FRANCIUM

Element symbol: Fr
Atomic number: 87

Francium (previously known as eka-cesium and actinium K) is a radioactive metal and the second rarest naturally occurring element after Astatine. It is the least stable of the first 103 elements. Very little is known of the physical and chemical properties of Francium compared to other elements.

Francium was discovered by Marguerite Perey of the Curie Institute in Paris, France in 1939. However, the existence of an element of atomic number 87 was predicted in the 1870s by Dmitri Mendeleev, creator of the first version of the periodic table, who presumed it would have chemical and physical properties similar to Cesium. Several research teams attempted to isolate this missing element, and there were at least four false claims of discovery during which it was named Russium (after the home country of soviet chemist D. K. Dobroserdov), Alkalinium (by English chemists Gerald J. K. Druce and Frederick H. Loring as the heaviest alkali metal), Virginium (after Virginia, home state of chemist Fred Allison), and Moldavium (by Horia Hulubei and Yvette Cauchois after Moldavia, the Romanian province where they conducted their work).

Perey finally discovered Francium after purifying radioactive Actinium-227 from Lanthanum, and detecting particles decaying at low energy levels not previously identified. The new product exhibited chemical properties of an alkali metal (such as co-precipitating with Cesium salts), which led Perey to believe that it was element 87, caused by the alpha radioactive decay of Actinium-227. The International Union of Pure and Applied Chemistry officially adopted the name Francium in 1949, becoming the second element (after Gallium) to be named after France.

Perey's discovery has been described as accidental, and simply attributed to an anonymous assistant of Marie Curie. However, whilst Perey began working as Marie Curie's personal assistant, she was an independent radiochemist at the time of discovery, which occurred five years after Curie's death. Perey's scientific publications on the discovery of Francium outline the painstaking work she undertook, carrying out analysis of hundreds of fractional crystallisations. Marguerite Perey was the first woman to be elected to the Académie de Sciences (French Academy of Sciences), was Professor and Chair of the Department of Nuclear Chemistry at the University of Strasbourg, but succumbed in 1975 to cancer contracted through her research at age 65.

There are 34 known isotopes of Francium ranging in atomic mass from 199 to 232. Francium-223 and Francium-221 are the only isotopes that occur in nature, though the former is the most common. Francium is the most unstable of the naturally occurring elements: its most stable isotope, Francium-223, has a half-life of only 22 minutes. Francium can also be synthesised in a nuclear reaction by combining isotopes of Gold and Oxygen, with the largest amount produced in the laboratory being a cluster of over 300,000 atoms. In this case, enough Francium was trapped to enable a video camera to capture the light given off by the atoms as they fluoresce, appearing as a glowing sphere about 1 millimetre in diameter. This was the very first time that anyone had ever seen Francium. Francium has yet to be synthesised in amounts large enough to weigh.

Due to its instability and rarity, there are no commercial applications for Francium. However, it is used for research purposes to investigate atomic structure. Francium's relatively simple atomic structure and large atomic mass and number have made it the subject of specialised spectroscopy experiments that have led to more specific information regarding energy levels and the coupling constants between subatomic particles.

Provided by the element sponsor Kathryn Linge

ARTISTS DESCRIPTION

I think Francium was the most brain stretching of my three elements. I was stimulated and highly motivated to try and absorb the idea that Francium is so rare that as little as 20-30 grams exists at any given time throughout the earth's crust. It is the second rarest naturally occurring element after astatine. With this in mind I tried to produce an image that had complex intertwining colours in an attempt to express the idea of how unique this element is.

KAYE GREEN