

"Types of Reactors"

Dr. Usha Kumari

Types of Reactors: -

(i) Light Water and enriched Uranium: - Most reactors use light water as moderator as well as a coolant. Light water is an efficient moderator. But the proton nuclei in water tends to capture neutrons to form deuterons. Light water reactors cannot therefore use natural uranium as fuel. They use enriched uranium in ~~cat~~ which the ^{235}U content is about 3 per cent.

The enrichment of natural uranium is a costly process involving one of the following methods.

(a) Gaseous diffusion: - Uranium hexa fluoride UF_6 is passed through 2000 successive permeable barriers. The rate of diffusion of ^{235}U is slightly greater than that of $^{238}\text{UF}_6$.

(b) Gas centrifuges :- Thousands of gas centrifuges are used for the separation.

(c) A laser is used to produce photons of the right energy to ionize ^{235}U but not ^{238}U . An electric field then separates the ionised isotope from the neutral one.

For a light water reactor the fuel is in the form of UO_2 sealed in long thin zirconium alloy tubes assembled in a steel pressure vessel. The water that circulates is kept at 150 atm to prevent boiling.

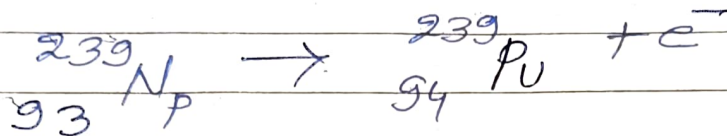
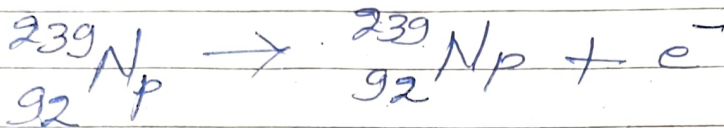
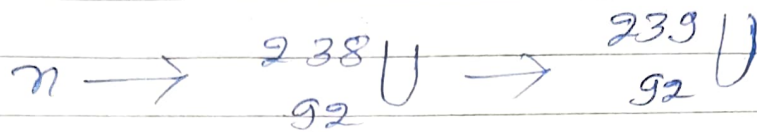
Boiling Water Reactor :-

This allows steam to form and this is separated out and sent to a turbine. This has a greater chance of contamination of the outside environment.

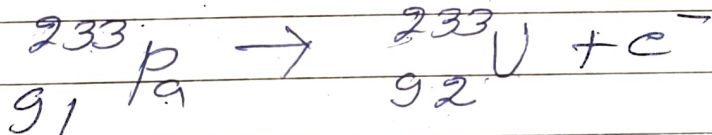
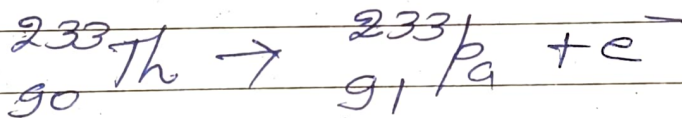
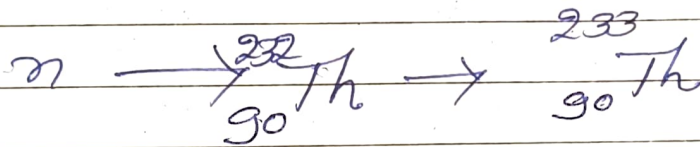
(ii) Heavy Water Reactor :- Heavy water makes a better moderator than light water, and natural uranium can be used as a fuel. Heavy water is less likely to capture neutrons.

(iii) Breeder Reactor:-

^{238}U becomes ^{239}U when it captures a neutron. The following changes ensue



Similarly thorium may become fissionable isotope ^{233}U



If ^{238}U and ^{232}Th are incorporated in a reactor to absorb neutrons not taking part directly in fission events, more new fissionable material can be produced than is consumed. This is the principle of the breeder reactor.

Fast neutrons are more effective in the breeder reactor. They use liquid sodium as coolant, as this is more effective for ~~the~~ heat transfer.

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