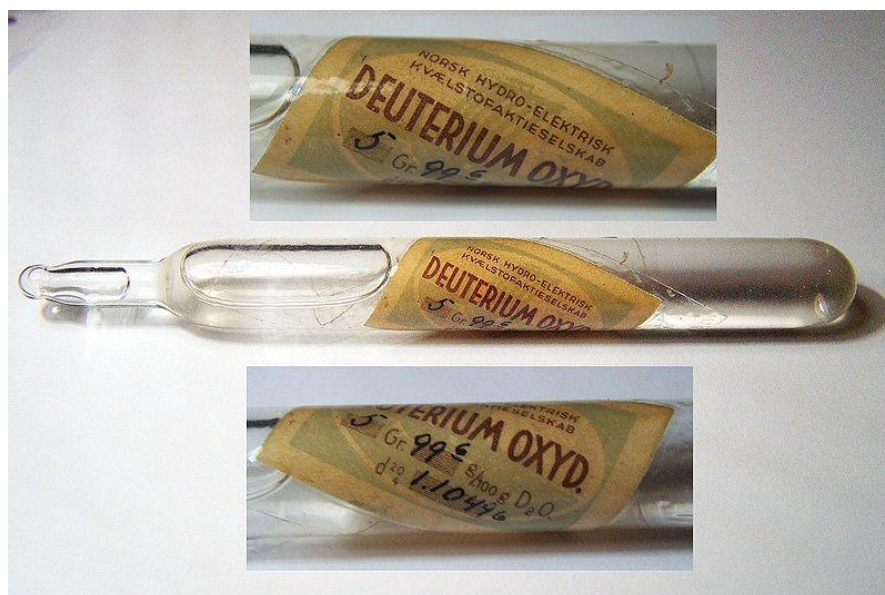


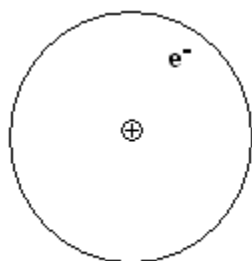
Laboratory Exercise: Deuterium Oxide

In this simple exercise we will make a Heavy Water ice-cube. Once the Heavy Water freezes we will compare the density of the ice cube with that of ordinary Water. According to our common experience, ordinary Ice has a lower density than ordinary Water; in other words Ice cubes will float in Water. Will our Heavy Water ice cube float in ordinary Water? We will test this idea.

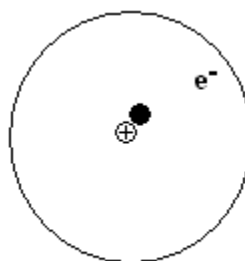


Norsk Heavy Water, Wikipedia

In naturally occurring samples, Hydrogen atoms are predominantly ^1H ; 99.985% ^1H (Protium) and 0.015% ^2H (Deuterium). So, Water occurs mostly as $^1\text{H}_2\text{O}$. Heavy Water is Water where the Hydrogen atoms are exclusively ^2H ; predominantly $^2\text{H}_2\text{O}$, otherwise designated as D_2O . ^1H atoms have a mass of 1.007825 amu, whereas ^2H atoms, because of the extra neutron in the nucleus, have a mass of 2.0140 amu. Thus, Deuterium containing compounds will be more dense, have a higher mass per unit volume, than will those compounds that contain predominantly Protium. Thus, Heavy Water will have a higher density than will ordinary Water, in both its liquid and solid forms. We will confirm this by direct observation.



Protium Atom



Deuterium Atom

Procedure

1. Obtain a clean dry 10 mL Graduated Cylinder
2. Fill the Cylinder to the 5 mL mark with Heavy Water. Add this to one of the dimples in an ice cube tray. Be sure to note where in the tray your ice cube is located
3. Your instructor will place the ice cube tray into the freezer until the next laboratory period.
4. During the next laboratory period, remove your Ice cube and place it in a beaker of ordinary Water. Observe what happens.

Post Lab Questions

1. Compare the density of Heavy Water with that of ordinary Water. Note the temperature and pressure for which your comparison is made.
2. What was the reason Heavy Water was initially produced?
3. Use the above data to calculate the Atomic Weight of Hydrogen.
4. What is the major use of Tritium, ^3H ? Why is Tritium not included in the above calculation of the atomic weight of Hydrogen?