HALF LIFE SIMULATION

Prelab Assignment:

Your prelab assignment will be to read the entire lab and to complete the beginning of your lab write-up including **title, purpose, background information, storyboard of the procedure, and two data tables.** This needs to be done by your lab day and in your lab notebook.

PURPOSE: The goal of this activity is to simulate radioactive decay with different color paper discs.

INTRODUCTION: The different color paper discs can be used to discover the relationship between the passage of time and the number of radioactive nuclei that decay. As with real nuclei, the passage of time will be measured in half-lives. We will suppose that a red/black discs represents an atom of a radioactive isotope of the fictitious element Discium (Di). When the radioactive isotope flips to the all red side it has become stable and will no longer be discium but will now be Grellium (Gr). This atom will be represented by the green/yellow discs (get the name now?).

You will be given 100 atoms of Discium (red/black discs) which are all radioactive to start (therefore they will all be red/black side up). Placing all the atoms in the paper bag and shaking it for 5-10 seconds represents one half-life period. During this period a certain number of the red/black nuclei will decay to the red only side and be replaced by Grellium. You will simulate several half lives and track the number of radioactive and stable isotopes. We will then compile class data and analyze this data.

PROCEDURE:

1. Place all 100 atoms of Discium (red/black discs) into the paper bag with the red/black side up. Shake it for 5-10 seconds.

2. Open the container and **carefully** pour the atoms onto a flat surface. Remove all atoms that have decayed (FLIPPED OVER TO RED ONLY SIDE). Record this number in your data table (below) as decayed atoms for the first half-life. Record the number of remaining undecayed atoms for the first half-life also (discs that are still red/black).

3. You have completed one half-life at this point. You will need to replace all of the decayed discs that you removed with a now stable atom of Grellium (a green/yellow disc) and then repeat the shaking and counting/removing/replacing part of the procedure to represent a total of 4 half-lives (three more times).

4. Return all of the colored discs to the bag when you are done.

5. Copy your data under the title "My data". Make a second data chart with the title "Class Data". We will collect data from the entire class which will be filled into this chart.

DATA: You will record your data and then the sum total of the entire class's data in a neatly prepared data table.

POST LAB CALCULATIONS: There are no specific calculations for the lab data; however you will need to create an **x-y scatter** graph of the **class data**. Plot the number of half-lives on the **x-axis** and the number of undecayed atoms (discium) for each half-life on the **y-axis**. This should be done on excel and should be properly titled and labeled to receive full credit.

POST LAB QUESTIONS: Answer each of these in your lab book as completely as possible. For questions number 2, 3, 6, and 7 you must show work to receive credit. The other questions are to be

answered in complete sentences.

1. Study your graph of the class data. How many undecayed atoms would you predict if we had done another half-life?

2. How many undecayed discium nuclei would remain in an original sample of 600 nuclei after three half-lives?

3. If 175 discium nuclei remain from a sample of 2800 nuclei, how many half-lives have passed?

4. Name at least one similarity and one difference between this simulation and the actual process of radioactive decay.

5. In this simulation, is there any way to predict when a specific disc will "decay" (flip)?

6. Suppose you were given $1000 and told that you could spend one-half of it in the first year, one half of the balance in the second year, and so on. (I.e. one year corresponds to one half-life of the money)

a. If you spent the maximum amount allowed in each year, at the end of what year would you have $31.25 left?

b. How much would you have after 10 half-lives?

7. Cobalt-60 is a radioisotope used as a source of radiation in cancer treatments. The radiation it emits is effective in killing rapidly dividing cancer cells. Its half-life is 5 years. If a hospital starts with a 1000 mg supply, how many milligrams of cobalt-60 would it need to purchase after 10 years to replenish its supply back to 1000 mg?

CONCLUSIONS: Summarize what you learned from doing this activity in your lab report.