

Simulation of Nuclear Decay Using Pennies and Paper

OBJECTIVES

- *Infer* that the rate of decay can be simulated by a random process.
- *Compare* the numbers of pennies that are showing heads with the number showing tails.
- *Create* a string plot that represents nuclear decay.
- *Relate* observations to the rate of nuclear decay.
- *Graph* the data.
- *Compare* the results of the two simulation procedures.

MATERIALS

- colored paper or cloth strips, approximately 65 cm \times 2.5 cm (2 strips)
- graph paper
- one sheet of stiff poster board, 70 cm \times 60 cm
- pennies or other objects supplied by your teacher (100)
- scissors, tape, meter stick, pencil, and string
- shoe box with lid



BACKGROUND

Radioactive isotopes are unstable. All radioactive matter decays, or breaks down, in a predictable pattern. Radioactive isotopes release radiation as they disintegrate into daughter isotopes.

The rate of decay is a measure of how fast an isotope changes into its daughter isotope. The rate of radioactive decay is conveniently characterized by the isotope's half-life, the period of time it takes one-half of the original material to decay. Half-lives vary from billions of years to fractions of a second.

SAFETY



For a review of safety, please see **Safety in the Chemistry Laboratory** in the front of your book.

PREPARATION

1. For Part A, make a data table that has at least 10 rows in your lab notebook by using the format described by your teacher.

PROCEDURE

Part A: Simulating radioactive decay with pennies

1. Place 100 pennies into the shoe box so that the head sides are up. The pennies will represent atoms. Record 100 in the "Unchanged atoms" column and 0 in the "Changed atoms" column.
2. With the lid on the box, shake the box up and down 5 times. We will count each shaking period as being equivalent to 10 s.
3. Open the lid, and remove all of the pennies that have the tails side up. These pennies represent the changed atoms.