

2. CONTROLLED CHAIN REACTION:

It is a chain reaction in which energy produced can be controlled in a desired level. In this reaction, the moderator [like graphite, heavy water (D_2O)] is used for slowing down the fast neutrons.

This Principle is used in nuclear reactor.

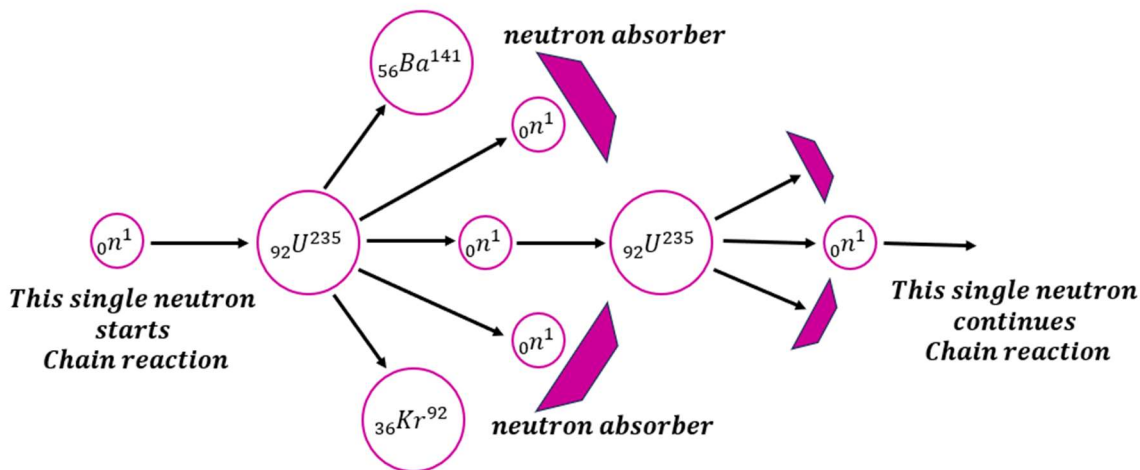


Figure: Controlled Chain reaction

CRITICAL SIZE & CRITICAL MASS:

The minimum size of fissionable material to sustain chain reaction is called critical size. The mass corresponding to critical size is called critical mass. If the size of fissionable material is less than critical size then a chain reaction is not possible.

The critical size of uranium-235 is about 17 cm in diameter.

The critical mass of a bare sphere of uranium-235 at normal density is approximately 47 kg.

DIFFERENCE BETWEEN NUCLEAR FISSION & NUCLEAR FUSION:

Nuclear Fission	Nuclear Fusion
1. Splitting of a heavy nucleus into light nuclei. ${}_0n^1 + {}_{92}U^{235} \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3 {}_0n^1 + Q$ where Q is energy released	Combination of lighter nuclei to form a heavy & stable nucleus. i.e. $1H^2 + 1H^2 \rightarrow 2He^4 + Q$ where Q is energy released
2. Energy released per fission of Uranium is around 200MeV.	Energy released per fusion is around 24MeV
3. Energy released per nucleon is about 0.8MeV	Energy released per nucleon is 6MeV.
4. Controlled fission reaction is the possible & is being used for constructive purpose in nuclear reactor.	Controlled fusion reaction is not discovered yet.
5. Uncontrolled fission reaction is principle of atom bomb	Uncontrolled fusion reaction is the principle of Hydrogen Bomb
6. Sources for nuclear fission are limited	Sources for nuclear fusion reaction are almost unlimited.
7. A minimum mass known as critical mass is required to start fission	No minimum mass is required for nuclear fusion.
8. It is induced by neutrons	It is Induced by protons
9. Fuel is either in solid or in liquid state	Fuel is in Plasma state