Name _____ Date _____ Period _____

RADIOACTIVE DATING OF ROCK

Background: Finding out how old something is helps scientists understand the history of Earth and determine evolutionary pathways. Radioactive dating is an important tool scientists use to do this. To find a radioactive date, the object being dated must contain a radioactive element such as uranium-235 or carbon 14. These elements are decaying by emitting a small part of the atom. They also become something new, uranium turns to lead, carbon 14 turns to carbon 12. By determining the ratio of uranium to lead or carbon 14 to carbon 12, it can be determined how long that item has been around. In this activity you will model the decay of three different "radioactive" atoms, each with a different half-life. Half-life is a common way to describe the length of time it takes for half the atoms in a particular element to decay.

Purpose: The purpose of this lab is to use licorice as a model of radioactive atomic decay. You will cut several pieces of licorice in half to model the decay of different "elements." This should help you understand the concept of a half-life and how it is used in dating fossils as evidence for evolution.

Prediction: How many cuts (half-lives) will it take until I cannot cut the licorice any more?

Materials: Licorice, scissors, scale

Procedure:

1. Obtain a piece of each color licorice from your teacher. Different colors of licorice represent different elements in nature. For example the red licorice could represent an element like carbon 14.
2. The color of the licorice determines its half-life. Each time a half-life passes 1/2 of the element decays.

Color (atom)	**Half-Life (years)**
Red	2000
Brown	1000
Black	500

3. In each table record the initial amount of each element. Do this by massing the piece of licorice.
4. Cut your licorice in half. Find the mass of the piece you cut. This is the amount (in g) of the element the licorice "decayed" into. Record in your data table.
5. Measure the amount of licorice you have left. This is the amount of the original element. Record in your data table. The time it took for this decay is the half-life.

Half-lives	Years Passed	Amt in g to start	Amt in g after half life
0	0	34	NA
1	2000	34	17
2	4000	17	?

6. Measure the amount of licorice you have left. This is the amount of the original element. Record in your data table. The time it took for this decay is the half-life.
7. Continue this process until you cannot cut your licorice any more.
8. Label your graph x-axis "years" (increments of 500) and y-axis "amount in grams to start" (increments of 1).
9. Graph your data. (Use a different color for each element.)
10. Repeat steps 1-8 for each piece of licorice.

Data: Table 1: **color**_____

Half-lives	Years Passed	Mass in g to start	Mass in g after half life

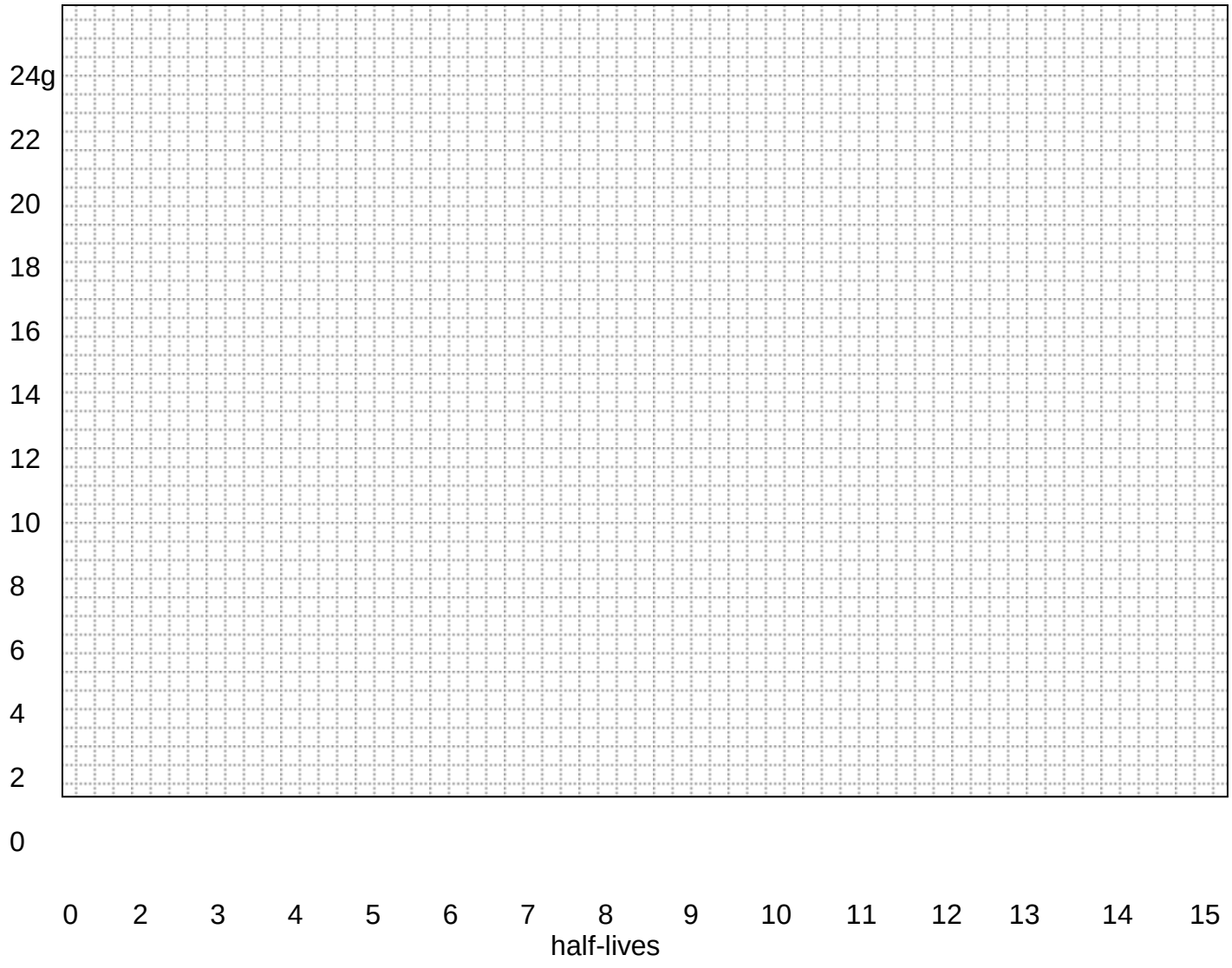
Table 2: **color**_____

Half-lives	Years Passed	Mass in g to start	Mass in g after half life

Table 3: **color_____**

Half-lives	Years Passed	Mass in g to start	Mass in g after half life

Graph all 3 colors of licorice using 3 different colors.



Analysis:

1. How many cuts did it take until you could not cut each licorice any more? How many half-lives does this represent for each element?

2. Describe radioactive atomic decay. How can it be used to date fossils?

3. Explain the shape of the 3 different lines. How were they similar and how were they different?

4. How did the length of half-life affect the amount of licorice left after 4000 years?

5. Some substances have very long half-lives. Uranium has a half-life of 4.5 billion years. Explain when using Uranium would be necessary.

6. A certain mammoth fossil was found to have one-fourth the number of Carbon 14 atoms present than it did when the animal died. The half-life for carbon 14 is 5730 years. How old is the fossil?

7. Why don't scientists use carbon-dating for dinosaur fossils which are hundred of millions of years old?

8. A certain scientist discovers several fossils in different layers of the earth at a site she is excavating. The fossils seem to show a progression from a land dwelling mammal to an aquatic mammal similar to the whale. In order for these fossils to be used as evidence for evolution and the change in a population over time, what must the scientist prove?