Student Sheet Name_____

Title: Penny Half-life Lab

Introduction: Archeologists find remains of ancient civilizations and the first question often is: How old is it? Modern methods of radiometric analysis can use radioactive atoms to provide an accurate answer. In this activity you will use a model of radioactivity to find out the age of items found in an Egyptian pyramid. Clothing found there shows 60% of the original C14 has decayed into N14.

In this model, a penny with heads up will represent a Carbon-14 atom, while a tails up penny will represent a decayed Nitrogen-14 atom. The decay of any individual atom is random but the decay of a sample is constant over time.

$$^{14}_{6}C \rightarrow {}^{0}_{-1}b + {}^{14}_{7}N$$

By establishing the rate of decay for C14, you can predict how old the clothing is. How old are the pyramids?

Procedure

1. Obtain a bag of pennies and a tray. Count all of your pennies (you should have 100, tell your teacher if you have some other number), and write the total number of pennies in the data table where it says total pennies.
2. Place your pennies in their container, close it and shake for several seconds. Open the container, pour the pennies onto a tray or the table and remove all of the pennies with the "tails" side up. Count these and record the number in the data table under the column number of pennies removed. Do *not* put the removed pennies back in the bag!
3. **Each shake represents 5730 years that have passed.**
4. Subtract the number of pennies removed from the total number of pennies to find the number of pennies remaining. Record that number in the data table.
5. Keep repeating steps 2 and 3 until one or no pennies remain. Record the number of pennies removed and the number of pennies remaining each time in the data table. (In order to calculate the # of pennies remaining, subtract the new # of pennies removed from the preceding # of pennies remaining.)

Data Table:

	Total pennies:				
Shake number	# of pennies removed	# of pennies remaining	Shake number	# of pennies removed	# of pennies remaining
1			6		
2			7		
3			8		
4			9		
5			10		

Analysis:

Graph the number of pennies remaining (vertical axis) vs. the number of shakes (horizontal axis). Give the graph a title and label both axes. Draw a smooth line that best fits the points.

1. How old is the clothing found in the Egyptian pyramid?

2. Each shake represents a half-life for the pennies. What is the definition of a half-life?

3. About how many carbon-14 atoms from a sample of 800 C-14 atoms will remain after 2.0 half-lives? (Show your work)

4. About how many N-14 atoms will be present from a sample of 800 C-14 atoms after 2.0 half-lives? (Show your work)

5. 100 C-14 atoms remain from a sample of 1600 C-14 atoms.
    a. How many half-lives have passed? (Show your work)

    b. How much time has passed? (The half life of C-14 is 5730 years) (Show your work)