Name: ______________________ Period: ______

# Half-Life of "Eminemium"

Radioactive decay is the spontaneous process by which the nucleus of an atom breaks into two or more pieces. Because this process changes the number of protons in the nucleus, it has the effect of transmuting one element into another.

Radioactive decay is a probabilistic process. This means that for any specific amount of time, there is a certain probability that any given atom of the isotope in question will decay. The "half-life" of an element is therefore the amount of time it takes for the atoms to have a 50% probability of decaying. On average, after one half-life, exactly 50% of the atoms of that isotope will have decayed.

The purpose of this activity is to better understand the process of radioactive decay.

## Directions

1. Obtain a cup full of M & M candies. Each of the M & Ms must have an "m" visible on one side. Eat any M & Ms that don't have an "m" on them.
2. Tape a *clean* piece of paper onto a desk or lab bench. Throughout this experiment, *eat ONLY M & Ms that land on this clean piece of paper!* Anything that touches a lab bench, a desk, or the floor may be contaminated with chemical residues, germs, or both.
3. Count your M & Ms. This is the number of "atoms" of Eminemium (symbol Mm; named after a famous musician) that you are starting with, (*i.e.,* after 0 half-lives).
4. Pour the M & Ms onto your clean piece of paper. This represents waiting one "half-life."
5. Remove and eat the ones that landed with the "m" side down. These are the atoms of Mm that have "decayed."
6. Record the number of number of half-lives that have elapsed and the number of atoms of Mm you have left in your data table.
7. Pour the M & Ms that landed with the "m" side up (the ones that haven't decayed) back into the cup and repeat steps 4–6 until all of the "atoms" of Mm have decayed.

## Data

Remember, if the "m" side is up, the "atom" is still there.

| Decay of Eminemium | | | | | | | |
|---|---|---|---|---|---|---|---|
| Half-Lives | # Left | Half-Lives | # Left | Half-Lives | # Left | Half-Lives | # Left |
| 0 | | 4 | | 8 | | 12 | |
| 1 | | 5 | | 9 | | 13 | |
| 2 | | 6 | | 10 | | 14 | |
| 3 | | 7 | | 11 | | 15 | |

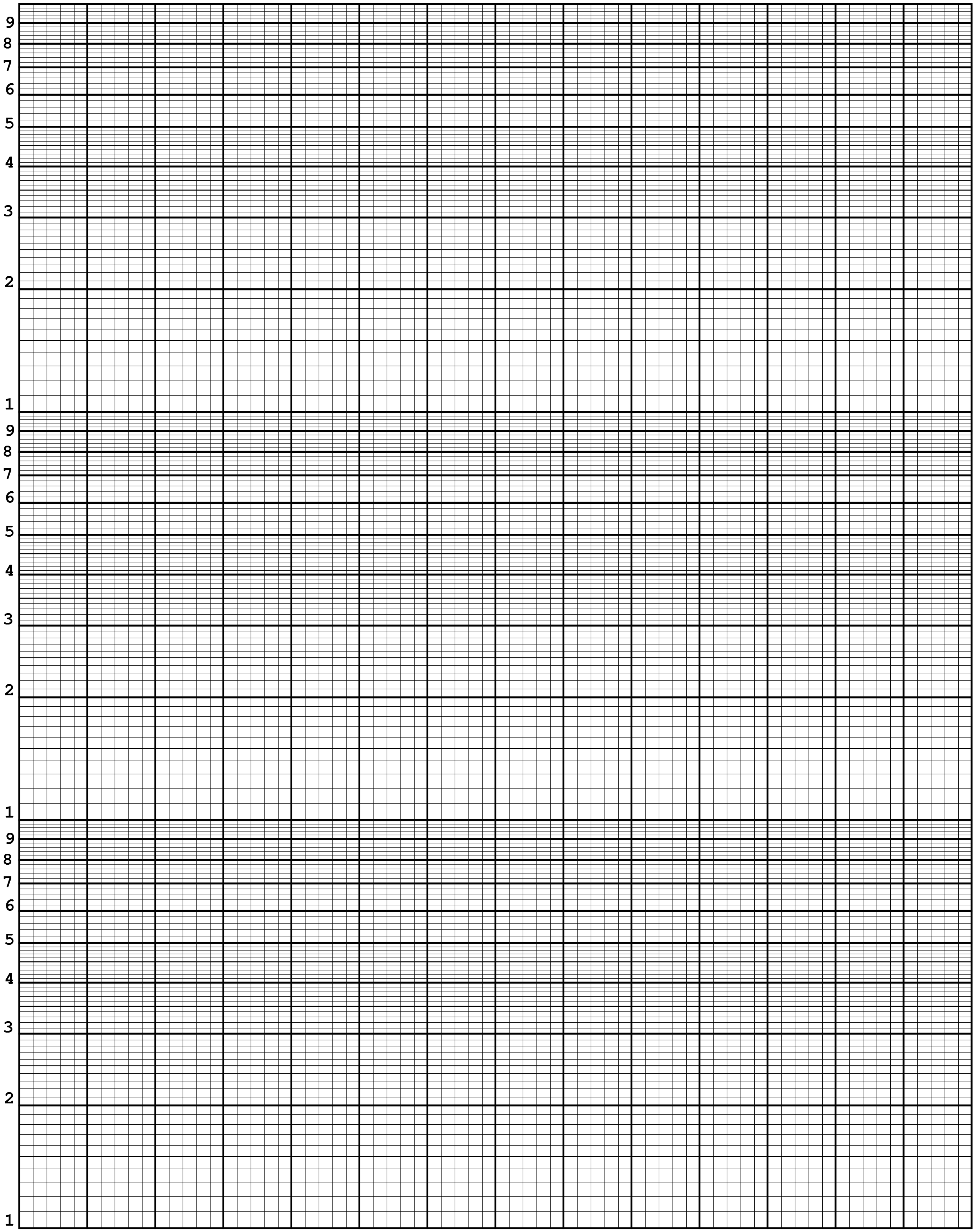
## Analysis

1. Plot the number of atoms of Mm left (dependent variable) *vs.* the number of half-lives that have elapsed (independent variable) on a sheet of regular (Cartesian) graph paper.
2. Plot the same data on a piece of semi-logarithmic graph paper. Plot a graph of the number of the number of atoms of Mm left (logarithmic scale) *vs.* the number of half-lives that have elapsed (linear scale).

## Questions

1. How many half-lives did it take for your entire sample to "decay"?

2. What happened when you had only one "atom" left? (Did half of it decay? Did it decay right away? Did it take several "half-lives" to decay?)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