

- Copy into your unit packet on the “Half Life” Tab
- Complete Practice Problems on your Worksheet – write down the entire problem

## Half Life

Half Life occurs with radioactive isotopes. They decay at the rate of their half-life. For example: if substance a has a half life of 10 years, and today you have 50 ounces of it, in 10 years you will have 25 ounces. That’s how half life works! To figure out how much you have of a substance t minutes/hours/days/years after you originally had it we use this formula:

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{t}{h}}$$

final amount  $\rightarrow$   $A$       initial amount  $\rightarrow$   $A_0$        $\left(\frac{1}{2}\right)$  is the split factor... After a half-life, one pound becomes  $\frac{1}{2}$  pound.  
 $t$  time       $h$  half-life

Example:

You discovered a new radioactive isotope and named it boogonium. It’s half-life is 1.23 years. If you start with a sample of 45 grams, how much will be left in 6.7 years?

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{t}{h}}$$

$$A = 45 \cdot \left(\frac{1}{2}\right)^{\frac{6.7}{1.23}} = 45 \cdot \left(\frac{1}{2}\right)^{5.447} = 45 \cdot 0.023 = 1.03 \text{ grams left}$$

Example:

An alien radioactive isotope has a half-life of 238 years. If you start with a sample of 8 kg, how much will be left in 100 years?

$$A = 8 \cdot \left(\frac{1}{2}\right)^{\frac{100}{238}} = 8 \cdot \left(\frac{1}{2}\right)^{0.42} = 8 \cdot 0.747 = 5.979 \text{ kilograms left}$$

Practice Problems:

1. Technetium-99 is used for brain scans. If a laboratory receives a shipment of 200 g of this isotope, how much will remain after 24 hours? The half-life of Technetium-99 is 6 hours.
2. Mercury-197 is used for kidney scans and has a half-life of 3 days. If the 32 grams of mercury-197 is ordered, but takes 15 days to arrive, how much would arrive in the shipment?
3. Sodium-25 was to be used in an experiment, but it took 3 minutes to get the sodium from the reactor to the laboratory. If 5 mg of sodium-25 was removed from the reactor, how many mg of sodium-25 were placed in the reaction vessel 3 minutes later if the half-life of sodium-25 is 60 seconds?