Experiment #27

Radioactive Decay of Candium

Radioactive decay processes occur in accordance with first order kinetics. This simulation provides a simple example of the rate at which a radioactive isotope decays.

Materials

- 👍 M&M™ candy pieces
- 👍 Re-sealable bag
- 👍 Graph paper

Procedure

1. Place 50 atoms of candium (pieces of candy) in the bag.
2. Seal the bag and gently shake for 10 seconds.
3. Gently pour out candy.
4. Count the number of pieces with the print side up—and record the data. These atoms have "decayed".
5. Return only the pieces with the print side down to the bag. Reseal the bag.
6. Consume the "decayed atoms".
7. Gently shake the sealed bag for 10 seconds.
8. Continue shaking, counting, and consuming until all the atoms have decayed.
9. Graph the number of undecayed atoms vs. time.

Data and Observations

Half-life	Total Time	# of Undecayed Atoms	# of Decayed Atoms
0			
1			
2			
3			
4			
5			
6			
7			
8			

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Questions

1. What is a half-life?
2. In the experiment, what was the half-life of the element candium?
3. At the end of two half-lives, what fraction of the atoms had not decayed?
4. Describe the shape of the curve drawn in step 9.
5. Repeat the experiment three more times, starting with 30 atoms, 80 atoms, and 100 atoms of candium. Compare the resulting graphs.
6. Repeat the experiment using half-lives of 5 seconds, 20 seconds, and 1 minute. Compare the resulting graphs.

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Teacher's Notes

Some naturally occurring isotopes of elements are not stable. They slowly decompose by discarding part of the nucleus. The isotope is said to be radioactive. This nuclear decomposition is called nuclear decay.   The length of time required for half of the isotope to decay is the substance's half-life. Each radioactive isotope has its own particular half-life. However, when the amount of remaining isotope is plotted against time, the resulting curve for every radioisotope has the same general shape.

Hint: Make sure you use candies with printing on one side (plain M&Ms™).

Answers to Questions

1. Half-life is the length of time required for one half of an isotope to decay.
2. The half-life of candium in this activity was 10 seconds.
3. At the end of two half-lives, $1/4$ of the original sample remained and 3/4 of the sample had decayed into a new element.
4. The graph is a decreasing logarithmic curve.
5. The shape of the graphs will be almost the same.
6. The shape of the graphs will be almost the same.