**Half-life: Determining and Graphing the Half-life of a Twizzler**

**Background:** You should know the term “half-life” and know how it is related to radioactive

elements. The half-life of a radioactive element is the time it takes for half of its atoms to decay into something else. For example, iodine-125 (I-125) has a half-life of about 60 days; therefore, in 60 days, 1g of I-125 will turn into half a gram of iodine-125 and half a gram of something else (the radioactive decay products of radium). After another 60 days have elapsed, only a ¼ of the original 1g of I-125 will remain.

**Purpose:** To determine the half-life of a Twizzler and graph the results.

**Materials:**

2 Twizzlers (1 for Part I and 1 for Part II)

Plastic knife

pencil/pen

2 sheets of graph paper

**Procedure: Part I: Amount of Twizzler vs. Bites**

1. Hold original Twizzler vertically against the 'y' axis with one end at the origin. Mark the

"length" on the y-axis. This represents the beginning amount.

1. Wait for further instructions to “Take a ½ bite!” You must eat HALF (and *only* half) the length of the Twizzler. (Or use a plastic knife to cut the twizzler in half).
2. Move the remaining Twizzler to the one unit right on the x-axis. Mark the new length (this is your *y-*coordinate).
3. Repeat steps 2 and 3 with the class until the instructor tells you to stop.
4. Draw a smooth curve through the points you graphed.
5. Make a table of your data from steps 1-4 below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of Bites | 0 | 1 | 2 | 3 | 4 | 5 |
| Amount of Twizzler |  |  |  |  |  |  |

1. What is the initial value? What does it represent in this situation?
2. Do the dependent values in your table represent an arithmetic or geometric sequence? Determine the common ratio or difference based on your answer.
3. Write a NOW-NEXT equation for the situation.
4. Write an explicit function for the situation in both “y=” and “f(x)” form.
5. Use the f(x) equation to find out the length for 10 bites or f(10).

12. If you keep halving the Twizzler will it ever completely disappear? Explain your thinking.

**Procedure: Part II: Amount of Twizzler vs. Time**

**Let’s say it takes you exactly 45 seconds to eat (or cut off) half the Twizzler. Fill in the table based on your values in Part 1.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (seconds) | 0 | 45 | 90 | 135 | 180 | 225 | 360\* | 720\* |
| Amount of Twizzler |  |  |  |  |  |  |  |  |

\*CAREFUL‼‼

1. In this scenario, what is the half-life of the Twizzler?
2. Write a NOW-NEXT equation for the situation.
3. How many times will the Twizzler have been halved after each of the following amounts of seconds?
   1. 0
   2. 45
   3. 90
   4. 135
   5. 180
   6. 225
   7. 360
   8. 720
4. How did you determine the answers to number 13? Compare your method to those of your classmates.
5. Write an explicit (“y=”) equation for this new situation. Let x = the number of seconds. Plug in the x-values from your table to make sure that your explicit equation really works. If it doesn’t, make changes until it does.
6. Use the explicit equation to find out the length after 405 seconds.

**Extension:**

1. If you had started with a GIANT Twizzler (2X the normal size), how would this have affected the shape of the graph? Explain.
2. Write an explicit equation if you took a bite from a regular size Twizzler every 90 seconds. Let x = the number of seconds.