Chemistry: Half-Life of Radioactive Isotopes Introduction:

Copy of LAB

The half-life is a measure of how much time it takes for ½ of a sample of radioactive atoms to decay into stable, or non-radioactive, atoms. After one half-life passes, only ½ of the atoms are still radioactive – the other half are stable. After a second half-life passes, another ½ of the remaining radioactive atoms have decayed into stable nuclei.

UNSTABLE
Isotope
(radioactive)

STABLE
Isotope
(non-radioactive)

(virtual lab)

What is the current year?
How old are you?

Each group needs 32 pennies. Place them on a desk in a 4 x 8 grid with heads up. *Each heads-up penny represents one gram of radioactive strontium-90 (sr-90)*, which means *you will start with 32 g of radioactive material*. Each tails-up penny represents one gram of stable, non-radioactive yttrium-90 (Y-90). Sr-90 has a half-life of 28 years.

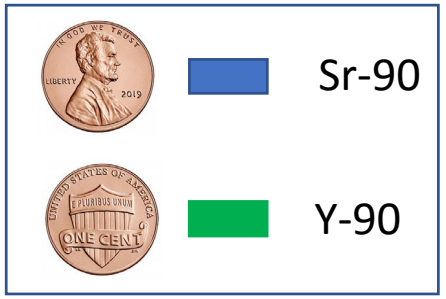
What is the current year?	
How old are you?	

Graph of Radioactive Decay

0 1 2 3 4

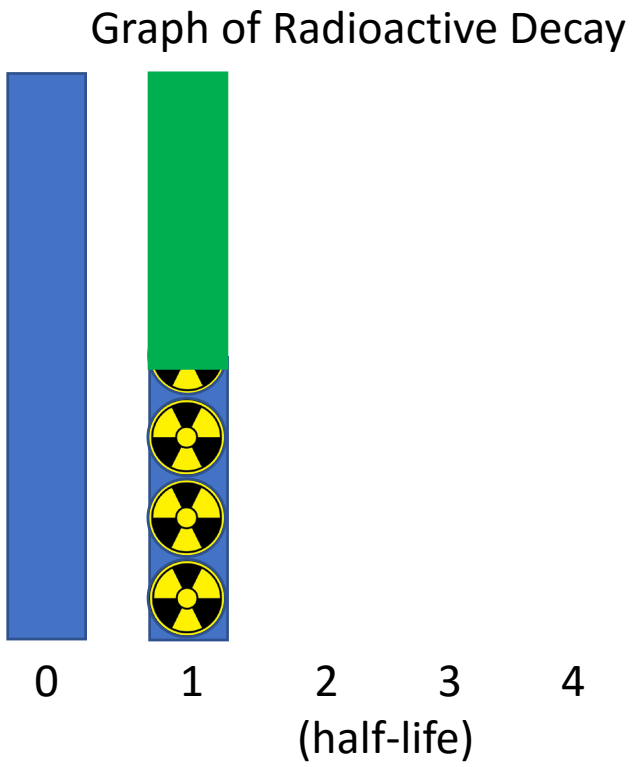
(half-life)

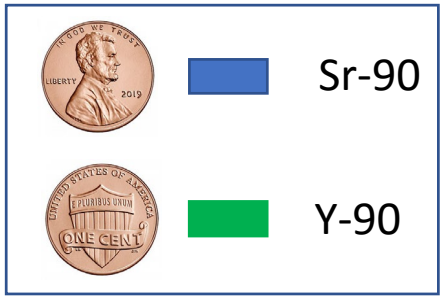
KEY



A. One half-life passes. Turn over (to tails-up) ½ of the pennies.

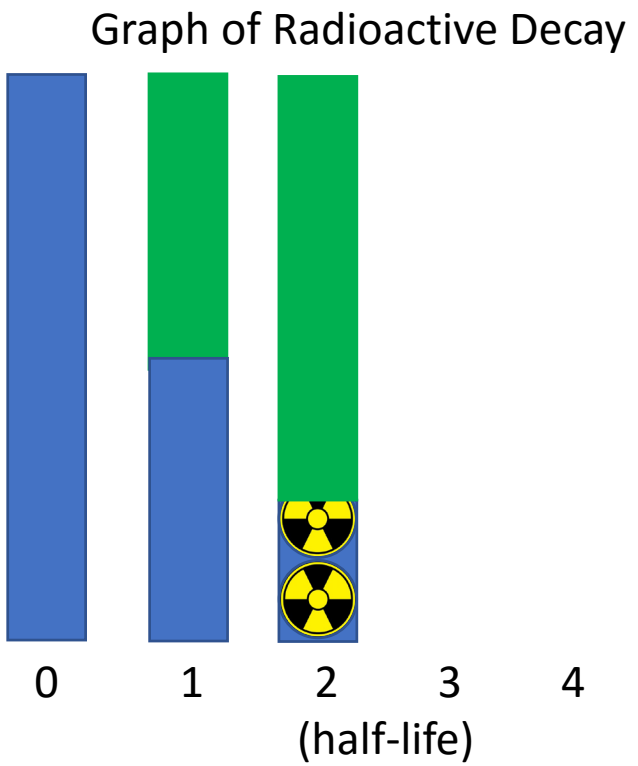
What year is it?	
How old are you?	
How many g of Sr-90 do you have now?	
How many g of Y-90 do you have now?	





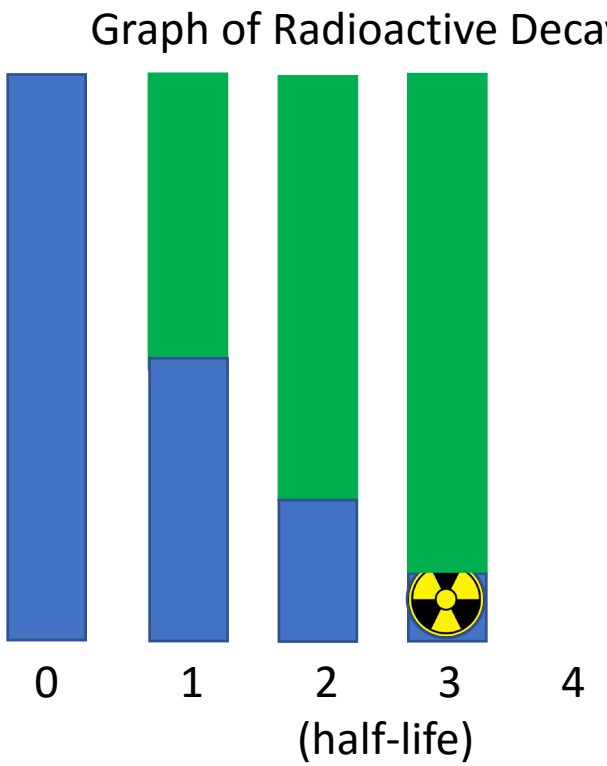
B. Another half-life passes. Turn over (to tails-up) ½ of the remaining Sr-90.

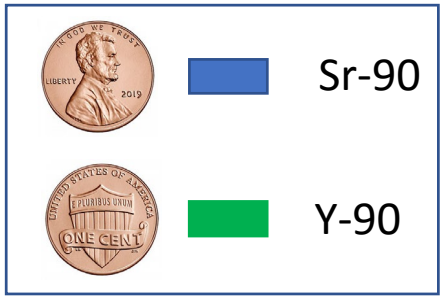
What year is it?	
How old are you?	
How many g of Sr-90 do you have now?	
How many g of Y-90 do you have now?	



C. Another half-life passes. Turn over the proper number of pennies.

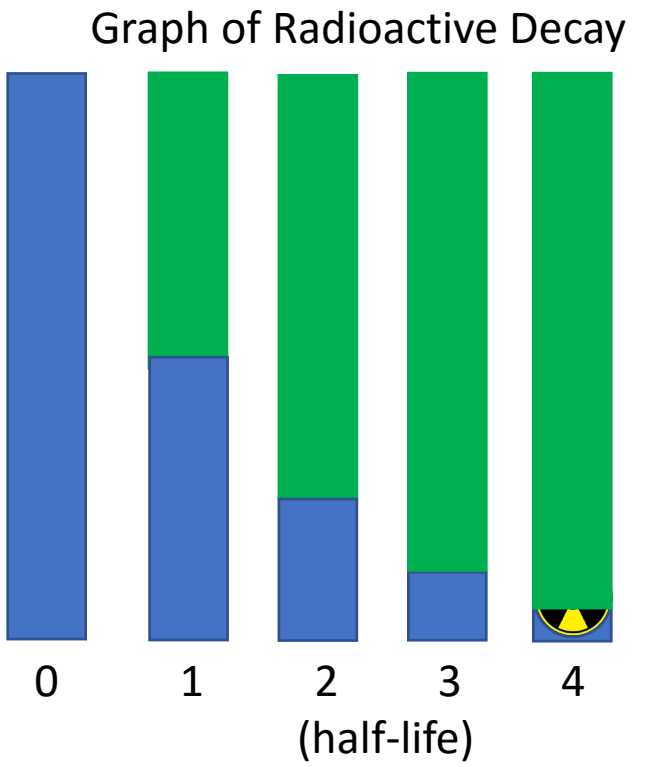
What year is it?	
Are you still alive?	
How many g of Sr-90 do you have now?	
How many g of Y-90 do you have now?	





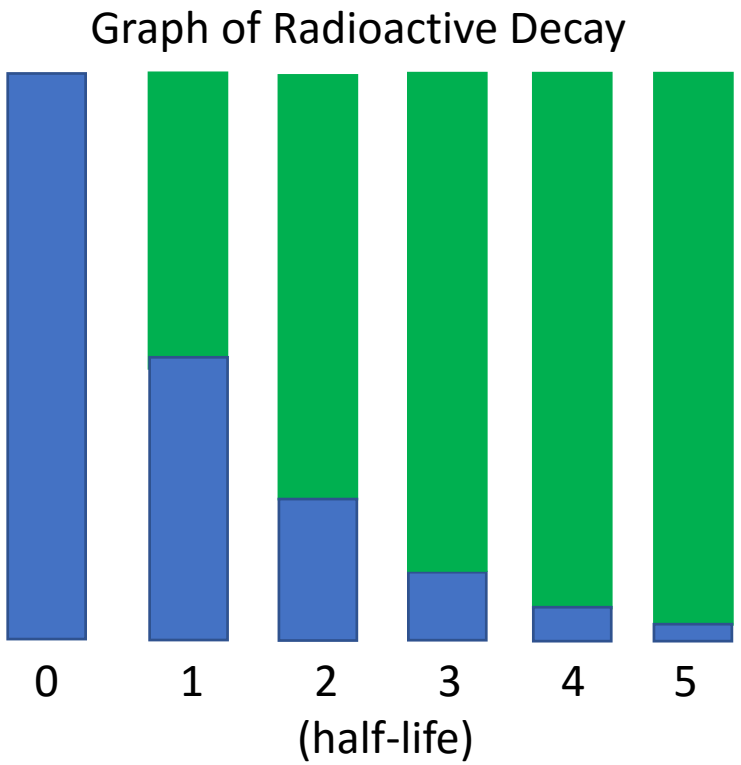
D. Another half-life passes. Turn over the proper number of pennies.

What year is it?	
How many g of Sr-90 do you have now?	
How many g of Y-90 do you have now?	



E. Another half-life passes. Turn over the proper number of pennies.

What year is it?	
How many g of Sr-90 do you have now?	
How many g of Y-90 do you have now?	



In our simulation, 32 grams of Sr-90 is equal to 220,000,000,000,000,000,000,000 pennies
(assuming each penny represents an atom of Sr-90)

More crazy calc's:

The pennies would have a volume of 3.74×10^{21} inch^3 or 8×10^{16} yards^3.

It would take 2.67×10^{16} pickup trucks full of pennies to hold this many pennies. Assuming a pickup truck can hold 3 cubic yards of pennies.

In reality, 32 grams of Sr-90 is actually equal to 2.2×10^{23} atoms of Sr-90.

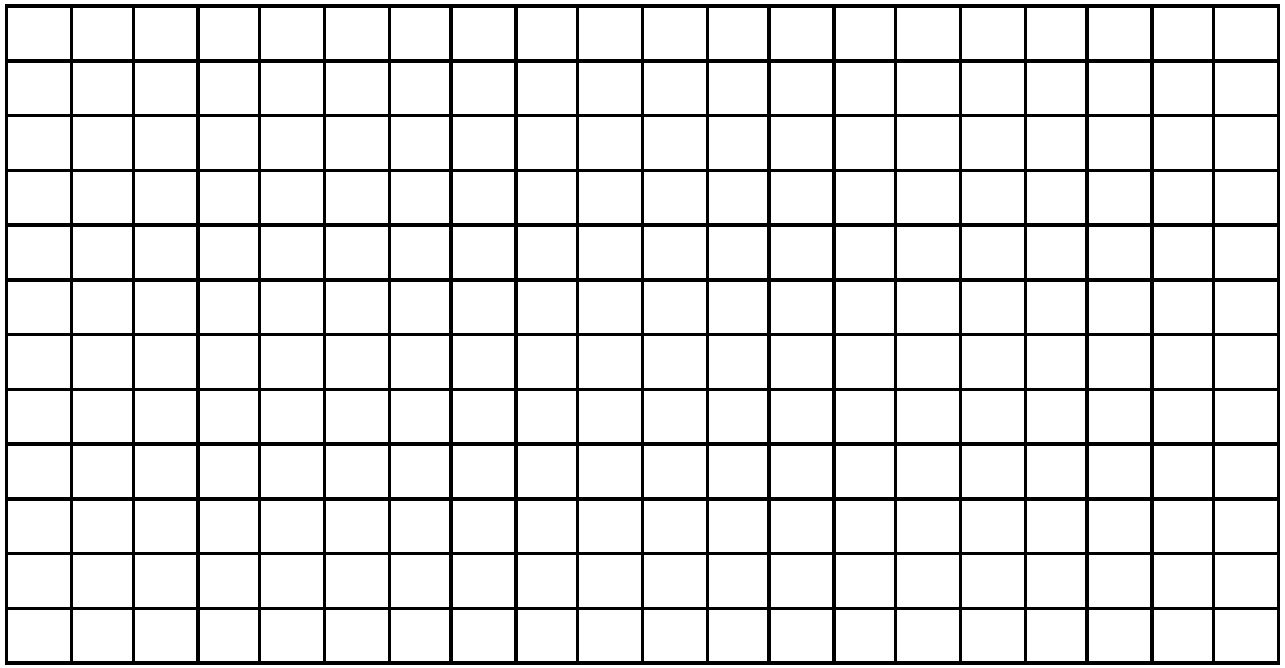
It would take you many, many, many life times to turn over all those pennies.

5,500,000,000,000,000,000,000,000,000,000,000,000 grams of pennies

A penny weighs 2.5 g. That means you would have 5.5×10^{36} g of pennies of Sr-90 if you had 2.2×10^{23} atoms of Sr-90.
That mass is equal to > 6×10^{14} kilotons [or 6050000000000000 tons].

In 560 years (20 half-life) you would still have 2.1×10^{17} pennies to turn over.

Make a graph of the half-life of Sr-90 using your data. Put the year on the horizontal axis and the number of grams of radioactive Sr-90 on the vertical axis. Include all the elements of a good graph, and make your graph neat.



Questions: Answer the following questions, based on your graph. Show work, if you need to.

1. About how many grams of Sr-90 will you have 16 years from now?

2. About how many grams of Sr-90 will you have in the year 2050?

3. About how many grams of Y-90 will you have 100 years from now?

4. Would Sr-90 be useful for finding out how old a dinosaur fossil is? Why or why not?

5. Theoretically, will the amount of Sr-90 in your 32 g sample ever be zero grams? Why or why not?