



## Half-Life Simulation Lab

## Lab #30

### Pre-Lab Discussion:

Carbon dating of once living organisms and uranium – lead dating of rocks are both based on the concept of radioactive half-life. This lab simulates radioactive decay with pennies by representing the parent isotope by heads facing up. Daughter isotopes are represented by pennies with the tails side facing up.

1. Define radioactive half-life:

\_\_\_\_\_

\_\_\_\_\_

2. What is the order of a radioactive decay reaction? \_\_\_\_\_

3. On the lines below, write the equation that relates the amount of radioactive material remaining to the time passed and define each variable in the equation.

\_\_\_\_\_

$N_0$ : \_\_\_\_\_

$N$ : \_\_\_\_\_

$t$ : \_\_\_\_\_

$t_{1/2}$ : \_\_\_\_\_

### Research Question:

How does the concept of half-life allow scientists to date things?

### Materials:

100 pennies

plastic cup

### Method:

1. Choose a partner and obtain 100 pennies and one plastic cup.
2. Place all the pennies in a cup and shake them up for about 5 seconds.
3. Carefully pour the pennies onto the lab bench.
4. Remove all pennies with tails side up and place off to the side.
5. Count all the remaining heads isotopes and record the data on the table on the next page.
6. Place the heads isotopes in the shaker cup and shake for 5 seconds.
7. Repeat steps 3 through 6 until five or fewer heads isotopes remain.
8. Obtain data for two trials.
9. Replace the pennies when both trials are completed.



**Conclusions:**

1. Look at your graph. Is the  $N$  vs. half-life graph linear or a curve?

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2. What kind of function does it appear to be?

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3. Compare the half-life statistics (how well the measured amount of  $N$  compares to expected values) when the number of heads isotopes was large.

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4. Compare the half-life statistics (how well the measured amount of  $N$  compares to expected values) when the number of heads isotopes was small.

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5. How could you alter the procedure to get better statistics?

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6. In the space below, calculate how many grams of  $^{14}\text{C}$  would remain after 35000 years if the initial amount was 500.0 g. The half-life of  $^{14}\text{C}$  is  $5730 \pm 40$  years. Express your answer as a range based on the precision given ( $\pm 40$  years per 5730 years).