

Atomic Target Practice

Solving the Structure of the Atom



Introduction

Rutherford scattering is one of the most famous experiments of all time. More than 25 years after conducting the experiment, Ernest Rutherford described the results this way:

"It was about as credible as if you had fired a 15-inch shell at a piece of tissue paper and it came back and hit you."

The experiment itself was actually the culmination of a series of experiments, carried out over a five-year period, dealing with the scattering of high-energy alpha particles by various substances. What is "Rutherford scattering" and why was it so important?

Concepts

- Atomic structure
- Atomic mass
- Nucleus
- Nuclear charge

Background

Ernest Rutherford received the Nobel Prize in Chemistry in 1908 for his investigations into the disintegration of the elements as a result of radioactive decay. Among the products of the radioactive decay of elements are alpha particles—small, positively charged, high-energy particles. In trying to learn more about the nature of alpha particles, Rutherford and his co-workers, Hans Geiger and Ernest Marsden, began studying what happened when a narrow beam of alpha particles was directed at a thin piece of metal foil. Alpha particles are a type of nuclear radiation, traveling at about 1/10 the speed of light. As expected for such high-energy particles, most of the particles penetrated the thin metal foil and were detected on the other side. What was unexpected was that a few—a very few, to be sure—of the alpha particles were actually reflected back toward the source, having been "scattered" or bent due to their encounters with the metal atoms in the foil target. The number of alpha particles that were reflected back depended on the atomic mass of the metal. Gold atoms, having the highest atomic mass of the metals studied, gave the largest amount of so-called "back scattering."

Rutherford's scattering experiments have been described as a "black box" experiment. The properties of the alpha particles, their mass, charge, speed, etc., were at least partially understood. The atoms making up the target, however, presented Rutherford with a kind of black box—the structure of the atom was not known at the time. In order to explain the results of the scattering experiments, Rutherford had to unlock the black box, that is, he had to solve the structure of the atom. In 1911 Rutherford proposed the following model for the structure of the atom:

- Most of the mass of the atom is concentrated in a very small, dense central area, later called the nucleus, which is about 1/100,000 the diameter of the atom.
- The rest of the atom is apparently "empty space." (*Most of the alpha particles traveled straight through the metal foil, as if nothing were in their path.*)
- The central, dense core of the atom is positively charged, with the nuclear charge equal to about one-half the atomic mass. (*A few alpha particles randomly struck the gold target, a few approached the nucleus of an atom head on. The positively charged alpha particles were strongly repelled by the nuclear charge and "recoiled" or bounced back to the source.*)

It is not practical to recreate Rutherford's original scattering experiments in the high school laboratory. Some idea of the challenge that faced Rutherford and his co-workers can be gained from the following "black box" activity using marbles and an unseen, unknown target.

Atomic Target Practice Lab Answers

Annelies Wilder-Smith



Atomic Target Practice Lab Answers:

Understanding the properties and behavior of the COSMOS Don Hainesworth,2011 **In Search of Schrodinger's Cat** John Gribbin,2011-05-04 Quantum theory is so shocking that Einstein could not bring himself to accept it It is so important that it provides the fundamental underpinning of all modern sciences Without it we d have no nuclear power or nuclear weapons no TV no computers no science of molecular biology no understanding of DNA no genetic engineering In Search of Schrodinger s Cat tells the complete story of quantum mechanics a truth stranger than any fiction John Gribbin takes us step by step into an ever more bizarre and fascinating place requiring only that we approach it with an open mind He introduces the scientists who developed quantum theory He investigates the atom radiation time travel the birth of the universe superconductors and life itself And in a world full of its own delights mysteries and surprises he searches for Schrodinger s Cat a search for quantum reality as he brings every reader to a clear understanding of the most important area of scientific study today quantum physics In Search of Schrodinger s Cat is a fascinating and delightful introduction to the strange world of the quantum an essential element in understanding today s world *Nuclear Science Abstracts* ,1963 **Nuclear Science Abstracts** ,1974-07 The EC Archives: Gunfighter Volume 1 Gardner Fox,2022-04-19 At last collecting the wild adventures of the lone lawman known as the Gunfighter and his comrade the Buckskin Kid as they take on multiple mean outlaws and ride a rough terrain of terror in this collection of thrilling pre trend EC tales of western lore This hardcover volume collects Gunfighter 5 9 recolored digitally using the original palette featuring art by legendary comics talents Johnny Craig Graham Ingels and more The Annual American Catalog, 1900-1909 ,1906 **The Annual American Catalog, 1905** ,1906 **The Annual American Catalog** ,1906 **The Publishers Weekly** ,1906 Transactions of the American Nuclear Society American Nuclear Society,1989 *Science Illustrated* ,1948 *INIS Atomindex* ,1985 **Physics Briefs** ,1993 *An Introductory Guide to EC Competition Law and Practice* Valentine Korah,1994 Aviation ,1946 **Aviation Week, Including Space Technology** ,1946 Includes a mid December issue called Buyer guide edition **The New York Times Index** ,1961 *Energy Research Abstracts* ,1993 *Bulletin of the Atomic Scientists* ,1950 **Journal of the Institution of Nuclear Engineers** Institution of Nuclear Engineers (Great Britain),1971

The Top Books of the Year Atomic Target Practice Lab Answers The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous captivating novels enthraling the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover "It Ends with Us" This touching tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids absorbing storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Atomic Target Practice Lab Answers : Delia Owens "Where the Crawdads Sing" This mesmerizing coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These top-selling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Pape, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and gripping novel that will keep you guessing until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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