RADIOACTIVE DECAY

Radioactive decay is the spontaneous decay of an unstable (radioactive) parent into a stable daughter product at a constant rate (half-life).

Half-life is the time it takes for one-half of the unstable parent to transform into stable daughter.

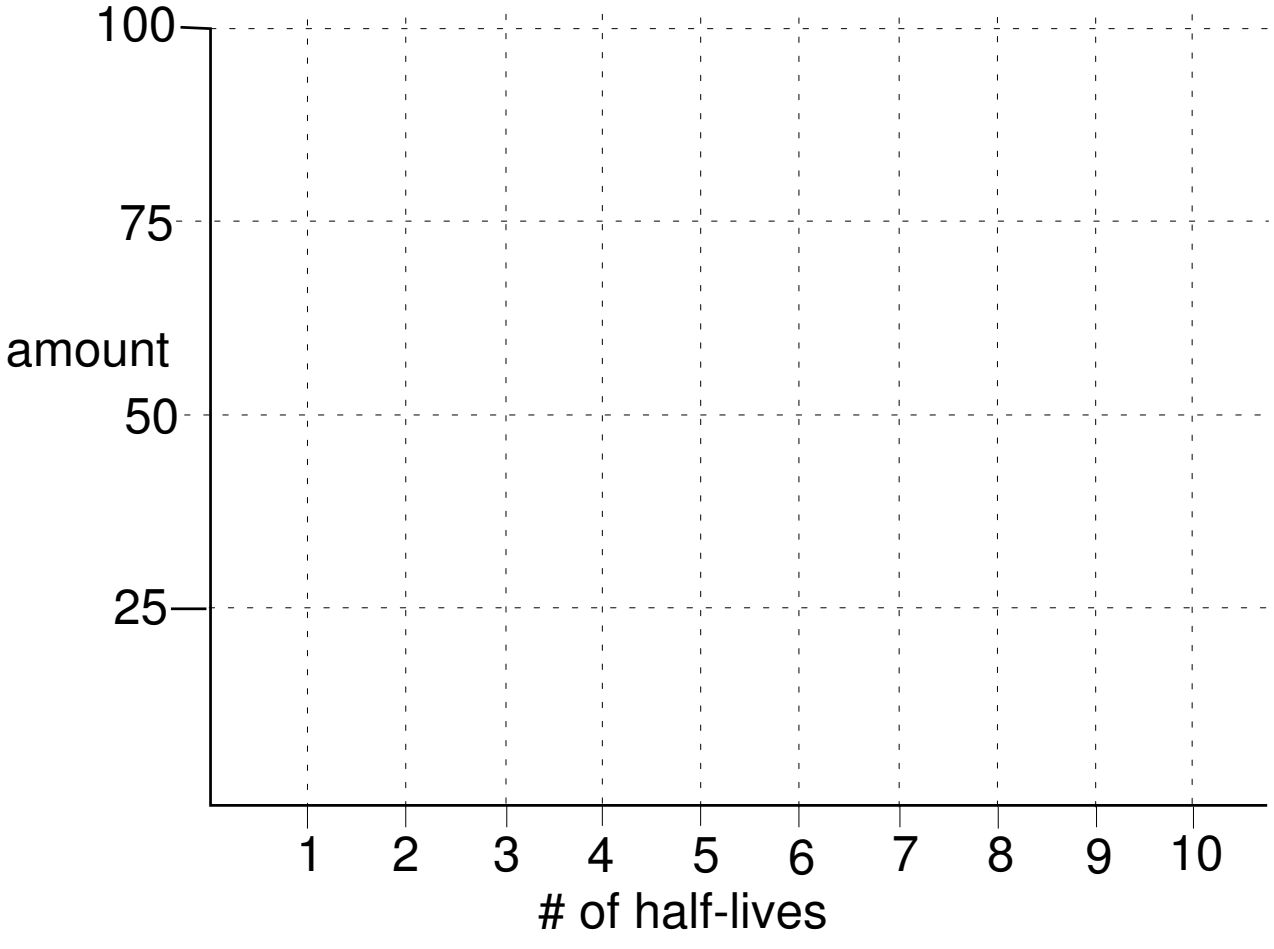
Radioactive dating of a mineral is based on the ratio between parent and daughter.

PROCEDURE:

1. Place 100 pennies face up on the table. Whenever a penny is face up, it represents one unstable, radioactive parent atom. By placing all of the pennies face up, you are starting with 100% unstable material.
2. Place the pennies in your container, shake them thoroughly, and pour them on the table. **This action represents one half-life.**
3. Separate the pennies into two piles; heads and tails. The heads represent atoms which are still unstable. The tails represent the atoms that have decayed and are now stable.
4. Record the number of heads and tails on the chart below.
5. Return **only the unstable heads** pile to your container (remember that tails are now stable and will not decay further). Shake the pennies thoroughly, and pour them on the table. This action represents a second half-life.
6. Again, separate the pennies into two piles; heads and tails. Since the tails represent the atoms that have decayed and are now stable, combine your new tails pile with the pile from your previous half-life.
7. Record the number of heads and tails on the chart below in the row for the second half-life. The tails number should be the sum of all the tails that have been produced so far.
8. Repeat steps 6 & 7 until you have no unstable atoms (heads) remaining.
9. Make a graph using a solid line to show how the amount of unstable, radioactive parent atoms (heads) changes with each half-life. Use a dashed line to show how the amount of stable daughter product (tails) changes with time. You may use different colors for the lines if you prefer.

Explain how the ratio of parent to daughter is unique for each half-life and can be used to determine the age of a mineral.

Half –life	Radioactive atoms (heads)	# Stable atoms in this ½ life (new tails)	Total Stable atoms (total # of tails)
original	100	0	0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Radioactive Parent	Stable Daughter	half-life
Rubidium-87	Strontium-87	49 billion years
Uranium-238	Lead-206	4.5 billion years
Potassium-40	Argon-40	1.3 billion years
Uranium-235	Lead-207	704 million years

QUESTIONS: (show your work for all questions)

1. If you have 25% parent and 75% daughter, and the half-life is 500 million years, what is the age of your rock?

2. If you have 80% parent and the half-life is 500 million years, what is the age of your rock?

3. If you have 700 atoms of Strontium-87 and 300 atoms of Rubidium-87, what is the age of your rock?

4. If you have 1320 atoms of Uranium-238 and 1320 atoms of Lead-206, what is the age of your rock?

5. If you have 3752 atoms of Potassium-40 and 6259 atoms of Argon-40, what is the age of your rock?

6. If you have 61,946 atoms of Uranium-235 and 190,266 atoms of Lead-207, what is the age of your rock? (be careful which half-life you use)

7. If you have 95,031 atoms of Rubidium-87 and 45,058 atoms of Strontium-87, what is the age of your rock?

EXTRA CREDIT: If a rock is 3 billion years old and contains 700 atoms of Argon-40, how many atoms of Potassium-40 does the rock contain?