19A – HALF-LIVES

INQUIRY

What is a half-life? How can we simulate this without using radiation?

MATERIALS

- Device with SPARKvue software
- Zip-seal bag, sandwich size
- Bag of M&M's®, pennies or puzzle pieces (100 pieces)

BACKGROUND

Radioactive elements decay with a certain time constant. This means that each radioactive atom has a certain probability of decaying in a given time. This leads to a "half-life" or a time after which one-half of the original radioactive element sample will remain. In this investigation, you will use 100 M&M's (or pennies, or puzzle pieces) to simulate a sample of 100 radioactive isotopes of an element. Assume all isotopes are the same.

SAFETY

Follow these important safety precautions in addition to your regular classroom procedures.

- Never eat or drink in the lab even when working with food.

PROCEDURE

1. Open SPARKvue.

2. Open the 19A Half-Lives lab file in SPARKvue.

3. Each group is starting with 100 isotopes, which is recorded as "Amount remaining" for 0 half-lives in SPARKvue and in Table 1 on your answer sheet. All of the isotopes are considered to be radioactive at the beginning.

4. Shake the bag and spill out the candies onto a flat surface.

5. Pick up ONLY the candies with the "m" showing – these are still radioactive. Count the "m" candies as you return them to the bag.

6. In Table 1 and in SPARKvue, record the number of candies remaining in the bag under "1st half-life."

PROCEDURE

7. Set the candies that are blank aside. These have now decayed to a stable state. Calculate the % of candies that have decayed for each individual run. Divide the amount decayed by the starting amount then multiply by 100. Round your answer to the nearest whole percentage and enter it in Table 1. For example, if the run started with 35 candies, 19 candies remained radioactive and 16 decayed, the percent decayed for that run is calculated as:

$$\frac{16}{35} \times 100 = 46\%$$

Note: Do not calculate a percent decayed when you reach zero radioactive isotopes remaining.

8. Repeat steps 4 through 7 until all the candies have decayed. Complete as many trials as required to reach zero radioactive isotopes.

9. SPARKvue created a graph of half-lives vs. amount remaining. Sketch the graph in Graph 1 on your answer sheet. Include numbers on the x- and y-axis at appropriate intervals.

ANALYSIS

Complete the analysis on your answer sheet.

QUESTIONS

Answer the questions on your answer sheet.