M&M Half Lives: Absolute Dating

Geology Mr. Traeger

Name: _____ Period: ____ Date: _____

Purpose

The purpose of this activity is to become familiar with the concepts of absolute dating of geologic time periods. These labs were adapted from labs found at http://www.ucmp.berkeley.edu.

Materials

M&M Half Lives

- 100 M&M candies per group of 4 students
- Your textbook pages 656-659!
- Periodic Table of Elements

Part 1: M&M Half Lives: Absolute Dating

Procedure

1. Count out 100 pieces of M&M candy and place them on a piece of notebook paper with the M facing down. These represent parent isotope. This is 0 half lives.

2. Now put your M&Mûs in a cup and shake them up. Pour them out on to the notebook paper so that all are spread out on the page. Remove the ones with the M facing up. Now count the number of M&Mûs with the M facing down. Record this number in the table below. This is 1 half life.

3. Now repeat the procedure from #2. This will be 2 half lives, 3 half lives, and so oné . Make sure to record your data below!

Experimental Results with Half Life

Run #	0	1	2	3	4	5	6	7	8	9
# of parent isotope atoms (# with M face down)										

4. After you are done recording your data, you may divide the M&Mûs up among the members of your group and eat them! Enjoy!

5. Now, graph your data on the graph of M&M Half Lives. Make your line a certain color or line type with a key.

6. Calculate and plot the mathematical line for half life below. Plot this data on the graph of M&M Half Lives. Make this line a different color or line type with a key.

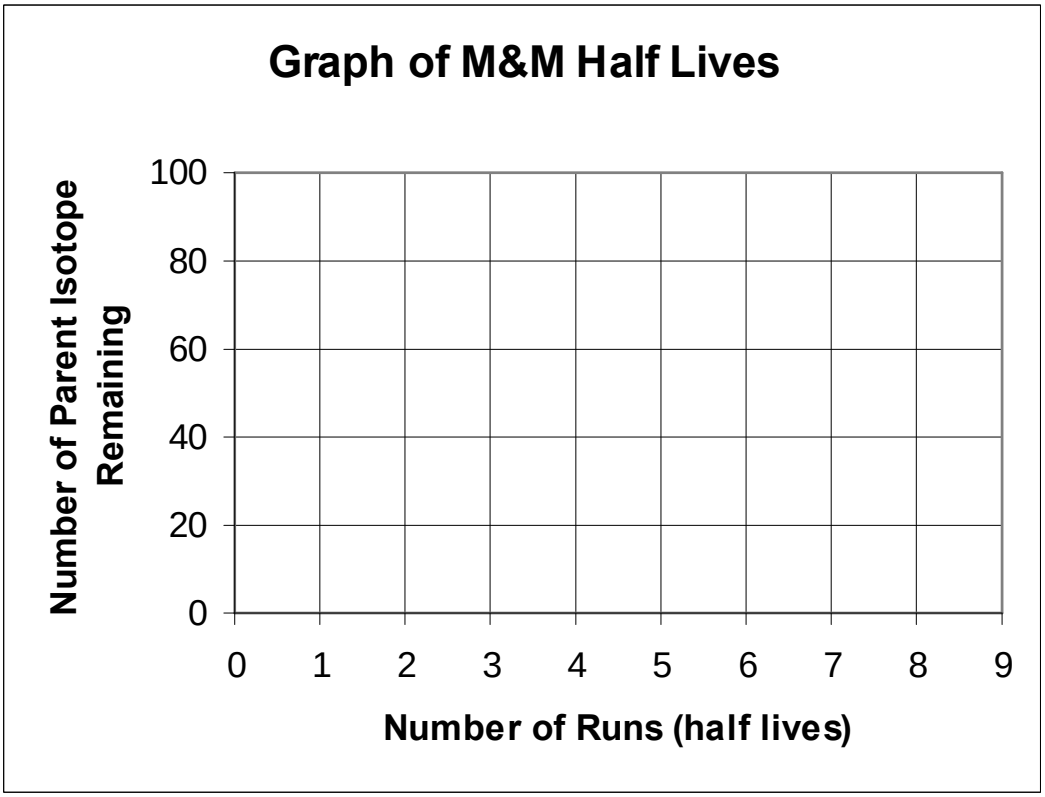
Mathematical Calculation of Half Life

Run #	0	1	2	3	4	5	6	7	8	9
# of parent isotope atoms (# with M face down)										

7. Now enter your experimental results data into the spreadsheet on the side computer. After everyone has entered data, Mr. T will reveal what the class averages are for each half life. Plot this data on the graph of M&M Half Lives. Make this line a different color or line type with a key.

Class Average for Half Life

Run #	0	1	2	3	4	5	6	7	8	9
# of parent isotope atoms (# with M face down)										



Questions

1. What is the mathematical probability that any one M&M will decay from parent to daughter isotope at any given time?

2. You also did the mathematical calculation of half life. How does your M&M experimental data compare to the mathematical data?

3. In the mathematical calculation, what happens to the number of parent isotope atoms for each run (half-life)?

4. How does the average value of half life compare to the mathematical results? Why might average values be more accurate than individual values?

For the following questions, assume that the half life of the M&M isotope is 1,000,000 years. Age = half life X number of half lives.

5. Fill in the blanks on the following chart based upon the graph above.

Percent of parent isotope?	100%	50%	25%	12.5%	
Age of Rock?					4,000,000 years

6. What kind of parent isotope would you use to date a set of bones that are 2,000 years old? Why? Hint: Look in your book!

7. What kinds of things would you use Uranium-238 to date? Why? Hint: Look in your book!

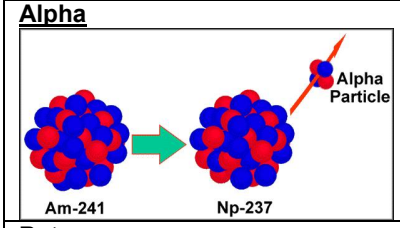
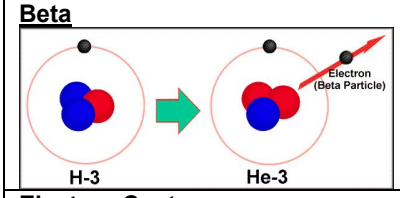
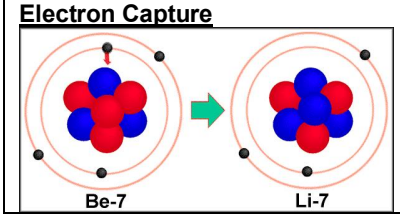
8. What kinds of things would you use Rubidium-87 to date? Why? Hint: Look in your book!

9. What kinds of things would you use Potassium-40 to date? Why? Hint: Look in your book!

10. What is an isotope?

11. What does it mean when something is ñradioactiveò?

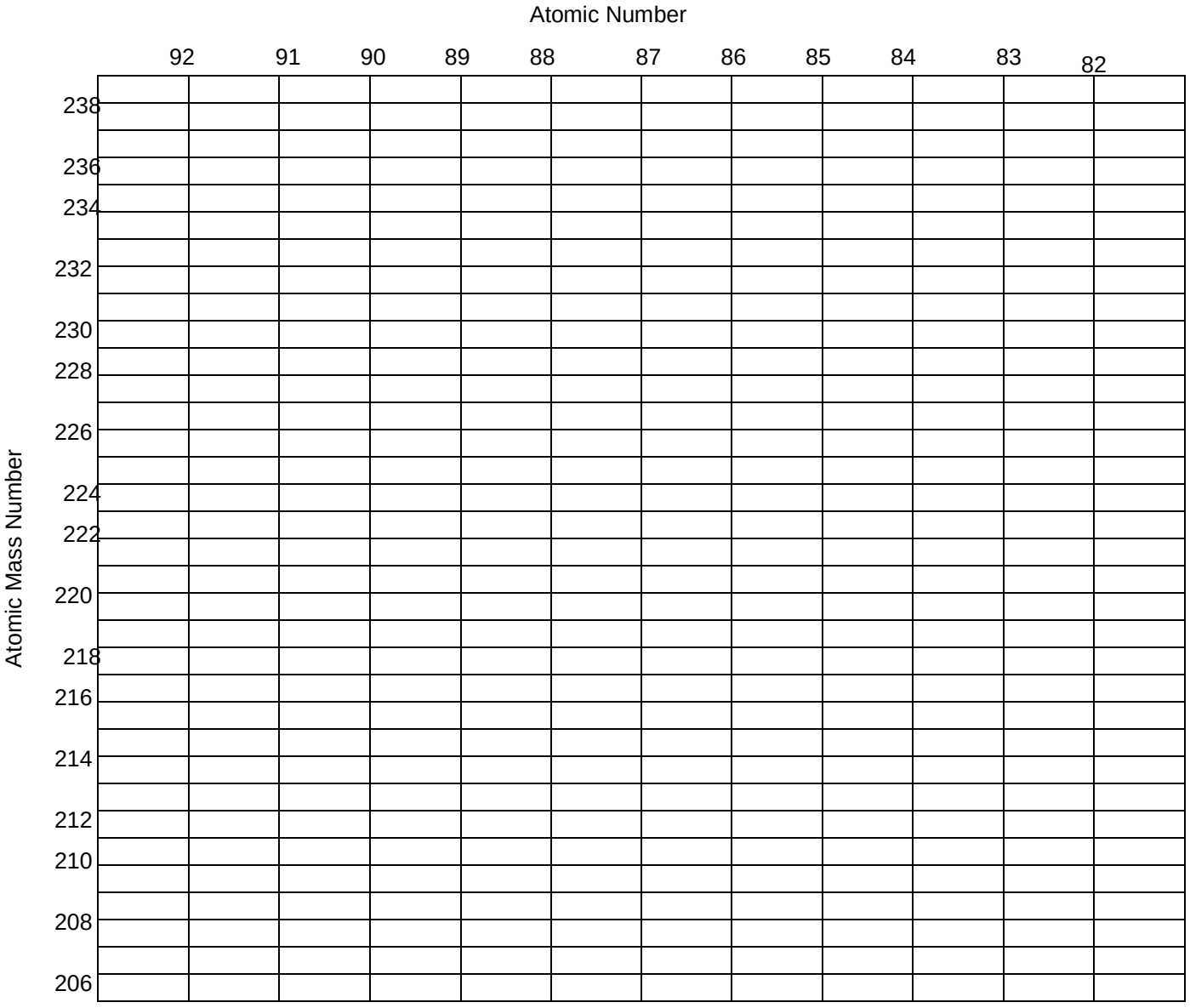
12. The following chart shows the three main types of radioactive decay as seen in your book on page 657. Describe what is happening in each type of decay on a sub-atomic scale.

Type of Decay	Atomic #	Atomic Mass	Describe What is Happening
Alpha 	2 fewer	4 fewer	
Beta 	1 more	No change	
Electron Capture 	1 fewer	No change	

Part 2: Graphing a Decay Path for Uranium-238

The decay of radioactive isotopes is not one single event. It is a series of events that eventually leads from the unstable parent isotope to the stable daughter isotope. In this next activity, you will graph the decay path of Uranium-238. Refer to the chart on the previous page and page 657 in your textbook to help you to do this.

The decay sequence of Uranium-238 is 1 alpha, 2 beta, 1 alpha, 4 alpha, 2 beta, 1 alpha, 2 beta, and 1 alpha. Graph this decay path below. Use a periodic table to name the transition isotopes for each decay sequence.



What is the name of the daughter isotope of Uranium-238?

How long does it take for half of the parent isotopes to change to daughter isotopes in this sequence?