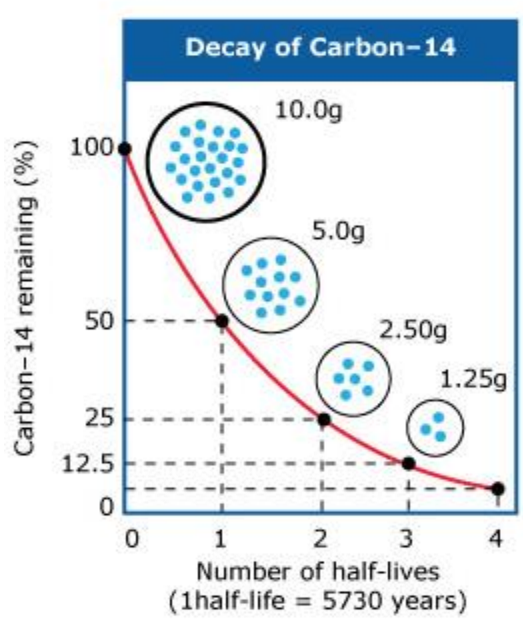
Name ____ Date ________________ Period _______

Lab: Radiometric Dating

HONORS BIOLOGY: UNIT 8

Problem: How long will it take for 100 atoms of the radioactive parent Carbon-14 to completely decay into the stable daughter isotope Nitrogen-14?

Background: ***Relative dating*** gives an approximate age of something compared to some other event in history. Scientists can tell that the item is “older” or “younger” than certain events in time, but cannot give an exact age of the item. Relative dating is common when comparing layers of rocks in different regions, and figuring out which fossil is older by comparing the rock layers the fossils are in.



Absolute dating gives an actual date in history that the item was formed or died. The most common type of absolute dating for geologic material is radiometric dating. A rock containing a radioactive element can be dated by measuring how much of the element remains.

Radiometric dating methods give absolute ages ranging from decades to billions of years. Radioactive elements are unstable and decay into other materials at a known, fixed rate through radioactive decay. Different radioactive elements have different rates of decay. Each radioactive isotope has a characteristic, fixed, half-life. The ***half-live*** is the amount of time it takes for half of the radioactive element to decay or change into another element. Half-lives of elements can range from microseconds to hundreds of billions of years, depending on the isotope.

Hypothesis: (Be specific. Include a variable you are measuring. In an If/then/because form)

Procedure:

1. Start with 100 pennies. Each penny represents an atom in the radioactive element Carbon-14.
2. Dump out all of the pennies and spread them out on the table.
3. Remove all the coins that show tails to the side. These are atoms that have “decayed” and are no longer radioactive.
4. Record the number of pennies with heads in the table below. These represent atoms that are still radioactive.

5. Put the pennies that had heads up back in the container, mix them, and spread them out on the table and repeat the above process until all the pennies are gone or until you have completed 15 trials.

6. Graph the data from Data Table #1 on the graph provided on the next page.

7. Enter your data into the master spreadsheet on the white board to chart an all class average.

Checkpoint*: Which data is more reliable: your own data or the class average? Explain why*

Experimental Design:

***Independent variable*:**

***Dependent variable*:**

Results:

DATA TABLE #1

Flip # (time elapsed)	# of pennies with heads (radioactive atoms remaining)
0	100
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Half Lives of Selected Radioactive Elements

Radioactive Parent	Stable Daughter	Half life
Potassium 40	Argon 40	1.25 billion years
Rubidium 87	Strontium 87	48.8 billion years
Thorium 232	Lead 208	14 billion years
Uranium 235	Lead 207	704 million years
Uranium 238	Lead 206	4.47 billion years
Carbon 14	Nitrogen 14	5730 years

GRAPH: Make sure to include a title and label your axes with units.

Conclusions questions:

1. What is the difference between absolute dating and relative dating? Give an example of each.

2. What is the half-life of your 100 atoms of Carbon-14? (How many flips did it take for half of your Carbon-14 to decay?)

Taken from Vicky Jordan http://www.nsta.org/images/news/legacy/scope/0604/jordanradiometrics.pdf

3. If each flip represents 5730 years, how many years would it have taken for all of your Carbon-14 pennies to become Nitrogen-14 pennies? Do you accept or reject your hypothesis? Explain

4. Study the chart that shows the half-lives of various elements. Most of these elements can be found in rocks all over the Earth. Why would scientists want to use more than one type of element to determine the age of a rock? Why aren't they satisfied with just using one element?

5. Based on radiometric dating, the oldest rocks scientists have found on Earth are 4.6 billion years old, but not ALL rocks are that old. Why might some rocks be 4.6 billion years old, and other rocks are only 2 billion years old, while yet others are only a few thousand years old?

6. Keeping in mind that scientists continue to gather information about rocks using radiometric dating, why are scientists interested in studying rocks from asteroids, the moon, and other planets?