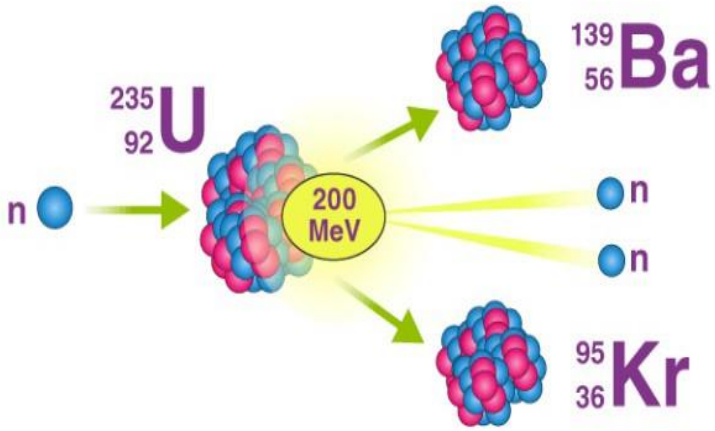
Types of Nuclear Reaction

- **Nuclear Fission**
- **Nuclear Fusion**

Nuclear Fission

When the nucleus of an atom splits into lighter nuclei through a nuclear reaction the process is termed as nuclear fission. This decay can be natural spontaneous splitting by radioactive decay, or can actually be simulated in a lab by achieving necessary conditions (bombarding with neutrinos). The resulting fragments tend to have a combined mass which is less than the original. The missing mass is what is converted into nuclear energy in the above reaction. Therefore, nuclear fission is defined as:

> The process in nuclear physics in which the nucleus of an atom splits into two daughter nuclei.



Examples of Nuclear Fission

An example of nuclear fission is the splitting of Uranium-235. The equation of the reaction has been given below:

$$
\begin{aligned}
&{}^{235}_{92}\mathrm{U} + {}^{1}_{0}\,\mathrm{n} \rightarrow {}^{144}_{56}\,\mathrm{Ba} \\
&+ {}^{89}_{36}\,\mathrm{Kr} + 3{}^{1}_{0}\mathrm{n} \\
&+ 210 MeV
\end{aligned}
$$

Nuclear Fusion

Nuclear fusion is a reaction through which two or more light nuclei collide into each other to form a heavier nucleus. This reaction takes place with elements which have a low atomic number, such as Hydrogen. It is the opposite of nuclear fission reaction in which heavy elements diffuse and form lighter elements. Both nuclear fusion and fission produce a massive amount of energy.

Applications of Nuclear Fusion

- Clean: No combustion occurs in nuclear power (fission or fusion), so there is no air pollution.
- Less nuclear waste: The fusion reactors will not produce high-level nuclear wastes like their fission counterparts, so disposal will be less of a problem. In addition, the wastes will not be of weapons-grade nuclear materials as is the case in fission reactors.