**Physics 30: Radioactive Decay**

*Simulating Radioactive Decay*

**Introduction:**

The rate at which radioactive isotopes decay can help us to determine how useful or how dangerous the isotope may be. Isotopes that decay rapidly can be useful for medical procedures because they pose no long term risks. Isotopes that decay more slowly, however, remain radioactive for a longer period of time and are considered much more hazardous. One way to measure the rate of radioactive decay is called ***half-life***. The half-life of a radioactive isotope is the time it takes for one half of the sample to decay.

**Purpose:** In this investigation we will be simulating the process of radioactive decay and half-life using a newly discovered radioactive material called Candium.

**Materials:**

* 50 – 60 Candium pieces (don’t been fooled by the similarity between Candium and M&Ms)
* Graph paper
* Plastic Cup
* Pencil
* Index Cards

**Procedure:**

1. Wash your hands and place a sheet of white paper on your lab bench or table.
2. Obtain a bag of Candium and count the total number of Candium pieces in the bag. Record this number on our data table. **Do not eat any of the Candium!**
3. Use the information below to conduct the simulation
   1. When the white “M” faces upwards the atom has not decayed
   2. When the white “M” faces downwards the atom has decayed
4. Record your start time.
5. Pour the Candium into your plastic cup. Cover with the index card and gentle shake for about 5 seconds. Pour the Candium onto the paper on your lab bench (be careful not to spill them on the floor).
6. Remove all the Candium that have *decayed* (Candium with the “M” face down) and set them aside. Count how many undecayed (radioactive) atoms remain and record this number in your data table. Wait 30 seconds before proceeding to step 6.
7. Place the remaining Candium atoms back in the plastic cup. Repeat steps 4 & 5 until you have completed your data table. You will need a total of 5 half-lives.
8. Once you have completed the table record your finish time.

**Observations:**

**Start time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**End time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |
| --- | --- | --- |
| **Half Lives** | **# of Undecayed M&Ms (Group Data)** | **# of Undecayed M&Ms (Class Data)** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |

**Analysis:**

1. Construct a graph for *your group’s* data. Plot # of **M&Ms** vs **number of half-lives**.
2. Construct a graph for *the class* data. Plot **# of M&Ms**  vs **number of half-lives.**
3. Compare the two graphs. Are they straight or curved? What sort of relationship is this?
4. Which data set do you believe provides a better demonstration of the half-life of Candium? Explain.
5. Using your start and end times and the initial and final numbers of Candium atoms, determine the experimental half-life of Candium.
6. If you started with 600 atoms of Candium how many would remain after 3 half-lives?
7. If you started with 3000 atoms of Candium and only 190 remain, how many half-lives must have passed?
8. Using the half-life you calculated in step 5 determine how much time has passed in question 7.
9. Using the model of Radioactive decay, can you predict when an individual Candium atom will decay? Why or why not?