

Rutherford Scattering

Solving The Structure of the Atom

Introduction

Demonstrate Rutherford Scattering using Ping-Pong balls and a model of an atom.

Concepts

- Atomic Theory
- Atomic Structure
- Atoms

Materials

Black box–gold foil sample

Ping-Pong® balls, 10

Plywood, 45 x 45 cm

Wood dowels, 4

Cardboard box, 18" × 18" square (optional)

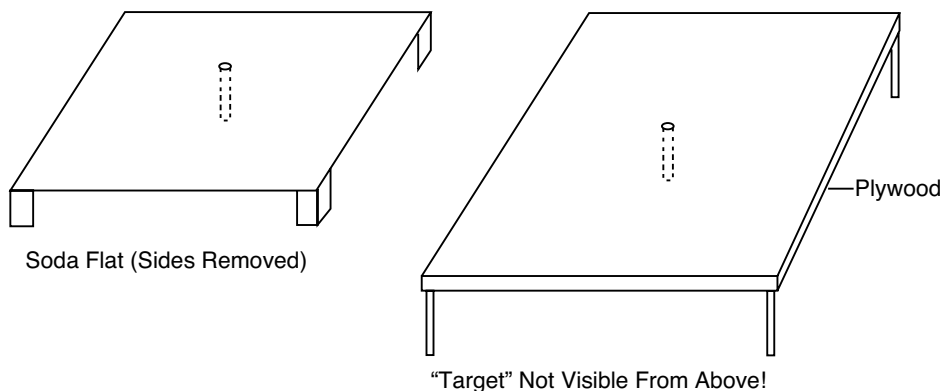
Safety Precautions

No special precautions are needed for this demonstration, but always follow laboratory safety rules while performing demonstrations.

Preparation

Prepare a “black box” to simulate the gold foil as follows:

1. Obtain a rectangular piece of plywood or cardboard about 45 cm on a side (a soda flat works well and is readily available).
2. Fasten to the center of the cardboard a target of about 0.5 cm diameter that will be hot glued or fastened firmly so that its location is not obvious to the student observers.
3. Raise the board high enough off the floor so a Ping-Pong ball will readily roll in one side and out the other. Corner supports may be made from pieces of dowel or small blocks of wood. If a soda flat is used, the corners may be cut about 1 cm on a side before removing the side panels. See the diagram below.



3. An alternative, more permanent board may be made of plywood with the target inserted into a shallow hole drilled halfway through the board. It may be supported on the corners with other pieces of dowel.

Procedure

1. Place the board on the floor. Have the students stand around the periphery where it is clearly visible to them.
2. Roll the Ping-Pong balls rapidly under one side of the board permitting them to come out the other side or ends. It is best to roll toward a wall to stop the balls.
3. Observe what happens to the balls that hit the target directly and those that are deflected off the sides of the target.
4. Alternative activities might include plotting the paths to show the low frequency of hits. Try to have students predict where the target is and how big it is. Remember, don't show them what is really there, this is a black box.

Disposal

The materials may be saved for future demonstrations.

Tip

For a similar student laboratory kit, *Atomic Target Practice—Rutherford Scattering and the Nuclear Atom*, consult your current *Flinn Scientific Catalog/Reference Manual*.

Discussion

When Rutherford “shot” alpha particles at a thin sheet of gold foil, he observed that most of the “bullets” passed straight through without interference, disproving the notion that the atom was a solid sphere. A few of the particles, however, veered off to the sides and even fewer bounced straight back.

The conclusion was that the atom was mostly empty space with a tiny, positively charged, dense central particle called the nucleus. The alpha particles that veered off were deflected by the charge as they came too close to the nucleus while those that came back, actually “bounced” off of the nucleus.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, structure of atoms, structure and properties of matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Rutherford Scattering* activity, presented by George Gross, is available in *Solving The Structure of the Atom*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for a similar student laboratory kit, *Atomic Target Practice—Rutherford Scattering and the Nuclear Atom* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP6496	Atomic Target Practice—Rutherford Scattering and the Nuclear Atom

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.