

M&Ms as Isotopes – Teacher Document

CONCEPTS: Isotope, Fractional Abundance, Average Atomic Mass

BODY:

M&M's (Mars, Inc.) come in a number of colors and sizes. I have found them to be a good visual and kinesthetic model for examining the concept of isotopes and average atomic mass. I use Mega M&Ms, M&Ms minis, and regular M&M's in this activity. All of these can be purchased in the candy or baking aisles of your local big box store. The color of the M&M's represent that they are the same element and have the same number of protons. The size represents, in a relative sense, the different numbers of neutrons. I set up 6 stations around my room, each having a portable balance with a weigh boat and a baggie of sorted M&Ms.

The make-up of each baggie is as follows:

	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Color → Size ↓	Red M&M's	Red M&Ms	Red M&Ms	Blue M&Ms	Green M&Ms	Brown M&Ms
Mega M&Ms	4	8	2	8	4	4
Regular M&Ms	16	32	8	16	32	16
Mini M&Ms	80	160	40	80	80	160

The numbers represent how many of that color and size M&M get included in that baggie. Stations 1, 2, and 3 will all have the same weighted average in the end because they have the same relative percentage of each size. They all have the same color M&M so that students view those as the same “atom”. Stations 4, 5, and 6 have different “isotopic ratios” so their average atomic mass will come out to be different, which is expected since they are different “elements” (represented by the different colors). It takes ~ 2 hours of teacher prep time to go shopping, count and sort the M&M's into baggies. Set out the baggies and portable balances prior to students entering the room if possible.

Students particularly like it when I allow them to eat the orange and yellow M&Ms at the end of the activity. These colors come in the bag, but are not used during the activity. I am not comfortable allowing students to eat the candy from the baggies since so many students have handled these candies.

I have seen an activity on the web similar to this that uses plain and peanut M&Ms, but it has been my experience that students don't connect the colors being the same element since those have different “insides”. Students seem to connect this model to atoms better in my experience – more chocolate equals more neutrons, but the same color candy shell means the same element. In addition, by using different sized M&Ms instead of just plain and peanut, I can have 3 “isotopes” in the sample instead of just 2.

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Class Time: 45-55 minutes

Materials:

- 6 baggies
- 6 balances
- 6 weigh boats

Teacher Preparation and Activity Sequence:

- Prepare the baggies and the stations as described above.
- Print out the student worksheets (below).
- Introduce the exercise and the concept of isotopes. Give instructions that no student is to eat any of the candies at any of the stations around the room.
- Allow students to complete the worksheet (traveling to different stations as necessary). I take the number of students in the room and divide by 6 to determine the group size.
- As time allows, review the “think about it” questions with students.