Learn & Climb™

Fun with Science

INSTRUCTION MANUAL

OVER 65 SCIENCE EXPERIMENTS

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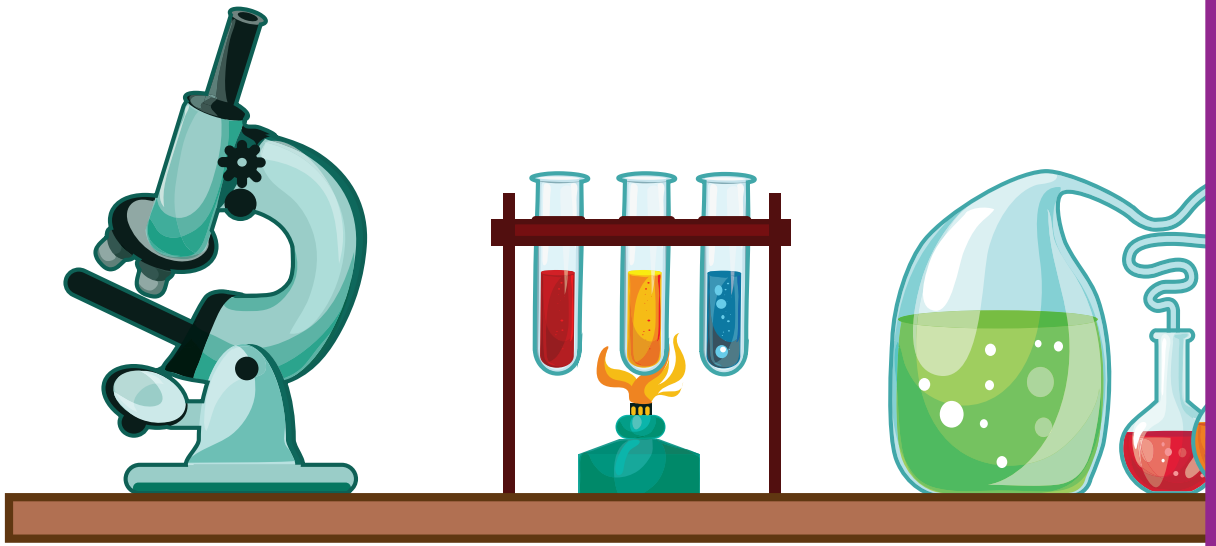
We are here to help!

For any questions, comments or for assistance with the science kit or manual please contact us. We will be happy to assist you!

support@learnandclimb.com

Want to unlock online video's to each experiment in this manual? Simply go here: www.learnandclimb.com and click the "video" tab in the menu bar, then scroll down to Science!



Science Kit Contents

Plastic Pipette
1 Beaker
1 Big Test Tube
3 Petri Dishes
4 Small Test Tubes
Test Tube Holder
Test Tube Connector
Double Sided Measuring Spoon
Funnel
Filter Papers (20 pcs)
Tweezer
Volcano Base
Small Balloons
1 Big Balloon
Propeller Joint
3 Propeller Blades
1 Magnet Stick
Purple String
20 Color Changing Beads
Keychain ring for beads
String for beads
Iron Filings - .50 oz
Sand Filing - .50 oz
Citric Acid - 1.5 oz
Borax - .10 oz
Corn Starch - 2 oz
Baking Soda - 1.5 oz
Purple Sweet Potato Powder - .35 oz
Urea – 4.23
Glow in the Dark Powder - .18 oz
Water Absorbing Polymer Crystals - .7 oz
Water Absorbing Polymer Beads - .18 oz
Coloring Agent, Red, Blue - .21 oz each
Foaming Agent - .53 oz
PVA Glue – 2.12 oz
Balloon Car
Test Tube Key Chain

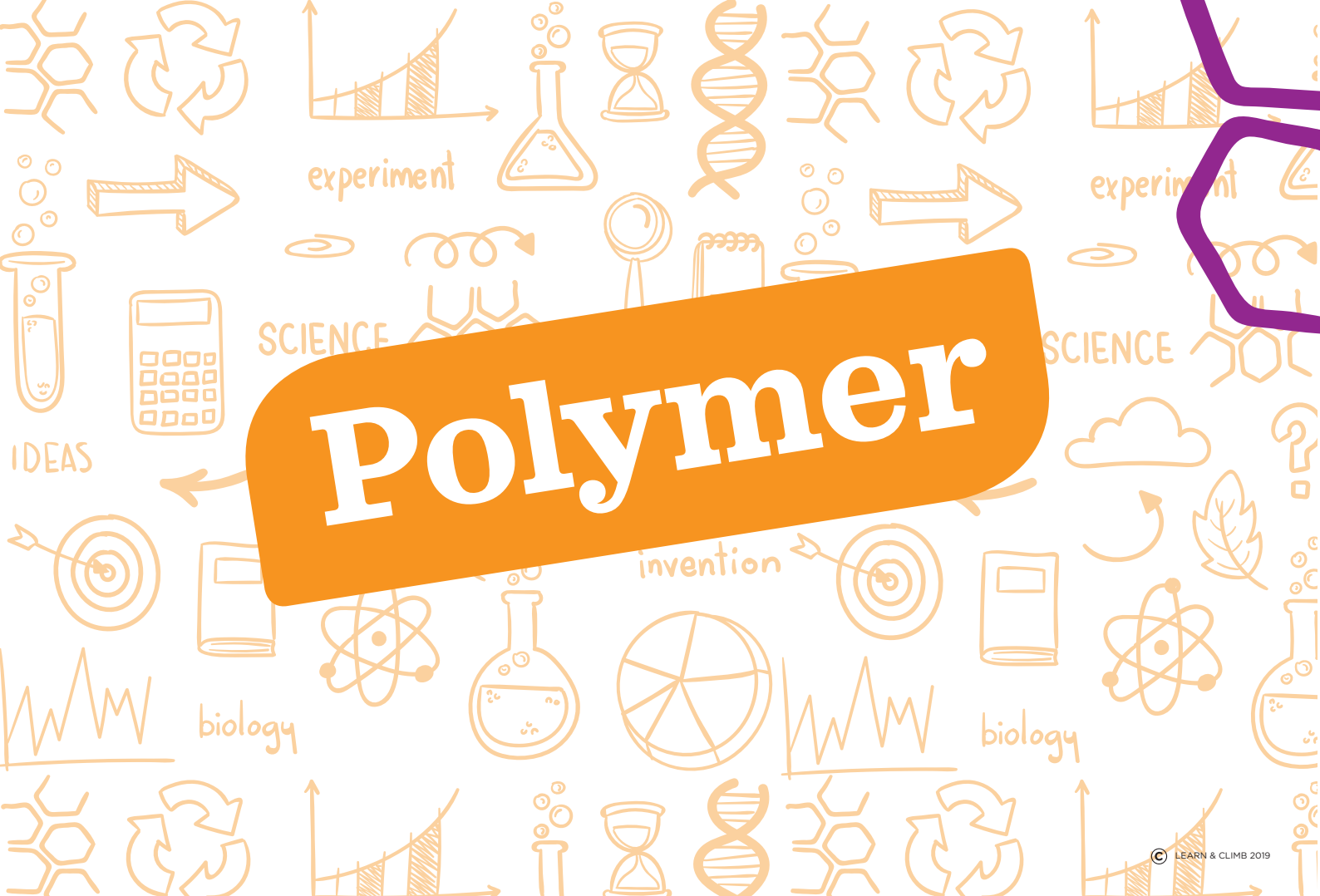
Adult Supervision Required

Welcome to a fun learning experience with your new science kit! We have a few suggestions to help you safely get started:

1. The ingredients in this kit are not for eating or tasting. **DO NOT EAT** or taste any ingredient in this kit.
2. Do not mix together ingredients in any way besides the way it is explained in each experiment, do not mix experiments together, or mix ingredients in any way except as directed.
2. Please read through each experiment carefully before beginning each activity.
3. Do not mix ingredients in closed or sealed containers unless it is specified in the directions.
4. Always be sure to clean your beaker, pipette, petri dishes, test tubes and any other utensils before moving on to the next experiment.
5. We suggest you perform the experiments in order as occasionally one experiment will use componenets from a prior experiment.

Enjoy this time to learn and explore science together!

CATEGORIES



WARNING: Polymer beads are unsafe to eat. Keep them on a table or a paper plate to avoid children or animals getting into them. When done, do not put polymer beads down the sink as they might clog the drain!

HAVE YOU EVER HEARD OF POLYMER?

Polymer is a compound that has a structure made up of small, similar units (called monomers) bonded together. Polymers can be both natural and synthetic (made by people). Natural polymers include rubber, silk, or wool. Synthetic polymers can be anything from polyvinyl acetate (PVA), found in the glue in your kit; polyvinyl chloride (PVC), which is in some pipes; and polystyrene (PS), which can be found in toys and packing foam. Every version of polymer is unique and made up of distinct monomers. Each has its own special properties that make it special.

POLYMER STRUCTURE

Polymer has a very interesting makeup, which looks something like spaghetti. Why spaghetti? Have you ever had trouble getting one strand of spaghetti out of the bowl? Well, polymer is the same way. It is very tough to get one piece of spaghetti (sort of like one monomer) out of the bowl because the strands of spaghetti (all of the monomers combined) are tangled up. For this reason, polymer is very hard to destroy! That makes it very appealing to scientists and engineers, who are always looking for objects with greater material strength that do not cost a lot to produce.

POLYMER OF THE FUTURE

Scientists and engineers are always looking 20 to 40 or even to 100 years in the future. They are constantly working on designing more durable and more usable polymer. From clothes that camouflage into surroundings to bendable artificial limbs that help amputees and more resistant plastics that can sustain large blasts, they are continually testing and looking to polymer as the next wave of scientific discovery and innovation.

WHO KNOWS?

Maybe one day **YOU** will invent a special kind of polymer that will help people in a way never thought possible. It's never too early to start!

TYPES OF POLYMER

As stated earlier, there are many different types of polymer. There are things like putty, glue, and even the slime you will make later! Many kinds of polymer, though, are known for their special ability to absorb, or soak up moisture. The polymer that you will work with will be displaying that ability in very cool ways!

Let's get started!

1 Incredible Expanding Beads

WARNING: Polymer beads are unsafe to eat. Keep them on a table or a paper plate to avoid children or animals getting into them. When done, do not put polymer beads down the sink as they might clog the drain!

SUPPLIES FROM KIT

1 large test tube
Polymer beads
Stirring stick
Yellow measuring spoon
Beaker

SUPPLIES FROM HOME

Water

How to Video - learnandclimb.com/pages/video-library

1

Add 10 water-absorbing polymer beads to the large test tube.

2

Fill the beaker halfway with water.

3

Pour water over the Beads in the test tube.

4

Stir the beads in the test tube.

5

Wait a few minutes and watch what happens!

*note!

If nothing happens, you might need to add a bit more water or wait a little longer. Continue to the next experiment to see how to reuse the polymer beads. ***Save the beads for the next experiment!***

Explanation

The polymers started out small, and now they increased in size! What happened?

Some polymers, like these beads, are great at absorbing water or other moisture and expanding in size. These polymers are special because of the spaces in between their molecules.

Can you think of a time when this would be very useful?

2 Incredible Shrinking Beads

SUPPLIES FROM KIT

Expanded polymer beads from Experiment 1

SUPPLIES FROM HOME

3 plastic cups
Spoonful of:
Sugar
Flour
Salt

How to Video - learnandclimb.com/pages/video-library

1

Dry the expanded beads from Experiment 1

2

Divide the dried beads into three separate cups and add water

3

Using your yellow measuring spoon, add a large spoonful of sugar to the beads in cup 1, a large spoonful of flour to cup 2, and a large spoonful of salt to cup 3.

4

Watch and see what happens, even if it takes a little bit of time to change.

5

Write/draw what you observed.

Explanation

Some substances can cling to or get more attracted to certain molecules. In this case, by clinging to the water molecules, the salt shrinks the size of the beads!

3 Color-Absorbing Polymer

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

1 large test tube
Yellow measuring spoon
Coloring agent
White polymer crystals

How to Video - learnandclimb.com/pages/video-library

1

Remember to use a level spoonful

Using your yellow measuring spoon, add 1 to 2 large spoonfuls of white polymer crystals to the test tube.

2

Fill the beaker halfway with water

3

Add 2-4 drops of any color coloring agent to the beaker

4

Pour the colored water over the crystals.

5

Shake well.
(You can save your creation!)

Watch what happens! Can the crystals absorb the water and/or the color?

Explanation

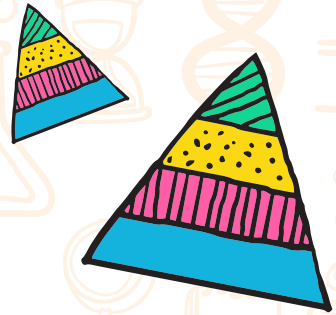
Can polymers absorb color? Since the water and the coloring agent bind to each other, the polymers not only absorb the water, but also the color along with the water.

Like the last experiment, the paint fills in the spaces that are open.

*note!

The more coloring agent you use, the darker the color will be. A little bit of coloring agent goes a long way!

4 Layered Colors



SUPPLIES FROM HOME

2 plastic cups

Water

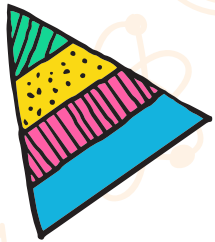
SUPPLIES FROM KIT

Small test tube

Yellow measuring spoon

Coloring agent

White polymer crystals



How to Video - learnandclimb.com/pages/video-library

1

Fill two plastic cups a quarter to half full of water.

2

Add 2-3 drops of coloring agent to each cup of water. Use a different color for each cup.

3

Stir

4

Add 2-3 small spoonfuls of white polymer crystals to each cup of colored water.

5

Stir the mixture in each cup and wait a few minutes.

6

Place the expanded colored crystals into the small test tube. Layer the colors

5 Overnight Rainbow

SUPPLIES FROM HOME

Paper Towel

Water

SUPPLIES FROM KIT

Test tube holder

2 small test tubes

Yellow measuring spoon

Coloring agent

White polymer crystals

How to Video - learnandclimb.com/pages/video-library

1

Fill both test tubes half full with water

2

Add 2 drops of coloring agent to both test tubes: use red for one test tube and blue for the other.

3

Secure the lid and shake!

Remember to use a level spoonful

4

Add 1-2 small spoonfuls of polymer crystals to each test tube.

5

Let it sit for a while, or overnight.

6

Dry the crystals off on a paper towel.

7

Layer the two-colored dried crystals into the small test tube. Squeeze the crystals in and close the cap.

Wait one or two days, or until you see results. Colors should mix together creating new color.

6 Bright Mix of Colors

(for Keychain Experiment 7)

SUPPLIES FROM KIT

Large test tube
Colored
Polymer beads

SUPPLIES FROM HOME

Water

1. Pour 12 to 20 polymer beads into the large test tube.

2. Pour water over the beads.

3. Shake the test tube.

4. Wait until your beads expand and save for the next experiment.

How to Video - learnandclimb.com/pages/video-library

7 Glow-in-the-Dark Keychain

SUPPLIES
FROM KIT

- Expanded polymer beads from Experiment 6
- Keychain
- Yellow measuring spoon
- Pipette
- Glow-in-the-dark powder

1

Take the expanded polymer beads from the large test tube and add them to the keychain, but don't fill it too much.

2

Add water with your pipette to the keychain, almost till the top.

3

Add one or two squeezes of glow-in-the-dark powder to the keychain.

4

Close lid and shake well.

5

Let your keychain sit in a lit room or under a light for a little bit.

6

Go into a dark room and observe.

*note!

To reuse the polymer beads, repeat Experiment 2.

8 Transparent Orbs

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

Small test tube
Colored Polymer beads
Funnel
Yellow measuring spoon

How to Video - learnandclimb.com/pages/video-library

1

Select 10 transparent polymer beads with no color)

2

Add the transparent polymer beads to the test tube.

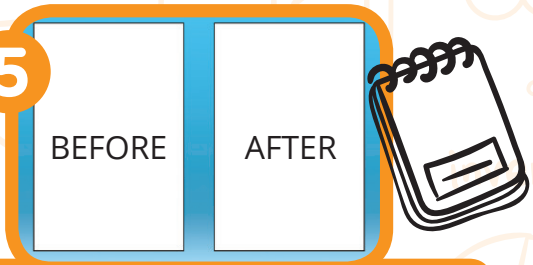
3

Pour water over your transparent beads. Fill half the test tube with water.

4

Wait a little while and watch what happens to your transparent beads.

5



Draw a “Before” picture and an “After” picture depicting what happened to your beads.

9 The Cooling Effect

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

- Large test tube
- Yellow measuring spoon
- Colored Polymer beads

How to Video - learnandclimb.com/pages/video-library

1

Put a few polymer beads into the test tube.

2

Fill a third of the test tube with water.

3

Put the cap on and put the test tube in the freezer.

4

Wait until the water in the test tube freezes, and see the results!

*note!

Make sure the test tube is kept away from the food and drinks in your freezer.

Explanation

If adding water causes the polymers to expand in size, what happens when you freeze the polymer beads? In this case, instead of adding moisture, you are really taking moisture away, or stopping it from getting absorbed. Colder temperatures make molecules move slower, therefore the beads and water freeze before all the water gets absorbed into the polymer beads.

Unmixable Water & Oil

MIXOLOGY

Humans have always been interested in how things mix together. In ancient times, before people knew a lot about science, they would try to create different things like medicines, dyes, inks, foods, clothes, and just about anything else from mixing. **They discovered mostly through trial and error, and they were constantly improving their process,** kind of like what you will be doing in this guide!

Have you ever mixed anything together? What happened? Did the thing you were mixing change color? Did it bubble up or start foaming? **Did what you were mixing change or transform into something entirely new?**

PROPERTIES

These ancient people (and then people who came after them, and people who came after them...) discovered that certain materials have special properties. **A property is just a trait or a quality of something.** An example is a bike. Most bikes are hard metal, shiny, and colorful. Or how about modeling dough? Modeling dough is colorful, squishy, and soft.

PROPERTIES OF COMMON SUBSTANCES

What are some common substances that you know of? In this guide, we will focus on liquids. Gasoline, soda, and milk are some common liquids. Water and oil are two very common substances that are also liquids. Draw three columns on a piece of paper. List some things that you might do with water on the left and some things that you might do with oil on the right. Can you do the same thing with both water and oil? Put that in the middle!

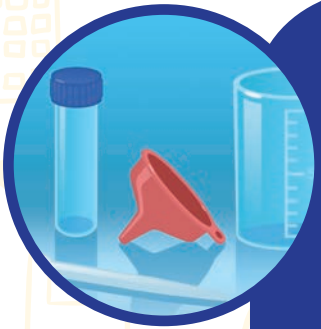
1 You go together like Oil & Water

SUPPLIES FROM HOME

Water

Oil

SUPPLIES FROM KIT



Small test Tube

Pipette

Funnel

Beaker

*note!

When you are done, spill the mixture outside instead of pouring it down the drain.

How to Video - learnandclimb.com/pages/video-library

1

Pour 5 ml of water into your test tube.

2

Pour 10 ml of oil into your test tube.

3

Screw on the cap.

4

Shake.

5

Let it stand for a few seconds.

6

Record your results.

Explanation

Have you ever heard the phrase "They go together like oil and water" ?
Normally, that describes people who have very different personalities.

Likewise, water & oil do not mix because they have different properties. For one, they are "packed" differently. Oil tends to sit on top of water because it is less dense than water, which means that its particles are not as tightly packed.

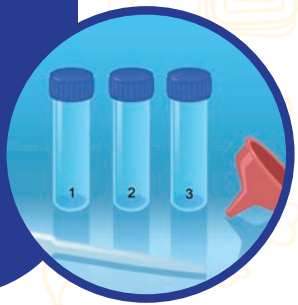
2 Mix it Up

SUPPLIES FROM HOME

Water
Oil
Vinegar
Lemon juice
Dishwashing soap

SUPPLIES FROM KIT

3 small test tubes
Funnel
Pipette



Explanation

What is so special about soap? Soap has special properties that allow it to mix with both water and oil! When it mixes with water and oil, the color changes. It forms a kind of "bridge" between the particles and makes a special mixture called an emulsion. Why might we need oil and water to mix? Hmmm... Think about it some more!

How to Video - learnandclimb.com/pages/video-library

1

Pour 5 ml of water into test tube 1.

2

Then add 5 ml of oil into the same test tube

3

Pour vinegar into test tube 1 till it reaches almost the top of the test tube.

4

Close the cap and shake well.

Are there any other liquids in your house that can help oil & water mix?!

5

Repeat instructions 1 and 2 to test tube 2. Then add lemon juice till it reaches almost the top of the test tube.

6

Close the cap and shake well.

7

Repeat instructions 1 and 2 to test tube 3. Then add dishwashing soap till it reaches almost the top of the test tube.

8

Close the cap and shake well.

9

Record which liquid will make the oil and water mix.

Which liquid will make the oil and water mix?

3 Eggy Emulsion

WARNING: Adult supervision and help needed. **DO NOT USE THE WHISK WITHOUT ADULT HELP** AND/OR SUPERVISION.

SUPPLIES FROM HOME

- Electric whisk
- 10–30 ml of oil
- 1/4 cup vinegar
- 1 egg yolk
- Salt
- Pepper
- Medium/large bowl

How to Video - learnandclimb.com/pages/video-library

1

Separate the egg yolk from the egg white. Place the egg yolk into your bowl.

2

Add salt, pepper, and 1/4 cup of vinegar to your bowl with the egg yolk.

3

Mix all the ingredients in the bowl with an electric whisk — only with adult supervision.

4

While still mixing the ingredients in the bowl, slowly add 10 to 30 ml of oil until you get an eggy emulsion.

Explanation

You just made another emulsion. You might need to make the emulsion a few times until you learn to get the right thickness. If you were to zoom in on the particles, you would see that they still don't truly mix! Instead, they arrange themselves in a certain pattern, where one particle surrounds another.

Eggs are involved in other emulsions, too. A lot of the things you eat and drink are emulsions, such as different sauces, ice creams, cake, milk, and more! See if you can find other emulsions in your kitchen or refrigerator and write them down.

4 Tick Tock Goes the Oil Clock

SUPPLIES FROM HOME

Bucket or bathtub
Water in a cup
Oil in a cup

SUPPLIES FROM KIT

Test tube holder
2 small test tubes
Coloring agent
Test tube connector

Explanation

You will make an oil clock. This clock uses the properties of oil and water. Based on your results, answer the following questions: What properties do you think are at work? Does it have to do with temperature? With weight? Tip the clock upside-down and right side up to see what happens! Does the water always go below the oil? Is there a barrier?

*note! **This experiment is very messy!** Even if you do it in a bucket, you may want to do it outside. Too much coloring agent may stain hands, clothing, or surfaces.

How to Video - learnandclimb.com/pages/video-library

1

Add 2-4 drops of coloring agent to test tube 1.

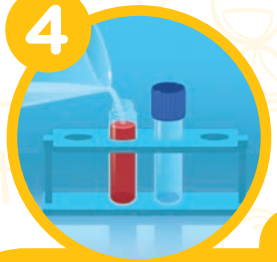
2

Add water to test tube 1 until it is half full.

3

Shake the test tube.

4



Add more water to test tube 1, almost till the top..

5

Shake again.

6

Fill the second test tube with oil.

7

Screw the test tube connector onto test test tube 2.

8

Close the opening of both test tubes with your thumbs.

9

Put both test tubes into a large bucket or your bathtub filled with water, with your thumbs still on them.

10

Quickly screw both test tubes together.

11

Create an oil clock by turning over your test tubes every few seconds.

5 Density Exploration

WARNING: KEEP MARBLE AWAY FROM YOUNG CHILDREN. DO NOT PUT MARBLE IN YOUR MOUTH.

SUPPLIES FROM HOME

Pitcher/cup filled halfway with water

Rubber ball

Marble

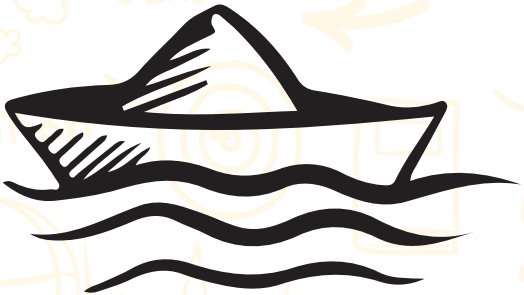
How to Video - learnandclimb.com/pages/video-library

1

Drop both the rubber ball and the marble into the pitcher at the same time.

2

Watch to see which one sinks first.



Explanation

If you compare a marble and a bouncy rubber ball, which one do you think will sink to the bottom? The bigger one- or the one that is denser? Go ahead and find out!

In this experiment, which one sinks first? Well, the marble, because it is denser! The rubber ball is less dense, so it did not sink as quickly. Density, for our purposes, refers to how compact or "packed in" a substance is. It is normally easy to move or lift less dense objects, while it is harder to move or lift denser objects. So why would we want to change the density of a mixture? There are many reasons, but for us, we want to make things fall slower in our clock. With the next experiment, you will see it in action! Have you ever seen a snow globe before? Well, kind of like that!

6 Changing the Oil Clock

Explanation

The previous oil clock could not "measure time" well. However, dissolving the salt into the water actually increased the water's density. Have you ever been in the ocean? It's easier to float in the ocean than it is in a pool because the ocean water is denser!

SUPPLIES FROM KIT

2 small tubes
Test tube connector
Coloring Agent (optional)

SUPPLIES FROM HOME

Water
Oil
Salt

How to Video - learnandclimb.com/pages/video-library

1

Fill test tube 1 a quarter full with salt.

2

Fill test tube 1 three-quarters full with water.

3

Close the cap and shake.

4

Add more water to the test tube, until it is almost full.

5

Fill test tube 2 with oil.

6

Put the connector onto test tube 1.

7

Place your thumb over the other side of the connector, and your other thumb over the opening of test tube 2.

8

Fill your bathtub with water.

9

Put your test tubes (with your thumbs still on it) into the bathtub and quickly connect test tube 2 to the connector.

10

11

Turn your connected test tube over every 5 to 10 seconds to watch your oil clock!

7 Floating Egg

SUPPLIES FROM HOME

1 cup of water
Egg
1/4 cup salt
Stirring stick

How to Video - learnandclimb.com/pages/video-library

1

Add the salt to the cup of water.

2

Stir the water and salt until the salt is dissolved.

3

Put the egg in.

4

Watch your egg float!

Expand

Take it even further and try it with two eggs, three eggs, or more! Do you need to add more salt? The more eggs you use the bigger your cup/bowl will need to be.

8

Mix the Unmixable Lava Lamp

note!

Oil may spill and/or shoot out of the bottle, so you might want to spread out a towel just in case.

SUPPLIES FROM HOME

- Water
- Oil
- Empty water bottle, medium or large/ about 20+ ounces

SUPPLIES FROM KIT

- Coloring agent (optional)
- Foaming agent
- Glow-in-the-dark powder
- Yellow measuring spoon

Expand

Try to add other ingredients and colors to make your lava lamp even more realistic! Try to make the best lava lamp you can!

How to Video - learnandclimb.com/pages/video-library

Put a few drops of coloring agent into your bottle.

Pour water into the bottle until it is one-fifth full.

Pour oil into the bottle until it is three-fifths full.

Close cap and shake well.

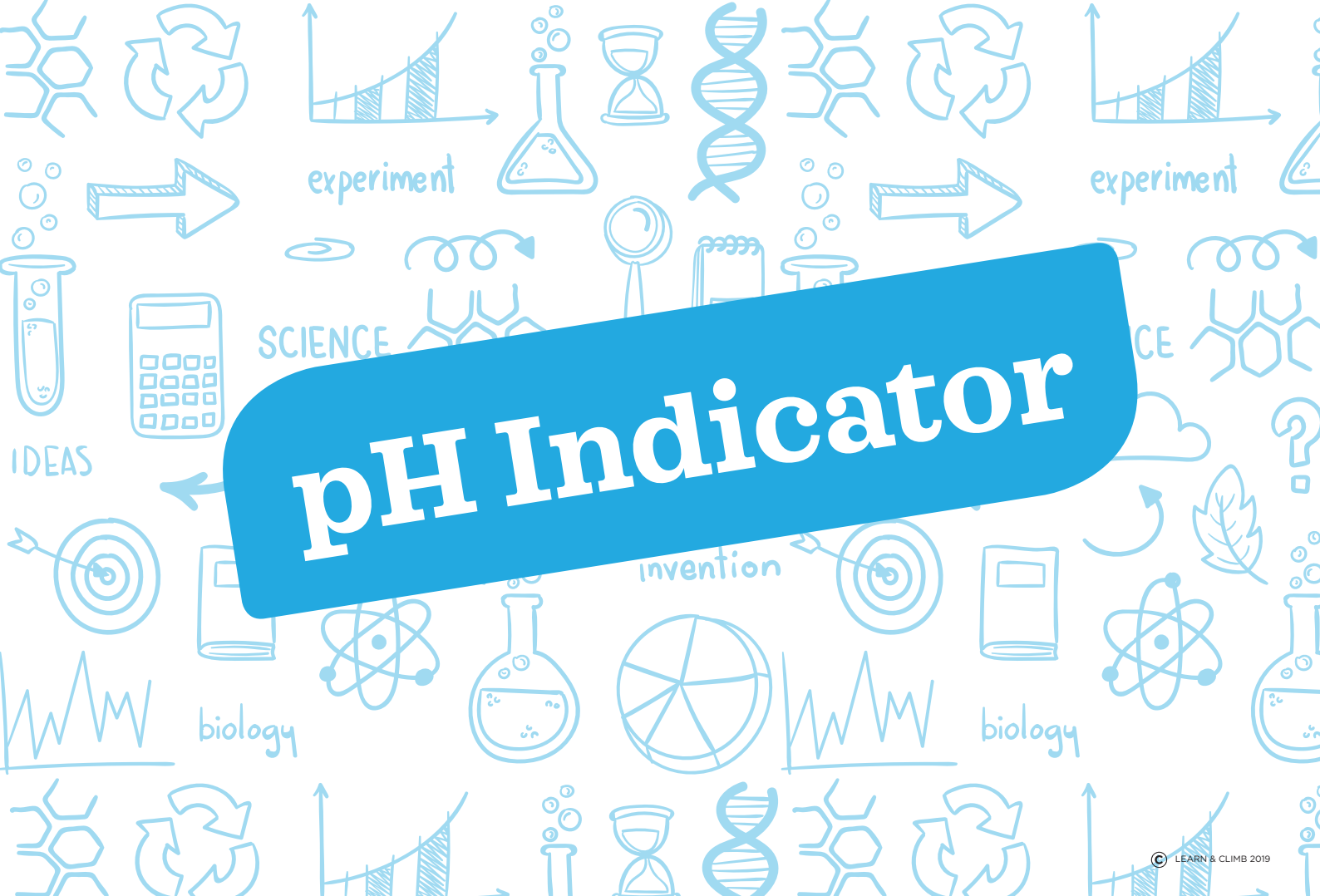
Add a few squeezes of glow-in-the-dark potion to the bottle for some extra magic!

Put all five foaming agents into the bottle Wait a moment.

Put on the cap and watch! If you used some glow-in-the-dark potion, then go into a dark room to watch the magic.

Explanation

The foaming agent reacts, or makes a new substance. The foaming agent also makes the water rise. But we know that the water is more dense than the oil, so it tries (and does) go back down — only to be pushed back up because of the reaction of the foaming agent! Then it goes back down because it is more dense than oil, and so on! This process happens over and over again due to convection, which is just the movement of liquids within other liquids due to different properties. Therefore, lava lamps continuously go up and down!



pH Indicator

pH INDICATOR

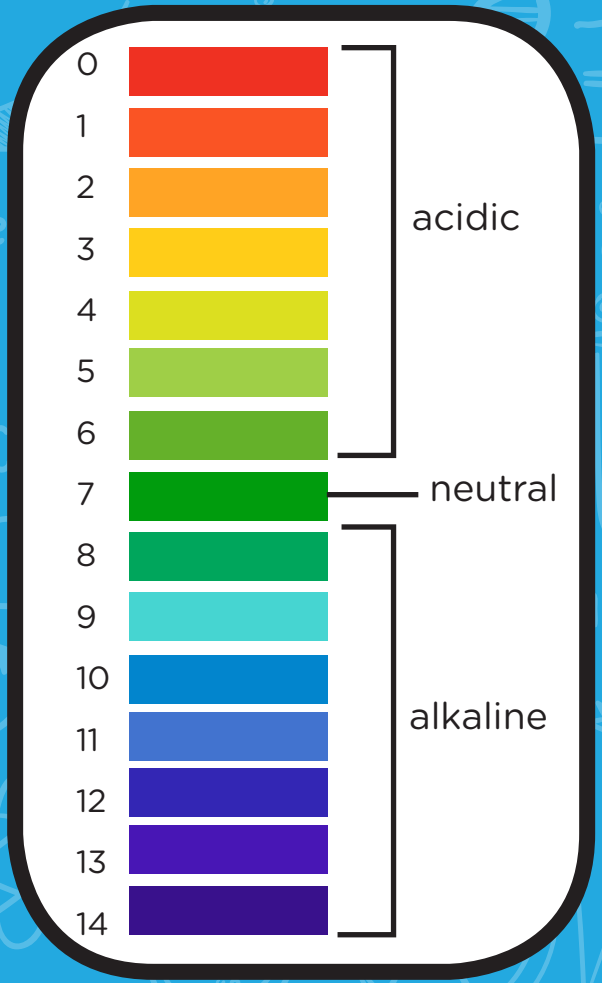
Many substances found on Earth have different properties. There is one special property that allows scientists and engineers to identify and see things easily when they are testing things in the field. That property is pH. pH stands for "potential of hydrogen." pH is measured on a scale of acidity and shows that some substances have more negative molecules of hydrogen, which is called hydroxide (OH-) while some have more positive molecules of hydrogen (H+). A molecule is a small part of any element. Hydrogen is a gas element that is usually found in the atmosphere or in water. pH just measures how many of each type of hydrogen molecules a solution has! Sometimes, when substances with different amounts of hydrogen molecules join or mix, they often cause a reaction, signaled by a color change, bubbling, or other sign. Each time you measure pH, you look for a color change, which shows a mini reaction has taken place!

pH SCALE

There are other types of scales you probably know about, like a regular scale that measures how much you weigh. The Richter scale measures how powerful earthquakes are. The pH scale measures how many positive hydrogen molecules (H+) a solution has. If it has a lot more H+ molecules, then it is an acidic solution. If it has a lot more (OH-) molecules, then it is a basic solution. If it is in the middle, near water, it is neutral. pH Importance: pH is a property of liquids. To see what the pH of a solid is, you would first need to dissolve it, or mix it in water, and then measure the resulting pH.

pH MEASURING TOOLS

A sophisticated, or high-level, pH test is often done with an electronic pH meter. You hold the node(s) of the meter in a liquid, and the electrode inside the meter reads the pH of that liquid, just like in this picture! Some can even measure pH levels of solids since they are tipped with metal to pierce them! When performing smaller experiments, pH is often measured by dipping pH strips into the liquid being tested. One then matches the color change to the color on the bottle to see what the pH level is. Also used are pH indicators, or substances that change the color of liquids to show pH levels. You will also be using a type of pH indicator in your experiments!



18 Litmus Paper Maker

SUPPLIES FROM HOME

Water

Scissors

SUPPLIES FROM KIT

- Beaker
- Pipette
- Yellow measuring spoon
- Stirring stick
- Litmus paper
- Purple sweet potato powder

How to Video - learnandclimb.com/pages/video-library

1

Cut one Litmus paper round into 3 to 5 strips

2

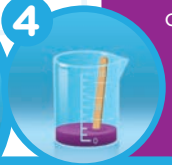
Pour 10 ml of water into the beaker.

Remember to use a level spoonful

3

Using your yellow measuring spoon, add 2 large spoonfuls of purple sweet potato powder to the beaker.

4



Mix it.

5

Dip half of each cut Litmus paper strip into the purple sweet potato mixture.

6

Dry the cut dipped Litmus paper in a plate. Give the litmus paper enough time to dry.

7

Save the dipped, cut and dried litmus paper for the next experiments.

Explanation

Litmus paper was originally created from lichens, which are tiny plants that grow in very cold climates. Crushing up the lichens releases the " juice," which is purple. Litmus has been around for more than 700 years! Purple litmus paper means that the pH is near 7, or at a neutral value. Neutral means in the middle. Since it is in the middle, it will make it easier to identify acids and bases, which fall near the outer ends of the pH scale. We will look a little more into the pH scale in a few experiments.

19 So Many Liquids, So Little Time

SUPPLIES FROM HOME

3 liquids from home (for example: lemon juice, apple cider vinegar, and vanilla extract)

SUPPLIES FROM KIT

Beaker
Pipette
3 petri dishes (fo liquids if you prefer)
Purple litmus paper
that you made in the previous experiment

Explanation

What happened? Why do you think purple changed to red? To blue? Stayed purple? Well, the liquids' level of acidity (how acidic they are) and alkalinity (how basic they are) affected how they mixed with the litmus paper. The acidic liquids normally change the color to red while the basic liquids change the color to blue. The color change is because of a special chemical in the purple powder that makes it change color rapidly! As you know from before, acids and bases have different properties. Can you remember any acids and bases from earlier guides? Acids taste sour, but bases taste bitter. Acids can melt metallic objects, while bases can melt proteins. And pH is just one more property where they differ!

How to Video - learnandclimb.com/pages/video-library

1

Put three strips of litmus paper on a plate.

2

Take a little bit of lemon juice into the pipette.

3

Squeeze a bit of the lemon juice from the pipette onto the purple part of the first litmus paper.

4

Rinse the pipette well. Then take a little bit of apple cider vinegar into the pipette.

5

Squeeze a bit of the apple cider vinegar from the pipette onto the purple part of the second litmus paper.

6

Rinse the pipette well. Then take a little bit of vanilla extract into the pipette.

7

Squeeze a bit of the vanilla extract onto the third litmus paper.

8

Examine your results.

I'll bet you're starting to see how pH works.

20 A Tiny Drop Creates a A Big Change

SUPPLIES FROM HOME

3 liquids in plastic cups from previous experiment

Plastic cup with water

SUPPLIES FROM KIT

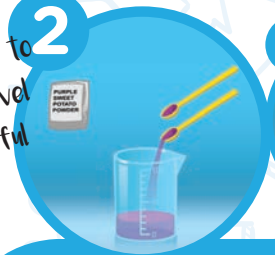
Beaker
Pipette
3 small test tubes
Test tube holder
Yellow measuring spoon
Purple sweet potato powder

How to Video - learnandclimb.com/pages/video-library

1

Pour 10 ml of water into the beaker.

2



Remember to use a level spoonful

Using your yellow measuring spoon, add 2 large spoonfuls of purple sweet potato powder to the beaker.

3

Stir. If it is too thick, add a little more water.

4

Take lemon juice into the pipette and add 5 ml of the lemon juice from the pipette into test tube 1.

5

Rinse the pipette well with water until it is perfectly clean.

6

Take apple cider vinegar into the pipette and add 5 ml of the apple cider vinegar from the pipette into test tube 2.

7

Rinse the pipette well with water until it is perfectly clean.

8

Take vanilla extract into the pipette and add 5 ml of the vanilla extract from the pipette into test tube 2.

9

Rinse the pipette well with water until it is perfectly clean.

Save the purple liquid for the next few experiments!

10

Add 2 drops of purple sweet potato water into each test tube. Observe if any of the liquids changed colors.

21 A Little Acidic A Little Basic

SUPPLIES FROM KIT

- 2 test tubes
- Test tube holder
- Measuring spoon
- Funnel
- Baking soda
- Pipette
- Purple sweet potato liquid
  from Experiment 20, or make new liquid following instructions from Experiment 20

SUPPLIES FROM HOME

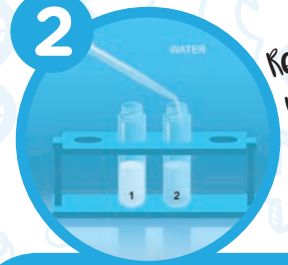
- Water
- Vinegar

How to Video - learnandclimb.com/pages/video-library

1

Add 5 ml of vinegar into test tube 1.

2



Add 5 ml of water into test tube 2.

Remember to use a level spoonful

3

Using your yellow measuring spoon, add one large spoonful of baking soda to test tube 2.

4

Close the cap of test tube 2 and shake.

5

Add 2 to 3 drops of purple sweet potato water mixture to both test tubes.

6

Notice the color!

Explanation

The colors should change! In any mixture, the proportions of substances matter. A proportion is just a part of something compared to the whole. In the first half of this experiment, you mixed about the same proportions of baking soda and vinegar. What color was your resulting mixture? After adding the sweet potato powder it should have been purple! But when mixing more vinegar and less baking soda or more baking soda and less vinegar, you should get different colors.

Try it with different amounts of baking soda and vinegar, did the colors change?

22 Painting a Proud Little Picture

SUPPLIES FROM KIT

- Litmus paper
- 3 petri dishes
- Beaker
- Yellow measuring spoon
- Purple sweet potato powder

SUPPLIES FROM HOME

- Water
- Vinegar
- Orange juice
- Plastic or paper plate
- 3 cotton swabs

Explanation

Again, you caused liquids to change color, just as you did in the previous experiments. **Yet this time you used a special paintbrush to accomplish that goal. You are doing almost the same thing painters in ancient times used to do — mixing natural dyes and crude chemical mixtures to make primitive paints.** See how many cool, colorful drawings you can create. Scale it up to computer paper or a small canvas with paint brushes! How creative can you get?

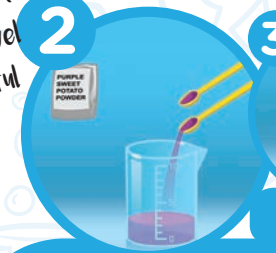
How to Video - learnandclimb.com/pages/video-library

Remember to use a level spoonful

1

Pour 20 ml of water into the beaker.

2



3

Stir well.

Using your yellow measuring spoon, add 2 large spoonfuls of purple sweet potato powder to the beaker.

4

Pour some of the purple mixture into petri dish 1.

5

Soak a non-cut litmus paper in the purple water.

6

Wait 30 seconds to 2 minutes for the Litmus paper to be fully coated.

7

Skim away any extra clumps and set aside to dry.

8

After the Litmus paper is dry, dip a cotton swab into each of the liquids that you have collected from your house.

9

Draw on the Litmus paper using your dipped cotton swabs!

23 Acids & Bases React in Spaces

SUPPLIES FROM KIT

- Small test tube
- Stirring stick
- Measuring spoon
- Citric acid
- Baking soda
- Purple sweet potato powder
- Beaker

SUPPLIES FROM HOME

- Oil
- Water
- Plastic Plate

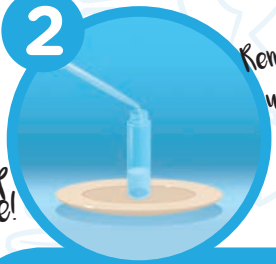
How to Video - learnandclimb.com/pages/video-library

1

Don't skip the plate!

Put the test tube into the plastic plate.

2



Remember to use a level spoonful

Pour 5 to 7 ml of water into the test tube.

3

4

Stir with the stirring stick.

Using your yellow measuring spoon, add one large spoonful of baking soda to the test tube with water.

5

Add one large spoonful of purple sweet potato powder to the test tube.

6

Stir with the stirring stick.

7

Pour oil into the test tube until it is almost full.

8

Wait 10 to 20 seconds for it to settle.

9

Add one large spoonful of citric acid and push it down until it reaches the purple powder

10

Watch!
Draw or write a description of what happened.

24

Don't Judge an Egg by Its Shell

SUPPLIES FROM HOME

- Plastic wrap
- Cup
- Raw egg
- Vinegar

How to Video - learnandclimb.com/pages/video-library

1

Fill your cup halfway with vinegar.

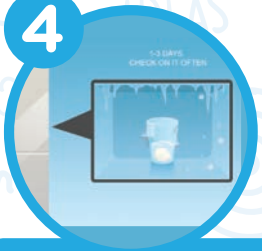
2

Put your egg in the vinegar (making sure the egg is fully immersed in the vinegar).

3

Cover the top of your cup with plastic wrap.

4



Put it into your fridge for one to three days. Check on your egg every so often.

5

Remove your egg from the fridge. What happened? Put your egg under a light- see what happened then.

Record what changed & happened to your egg.

Explanation

If objects like an egg shell, which is somewhat basic, is put into vinegar, which is somewhat acidic, they will "react." In this case, the vinegar should "transform" the egg shell and virtually dissolve it away! It is like the process where some metals are put into acid baths to purify or dissolve excess grit or stains from their surface.

Slime

Slime. Gloop. Ooze.

COMPOUND BACKGROUND

Bouncy balls. Quicksand. Cheese. Whatever you call them, they are cool, right? But how are all of these things made? Well, when you combine certain items, they make compounds. Compounds are just combinations of two or more elements. Often, combining two elements makes something entirely new with entirely different properties. If you combine certain liquid and solid substances, they can make something that is like a liquid and a solid. Substances like slime or quicksand might feel and move like a liquid, but they look like a solid.

AMORPHOUS SOLIDS

There are foods like these — cottage cheese, sour cream, yogurt and gelatin to name a few — that are inbetween liquids and solids. They have properties of both liquids and solids. Sometimes they are called amorphous solids because they do not have a definite crystal structure. They are solids that look like a solid, but feel and move like a liquid. Like the crystals you will make in later experiments. Most solids are made of crystals at the microscopic level. In this guide, you will be making mostly amorphous solids.

Ready?
Let's get started!

25 Time for Slime!

SUPPLIES FROM KIT

2 test tubes
Beaker
Test tube holder
Yellow measuring spoon
PVA glue
Borax
Coloring Agent

SUPPLIES FROM HOME

Water

note!

When you first open the glue from the kit, use a toothpick or paper clip to open the top of the glue bottle. Be careful because this glue and others can stick to your hands. Wash beaker out very well after each use!

Expand

This experiment normally works with glues that have a special compound called PVA, or polyvinyl alcohol. Other glues also contain PVA, like wood glue or white school glue. Try some different glues and see if the experiment still works. Try not to use up all the borax, though! **Did the experiment work better or worse?**

Explanation

You take glue and water — two liquids — and combine them with a solid — borax — and they make an entirely new substance: slime! How does this happen? **The molecules, or smallest parts of the different compounds, bond together with one another and make a stretchy kind of solid**.

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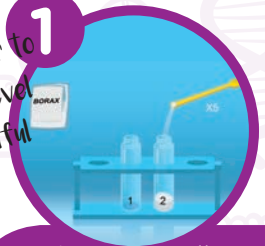
Remember to use a level spoonful



1. Using your yellow measuring spoon, add 5 small spoonfuls of borax to test tube 1.

2. Add 10 ml of water to test tube 1.

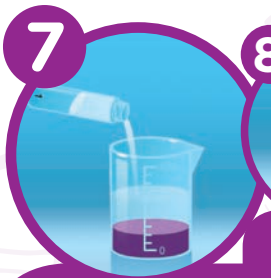
You can use your beaker for easier pouring.

3. Secure the cap on test tube 1 and shake until the borax is dissolved in the water.

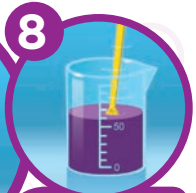
4. Pour 10 ml of water into test tube 2. Add 2 drops of coloring agent (optional) to test tube 2 and shake well.

5. Add 20 ml of glue into the beaker.

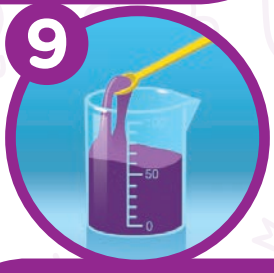
6. Pour the water from test tube 2 into the beaker.



7. Pour the mixture from test tube 1 into your beaker.



8. Stir.



9. You just made slime!
if you feel your mixture needs more borax, go ahead and add more.

Record the smell, feel, & color of the three substances in test tubes 1 and 2 & the beaker.

26 Follow the Bouncing Ball

*note!
If it does not work the first time, add more spoonfuls of salt.

SUPPLIES FROM KIT

- Yellow measuring spoon
- Beaker
- PVA Glue
- Glow-in-the-dark potion
- Coloring agent, *optional*

SUPPLIES FROM HOME

A few spoonfuls of salt

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1

Pour 20 ml of PVA glue into the beaker.

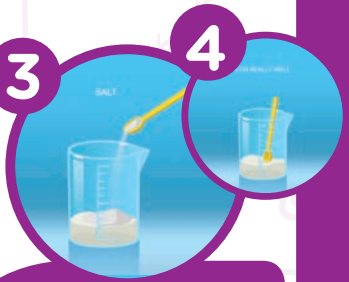
2

For added excitement, add 2 to 4 squeezes of the glow-in-the-dark powder to the beaker.

Remember to use a level spoonful

3

4



Using your yellow measuring spoon, add 5 large spoonfuls of salt into the beaker and stir quickly. When white particles start to form, stop stirring.

5

Get the solid mixture from the beaker out, and try to form a ball.

6

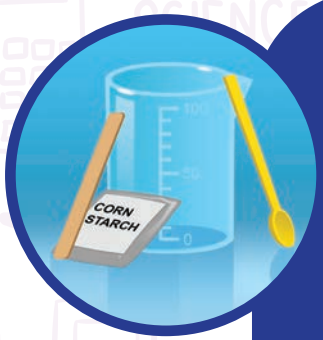
Drop your ball on a flat surface. Did it bounce?

If you added glow in the dark powder then you can bounce it in a dark room & see the ball light up! How cool is that?!

Explanation

This experiment was slightly different than the last one. The salt particles fill in the spaces between the "glue particles." The PVA particles are pushed aside, and they bunch up and harden into a ball. This process happens with other compound mixtures like tofu or gelatin — you add certain solids to certain liquids, and parts of the mixture harden into a gel-like substance. Sometimes this process is used to purify parts of liquids or get out tiny particles that might otherwise be "stuck" in them.

27 The Great Thickening



SUPPLIES FROM KIT

- Beaker
- Yellow measuring Spoon
- Cornstarch
- Stirring stick

SUPPLIES FROM HOME

- Water

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1. Pour 20 ml of water into the beaker.

Remember to use a level spoonful

2. Using your yellow measuring spoon, add 10 to 15 large spoonfuls of cornstarch into the beaker.

3. Stir.

4. Try to push down the thickened mixture really FAST and with a lot of FORCE.

See what happens!

5. Now try to push down on the thickened mixture SLOWLY and SOFTLY.

What happened now?!

6. Turn the beaker with the mixture in it over really fast. Did the mixture run out? Now try to turn it over slowly (over a plate or bowl).

What happened now & why?

Explanation

When separate, liquid molecules or particles are farther apart than solid particles. Some substances, though, end up feeling like both liquids and solids. When you mix cornstarch and water together, you end up producing one of these substances. It actually feels different depending on whether you mix it quickly or slowly! If you stir slowly, the particles move together and the substance feels like a liquid. If you stir quickly, the water particles move faster. The cornstarch particles fall behind, and the liquid tends to act like an amorphous solid. Keep trying until you get it right!

28 It Ain't Easy Being Cheesy

WARNING: ADULT SUPERVISION REQUIRED. DO NOT USE THE MICROWAVE OR TOUCH HOT LIQUIDS WITHOUT ADULT SUPERVISION.

SUPPLIES FROM KIT

- Beaker
- 1 test tube
- Yellow measuring spoon
- Pipette

SUPPLIES FROM HOME

- Vinegar or lemon juice
- Strainer or cheesecloth
- Milk
- Bowl

How to Video - learnandclimb.com/pages/video-library

1

Measure 40 ml of milk into the beaker.

2

Heat the milk in the microwave for 40 seconds. watch the milk so it does not boil.

3

Remove the beaker with milk from the microwave with an oven mitt or cloth being careful not to burn yourself.

4

Using your pipette, add 10 ml of vinegar or lemon juice to the test tube.

5

Pour the vinegar or lemon juice from your test tube into the beaker.

6

Stir & stir & stir until clumps start to form!

7

Pour the mixture through your strainer or cheesecloth into a cup or bowl and strain well. Enjoy!

Explanation

Have you ever held cheese in your hands and thought, Hmmm... Why does it feel like that? Have you ever wondered how it is made? Well, you just completed a process that was a lot like the cheese-making process. Looking at the ingredients. What do you know about milk? Milk is high in protein. When the temperature of protein particles increases or decreases, the particles "bunch up" or congeal. It can also happen when milk sours or is exposed to something sour like lemon juice or vinegar. It just so happens that cottage cheese is made like this! The milk molecules were able to bunch up when they came in contact with either the lemon juice or vinegar in this experiment, and that's how you created something like cheese!

You've made yummy cheese!

29 Quicker Than Quicksand

SUPPLIES FROM HOME

Baking pan or anything to mix in

Spoon

Generous amount of water

Something small to bury in the quicksand

SUPPLIES FROM KIT

Cornstarch

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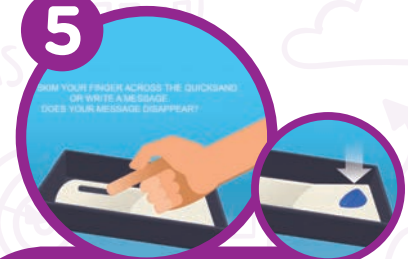
Pour about 1/2 cup ofthe water into the mixing tray.

Add cornstarch to the tray of water, a little at a time.

Stir.

Add more cornstarch if needed.

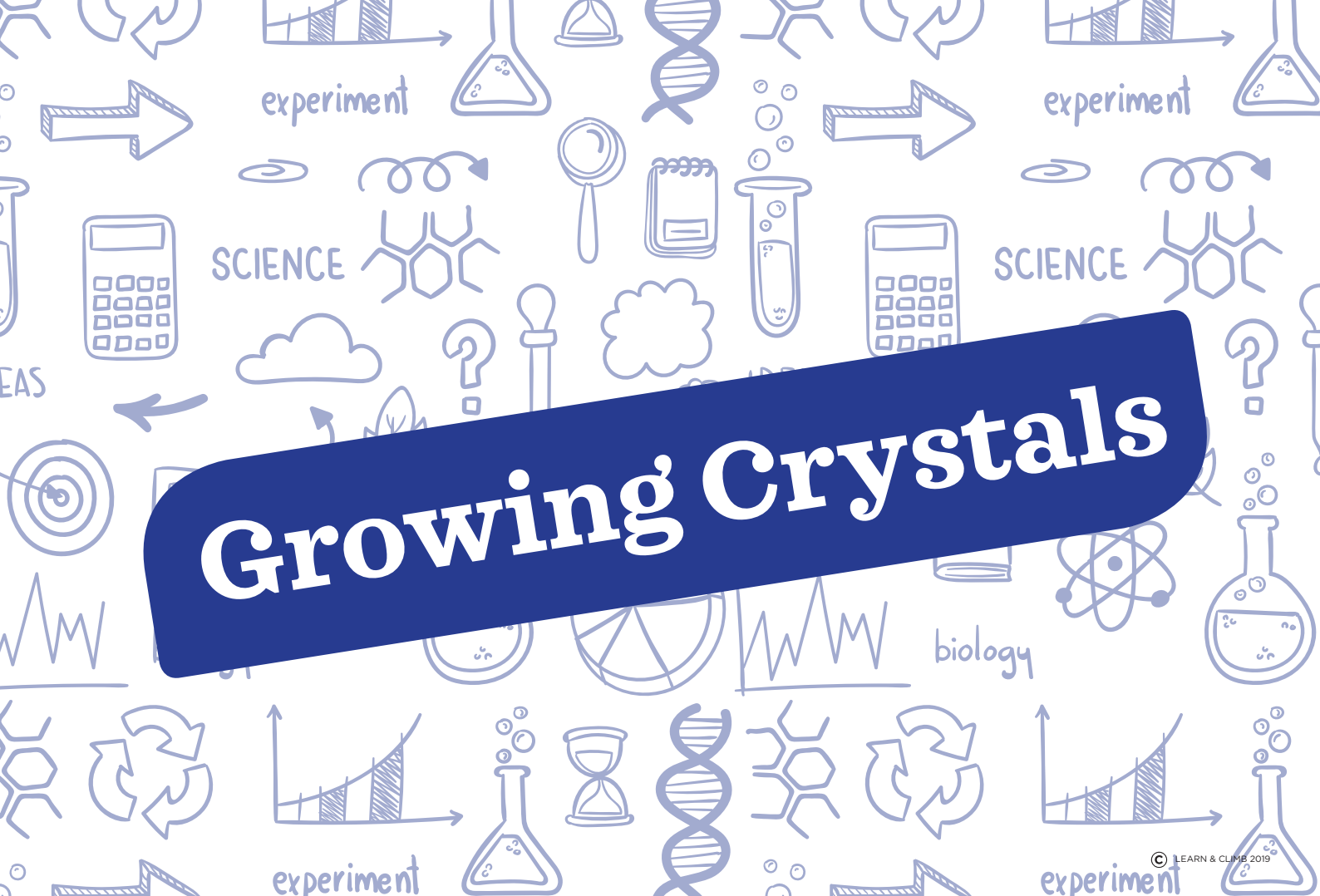
Add more water or cornstarch and play around with the quicksand you just created.



Try to skim your finger across the quicksand or write a message.

Explanation

Once your quicksand reaches a certain point, it starts behaving like an amorphous solid. You run your hands through it or try to pick it up, and it is almost solid. If you skim your hand across the top or write messages in it, it is more like liquid. It really depends on how you interact with the substance. The response of the substance depends on its thickness, or more accurately, its resistance to flow. Have you ever poured honey or syrup? These liquids are very thick. How about water or rubbing alcohol? These liquids are very thin. Sometimes temperature can affect how fast or slow a liquid will flow, too! You have made a special type of fluid almost exactly like quicksand! Bury an object in it and see what happens.



Growing Crystals

WARNING: ADULT SUPERVISION REQUIRED: BE VERY CAREFUL WHEN HANDLING THE UREA! Put down a paper plate so that none of it spills onto the ground. Wash your hands after using the urea, or use rubber gloves. Make sure not to touch your eyes or nasal passages. Put all urea mixtures into a plastic bag for disposal and throw away. Do not pour into sink!

CRYSTAL DEFINITION

Crystals appear like a large object made up of many different, tiny objects. But all crystals are made of the same thing! **They can be made of an element or a compound. An element is a pure substance that cannot be broken down into smaller parts. A compound is two or more elements put together.** Do you know any elements? I bet you do; iron, aluminum, and sodium are some common examples. Do you know any compounds? There's salt, sugar, oil, and many more! See if you can recall any other elements or compounds.

Every elements crystal shapes are unique, just like every snowflake or every sand grain is unique.

CRYSTAL FORMATION & GROWTH

Many crystals occur naturally. Some, though, you can grow! The conditions need to be just right, and most times water is involved. That is what you will be doing in following experiments — making your own crystals. You also might be familiar with crystals of the gemstone variety, like amethyst and garnet.

CRYSTALS

Have you ever been in a cave or seen one on TV? Did you notice these tiny, jewel-like objects glistening off the cave walls? These objects are crystals. You can find other everyday objects that are crystals, too, if you know where to look.

Can you think of any other crystals you have seen?

30 The Cooling Effect

SUPPLIES FROM HOME

Water
Sugar
Salt

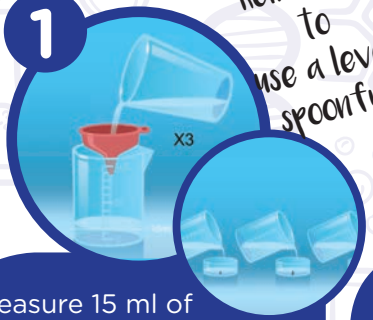
SUPPLIES FROM KIT

3 petri dishes
Yellow measuring spoon
Funnel
Urea
Beaker

How to Video - learnandclimb.com/pages/video-library

Remember to use a level spoonful

1



Measure 15 ml of water in the beaker
Pour 15 ml water into each petri dish.

2

Using your yellow measuring spoon, add 3 to 5 large spoonfuls of sugar to petri dish 1.

3

Add 3 to 5 large spoonfuls of
salt to petri dish 2.

4

Add 3 to 5 large spoonfuls of urea to petri dish 3.

5

Stir the contents of each petri dish really well until the grains disappear.

6

Place each petri dish in the palm of your hand. Record your results.

Explanation

The petri dish with the urea got colder, didn't it? When urea and water combine, they cause a chemical reaction. A chemical reaction occurs when something brand-new is made, and it tends to cause a change in temperature, bubbling, sound, smell or even can create fire! Urea is also used in cooling packs. Have you ever used a cooling pack before? It stayed cold, right? Thats because of the urea in it!

What do you feel? Is one of the petri dishes cold?

31 Too Much or Not Enough

*note

The water that is used for each petri dish should be the same temperature and from the same source.

SUPPLIES FROM KIT

- 3 petri dishes
- Yellow measuring spoon
- 1 test tube
- Urea
- Beaker

SUPPLIES FROM HOME

- Water
- Sugar
- Salt

How to Video - learnandclimb.com/pages/video-library

1

Measure 10 ml of water in the beaker for each petri dish.

2

Pour the 10 ml of water into each petri dish.

Remember to use a level spoonful

3

Using your yellow measuring spoon, add one large spoonful of salt into petri dish 1. Add one large spoonful of sugar into petri dish 2, and add one large spoonful of urea into petri dish 3.

4

Mix the contents of each petri dish until the grains are dissolved.

5

Repeat the instructions of adding one spoonful of salt, sugar, and urea into the correct petri dish, and stir very well between each spoonful.

6

Keep adding and mixing until the grains do not dissolve any longer.

Explanation

Have you ever been dripping with sweat when it is extremely hot outside? Were your hat or clothes soaked, too? Well, you might say that you were saturated with sweat. That means that your clothes or forehead or anything had the maximum amount of moisture that it could hold. In this case, when you are trying to dissolve the grains in the water, once it reaches its maximum, then no more grains will dissolve! You will see visible grains remaining in the water, no matter how hard you stir. (This saturation will later influence crystals, too!)

32 To Grow or Not To Grow

SUPPLIES FROM KIT

- Petri dish
- Yellow measuring spoon
- Litmus paper
- Urea
- Beaker

SUPPLIES FROM HOME

- Scissors
- Stapler
- Paper clip (or something else to hold the paper together)
- Pencil
- Water

How to Video - learnandclimb.com/pages/video-library

1

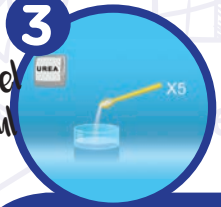
Pour 15 ml of water into the beaker.

2

Pour the water from the beaker into the petri dish.

Remember to use a level spoonful

3



Using your yellow measuring spoon, add 5 large spoonfuls of urea to the petri dish with water.

4

Create a standing litmus paper as follows: 1. Fold the litmus paper in half. 2. Either staple the two ends of the litmus paper together, or attach a paper clip to hold the paper together.

Explanation

Over some time, the water gets absorbed by the paper, and the urea is left behind and covers the paper. **Only urea crystals are left behind!**

5

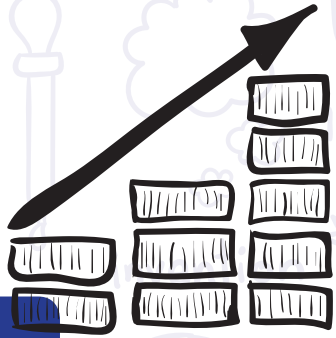
3. Cut off the bottom or side of the litmus paper, making a "floor" so the litmus paper can stand in the petri dish.

6

Place the litmus paper into the petri dish

7

Draw or write down the results you observed. Draw four boxes. Write "30 minutes," "1 hour," "1 day," and "3 days" above each box. The boxes should have enough room to describe or draw or the results.



33 The Knowledge of Crystalization

SUPPLIES FROM KIT

- 3 petri dishes
- Yellow measuring spoon
- 3 litmus papers
- Urea
- PVA glue
- Beaker

SUPPLIES FROM HOME

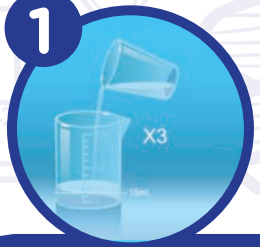
- Dishwashing soap
- Water
- Scissors

Explanation

What did your crystals look like this time? Did the crystals make different shapes? If they did, it could be due to the absorption rates from the different liquids. Absorption is just how a material will soak up a liquid. Because different liquids are made up of different elements and compounds, their crystal formation patterns should be one of a kind! Try to make the crystals with different liquids that you find in your house. You will always need to use urea, too.

How to Video - learnandclimb.com/pages/video-library

1



Pour 15 ml of water in the beaker. (You will need to do this three times.)

2

Pour 15 ml of water into each petri dish.

Remember to use a level spoonful

3

4

Using your yellow measuring spoon, add 5 large spoonfuls of urea into each petri dish.

Stir until dissolved.

5

Once the urea is dissolved, add a few drops of PVA glue into petri dish 1.

6

Add a few drops of dishwashing soap into petri dish 2.

7

Add a few drops of PVA glue and dishwashing soap into petri dish 3.

8

Create a standing litmus paper as follows: 1. Fold the litmus paper in half. 2. Either staple the two ends of the litmus paper together, or attach a paper clip to hold the paper together.

9

3. Cut off the bottom or side of the litmus paper, making a "floor" so the litmus paper can stand in the petri dish.

10

Put one prepared litmus paper into each petri dish

11

Wait and record. Measure the crystal growth after 30 minutes, one hour, one day, three days. Draw it as best you can!

34 Color the Crystals

SUPPLIES FROM HOME

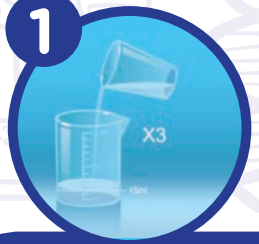
3 non-permanent color markers
Dishwashing soap
Water

SUPPLIES FROM KIT

3 petri dishes
Yellow measuring spoon
Litmus paper
Urea
Beaker
PVA Glue

How to Video - learnandclimb.com/pages/video-library

1



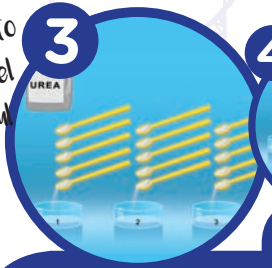
Pour 15 ml of water into the beaker. (You will need to do this three times.)

2

Pour 15 ml of water into each petri dish.

Remember to use a level spoonful

3



Using your yellow measuring spoon, add 5 large spoonfuls of urea into each petri dish.

4

Stir until dissolved.

5

Once the urea is dissolved, add a few drops of PVA glue into petri dish 1.

6

Add a few drops of dishwashing soap into petri dish 2.

7

Add a few drops of PVA glue and dishwashing soap into petri dish 3.

8

Create a standing litmus paper as follows: 1. Fold the litmus paper in half. 2. Either staple the two ends of the litmus paper together, or attach a paper clip to hold the paper together.

9

3. Cut off the bottom or side of the litmus paper, making a "floor" so the litmus paper can stand in the petri dish.

10

Color each litmus paper with a different color marker.

11

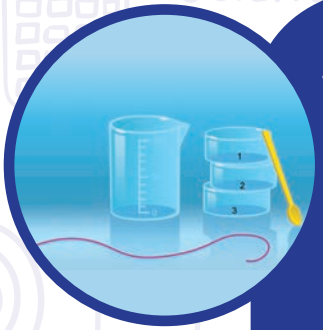
Place one colored litmus paper into each petri dish. Wait one hour, one day, and three days. Did the crystals take on the color the markers? Record Your results.

35 The Kingdom of Crystal Bridge

note!

If you do not have petri dishes available, you can use small plastic cups, too.

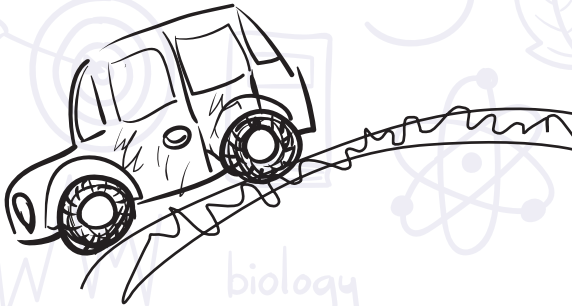
SUPPLIES FROM KIT



- 3 petri dishes
- Yellow measuring spoon
- Purple string
- Beaker

SUPPLIES FROM HOME

- Water
- Sugar (optional)
- Salt

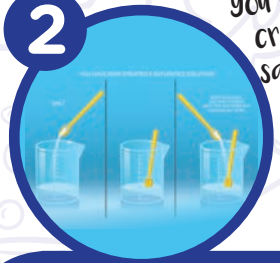


How to Video - learnandclimb.com/pages/video-library

1

Pour 20 ml of water into the beaker.

2



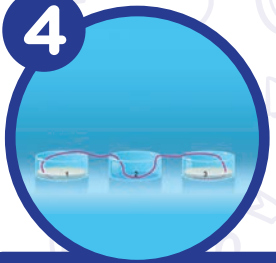
Add a little salt into the beaker with water. Stir until the salt dissolves. Keep on adding salt and stirring until the salt does not dissolve any more.

you have now created a saturated solution.

3

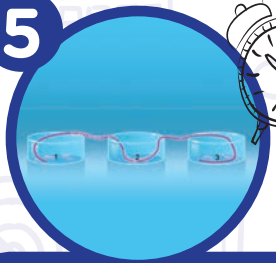
Divide the solution in your beaker between petri dish 1 and 3. Leave petri dish 2 empty.

4



Make a bridge with your purple string between the three petri dishes. The purple string should touch or rest in each petri dish.

5



Wait a few days and see what happens.
Try it with sugar too!

Explanation

After waiting a few days, what happened? Was there a salt bridge? Why did it happen? This time, instead of litmus paper absorbing the water directly, the water just evaporated, or turned from a liquid to a gas. The salt crystals were left behind and made their way across the bridge. The bridge hardened and almost looked like a real bridge! Did yours look like this?

Expand

Try this experiment with other crystalline substances. Start with sugar, which is very similar to salt. Were your results similar? You can even try to make crystal figures or animals! Draw a picture of all of your results!

Volcano Eruptions

FAMOUS VOLCANOES

There are many famous volcanoes scattered throughout the world. There are three main types of volcanoes: Composite (strato) volcanoes, shield volcanoes and dome volcanoes. About 75 percent of the world's volcanoes lie along a special "line" in the Pacific Ocean called the Ring of Fire. Indonesia lies along this line, and it is the most volcanically active country in the entire world. Some famous volcanoes are: Mount Vesuvius, Mount St. Helens, Krakatoa, and Mount Fuji. The largest volcano in the solar system is Olympus Mons. This shield volcano is on not on Earth, but rather on Mars!

Can you name any other famous volcanoes?

STUDYING VOLCANOES

It is important for scientists who study volcanoes, known as volcanologists, to actively study volcanoes. This way, they know when volcanoes are about to erupt and are able to warn people to evacuate or clear the area. They **measure things like temperature of lava, amount of smoke released, rumblings in the ground, and many other factors. They wear heavy suits made from special materials to protect themselves!**

A FORCE OF NATURE

A volcano is a true force of nature out of which gas, lava, rock, dust, and ash erupt. Volcanoes are responsible for some of the most powerful and devastating events in human history. Every day, you walk on the ground. That is the layer of Earth known as the crust. It is made up of huge slabs of rock called plates. These plates are in constant motion across the Earth. They move very slowly, though, about 1 to 4 centimeters per year. The plates move because the mantle, which is the layer of Earth under the crust, is like a giant ocean of magma. Magma is lava before it reaches the surface. Since the magma in the mantle is always moving around, the plates will move on top. Plates may sometimes move under or over one another. Since magma is less dense than solid rock, it is pushed up to the surface. When enough magma builds up and the magma chamber under a volcano gets too full, the volcano will erupt! Under the mantle is the layer of Earth called the core. It is extremely hot, with temperatures as high as 10,000,000° Celsius! It heats the mantle above it and started the process moving. The entire process is part of a theory called plate tectonics.

ERUPTION CONTENTS

Most volcanoes erupt lava. Lava is molten —or melted — rock, so hot that instead of acting like solid rock, it flows like liquid! Volcanoes also eject debris like small rocks and ash, which is made up of volcanic glass, other rocks, and minerals. They can even release gas or smoke like a fire. There are even volcanoes on other planets and moons in our solar system that erupt water and ice!

Why do you think that happens?

36 Load to Explode

SUPPLIES FROM KIT

Volcano base
baking soda
citric acid
Yellow measuring spoon
Beaker

SUPPLIES FROM HOME

Water

How to Video - learnandclimb.com/pages/video-library

1

Place your Volcano base on a plate.

2

Using your yellow measuring spoon, add 2 large spoonfuls of baking soda to the “crater hole” found in the top of your volcano.

3

Add 1 large spoonful of citric acid to the baking soda in the crater hole and mix well.

4

Fill the beaker with 15ml of water.

5

Pour the water into the crater hole with the citric acid and baking soda.

6

Watch your eruption!

Now let’s try some different ingredients for different eruptions!

37 More Eruptions

SUPPLIES FROM HOME

Water

Dish soap

SUPPLIES FROM KIT

Volcano base

baking soda

citric acid

Yellow measuring spoon

Beaker

Explanation

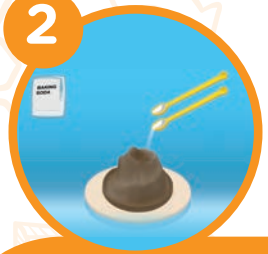
You just simulated volcanic layering. Some volcanoes do not erupt in one massive explosion. Instead, they have a series of constant, smaller eruptions. When the magma from these eruptions cools, it hardens into a special type of rock known as igneous rock. Igneous rocks are formed from recent volcanic eruptions. You can even sometimes see it in their rocky pores! The layers build up over time and make a special type of volcano called a stratovolcano. Stratovolcanoes are built from layers of lava flow, ash, and igneous rock. An example of a famous stratovolcano is Mt. Etna.

How to Video - learnandclimb.com/pages/video-library

1

Place your Volcano base on a plate.

2



Using you yellow measuring spoon, add 2 large spoonfuls of baking soda to the "crater hole" found in the top of your volcano.

3

Add 1 large spoonful of citric acid to the baking soda in the crater hole and mix well

4

Fill the beaker with 15ml of water.

5

Add 1 large spoonful of dishsoap to the beaker and mix until dissolved.

6

Pour the mixture from the beaker into the crater hole with the citric acid and baking soda.

7

Watch your eruption!

What was different this time?

38 Colorful Flow

SUPPLIES FROM KIT

- Volcano Base
- Yellow measuring spoon
- Baking soda
- Citric acid
- Coloring Agent
- Beaker

SUPPLIES FROM HOME

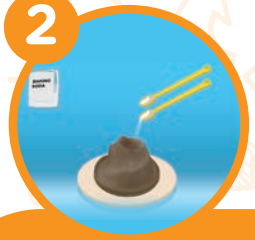
- Water
- Dish soap

How to Video - learnandclimb.com/pages/video-library

1

Place your Volcano base on a plate.

2



Using your yellow measuring spoon, add 2 large spoonfuls of baking soda to the “crater hole” found in the top of your volcano.

3

Add 1 large spoonful of citric acid to the baking soda in the crater hole and mix well

4

Pour 15ml water into the beaker

Repeat with other colors.

5

Add 1 large spoonful of dishsoap to the beaker and mix until dissolved.

6

Add a drop or two of coloring agent into the beaker and mix.

7

Pour the mixture from the beaker into the crater hole with the citric acid and baking soda.

8

Watch your colorful eruption!

Do you like the color?

39 Glow with the Flow

SUPPLIES FROM HOME

Water

Dish soap

SUPPLIES FROM KIT

Volcano Base

Yellow measuring spoon

baking soda

citric acid

Glow in the Dark Powder

Beaker

How to Video - learnandclimb.com/pages/video-library

1

Place your Volcano base on a plate

2

Using your yellow measuring spoon, add 2 large spoonfuls of baking soda to the “crater hole” found in the top of your volcano

3

Add 1 large spoonful of citric acid to the baking soda in the crater hole

4

Add 4-5 squeezes of Glow in the Dark Powder to crater hole

5

Fill the beaker with 15m of water

6

Add 1 large spoonful of dishsoap to the beaker and mix until dissolved.

7

Pour the mixture from the beaker into the crater hole with the citric acid, baking soda and Glow

8

Turn off the lights & Watch your glowing eruption!

40 The Bubbly Eruption

SUPPLIES FROM KIT

- Volcano Base
- Yellow measuring spoon
- Baking soda
- Citric acid
- Purple Sweet Potato Powder

SUPPLIES FROM HOME

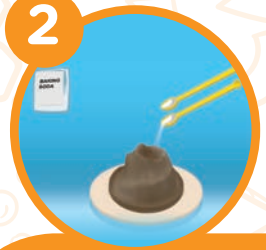
- Water
- Dish soap

How to Video - learnandclimb.com/pages/video-library

1

Place your Volcano base on a plate

2



Using your yellow measuring spoon, add 2 large spoonfuls of baking soda to the "crater hole" found in the top of your

3

Add 1 large spoonful of citric acid to the baking soda in the crater hole

4

Add 1 large spoonful of purple sweet potato powder to the crater hole and mix.

5

Fill the beaker with 15ml of water

6

Add 1 large spoonful of dishsoap to the beaker and mix until dissolved.

7

Pour the mixture from the beaker into the crater hole with the citric acid, baking soda and sweet potato powder

8

Watch your eruption!

41 A Truly Explosive Eruption

notes

You might need adult or another person's assistance for this experiment. Be sure to clean up after you are done so the area doesn't become sticky.

SUPPLIES FROM HOME

Mentos

2 liter bottle of carbonated diet cola

2 liter bottle of carbonated cola

How to Video - learnandclimb.com/pages/video-library

1

Put your 2 liter bottle of diet carbonated cola on a surface outdoors.

2

Open the top of your package of Mentos, keeping all the Mentos in the package.

3

Open the cap of the Diet Cola.

4

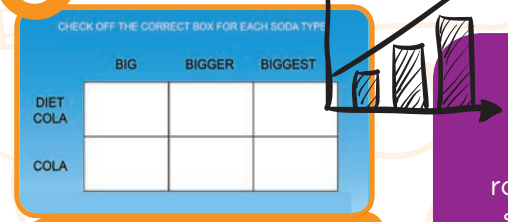
See what happens!

Turn the Mentos package over directly on top of the bottle of soda, but keep the Mentos from falling out of the package by keeping your thumb on the Mentos. When the Mentos are directly on top of the soda, remove your thumb and push the Mentos into the bottle of diet cola.

5

Now try doing the same thing with regular Cola!

6



Use the graph to record which soda type caused what type of eruption.

Explanation

The Mentos and Cola experiment works so well mostly because of the roughness and density of Mentos (it can sink quickly to the bottom, unlike other candies). This way, the cola permeates almost every pore of the Mentos in what is called an activated-site reaction.

42 Different Reactions

SUPPLIES FROM KIT

Beaker

SUPPLIES FROM HOME

Salt

Carbonated cola

Big container

How to Video - learnandclimb.com/pages/video-library

1

Fill the beaker halfway with cola.

2

Get a handful of salt.

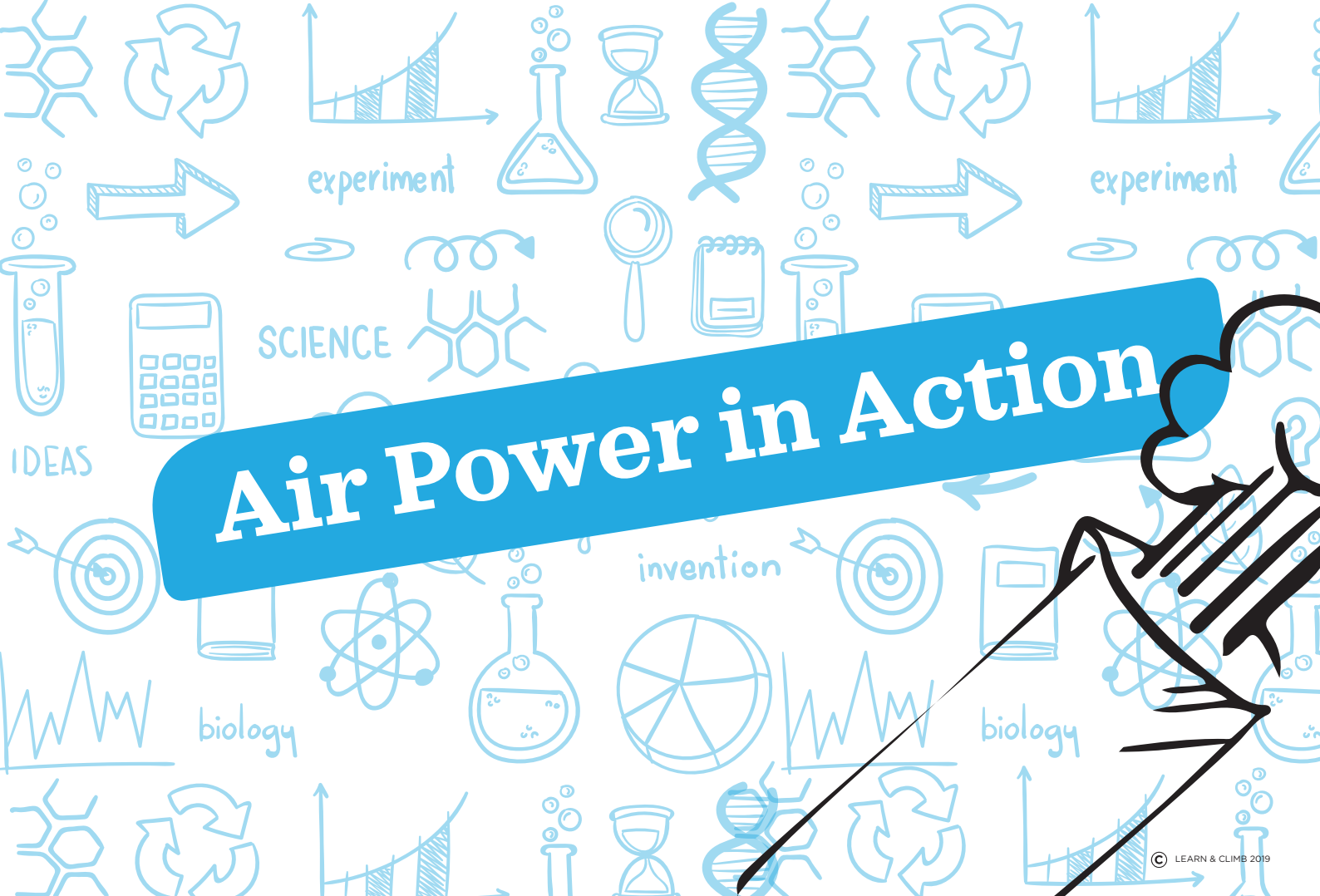
3

Pour the salt into the beaker with Cola.

4

See what happens!

Air Power in Action



EXPLORING AIR

Air is a substance that is all around us. It seems invisible, but it isn't. Have you ever "seen" the wind blow trees or grass? What you see is air moving from one place to another! What else can you do with air? Can you smell it? Can you taste it? Can you touch it?

Air is made up of air molecules that are really, really tiny**. Normally, we cannot see or even catch air. Or can we?**

THE ULTIMATE EXTENSION

Toy designers are constantly thinking of the best ways to use air power. If you can, buy some toys and try to see how they use air to propel them. **Have fun with air-powered cars, rockets, and squirt guns, as well as hover toys and air-hockey tables!**

Try to create your own idea for a toy that uses air power. **See how far your air will take you!**

43 Catching Some Air

SUPPLIES FROM HOME

Plastic bag

How to Video - learnandclimb.com/pages/video-library

1

Open the bag and swing it around to get some air into it.

2

Once you have enough air in the bag, twist the opening of the bag closed to keep the air in.

3

Press the bag with your finger

Notes

You might need to swing it around a few times to make sure enough air gets inside. It could take some practice.

Explanation

Sometimes, if there is enough air in one place, like in our experiment, you can kind of "see" it. This is like the air in a balloon, you can't actually "see" the air, but you know it's there! You also "felt" the air. Hmmm... Does this mean that air can have weight? Or might air even have some power? *Let's find out!*

44 The Power of Air

notes

If the balloon doesn't inflate immediately, you might need to stretch it. Stretching the balloon will make it easier to fill with air. Make sure that you put the balloon very close to the bag.

SUPPLIES FROM HOME

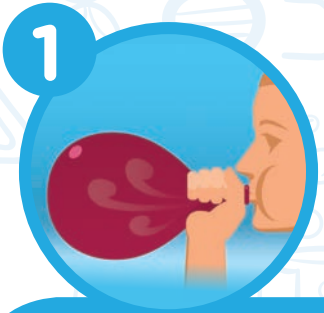
Plastic bag

SUPPLIES FROM KIT

Balloon

How to Video - learnandclimb.com/pages/video-library

1



Blow up the balloon and pinch the opening so the air doesn't get out.

2

While pinching the balloon closed, place the balloon very close to the opening of the bag.

3

Release your hold, and watch the bag move!

Explanation

There are a lot of things that run by air power. You just saw that air is power too! It comes in the form of air pressure. When a lot of air builds up in one place like a balloon, the air molecules come closer together and start moving a lot faster. When you held the balloon closed, these molecules could not escape. They wanted to get out, because they were under pressure. By releasing the balloon, you released the air molecules! You probably felt them whoosh, too!

Extend

Blow up your balloon again, and release the air into your hair! Now you look windswept!

45 Will the Car Go?

SUPPLIES FROM KIT

Balloon Car

notes

This experiment will work best on very flat surfaces. **The balloon is already attached to the car; please do not try to remove it.**

How to Video - learnandclimb.com/pages/video-library

1

Blow some air into the straw at the back of the balloon car.

2

Block the end of the straw with your finger to stop the air flow. Keep your finger on the straw as you place the car on a surface.

3

Release your finger from the straw and watch!

Explanation

Did the balloon car shoot away fast? What will happen if you blow up the balloon any bigger? Will the car go slower, because more air makes it heavier? Or will it run faster, because of more air pressure? Predict what will happen, and then try it yourself!

46 Racing Down the Track

SUPPLIES FROM KIT

Balloon Car

Explanation

Your balloon car has no steering wheel, so it needs a track to race on! Sometimes people drive go-karts on tracks. Professional race car drivers compete on tracks. Cars race on tracks because they can go faster in a safe environment!

SUPPLIES FROM HOME

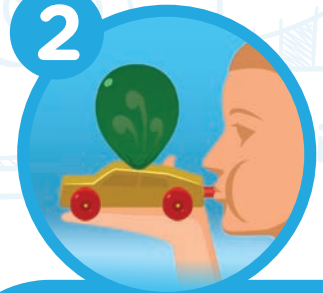
2–5 large books or anything to make a raceway

How to Video - learnandclimb.com/pages/video-library

1

Create your raceway.

2



Blow air into the straw at the end of the car, and hold your finger on the straw to stop the air flow.

3

Hold your finger on the straw as you place the car at the beginning of the track you made.

4

Release your finger from the straw and watch your car go.

Evaluate

Evaluate and Extend See how straight you can make your track. An erratic or curvy track can decrease speed. If you keep everything straight, your car will zoom! Try it out and see for yourself!

47 Racing Up the Track

SUPPLIES FROM KIT

Balloon Car

SUPPLIES FROM HOME

2–5 large books or anything to make a raceway

Extend

Try to make your slope as steep as possible. First try one book, then two, then three or more! What happened? What was the steepest slope your car could get over? Four books? Six books? *Try and see!*

How to Video - learnandclimb.com/pages/video-library

1

Stack the books until they are slightly higher than the car.

2

Lean the piece of cardboard or the smaller book against the large books to make a slope.

3

Blow up the balloon by blowing air into the straw at the end of the car.

4

Block the straw with your finger so the air of the balloon can't get out, then place the car at the bottom of the slope

5

Release your finger and watch!

Explanation

Roads and tracks are not always perfectly straight. Sometimes they are angled or sloped. Have you ever seen a car go up a very steep hill? Or how about a truck? They can ascend hills because of power. The steeper the slope, the more power the vehicle needs to climb it! If you blow the balloon up larger, there are more particles inside thus more air pressure. When you release them, the force of that air propels your balloon car!

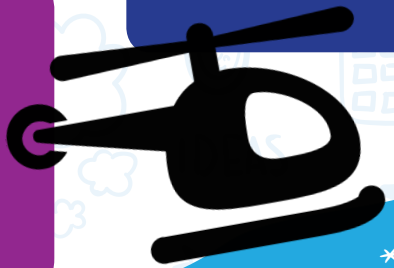
48 The Flying Helicopter

SUPPLIES FROM KIT

- Balloon
- Balloon joint
- Propeller joint
- 3 propeller blades

Explanation

You blew up the balloon this time, and it propelled the blades through the air. But how? Again, air power and air pressure were at work. Each blade has a tiny passage where air can escape. The air pushed out through the balloon and through the passages pushes the propeller blades the whole time. This causes the propeller to spin, just like in a real helicopter!

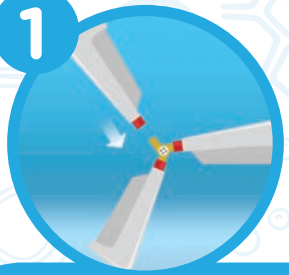


*Notes

Be sure to release your helicopter away from your eyes and away from any fragile items. Propeller blades are delicate; hold them toward the red cap ends so you do not break them.

How to Video - learnandclimb.com/pages/video-library

1



Fit the three propeller blades into the propeller joint. You should hear a click when they snap into place.

2

Fit the balloon around the wire end of the balloon joint.

3

Give a little pull on the balloon and Blow air into the balloon through the other end of the balloon joint.

4

Pinch the opening of the balloon so air doesn't get out.

5

Insert the balloon joint into the propeller joint.

6

Let go & watch it fly!

Hold your helicopter with the propeller on top and the balloon underneath.

49 The Amazing Blow-Up

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

1 Balloon
Funnel
Citric Acid
Baking Soda
Yellow measuring spoon
Large test tube

Explanation

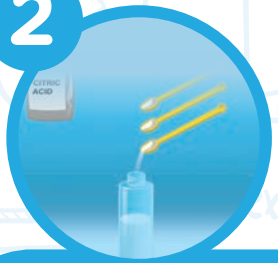
Did the balloon fill with air? It sure does look like it- but it actually filled with gas. The combination of citric acid and baking soda created a chemical reaction resulting in a gas called carbon dioxide (CO_2). Carbon dioxide is one element found in air, if you add one carbon atom to 2 oxygen atoms (CO_2) you've made carbon dioxide! The gas trapped in the test tube tries to escape- and it does- right into your balloon!

How to Video - learnandclimb.com/pages/video-library

1

Fil the large test tube about half way with water.

2



Using your yellow measuring spoon, place 3 large spoonfuls of citric acid into the test tube

3

Replace the test test tube lid and shake until dissolved.

4

Using your funnel, add 4 large spoonfuls of baking soda into the mouth of the balloon and remove the funnel.

5

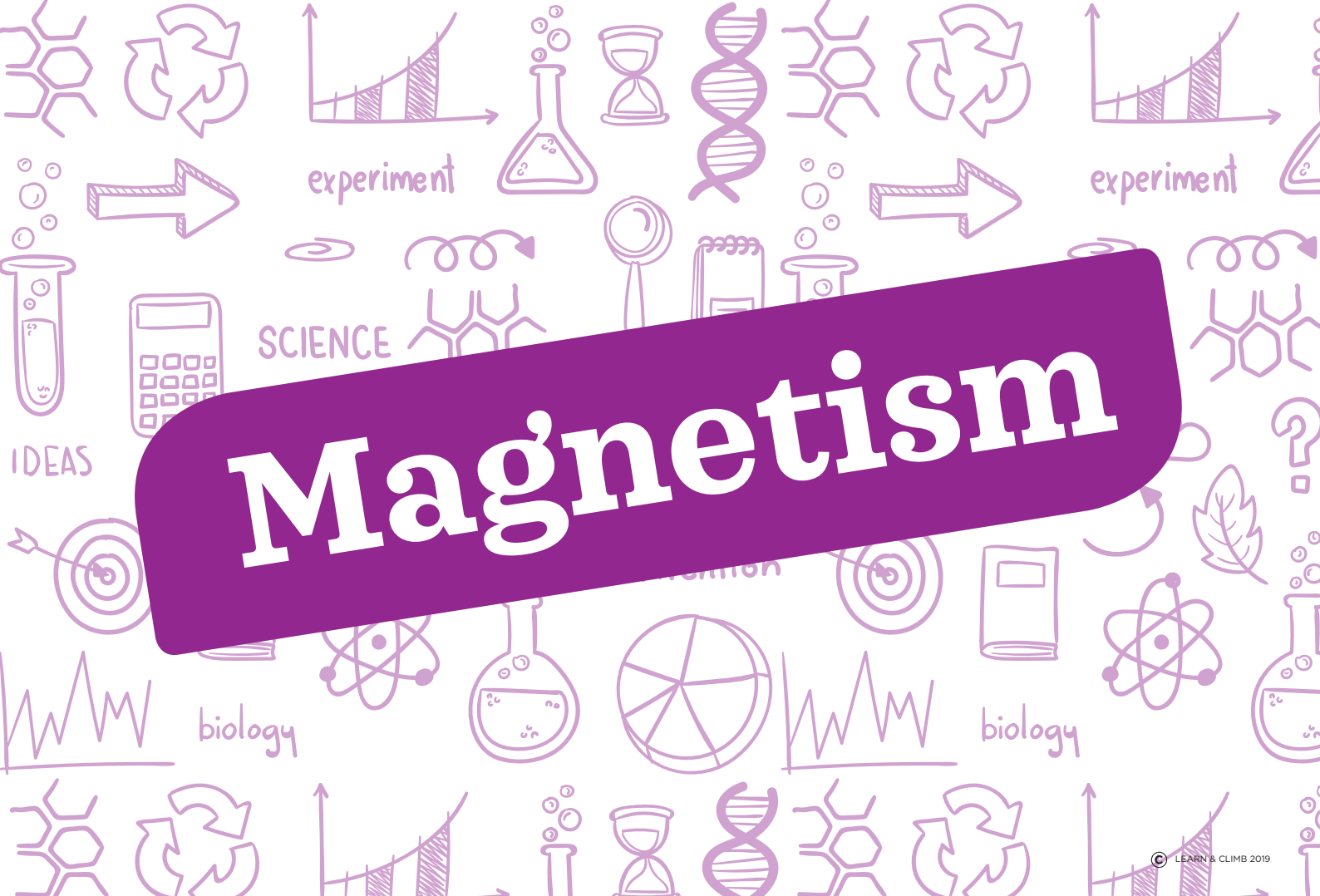
While holding the balloon closed, secure the mouth of the balloon onto the top of the test tube without allowing the baking soda to fall into the test tube... yet.

6

Place the test tube with balloon attached on a flat surface.

7

Release the baking soda into the citric acid and water and watch the balloon expand!



Magnetism

MAGNETISM & NAVIGATION

Magnetism is a very interesting phenomenon. It works based on the principle that two objects can have an attraction or are drawn to each other. If you stick a piece of wood next to a piece of paper, they are not attracted to each other. Likewise, if you put a rock next to a blade of grass, they will not stick together. They are not magnetized. There are three main types of magnets: temporary, permanent, and electromagnets.

The Earth's surface has a dipolar (2 magnetic poles, equally strong but opposite polarity) magnetic field. This field also causes compasses to point to the North Magnetic Pole. The North Magnetic Pole is the wandering point on the surface of Earth's Northern Hemisphere, at which the planet's magnetic field points vertically downwards (in other words, if a magnetic compass needle is allowed to rotate about a horizontal axis, it will point straight down). Did you know that the North Magnetic Pole is not exactly where the Geographic North Pole is? Earth's magnetic poles are actually pretty far from its geographic poles. In 2005, the North Magnetic Pole (NMP) was about 810 km (503 miles) from the Geographic North Pole. The NMP was in the Arctic Ocean north of Canada. Similarly, the South Magnetic Pole (SMP) was about 2,826 km (1,756 miles) from the Geographic South Pole.

Early navigators, especially sailors, used compasses to make sure that they were going in the right direction during their journeys. Since compasses always point to the magnetic north, it gave them a benchmark that they could always use! You can still use a compass today to navigate through the woods or through your local town.

Try it yourself!

MAGNETIC PROPERTIES

Have you ever heard the phrase opposites attract? All magnets have two poles: a north pole and a south pole. Can you guess which ends of a magnet are attracted to each other? If you put two north ends of two separate magnets together, you will feel a tiny force pushing them apart. The same thing happens if you put the two south ends of those magnets together. You actually have to put the north pole of one magnet and the south pole of another magnet together to make them stick together. Only then will they pull toward each other and create a magnetic field! Try it with another magnet if you can!

ELECTRICITY MAGNETISM ON EARTH

Believe it or not, electricity and magnetism are related. The Earth has what is called a giant electromagnetic field, sometimes known as the geomagnetic field. It is a field that allows electricity, like lightning, to flow freely in the atmosphere. Without the electromagnetic force created by this giant electromagnetic field, our satellites would stop working. Our cell phones, computers, and other electronic devices would not work, either!

50 What Is Left Behind

SUPPLIES FROM KIT

- Magnet stick
- Beaker or test tube
- Iron filings
- Sand filling
- 2 petri dishes or plates

*notes

It might take a little while until you are able to get it just right, so practice!

Extend

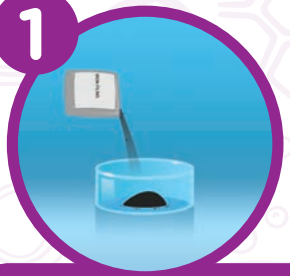
Can you pick up anything else with this magnet? Try it with some different objects in your house.

Explanation

Magnets, as you might have known, are attracted to certain types of metals. A metal is an object that is typically very shiny, very dense, and very durable. You might have even heard of some metals. List any that you have heard of. Three specific metals that magnets are attracted to are nickel, iron, and cobalt. If you stick a magnet next to any of these materials, the metal will be attracted to and stick to the magnet! Scientists are still researching how exactly magnets work today.

How to Video - learnandclimb.com/pages/video-library

1



Pour half of the packet of iron filings into the petri dish.

2

Pour half of the packet of white sand onto the iron filing.

3

Put the magnet stick into the test tube or beaker.

4

Lower the beaker into the mixture and pick up only the iron filings.

5

Move the test tube or beaker with fillings now attached to the second plate.

6

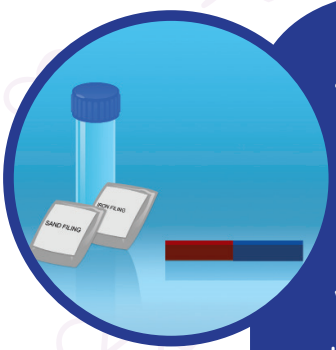
Lift the magnet stick up and away from the test tube/beaker and watch the fillings drop.

Repeat until there are no more iron filings mixed with the sand.

51 Sand & Magnet Artist

SUPPLIES FROM HOME

Paper plate

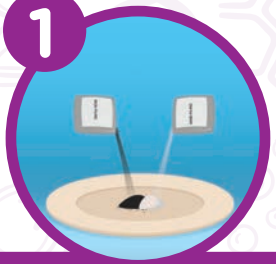


SUPPLIES FROM KIT

- Magnet stick
- Small test tube
- White sand
- Iron filings

How to Video - learnandclimb.com/pages/video-library

1



Pour some iron filings and white sand into your paper plate.

2

Mix them up.

3

Place your magnet stick into the small test tube.

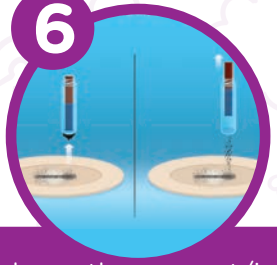
4

Hover (without touching the sand and iron mixture!) your small test tube with the magnet stick over the paper plate with iron filings and white sand.

5

You will notice the iron filings following your magnet stick in the test tube. You can draw a picture with the lines of iron filings!

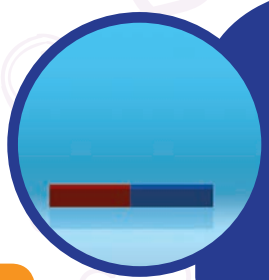
6



To release the magnet/iron filings from the bottom of the test tube, simply remove the magnet from the test tube.

Flip the magnet over and try it that way!

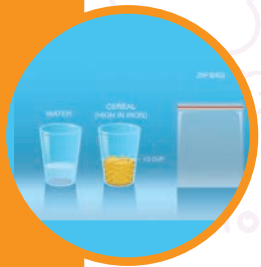
52 Am I Eating Iron



SUPPLIES FROM KIT

Magnet stick

SUPPLIES FROM HOME



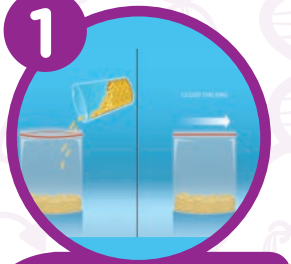
A 1/2 cup cereal high in iron (see notes)

Water

Zipper bag

How to Video - learnandclimb.com/pages/video-library

1



Pour the cereal into a zipper bag and seal the bag.

2

Crush the cereal in the bag until the cereal is really well crushed.

3

Pour some water into the bag. Use enough water to cover the cereal.

4

Run the magnet right on top of the bag.

Do you notice anything?!

note!

This experiment works best with cereals that are high in iron, usually listed in the Nutritional Facts section of the cereal box, just look at the label on the side panel of the box!

Explanation

The tiny iron particles in the cereal act just like the iron filings in our experiment. The magnet should have moved the tiny pieces around because it was attracted to them! It is very similar to the experiment that you did before. It might sound weird that we "eat" iron, but there are many other metal elements, or pure substances, that are in our foods, such as iron, magnesium, potassium, and more! In food, they are often called minerals and are part of a balanced diet!

53 Take me Out to the Field

SUPPLIES FROM KIT

Magnet stick
Iron filings

SUPPLIES FROM HOME

Parchment paper
plate

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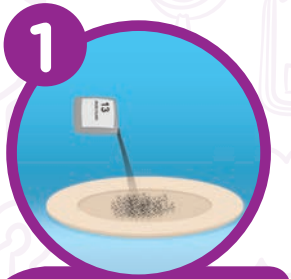


1

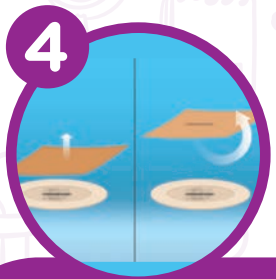
Put the iron filings onto the plate.

2

Place a piece of parchment paper on top of the plate with the filings.

3

Move the magnet on top and around the parchment paper.



4

Pick up the parchment paper carefully. Note the pattern underneath.

Sprout Garden

PLANT CONSERVATION

Overall, plants are incredible! They can grow in a variety of climates and in a variety of positions; they even give us oxygen when they photosynthesize. We must protect plants and conserve their habitats to ensure that we have as many plants as possible for years to come!

PLANT GROWTH

To make certain things, you need certain ingredients. For instance, to make pancake batter, you need eggs, water, and flour. To make slime, you need borax, glue, and water. Plants need three main ingredients to grow; can you guess what they are? Well, if you guessed sunlight, water, and air, then you guessed right! If plants do not receive even one of these three ingredients, then their leaves will shrivel, they will turn brown, and they will wilt, or die.

Have you ever seen a plant grow? What kind of plant was it? Was it a tree or a flower? A fern or a shrub? A moss or a lichen?

PLANTS

Most plants are green, but many are very vibrant colors! What color plants have you seen before? Even though there are many kinds of plants, all plants have the same basic structures, all the way down to their cells!

PLANT CELLS

Plant cells are very special. They have unique structures called chloroplasts, which are filled with chlorophyll. Chlorophyll is the green pigment (which works like paint) that gives plants their color. Chloroplasts are the structures that contain the chlorophyll.

Have you ever seen a plant walk? No, of course not! Well, since plants cannot move on their own, they need structure to be able to stand up straight, which is why they have rigid cell walls. These help the plants "stand" on their own.

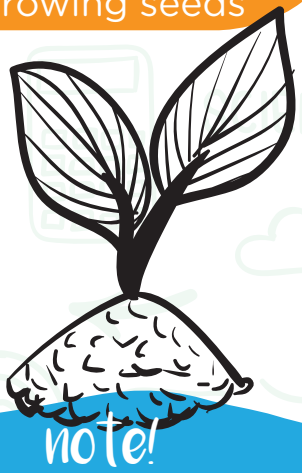
54 Sprout Up

SUPPLIES FROM KIT

Test tube holder
4 test tubes
Water-absorbing polymer crystals
Yellow measuring spoon
Tweezers (for seeds)
Beaker

SUPPLIES FROM HOME

Water
Fast-growing seeds



note!

Some fast growing seeds are Mung beans, Lentils, Alfalfa, Sweet Alyssum, Bachelor Buttons, Marigold, Cosmos, lettuce, Sun Flowers, Broccoli and Kale.

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1

Put one small spoonful of water-absorbing polymer crystals into test tubes 1 & 2.

2

Fill test tubes 1 and 2 with 15 ml of water. Add a few seeds to test tubes 1 and 2.

3

Put one small spoonful of water-absorbing polymer crystals into test tube 3.

4

Add a few fast-growing seeds to test tube 3 and leave in holder.

5

Put one small spoonful of water-absorbing polymer crystals into test tube 4.

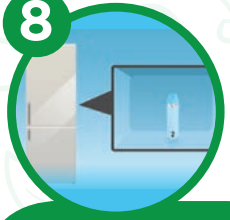
6

Add a few seeds to test tube 4 and add 15 ml of water to test tube 4.

7

Close the cap of test tube 4 and leave it in the test tube holder.

8



Put test tube 2 in the refrigerator.

9

Wait a few days and observe! Which seeds grew best?

Explanation

Were you surprised at the results? Which seeds grew best? Most seeds need to be at the right temperature and have the right amount of air and water to germinate, or begin to grow.

55 Acid Rain, No Gain

SUPPLIES FROM KIT

- Water-absorbing polymer crystals
- Yellow measuring spoon
- Test tube holder
- 4 test tubes
- Pipette
- Tweezers (for seeds)
- Beaker

SUPPLIES FROM HOME

- Water
- Permanent marker
- Lemon juice or vinegar
- Fast Growing Seeds

note!

Label your test tubes on the side of each tube with a permanent marker so you do not confuse your test tubes.

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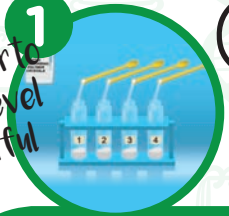
Remember to use a level spoonful

1



Using your yellow measuring spoon, add one small spoonful of water-absorbing polymer crystals into each test tube.

2

Add 15 ml of water to each test tube.

3

Add a few seeds to each test tube.

4

Test tube 1 stays the way you prepared it. Do not add lemon juice or vinegar.

5

With your pipette, add 1 drop of lemon juice or vinegar to test tube 2 each day.

6

Add 2 drops of lemon juice or vinegar to test tube 3 each day.

7

Add 3 drops of lemon juice or vinegar to test tube 4 each day.

Look at your results after a few days of adding the correct amount of drops of lemon juice or vinegar to your test tubes.

Draw or write down you results!

Explanation

What happened to the plants? Did they stop growing? Why? Keep testing with different acidic liquids. They are not good for plants!

56 What Does a Plant Drink?

SUPPLIES FROM HOME

Energy drink
Orange juice
Milk
Permanent marker (to label test tubes)
Water
Fast-growing seeds

SUPPLIES FROM KIT

Test tube holder
4 test tubes
Yellow measuring spoon
Water-absorbing polymer crystals
Tweezers (for seeds)

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1

Using your yellow measruing spoon, add one small spoonful of water-absorbing polymer crystals into each test tube.

2

Add 15 ml of water to each test tube.

3

Add a few seeds to test tube 1 .

4

Fill test tube 2 with 15 ml of energy drink.

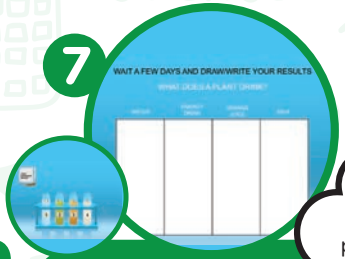
5

Fill test tube 3 with 15 ml of orange juice.

6

Fill test tube 4 with 15 ml of milk

7



Add a few seeds to test tubes 2, 3, and 4. Wait a few days and draw or write down your results.

What do plants drink?

Explanation

Are there some days when you feel like drinking only water? How about after you sweated or ran around a lot? Sometimes, however, you feel like drinking milk, sometimes you feel like drinking juice, and sometimes you even feel like drinking a smoothie! Well, plants always feel like water! That is their all-time favorite drink! That's why everyone waters their gardens with water and not with Gatorade, milk, or any other liquids. Now, liquid fertilizer is special, it does have some nutrients that plants like.

57 All Light Is Alright

SUPPLIES FROM HOME

Water
Fast-growing seeds

SUPPLIES FROM KIT

Test tube holder
2 test tubes
Yellow measuring spoon
Water-absorbing polymer crystals
Tweezers (for seeds)
Beaker

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Explanation

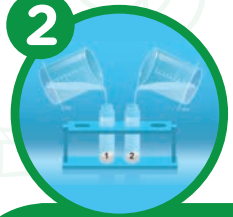
Are you the same as a plant? Do you need the same amount of light? Of course not! Light, though, is essential to plant growth!

Remember to use a level spoonful

1

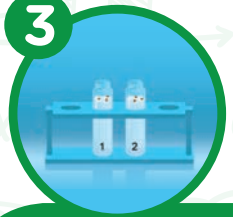
Using your yellow measuring spoon, add one small spoonful of water-absorbing polymer crystals into each test tube.

2



Add 15 ml of water to each test test tube.

3



Add a few seeds to each test tube.

4

Put test tube 1 in a dark room without sunlight.

5

Put test tube 2 under artificial light, like a lamp.

6

Record your results!

Is artificial light better than no light at all?

58 No Light Is Not Right

SUPPLIES FROM HOME

Water
Fast-growing seeds

SUPPLIES FROM KIT

Test tube holder
2 small test tubes
Yellow measuring spoon
Water-absorbing polymer crystals
Tweezers (for seeds)
Beaker

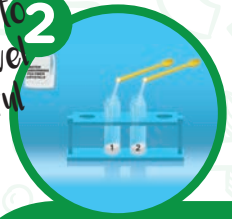
How to Video - learnandclimb.com/pages/video-library

1

Put the test tube into the holder.

2

Remember to use a level spoonful



Using your yellow measuring spoon, put one small spoonful of water-absorbing polymer crystals into each test tube.

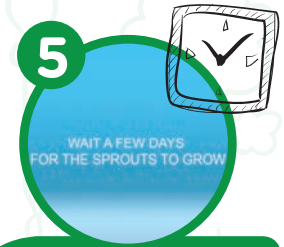
3

Fill each test tube with about 15 ml of water.

4

Add a few seeds to each test tube.

5



Wait a few days for the sprouts to grow.

6

Refer to picture to see what the sprouts should look like after a few days.

7

Put one test tube near the window, and put the second test tube in a box in a corner.

8

Watch what happens over the next few days.

No light is not right!

Thinking about the last experiment, is sunlight or is artificial light better?

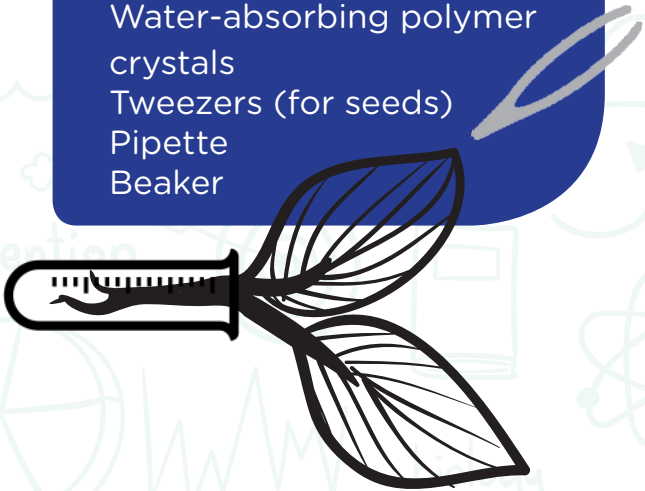
59 A Sideways Plant

SUPPLIES FROM HOME

Water
Fast Growing Seeds

SUPPLIES FROM KIT

Test tube holder
1 test tube
Yellow measuring spoon
Water-absorbing polymer crystals
Tweezers (for seeds)
Pipette
Beaker



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Remember to use a level spoonful

1

Using your yellow measuring spoon, add one small spoonful of polymer crystals to the test tube.

2

Fill the test tube with about 15 ml of water.

3

Wait 10 minutes or until the crystals expand to fill the test tube.

4

Put some fast-growing seeds into the test tube.

5

Using the pipette, make sure to add water regularly to keep the seeds moist.

6

Turn the test tube on it's side.

7

Watch the plant grow sideways over the next few days.

Why do you think the plants are growing upward? Are they growing toward something?

UV Rays

We all need some sun exposure — it's the top source of vitamin D, which helps our bodies absorb calcium for stronger, healthier bones. But it doesn't take much time in the sun for most people to get the vitamin D they need. Repeated unprotected exposure to the sun's ultraviolet (UV) rays can cause skin and eye damage. Use the information you will learn in the next few experiments to know how to protect yourself.

Have fun in the sun!

SUNLIGHT OR SOLAR ENERGY

The energy produced by the sun is electromagnetic radiation with many different wavelengths. Only a small portion of these wavelengths are visible to the human eye. These visible wavelengths are seen as colors of the rainbow, depending on the wavelength. Red has the longest visible wavelength, and violet has the shortest visible wavelength. When all the waves are seen together, they make white light.

Waves longer than those seen as red are called infrared, and waves shorter than violet are called ultraviolet. Ultraviolet light comes in different lengths too. Shortwave ultraviolet light is used to kill bacteria, hasten chemical reactions, and can be used to identify some fluorescent minerals. Unlike longwave ultraviolet light, the shortwave UV light cannot pass through ordinary glass or most plastics.

PROPERTIES OF ULTRAVIOLET LIGHT

Ultraviolet light (UV light) has shorter wavelengths than violet light. It cannot be seen by the human eye. Some animals — including birds, reptiles, and insects such as bees — can see into the near ultraviolet. Many fruits, flowers, and seeds stand out more strongly from the background in ultraviolet wavelengths as compared to human color vision. Many birds have patterns in their plumage that are invisible at usual wavelengths but seen in ultraviolet.

Although invisible to humans, UV light has many of the properties of normal sunlight. UV light can cause sunburn, hurt the eyes, and even cause discoloration of material dyed with organic dyes. Some UV light is absorbed by the ozone in the atmosphere, but some of the UV light still reaches Earth and can cause damage to the skin.

EFFECTS OF ULTRAVIOLET LIGHT

When bare skin is exposed to sunlight, most skin will either burn or tan. UV light wavelengths are short enough to break the chemical bonds in skin tissue. With prolonged exposure, skin may wrinkle or skin cancer may appear. Burning or tanning of skin is the natural response when skin cells are exposed to UV light.

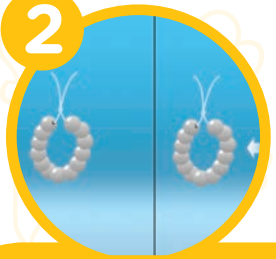
60 DIY Energy Bead Keychain/ Bracelet

SUPPLIES FROM KIT

- Energy beads
- String
- Keychain

Instructions

1. 
   Thread the energy beads through the string.

2. 
   You can choose to either tie it closed as a bracelet, or use the keychain to create a keychain.

3. 
   Cut off the extra string.

Save for the next few experiments.

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61 Are You Exposed to UV Rays?

SUPPLIES FROM KIT

Energy bracelet or keychain you made in a previous experiment.

Instructions

1. Choose a sunny day for this experiment.

2. Take your energy bead keychain/ bracelet for a walk.

3. See what happens!

4. Take your energy beads back inside.

Did your beads change colors?

How long did it take for the beads to change back to its original color?

Explanation

Energy beads have a unique pigment in them that changes colors when exposed to ultraviolet light from the sun (or other UV sources). If your beads have changed colors while you were out on your walk, then you were exposed to UV rays that the sun gives off. UV rays (ultraviolet rays) can be dangerous for your skin and eyes. In later experiments, you will learn how to protect yourself from the sun's UV rays.

62 Clouds and UV Rays

SUPPLIES FROM KIT

Energy bracelet or keychain you made in a previous experiment

Instructions

1. Choose a cloudy day for this experiment.

2. Take the keychain for a walk.

3. Wait and see if the beads changed colors.

4. Take your energy beads back inside.

How long did it take for the beads to change colors?

Explanation

It's interesting to know that up to 80 percent of the sun's UV Rays can pass through clouds! People often think that if it is cool or cloudy outside, you don't need sunscreen. This is the reason people often end up with sunburns on overcast days if they've spent time outdoors.

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63 Is Your Sunscreen Working?

SUPPLIES FROM KIT

Energy bracelet or key-chain you made in Experiment 60

SUPPLIES FROM HOME

SPF 30 or higher sunscreen that is less than a year old

Plate

1

Cover only a few of your beads with sunscreen.

2

Put your keychain/ bracelet on a plate outside and put it under sunlight.

3

What happened to the beads you covered, and what happened to the the beads you didn't cover?

Explanation

If your sunscreen is of good quality, then the beads you have covered should have stayed white. That is because sunscreen has several ingredients in it that will help prevent the sun's UV Rays from reaching your skin. If your covered beads changed colors, then the sunscreen you used did not protect the beads from the sun and will not protect you either! Such sunscreen should not be used!

64 Protect Your Eyes

SUPPLIES FROM KIT

Energy bracelet or key-chain you made in a previous experiment

SUPPLIES FROM HOME

Sunglasses

1. 

Take your bracelet or keychain outside and put it under sunlight.

2. 

Put your sunglasses over your beads so they are completely covered.

3. 

Observe. Did your beads change colors?

Explanation

Your eyes need to be protected from the sun's UV Rays too! You can't put sunscreen in your eyes, though, so what can you do?! Wear sunglasses! The most important job of sunglasses is to protect your eyes from UV rays. Sunglasses must have 100% UV protection for them to protect your eyes from damage.

How to Video - learnandclimb.com/pages/video-library

65 Testing Glass & Plastic

SUPPLIES FROM HOME

Glass jar
Plastic container

SUPPLIES FROM KIT

Energy bracelet or key-chain you made in a previous experiment

1 Place the bracelet or keychain into the glass jar.

2 Take it outside and put it under sunlight.

Did your beads change colors?

Test different jars and plastic and observe if any of the other objects can protect your beads from the sun.

Notes

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