Radioactive Decay: A Sweet Simulation of Half-Life

OBJECTIVE: In this activity, you will simulate the decay of radioactive "nuclei."

MATERIALS:

- 200 small candies marked on one side, such as M & M's or Skittles. Alternatively, you may use any small object with two different sides, such as coins.
- Paper towel on which to place your "nuclei"
- Paper or plastic cup

PROCEDURE:

**This lab is to be written up in your lab book

1. Count your nuclei (candy). Write that number in Data Table 1 under the heading "Number of Radioactive Nuclei." In the column marked "Prediction for Next Toss," write the number of radioactive nuclei you think you will have with your next toss. (Radioactive nuclei will be those candies with the marked side down.)

Data Table 1 (Enlarge and add or delete rows as needed)

Toss	Number of radioactive nuclei	Prediction for next toss
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

2. Place your "nuclei" in a paper or plastic cup, cover and shake the cup. Pour the "nuclei" onto your paper towel. Separate the "nuclei" into two piles, one with the marked side up and the other with the marked side down. Count the number of "nuclei" in each pile. On your data table, record the number of "radioactive nuclei" candies with the marked side down. Predict how many radioactive "nuclei" you will have after the next toss.

3. Return only the radioactive "nuclei" to your paper cup. (You decide what to do with the "decayed nuclei," or those with the marked side up.)

4. Continue this process until there are no radioactive "nuclei" left. Add more rows to your data table, if needed.

5. Pool the class data by summing the number of radioactive "nuclei" of all the class groups for each toss in Data Table 2.

Data Table 2 (Class Data)

Toss	Number of Radioactive Nuclei
(Before the first toss)	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

ANALYSIS QUESTIONS: (Answer and show all calculations AFTER you write your conclusion. Draw the graph on a full sheet of graph paper, and attach it - folded in half, with tape or stapled, to a page in your lab book.)

1. ***Using the pooled data***, prepare a graph on a full sheet of graph paper by plotting the number of radioactive "nuclei" on the y-axis and the number of tosses, which we will call half-lives, on the x-axis. Attach the graph paper in your lab book.

2. How good is our assumption that half of our radioactive "nuclei" decay in each half-life? Explain.

3. If you started with a sample of 600 radioactive nuclei, how many would remain undecayed after three half-lives? Show your calculations along with your answer.

4. If 175 undecayed nuclei remained from a sample of 2800 nuclei, how many half-lives have passed? Show your calculations along with your answer.

5. Why did we pool the class data? How does this relate to radioactive nuclei?

6. Is there any way to predict when a specific piece of candy will land marked side up or "decayed?" If you could follow the fate of an individual atom in a sample of radioactive material, could you predict when it would decay? Explain.

7. Strontium-90 has a half-life of 28.8 years. If you start with a 10-gram sample of strontium-90, how much will be left after 115.2 years? Show your calculations along with your answer.

8. What do we mean by half-life? With what kinds of materials do we use this term?