Graphing a Radioactive Decay Simulation

Objectives: To prepare a graph with clearly labeled axes, a title, and a neatly drawn curve representing the process of radioactive decay.

Materials: One hundred objects with two distinct sides such as pennies, m&ms, or buttons; graph paper, box with a lid to hold objects.

Background: When a radioactive atom decays to a daughter product the decay process follows a specific pattern. Each radioactive isotope has its own unique half-life. This is a period of time, 5000 years, 2 million years, 5 billion years; it could be anything, during which half of the parent atoms will form daughter products. This means that after one half-life half of the atoms are parents and half are daughters. After two half-lives half of the remaining half of atoms covert to daughters resulting in three-fourths daughters and one-forth parents. You can understand this mathematical decay process better if you simulate it and graph it for yourself.

Instructions: Obtain 100 objects and place them in a box so that the same side of each object faces up. For example if the objects are pennies then turn all the heads facing up. If the objects are m&m candies turn all the blank sides up. Shake the box. This represents one half-life. Take out all the objects that have turned over and count them. These are the atoms that have decayed i.e. the daughter atoms. Record this number. Now do it again. Remove the objects that have flipped over and record their number then do it again and again until there are no objects left in the box. Use the following data table to record your results:

Original Number of objects: 100

Half-Life Intervals	Total number of objects that "decayed"	Number of objects that remain
1		
2		
3		
4		
5		
6		

Plot two graphs on one page of graph paper: one showing the process of "radioactive decay" and one showing the number of atoms remaining. The graphs will overlap. Use different colors for each graph. The horizontal axis for both graphs is the number of half-life intervals (1, 2, 3 …). The vertical axis is the number of objects. The title of the graph is "Simulation of Radioactive Decay".

Discussion and Questions:

1. Describe the shape of the decay curve.

2. How many objects have decayed after 2.5 half-lives (estimate by using the graph)?

3. If the half-life of a radioactive atom is 30,000 years, how old is an object that has 82% daughter atoms and 18% parent atoms?

Rules for excellent graphing technique

1. A graph needs to have a title and clearly labeled axes showing units of measurement.

2. The graph should use most of the space available – not be squeezed into a tiny portion of the page.

3. Curves should be drawn smoothly (and not look like 'connect the dots' drawings). This means that the curve may not pass through all of the points.

4. The graph should be neat with small data points.