**PhET LAB 1: Alpha Decay** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

$$ \rightarrow +$$

**OBJECTIVE**: explain the alpha decay process; complete radioactive decay equations; define and analyze half-life through applying the PhET “Alpha Decay” simulation at [http://phet.colorado.edu](http://phet.colorado.edu/).

**Open/Run Alpha Decay at** [**http://phet.colorado.edu**](http://phet.colorado.edu/)**.**

**Take 5 minutes to freely explore the sim.**

Investigating Alpha Decay

1. Start on the **SINGLE ATOM** tab. Observe the decay of Polonium-211. After each decay, press the RESET NUCLEUS button to watch the process again. **Write a description of alpha decay for Po-211.**

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Complete the following alpha decay equations, using [http://www.chemicalelements.com](http://www.chemicalelements.com/) as a resource:

2. Polonium-211: $\rightarrow +$ 3. Radium-226: $\rightarrow +$

4. Uranium-238: $\rightarrow +$ 5. Plutonium-240: $\rightarrow +$

6. Americium-241: $\rightarrow +$

7. How is alpha decay used in everyday life? (give at least two uses)

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Investigating Half-Life of Alpha Decay

8. Click the **MULTIPLE ATOMS** tab. Execute five trials to determine the number of parent and daughter nuclei at one half-life. Complete the table below.

|  |  |  |
| --- | --- | --- |
| **Parent Nuclei Po-211** | **Parent Nuclei (remaining nuclei) [yellow]** | **Daughter Nuclei (decayed nuclei) [black]** |
| 100 |  |  |
| 80 |  |  |
| 60 |  |  |
| 40 |  |  |
| 20 |  |  |

9. Define half-life.

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10. Suppose a substance has a half-life of 0.52 s. Create accurate pie charts *showing the number* of remaining parent nuclei and decayed daughter nuclei (shade slightly) starting with 40 total nuclei.

$t=0.52 s$$t=1.04 s$$t=1.56 s$$t=2.08 s$

**PREDICTION with VALUES:**

11. Use the PhET alpha decay simulation to test your scenario copying each pie chart.

$t=0.52 s$$t=1.04 s$$t=1.56 s$$t=2.08 s$

**SIMULATION with VALUES:**

12. How does your prediction match with the results of the simulation? Convey with actual values from the simulation and a calculation of percent difference on 0.52 seconds.

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13. Run three trials and complete the data table below. Include uncertainty.

|  |  |
| --- | --- |
| **Time (t, s)**$$\pm 0.05 s $$ | **Number of Decayed Daughter Nuclei (n/nuclei)** |
| **Trial 1** | **Trial 2** | **Trial 3** | **Average**$$\pm \\_\\_\\_\\_\\_\\_ nuclei $$ |
| 0.52 |  |  |  |  |
| 1.04 |  |  |  |  |
| 1.56 |  |  |  |  |
| 2.08 |  |  |  |  |
| 2.60 |  |  |  |  |

14. **Share and discuss** one aspect of your table with another student in the class.

15. Use MS Excel to make a graph of **average decays v. time** including vertical uncertainty error bars. Staple this to this graph worksheet.