

Alpha Particle Encyclopedia Article

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Contents

Alpha Particle Encyclopedia Article.....	1
Contents.....	2
Alpha Particle.....	3

Alpha Particle

The earliest studies of nuclear radiation suggested that it consisted of at least one kind of charged particle. Various experiments showed that nuclear radiation can be deflected by a magnetic field. This finding confirms that at least some part of the radiation must consist of charged particles. By 1900, these particles had been identified as electrons.

At about the same time, Ernest Rutherford in England, working with more powerful magnetic fields, had found that nuclear radiation could be separated into at least two parts, one deflecting clockwise when moving perpendicular to a magnetic field and the other counter-clockwise. He suggested the names alpha rays and beta rays for these two forms of radiation.

Rutherford next turned his attention to identifying the nature of the particles that make up alpha rays. Charge-to-mass calculations suggested two possibilities. First, the particles could be hydrogen molecules with a single positive charge (H^+). Second, they could be helium atoms carrying two positive charges (He^{++}).

Evidence for the second of these possibilities began to accumulate. Experiments carried out by Rutherford and Hans Geiger in 1908 and by the German physicist Regener in 1909 showed that each alpha particle carries two positive electrical charges. The hydrogen molecule possibility appeared to be eliminated.

Conclusive proof about the character of the alpha particle was obtained in an elegant experiment conducted by Rutherford and Royds in 1909. Rutherford recognized that helium gas is commonly found in rocks that also contain uranium and other radioactive materials. This information had, earlier on, inclined Rutherford to the second of the two possibilities mentioned above. In their 1909 experiment, Rutherford and Royds constructed a thin-walled glass tube surrounded by an evacuated wider glass tube. An alpha-emitting radioactive material was then introduced into the inner tube. After several days, the gas in the outer tube was examined by spectrographic analysis. The analysis showed the presence of helium in the tube. The identification of alpha particles as doubly-charged helium atoms, that is, as helium nuclei, was confirmed.

Alpha particles are emitted from nuclei with much less speed than that of beta particles. Their average speed is about $1.4\text{--}2.2 \times 10^9$ cm/sec, less than 10% the speed of light. They travel only a short distance in air and are stopped by a thin sheet of aluminum metal.