

Radioactive Decay & Half-Life Simulator

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/radioactive-decay/>

Name: _____ Date: _____

Learning objectives

- Define half-life and apply it.
- Describe decay as an exponential process.
- Relate activity to the number of remaining nuclei.

Variables to change

- Half-life
- Initial number of nuclei

Procedure

1. Start with a full sample and step forward one half-life at a time.
2. Record the fraction remaining after 1, 2, 3, and 4 half-lives.
3. Observe how the activity (decays per second) changes over time.

Observations

Record the fraction of nuclei remaining after each half-life and how activity falls.

Questions

1. What is a half-life?
2. What fraction remains after 3 half-lives?
3. Write the decay law.
4. How does activity change as the sample decays?

5. Can you predict when a specific atom will decay?

Answer key (instructors)

- **1.** The time for half of the radioactive nuclei in a sample to decay.
- **2.** One eighth ($\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$).
- **3.** $N = N_0 \cdot (\frac{1}{2})^{(t/T_{1/2})}$, equivalently $N = N_0 \cdot e^{(-\lambda t)}$.
- **4.** It decreases over time, proportional to the number of nuclei remaining.
- **5.** No — individual decays are random; only the statistical half-life of a large sample is predictable.

Radioactive decay is exponential: each half-life halves the remaining nuclei, so $N = N_0 \cdot (\frac{1}{2})^{(t/T_{1/2})}$. Activity falls in step with the number remaining. Individual decays are random, but the half-life makes large samples predictable — the basis of radiometric dating.