

Mystery of the Red Cups Teacher Notes:



INTRODUCTION

This is a great story because the demonstration that goes with it is unusual, unexpected and very thought provoking. It is a great story to tell during the first week of school when you are talking about the importance of making careful observations of the world us. In this Explora-Story, students make observations, form explanations, and then connect their ideas to the real world. It is also a super activity to do when you are studying matter - the stuff of the universe - because you work with a compound called Waterlock that is the coolest substance on the planet. It's amazing and unusual properties will fascinate your kids and they'll be eager to discuss some very important science concepts.

During the story, students will gain vital experience with scientific thinking. They will see water seemingly disappear from a cup in front of their eyes, and use their powers of observation and logic to advance explanations for what they saw. *The Mystery of the Red Cups* is an excellent way to start students thinking like scientists – without them even knowing they're doing it.

OBJECTIVES

The students will describe that nature is predictable and we can use evidence to explain and understand it.

The students will understand that each substance (material) has unique properties that help make it useful.

SCIENCE STANDARDS

Georgia Performance Standards: Habits of the Mind

SK-5CS1. Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

- a. Keep records of investigations and observations and do not alter the records later.
- b. Carefully distinguish observations from ideas and speculation about those observations.
- c. Offer reasons for findings and consider reasons suggested by others.

National Science Standard: Unifying Concept

Nature is predictable and we can use evidence to explain and understand it.

National Science Standard: Physical Science Content Standard:

Objects have many observable properties, including size, weight, shape, color and the ability to react with other substances. These properties can be measured using tools such as rulers, balances, and thermometers.

MATERIALS

Three 16-24 ounce plastic cups (not included)	Cups must be opaque (not see-through) and colored white on the inside to hide the Waterlock powder.
1 clear plastic cup (not included)	Clear plastic cup similar in size to opaque cups.
Waterlock powder (included)	Two teaspoons needed per demonstration.
Plastic teaspoon	For spooning and stirring Waterlock.
Safety Goggles (recommended)	One pair for teacher.

Safety and Disposal

Although Waterlock is not toxic, you should avoid letting students touch it because if crystals get from their fingers to their eyes it can be very irritating. Anyone who does touch the Waterlock should rinse their hands thoroughly after the demonstration. You can dispose of it by washing it by throwing it away or washing it down the sink with a lot of water.

Concept Discussion:

The Mystery of the Red Cups Explor-A-Story allows teachers to demonstrate the scientific way of thinking in an exercise that truly engages students. It presents them with an unexpected result and challenges them to develop explanations – just like a good magic trick. The exercise has students make careful observations as the cups are being shuttled around so that they can follow the one containing the water. When the water fails to fall from the inverted cup, students must then make additional observations and develop explanations to explain the missing water. The Explor-A-Story enables teachers to give their students practical experience with scientific thinking and it can also be used to show how seemingly unexplainable events have logical answers if studied carefully.

“Waterlock” is the trade name for sodium polyacrylate, a light-colored crystal that resembles table salt. It has the ability to absorb 800 times its weight in water and it binds up liquids in gel form (Figure 1). That means that if you were a 100 pound chunk of this stuff and you jumped into a swimming pool, you would absorb over 80,000 pounds of water from the pool. Waterlock is consequently used in instances where liquids are undesirable. Plumbers use it to soak up standing pools of water. Emergency rooms use it to bind up liquid blood on floors. But the most famous and profitable use of Waterlock is in diapers where it is sewn into the fabric so that the baby’s urine (mostly water) gels rather than leaks through the diaper and pants.



Fig. 1. Sodium polyacrylate gel

As a side note, substances, including water, usually move from where it is more crowded to where it is less crowded (from higher to lower concentrations). The water molecules move into the center of the sodium polyacrylate molecules because there is less water on the inside than there is on the outside. This causes the water to "gel". You can reverse the process by adding sodium (table salt) to the glass and stirring it.

Explor-A-Story Preparation

Before you begin this Explor-A-Story, you will need three identical cups that are opaque and white on the inside. Place about one-fourth (or one scoop of Water Gel if you get it from Steve Spangler) you have of a teaspoon of Waterlock into one of the cups before students come into the class. Have the three cups placed out on a table for your students to see before you start the story. Also, have a couple of clear glasses of water (room temperature or slightly warm is best) and a spoon out in view of the students. Keep the Waterlock and the salt close by but out of sight at the start of the story.

Essential Questions

1. What observations did you make that might help you explain what happened to the water?
2. Brainstorm 3-5 ideas that could possibly explain what happened to the water.
3. If you invented this substance, what could you use it for and how could you sell it to make a profit?
4. Describe other ways that scientists depend on careful observations to explain things that are happening in the world.