Classroom Experiment: Radioactive Decay of M&Ms

This is a classic experiment to explain radioactive decay.

Hypothesis

How many times do you have to shake the bag and count the decayed atoms before they are all gone?

Materials

- M&M™ candy pieces*
- resealable plastic bag
- graph paper

* use only candy with printing on one side (plain M&Ms); pennies work well too.

Instructions

Place 50 "atoms" of M&Ms in the bag. Seal the bag and gently shake for 10 seconds. Gently pour out candy.

Count the number of pieces with the print side up and record the data. These atoms have "decayed." Return only the pieces with the print side down to the bag and reseal the bag. Consume the decayed atoms! Gently shake the sealed bag for 10 seconds. Continue shaking, and counting until all the atoms have decayed. Graph the number of undecayed atoms vs. time.

Questions

1. What is a half-life?
2. In the experiment, what was the half-life of the M&Ms?
3. At the end of two half-lives, what fraction of the atoms had not decayed?
4. Describe the shape of the curve drawn (undecayed atoms vs. time).
5. Repeat the experiment three more times, starting with 30 atoms, 80 atoms, and 100 atoms of M&Ms. Compare the resulting graphs.
6. Repeat the experiment using half-lives of 5 seconds, 20 seconds, and 1 minute. Compare the resulting graphs.

Instructor's Note: Theoretically, an individual atom might never decay, just as a student might never see an M&M fall print side up). Students can keep track of this data and graph the results. The overall shape of the graph is similar to that for the decay of all radioactive isotopes (but the rate varies by type of isotope). A variation on this idea, which would make this simulation more realistic, would be to have different students (or groups) shake the candy at specified time intervals. For example, one group could shake

the candy every minute, another group every minute and a half, and another group every two minutes. This would help simulate that different isotopes have different half-lives. This would also reinforce the idea that the general shape of the graph is the same even if the time scales are different.

Radioactive Decay Diagrams

Most physical science textbooks include information on radioactive decay and examples of at least one of the radioactive decay series. Have students chart or diagram an atom and show what it becomes as it gives off radiation and moves toward stability. Good worksheets of this for the U-235, U-238, and Thorium-232 series can be found in the *Science, Society, and America's Nuclear Waste* series.
(http://www.ocrwm.doe.gov/info_library/program_docs/curriculum/)