4-H Grows Scientists

You can explore science, too!

Did you know?

Research shows that **out of school time STEM education**, like that of 4-H, has a positive effect on developing life skills, such as **critical thinking, communication and problem solving**.

Here's something you can do to **explore science**

Make an Amazing Air Pressure Cup!

Watch how it's done: https://www.youtube.com/watch?v=dOnpAA3nbpE

Time required: 5 minutes

Supplies:

Drinking glass

Bucket

Stiff paper (Manila file folder)

Kleenex

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Time required: 5 minutes

Supplies:

Drinking glass

Bucket

Stiff paper (Manila file folder)

Kleenex

The Experiment:

Fill a drinking glass half full of water.
Hold a stiff piece of paper over the glass and hold it tight.
Flip it all upside down over a bucket, holding tight – what happens?

How does it work?

There is air (atmospheric pressure) on the outside of the cup and stiff paper pushing inwards on it. The air inside the cup is a place of low air pressure while the air outside has high air pressure, because there are more molecules outside of the cup. The low pressure prevents the weight of the water from pushing the card down.

The cup doesn't slide off the paper because of surface tension and adhesion. Surface tension also holds water molecules together through attractive force, creating an elastic-like surface layer. In adhesion, water molecules are attracted to the paper, adhering to it, while continuing to keep surface tension with other water molecules.

Adapted by Anna DeMers from a lesson by Marilyn Duerst, University of Wisconsin River Falls, Marilyn.d.duerst@uwrf.edu

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, or hear?
Think	What is the purpose of the paper?
Apply and Investigate	What are the properties of water that cause this to happen?
Apply and Investigate	What happens if you do the experiment in another container?
Apply and Investigate	What happens when you put a small screen/mesh between the cup and paper?
Apply and Investigate	What happens when you put soap on the rim of the glass?

The Experiment:

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4-H Grows Scientists

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Did you know?

Science and Technology jobs are projected to grow by **over 20%** by 2020 and the top 10 college majors with the **highest salary earnings** are all STEM related jobs.

Here's something you can do to **explore science**

Make a Baby Powder Star!

Watch how it's done: https://www.youtube.com/watch?v=nK72nEjrDJE

Time required: 5 – 10 minutes

Supplies:

Aluminum pie tin

Toothpick

Dish soap

Water

Baby Powder

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Time required: 5 – 10 minutes

Supplies:

Aluminum pie tin

Toothpick

Dish soap

Water

Baby Powder

The Experiment:

Fill the aluminum pie tin ¾ full of water.
Sprinkle baby powder thinly on the surface of the water.
Poke a toothpick into dish soap.
Poke the soapy toothpick into the center of the baby powder – what happens?

How does it work?

Water molecules hold onto each other (cohesion). Surface tension is the act of molecules (in this case water) trying to take up as little space as they can. Through this act, they are able to hold things up, like the baby powder.

When soap is added, it lowers the surface tension of the water, causing the water to expand. The water doesn't have anywhere to go in the pan, so it ruptures upwards into the baby powder.

Adapted by Anna DeMers from a lesson by Marilyn Duerst, University of Wisconsin River Falls, Marilyn.d.duerst@uwrf.edu

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, hear or smell?
Think	What is the purpose of the baby powder?
Think	What is the purpose of the soap?
Apply and Investigate	What are the properties of soap that cause this to happen?
Apply and Investigate	What happens if you do the experiment in another container?
Apply and Investigate	What other liquids can do what the soap does in this experiment?
Apply and Investigate	What else can break the surface tension of water?

The Experiment:

Fill the aluminum pie tin ¾ full of water.
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4-H Grows Scientists

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Did you know?

Youth in **4-H** are 3.9 times **more likely** to make **contributions** to their communities.

Here's something you can do to **explore science**

Create Your Own Bee Buzzer!

Watch how it's done: https://www.youtube.com/watch?v=iGEqOM66O0A

Time required: 15 minutes

Supplies:

Craft Stick	3" X 5" Index Card
Stapler	2 feet of string
2 cap erasers	¼ Wide Rubber Band
Scissors	

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Supplies:

Craft Stick	3" X 5" Index Card
Stapler	2 feet of string
2 cap erasers	¼ Wide Rubber Band
Scissors	

The Experiment:

Put one cap eraser on each end of the craft stick
Trim the index card so it fits between the erasers.
Staple the card to the stick.
Tie the string to the stick next to one of the erasers using several knots to secure the string.
Stretch the rubber band around the craft stick from one eraser to the other.
Move to an open area and swing the string around. What happens?

How does it work?

When you spin the hummer (buzzer), moving air causes the rubber band to vibrate. Sound is produced by those vibrations, in the same way that vibrating strings on a guitar or violin produce sound. The sound is amplified--made louder--by the index card.

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, hear or smell?
Think	What is the purpose of the rubber band?
Think	What is the purpose of the index card?
Apply and Investigate	What happens if you use a different size or type of rubber band?
Apply and Investigate	What happens if you fold or cut the card?
Apply and Investigate	What happens if you use a different thickness or type of string?
Apply and Investigate	What other instruments use vibration to make a sound?

Adapted from a lesson by Patrick Willis, Oregon State Extension,
http://extension.oregonstate.edu/hoodriver/sites/default/files/4h/stem_activity_-_engineer_-_bee_buzzer_lesson.pdf

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4-H Grows Scientists

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Did you know?

Research shows that engaging youth in **science and math at an early age** has a **positive effect** on participation in science related subjects in school.

Here's something you can do to **explore science**

Blow up a Balloon with Carbon Dioxide (CO_2)!

Watch how it's done: https://www.youtube.com/watch?time_continue=19&v=31mNUfMgkwQ

Time required: 5 minutes

Supplies:

Baking soda

Soda bottle

Balloon

Vinegar

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Supplies:

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The Experiment:

Put a good sized scoop of baking soda in a balloon.
Pour ¼ cup vinegar in the soda bottle.
Put the balloon on the soda bottle, holding it tightly so that none of the reaction escapes, while the baking soda drops into the soda bottle – what happens?

How does it work?

The acid in the acetic acid (vinegar) reacts with the sodium bicarbonate (baking soda), forming carbon dioxide (CO_2) and water (H_2O). This is a reaction of an acid with a base. The CO_2 gas takes up a lot of space, so it inflates the balloon.

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Observe	What do you see, feel, hear or smell?
Think	What is the purpose of the baking soda?
Think	What is the purpose of the vinegar?
Think	How do you know that CO_2 is formed?
Apply and Investigate	What happens if you do the experiment in another container, a bag for example?
Apply and Investigate	Are there other household items that can create CO_2?

The Experiment:

Put a good sized scoop of baking soda in a balloon.
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4-H Grows Scientists

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Did you know?

80% of the **fastest growing careers** in the U.S. require science, technology and engineering literacy.
Girls in **4-H** are **three times** more likely to take part in **science programs** compared to girls in other programs.

Here's something you can do to **explore science**

Investigate Color Changing Milk!

Watch how it's done: https://www.youtube.com/watch?v=Hr6dZ6aWpF4

Time required: 5 minutes

Supplies:

Whole Milk (one gallon will enable about 50 experiments)
Food Coloring
Dish Soap
Styrofoam plate
Cotton Swab
Small cup of bowl for dish soap

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Food Coloring
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Styrofoam plate
Cotton Swab
Small cup of bowl for dish soap

The Experiment:

Pour about 1/3 of a cup of milk onto the Styrofoam plate
Carefully drip a few drops of food coloring in the center of the plate of milk. You can use multiple colors!
Dip the cotton swab into the dish soap
Dip the soapy swab into the center of the food coloring drop

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, hear or smell?
Think	What is the purpose of the food coloring?
Think	What is the purpose of the soap?
Apply and Investigate	How do you think using skim or 1% milk might change what you see?
Apply and Investigate	Do you think this experiment would work with soy milk?
Apply and Investigate	Olive oil also contains a type of fat. Do you think this experiment will work with olive oil or other oils?

How does it work?

Milk is mostly water but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended in solution. Dish soap, because of its bipolar characteristics (nonpolar on one end and polar on the other), weakens the chemical bonds that hold the proteins and fats in solution. The soap's polar, or *hydrophilic* (water-loving), end dissolves in water, and its *hydrophobic* (water-fearing) end attaches to a fat globule in the milk.

The molecules of fat bend, roll, twist, and contort in all directions as the soap molecules race around to join up with the fat molecules. During all of this fat molecule gymnastics, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity.

Adapted with permission from Steve Spangler Science (2015):
http://www.stevespanglerscience.com/lab/experiments/milk-color-explosion/

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Did you know?

Youth in 4-H Science programs are **two times** more likely to participate in science and engineering programs. Science exploration is a great way to build **problem solving skills**!

Here's something you can do to **explore science**

Investigate Color Chromatography!

Watch how it's done: http://www.hometrainingtools.com/a/chromatography-science-project/#video

Time required: 10 minutes

Supplies:

Paper towel or coffee filter

Water

Scissors

Plastic cup

Water-based black marker (do not use washable markers)

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Water-based black marker (do not use washable markers)

The Experiment:

Cut a strip of paper towel or coffee filter 2” wide and 5-6” long.
Using the black marker, draw a line across the paper strip that is 1 to 2” from the bottom and parallel to the bottom of the paper.
Put water in the cup to just cover the bottom.
Place the paper strip in the cup with the black line closest to the bottom making sure the bottom of the strip is in the water with the black mark not touching the water.
Fold the end of the paper strip over the cup’s edge.
When the water nears the top of the paper, remove the strip from the cup and let it dry on a paper plate.

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, hear or smell?
Think	What is chromatography?
Think	What made the water move up the paper?
Apply and Investigate	What happened when the water reached the black line?
Apply and Investigate	Why does mixing many colors of ink make black?
Apply and Investigate	What happens if you use a brown, purple or orange marker?
Apply and Investigate	If you use a clean filter and a different marker, do you get the same results?

How does it work?

As the water travels up the paper strip, it dissolves the ink and pulls it up the paper too. The black ink is actually a mixture of several different pigments, or coloring agents. Some pigments dissolve in water easier and are pulled with the water farther up the paper. Others are more attracted to the paper and move more slowly. Usually smaller molecules will move farther than larger ones. The three primary colors used when mixing dyes or paints are red, yellow, and blue. Other colors are often a mixture of these three colors.

Adapted from http://www.exploratorium.edu/science_explorer/black_magic.html and http://www.hometrainingtools.com/a/colorful-chromatography-science-newsletter

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Here's something you can do to **explore science**

Create Your Own Hand Warmer!

Time required: 5 minutes once you have the water gel crystals prepared.

Supplies:

Prepared jelly crystals (also called water beads found in gardening section of stores or at Stevespangler.com)
Calcium chloride or ice melt salt (must be calcium chloride pellets/-25 degree melt)
Two zipper bags per experiment

Do this before the lesson: Prepare the jelly crystals: 1.5 cups of water to 1 tablespoon of jelly crystals. Wait for all the water to be absorbed (20 min.). The prepared crystals can be stored in a zipper bag for months.

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The Experiment:

3 tablespoons of prepared jelly crystals into a zipper bag
Add 1 tablespoons of calcium chloride or ice melt
Make sure the bag is sealed
Place the mixture bag into another zipper bag
Seal the zipper bag
Mix the contents by squishing the bags with your fingers

How does it work?

The heat is a byproduct of the chemical reaction between the salt and water (locked inside the jelly crystals). The reaction is therefore called exothermic (exo – means out and -thermic means heat). At some point the reaction will be completed and the hand warmer will stop producing heat. The salt and water will produce heat on its own; however, adding water in the form of jelly crystals will keep the hand warmer from getting too hot to handle and slow the reaction so that the hand warmer stays warmer longer.

Adapted with permission from Steve Spangler Science (2015):
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THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, hear or smell?
Think	What is the purpose of the jelly crystals?
Think	What is the purpose of the salt?
Apply and Investigate	How do you think adding more salt might affect how long the hand warmer stays warm?
Apply and Investigate	Have you ever used other types of hand warmers? How do they work?
Apply and Investigate	What happens to the jelly crystals after about an hour?
Apply and Investigate	Can you add calcium chloride to water and see the same reaction?

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Create Oxygen in a Bag!

Watch how it's done: https://www.youtube.com/watch?v=S29upvX4rrE

Time required: 5 – 10 minutes

Supplies:

Dry yeast powder
Food coloring
Zipper plastic bag
3% hydrogen peroxide

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Supplies:

Dry yeast powder
Food coloring
Zipper plastic bag
3% hydrogen peroxide (H_2O_2)

The Experiment:

Put about ½ tsp. of dry yeast powder in a zipper plastic bag.
Add a drop of food coloring.
Pour in about 1 tbsp. of the hydrogen peroxide and zip it up – what happens?

How does it work?

The yeast catalyzes (speeds up) the release the oxygen molecules that are contained in the hydrogen peroxide. This is called decomposition as the hydrogen peroxide breaks down into its two components: water and oxygen. As the oxygen is released, the air fills up the bag. As the bonds between the oxygen and water break, they also release energy in the form of heat.

Adapted by Anna DeMers from a lesson by Marilyn Duerst, University of Wisconsin River Falls, Marilyn.d.duerst@uwrf.edu

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, or hear?
Think	What is the purpose of the hydrogen peroxide?
Think	What is the purpose of the yeast?
Apply and Investigate	What are the properties of the yeast that cause this to happen?
Apply and Investigate	If you do this in a test tube, how could you test to see if oxygen was released?
Apply and Investigate	What happens if you do the experiment again with a little bit of liquid soap in the bag?

The Experiment:

Put about ½ tsp of dry yeast powder in a zip lock bag.
Add a drop of food coloring.
Pour in about 1 T of the hydrogen peroxide and zip it up – what happens?

How does it work?

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4-H Grows Scientists

You can explore science, too!

Did you know?

Science and Technology jobs are projected to grow by **over 20%** by 2020 and the top 10 college majors with the **highest salary earnings** are all STEM related jobs.

Youth in 4-H Science programs are **two times** more likely to participate in science and engineering programs. Science exploration is a great way to build **problem solving skills**!

Here's something you can do to **explore science**

Skewer a Balloon!

Watch how it's done: https://www.youtube.com/watch?v=LO8OGkhsX6M

Time required: 5 minutes

Supplies:

Balloon

Oil or water

Wooden Skewer

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The Experiment:

Blow up a balloon (not absolutely full), and tie it.
Take a wood skewer and cover all of it in oil (or water if you have no oil).
Push fairly hard into an end of the balloon where the rubber isn't stretched as much and wiggle a little.
Push the skewer through the other end of the balloon where it isn't stretched as much – Does it pop?

How does it work?

You have put the skewer through the balloon at an area where there is not much stress on the rubber molecules. Rubber is made up of long chains of molecules called polymers. The elasticity of these chains is what causes rubber to stretch.

When you skewer the balloon, the polymer chains stretch around the skewer and keep the air inside from coming out the hole.

THINK LIKE A SCIENTIST!	
Observe	What do you see, feel, or hear?
Think	What is the purpose of the oil?
Apply and Investigate	What are the properties of oil that cause this to happen?
Apply and Investigate	What happens if you don't put oil on the skewer?
Apply and Investigate	What happens when you take the skewer out of the balloon?
Apply and Investigate	What happens if you try to skewer the balloon where it is stretched a lot?

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