Learn & Climb™

BOOM!

Fun with Science

INSTRUCTION MANUAL

OVER 65 SCIENCE EXPERIMENTS

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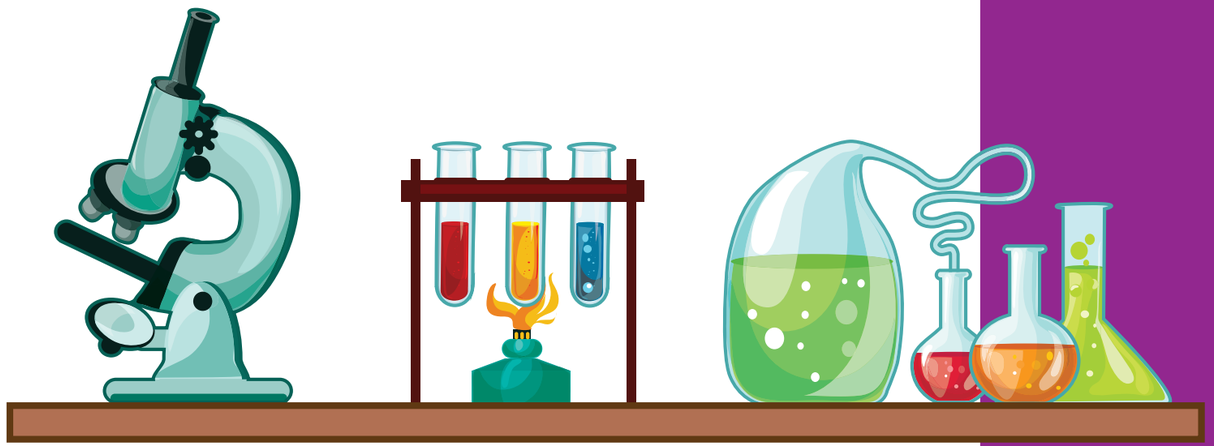
We are here to help!

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

For your convenience, this QR Code will link you directly to our support email.



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Instruction DVD
Instruction Manual
Plastic Pipette
Syringe
2 Beakers
2 Big Test Tubes
1 Small Bottle with Cap
3 Petri Dishes
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Test Tube Holder
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Double Sided Measuring Spoon
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Volcano Model and Base
Connective Tubing
Mini Container
Crater Cap
Transparent Tape
3 Small Balloons
1 Big Balloon
Hover Disc
Propeller Joint
3 Propeller Blades
1 Magnet Stick
2 Magnet Rings
String
20 Color Changing 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
2 Magma Gel
Packs - 1.41 oz each
Glow in the Dark - .18 oz
Water Absorbing Polymer
Crystals - .7 oz
Water Absorbing Polymer
Beads - .18 oz
Coloring Agent, Red, Yellow,
Blue - .21 oz each
Foaming Agent - .53 oz
6 Colored Sand - .11 oz each -
Red - .21 oz
PVA Glue – 2.12 oz

CATEGORIES

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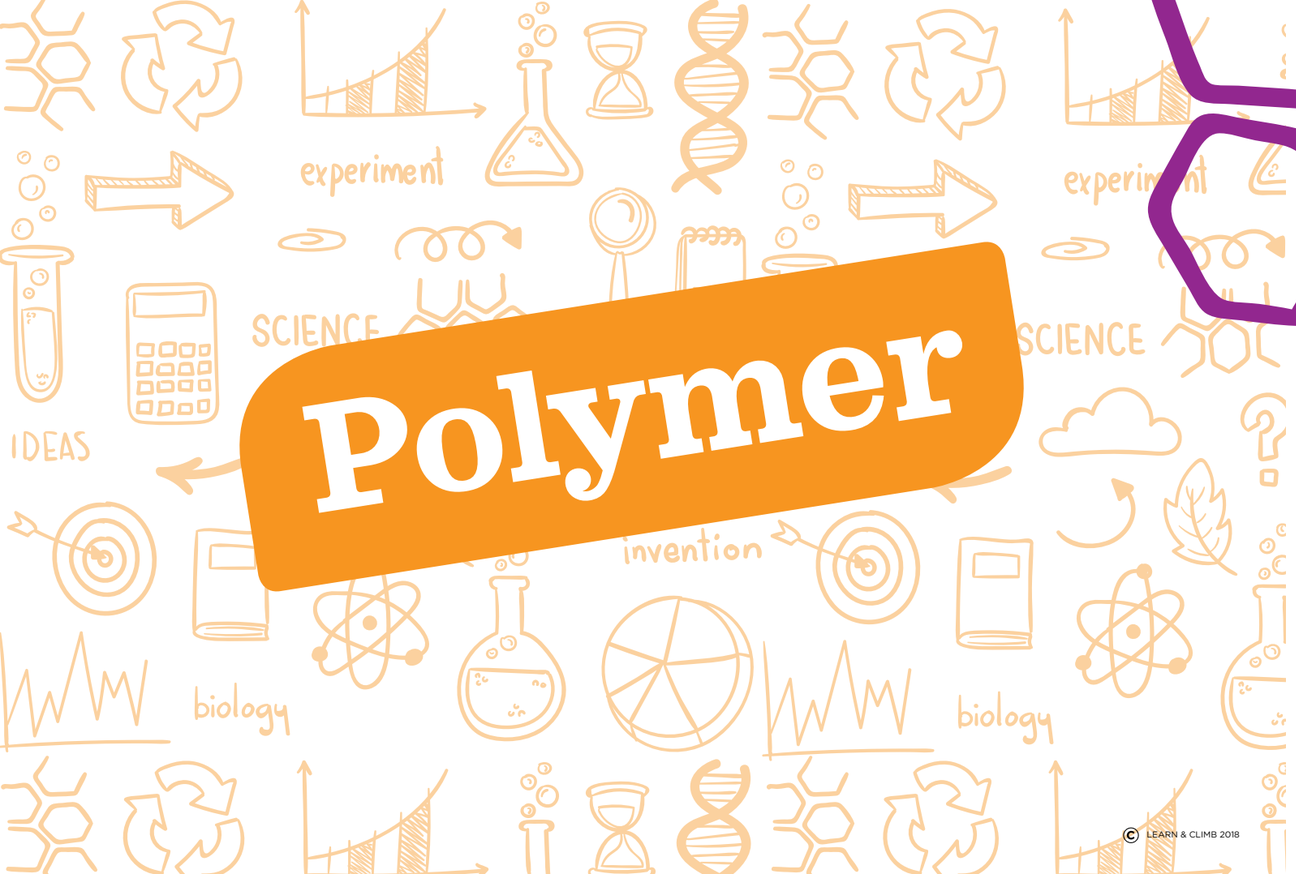

Polymer

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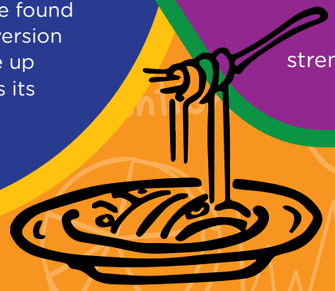
WARNING: Polymer beads are unsafe to eat. Keep them on a table or a paper plate to avoid children or animals getting into them. When done, do not put polymer beads down the sink as they might clog the drain!

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.



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POLYMER OF THE FUTURE

Scientists and engineers are always looking 20 to 40 to even 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!

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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

- 2 large test tubes
- Polymer beads (14 Pack)
- Stirring stick
- Yellow measuring spoon

SUPPLIES FROM HOME

- Water

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1 Add 10 water-absorbing polymer beads to one of the large test tubes.

2 Fill the second test tube halfway with water.

3 Pour water over the beads in the first bottle.

4 Stir the beads in the bottle.

5 Wait a few minutes and watch what happens!

*note!

If nothing happens, you might need to add a bit more water. 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 the spaces in between their molecules allow for the hydrogen bonds that water molecules have to get into them.

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

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2 Incredible Shrinking Beads

SUPPLIES FROM KIT

Expanded polymer beads from Experiment 1

SUPPLIES FROM HOME

3 plastic cups
Spoonful of:
Sugar
Flour
Salt

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1

Dry the expanded beads from Experiment 1

2

Divide the dried beads into three separate cups

3

Add a spoonful of sugar to the beads in cup 1, a spoonful of flour to cup 2, and a 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 shrink the size of the beads!

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3 Color-Absorbing Polymer

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

2 large test tubes

Yellow measuring spoon

Coloring agent (Packet 11)

White polymer crystals (Packet 10)

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1. Add 1 to 2 scoops of white polymer crystals to test tube 1.

2. Fill test tube 2 halfway with water

3. Add 2-4 drops of any color coloring agent to test tube 2.

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!

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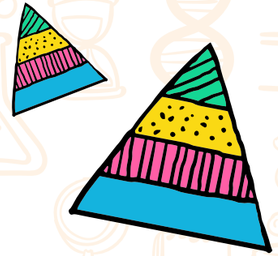
4 Layered Colors



SUPPLIES FROM HOME

2 plastic cups

Water

SUPPLIES FROM KIT

Small test tube

Yellow measuring spoon

Coloring agent (Packet 11)

White polymer crystals (Packet 10)

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1

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

2

Add 2-4 drops of coloring agent to each cup of water. Use a different color for each cup.

3

Stir

4

Add 1-2 scoops of white polymer crystals to each cup of colored water.

5

Stir the mixture in each cup and wait.

6

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

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5 Overnight Rainbow

SUPPLIES FROM HOME

Paper Towel

Water

SUPPLIES FROM KIT

Test tube holder

2 small test tubes

Yellow measuring spoon

Coloring agent (Packet 11)

White polymer crystals (Packet 10)

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1

Fill both test tubes half full with water

2

Add 2-4 drops of coloring agent to both test tube. Use yellow for one test tube and blue for the other.

3

Stir

4

Add 1-2 scoops 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.

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6 Bright Mix of Colors

(for Keychain Experiment 7)

SUPPLIES FROM KIT

Large test tube

Polymer beads (Packet 14)

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 till your beads expand and save for the next experiment.

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7 Glow-in-the-Dark Keychain

SUPPLIES FROM KIT

Grown polymer beads from Experiment 6

Keychain

Yellow measuring spoon

Pipette

Glow-in-the-dark potion (Packet 9)

1

Take the grown 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 potion 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.

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8 Transparent Orbs

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

- Small test tube (Packet 14)
- Polymer beads
- Funnel
- Yellow measuring spoon

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1

Find the transparent polymer beads (beads with no color) from Packet 14.

2

Add the transparent polymer beads to the test tube.

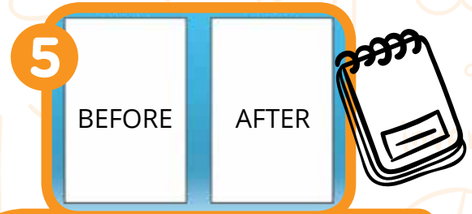
3

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

4

Wait a little 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
- Polymer beads (Packet 14)

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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.

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Unmixable Water & Oil

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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?**

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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 metal, shiny, and colorful. Or how about Play-Doh? Play-Doh 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!

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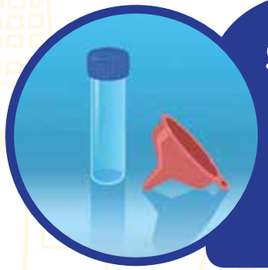
10

You go together like Oil & Water

SUPPLIES FROM KIT



Small test Tube

Funnel

SUPPLIES FROM HOME

Water

Oil

**note!*

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

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1

Pour 5 ml of water into your test tube.

2

Pour oil into your test tube, until you reach the 10 ml mark.

3

Screw on the cap.

4

Shake.

6

Let it stand for a few seconds.

5

Record your results.

Explanation

Have you ever heard the phrase "They go together like oil and water"? Normally, that describes people who do not get along because of their 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. Oil particles have some other properties, too, which make it sort of afraid to mix with water particles. You will learn more about this when you're a little older.

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11 Mix it Up

SUPPLIES FROM KIT

3 small test tubes
Funnel

SUPPLIES FROM HOME

Water
Oil
Vinegar
Lemon juice
Dishwashing soap

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!

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1

Pour 5 ml of water into test tube 1.

2

Pour oil into test tube 1 till it reaches the 10 ml mark.

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 a and b 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 a and b 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?

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12 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

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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.

3

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

4

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.

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13 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 (Packet 11)
Test tube connector

Explanation

You just made an oil clock. This clock uses the properties of oil and water. 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? Based on your results, answer the following questions.

*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.

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1. Add 2-4 drops of coloring 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 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.

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14 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

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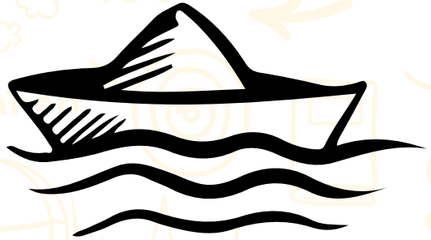
1

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 be 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!

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15 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 (Packet 11)

SUPPLIES FROM HOME

- Rubber gloves
- Water
- Oil
- Salt

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

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16 Floating Egg

SUPPLIES FROM HOME

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

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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 plate/bowl will need to be.

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17 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 KIT

- Coloring agent (Packet 11)
- Foaming agent (Packet 12)
- Glow-in-the-dark potion (Bottle 9)
- Yellow measuring spoon

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SUPPLIES FROM HOME

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

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! To buy more foaming agent, contact us through our website,

www.learnandclimb.com

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1. 
Put a little coloring agent into your bottle.

2. 
Pour water into the bottle until it is one-fifth full.

3. 
Pour oil into the bottle until it is three-fifths full.

4. 
Close cap and shake well.

5. 
Add a little of glow-in-the-dark potion to the bottle for some extra magic!

6. 
Put all five foaming agents into the bottle Wait a moment.

7. 
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!

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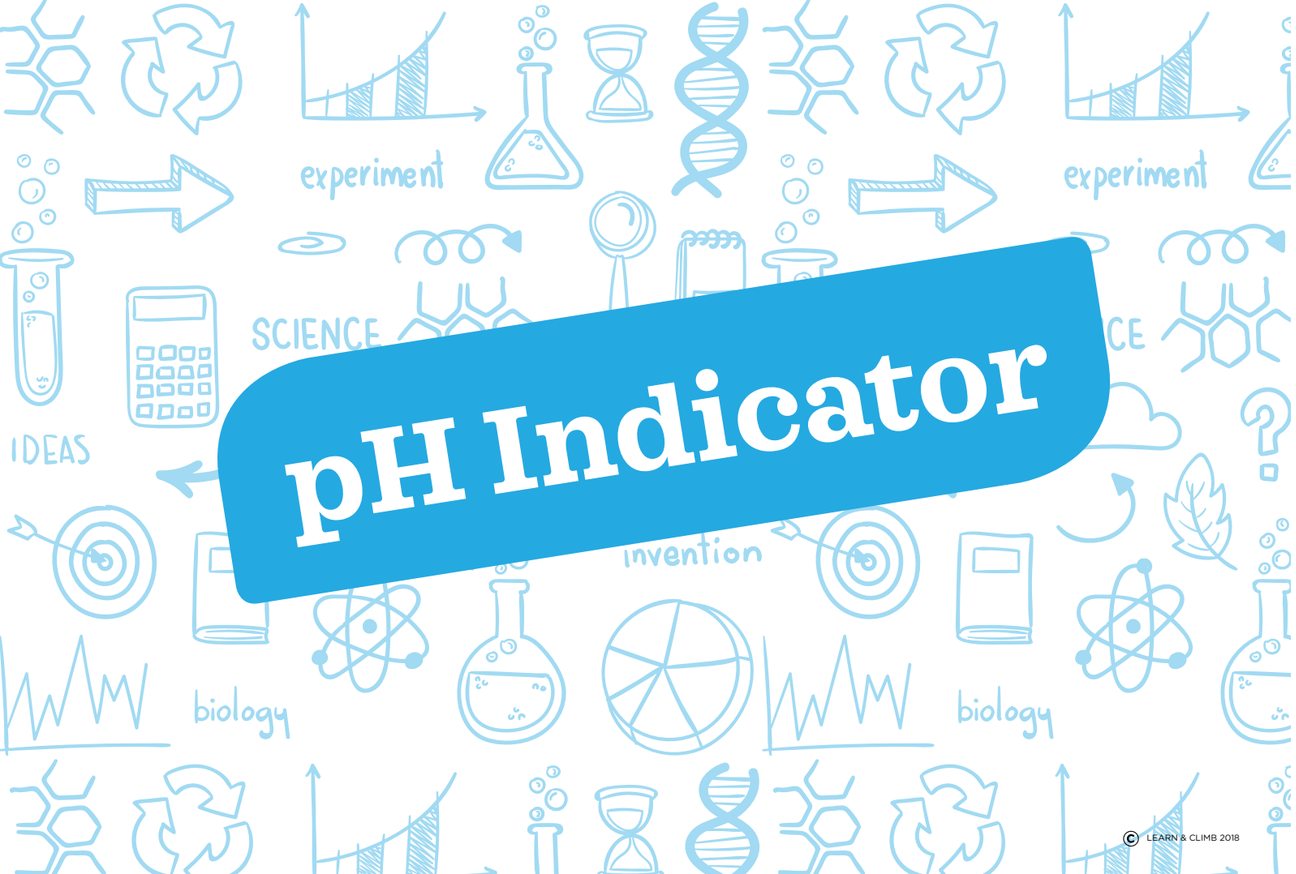

pH Indicator

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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.” But you really don’t know what that is, right? PH means that some substances have more negative molecules of hydrogen (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 molecule 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.

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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!

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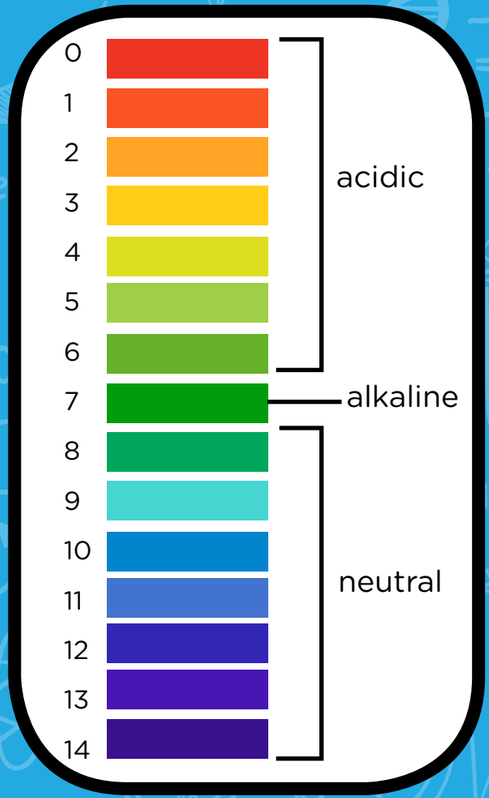

18 Litmus Paper Maker

SUPPLIES FROM HOME

Water

Scissors

SUPPLIES FROM KIT

- Beaker
- Pipette
- Yellow measuring spoon
- Stirring stick
- Litmus paper
- Purple sweet potato powder (Packet 4)

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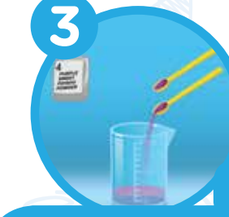
1

Cut one Litmus into 3 to 5 strips

2

Pour 10 ml of water into the beaker.

3



Add 2 scoops of purple sweet potato powder to the beaker.

4

Mix it.

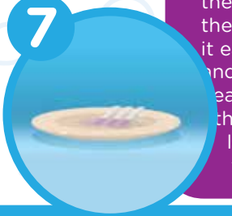
5

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

6

Save the dipped cut litmus paper for the next experiments.

7



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

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

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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
Purple litmus paper
that you made in the previous experiment

Scan QR Code

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!

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 one strip.
4. Rinse the the pipette really well until it is perfectly clean.
6. Take a little bit of apple cider vinegar into the pipette.
7. Squeeze a bit of the apple cider vinegar from the pipette onto the purple part of the second litmus paper.
8. Rinse the pipette really well until it is perfectly clean.
9. Put your test tubes (with your thumbs still on it) into the bathtub and quickly connect test tube 2 to the connector.
10. Turn your connected test tube over every 5 to 10 seconds to watch your oil clock!

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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
(Packet 4)

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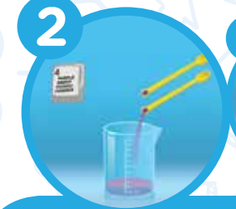
1

Pour 10 ml of water into the beaker.

2



3

Add 2 scoops of purple sweet potato powder to the beaker.

Stir.

Use the smaller end of the measuring spoon

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.

10

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

Save the purple liquid for the next few experiments!

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21 A Little Acidic A Little Basic

SUPPLIES FROM KIT

- 2 test tubes
- Test tube holder
- Measuring spoon
- Funnel
- Baking soda (Packet 5)
- Pipette
- Purple sweet potato liquid
  from Experiment 20, or make new liquid following instructions from Experiment 20

Scan QR Code

SUPPLIES FROM HOME

Water
Vinegar

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1 Pour 5 ml of vinegar into test tube 1.

2 Pour 5 ml of water into test tube 2.

3 Add one scoop 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!

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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? 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 (Packet 4)

SUPPLIES FROM HOME

- Water
- Vinegar
- Orange Juice
- Plastic or paper plate
- 3 cotton swabs (Q-tips)
- Plastic wrap

Scan QR Code

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?

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1. Pour 20 ml of water into the beaker.

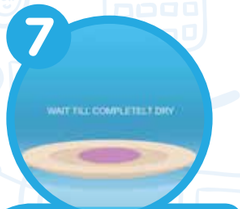
2. Add 2 scoops of purple sweet potato powder to the beaker.

3. Stir well.

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.

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

10. Draw on the Litmus paper using your dipped cotton swabs!

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23 Acids & Bases React in Spaces

SUPPLIES FROM KIT

- Small test tube
- Stirring stick
- Measuring spoon
- Citric acid (Packet 2)
- Baking soda (Packet 5)
- Purple sweet potato powder (Packet 4)

SUPPLIES FROM HOME

- Oil
- Water
- Plastic Plate

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1. Put the test tube into the plastic plate.

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

3. Add one scoop of baking soda to the test tube with water.

4. Stir with the stirring stick.

5. Add one scoop 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 scoop of citric acid and push it down.

10. Watch!
Draw or write a description of what happened.

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24

Don't Judge an Egg by Its Shell

SUPPLIES FROM HOME

- Plastic wrap
- Cup
- Raw egg
- Vinegar

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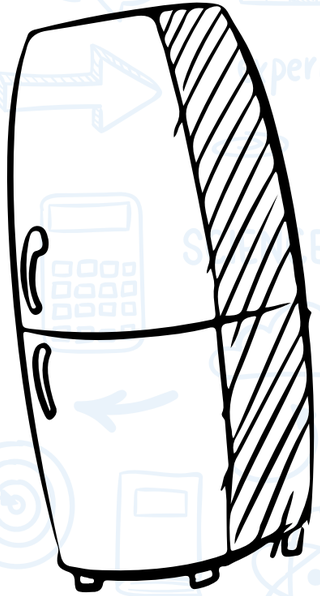

1. Fill your cup halfway with vinegar.

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.

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Slime

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Slime. Gloop. Ooze.

COMPOUND BACKGROUND

Whatever you call it, it is cool, right? Bouncy balls. Quicksand. Cheese. 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 make something that is like a liquid and a solid. Substances like slime or quicksand might feel and move like a liquid, but look like a solid.

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AMORPHOUS SOLIDS

There are foods like these — cottage cheese, sour cream, yogurt, Jello® to name a few — that are a combination between 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!

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25 Time for Slime!

SUPPLIES FROM KIT

- 2 test tubes
- Beaker
- Test tube holder
- Yellow measuring spoon
- PVA glue (Packet 17)
- Borax (Packet 3)

SUPPLIES FROM HOME

- Glue (jf there's no more left in Packet 17)
- 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 Elmer's 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 an stretchy kind of solid**.

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1. 
Add 5 scoops of borax to test tube 1.

2. 
you can use your beaker for easier pouring.
Add 10 ml of water to test tube 1.

3. 
Cap test tube 1 and shake until the borax is dissolved in the water.

4. 
Pour 10 ml of water into test tube 2.

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.

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26 Follow the Bouncing Ball

SUPPLIES FROM KIT

- Yellow measuring spoon
- Beaker
- PVA Glue (Packet 17)
- Glow-in-the-dark potion (Packet 9)
- Coloring agent (Packet 11), *optional*

SUPPLIES FROM HOME

A few spoonfuls of salt

*note!

If it does not work the first time, add more 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 potion to the beaker.

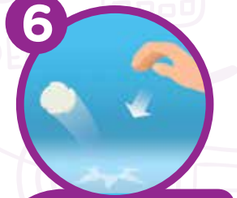
4

Add 5 large spoonfuls of salt into the beaker and stir quickly. When white particles start to form, stop stirring.

5

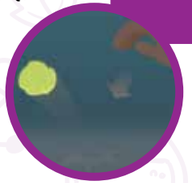
Get the solid mixture from the beaker out, and try to form a ball.

6



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

If you added glow in the dark, 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 jello — 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.

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27 The Great Thickening

SUPPLIES FROM KIT

- Beaker
- Yellow measuring Spoon
- Cornstarch (Packet 1)
- Stirring stick

SUPPLIES FROM HOME

Water

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1

Pour 20 ml of water into the beaker.

2

Add 10 to 15 scoops of cornstarch into the beaker.

3

Stir.

4

See what happens!

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

5

What happened now?!

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

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 or not 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

- 2 beakers
- 1 test tube
- Yellow measuring spoon

SUPPLIES FROM HOME

- Vinegar or lemon juice
- Strainer or cheesecloth
- Milk

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1. 
Measure 40 ml of milk into the beaker.

2. 
Heat the milk in the microwave for 40 seconds. watch the milk so it should not boil.

3. 
Remove the beaker with milk from the microwave with an oven mitt or cloth so as not to burn yourself.

4. 
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 till clumps start to form!

7. 
Pour the mixture through your strainer or cheesecloth into the second beaker.

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 got cheese!

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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 (Packet 1)

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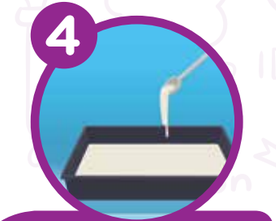
1. Pour the water into the mixing tray.

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

3. Stir.

Add more cornstarch if needed.



4. Play around with the quicksand you just created.

5. 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 flows, too! You have made a special type of fluid almost exactly like quicksand! Bury an object in it and see what happens.

Growing Crystals

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WARNING: 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 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!

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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 element's crystal shapes are unique, just like every snowflake or every sand grain is unique.

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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?

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30 The Cooling Effect

SUPPLIES FROM HOME

Water
Sugar
Salt

SUPPLIES FROM KIT

3 petri dishes
Yellow measuring spoon
1 test tube
Funnel
Urea (Packet 6)

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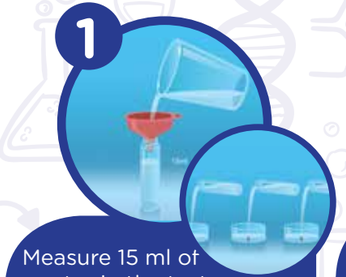

1. Measure 15 ml of water in the test tube. Pour 15 ml water into each petri dish.

2. Add 3 to 5 spoonfuls of sugar to petri dish 1.

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

4. Add 3 to 5 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.

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

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 change in temperature, bubbling, sound, or 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!

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31 Too Much or Not Enough

SUPPLIES FROM KIT

- 3 petri dishes
- Yellow measuring spoon
- 1 test tube
- Urea (Packet 6)

SUPPLIES FROM HOME

- Water
- Sugar
- Salt

Scan QR Code

*note

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

1. Measure 10 ml of water in the test tube for each petri dish.

2. Pour the 10 ml of water into each petri dish.

3. Add one spoonful of salt into petri dish 1. Add one spoonful of sugar into petri dish 2. Add one 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 in 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!)

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32 To Grow or Not To Grow

SUPPLIES FROM KIT

- Test tube
- Petri dish
- Yellow measuring spoon
- Litmus paper
- Urea (Packet 6)

SUPPLIES FROM HOME

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

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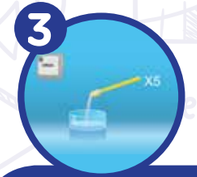
1. Pour 15 ml of water the test tube.

3. Pour the water from the test tube into the petri dish.

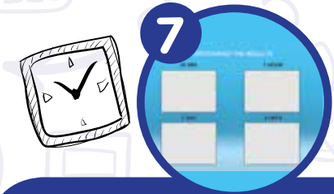


3. Add 5 spoonfuls of urea to the petri dish with water.

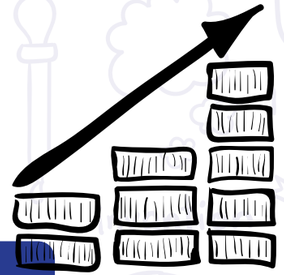
4. Create a standing litmus paper as follows: 1. Fold the litmus paper in half. 2. Either staple the two ends of the litmus paper together, or attach a paper clip to hold the paper together.

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 place to describe or draw or the results.



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!**

33 The Knowledge of Crystalization

SUPPLIES FROM KIT

- 3 petri dishes
- Yellow measuring spoon
- Test tube
- 3 litmus papers
- Urea (Packet 6)
- PVA glue (Packet 17)

SUPPLIES FROM HOME

- Dishwashing soap
- Water
- Scissors

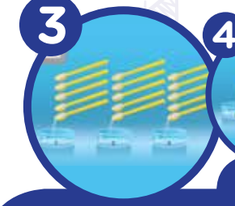
Scan QR Code

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 soaks up 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. If you need more urea, either contact us or visit our website.

Measure 15 ml of water in the test tube. (You will need to do this three times.)

Pour 15 ml of water into each petri dish.



Add 5 spoonfuls of urea into each petri dish.

Stir until dissolved.

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

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

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

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.

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

Put one prepared litmus paper into each petri dish

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

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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
1 test tube
Urea (Packet 6)

Scan QR Code

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1. Measure 15 ml of water in the test tube. (You will need to do this three times.)

2. Pour 15 ml of water into each petri dish.

3. Add 5 spoonfuls of urea into each petri dish.

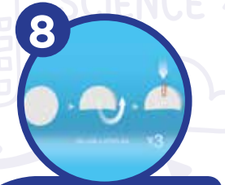
4. Stir until dissolved.

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.

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35 The Kingdom of Crystal Bridge

SUPPLIES FROM KIT

- 3 petri dishes
- Yellow measuring spoon
- 1 small test tube
- Purple string
- Beaker

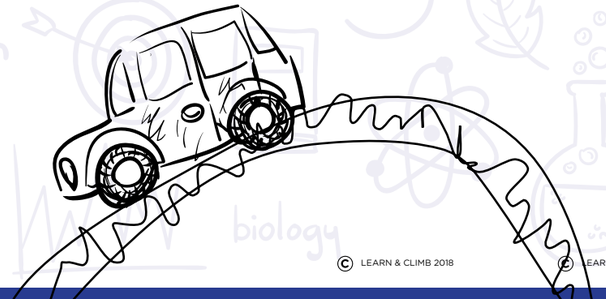
Scan QR Code

SUPPLIES FROM HOME

- Water
- Sugar
- Salt

note!

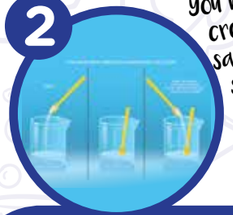
If you do not have petri dishes available, you can use small plastic cups, too.



1

Pour 20 ml of water into the beaker.

2



you have now created a saturated solution.

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.

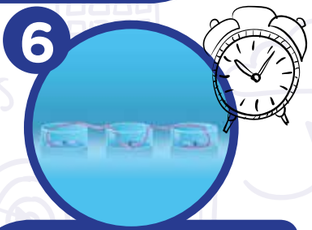
3

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

5

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

6



Wait a few days and see what happens.

Explanation

After waiting for 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!

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Volcano Eruptions

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FAMOUS VOLCANOES

There are many famous volcanoes scattered throughout the world. 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 shown here. (Olympus Mons 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
- Volcano model
- Crater cap
- Syringe
- Connective tubing
- Clear big measuring spoon
- Beaker
- Magma gel (Packet 8)
- Tape
- Yellow measuring spoon

SUPPLIES FROM HOME

Water

note!

If your mixture is too difficult to get into the syringe, add a little bit more water to it. Be careful when the volcano erupts; the magma might shoot very high! Clean the volcano with water soon after you are done so the "lava" does not harden. Keep your volcano assembled; you will need it for other experiments!

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TO USE THE SYRINGE:

1. Push the plunger of the syringe all the way to the bottom. 2. Place the syringe into the water or mixture. 3. Pull up the plunger until you have the desired amount of water or mixture in the syringe. 4. Empty the syringe by pushing down the plunger.

TO CONNECT THE VOLCANO BASE & MODEL:

1. Turn over the volcano model. 2. Place the volcano base on top of the model (the base does not click into the model). 3. Tape the sides of the base and model with the tape provided in the kit.

Place the crater cap into the hole on top of the volcano model. Put the connective tubing in through the hole in the volcano base. Push it up and out through the hole of the crater cap on top of the model. (If the hole in the crater cap is too small, you can ask an adult to make the hole bigger by scraping the sides with a knife.)

1

Add 5 scoopfuls of magma gel to your beaker.

2

Suck up 18 ml of water into your syringe. Squirt the water from the syringe into the beaker with gel.

3

Mix the mixture in the beaker well until the mixture is smooth.

4

Draw the new mixture into the syringe.

5

Insert the syringe into the end of the tubing.

Explanation

Your volcano worked because you put pressure on the syringe, just like the pressure that is in a volcano's magma chamber. You collected "magma" in your "magma chamber." The pressure got more intense the more you added to the syringe. When the pressure was too much, it erupted!

6

Push the plunger of the syringe down, and see your volcano erupt! The faster you push down the plunger, the faster and higher your eruption will be!

37 More Eruptions

SUPPLIES FROM KIT

- Volcano base
- Volcano model
- Connective tubing
- Clear big measuring spoon
- Crater cap
- Syringe
- Beaker
- Stirring stick
- Tape
- Magma gel (Packet 8)
- Colored sand (Packet 16)

Scan QR Code

SUPPLIES FROM HOME

Water

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 rocks that 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, the volcano is this picture.

1. 
Assemble volcano model and base like in previous experiment.

2. 
Put the tubing into the volcano base and model like in previous experiments

3. 

Add 5 scoops of magma gel to the beaker. Be sure to use the correct measuring spoon.

4. 

Add 1 to 2 scoops of any color sand.

5. 
Suck up 18 ml of water into your syringe. (The more water you add, the easier the mixture will push up through the tubing.)

6. 
Add the water from the syringe into the beaker with magma gel.

7. 
Stir until smooth.

8. 
Suck the new mixture into the syringe.

9. 
Insert the end of the syringe into the end of the connective tubing sticking out of the volcano base.

10. 
Push the plunger of the syringe down and watch the volcano erupt!

11. 
Do not wash the volcano. Wash out the mixture in the syringe really well.

12. 
Redo the experiment with a different color sand. Repeat with another color.

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38 Slow Flow NO GO

SUPPLIES FROM HOME

Water

SUPPLIES FROM KIT

- Volcano base
- Volcano model
- Connective tubing
- Yellow measuring spoon
- Coloring agent (Packet 11)
- Magma gel (Packet 8)
- Beaker
- Syringe

Scan QR Code

Explanation

What happened this time around? Did the flow from the tube go faster or slower? If you did the experiment correctly, it should have gone slower. Can you think of any liquids that flow very slowly? Write them down here.

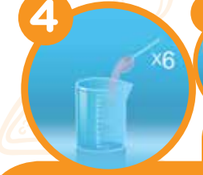
Did you list things like syrup or honey? Some liquids flow very quickly, and some flow very slowly. Lava and magma are like these liquids, too. Depending on how hot the conditions are or where the volcanoes are on Earth, the flow might be different. Some might be filled with more rocks, some might have more ash and smoke, while others have more lava.

1. Assemble volcano model and base like in previous experiment.

2. Put the tubing into the volcano base and model like in previous experiments

3. Add 12 to 14 ml of water to the beaker.

4. Add 6 scoops of magma gel to the water in the beaker.



5. Stir well.

6. Add 1 or 2 scoops of colored sand to the beaker.

7. Stir.

8. Draw in the mixture from the beaker into the syringe

9. Put your syringe into the end of the connective tubing

10. Push down the plunger of the syringe &

Repeat with more colors.

What was the differences of the eruptions of Experiment 37 and the eruptions of Experiment 38?

Extend

See if you can get different flows by varying your magma mixture! Take pictures to see the differences in your volcano layering! Different volcanoes can have different shapes based on how they flow, just like in these pictures.

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39 Don't Blow Your Stacks

SUPPLIES FROM KIT

- Volcano base
- Volcano model
- Connective tubing
- Syringe
- Beaker
- Black Sand (Packet 16)

SUPPLIES FROM HOME

- White piece of paper
- Pencil/Pen

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1

Assemble volcano like in previous experiments.

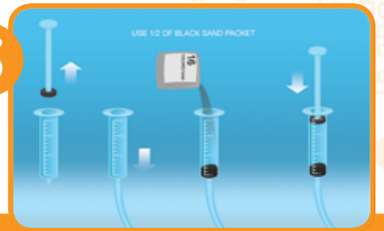
2

Draw a contour map by drawing circles around the volcano, each circle larger than the one before.

Explanation

When you shoot things out of the volcano, watch how far the debris flies. That is due to the amount of pressure you exert on the plunger. Press down with different amounts of strength on your plunger, and see how far the black sands fly!

3



Take the plunger part of the syringe out. Put the connective tubing into the syringe without the plunger. Put the tip of the plunger back into the syringe slowly and carefully, making sure that the end of the syringe, which is connected to the tubing, is face-down so all the sand is on the bottom.

4

Push the plunger down into the syringe really quickly and watch where the debris goes.

5

Mark till where your debris went.

40 The Bubbly Eruption

SUPPLIES FROM KIT

- Volcano model
- Mini container
- 1 small test tube
- Yellow measuring spoon
- Baking soda (Packet 5)
- Colored sand (Packet 16)

SUPPLIES FROM HOME

- 5 ml Vinegar
- Baking pan

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notes

This experiment can also be done without colored sand if you do not have any left. You might want to put paper towels down in case the mixture overflows out of the volcano.

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1

Put the mini container into the volcano model.

2

Add one scoop of baking soda to the mini container.

3

Add a small scoop of any color sand to the mini container.

4

Draw what happened!

Slowly pour the 5 ml of vinegar into the mini container.

5

Watch!
Repeat with a different color sand

Explanation

See how the volcano erupts! Baking soda and vinegar create an acid and base reaction. When acids and bases mix, they normally do things like make bubbles and produce sounds or smells. Gently wave the mixture past your nose. Does it have a smell? Did you hear the bubbles? Try to vary your amounts of vinegar and baking soda. Find the perfect amounts! Also, try to keep pouring vinegar into the container. It should keep reacting! See if it starts to react less and less...

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 are doesn't become sticky.

SUPPLIES FROM HOME

Mentos

2 liter bottle of Coke, Diet Coke or Sprite

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1

Put your 2 liter bottle of Coke 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 one of the Diet Coke.

4

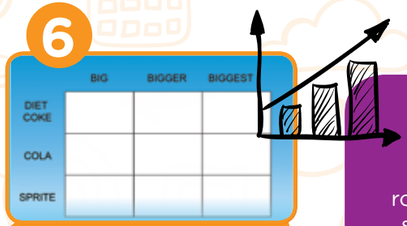
See what happens!

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 soda.

5

Now try doing the same thing with Sprite!
Now try doing the same with regular Coke!

6



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

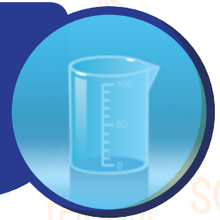
Explanation

The Mentos and Coke 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 Coke 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

Coke

Big container

Scan QR Code

1. Fill the beaker halfway with Coke.

2. Get a handful of salt.

3. Pour the salt into the beaker with Coke.

4. See what happens!

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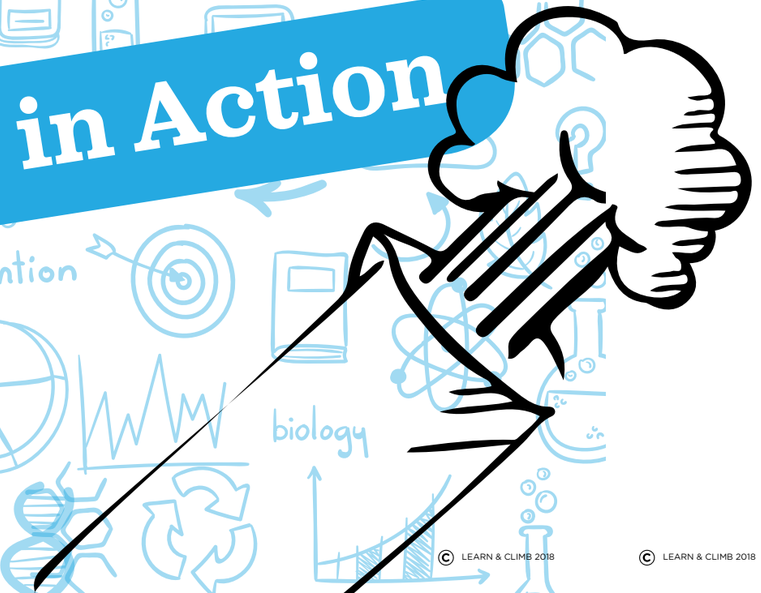
Air Power in Action



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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**. If you were to get a very powerful microscope, air would look like this picture. But normally, we cannot see or even catch air. Or can we?**

What is air?

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 balls 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

Scan QR Code

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 "see" it. This is like the air in our atmosphere. 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!*

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44 The Power of Air

notes
If the balloon doesn't inflate immediately, you might need to stretch it. Make sure that you put the balloon very close to the bag or to your hair.

SUPPLIES FROM HOME
Plastic bag

SUPPLIES FROM KIT
Balloon

Scan QR Code

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 by the opening of the bag.

3

Release your hold, and watch the bag move!

Explanation

Lots of things are run by power. You just saw that air has 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, these molecules could not escape. They wanted to get out. By releasing the balloon, you released the air molecules! You probably felt them woosh, too!

Extend

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

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45 Will the Car Go?

SUPPLIES FROM KIT

Balloon Car

notes

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

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1

Blow 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!

Extend

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

46 Racing Down the Track

Explanation

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

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SUPPLIES FROM KIT

Balloon Car

SUPPLIES FROM HOME

2–5 large books or anything to make a raceway

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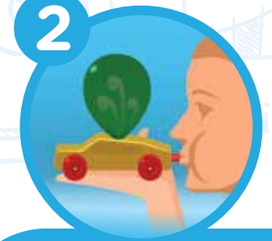
1

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.

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Explanation

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

Evaluate and Extend See how straight you can make your track. An erratic or wildtrak can decrease speed. If you keep everything straight, your car will zoom!

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!*

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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, and 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 and therefore more air pressure. When you release them, the force of that air propels your balloon car!

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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, and the air pushed out through the balloon and through the passages, pushing the propeller blades the whole time. This caused the propeller to spin, just like in a real helicopter!

Extend

See how straight you can make your track. An erratic or wildtrak can decrease speed. If you keep everything straight, your car will zoom!

*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 in order to not break them.

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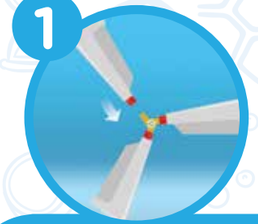
1



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

Leave go & watch it fly!

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

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49 The Magic Floating Disc

SUPPLIES FROM KIT

1 Balloon
Balloon joint
Hover disc

Extend

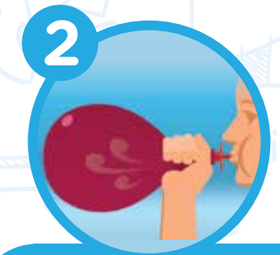
See what happens when you gently touch the balloon. Does it slide? How far? Test different surfaces to see which one works best. Some slick surfaces are stone tile, laminated wood, and ice. They have very little friction, or resistance from one surface rubbing against another. See if you can test any other surfaces and discover more things about friction!

*Notes

This works better when there is less air in the balloon.

Scan QR Code

1 Attach the balloon to the wider part of the balloon joint.



2 Blow up the balloon by blowing air into the other end of the balloon joint.

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

4 Insert the balloon joint into the hover disc.

5 Place on a flat surface and gently release the balloon.

Explanation

If the air has nowhere to go, how does it work? Well, there is a lot of the air in the balloon that needs to go somewhere. Because there is a hole at the bottom of the hover disc, air escapes there. And because there is a little space between the disc and your surface, the air goes into that space and causes the disc to "hover" slightly.

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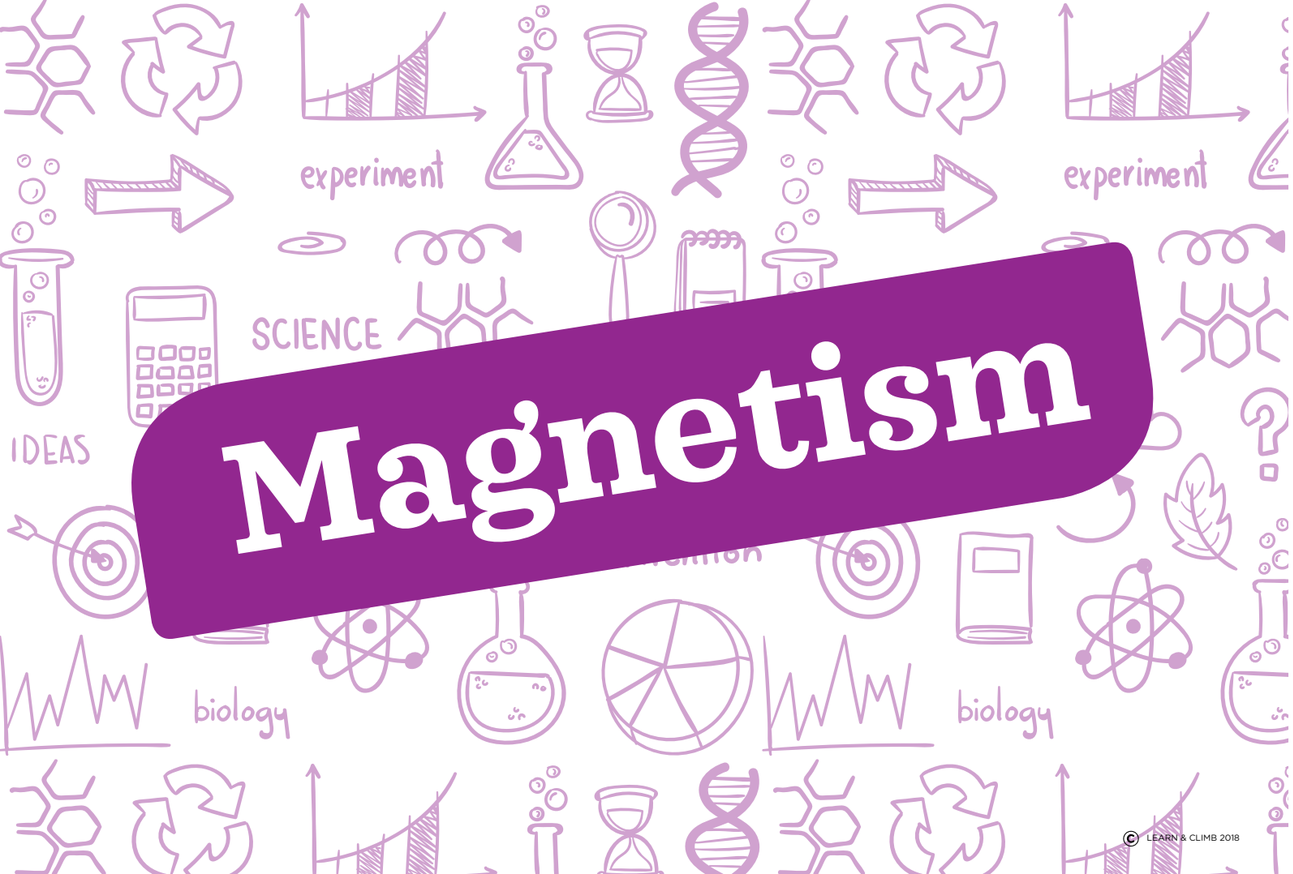

Magnetism

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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. For something to be considered magnetic, it must be made of a unique material called a ferromagnet. That is just a fancy term for an object with magnetic power.

Try it yourself!

MAGNETISM & NAVIGATION

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.

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. 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. 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, satellites, and other electronic devices would not work, either!

50 What Is Left Behind

SUPPLIES FROM KIT

- Magnet stick
- Beaker or test tube
- Iron filings (Packet 13)
- Sand filling (Packet 7)
- 2 petri dishes or plates

*notes

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

Extend

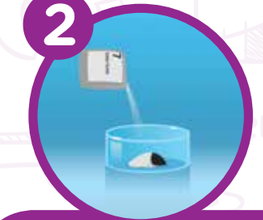
Can you pick up anything else with this magnet? Try it with some different objects in your house.

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.

Scan QR Code

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 is no more iron filings mixed with the sand.

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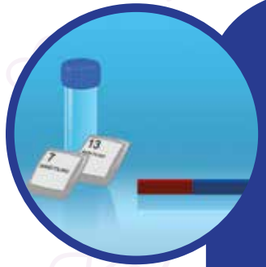
51 Sand & Magnet Artist

SUPPLIES FROM HOME

Paper plate

SUPPLIES FROM KIT



- Magnet stick
- Small test tube
- White sand (Packet 7)
- Iron filings (Packet 13)

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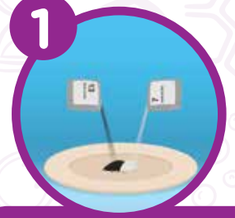
1



Spill iron filings and white sand into your paper plate.

2

Mix them up.

3

Place your magnet stick into the small test tube.

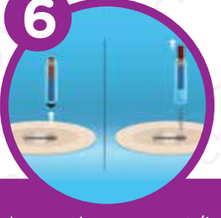
4

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.

52 Am I Eating Iron

SUPPLIES FROM KIT

Magnet stick

SUPPLIES FROM HOME

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

Water

Ziploc bag

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1 Pour the cereal into a Ziploc 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!

Some cereals that are high in iron are Raisin bran, Oat bran, and Total® cereals. There are other cereals that are high in iron; just look at the label on the back 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!

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53 Take me Out to the Field

SUPPLIES FROM KIT

Magnet stick

Iron filings (Packet 13)

SUPPLIES FROM HOME

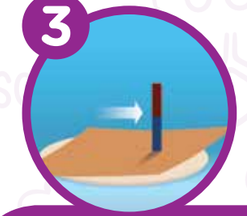
Parchment paper

Plastic bag

Soup plate

Put the iron filings into the soup plate.

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



Move the magnet on top and around the parchment paper.

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

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Sprout Garden

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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 thee 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.

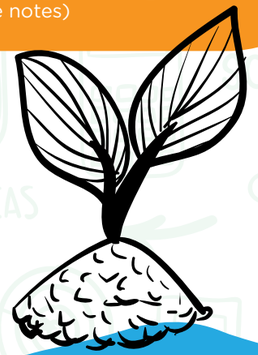
54 Sprrrout Up

SUPPLIES FROM KIT

Test tube holder
4 test tubes
Water-absorbing polymer crystals
(Packet 10)
Yellow measuring spoon
Tweezers (for seeds)

SUPPLIES FROM HOME

Water
Fast-growing seeds
(see notes)



note!

Some cereals that are high in iron are Raisin bran, Oat bran, and Total® cereals. There are other cereals that are high in iron; just look at the label on the back of the box!

Scan QR Code

1. 
Put one scoop of water-absorbing polymer crystals into both 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 scoop 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 scoop 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 to germinate, or begin to grow.

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55 Acid Rain, No Gain

SUPPLIES FROM KIT

Water-absorbing polymer crystals
(Packet 10)
Yellow measuring spoon
Test tube holder
4 test tubes
Pipette
Tweezers (for seeds)

SUPPLIES FROM HOME

Water
Masking tape
Pen or Sharpie marker
Lemon juice or vinegar
Fast-growing seeds
(see notes at Experiment 54)

note!

Label your test tubes with masking tape and sharpie so not to confuse your test tube.

Scan QR Code

1. 
Add one scoop of water-absorbing polymer crystals into each test tube.

2. 
Add water until the 15 ml line in 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. 
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!

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56 What Does a Plant Drink?

SUPPLIES FROM KIT

- Test tube holder
- 4 test tubes
- Yellow measuring spoon
- Water-absorbing polymer crystals (Packet 10)
- Tweezers (for seeds)

SUPPLIES FROM HOME

- Energy drink
- Orange juice
- Milk
- Masking tape
- Pen or Sharpie marker
- Fast-growing seeds
- Water

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1. Add one scoop of water-absorbing polymer crystals into each test tube.

2. Add water until the 15 ml line in each test tube.

3. Add a few seeds to test tube 1 .

4. Fill test tube 2 with energy drink until the 15 ml line.

5. Fill test tube 3 with orange juice until the 15 ml line.

6. Fill test tube 4 with milk until the 15 ml line.

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 soda, 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; that does have some nutrients that plants like. You can try to do this experiment with liquid fertilizer. Did liquid fertilizer work better or worse than regular water?

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57 All Light Is Alright

SUPPLIES FROM KIT

- Test tube holder
- 2 test tubes
- Yellow measuring spoon
- Water-absorbing polymer crystals (Packet 10)
- Tweezers (for seeds)

SUPPLIES FROM HOME

- Fast-growing seeds (see notes at Experiment 54)
- Water

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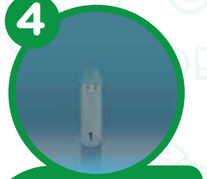
1. 
   Add one scoop of water-absorbing polymer crystals into each test tube.
2. 
   Add 15 ml of water to each test tube.
3. 
   Add a few seeds to each test tube.
4. 
   Put test tube 1 in a dark room without sunlight.
5. 
   Put test test tube 1 in a dark room without sunlight.
6. 
   Put test tube 2 under artificial light, like a lamp.

Record your results.

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!

58 No Light Is Not Right

SUPPLIES FROM KIT

Test tube holder
2 small test tubes
Yellow measuring spoon
Water-absorbing polymer crystals (Packet 10)
Beaker
Tweezers (for seeds)

SUPPLIES FROM HOME

Fast-growing seeds
(see notes at Experiment 54)
Water

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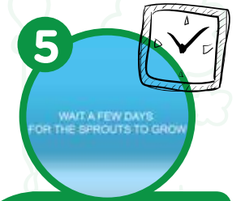
1. 
Put the test tube into the holder.

2. 
Put one scoop of water-absorbing polymer crystals into each test tube.

3. 
Fill each test tube with 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 by 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!

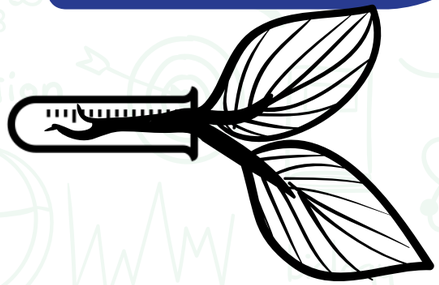
59 A Sideways Plant

SUPPLIES FROM HOME

- Energy drink
- Orange juice
- Milk
- Masking tape
- Pen or Sharpie marker
- Fast-growing seeds
- Water

SUPPLIES FROM KIT

- Test tube holder
- 4 test tubes
- Yellow measuring spoon
- Water-absorbing polymer crystals (Packet 10)
- Tweezers (for seeds)



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1. 
With the small end of the yellow measuring spoon, add one scoop of polymer crystals to the test tube.

2. 
Fill the test tube until the 13 ml mark with water.

3. 

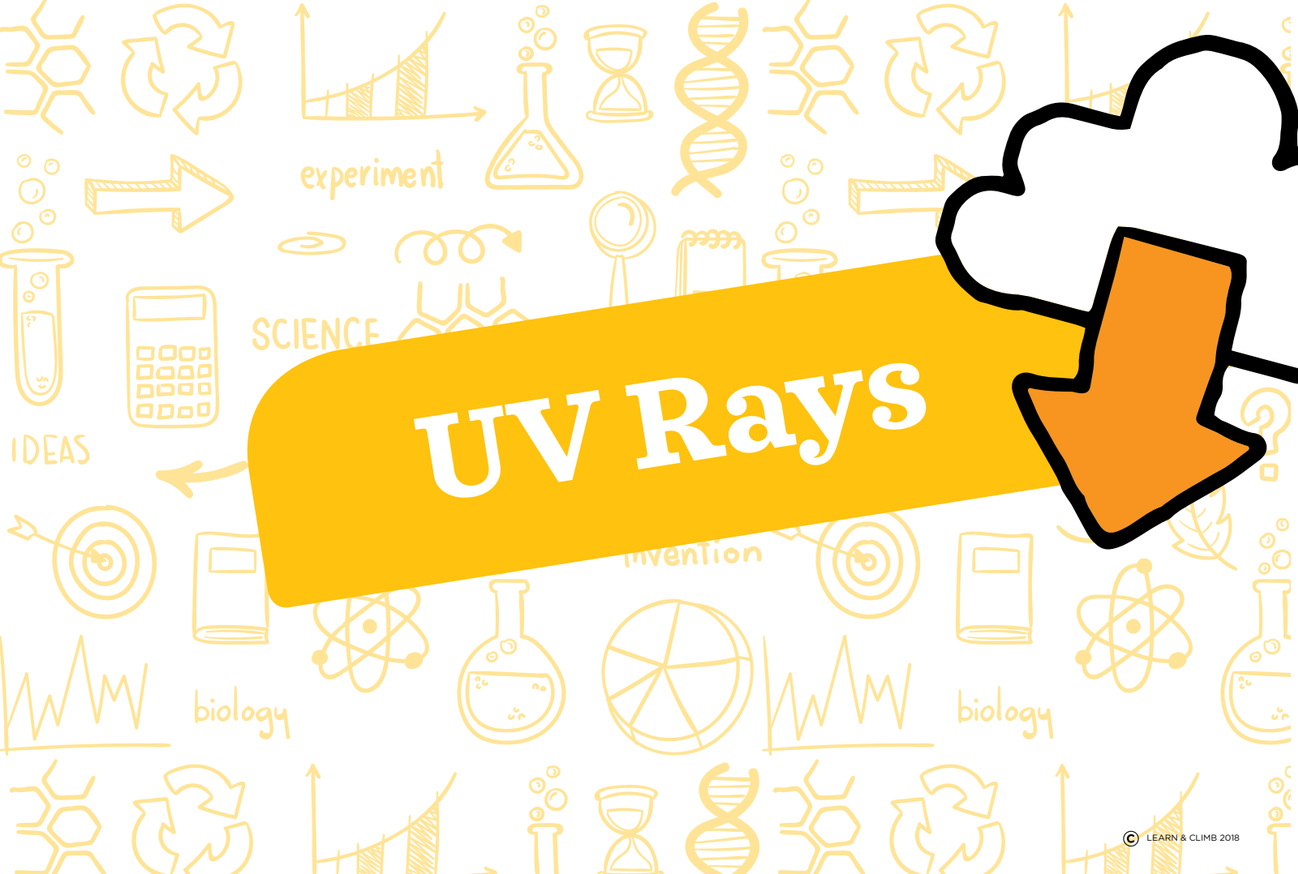
Wait 10 minutes or until the crystals expand to fill the test tube.

4. 
Put some fast-growing seeds into the test tube.

5. 
Make sure to add water regularly to keep the seeds moist.

6. 
Turn the test tube to the side.

7. 
Watch the plant grow sideways over the next few days.



UV Rays

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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. And 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 are the skin's natural response when skin cells are exposed to UV light.

60 DIY Energy Bead Keychain/ Bracelet

SUPPLIES FROM KIT

Energy beads
(Packet 15)
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 Experiment 60

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?

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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 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.

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62 Clouds and UV Rays

SUPPLIES FROM KIT

Energy bracelet or keychain you made in Experiment 60

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?

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Explanation

If your sunscreen is of good quality, then the beads you covered should have stayed white. That is because sunscreen has several ingredients in it that helps prevent the sun's UV Rays from reaching your skin. If your covered beads did change 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!

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64 Protect Your Eyes

SUPPLIES FROM KIT

Energy bracelet or key-chain you made in Experiment 60

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 need to be 100% UV protected for it to protect your eyes from damage.

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65 Testing Glass & Plastic

SUPPLIES FROM HOME

Glass jar

Plastic container

SUPPLIES FROM KIT

Energy bracelet or key-chain you made in Experiment 60

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.

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