

Ms. Randall (compliments of Ms. Drury)
Regents Chemistry
Lab activity: Radioactivity: Half-life of Candy

Background: Transmutation describes a process by which the nucleus of a radioactive atom undergoes decay into an atom with a different number of protons, until such time as a stable nucleus is produced. Each radioactive nuclide emits radioactivity at its characteristic rate, different from that of other nuclides. The rate of radioactive decay is related to the energy change that accompanies the transformation, but it is not a direct relationship. The rate of radioactive emissions of a radioactive nuclide is directly proportional to the amount of radioactive material present. The rate of decay of a radioactive nuclide is measured by its half-life. Half-life is the time required for one half of the atoms in any starting sample of a radioisotope to decay. This lab will be used to simulate the process of decay.

Procedure:

1. Count the pieces of candy you are given. Record the number as the original amount of candy.
2. Place your candy in the plastic cup.
3. Shake your candy for 5 seconds and then lay them out onto a piece of paper towel.
4. Eat or discard all the candy that lands with the emblem face up.
5. Count the candy that is left and record that number.
6. Repeat steps 4 and 5, recording your numbers, until all the candy has been eliminated.
7. Graph your data on graph paper. Place the trial number on the x-axis, and the number of candies left on the y-axis. Connect the points in a best-fit curve.

Data:

Time (seconds)	Number of candy pieces
0	
5	
10	
15	
20	
25	

Analysis:

1. What is the half life of the candy in this lab?
2. A laboratory orders 10 grams of I-131 for the diagnostics of thyroid disease. After a period of 32 days, how much I-131 is left? (Half life= 8days)
3. Write the nuclear equation for the beta decay of I-131.
4. What was the original mass of a sample of Tc-99 used to locate a brain tumor if 1mg of a sample remains after 2 days of decay? (Half life= 6 hours)

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Lab conclusion: Radioactivity: Half life of Candy

1. Write a paragraph summarizing what you have learned about the scientific concept of the lab from doing the lab. Back up your statement with details from your lab experience.

2. An original sample of K-40 has a mass of 25.00 grams. After 3.9×10^9 years, 3.125 grams of the original sample remains unchanged. What is the half-life of K-40?

A) 1.3×10^9 y B) 2.6×10^9 y
C) 3.9×10^9 y D) 1.2×10^9 y

3. Which fraction of an original 20.00-gram sample of nitrogen-16 remains unchanged after 36.0 seconds?

A) $1/5$ B) $1/8$ C) $1/16$ D) $1/32$

4. What is the half-life of sodium-25 if 1.00 gram of a 16.00-gram sample of sodium-25 remains unchanged after 237 seconds?

A) 47.4 s B) 59.3 s C) 79.0 s D) 118 s

- 5 Based on Reference Table N, what is the fraction of a sample of potassium-42 that will remain unchanged after 62.0 hours?