



# Alpha particle

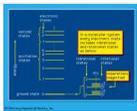
PHYSICS

WRITTEN BY: [The Editors of Encyclopaedia Britannica](#)

**Alternative Title:** helium-4 nucleus

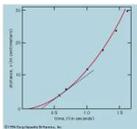
**Alpha particle**, positively charged particle, identical to the nucleus of the [helium-4 atom](#), spontaneously emitted by some radioactive substances, consisting of two protons and two neutrons bound together, thus having a mass of four units and a positive [charge](#) of two. Discovered and named (1899) by [Ernest Rutherford](#), alpha particles were used by him and coworkers in experiments to probe the structure of atoms in thin metallic foils. This work resulted in the first concept of the atom as a tiny planetary system with negatively charged particles (electrons) orbiting around a positively charged nucleus (1909–11). **Later, Rutherford bombarded nitrogen with alpha particles, changing it to oxygen, in the first artificially produced nuclear transmutation (1919).** Today, alpha particles are produced for use as projectiles in nuclear research by ionization—i.e., by stripping both electrons from [helium](#) atoms—and then accelerating the now positively charged particle to high energies.

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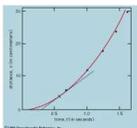
## radiation: Matter rays

...of the helium atom, or alpha particle, which has a double positive charge. The more-massive positive nuclei of other atoms show similar wavelike properties when sufficiently accelerated in an electric field. All charged matter rays have a charge exactly equal to that of the negative or positive electron or to...



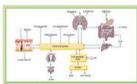
## principles of physical science: Unexpected observation

...of Manchester in England), that alpha particles from a radioactive source were occasionally deflected more than 90° when they hit a thin metal foil. Astonished at this observation, Rutherford deliberated on the experimental data to formulate his nuclear model of the atom (1911)...



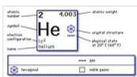
## principles of physical science: Development of the atomic theory

...showed how the emission of alpha and beta particles from radioactive elements causes them to be transformed into elements of different chemical properties. By 1913, with Rutherford as the leading figure, the foundations of the modern theory of atomic structure were laid. It was determined that a small, massive nucleus...



## poison: Ionizing radiation

...thus containing a  $2^+$  charge, alpha particles are the heaviest ionizing particles. Although they do not penetrate tissue very well, alpha particles turn many atoms in their short paths into ions, producing intense tissue ionization...



## Helium

Helium (He), chemical element, inert gas of Group 18 (noble gases) of the periodic table. The second lightest element (only hydrogen is lighter), helium is a colourless, odourless, and tasteless gas that becomes liquid at  $-268.9\text{ }^{\circ}\text{C}$  ( $-452\text{ }^{\circ}\text{F}$ ). The boiling and freezing points of helium are lower than...

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