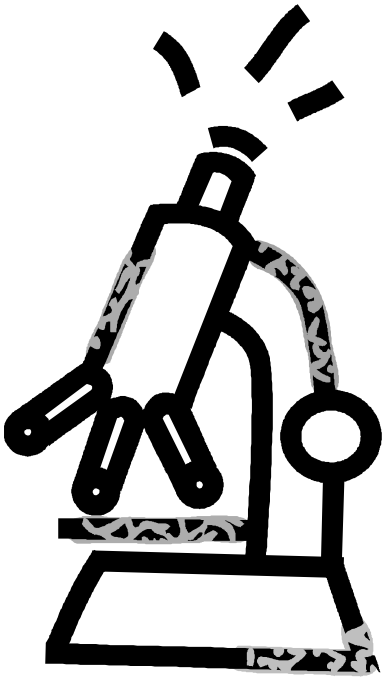
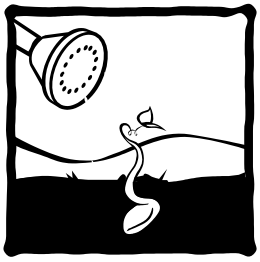
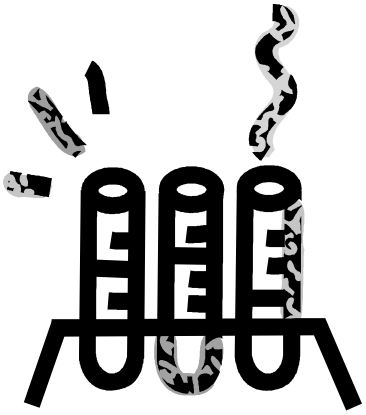


My Science Notebook



Name _____



Stephanie Lester – 2014

Rainbow Crystals – Water -Absorbing Polymer Crystals

Materials:

- Water absorbing crystals – 12 oz. of dehydrated crystals – 1 tsp in 16 oz. of water = 1 quart of hydrated crystals, 2 T in 64 oz. of water = 1 gallon of hydrated crystals
  (You can find these crystals at plant nurseries, garden centers, and some educational companies. They are sold by various companies such as: Stephanie Lester Sensible Science.
  Only use the crystals that DO NOT have any additives for plant growth.
  Coarse granule size works best for the color changing and crystal observation experiments.)
- Liquid watercolor (red, blue and yellow) or coloring tablets (bath tub tints work)
- Water source (tap water works fine although you may want to compare the difference between tap and distilled water)
- Tablespoon (for measuring crystals)
- 4 gallon and/or quart size resealable plastic bags – (quart-size for 1 teaspoon of crystals, gallon-size for 2 Tablespoons of crystals)
- Clear containers - (empty water bottles, graduated cylinders, clear cups, pre-form soda bottles) – each child could have one and/or you may choose to use one large container as a demonstration to keep in the classroom.
- Pipettes or eye droppers (to put liquid watercolor in bags of crystals)
- Red, orange, yellow, green, blue and purple crayons, pencil, rainbow crystals observation sheet

Step By Step:

This activity will be completed in two parts.

Part one

1. Encourage the exploration of the dehydrated crystals by the children. Pass some around in a small container to be touched and observed.
2. Measure out 2 Tablespoons of the crystals into each gallon size plastic bag.
3. Fill the bag ½ full with water.
4. Add liquid watercolor to create a vibrant primary color in three of the bags (red, blue and yellow), leave the 4th bag clear. Seal the tops of all the bags.
5. Setting the bags of crystals inside of a tub-type container keeps them upright.

Part Two

1. Periodically check on the crystals with your students. When the crystals have absorbed all the water they are ready for part two. It could take 1-2 hours for the crystals to become completely hydrated depending on conditions in the room.
2. If you are creating one rainbow crystal display – you are ready to go. If each child will be creating a rainbow display, the containers and colored crystals need to be put out at their group spaces.

To Introduce the Activity

1. Read the book of your choice that reinforces the theme of color.
(*White Rabbit's Color Book*, Alan Baker, *All The Colors of the Rainbow*, Allan Fowler)
2. Demonstrate the process of performing this experiment to the entire group by following the steps outlined below:

Steps To Complete the Activity

1. Pass around a cup of the hydrated crystals. Encourage the children to describe the crystals. How have they changed?

2. Review the colors of the rainbow, red, orange, yellow, green, blue, and purple. Ask how we could use these three primary colors to make a rainbow in our container.

3. Fill the bottom 1/3 of the container with the red crystals, then add yellow crystals for the next 1/3, end with the blue crystals, leaving enough room to add a layer of red crystals (to make purple). Seal the top of your container, if it doesn't have a tight fitting lid, use plastic wrap to seal the top.
4. Have the children observe closely and see if they notice any changes. Have them record their observation on the rainbow crystals observation page.
5. If each child is making a rainbow display, have them go to their groups and create their rainbow display, using the classroom display as a model.
6. Put the clear crystals out in a tub, creating a sensory activity for the children. Have them wash their hands before and after touching the crystals. (This will help to keep the crystals clean and last longer.) You can repeat this activity over a few days.

Fun Water Absorbing Polymer Crystal Questions and Facts

What are these crystals made out of?

They are a polymer, which is a long chain of molecules. Their official name is *cross-linked potassium polyacrylamide copolymer gel.* They can soak up to 300 times their weight in water and have been determined to be non-toxic and non-hazardous. These crystals are mostly used in the agriculture business by farmers and gardeners. Another form of this polymer is used in baby diapers due to its ability to absorb lots of liquid.

How long will they last?

The crystals will stay hydrated as long as they are kept in a sealed container. They will continue to 'mix' colors and the rainbow will eventually be brownish. If you just mix two primary colors in the container and seal it, the crystals will remain the secondary color once they are totally mixed.

Could I put them in my yard?

The original use of these crystals was for gardeners desiring to reduce the need for watering their plants. Since the crystals absorb so much water and release it slowly over time, they are effective in reducing the amount of water needed for a plant to grow by 50 – 75%. They are commonly used in golf courses and other areas that require lots of watering.

What would happen if I put them in my houseplants?

They can be mixed in your houseplants' soil to reduce the need to water. Be sure to hydrate them before mixing them into your houseplant soil, otherwise when you water your plant and the crystals expand they will push your plant out of the pot. (This would be a good practical joke, but for someone else!) For outside flower beds, you can just mix some into the soil around your plants.

What happens if they dry out? Can I reuse them?

Dehydrating the crystals is another activity for your class, lay some out on a flat surface and observe what happens. After a couple of days they will be dehydrated back to their original size. At that time, you can rehydrate them by placing them in water. This process can be repeated over and over.

Can I color them once they are hydrated?

NO, they only way to color them is by using colored water to hydrate them.

How long can I use them in a sensory table?

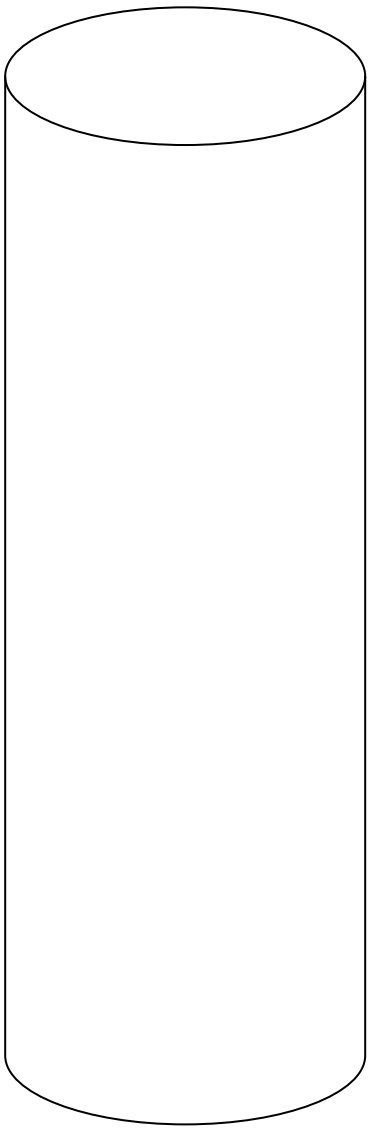
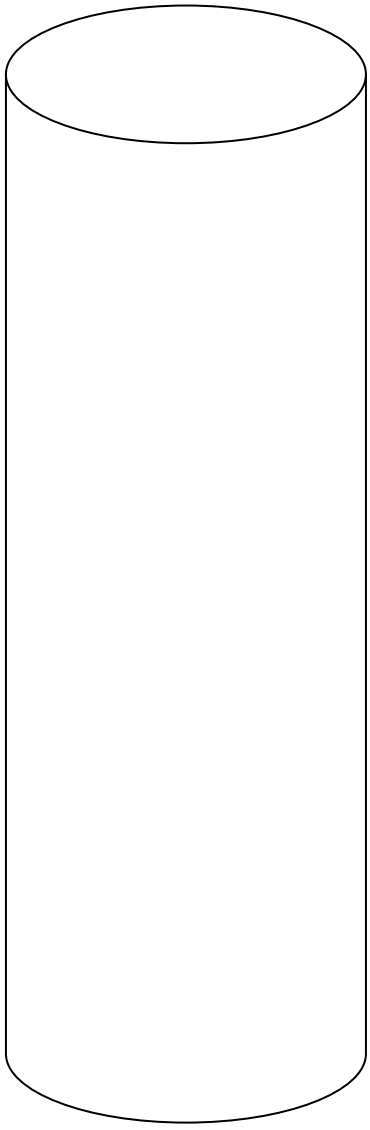
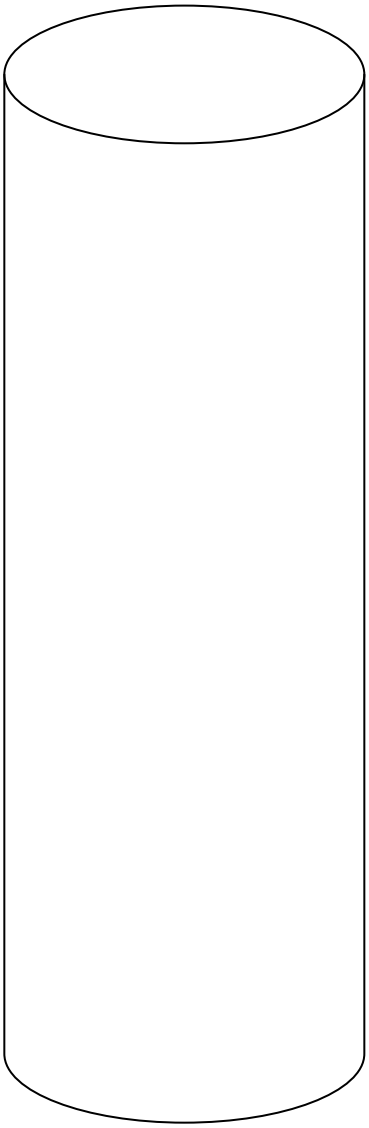
Consider them as a play dough-type product, the cleaner the hands that are exploring, the longer they will last. Sealing them up between uses will keep them hydrated.

What else can I do with the clear crystals?

The clear crystals are a great way to allow children to see the roots of a plant. Take a small plant out of its soil, carefully rinse off its roots and place it into a clear cup filled with clear hydrated crystals. Add a little water until you can see the roots clearly. It will live in the crystals for a couple of weeks before running out of nutrients. Using the clear crystals, you can also sprout seeds in a clear cup and observe the whole process.

Name_____

Rainbow Crystals Observation Recording Sheet

Observation #1	Prediction	Observation #2
This is what the rainbow crystals display looks like on day 1:	This is what I **predict** the rainbow crystals display will look like on day 5:	This is what the rainbow crystals display actually looks like on day 5:
		

A Rainbow of Color - Color Mixing

Materials:

- colored water in the primary colors (red, blue, yellow)
- clear mixing trays (egg cartons, ice cube trays)
- clear plastic cups (10 – 12 oz work well)
- pipettes or eye droppers (at least one per cup)
- crayons, pencil, color mixing recording sheet

Experiment:

1. Fill the three plastic cups 3/4 full with colored water.

2. Using a pipette dip the end of the pipette into the colored water, squeeze the bulb to push the air out, and release your squeeze to draw up some liquid. It's great for developing fine motor skills and offering opportunities for practice enhances this activity.

4. Drop a few drops of colored water into one of the compartments in the mixing tray, record the color on your recording sheet (make a small circle with the matching crayon), predict what will happen if you add another color, then add the second color and observe. Record your observation on your recording sheet. What is the secondary color you created?

5. Continue until all the compartments are full of different shades of the secondary colors (green, purple and orange). Remember to emphasize the scientific process throughout the experiment of predicting, observing, recording (if possible) and evaluating.

Notes for facilitator:

Allow the students to make their own discoveries as you are reinforcing the scientific process of prediction, observation, recording and evaluation.

Have clipboards available for the students to use while completing their recording sheets. (A piece of heavy cardboard with a clothespin works well.)

Remember that exploration leads to inquiry which leads to a discovery! It's sometimes difficult to find time for students to explore and discover on their own. After completing this experiment with your class, set up a discovery center with all of the materials needed for 3 or 4 students to revisit the color mixing activity independently.

Name _____

A Rainbow of Color - Color Mixing Recording Sheet

Use crayons to record the colors you mix below. Remember to make a prediction to your partner or group before adding the 2nd color. Print the numbers and symbols for the last 3 equations. Read your equations to your partner or group (for example: Red plus blue equals purple).

1.		**+**	**=**
2.		**+**	**=**
3.		**+**	**=**
4.		**+**	**=**
5.		**+**	**=**

Reduce, Reuse, Recycle, Redecorate

Materials

Demonstration Materials:

Science journal *Reduce, Reuse, Recycle, Redecorate* observation page
Cornstarch packing peanuts (You can tell if they are cornstarch if they dissolve when put in water.)
Cup of water (large enough for a few packing peanuts to fit inside)
A damp sponge on a plate
Scissors
Pencil
crayons

Student Materials:

Science journal *Reduce, Reuse, Recycle, Redecorate* observation pages
Cornstarch packing peanuts (You can tell if they are cornstarch if they dissolve when put in water.)
damp sponges on plates (one for every 2 -3 students)
scissors
pencils, crayons
Family Connection pages – Reduce, Reuse, and Recycle, And Redecorate

What to Do

Get Ready for the Activity

1. Make copies for each student of the Science journal *Reduce, Reuse, Recycle, Redecorate* observation pages and the Family Connection pages – Reduce, Reuse, Recycle, Redecorate.
2. Set out packing peanuts and sponges for each group.
3. Place the Science journal *Reduce, Reuse, Recycle, Redecorate* observation pages, pencils, and crayons out for each group.

Introduce the Activity

1. Read the book of your choice that reinforces the theme of recycling or taking care of our Earth.
(*Recycle: A Handbook for Kids*, Gail Gibbons, *Garbage and Recycling*, Rosie Harlow)
2. Ask for predictions for what will happen if you place a packing peanut into the cup of water. Put the packing peanut into the water. Observe and discuss what is happening. Stirring will speed up the dissolving process.

3. Now ask for predictions on what will happen if you just get part of the packing peanut damp and press it on another packing peanut. Demonstrate the process explained below to the entire group.

Steps To Complete the Activity

1. Choose a packing peanut and carefully push one end into the sponge, then attach that end to another packing peanut.
2. Continue to stick these together creating your own packing peanut 'sculptures'.
3. CAUTION: If the packing peanuts become too wet they will dissolve into a gooey blob.
4. Add details as desired until sculptures are complete.
5. Draw a picture illustrating this experiment on your science journal Reduce, Reuse, Recycle, Redecorate observation page.
7. Take the Family Connection Page home. Discuss Recycling with your family and complete the activity on the Family Connection Page.

Fun Science Questions and Facts

What if I put a packing peanut in my mouth?
They are harmless and will dissolve in your mouth; plain cornstarch isn't very tasty though!

What are the packing peanuts made out of?
Cornstarch, so it will totally dissolve in water and is harmless to our environment.

Will all packing peanuts work for this experiment?
No, if the packing peanut is made out of Styrofoam, it won't dissolve. A good extension activity is to have some types of packing peanuts mixed together and ask your students to conduct this experiment and identify which are cornstarch (recyclable) and which are Styrofoam (not able to be recycled).

Can I use markers to add details to my sculpture?
Remember that the cornstarch will dissolve when it gets wet, so if you are careful not to get it too wet, you can add details with markers.

Where can I get this type of packing peanut?
Many environmentally friendly companies have switched from Styrofoam to cornstarch packing peanuts. Often the mail service-type stores use the cornstarch packing products. Several of the educational supply companies also carry cornstarch peanuts in a variety of colors and shapes.

Science Journal Reduce, Reuse, Recycle, Redecorate observation page.

Draw a picture of your packing peanut sculpture:

Reduce, Reuse, Recycle, Redecorate

We have been discussing ways to help take care of our Earth. Today we were conducting an experiment using packing peanuts. Did you know that there are cornstarch packing peanuts that will totally dissolve in water and are environmentally safe? We used them in class today to create sculptures. This is just one way that we can help to take care of our environment.

Your child's assignment is to discuss ways to take care of our environment by Reducing, Reusing, Recycling and Redecorating and then complete the activity below.

(Art: Child and adult performing a recycling activity, collecting cans or newspaper or using your own shopping bag, etc.)

Choose one activity that you can complete as a family to help take care of our environment. Complete the following sentence and illustrate your activity

As a family, we will help take care of our environment by

_____.

Recycling Facts:

Paper: Recycling one ton (2000 pounds) of paper will save 17 trees. Over one third of the area in landfills is taken up by paper that could be recycled.

Aluminum: Recycling one aluminum can saves enough energy to run a TV or computer for three hours. It takes 500 years to break down an aluminum can in a landfill.

Glass: Recycling one glass bottle saves enough energy to light a 100 watt light bulb for four hours. It takes at least 4000 years for a glass bottle to decompose.

Plastic: Americans use 2.5 million plastic bottles every hour! Plastic bags and other garbage that is thrown or ends up in the ocean account for over one million deaths to sea creatures each year.

Energy Ball

The Energy Ball may look like a simple ping-pong ball with two pieces of metal, but when both pieces of metal are touched simultaneously, the ball lights up and makes noise.

Experiments

1. Touch one metal contact. What happens?
2. Touch both metal contacts at the same time with the same hand. What happens? What happens if you use two hands? A hand and a toe?
3. Touch one metal contact. Have a partner touch the other. What happens?
4. Touch one metal contact. Have a partner touch the other with one hand, and have him/her touch your hand with the other. Does the ball light up?
5. Touch one metal contact. Have a partner touch the other with one hand. With the free hand, have each person hold a piece of metal. Does the ball light up?
6. Touch one metal contact. Have a partner touch the other with one hand. With the free hand, have each person hold a piece of plastic. Does the ball light up?
7. Have two students each touch one of the metal contacts. Have the rest of the class hold hands (or make some kind of contact) with each person touching the metal contact in the circle. Does the ball light up? How big can you make the circle?
8. Take two energy balls and line them up so that a metal contact on ball A is touching a metal contact on ball B. Touch each of the other metal contacts (one from each ball). Does it light up?
9. Have two students touch one of the metal contacts. Have each student put a finger of the other hand in a glass of water without their fingers touching. Does it light up?

How does it work?

You should have observed that the ball lights up and makes noise when it is touched by the same person or by two people touching each other. The Energy Ball contains two exposed contacts and a small amount of electricity. The electricity cannot be used to turn on the light in the Energy Ball unless the electricity can move freely from one metal contact to the other. By touching each contact, you are completing an electrical circuit in the Energy Ball. If electricity can move from one piece of metal to the other, the circuit is closed and the ball will come to life.

You may know that tap water is an excellent conductor of electricity. (That's why you shouldn't go swimming when there is lightning—the electricity from the lightning can travel through the water and shock you.) The human body is about 65% water with salt dissolved in it, so the electricity can travel through a human from one contact to the other. When we perspire a layer of salt water is on the outer layer of skin. Most metals conduct electricity, which is why two partners holding a piece of metal can make the ball light up. Plastic, on the other hand, does not conduct electricity. Anything that does not conduct electricity is called an insulator. When an insulator blocks the flow of electricity from one metal contact to the other, the ball does not light up.

Circuits

The word "circuits" sounds like another word, "circle." This is not a coincidence. A circuit is a closed circle through which electricity flows. If there is a break in the circle or circuit, the electricity cannot flow through it. When you flip a light switch to the "on" position, the electrical circuit is closed, so the light can turn on. Turning the light switch to the "off" position creates a break in the circuit, turning off the light.

Fun Facts

- Light bulbs work in much the same way as an Energy Ball. The filament in a light bulb (the small wire that emits light in the middle of the bulb) provides the connection to close the circuit. A dead light bulb stops emitting light because the filament breaks and the electricity cannot travel through it.
- Insulators like certain kinds of rubber are used to cover electrical cords so that they are safe to touch. Be careful not to touch an electric cord that does not have an insulator.

Twister Tube Experiment Instructions

What is a Vortex?
Whirling water creates a tornado in a bottle.
Water forms a spiraling, funnel-shaped vortex as it drains from a soda bottle. A simple connector device allows the water to drain into a second bottle. The whole assembly can then be inverted and the process repeated.

materials

- **Two 1-liter or 2 liter soda bottles (any 1 liter clear plastic bottle will work well, preferable with smooth sides) I prefer 1 liter bottles so they can be easily manipulated by small children.**
- **A Tornado Tube™** plastic connector (available from science museums, science stores, novelty stores, and some scientific supply companies).
- **Optional:** A small dropper bottle of liquid water color or food coloring and/or bits of paper.

assembly

(5 minutes or less with the Tornado Tube™)

Fill one of the soda bottles about two-thirds full of water. For effect, you can add a little food coloring or paper bits to the water. Screw the bottles onto both ends of the plastic connector. (CAUTION: Do not screw the connector on too tightly!)

to do and notice

(15 minutes or more)

Place the two bottles on a table with the filled bottle on top. Watch the water slowly drip down into the lower bottle as air simultaneously bubbles up into the top bottle. The flow of water may come to a complete stop.

With the filled bottle on top, rapidly rotate the bottles in a circle a few times. Place the assembly on a table. Observe the formation of a funnel-shaped *vortex* as the bottle drains.

Notice the shape of the vortex. Also, notice the flow of the water as it empties into the lower bottle.

You can make the vortex with a single bottle by twirling the bottle and holding it over a water basin or the ground to drain, but you lose the water and have to refill the bottle each time you use it.

what's going on?

When the water is not rotating, *surface tension* creates a skin like layer of water across the small hole in the center of the connector.

If the top bottle is full, the water can push out a bulge in this surface to form a bulbous drop, which then drips into the lower bottle. As water drops into the lower bottle, the pressure in the lower bottle builds until air bubbles are forced into the upper bottle. The pressure that the water exerts on the surface in the connector

decreases as the water level in the upper bottle drops. When the water level and pressure drop low enough, the water surface can hold back the water and stop the flow completely.

If you spin the bottles around a few times, the water in the upper bottle starts rotating. As the water drains into the lower bottle, a vortex forms. The water is pulled down and forced toward the drain hole in the center by gravity. If we ignore the small friction forces, the *angular momentum* of the water stays the same as it moves inward. This means that the speed of the water around the center increases as it approaches the center of the bottle. (This is the same reason that the speed of rotating ice skaters increases when they pull in their arms.)

To make water move in a circle, forces called *centripetal forces* must act on the water. These "center pulling" forces are provided by a combination of air pressure, water pressure, and gravity.

You can tell where the centripetal forces are greater by looking at the slope of the water. Where the water is steeper, such as at the bottom of the vortex, the centripetal force on the water is greater. Water moving with higher speeds and in smaller radius curves requires larger forces. The water at the bottom of the vortex is doing just this, and so the wall of the vortex is steepest at the bottom. (Think about race cars: Racetracks have steeper banks on high-speed, sharp corners to hold the cars in their circular paths around the track.)

The hole in the vortex allows air from the lower bottle to flow easily into the upper bottle. This enables the upper bottle to drain smoothly and completely.

etcetera

Vortices occur in nature in many forms: Tornadoes, whirlpools, weather systems, galaxies, etc.

The essence of a vortex is that objects are drawn together toward the center, and then miss!

Spiral waves form in the water surface of the vortex. These waves appear to move in slow motion as they travel upward through the downward flowing water.

The Exploratorium's Vortex exhibit was created by artist Douglas Hollis. Related Snacks are Momentum Machine and Spinning Blackboard.