**Simulating radioactive decay**

**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Class :\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Background | Assume that a radioisotope of element X, has a half-life of one year.  Complete Table 1.  **Table 1: The radioactive decay of X**   |  |  |  |  | | --- | --- | --- | --- | | **Number of half-lives** | **Number of radioactive atoms of X**  **present after half-life decay** | **Number of atoms decayed** | *This is what will happen in theory* | | 0 | 64 | 0 | | 1 | 32 | 32 | | 2 |  |  | | 3 |  |  | | 4 |  |  | | 5 |  |  | | 6 |  |  | |
| Aim | To simulate the practical radioactive decay of a radioisotope. |
| **Materials** | 64 squares of paper — plain on one side and an X on the other Brown paper bag or empty container |
| **Method** | 1. Cut out the 64 squares from the page attached. Each square with an X represents an atom of an unstable radioisotope, X. 2. Place the squares in the brown paper bag or empty container. 3. Record the starting number in Table 2 below. 4. Each time you empty the bag represents one year of time. Shake the bag and empty the ‘atoms’ on the desk. If an atom lands X-up it has radioactively decayed and is now a stable atom. Remove these from the bag. 5. Record the number of atoms remaining in the table. 6. Return the un-decayed atoms to the bag. 7. Repeat steps 4–6 until all atoms of X have decayed. 8. Total up the class results (starting number is the number of groups multiplied by 64) |
| **Data collection** | **Table 2:** Decay Simulation results   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Your results** | | | **Whole Class results** | | | | Number of years | Number of radioactive atoms of X | Number of atoms of X decayed | Number of years | Number of radioactive atoms of X | Number of atoms of X decayed | | 0 | 64 | 0 |  |  |  | | 1 |  |  |  |  |  | | 2 |  |  |  |  |  | | 3 |  |  |  |  |  | | 4 |  |  |  |  |  | | 5 |  |  |  |  |  | | 6 |  |  |  |  |  | |
| **Analysis of results and observations** | Construct two graphs (one for your group and one for the class results) of the change in the number of atoms of X left versus time.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |
|  | Describe the graph. What does it tell you? |
| **Discussion** | Use your graph to determine how many years it would take for half of the 64 atoms to decay.  How long does it take for the number of un-decayed atoms to change from 32 to 16?  How long does it take for the number of un-decayed atoms to change from 16 to eight?  How long does it take for the number of un-decayed atoms to change from eight to four?  How do your results compare to ‘Table 1: The radioactive decay of X’?  Is your simulation a good model of the radioactive decay of a radioisotope?  How could the model be altered to be a better representation of the radioactive decay of an isotope? |
| **Conclusion**  1–2 sentences. Must relate to the aim. |  |

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