**Intro to Half-Life PhET Lab (Radioactive Dating Game)** **Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_**



**Introduction:** Radioactive particles decay. What does it mean when a substance is radioactive? In this simulation, you will investigate the concept of half-life.

**Procedure:**

1. Go to the following link: <https://phet.colorado.edu/en/simulation/radioactive-dating-gameand> and hit the “Play” arrow.
2. Play around with the simulation for a few minutes.

**Carbon-14**

1. Click on the tab for Decay Rates. Check Carbon-14.
2. Click on the bucket and add some nuclei to the simulation. Observe what happens.
3. What do the red dots represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What do the blue dots represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Use the Stop and Play buttons to control how fast the decay occurs.
6. Explain what happens to the Carbon-14 atoms as the simulation goes on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Do all the Carbon-14 atoms decay at the same time? Explain\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Do any of the Nitrogen-14 atoms change back to Carbon-14 atoms? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Let the graph run to completion and fill in the following table using the Half-Life graph.:

|  |  |  |
| --- | --- | --- |
| **# of Half-Lives** | **% Carbon Remaining** | **Approximate Age in Years** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |

1. Approximately how many years separate each half-life event?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Uranium-238**

1. Click on the tab for Decay Rates. Check Uranium-238.
2. Click on the bucket and add some nuclei to the simulation. Observe what happens.
3. What do the green dots represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What do the gray dots represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Explain what happens to the Uranium-238 atoms as the simulation goes on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Do all the Uranium-238 atoms decay at the same time? Explain\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Do any of the Lead-206 atoms change back to Uranium-238 atoms? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Let the graph run to completion and fill in the following table using the Half-Life graph.:

|  |  |  |
| --- | --- | --- |
| **# of Half-Lives** | **% Uranium Remaining** | **Approximate Age in Years** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |

1. Approximately how many years separate each half-life event?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Analysis:** Examine the data tables for both Carbon-14 and uranium-238.

1. Explain what happens to the percent of the original element each time a half-life occurs.
2. Explain what happens to the percent of the new element each time a helf-life occurs.
3. Explain how the time between each half-life compares for:
	1. Carbon:
	2. Uranium: