

HEAVY WATER(D₂O)

Introduction of Heavy Water

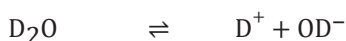
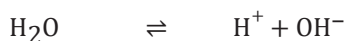
Heavy water, chemically known as deuterium oxide (D₂O), was first discovered by Harold Urey in the year 1932.

Preparation

Heavy Water (D₂O) Method of Preparation

Repeated Electrolysis of H₂O:

On electrolysis of water (impure) H₂O dissociate into H⁺ & OH⁻ while a fractional part of D₂O will dissociate into D⁺ & OD⁻



D⁺ & OD⁻ due to more mass have less mobility i.e., why H⁺ & OH⁻ will move towards cathode & anode respectively while D⁺ & OD⁻ will be in solution. This process will repeat for six time.

Uses of Heavy Water

As a neutron moderator: Fission in uranium-235 is initiated by the presence of sluggish or slow-moving neutrons. These materials, known as moderators, are employed to decelerate the velocity of neutrons. In nuclear reactors, heavy water serves as one such moderator, playing a significant role in this process. Uranium-235 (U-235) is a crucial element in nuclear fission reactions. When U-235 nuclei capture neutrons, they become unstable and split into two or more smaller nuclei, along with the release of a substantial amount of energy. However, for this fission process to be efficient, it requires neutrons to be in a specific state - slow-moving or "thermal" neutrons. These slow neutrons are much more likely to be captured by U-235 nuclei, which triggers the fission reaction. To achieve the necessary moderation of neutron speed, substances known as moderators are employed. Moderators serve as a means to slow down high-energy, or "fast," neutrons that are generated in various nuclear processes. By reducing the velocity of these fast neutrons, moderators increase their chances of interaction with the U-235 nuclei, increasing the likelihood of successful fission events. Heavy water, a unique form of water in which the hydrogen atoms are replaced by deuterium, an isotope of hydrogen containing both a proton and a neutron in its nucleus, plays a critical role as a moderator in nuclear reactors. Deuterium, due to its larger mass compared to ordinary hydrogen, is more effective at moderating neutrons. When heavy water is used as a moderator in a nuclear reactor, it serves to slow down neutrons to the optimal velocity for inducing fission reactions. This, in turn, promotes a sustained and controlled release of energy in the form of heat. Heavy water's ability to effectively moderate neutrons is pivotal for the operation of nuclear reactors. It enables the controlled harnessing of nuclear energy for various applications, including electricity generation and scientific research. The use of heavy water as a moderator is a key safety measure in nuclear reactor design, ensuring that the necessary neutron moderation is achieved efficiently, contributing to the reactor's stability and overall performance.