THE M&M's LAB

In this experiment, you will be practicing the skills of observing, hypothesizing, estimating, graphing, and measuring. WARNING: *DO NOT EAT any portion of your experimental materials until you are finished with the entire experiment, or until you are directed to do so in the procedure!*

PART ONE

1. Gather the following materials for each student on the team:
   1 snack pack of M&M's Plain chocolate candies, UNOPENED
   1 student data sheet

2. Without opening the package of M&M's, **guess how many** pieces of candy you think there are in the package. Record that guess on your data sheet.

3. How many colors of M&M's do you think there are? **List the colors of the M&M's you expect to find** on the data sheet. Which color do you think will be the most common in your packet of M&M's?

4. If a balance is available, weigh the UNOPENED package of M&M's. Record the mass on the data sheet.

5. Place the data sheet on the lab table with the grid side up. Open the package of M&M's and carefully pour them onto the data sheet. **SAVE THE EMPTY PACKAGE FROM THE M&M's.**

6. If a balance is available, weigh the empty package from the M&M's. What is the **net weight** of the candies? (Save the empty package.)

7. Count the actual number of M&M's that were in the package. List the actual colors of the M&M's that were in the package. Which colors are different than those you guessed above? If you got all the colors correct, congratulations! You have observed lots of M&M's before!

8. Sort the M&M's into colors, so that you know how many of each color you have. You can use the squares on the data sheet to make a bar graph of the M&M's colors. Count and record the number of M&M's of each color on the data sheet.

9. Check with several people to see if they had the same number of M&M's and if they had the same color frequency. Did they have the same number of M&M's of each of the colors? These packages are sold by weight, do the total candies in each package weight the same? If these packages contain the same weight, why do they contain different numbers of candies? Why do you suppose that there are different numbers of candies of each color? Which color is most common for most people? Which color is least common?
   Discuss these answers with your group and with the instructor.

10. Do a comparative taste test. Eat no more than one of each color, and eat them one at a time. Is there any difference in the taste of the different colored M&M's?

PART TWO

11. Gather the following additional materials for each group:
    6 pieces of filter paper (coffee filters) or paper towel
    1 eyedropper filled with water

1 M&M of each color
1 sheet of waxed paper or plastic wrap
Your empty M&M's package wrapper

12. Read the ingredients on the M&M's package, and list any ingredients that seem to be involved with the *color* of the M&M's.

13. Examine the M&M's, and list those colors you think contain one or more of the ingredients listed in #12, above.

14. List the colors that you know as primary colors.

15. How are colors such as orange, brown, and other non-primary colors made?

16. To test to see what colors might be in the candy shell of an M&M, we will use a technique called paper chromatography. We will transfer some of the color from an M&M to paper, and use a liquid to "carry" the color across enough paper to be able to see if there are different primary colors in the M&M candy shell. Separate the six pieces of filter paper and place them on a sheet of waxed paper. Put one M&M in the center of each filter paper. (If a paper towel is used, spread the six pieces of M&M's evenly around the sheet of paper towel.) Place ONE drop of water onto each M&M so that some water runs down onto the filter paper. Add a second drop only if the first drop does not seem to run onto the paper, but do not add too much water. When they have developed enough to see, remove the M&M from the water and discard it. Record the composition of the dye for each of the M&M's in the space on the data page. Be sure to label each diagram for the color of the original M&M.

17. Attach the filter papers to your data sheets. (Split them between the members of your group.)

18. After cleaning up all materials, you may eat the rest of your M&M's.

Acknowledgement

This investigation is based on *The M&M Lab* by Irene Jordan, Central High School, Greeley, Colorado

THE M&M's LAB
TEACHER NOTES

This experiment is particularly useful for an introduction to graphing. Each square on the grid is one M&M square. DO NOT instruct students on how to make their graphs.

When the students place their pieces of M&M's on the grids provided, they will use different type of graphs, mainly bar graphs, depending on their personal preferences. Some will be horizontal, some will be vertical, some will have colors on two or more lines, some will extend the lines to make them longer. ALL the graphs are CORRECT. Some are better than others. Have the class observe the different types of graphs and let them "discover" which graphs give them the best information.

There are two answer sheets with grids provided. The grids are constructed so that one contains one more line than actual M&M colors and one contains one line less than actual M&M colors. Use the same grid for the entire class to avoid confusion. Use different grids for different classes to see how the different classes responded to the different data pages. Point out, to the class, how different students handled the problem when they have the grid that contains one less line than actual M&M colors.

Name _____ Date _____

THE M&M's LAB

DATA AND RESULTS

PART ONE: The answers are keyed to the questions on "The M&M's Lab"

2. There are _____ M&M's in the package.

3. There are _____ colors of M&M's. The colors are _____

_____

4. The mass of the package of M&M'S is _____

6. The empty package weighs _____. The net weight of the M&M's is _____

7. The actual number of M&M's is _____

The actual colors of the M&M's are _____

_____

	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												

8. The total number of M&M's of each color are _____

_____

_____

9. Record summary of discussions with other groups and any additional observations below:

10. Taste test results: _____

_____

_____

PART TWO

12. Ingredients linked with color might be: _____

_____

13. Colors that contain one or more of the ingredients in 12, above _____

_____

14. Primary colors include _____

15. Non-primary colors _____

16. Colored dyes in M&M's

A. Original Color _____ Composition of dye _____

B. Original Color _____ Composition of dye _____

C. Original Color _____ Composition of dye _____

D. Original Color _____ Composition of dye _____

E. Original Color _____ Composition of dye _____

F. Original Color _____ Composition of dye _____

G. Original Color _____ Composition of dye _____

Name _____ Date _____

THE M&M's LAB

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8. The total number of M&M's of each color are _____

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