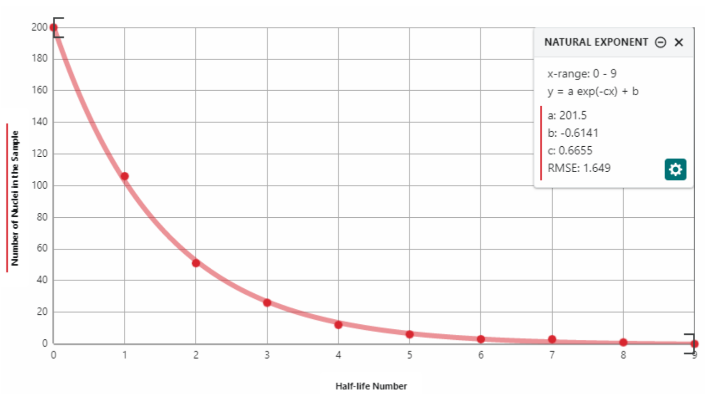
Brady Kondek **6.08 Honors Radiation and Radioactivity**

Data Table

Half-life Number	Number of Nuclei in Sample	Number of Decayed Nuclei
Start	200	0
1	106	94
2	51	55
3	26	25
4	12	14
5	6	6
6	3	3
7	3	0
8	1	2
9	0	1

Graph



Analysis

1. **Graph the "Number of Nuclei in the Sample" versus the "Half-life Number." If the sample has 1/8 of the radioactive nuclei left, how many half-lives would the sample have gone through?**

   1/8 of the radioactive nuclei sample would be 25. With that in mind, the sample would have gone through 3 half-lives to reach that point, as can be seen on the graph.

2. **Each time you dumped the pennies, one half-life passed; it has been shown that the half-life for this radioactive isotope is 25 years. In the year 2020, an archaeology team unearths pottery and is using this isotope for radiometric dating to place the age of the pottery. It is shown that 90% of the nuclei have decayed. Using your graph, approximately how long ago was the pottery made?**

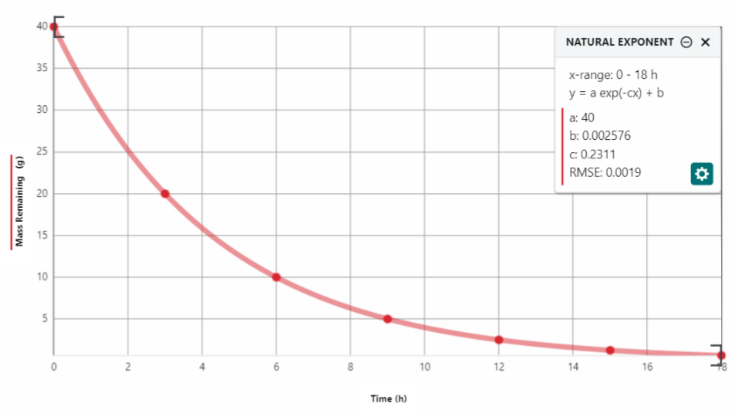
   $\frac{A_t}{A_o} = 2^{\left(\frac{-t}{h}\right)}$

   $0.10 = 2^{\left(\frac{-t}{25}\right)} = 83.048$

   t = 83.04 years/83 years

3. **While investigating the half-life of a radioactive isotope, the following data was gathered. Graph the data; this graph should resemble the graph from your lab. Notice that you have a y-value at x = 0. This is called a decay curve.**

Time (h)	Mass Remaining of the Isotope (g)
0.0	40.00
3.0	20.00
6.0	10.00
9.0	5.00
12.0	2.50
15.0	1.25
18.0	0.63



Answer the following questions:

a. Approximately how much mass remains after 10.0 hours?

According to the graph, after 10.0 hours, there would be approximately 4.00 g of mass remaining.

b. Approximately how much mass remains after 28.0 hours?

After 28.0 hours, there would be no mass left. Further, by using the graph, the exact value would come out to around -1.00 to -1.11 g.

c. What is the half-life for this isotope?

The half-life for this isotope is 3.0 seconds.

4. **We are simulating the decay of a radioactive substance with pennies. Do you think this is a reasonable simulation? Explain your answer.**

I think that this is a reasonable simulation, in the context that it helps to reinforce the idea of what the decay of a radioactive substance would look like in real life. Even though pennies are not radioactive substances, being used in this simulation gives a first-hand look at this and shows the same concepts and gives you similar information on a graph.

5. **If we assume that the radioisotope used in question 3 is Lawrencium-133, the sample will contain 3.621 E23 atoms of Lawrencium. Compare your graph from question 1 with your graph from question 3. Is there a difference in how the data fits the curve? Explain your answer.**

    When comparing the two graphs, the main noticeable difference is that the data appears to fit the graph more precisely within the graph from question 3. They both follow a mostly similar path, however they fit more directly in the question 3 graph, and there are more data points (half-lives) on the question 1 graph as compared to the question 3 graph.

Connection Questions

1. **What are the claims related to radiation exposure and safety?**

    Within the first passage, "International Space Station Internal Radiation Monitoring," the main claim stated is that "*Detailed consideration of radiation effects during design, development, and operation of the station has kept it largely immune to harm from radiation, but more work is needed to address events such as solar flares*."

    The second passage, titled "Space faring: The Radiation Challenge," the author's main claim states that "*precautions are necessary to prevent unnecessary risks*," after explaining the risks and potential danger of ionizing and non-ionizing radiation, and their specific types followed by what effects they can have.

2. **Based on your learning of ionizing and non-ionizing radiation, explain how the graphic supports or contradicts each of the claims.**

    The Electromagnetic Spectrum graphic shown helps to support each of the claims made throughout the two passages. Specifically, it helps to give specific context into the discussed details and allows the reader to have a visual to look at.

    In terms of how it supports the claims, it gives further context into how strong these solar flares (gamma rays, x-rays, etc.) and why they really are a topic of great urgency. Understanding the concept to something goes a long way into helping to address a concern about it, and this graphic helps to do so.

3. **From the excerpts and the electromagnetic graphic, describe the safety concerns for astronauts that plan to live in space for a long period of time.**

    For astronauts that plan to live in space for a long period of time, there are a number of safety concerns for them in this manner. The big concern has to do with the fact that there can be more exposure to harmful radiation in space than on Earth. Since a lot of the radiation specifically from the sun gets trapped by the atmosphere, we don't get all of it here. But in space you're on the other end of that, and there can be a lot more exposure to this radiation.

    As well, there are concerns that, in the case of the ISS, that the radiation protections may not be fully great enough in the event of solar flares, as it is stated in the first passage that "*more work is needed to address events such as solar flares*." With that being said, more work still needs to be done.