Date: _____ Name: _____

Half-Life and Radioactive Decay

Recall:

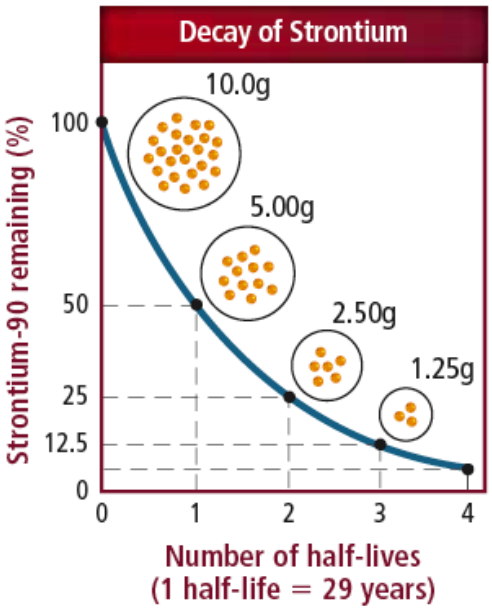
Parent nucleus: **<u>original</u>** radioactive material (species)

Daughter nucleus: the **<u>stable</u>** species produced **<u>after</u>** decay takes place

Half-life is the **<u>amount</u>** of **<u>time</u>** it takes for **<u>half</u>** of the parent nuclei to decay into **<u>daughter</u>** nuclei.

➔ How much **<u>time</u>** it takes for **<u>half</u>** of the sample to **<u>decay</u>** into something else

Example: If you have 10 grams of a sample of Strontium-90, and the half-life is 29 years. How much of it will be left after 29 years? *(How much is parent and daughter?)*



29 years = 1 half life

Mass of Strontium-90 = 10 grams $\times \frac{1}{2}$

*This is a **decay curve** which shows us the relationship between half-life and the amount of the original substance remaining.*

On a graph, the **half-life** is found when **<u>50%</u>** of the substance **<u>remains</u>**.

Example:

The half-life of Uranium-235 is 700 million years. How much parent is left and daughter produced after 3 half-lives if the initial amount of parent nuclei was 50 g?

Parent mass = 50 g $\times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ **= 6.25 g** **or** **parent mass = 50 g** $\times 1/2^3$ **= 6.25 g**

Daughter mass = 50 – 6.25 g = 43.75 g

Date: _____ Name: _____

Radioactive Dating: used to determine the **age** of really old items based on the **ratio** of radioactive **materials** to **stable** elements.

Carbon Dating: is a **popular** way to see how **old** a material that used to be **alive** was

> **Carbon-14** is used to determine how old something is. Carbon-14 is **only** created when something is **alive** and stops being created after something **dies**. Carbon-14 decays into Carbon-12 which is **stable**.

Note: carbon dating is **only used for things that used to be **alive** and can only be used to date objects **less** than ~40 000 years old.*

Practice

1. If a sample contains 30 g, how much is left (mass) if it undergoes one half life?

Mass (g) = 30 g $\times \frac{1}{2}$ **= 15 g**

2. The same sample above undergoes a second half-life. How much of it is left?

Mass (g) = 30 g $\times \frac{1}{2} \times \frac{1}{2}$ **= 7.5 g (or exponent rule)**

3. Assume a sample contains 25% parent isotope.

a) How much of the parent sample has decayed? Represent this as a percent.

75% has decayed

b) How many half-lives have passed?

$\mathbf{100\% \times \frac{1}{2} = 50\%}$

$\mathbf{50\% \times \frac{1}{2} = 25\ \%}$ **(2 HALF LIVES HAVE PASSED)**

c) How much of the sample is daughter isotope?

100% - 25% = 75% daughter isotope