WEEK 3
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Solids, Liquids and Gases

Science Studies Weekly
Challenger
SCIENCE 5 STUDIES

Solids, Liquids and Gases

It took more than 2,000 years to find out if Greek thinkers were right about the existence of atoms. Since those days, we have learned much about matter and how matter works. Matter can exist in three main states or "phases." What are they? They are solids, liquids and gases.

Solids are things like rocks, metals and stuff that keeps its shape. Solids have shape and volume.

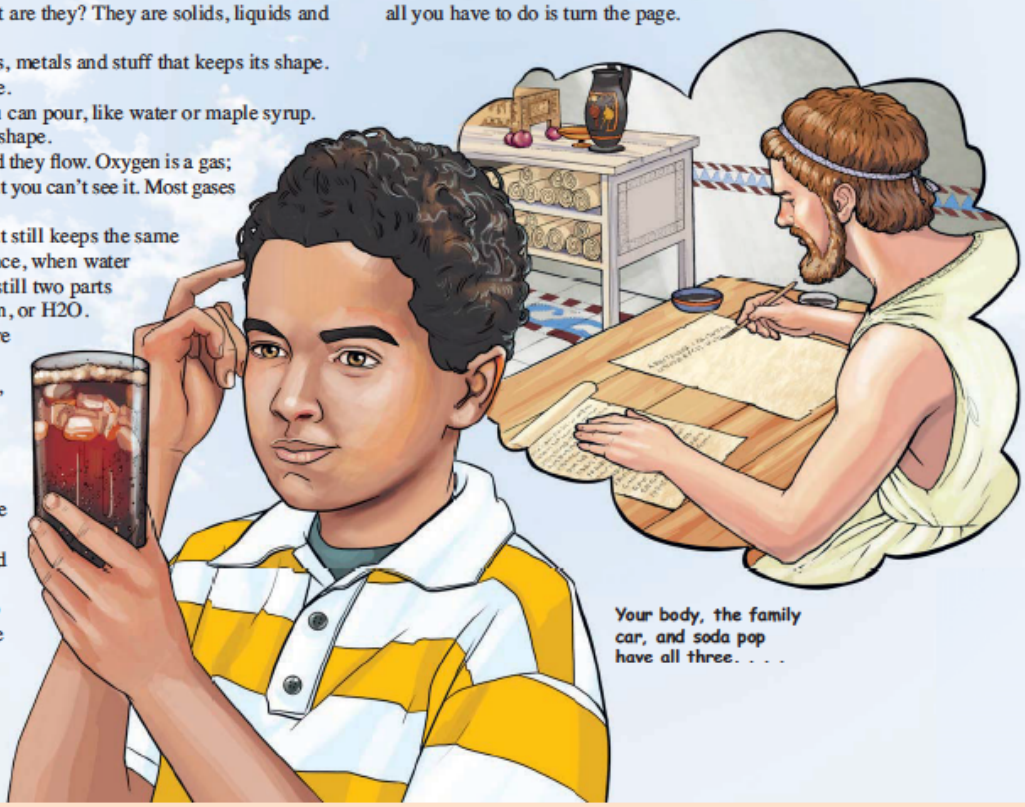
Liquids are things that you can pour, like water or maple syrup. Liquids have volume, but no shape.

Gases don't have shape, and they flow. Oxygen is a gas; you breathe it. It has matter, but you can't see it. Most gases cannot be seen.

As matter changes states, it still keeps the same chemical structure. For instance, when water freezes into a solid (ice), it's still two parts hydrogen and one part oxygen, or H_2O.

Solids, liquids and gases are found all over the place! The family car has all three–metal, gasoline, and exhaust gases. A bottle of soda pop has all three–bottle, drink, and bubbles. Even your body has them. Your bones and teeth are solid, your blood and bile are liquids, and the oxygen carried in your blood is gas, needed for life. That unwelcome burp at the lunch table—well, those are gases making their escape from the surrounding liquids and solids in your stomach. Excuuuuuuse me!

Now we're going to ask you the same question Greek thinkers asked themselves more than 2,000 years ago: Why are some things solid, liquid or gas? But, instead of waiting 2,000 years to learn the answer, all you have to do is turn the page.



Your body, the family car, and soda pop have all three. . . .

Connections *Philanthropy and Values*

Maybe you have heard the word "philanthropy" before. What does it mean? It describes actions that people make for the good of other people. What is a value? It's a way of behaving that people believe is good—like believing it's good to be honest. Is honesty one of your values?

One way you can practice philanthropy today is to help yourself and others learn good values. How do you learn good values? You can learn them from your parents and grandparents, your teachers at school or church and other people you trust.

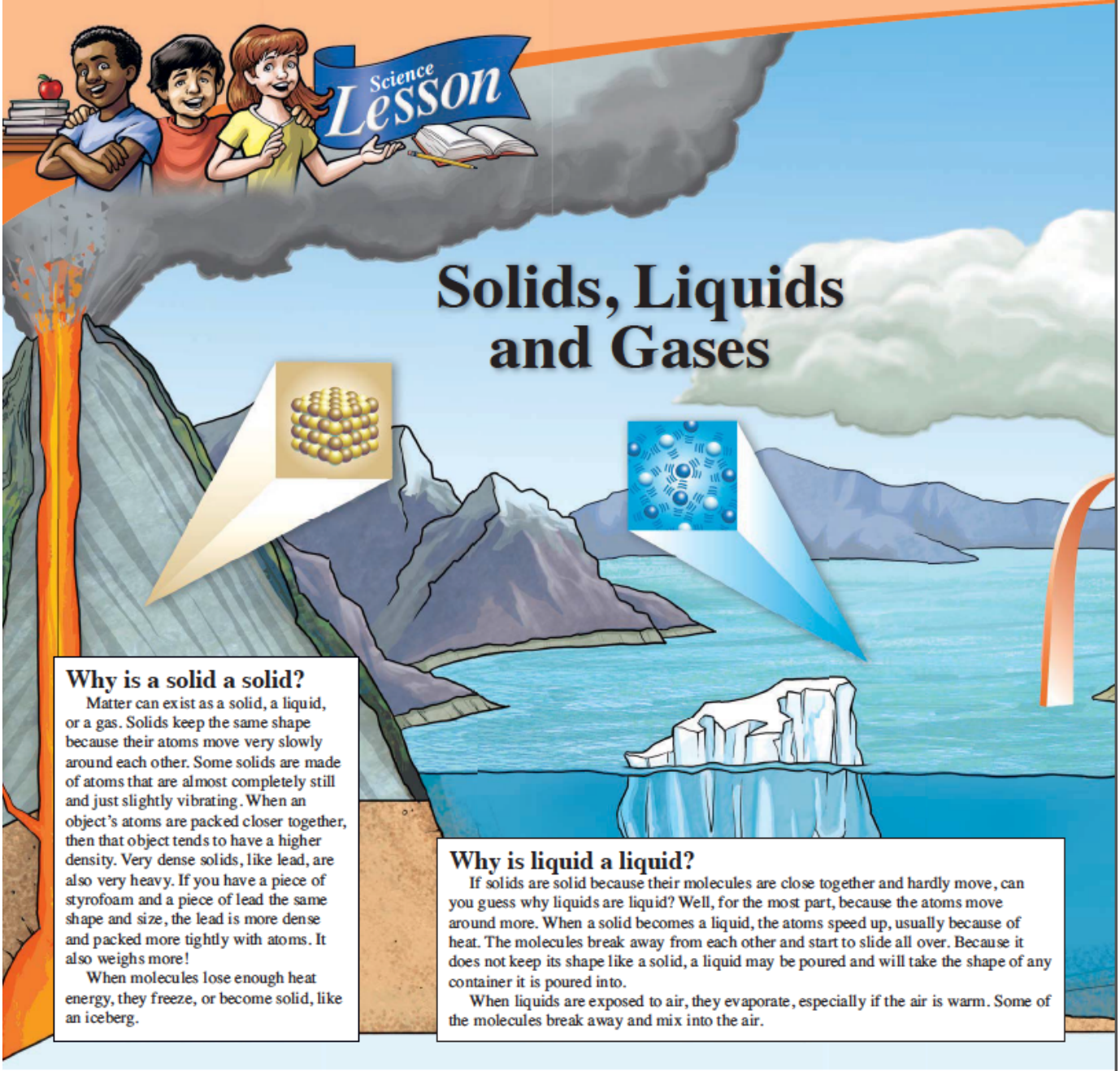
You can also learn them from people that have been recognized for doing good things for society. An easy way to learn about people that have done good things is to visit values.com. Values.com has lots of stories and short videos that highlight the traits that make each of us better people. They even have billboards on the highway to remind you about good values.

For example, you may have seen a billboard that looks like the one shown here.

This billboard is about Oral Lee Brown, who saved money from her job to send 19 kids to college...all by herself! Wow! Isn't that cool? You can learn about lots of other people who practice philanthropy at values.com. Be sure to look for more of their "billboards" on Page 4 of Studies Weekly this year. We think they're so cool we want to remind you to check them out!

Science Lesson

Solids, Liquids and Gases



Why is a solid a solid?

Matter can exist as a solid, a liquid, or a gas. Solids keep the same shape because their atoms move very slowly around each other. Some solids are made of atoms that are almost completely still and just slightly vibrating. When an object's atoms are packed closer together, then that object tends to have a higher density. Very dense solids, like lead, are also very heavy. If you have a piece of styrofoam and a piece of lead the same shape and size, the lead is more dense and packed more tightly with atoms. It also weighs more!

When molecules lose enough heat energy, they freeze, or become solid, like an iceberg.

Why is liquid a liquid?

If solids are solid because their molecules are close together and hardly move, can you guess why liquids are liquid? Well, for the most part, because the atoms move around more. When a solid becomes a liquid, the atoms speed up, usually because of heat. The molecules break away from each other and start to slide all over. Because it does not keep its shape like a solid, a liquid may be poured and will take the shape of any container it is poured into.

When liquids are exposed to air, they evaporate, especially if the air is warm. Some of the molecules break away and mix into the air.

Technology & Science

The Power of Changing States

Some pretty smart people realized that if you put water in a closed container and use heat to change its state from liquid to steam (gas), it will take up more space as the molecules move farther apart. As a result, great pressure is created that can push a piston and make an engine turn.

In the 1800s, trains and steam ships were powered by steam engines. Today, nuclear power plants use steam turbines, and the Navy uses steam-powered catapults to launch jet fighters from aircraft carriers. Steam power is still very much in use today. For many jobs that need lots of power, steam is simply the best!

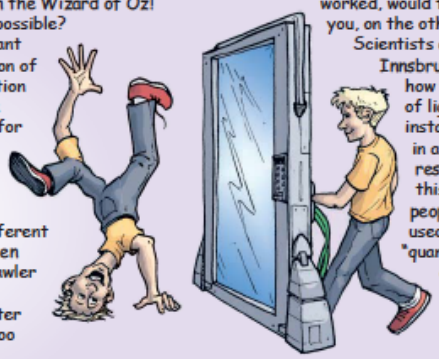
All this technology is made possible because of a scientific understanding of the changing states of matter.

Book Science

There's No Place Like Somewhere Else!

Do you ever wish you could just disappear from one place and appear in another? During a spelling test you might have thought, "Why can't I be out on the playground?" When your parents tell you to clean your room, you'd probably rather be just about anywhere else on the planet. You might have even tried closing your eyes, clicking your heels and saying, "There's no place like Disney World," kind of like Dorothy in the Wizard of Oz!

Will that ever be possible? Well, the idea of instant (quantum) teleportation of matter from one location to another has been a popular idea in books for hundreds of years. The djinns in "The Arabian Nights" stories could travel instantly between different countries. In the X-Men comic books, Nightcrawler teleports in a puff of red smoke. Harry Potter and his friends use Floo Powder to teleport through fireplaces. But in real life? Well, that's a different story. Atomic particles are tricky because they can move incredibly fast, and that makes recording them at any point in time a big problem. Some scientists argue that anyone who steps into the teleporter would disintegrate (be destroyed) as his or her information is sent to the other side! If it worked, would that be you, or a copy of you, on the other side?

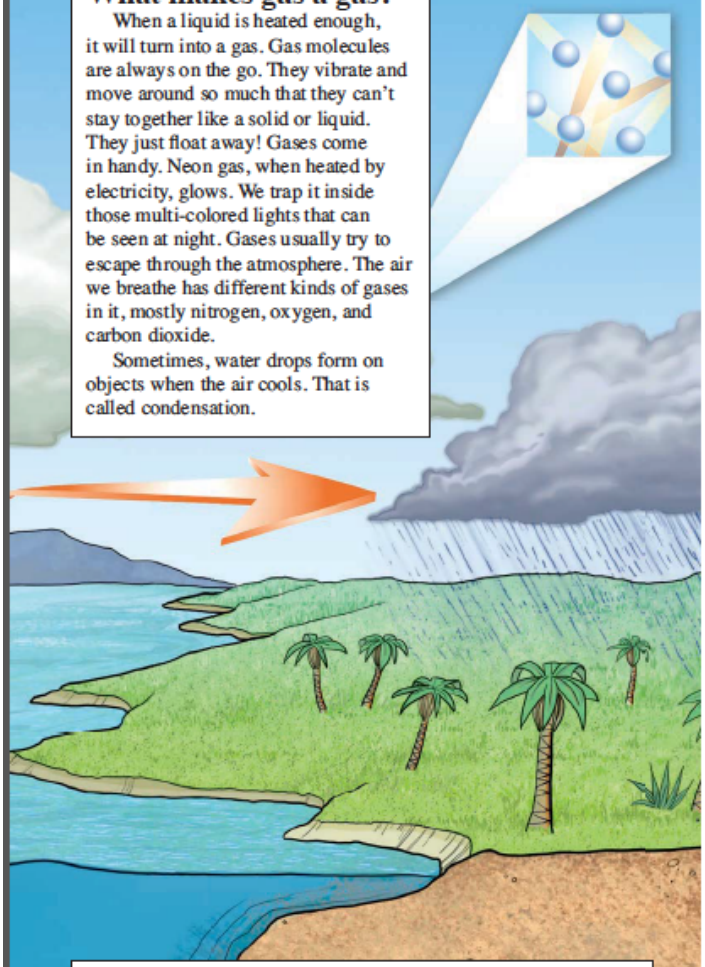


Scientists at the University of Innsbruck, Austria, have shown how to take a photon (particle of light energy) and in an instant make a replica of it in a different place. The researchers don't believe this will lead to teleporting people. Instead it will be used for making super "quantum" fast computers and communications. For now, we'll just have to settle for "teleporting" ideas.

What makes gas a gas?

When a liquid is heated enough, it will turn into a gas. Gas molecules are always on the go. They vibrate and move around so much that they can't stay together like a solid or liquid. They just float away! Gases come in handy. Neon gas, when heated by electricity, glows. We trap it inside those multi-colored lights that can be seen at night. Gases usually try to escape through the atmosphere. The air we breathe has different kinds of gases in it, mostly nitrogen, oxygen, and carbon dioxide.

Sometimes, water drops form on objects when the air cools. That is called condensation.



Changing States

Matter changes state when it's heated or cooled. So, water changes from solid (ice) to liquid at about 32 degrees Fahrenheit (which is its melting point) and transforms from liquid to gas (steam) at 212 degrees Fahrenheit (boiling point).

Different molecules melt at different temperatures: Gold stays solid (or frozen) until melted at 1,948 degrees Fahrenheit. It boils at a whopping 5,085 degrees!

In the Lab

Cooling Molecules

Purpose: This experiment will show that molecules take up less room when they are cool and are moving slowly.

Materials

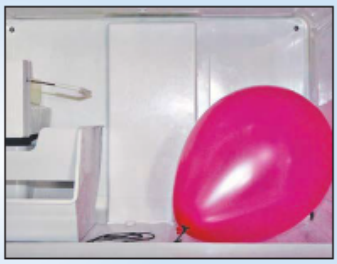
- 2 balloons

Directions

1. Blow into the balloons until they are full.
2. Now they have mostly carbon dioxide, nitrogen and some oxygen in them!
3. Make sure they have roughly the same amount of air in them and seal them by tying the ends.
4. Put one balloon in the freezer.
5. Put the other in direct sunlight near a window.
6. Let them sit there for 20 minutes or so.

Take out the freezer balloon and compare the two. What happened?

Did the freezer balloon seem to lose air? Well, it didn't really. The air just compressed because of the lack of energy in the cold freezer. Molecules at lower temperatures have less energy, move around less, and stay closer together. Because of this, they take up less space.



How do hot air balloons work?

This Week's Question

Have you ever heard the expression "you are just full of hot air!"? Well, if you were, you might be a bit lighter. When you heat a gas, it expands. If you trap hot, expanding air in a ballon, it becomes lighter than the cooler air outside and goes up! People control balloons by heating them up with a flame. When heated, the balloon goes up, and when it's cool, it comes back down. Balloons are steered by going up or down to find air currents to blow them in the right direction.

Hot air balloons were first used centuries ago. Did you know that the first recorded passengers in a hot air balloon were a sheep, a rooster, and a duck in 1793? The first manned flight was a few months later. Since then, balloons have been made for many uses.

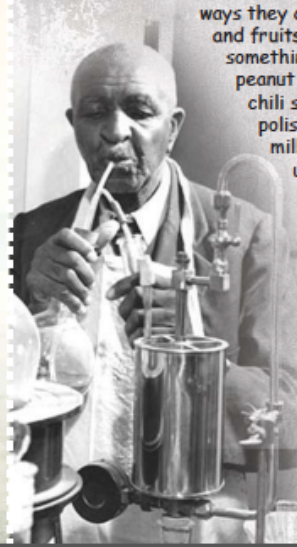
Airships, such as blimps, have been around for about 100 years and were once used to fly people across the Atlantic. At first, they were filled with hydrogen, which is flammable, but now they are filled with helium.

People still fly in hot air balloons. In 1999, Bertrand Piccard and Brian Jones were the first to fly a balloon around the world nonstop. They did it in 19 days, 1 hour, and 49 minutes.

Nowadays, scientists and students send up equipment such as cameras or measuring devices in helium-filled balloons and blimps. This lets them study the Earth's weather and atmosphere.

George Washington Carver c.1864-1943

Spotlight



If you want to read an inspiring story, read about George Washington Carver! He was a teacher, scientist, businessman, farmer, writer, artist and performer. George invented things using chemistry and food. Food?

George lived in the South after the Civil War. Things were hard for people in the South. It was hard for them to sell their crops. Carver thought of ways they could make new products out of the vegetables and fruits they grew. You have probably used or eaten something Carver invented. He invented an early form of peanut butter! He developed grease for cars, bleach, chili sauce, dyes, ink, conditioning shampoo, shoe polish, shaving cream, Worcestershire sauce, dried milk, face creams, paints, paper, and many other useful things.

In his day, Carver was considered one of the world's greatest chemists. It didn't come easy for him. He was on his own at age 13 and had to work to pay for his schooling. He did not make money from his products. He gave them away to help people. Mr. Carver was honored with a national monument dedicated by President Franklin Delano Roosevelt on July 14, 1943. Before his death in 1943, Carver was given many prestigious awards. The scientific field that now continues to make useful things out of agriculture by using chemistry is called biochemical engineering.

Name _____

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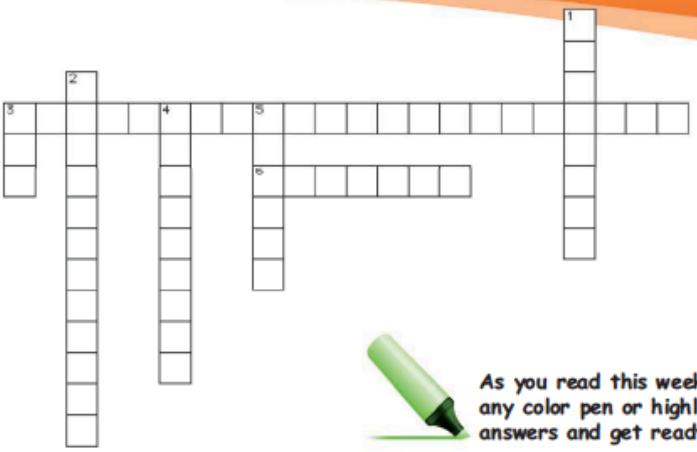


ACROSS
3. He invented an early form of peanut butter.
6. things that you can pour, like water or maple syrup

DOWN
1. a flammable gas once used to fill blimps
2. this happens when drops of water form on objects as the air cools
3. it doesn't have a shape, but it flows, like oxygen
4. When liquids are exposed to air, they _____.
5. things like rocks and metals that keep their shape

As you read this week's lesson, circle or highlight all proper nouns with any color pen or highlighter. This will help you find some of the crossword answers and get ready for this week's test.

Solids/Liquids/Gases

Mini-Lab

Cold air takes less space than hot air!

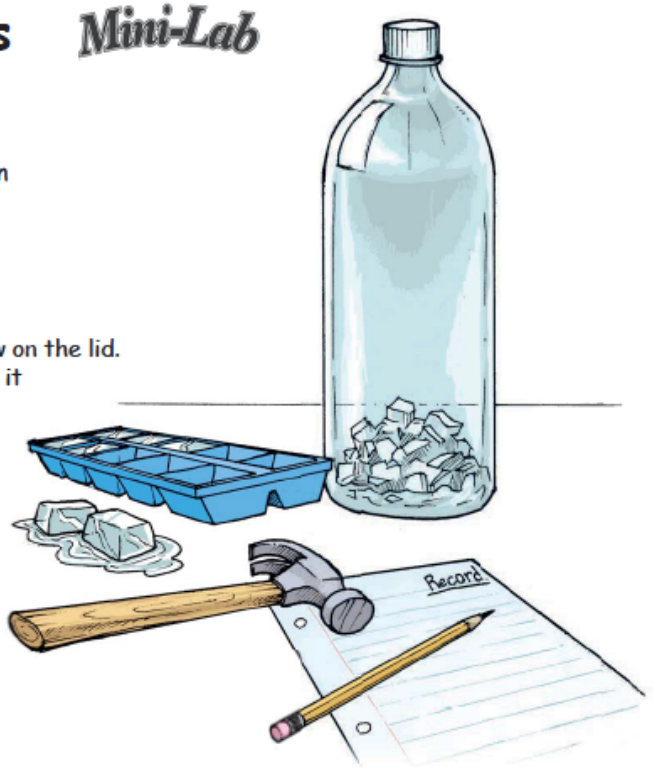
Materials
- a plastic bottle with cap that screws on
- ice cubes
- a plastic bag

Directions
1. Crush the ice cubes in the plastic bag.
2. Put the ice into the plastic bottle. Screw on the lid.
3. Shake the ice in the bottle and then set it down.
4. Record what happens.

(Note: For a more dramatic effect, set the bottle in warm water without the lid on it before you add the ice.)

Why?

As the air cools, it takes up less space. This causes the air on the outside of the bottle to crush the sides.



If you'd like to make any editorial comments about our paper, please write to us at feedback@studiesweekly.com.

Let's Investigate

This week we're going to help you plan an investigation about how matter changes. We'll start by asking a question: Which melts faster- an ice cube on a sunny windowsill or an ice cube under a lamp? Now, you need to think of a possible answer (hypothesis) and write it down. Next, you need a plan. Make a list of things you'll need to test your hypothesis and the steps you will follow in the test.

Here's the fun part. Do the test. Record your results by writing down how long it took each ice cube to melt. Finally, share your results. What's the best way to do that? You can write a paragraph, draw a picture, use a computer or give a report to your class. And those are just a few ideas. Different ideas work for different investigations.