Lab: Percent Composition of M&M’s

FOR THE TEACHER

Summary
In this lesson, students explore the idea of percent composition by investigating different varieties of M&M’s.

Grade Level
High or middle school

Objectives
By the end of this lesson, students should be able to
- Understand percent composition

Chemistry Topics
This lesson supports students’ understanding of
- Percent composition

Time
Teacher Preparation: 30 minutes
Lesson: 45 minutes

Materials
- M&M’s (different varieties)
- Balance
- Paper towels
- Cupcake liners

Safety
- Food should never be consumed in a lab setting, so if students are permitted to eat their M&M’s after the lab, make sure the activity is carried out not in a lab setting.

Teacher Notes
- To extend this investigation, students could determine whether the different colored M&M’s have different masses, and that equates to different elements having different atomic masses in a compound.

FOR THE STUDENT

Student Activity Sheet: Percent Composition of M&M’s

Lesson
Background
M&M’s milk chocolate candies were first manufactured in 1941 when Forrest E. Mars, Sr. formed a company in Newark, New Jersey, to make chocolate candies. The original idea was to offer chocolates that could be sold throughout the year including summer, when many consumers stopped buying chocolate because of the
elevated temperatures. Many stores either discontinued stocking chocolate or greatly reduced buying because homes, cars, and shops were not air conditioned at that time.

M&M’s are milk chocolate inside a thin, colorful shell. The chocolate used in M&M’s has melting characteristics of fine chocolate. This gives the product its great taste; however, the shell encapsulates the chocolate and gives a crunchy texture. This eventually gave rise to the slogan “melts in your mouth, not in your hand,” which was used all over the world in many different languages. M&M’s peanut chocolate candies are whole roasted peanuts covered with milk chocolate inside a thin, colorful shell. They were first manufactured in 1954.

In the seasonal Christmas and Easter presentation of M&M’s candies, an almond variety was introduced in 1988 and a mint chocolate variety in 1989. In 1990, the company began to sell M&M’s peanut butter chocolate candies. One of the latest additions to the M&M’s candies is the M&M’s MINI’s. They are one-third the size of regular M&M’s. M&M’s MINI’s also contain a pink color in the mix. Specially designed packaging adds to kid friendliness. Each M&M’s MINI’s tube contains more than 100 pieces of candy.

M&M’s colorworks, a kaleidoscope of 21 brightly colored plain M&M’s, are available at selected specialty candy stores and via the Internet (www.mms.com). The 21 colors can be blended in any combination imaginable via the unique dispenser system. Colors include white, black, gray, gold, brown, red, green, orange, yellow, blue, light blue, pink, dark green, teal green, aqua green, dark blue, purple, light purple, dark pink, cream, and maroon.

The average color composition of large batches of M&M’s is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Brown</th>
<th>Yellow</th>
<th>Red</th>
<th>Blue</th>
<th>Orange</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain</td>
<td>13%</td>
<td>14%</td>
<td>13%</td>
<td>24%</td>
<td>20%</td>
<td>16%</td>
</tr>
<tr>
<td>Peanut</td>
<td>12%</td>
<td>15%</td>
<td>12%</td>
<td>23%</td>
<td>23%</td>
<td>15%</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>10%</td>
<td>20%</td>
<td>10%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Almond</td>
<td>10%</td>
<td>20%</td>
<td>10%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Crispy</td>
<td>17%</td>
<td>17%</td>
<td>17%</td>
<td>17%</td>
<td>16%</td>
<td>16%</td>
</tr>
<tr>
<td>Christmas</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
</tr>
<tr>
<td>MINI’s</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>25%</td>
<td>25%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Varieties with custom colors have the following breakdown:
- Valentine’s Day: 40% pink, 40% red, 20% white
- Easter: 25% each of pastel yellow, pastel blue, pastel green, and pastel pink

**Prelab Questions**

1. How do you find the percent composition by mass of individual elements in a compound?
2. Do you think the percent color in each bag of M&M’s will match the table above? Why or why not?

**Purpose**

To find the percent composition of the different colors of M&M’s candy.

**Materials**
balance, cupcake papers, paper towels, calculator, variety of M&M’s in small packages

SAFETY
1. Do not let the M&M’s come into contact with the lab bench. It is not sanitary and any contaminated M&M's cannot be eaten at the end of the lab.
2. Always take the mass of the M&M's in cupcake papers.
3. Get permission from your teacher before you eat the M&M's.

Procedure
1. Determine what package of M&M’s your group is responsible for collecting data in addition to plain M&M’s.
2. Find the total mass of only the M&M's in one package and record it in table 1.
3. Separate the M&M's by color on a several paper towels.
4. Find the mass of each color of M&M's and record the masses in table 1.
5. Repeat steps 2–4 for each different package of M&M’s that your group is responsible for.
6. Record your data with the class data.

Data
PLAIN M&M’S
Total mass of M&M’s:

<table>
<thead>
<tr>
<th>Mass of individual colors</th>
<th>Percent of individual colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
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<tr>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

____________ M&M’S
Total mass of M&M’s:

<table>
<thead>
<tr>
<th>Mass of individual colors</th>
<th>Percent of individual colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td></td>
</tr>
</tbody>
</table>
Analysis
1. Which color of M&M's had the highest percent composition for your group? for the class? Should these colors be the same percentage for every group? Why or why not? (Give separate answers for the different packages of M&M's.)
2. Which color of M&M's had the lowest percent composition for your group? for the class? Should these colors be the same percentage for every group? Why or why not? (Give separate answers for the different packages of M&M's.)
3. Why do you think the percentage came out the way they did? Is there a reason for some colors to be more prevalent than others?
4. Do you think the M&M candy company sorts the M&M's into the bags on purpose or is it random? How would they sort them?
5. Did the other variety/varieties of M&M's have the same color percent composition as the Plain M&M's? Is this what you expected?