

# Exploring Science with M & M's™

## Overview

This experience provides an introduction to the methodology and framework of Questions, Claims, and Evidence investigations. Using simple equipment and a common candy, students practice observational skills, forming testable questions, designing experiments, data collecting, and analyzing data to provide evidence for a claim that can be defended. The initial investigation can lead to many more testable questions that can easily be done to experience the eight practices of science outlined in the Next Generation Standards. This is not a step by step activity. It is intended to provide different possibilities for completely the activity. The decision making is negotiated between teacher and the students. We recognize that each teacher and each of their classrooms are unique and thus the implementation of each of these activities is not based on replication but rather an adaption to each of these individual settings. Each of these different situations will provide a unique pathway for reaching the final outcome of the activity.

This activity and those that follow engage students using two knowledge bases, the knowledge of science argument and the conceptual knowledge related to the activity. For example, in this activity the science argument knowledge prior knowledge of QCE and their science knowledge is expanded through the activity. The point of emphasis is that students are using both of these knowledge bases at the same time; they are not done separately. The advantage of this is that students are engaged in construction science knowledge in the ways in which science is practiced. This is what scientists do.

## Key Science Concepts

- Properties of matter
- Dissolving
- Density
- Solvents
- Properties of matter

## Key Science Argument Concepts

- Testable questions
- Data
- Reasoning
- Evidence
- Claims

## Setting the scene

### Multiple ways to introduce the investigation including

- Put an M&M in your mouth, without chewing. How long will it last?
- You know how the candy acts in your mouth, I wonder what will happen if I put it in water?
- Someone told me about this activity but I don't know what will happen.

## Lab Safety

Safety should not be approached as a set of rules but a culture of lab safety. What is appropriate behavior in a lab where food is used for experimentation? Why? Does this pertain to food in general brought into the lab? Discuss the reasons. *It is important to remember that there is no eating in a lab and things are not to be tasted unless an instructor says it's ok.*

## Procedure

Groups should design their own experiments. When claims and evidence are presented during discussion of results, peers have an opportunity to correct errors in experimental design.

### Question generation:

- Do all the colors act similarly?
- Does the temperature of the water affect the rate of dissolving?
- If I use more than one M&M in the same bowl, will the colors mix?
- If I do the experiment using oil instead of water, will the results be the same?
- What will happen if I stack M&M's in a test tube instead of a bowl?
- When I stack them, is the order of the color important?
- Is there a difference in the results if I pour the water over them as opposed to dropping them in water?
- Do different types of M&M's (peanut, pretzel) act similarly?
- Do other types of hard-shelled candy (Skittles, Reese's pieces) are in a similar manner?
- Is the color that dissolves in a sphere completely surrounding the candy?
- Would a colored sugar solution dropped in water act similarly?

### Selecting your question:

There are many ways to decide on the question the class will explore. This selection will be based on the experience and personality of the instructor, classroom setup (arrangement of the room), and the comfort zone of instructor.

1. One question for the class to explore
2. Each group selects their own question
3. Half class explore one; other half a different question

### Recording data:

Deciding on protocol for their test small or whole group negotiated; shared data whole class or individual groups. Some possible formats include:

1. Cell phones/tablets for timing, videoing, still or time-sequence picture
2. Google docs, shared formats
3. Notebooks

### Analysis of data:

Pattern analysis, time analysis

### Claims and Evidence:

Each group will present their claim and defend it with the evidence they collected. During this

peer review, all class members will have an opportunity to question results and claims, methods of experimentation used, and negotiate meaning.

## Science Explanation

A solution consists of one substance, the solute, dissolved in another substance, the solvent. The solvent is generally the component present in the smallest amount. In this case, the sugar coating on the candy is the solute and the water or oil is the solvent. As a generalized rule, one substance will dissolve in another if the two have similar composition—hence the expression, “like dissolves like.” If a material dissolves in water, it is either a polar material or an ionic compound. Water, a polar molecule, has a slight negative charge on one side of the molecule and a slight positive charge on the other. Substances with similar areas of slight negative and positive charge are attracted to water molecules and so dissolve in water. Ionic compounds are also dissolve in water. Since the coating on the candy dissolves, the sugar and the food coloring dye must be polar. Oil, on the other hand, is nonpolar. It will dissolve other substances that are similar in composition like grease, some types of dirt, chocolate; it does not dissolve sugar.

Mixing is a very slow process. That is why things are stirred to encourage mixing. As the sugar coating dissolves, the dissolved solute stays in close proximity to the candy forming a circle. The circle is actually on the bottom of the container as it is denser than the water. If two candies are placed close to each other, the circles from each candy do not mix. Sometimes the glue holding the M on the candy will dissolve and the M will slide off or float off the candy intact.

The sugar coating will not dissolve in nonpolar oil.