Earth Science	Name: ______________________________
LAB #25: HALF-LIFE	Date: ________________________

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:

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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.

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   N_0: ____

   $N_{(t)}$: ____

   t: ____

   $t_{½}$: ____

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.

Data Collection and Processing:

	Trial 1	Trial 2	Sum of Trials 1 & 2	Analysis		
Number of Half-Lives	Heads Isotopes Remaining	Heads Isotopes Remaining	Number of Heads Isotopes Remaining	Expected Fractions	Measured Fractions	Percent Difference
0	100	100	200	1 / 1		
1				1 / 2		
2				1 / 4		
3				1 / 8		
4				1 / 16		
5				1 / 32		
6				1 / 64		
7				1 / 128		
8				1 / 256		
9				1 / 512		
10				1 / 1024		

Analysis:

Graph: On the grid below, make a graph of N vs. number of half-lives, circle data points and draw a best fit line or curve.

***N* as a function of Half-Life**

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}C would remain after 34 380 years if the initial amount was 500.0 g. The half-life of ^{14}C is 5730 ± 40 years. Express your answer as a range based on the precision given (± 40 years per 5730 years).