Magnificent Meteorology

Presented by: Hands On! Discovery Center

In partnership with: Summit Leadership — Doug & Judy Lowrie

UV Beads

Materials

- UV detecting beads (5 per student, colors vary)
- Cording (approximately 12-15" piece per student)
- Scissors (not included)
- Sunscreen (optional, not included)

Make a UV bead bracelet!

1. Tie a knot on one side of the cording to help keep the beads in place.
2. Have students thread 5 UV beads onto their piece of suede cording to make a bracelet. Tie off other end.
3. Have students cover the bracelet with their hand and walk outside into the sunlight. What happens to the colors?

Take It Further

Try identifying and testing variables. A variable is an aspect or factor of the experiment that you can control and alter. Don't forget, you can change only change one variable for each test while making sure that all the other variables in your test remain the same! Here are some examples of variables:

- What happens if you apply sunscreen to a bead? Does a different SPF make a difference?
- Place your UV beads near different light sources (fluorescent, black light, etc.) Do any of the beads change color?
- Test out your UV beads on a cloudy day. Observe how well the beads change color when exposed to sunlight at different times of the day. When does the sun give off its most intense UV light?
- Try covering your beads with sunglasses! Do any of the beads change color?

What science is at work?

UV Beads are made with pigments that change color when exposed to ultraviolet light. The beads look white in visible light. In UV light, you will see different colors. The term "light" often describes many different forms of light such as fluorescent, incandescent, and even sunlight. Not all light is made up of the same energy. By using the UV beads, you will be able to uncover an invisible form of light energy called ultraviolet light. UV Beads are a great tool for understanding how solar radiation can be harmful.

Sun-sensitive Paper

Materials

- 1 sheet of sun-sensitive paper (per student) **(*Store in a cool, dark place. Don't expose to light until use.)**
- Objects for prints such as leaves, flowers, keys, paper cutouts, buttons, lace, toys, etc. (not included)
- A sunny day (not included)

Make a print!

1. Have students select flat objects they would like to "print".
2. In dim light, remove a sheet of solar paper and reseal the bag. Place solar paper (blue side up) on a flat surface.
3. Have students place objects on the solar paper, and place it in sunlight for 2 minutes or until it turns light blue.
4. After removing objects from paper, protect the print from light and soak in a container of plain tap water for about 1 minute, and then place on a flat surface to dry.

Take it Further

Try identifying and testing variables. Some examples of variables that you could use are sunglasses vs. no sunglasses, transparent vs. translucent vs. opaque, natural vs. man-made, etc. Don't forget, you can change only one variable for each test while making sure that all the other factors in your test remain the same!

What science is at work?

The sun-sensitive print paper is coated with light-sensitive chemicals which react to light waves and particles when exposed to light. When you place objects on the paper, they block the light and turn the paper white while the paper around them remains blue. Water stops the process and fixes your images on the paper.

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Shaving Cream Clouds

Materials

- Shaving cream
- Blue plastic tablecloth
- A large table or sidewalk space

Make clouds!

1. Lay down your plastic tablecloth on a flat surface. It can be a desk, table, floor, etc.
2. Divide the surface, top to bottom, into three regions to represent the three different cloud "levels", and spray three piles of shaving cream each in the middle and top levels, and four piles in the low level.
3. Have students use the images of cloud types from the slide show for reference to "paint" clouds using the shaving cream piles. After they have created all of their clouds, discuss the characteristics of each cloud type.

Take it Further

You can mix in food coloring or other dyes to make darker clouds. Look up in the sky, do you see any of these clouds? You could track which types of clouds you see in the sky each day and identify the weather at that time. Are any cloud types more common than others? Do they always have the same shape and size or does it change?

What science is at work?

A cloud is a collection of small droplets of water/ice crystals that are small enough to float. Air contains water in the form of an invisible gas called water vapor. When warm air rises, it expands and cools. Cool air cannot hold as much water vapor as warm air, so some of the vapor condenses, forming a tiny droplet. When billions of these droplets come together they become a visible cloud. Clouds are white because their water droplets/ice crystals are big enough to scatter the light of the seven wavelengths (red, orange, yellow, green, blue, indigo, and violet), which combine to produce white light. If the clouds get thick or high enough, all the light from above is not able to pass through, creating a darker appearance. If other clouds are around, their shadow may also add to the darker appearance.

Shaving Cream Rain Cloud in a Cup

Materials

- Clear cups
- Pipettes
- Water (not included)
- Blue drink mix
- Shaving cream

Make a rain cloud!

1. In a clear cup, mix a small amount of the blue drink mix in water. This will be enough for several students to use.
2. Fill a separate clear cup with regular water (no drink mix) and fill until it is about 3/4 full.
3. Right before students are ready to do the experiment, spray shaving cream over the top of the cup with no drink mix. The shaving cream will serve as the "cloud".
4. Have students take turns using the pipette/dropper to squirt some of the colored water onto the top of the shaving cream to simulate "rain".
5. Remind students to watch their shaving cream "clouds" to see what is happening below. The colored water will begin to seep down through the shaving cream and into the water below just like rain!

What science is at work?

The shaving cream represents the clouds and the clear water represents the air. The colored water represents rain. As the colored water saturates the "cloud", it gets heavy and eventually is so heavy that it can no longer hold the water. It "rains" down into the jar – through the "air." It is just like how real rain falls through the air.

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Faux Snow

Materials

- Polymer snow powder (approximately 1 tsp. per student)
- 1 small condiment cup with lid (per student)
- Water (not included)
- Paper towels (not included)

Make Snow!

1. Measure out 1 tsp. of the snow powder into an empty cup or bowl.
2. Measure 8 ounces of room temperature water into a second cup.
3. **QUICKLY** pour all of the water into the cup with the snow powder and watch for "erupting" snow! Now play!
4. The snow powder is reusable if you let it sit out to dry. The water evaporates and the snow will turn back into a powder.

Take it Further

- Experiment with different ratios of powder to water.
- Put a small amount of salt into the snow mixture. Within seconds, the snow appears to "melt". Why? Salt breaks down the superabsorbent polymer and releases the water.
- After making your batch of fake snow, put some in the freezer for about 8 hours. What does it feel like?

What science is at work?

The same superabsorbent polymer found in diapers is found in the snow powder. The difference is that the snow powder not only absorbs water but then the molecules will also swell. The polymer soaks the water up using a process called osmosis (water molecules pass through a barrier). When water comes in contact with the polymer, it moves from the outside of the polymer to the inside, causing it to swell. The polymer chains have an elastic quality, but can only stretch so far and hold just so much water. The snow powder reaction is an example of a physical reaction where the substance itself does not change. When an ice cube melts, a physical reaction occurs where the solid ice turns into a liquid, but the substance (water) never changes because it is still water. In a chemical reaction, a new substance is formed and energy is either given off or absorbed.

Tornado Tube

Materials

- (2) water bottles per student (not included)
- Blue food coloring (if desired, not included)
- (1) tornado tube plastic connector (per student)
- Glitter or beads (if desired, not included)

Make a Tornado Tube!

1. Have students keep the water in one of the water bottles, and empty the other.
2. Next, have students screw the bottles into opposite ends of the tube connector.
3. Now have students tip the connected bottles so that the full bottle is on top and have them give it a circular whirl.
4. Students now have a vortex, or a tornado if they're into meteorology, or a whirlpool if they're into oceanography.

Take it Further

- Add items to your bottles such as glitter or miniature hobby/diorama items.
- Have you ever been in a tornado or seen one on TV? What are ways you can stay safe during a tornado?

What science is at work?

Tornadoes and waterspouts occur when liquid drops through an opening are called vortexes. This happens from the kinetic energy created by the motion of the fluid. In the atmosphere, thermal columns of rising air and wind shear create the energy causing the vortex. In liquids, the potential energy is converted to kinetic energy as it descends, pulled by gravity through an opening. A small starting rotation around the opening develops a higher rotational velocity as molecules come closer to the center. The resulting outward force tends to keep the liquid out of the very center, maintaining a hole/space in the remaining liquid.

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Making Rainbows

Method #1

Materials

- A glass
- Water (not included)
- A spray bottle
- A piece of paper (not included)
- Sunlight (not included)
- Window and window sill (not included)

Make a Rainbow!

1. Put the glass of water on a table or window sill where there is sunlight.
2. Place the piece of paper on the floor where the sunlight hits, in the line with the glass.
3. Spray the window with warm water where the sun is coming through, so it lines up with the paper.
4. Move the glass and paper around until you see a little rainbow, not the paper.

What science is at work?

Light bending, or refraction, takes place as light waves pass through the water. When the sunlight shines, the light waves are bending. Each one of the waves bend at slightly different angles resulting in the different colors of the rainbow. This is the same basic principle that occurs when water and sunlight create a rainbow in the sky.

Method #2

Materials:

- Prisms
- Scraps of paper with various designs/patterns (not included)
- Blank white paper (not included)
- Crayons or colored pencils in the colors of the rainbow (not included)

Make a Rainbow!

1. Hold the prism up to sunlight and demonstrate how the prism creates a rainbow in the distance.
2. Place a piece of paper between the prism and sunlight and ask students to observe what happens to the light and the rainbow. Ask students what they think would happen on a cloudy day.
3. Allow each student a turn at manipulating the prism to create a rainbow. Can they direct the rainbow to a specific spot by moving it around?
4. Place the prism on a window sill and ask students to look inside the prism. They should be able to see very small rainbows inside.

Take It Further

- Use colored pencils or crayons on white paper to color over the rainbows created by the prisms. This is a fun way to see all the colors of the rainbow up close!
- Objects can also look quite different when observed through a prism. Place the prism onto patterned paper. What happens? The patterns change and are bent just like the sunlight!
- Prisms are also a great lesson in geometry!

What science is at work?

White light is a combination of all the colors of the rainbow. As the light from the sun passes through the prism, the light refracts (bends) and separates, making the colors of the visible spectrum.

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Windbag Challenge

Materials

- 8-foot long Bernoulli windbag (this works best with partners or teams)
- A large room such as a gym or an open space such as a field (not included)

Inflate a windbag!

1. Unfold your windbag and gently pull the plastic apart.
2. Tie off one end of your windbag with a basic overhand knot.
3. Put the open end of your windbag over your mouth and blow three big breaths of air into it. Take your time and don't overdo it or you might get lightheaded.
4. Grab the windbag near your mouth and squeeze the bag closed. Slide your hand down the bag so you push the air you blew into it toward the knotted end. How did you do? The bag is completely full. Right? Nope!
5. Make an estimation (educated guess) of the number of breaths you think it will take to completely fill the Windbag. Don't panic because there is an easy way to do it with only one breath!
6. Find an assistant to hold the knotted end of the windbag at your mouth level. Keep the windbag horizontal and straight away from you. Use your hand and fingers to make the opening of the bag as wide open as possible.
7. Keep your mouth approximately 10 inches from the open end of the windbag. Take some deep breaths and blow one long breath of air into the opening of the bag. What happened? Did you get a different result?
8. As soon as you fill the windbag, grab the open end with your hand and seal in the air. Slide your hand forward down the bag until it stops from the resistance of the air built up inside. You can either tie off the end with a knot like before or you can push the air out from the knotted end and have your assistant give it a try.

Take it Further

Try identifying and testing different variables. A variable is something that might change the outcome. You could change variables such as distance for breaths, temperature/sun exposure, tying a knot in a different spot, etc. Don't forget, you can change only one variable for each test while making sure that all the other factors in your test remain the same!

What science is at work?

You are able to inflate the Windbag quickly because the air from the atmosphere is drawn into the bag along the sides of the stream of air from your lungs. This observation was originally made by a scientist named Daniel Bernoulli sometime around the year 1738. He observed that a stream of moving air is surrounded by an area of low atmospheric pressure. The faster the stream of air moves, the lower the pressure becomes around it. When you are blowing into the windbag, you are creating an area of low pressure inside the bag. The higher pressure air around you in the atmosphere rushes into the bag to equalize the pressure. The air in the atmosphere is drawn into the bag at the same time you are blowing into it as long as the opening of the bag is not on your mouth.

Water Cycle in a Bag

Materials

- (1) zippered sandwich bag (per student)
- (1 drop) blue food coloring (if desired, not included)
- Permanent markers
- A window with direct sunlight (not included)
- Masking tape
- Water (not included)

Make a water cycle bag!

1. Have students mark a clear water line. We suggest marking it about 1 inch up from the bottom of the bag.
2. Next, have students fill the bag with water just to the water line and add blue food coloring if desired. (This gives the impression of water and helps kids see the process a bit better.)
3. Have students seal their bag well and tape off the top.
4. Find a sunny window to hang the bags in, making sure it is secure.
5. When water absorbs and releases energy from the heat it changes into the different states of matter. The first thing students will notice in the bag is that after a while in the sun, small droplets will begin to form inside the walls.

What science is at work?

The water in the water cycle bag is heated by the sun and turns into a gas (evaporation). When it hits the sides of the bag and cools it becomes solid water again (condensation). As the water drops grow larger and heavier they begin to fall back down into the bag (rain). Then the cycle begins all over again.

One detail to point out to your students is that the droplets on the side of the bag are clear, not blue. This is because the blue food coloring is left behind when the water evaporates.

Activities listed in this collection of activities align with the following Tennessee Science Curriculum Standards:

Pre-K: PK.PS1.01a, PK.PS1.01b, PK.PS1.01c, PK.ESS2.01a, PK.ESS2.01b, PK.ESS3.01b, PK.ETS1.01a, PK.ETS1.01b, PK.ETS1.01c, PK.ETS2.01a, PK.ETS2.01b, PK.08,

Kindergarten: K.PS1.2, K.LS1.3, K.ESS2.1, K.ESS2.2, K.ESS3.2, K.ETS1.1, K.ETS1.2, K.ETS2.1

First Grade: 1.PS3.1, 1.PS4.1, 1.PS4.2, 1.LS1.3, 1.ESS1.3, 1.ETS1.1, 1.ETS2.1

Second Grade: 2.PS2.1, 2.PS4.2, 2.ESS1.1, 2.ESS2.4, 2.ETS1.1, 2.ETS1.2, 2.ETS1.4, 2.ETS2.1, 2.ETS2.2