Full name: _____

Radioactive Decay Lab

Background: Some atoms spontaneously decay, they break down into other elements and release particles such as protons, electrons or neutrons as well as energy. Such atoms are said to be unstable or radioactive. It is impossible to predict just when any individual atom will decay but by looking at large numbers of such atoms we can make predictions based on their average decay rate.

Objective: You will collect data about the decay rates of atoms (m&m's) and from this data you will determine the half life.

Vocabulary: On the back of this lab or on a separate piece of paper define the following terms:

Radioactive, Half life, Isotope, Relative age, Absolute age

Procedure:
> You will be given a cup containing about 100 m&m's. Spread clean paper towels on your desk and pour the m&m's onto the towels. Do not let m&m's touch the dirty desk surface.
> Use hand sanitizer to be sure your hands are germ-free and then count exactly 100 m&m's and return them to the cup. Eat any excess. If you need more ask your teacher*.
> Shake the cup gently and pour the m&m's back onto the towels and count the number which land m&m side up. Record this number in the proper column in the chart below (column 3). These are the atoms which decayed. **EAT THEM!** Return the rest to the cup.
> The number you returned (the ones you didn't eat) is the starting number for trial #2. Shake gently again and pour them out onto the paper towels and repeat the procedure: Count the ones that landed m&m side up, **EAT THEM,** return the rest to the cup.
> Continue until you have eaten all the m&m's.
> Your teacher will collect class data and will post it on the board. Copy the class data into the appropriate columns in the chart.
> Draw the graph (see graph directions) and answer the questions.

STOP! Before you begin ask yourself:

Am I sure I really know what to do? Do I know what data to record and where to record it? IF NOT, re-read the directions and/or ask for help. Ask now. It's easier than re-doing the whole lab later!

*WARNING: Eating too many m&m's and then pretending that you didn't get enough will result in penalties too horrible to mention here!

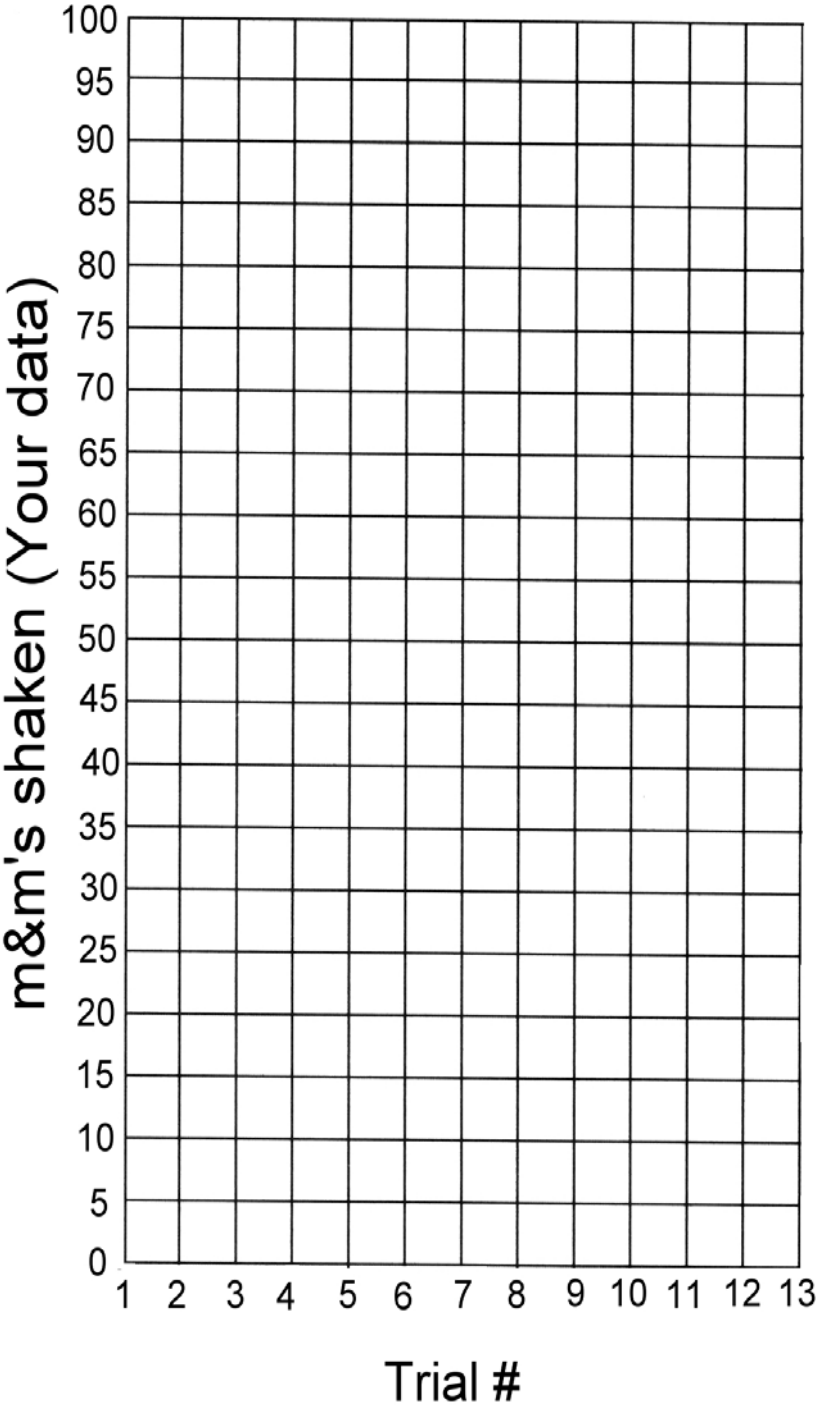
Report Sheet

1 Trial #	2 # m&m's Shaken	3 # m&m's eaten (decayed)	4 # m&m's remaining (col. 2 minus col. 3)	5 Class avr. # m&m's Shaken	6 Class avr. # m&m's eaten	7 Class avr. % eaten (decayed)
1	100			100		
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Note: The number in column 4 becomes the same number as the number in column 2 for the next trial. Example: If column 4, trial 1 = 48 m&m's, then column 2, trial 2 is 48 m&m's.

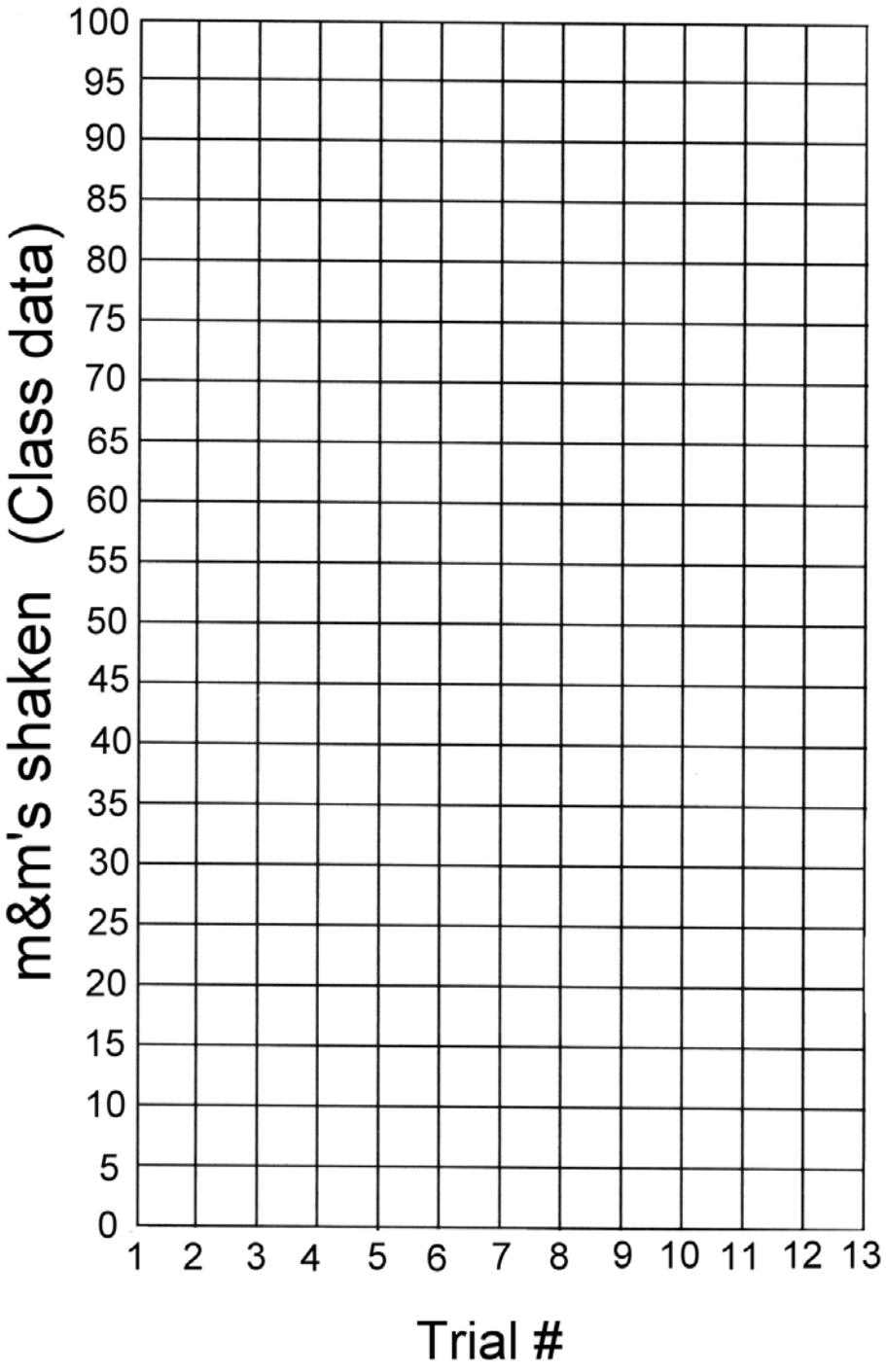
You and your partner(s) should fill in columns 2,3,& 4 until there are no m&m's left. The whole class will fill in columns 5,6, & 7 together with your teacher.

Graph 1: Graph YOUR DATA from column # 2



Draw a straight line from 50% over to your line on the graph. Where the two lines intersect draw a straight line down to the bottom axis. The point on the bottom axis where this line touches is the half life. Your half life is _____ trials.

Graph 2: Graph CLASS DATA from column # 5



Draw a straight line from 50% over to your line on the graph. Where the two lines intersect draw a straight line down to the bottom axis. The point on the bottom axis where this line touches is the half life. The class half life is _____ trials.

Answer the following questions:

1) If each trial represents 10,000 years, what would be the half life of the m&m's based on your data (graph #1)

_____ years

2) Again, based on your data, what % of the m&m's remained after 2 trials? _____

What % remained after 3 trials? _____

3) If each trial represents 1.5 million years, what would be the half life of the m&m's based on the class data (graph #2)

_____ years

4) Which do you think is a more accurate value, your data or the class data **AND** explain why!

_____

_____

_____

5) Which element, present at the formation of our solar system, is just now reaching 1 half life?

_____

6) A piece of mammoth tusk contains C^{14} and N^{14} in the ratio of 1:3. Based on information in the reference tables, how old is the tusk?

_____ years

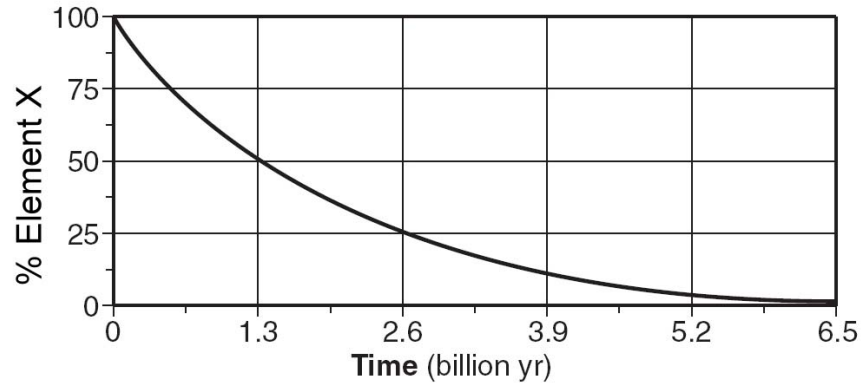
7) What % of the original K^{40} contained in a rock would remain after 3.9×10^9 years?

_____ percent

8) State one limitation on the use of carbon 14 for dating ancient artifacts.

_____

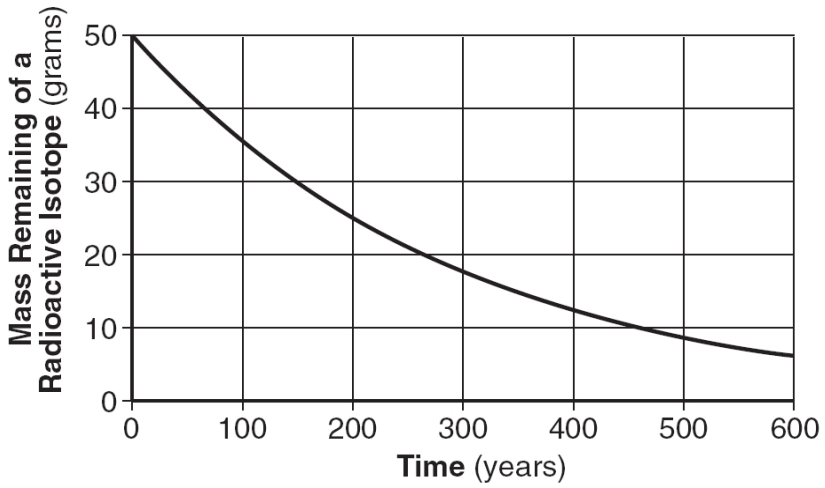
_____



9) Based on the graph (above), what is the half life of 'element X" ?

_____

10) Based on the reference tables, 'element X' is probably _____



11) Based on the graph (above) what is the half life of this element? _____

12) How many grams of this element will remain after 2 half life periods have gone by?

_____

13) The graph above represents the decay of element X into element Y. If we began with 50g of element X at time 0 and no element Y, what will be the total <u>combined</u> mass of elements X and Y after 8 half lives?

_____g