Virtual Lab: Half-Life

Background Information:

The rate of decay of a radioactive isotope of an element is measured in terms of its half-life. When a radioactive isotope decays, the decayed atoms form a daughter product. The half-life of a radioactive element is the time it takes for half of its atoms to decay into the daughter product. After two half-lives, one-fourth of the original isotope's atoms remain, and three-fourths have turned in the daughter product. After many more half-lives, a very small amount of the original parent isotope remains, almost all of it has decayed into the daughter product.

Each radioactive isotope has its own characteristic half-life. For instance, the naturally occurring radioactive isotope of uranium (U-238) decays into thorium-234 with a half-life of 4.5 billion years. This means that half of the original amount of uranium-238 still remains after this time. In contrast, some radioactive isotopes decay quickly. For instance, polonium-214 has a half-life of 0.00016 seconds!

Journal Questions:

Answer using complete sentences in your notebook

1. Define Isotope.
2. What do you think "Half-life" means?
3. What does "decay" mean?
4. When an isotope decays, does it disappear?
5. How much of a sample of Uranium-238 do you think would still be present after 9 billion years?

Objectives:

In this virtual lab you will:

- Investigate the meaning of radioactive half-life
- Simulate the radioactive decay of four hypothetical isotopes
- Collect data to be used to determine, compare, and contrast half-lives of these elements

Procedure:

1. Click the "Video" button. Watch the video. In your notebook write down a paragraph summary.
2. Select "Element A" from the pulldown menu. Using the controls, record the number of remaining radioactive atoms for each time period until no more remain on your data table.
3. Repeat Step 2 for Element B through Element D.
4. Create a graph showing the decay of all four elements.
5. Answer the follow-up questions in your notebook using complete sentences.
6. Glue your data table and graph into your notebook.

Follow-Up Questions:

1. According to your data, what are the approximate half-lives of each element?
    a. Element A:
    b. Element B:
    c. Element C:
    d. Element D:
2. What happens to a radioactive isotope as it decays? Does it disappear?
3. After three half-lives of an isotope, 1 billion (one-eighth) of the original isotope's atoms still remain in a certain amount of this element. How many atoms of the daughter product would you expect to be present?
4. Why would scientists look at the decay rate of different elements?
5. How does radioactive decay help support the age of the Earth?

Data Table:

Years	Remaining Radioactive Atoms			
	Element A	**Element B**	**Element C**	**Element D**
0				
1,000				
2,000				
3,000				
4,000				
5,000				
6,000				
7,000				
8,000				
9,000				
10,000				
11,000				
12,000				
13,000				
14,000				
15,000				
16,000				
17,000				
18,000				
19,000				
20,000