

## The Great Invention | Inventors | James Dewar (1842 - 1923)

The youngest of six boys, Dewar was born and raised in Scotland. By the time he was fifteen he had lost both parents, and went to live with his brother. The following year he went to Edinburgh University and, after graduation, stayed on to work as a tutorial assistant to Professor Playfair. Dewar's first paper was given by the Professor to the Royal Society of Edinburgh in 1867 and outlined a means to represent organic structures with copper strips and disks, using this method to suggest several different possible structures for benzene, including the correct one.

In 1869 he became a lecturer at the Royal Veterinary College, and it was here that he began his life's work on cryogenics, broken only by a two year period from 1873 when he became the Assistant Chemist at the Highland and Agricultural Society where he analysed manure and fertilisers. In 1875 he became Jacksonian Professor at Cambridge, a post he would hold to his death.

In 1877 he was appointed to the Fullerian Chair at the Royal Institute in London, another post he held to his death and where his best work - specifically cryogenics - was completed. Although he had successfully liquefied most gases at Cambridge, it was in London that this work continued. In 1877 Louis Caillete and Raoul Pictet liquefied a small amount of oxygen, and the following year Dewar was the first in Britain to do the same, at a Royal Institution lecture; by 1885 he could fill buckets with it.

In the 1890s he worked to liquefy, and then solidify, hydrogen. This he had successfully completed by 1899, and he was able to cool solids to minus 260 centigrade. He also discovered that most chemical reactions were adversely affected by low temperature, with the exception of fluorine: solid fluorine is explosive and liquid fluorine sets fire to wood. In further work, Dewar looked

at phosphorescence at low temperatures, and worked with Pierre Curie on radium decay to helium in 1904, the same year that he was knighted. With John Fleming of University College London, he investigated electrical resistance between +200 and -200° centigrade, predicting that resistance would disappear at zero degrees Kelvin (-273.15° C). This is known as superconductivity.

In the course of his cryogenic work he invented the vacuum flask. The original vessel of 1892 was made of glass and was unsilvered. He wanted to make them from metal, to be less fragile and easier to construct, but gas absorbed onto the surface of the metal spoiled the vacuum. However, in 1905 he discovered that charcoal made from coconut husk, when cooled to -185° centigrade, was very efficient at absorbing gases. By placing charcoal into the flask, and cooling it, he could get the vacuums he needed. He also realised that painting the inside of the flask silver could minimise radiation. The flask was not manufactured for commercial or domestic use until 1904, however, when two German glass blowers formed Thermos GmbH, after the Greek word 'therme' meaning 'hot'.

In the meantime he had served on the Government Committee on Explosives for three years from 1888, and with Sir Frederick Abel invented cordite in 1889, an explosive that was to prove vital in the First World War. During the war, cryogenic research was prohibitively expensive, so Dewar began working on thin films - bubbles - to research surface tension and analyse sound waves. One bubble lasted 322 days, and another grew to four feet in diameter. His final work, in 1921, measured solar radiation, using sensitive instruments cooled with liquid oxygen. He died two years later.