Modeling Radioactive Decay/Absolute Dating

Name:_________________________________ **BLOCK:**________ **Partner:**________

Background: How is it possible that we can know the exact date that a rock or fossil was formed? Relative age dating gives us information on what rocks are older and younger than one another, but absolute dating gives us the most accurate date with a small margin of error. Radioactive elements such as Ur-238 and C-14 are unstable. That is, they constantly are changing into new elements as time goes on. By counting the number of new versus old elements (getting a parent-to-daughter ratio), we can figure out how old something is. The only reason this works is that the rate of radioactive element decay (change to other element) is constant.

Objective: To model radioactive decay of an isotope (skittles) using **probability**.

Materials: 50 skittles, cup with lid, paper towel or plate to putt skittles on (the desks are nasty).

Pre-Lab Questions:

1.) If decay rates were not constant, would one be able to yield an absolute age of any rock or fossil?

2.) When we say that decay rates are constant, what sort of changes to a rock/fossil do NOT affect the decay rate of the radioactive isotope?

a.
b.
c.

3.) List two reasons why one could not use 14-C to date a rock that was from the Jurassic.

a.
b.

4.) What percent of the original radioactive isotope remains after two half lives of any radioactive substance?

5.) If 12.5 % of the original radioactive isotope of 14-C were found in a fossil sample, what percent of the daughter product (14-N) would be present?

6.) If 12.5% of the original radioactive isotope of **40-K** is found in a rock sample, what is the estimated **age** of the rock?

Directions to follow in order to carry out experiment

1.) Count out 50 skittles that clearly have an **"s"** imprinted on them. You can eat extra's that are "blank" but you need 50 total to start. Put them into the cup and place the lid on. This represents the total number of radioactive isotopes at the start of this activity at 0 half-lives. **The "s"-side represents the radioactive isotope.**

2.) Shake your cup (with the top on) gently for about 10 seconds. Magic! You just represented the passing of ONE HALF LIFE. **Gently** pour all 50 skittles onto the plate/paper towel. Do not touch the skittles/alter the placement. **Count** the number of "**s-side" skittles** (Parent isotopes), report this number in data column 2. Then put the atoms **BACK INTO THE CUP**.

3.) **Count** the number of "**blank side" skittles (daughter atoms**); report this in column 3. You can now **eat** the blank side skittles. If you do not want to eat them, just place them to the side where they will not be utilized again.

4.) **Calculate** the total percent of parent vs. daughter isotopes (column 5 and 6) using column 2 and 4. Your total percent's should always add up to 100% if you are doing this correctly. Keep in mind you must keep adding up the total number of daughter atoms as this experiment progresses (column 4- this number will continue to grow while the number of parent isotopes continues to decline).

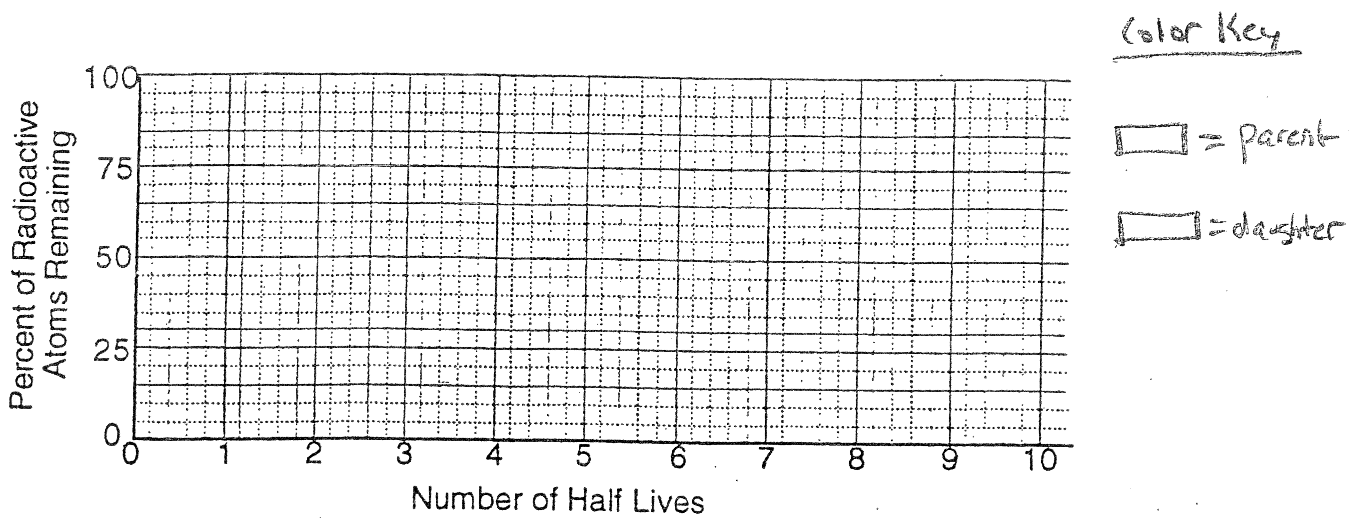
5.) Put the lid back on the cup. Lightly shake the cup and spill the contents back on to your clean paper/plate. You are now demonstrating the second half-life. Repeat steps 2-5 until you have no more skittles left and you have gone through the amount of half-lives required to get there. **Please note that because we are relying on probability, you may not need to reach 10 trials, or you may need more, add rows if necessary.**

Data Table:

Starting Number of Radioactive Isotope: 50					
Column 1	Column 2	column 3	Column 4	Column 5	Column 6
Trial # which represents the number of half lives	Radioactive Isotope/Parent remaining **"S-side"**	# Daughter atoms produced this trial **(Blank side)**	**Total** Daughter atoms produced (this trial+ total from previous trial)	Total % Parent atoms (S-side remaining) **(column 2 x 2)**	Total % daughter atoms (total decayed) **(column 4 x 2)**
0	**50**	**0**	**0**	**100%**	**0%**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Part II

Create a graph of the **# of half-lives (x -axis) vs. the % of radioactive (parent) and non-radioactive (daughter) atoms (y-axis)** left. The parent graph line and daughter graph line should be plotted in two different colors.



Part III- Analysis Questions (Base on YOUR results)

1.) What % of the original atoms are unchanged/remain after 1 half-life?_______________

2.) How many trials (half-lives) did it take for roughly ½ the atoms to decay? ________________

3.) What % of the original atoms are unchanged after 2 half-lives? ___________

4.) What % of the original atoms remained after 8 trials? ______________________

5.) If you were using skittles…well, actually Carbon-14 to date a fossil that lived 1,000,000 years ago, what problems would arise when you tried to measure the amount of 14-C?