History

Explore the discoverer's biography, including general facts about his life and anecdotes regarding how he made this particular discovery. Also see other significant scientific discoveries built largely on this concept and other real-world applications in history that may not still be relevant.

Discoverer/Developer

Ernest Rutherford (1871-1937) was the first person to coin the term alpha radiation. He was born in New Zealand and became a professor at McGill University where he studied radioactivity. He later went on to become a professor at Cambridge University. Rutherford's Model of the Atom, based off his Gold Foil Experiment, was a significant step forward in understanding the composition of the atom. In 1899, Rutherford named the mysterious particles given off by radium alpha particles. The alpha particles were not able to penetrate thin sheets of metal foil, such as aluminum foil. Rutherford measured the charge to mass ratio of the alpha particles, and hypothesized they were helium nuclei. In a 1907 experiment, Rutherford determined alpha particles were in fact helium ions by analyzing their spectrum. One of Rutherford's students was James Chadwick, who discovered neutrons in the nucleus of atoms. The 1908 Nobel Prize in Chemistry was awarded to Rutherford, and he was knighted in 1914. Element 104, Rutherfordium, was named in honor of him.

Use/Application through History

Alpha particles were used in Rutherford's Gold Foil Experiment, which showed atoms have dense, compact nuclei and led to Rutherford's Planetary Model of the Atom.

James Chadwick used alpha particles to prove neutrons existed in the nuclei of atoms in 1932.

Real World Application

Discover processes or disciplines in the natural or man-made worlds that employ the concept.

Smoke detectors work by alpha decay. Americium-241 is inside smoke detectors, and when smoke particles enter the detector the alpha particles released by the americium atoms in alpha decay are caught by the smoke particles, which activates the smoke detector's alarm system.

Gaseous radon in the soil is an alpha particle emitter. Breathing in radon gas can damage lung

cells due to the alpha particles that the gas molecules emit.

Alpha Particle X-Ray Spectroscopy (APXS) is a method of determining the elemental composition of substances such as rocks and soil. The alpha particles come from an alpha decay reaction, usually of curium-244. NASA used APXS in its rover missions to Mars, including the Pathfinder missions, to determine what elements are present in Martian rocks.

A new cancer treatment, targeted alpha therapy (TAT), uses alpha decay to kill cancer cells. Lead-212 is attached to a carrier molecule, which when ingested travels to the site of the tumor and gives off alpha radiation, killing all cells in the area.

Vocabulary

Learn important vocabulary for this concept, including words that might appear in assessments (tests, quizzes, homework, etc.) that indicate the use of this concept.

Important Vocabulary **Term** **Context**

alpha particle
- an alpha particle is released from the atom's nucleus

half-life
- Americium-243 undergoes alpha decay with a half-life of 7,370 years.

isotope
- two isotopes of uranium

nucleus
- alpha decay involves protons and neutrons in the nucleus of an atom

Videos

Browse relevant videos from the Journal of Chemical Education's (JCE) Chemistry Comes Alive! library and other video sources.

Radioactive Decay Equations

A description of alpha, beta, and gamma decay with reactions written out.

Cloud Chamber Apparatus

A cloud chamber with thorium nitrate and ethanol is used in order to see alpha and beta particles. The alpha particles are thin rays and the beta particles are wider blurs.

Computer Animations

Experience computer simulators or animations that illustrate the concept discussed here. Many simulators or animations come with worksheets for use in class.

http://www.colorado.edu/physics/2000/applets/iso.html

Works Cited

Review the works cited to write the researched parts of this page, such as the discover's biographical information and other areas.

Works Cited

Ihde, Aaron J. The Development of Modern Chemistry. New York: Harper & Row, 1964.