Simulating Radioactivity

Name(s): **Class:** **Date:**

In this classroom activity, you will investigate the process of radioactive decay, in which a sample of a radioactive nuclide decays over time.

Part I: Pennies

In this simulation, pennies are flipped to represent the decay of a nuclide.

1. Before the 100 pennies are flipped, predict how many of them will turn up heads. Write your prediction here, _____, and indicate your reasons.

2. Put 100 pennies in a container. Shake the container a few times, and then pour the pennies onto the floor, from a height of 20–30 cm. Each time you pour the pennies on the floor, it is counted as a flip.

3. The pennies that land as tails are considered decayed, and are removed from the sample. Count the number of pennies that landed as heads, and put them back into the container. Record the number of pennies that did not decay (heads) in Table 1.1.

Table 1.1

flip #	# of pennies remaining	flip #	# of pennies remaining
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

4. Repeat steps 2 and 3 with the remaining pennies, until Table 1.1 is completed, or until all the pennies have decayed (no heads).

5. On graph paper, graph the number of pennies remaining (y-axis) versus the flip number (x-axis). Draw a smooth line connecting the data points.

6. What does the graph represent? Is the plot linear? Explain.

7. Using the initial sample size (100 pennies) and the data from Table 1.1, calculate the percentage of pennies that remains after each flip. For example, to calculate this percentage for flip #2, you would take the number of pennies remaining, and divide it by the number that was flipped (found in the preceding row of the data table). Record these percentage values in Table 1.2.

Table 1.2

flip #	% of pennies remaining	flip #	% of pennies remaining
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

8. Do the percentages of pennies remaining, after each flip, change very much? Explain.

9. Explain the meaning of half-life. How many flips represent a half-life for the pennies?

Part II: Dice

In this portion of the activity, dice are rolled to represent the decay of another nuclide.

1. Before the dice are rolled, predict what fraction will land with a one showing. Write your prediction here, _____, and indicate your reasons.

2. Put 100 dice into a container. Shake the container a few times, and then pour the dice onto the floor, from a height of 20–30 cm. Each time you pour the dice on the floor, it is counted as a roll. The dice that land with a one facing up are considered decayed, and need to be removed from the sample. Count the remaining dice, record this value in Table 2.1, and return the dice to the container.

Table 2.1

roll #	# of dice remaining	roll #	# of dice remaining	roll #	# of dice remaining

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

3. Repeat step 2 until Table 2.1 is completely filled out, or until all the dice have decayed.

4. On graph paper, graph the number of dice remaining (y-axis) versus the roll number (x-axis). Draw a smooth line connecting the data points.

5. What are the similarities and differences between this graph and the graph you made for the pennies?

6. How many rolls does it take for half of the dice to decay?

7. What is the half-life of the dice? How does this compare to the half-life of the pennies?

8. Explain how the words "flip" and "roll," as they were used in this experiment, relate to time in actual radioactive decay.

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