# Pre-Lab Information

Purpose Explore the process of radioactive decay using a laboratory procedure.

Time Approximately 30 minutes

Question How does the number of radioactive atoms change over time?

Hypothesis If the number of half-lives increases, then the number of radioactive atoms decreases, because approximately half of the atoms’ nuclei decay with each half-life.

Variables *Independent Variable:* number of half-lives

*Dependent Variable:* number or radioactive atoms

Summary You will use pennies to simulate the process of radioactive decay. The heads-up pennies (showing Abe Lincoln) in your container represent the fictional radioactive element “lincolnium.” Lincolnium decays to the fictional element “memorium,” which is stable. Once the simulation is complete, you will construct a graph to analyze the data.

# Safety

* Always wear safety goggles when performing an experiment.
* Be careful when shaking the pennies so that they do not fall on the floor.
* Behavior in the lab needs to be purposeful.
* Report all accidents—no matter how big or small—to your teacher.

# Lab Procedure

1. **Gather materials.**

|  |  |
| --- | --- |
| * 200 pennies | * Shoe box with lid |

1. **Place the pennies in the box and run the simulation for the first half-life.**
   1. Place 200 pennies in the box. Be sure to place them so that all of the pennies are heads-up, indicating that your sample (box) contains only radioactive atoms (“lincolnium”) to start with.
   2. Put the lid on the box and shake the box for 5 seconds.
   3. Open the box and remove all of the memorium atoms (tails-up pennies) from the box.   
      **Note:** Once you remove the memorium atoms from the box, you do not return them to the box. The memorium atoms are stable and will no longer undergo radioactive decay, so they are not returned to the box.
   4. Count the number of stable memorium atoms and record your answer in Table A.
   5. Count the number of radioactive lincolnium atoms remaining in the box and record your answer in Table A.
2. **Run the simulation for additional half-lives.**
   1. Put the lid on the box and shake the remaining radioactive atoms (lincolnium) for 5 seconds.
   2. Open the box and remove all of the memorium atoms (tails-up pennies) from the box. **Note:** Once you remove the memorium atoms from the box, you do not return them to the box. The memorium atoms are stable and will no longer undergo radioactive decay, so they are not returned to the box.
   3. Count the number of stable memorium atoms and record your answer in Table A.
   4. Count the number of radioactive lincolnium atoms remaining in the box and record your answer in Table A.
   5. Repeat Steps 3a–d until the box is empty or only one lincolnium atom remains.
3. **Create a graph of the simulated results.**
   1. Construct a graph using the number of radioactive atoms and the number of half-lives. The number of half-lives should be on the *x*-axis, and the number of radioactive atoms on the *y*-axis.
   2. Draw a single line of best fit through the data points.
   3. Title the graph and label the axes with units.
4. **Clean up the lab.**
   1. Put away the pennies and shoebox in locations specified by your teacher.

# Data

Record your data either in your lab notebook or in the table below.

**Table A**

|  |  |  |
| --- | --- | --- |
| **Number of Half-Lives** | **Number of Radioactive “Lincolnium” Atoms** | **Number of Stable “Memorium” Atoms** |
| 0 | 200 | 0 |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |