

Science for Everyone



Science Literacy Student Book

Patterns and predictions



Problems and solutions



Curiosity



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Science for Everyone



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Science for Everyone

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Think Like a Scientist

"It is eight o'clock. Time for bed!" Sofia's dad says.

"But the sun is still up. It's still daytime!" Sofia replies.

Sofia remembers other bedtimes when it was dark at eight o'clock.

Sofia notices the world around her.

She wonders about it.

Observing the world around you is a part of science.

Wondering is a part of science, too.



Science can begin when you ask questions.



How come my bedtime is sometimes before the sun sets?

What does a wild bunny eat?



Where does salt go when I mix it with water?

Asking many questions means you are curious.
Being curious is part of doing science!

Science also includes talking to others about your questions.

You tell them what you observed.

You ask them what they think the answers are.

You ask, "How do we know?"



Science includes planning a way to find an answer to your question.



You might write down what time the sun sets each day.

You might put out three foods and watch which ones the bunny eats.



You might mix a spoonful of salt in water and leave it for a few days.

Science includes comparing what you observed to what others observed.

Do you all agree?

Does anyone disagree?

You can ask someone older to look up sunset times online. Do the times match your observations, or are they different?



You can ask a neighbor what they see bunnies eat. Does your neighbor's answer support what you found?

You can ask a friend to try what you did with salt and water. Does your friend get the same results as you?



People do science to learn how the world works.
Scientists are curious people.
They ask questions.
They observe.
They investigate.
They know they might be wrong.
So, they compare what they discover with others.
Kids like you and Sofia can do these things.
Then you are thinking like a scientist!



Main Science Idea

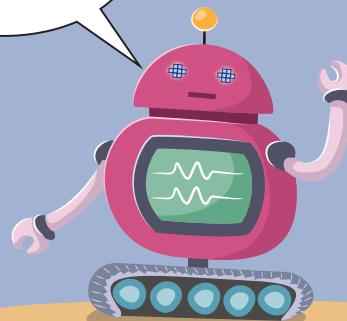
Science is a way to find out about things we are curious about.
Science includes observing, asking questions, and investigating
as a process for discovery.

What Is Nature?



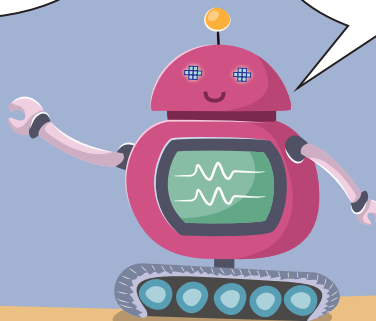
Let's explore nature.

Okay,
but trees do not
really talk.

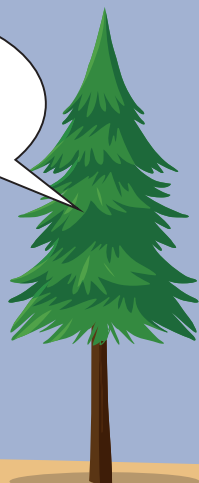


True, but robots do
not really think.

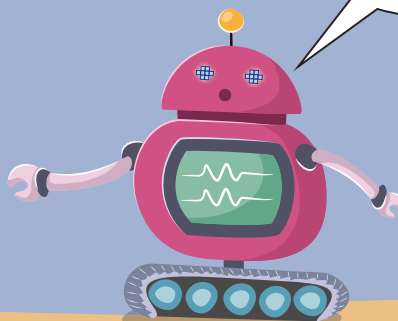
Yeah,
but people design
us to seem like
we think.

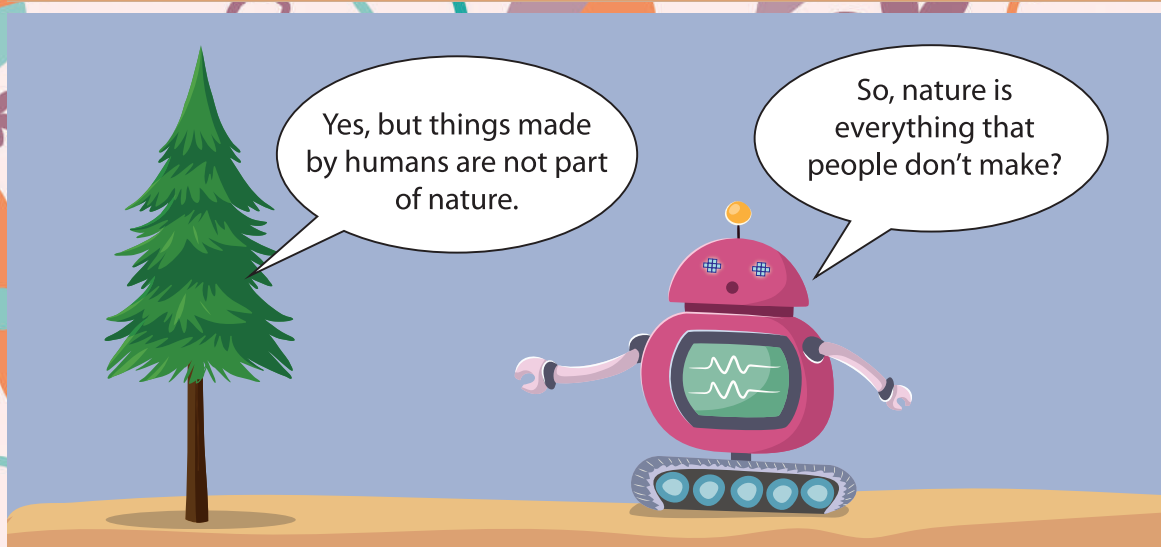
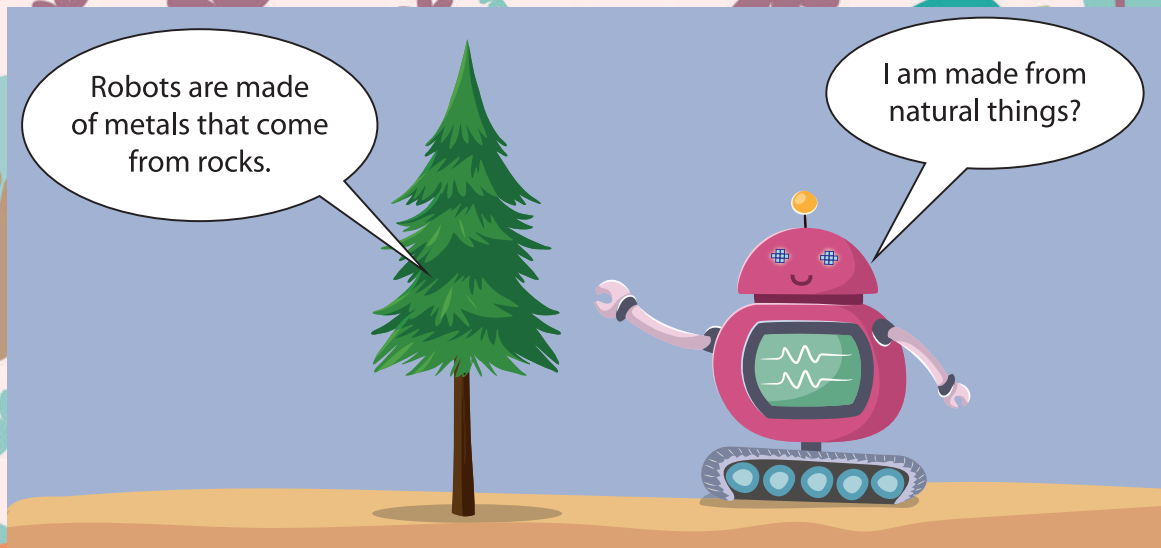
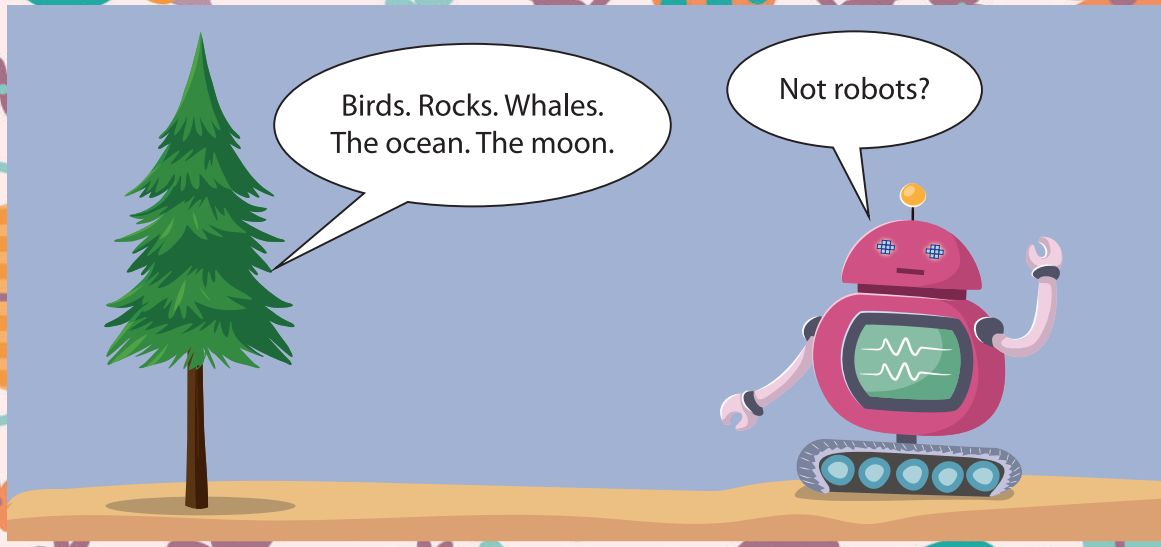


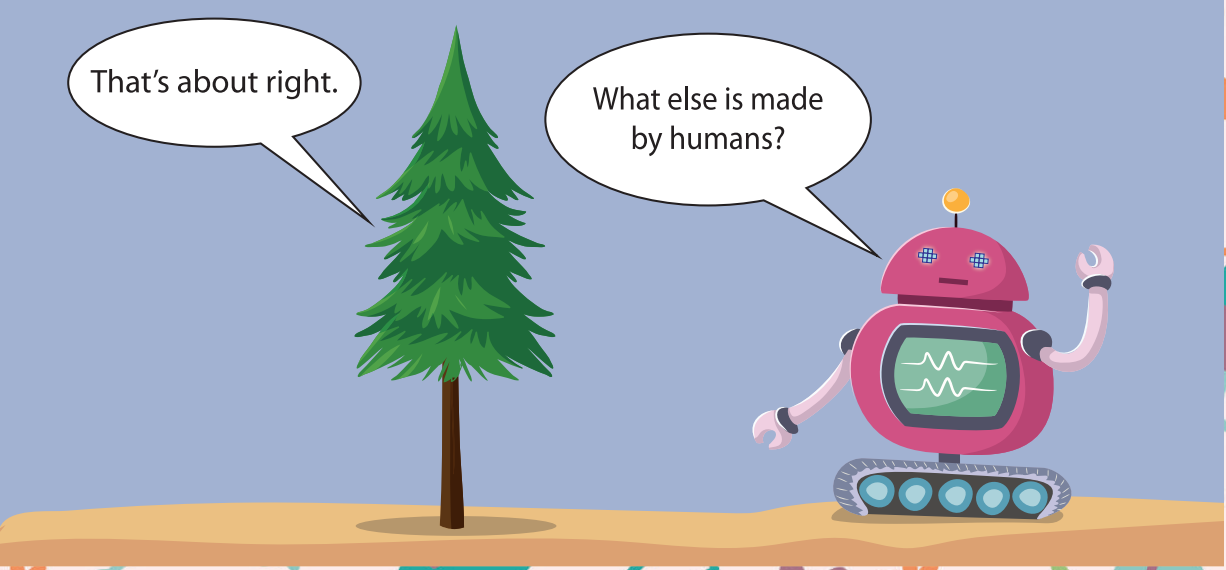
Trees are part of
nature. That is
why I'm here.



What else is
part of nature?

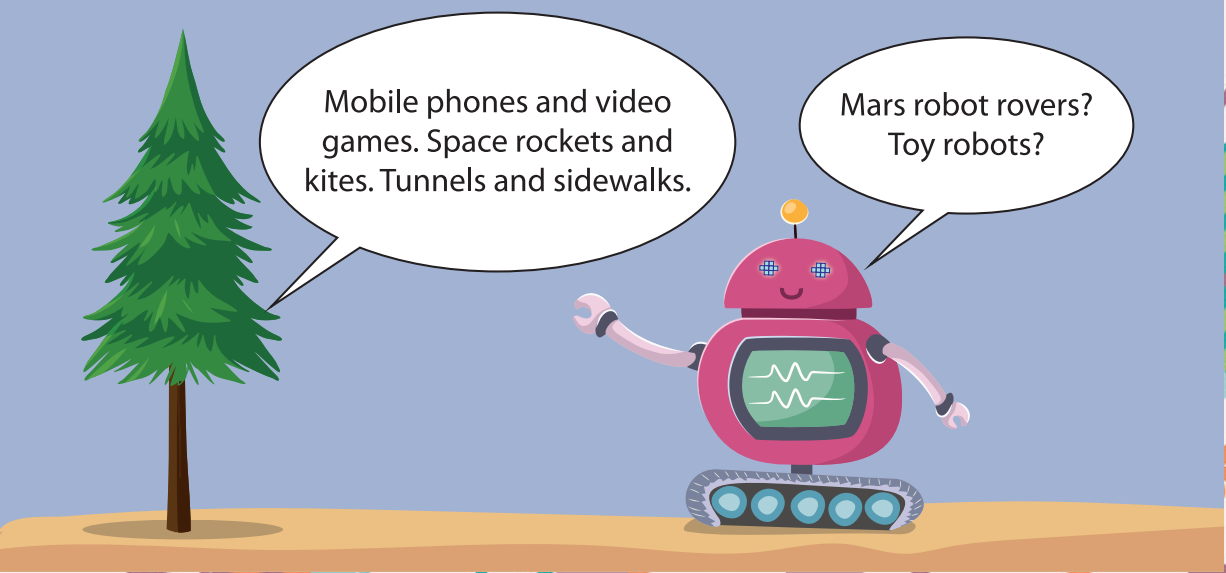






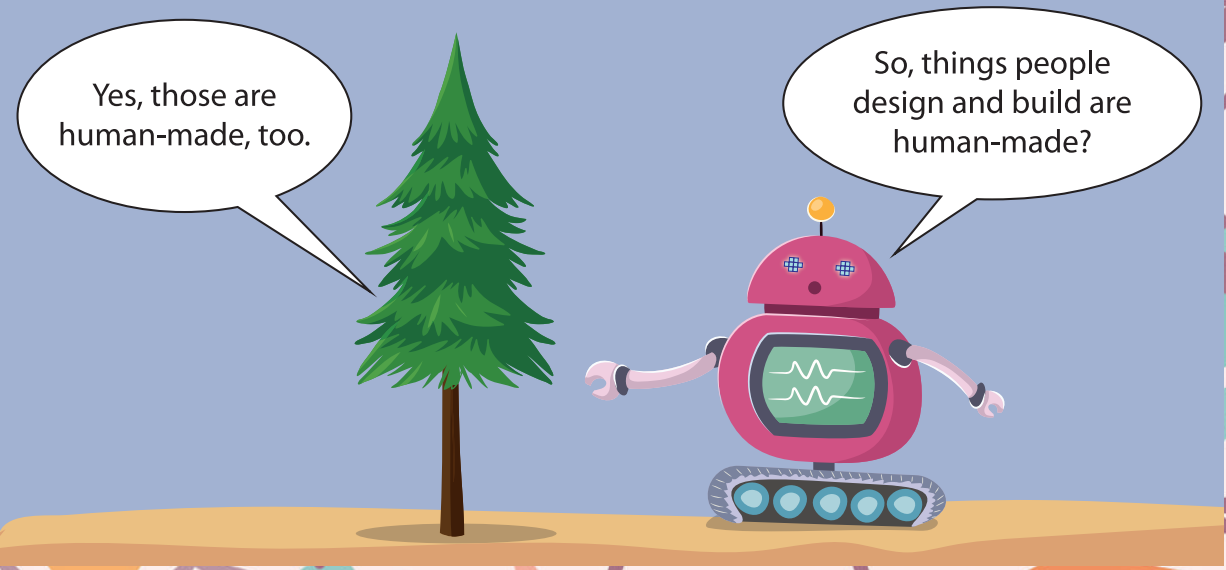
That's about right.

What else is made by humans?



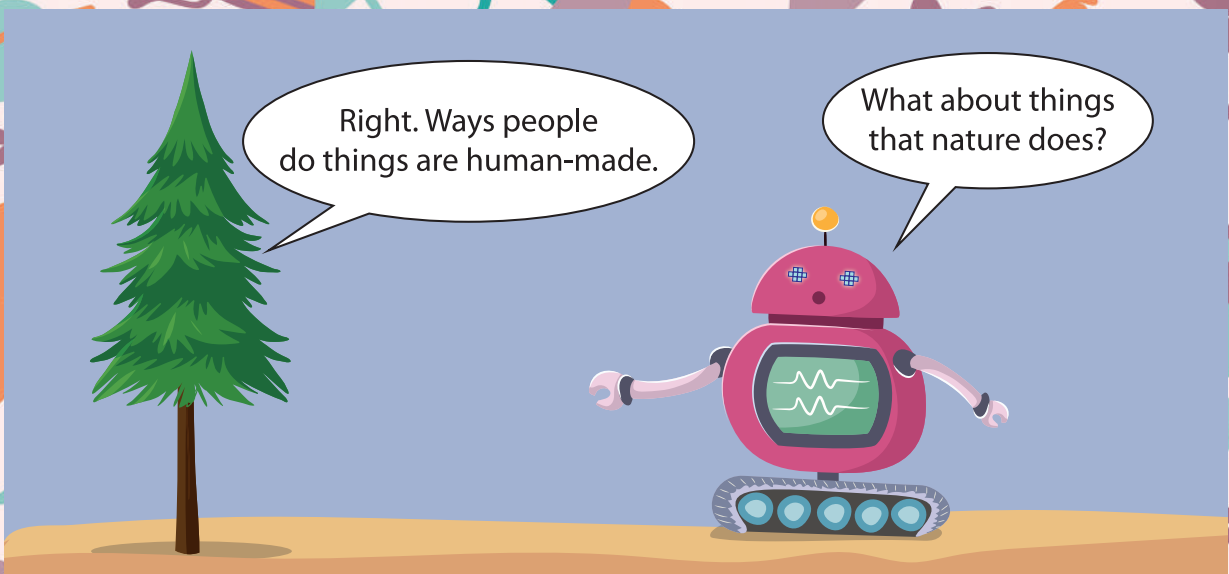
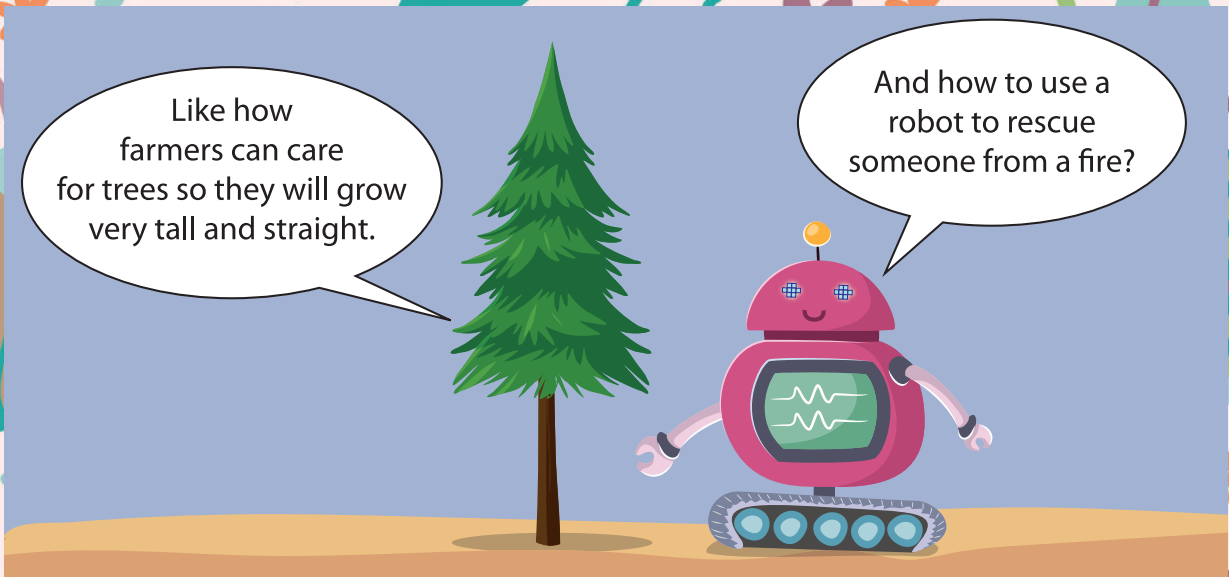
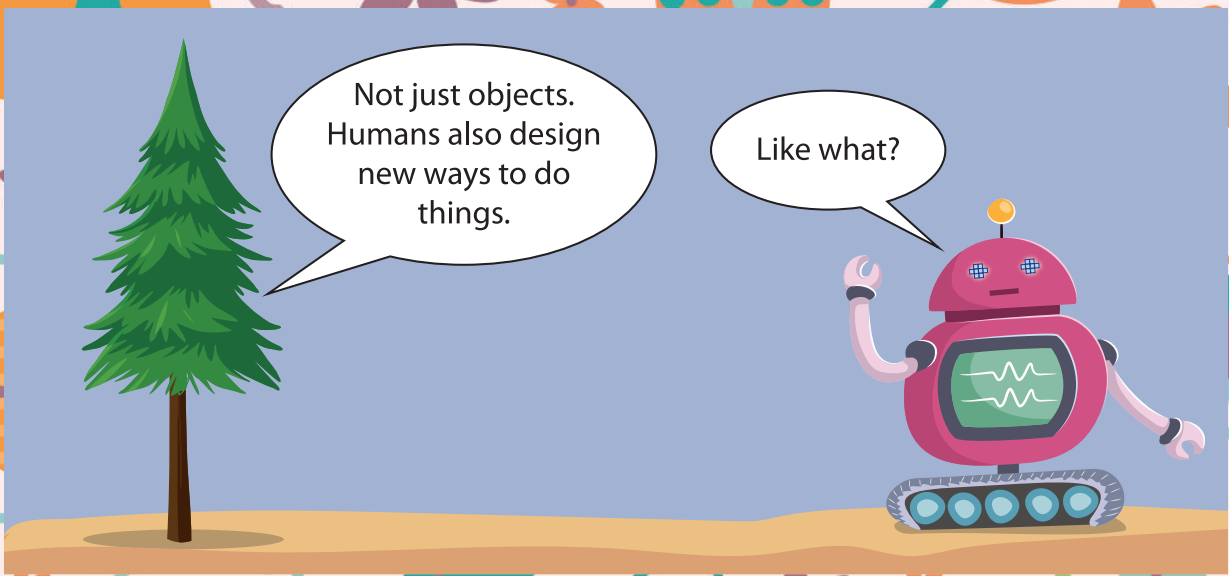
Mobile phones and video games. Space rockets and kites. Tunnels and sidewalks.

Mars robot rovers?
Toy robots?



Yes, those are human-made, too.

So, things people design and build are human-made?





Many things
happen in nature that
people do not cause.

Like what?



Like when a volcano
erupts. And when storms
like hurricanes form.

And the
sun moving across
the sky?



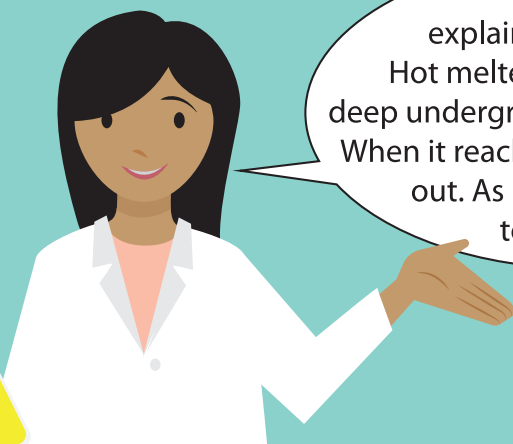
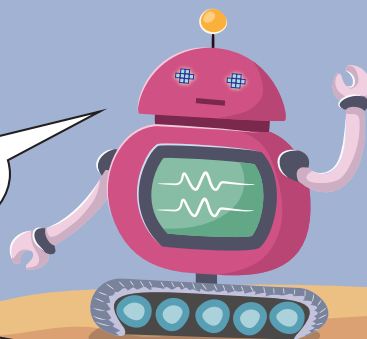
Exactly. The
way the sun appears
to move repeats
every day.

So, I am not the only
one who repeats myself.
Nature does, too!

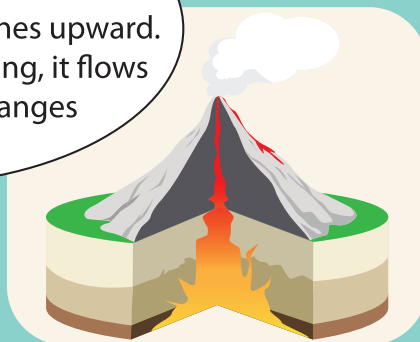


Let's get back to volcanoes.
What makes them erupt?

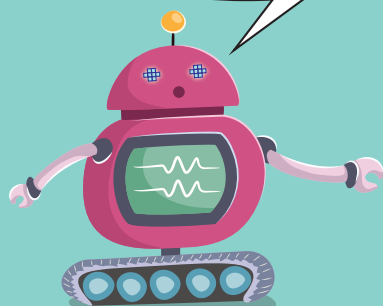
Maybe we can
ask a scientist.



I can
explain with a drawing.
Hot melted rock comes from
deep underground. It pushes upward.
When it reaches an opening, it flows
out. As it cools, it changes
to solid rock.



The drawing helps!
Thanks for explaining how
something in nature works!



My pleasure!
Scientists love to
answer questions!



Main Science Idea

Nature includes everything that exists or happens without people making it so.

What Is Measuring?

Nia is visiting Grandma in the city.

Grandma surprises Nia with a gift in a box.

It is a scooter!

Nia has fun riding her scooter in the city.

She and Grandma go to a skate park where there are ramps.

The wheels on the scooter turn easily.

Nia hardly has to push hard going up the ramps.

Rolling down the ramps takes no effort at all!



As the time to travel back home nears, Nia worries.

“What if my scooter is too big for the bus?”

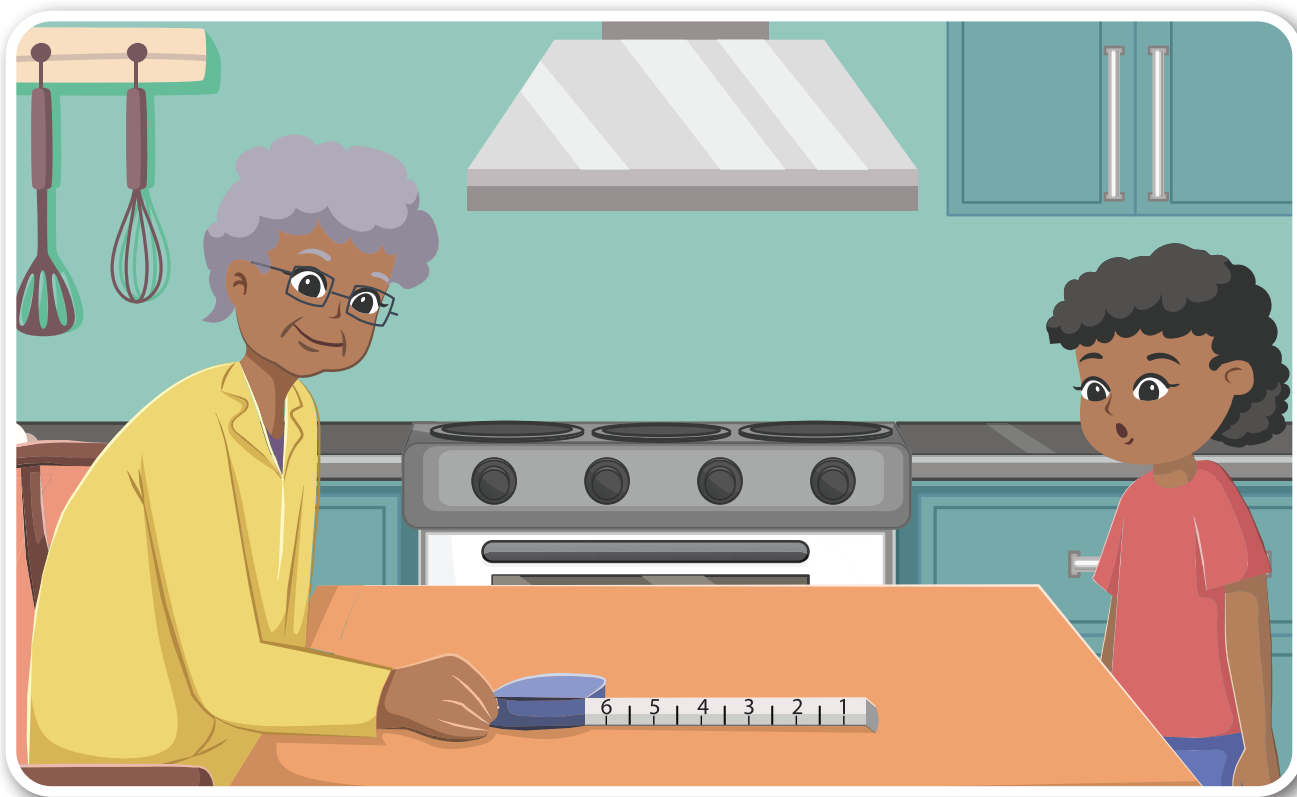
“What if it is too long?”

“What if it is too heavy?”

“Don’t worry, Nia,” says Grandma. “You can measure to find out.”



Nia learns how to measure length.
She uses a tape measure that has marks along it.
Some marks have numbers.
She can count them.
For the marks in between, she can count them, too.



Larger objects have higher measurements than smaller objects.

Nia and Grandma read the bus rules.

Grandma gets her bathroom scale.

"Put your suitcase on the scale. What is its weight?" she asks.

Nia reads the numbers on the scale. "It says 16 pounds."

"Now, put your scooter in its box, and put the box on top of your suitcase," says Grandma.

Nia reads the scale again. "It is now 22 pounds."

Will Nia's item meet the bus rules?



City Bus Lines

Personal Items

Personal items must fit in the rack over your seat.

Items must be smaller than:

- 29 inches in length
- 12 inches in width
- 6 inches in height

Items must be less than 50 pounds.

Plan Ahead! Measure!

Grandma shows Nia how to figure out if the box will fit in the rack on the bus.

They estimate the size of the box in inches.

About how long is it?

It is about as long as Nia's arm. About 20 inches.

About how wide is it?

If they fold the handle, it is about 10 inches.

"About how high is it?"

"It is about the height of my hand. About 6 inches."

Will those measurements meet the bus rules?



"I think it will fit!" Nia says.

"If you want to be sure, run and get the tape measure," says Grandma.

They measure the size of the box, and Nia smiles.

Her new scooter gets to ride home on the bus with her!



Main Science Idea

Measurements let us know and describe the sizes of things.

Questions to Investigate

Will the night sky look the same a month from now as it does tonight?

Does the night sky look the same from all parts of Earth?

These questions can be answered with science investigations.



You can take a photo of the sky tonight at 8:00 p.m. Then wait a month.

At 8:00 p.m., you take another picture from the exact same spot.

You see that the stars seem to have moved in the sky. Which of the two questions about the night sky can you answer?

What kind of investigation would answer the other question?



You could message your friend who lives far away.
He could take a photo at 8:00 p.m. on the same day you do.
Then you could compare the photos.

Which question would this science investigation answer?

You would find that the night sky looks different from
different places on Earth.

Long ago, people drew pictures over the patterns of stars.
They made up stories about the pictures.
The stories helped them remember the patterns.



They thought this group of stars looked like the tail and back of a bear.

You could ask many people and count their answers.



Look at this picture of the daytime sky.
Notice the clouds and the shadows within them.



What do you think the clouds look like?

Are the clouds pretty?

These are not questions you could answer with a science investigation.

The answers are opinions.

They are just what you think, not something that can be proven.

Let's ask some more questions.



Do shadows
always point in the
same direction?

How do the
positions of the
shadows change
through the day?



These are questions you could answer with science investigations.
How would you investigate each question?

Main Science Idea

Some questions can be answered through science investigations, but science cannot answer all questions.

The Sun Queen

People called scientist Mária Telkes the “Sun Queen.”
Why?

Because she invented so many ways to use sunlight.



Each of her inventions began with a model.

Models are used to explain ideas.

Scientists use models to make things clear and simple.

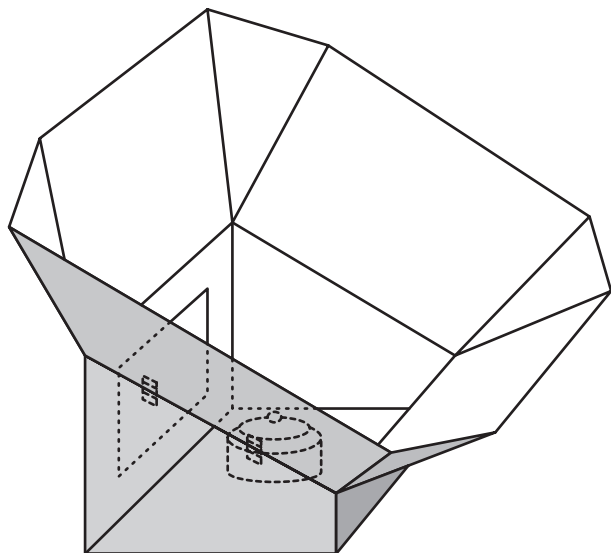
A model also can show something you want to build.

There are many kinds of models.

Drawings and diagrams can serve as models.

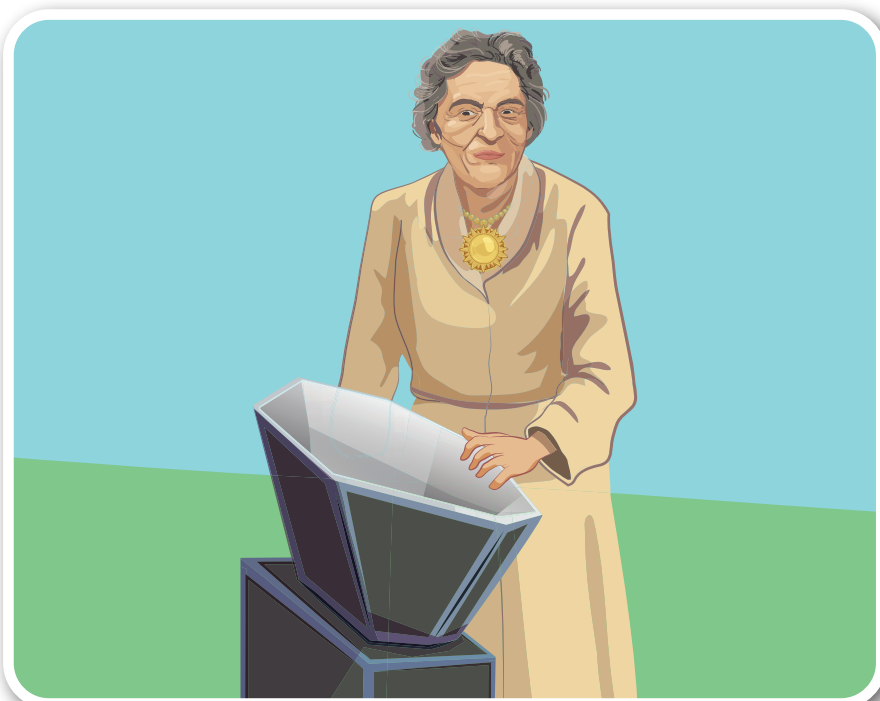
So can objects that can be handled.

Mária Telkes thought about how people could use sunlight to cook food.



First, she made a drawing of a solar oven to share her idea.

Then, she built a working model. It could bake many foods, such as chicken and cookies. People still use her oven today!



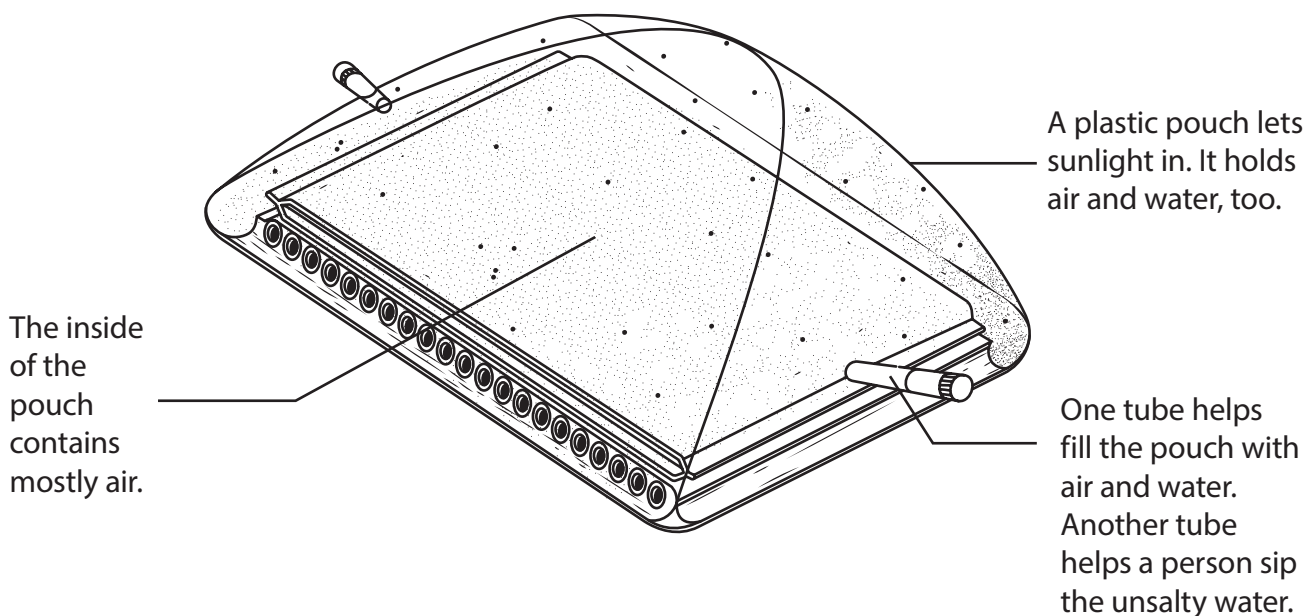
How is the drawn model like the working model oven?
How are they different?

Mária Telkes also invented a device to make drinking water from salt water.

It fit into a life raft.

If someone was lost at sea, they could use the device to get unsalty water to stay alive.

Mária Telkes made a drawing to show the parts.



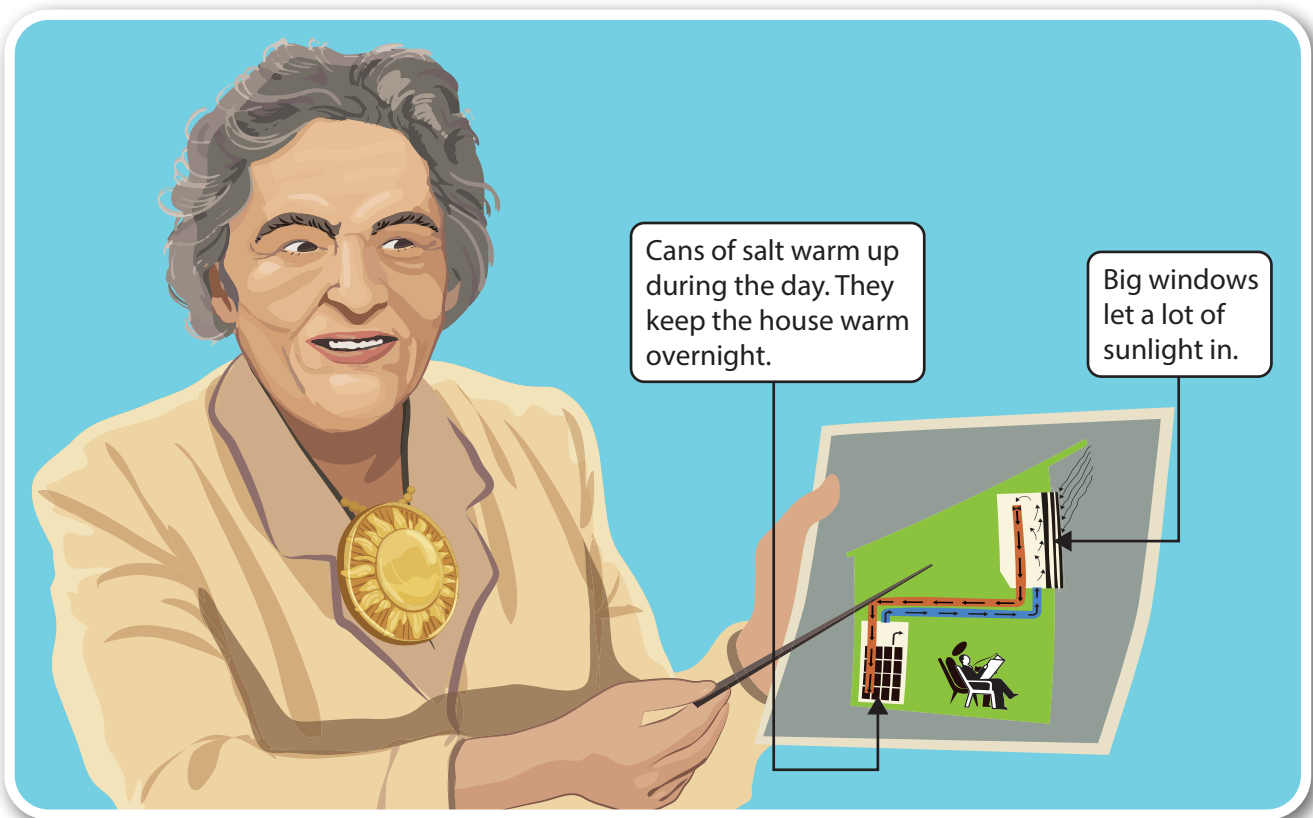
Later, working models were built in a factory.
The models were tested by sailors.
It worked! It could save lives!



A working model can change from the first design.
That's part of figuring out the best solution.

The Sun Queen even invented a house heated only by the sun. She figured out how to keep the house warm at night, when the sun was not shining.

Her drawings showed a wall of very big glass windows. That wall would face the part of the sky that got the most sunlight.



The model house was called the Dover Sun House.
A little boy and his parents moved in.
Curious people came to tour the house.
They felt how warm it was inside, even when it was cold outside!

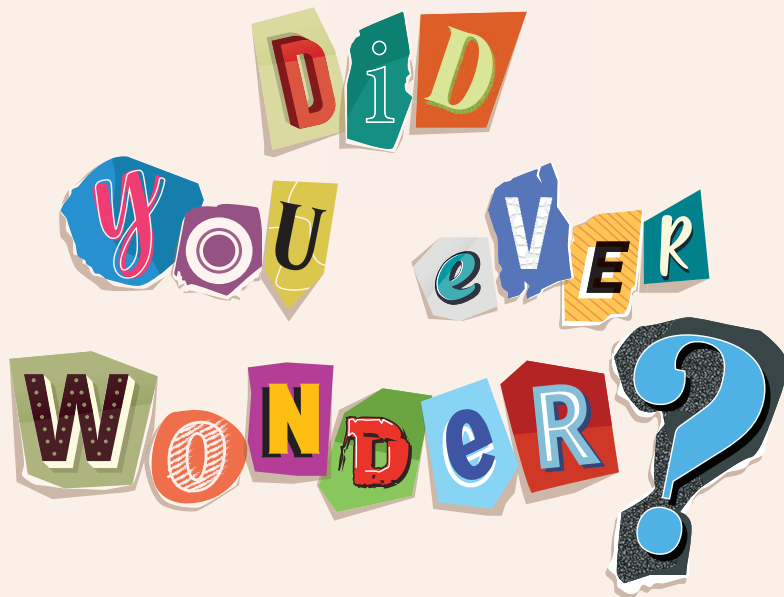


What would you like to invent?
How could a model help you share your ideas?

Main Science Idea

A model represents something else. In some ways, a model is like the real thing. In other ways, it differs.

Investigate!



How do popcorn kernels sprout?

Try this investigation at home to find out.

- 1 Ask an adult for ten popcorn kernels.
- 2 Spread out the kernels on a paper towel.
- 3 Spray or sprinkle the towel with water until it is damp but not too wet.
- 4 Fold the towel in half, slide it into a zipper plastic bag, and seal the bag.
- 5 Place the bag inside a cabinet or closet.
- 6 Observe the kernels each day. What changes do you notice? What parts sprout first—roots or stems?



DID YOU EVER WONDER?

What do insects drink?

Try this investigation with an adult to find out.

- 1 Put warm water in a small cup.
- 2 Add a spoonful of salt. Stir until the salt seems to disappear.
- 3 Pour a little salt water into a bottle cap.
- 4 Do Steps 1–3 again, but use sugar instead of salt.
- 5 Place the two caps next to each other on the ground outside.
- 6 Check the caps during the day to see if insects visit them.



DID YOU EVER WONDER?

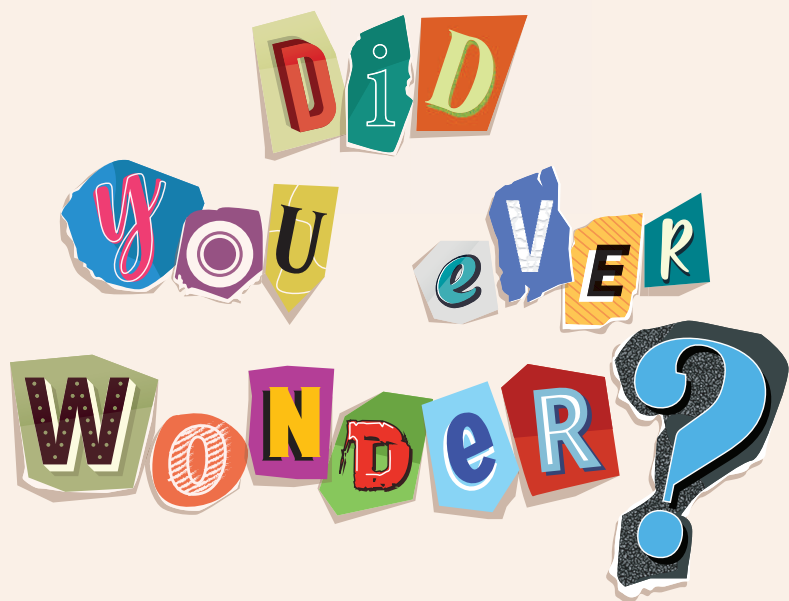
Do plants sense sunlight?

- 1 Ask an adult to cut off the top of a carrot, leaving about 2 cm of the orange root.
- 2 Place a few pebbles in a small container.
- 3 Sit the carrot root on top of the pebbles. Add water halfway up the root.
- 4 Put the container near a sunny window. Check it each day, but do not turn the container. When the water gets low, add more.
- 5 Draw what you observe each day.



There are wildlife guides for cities and states but not for your neighborhood.

You can solve this problem!



How can you plan a wildlife trail for your neighborhood?

- 1 With an adult, walk around your neighborhood.
- 2 Look for wild animals. They can be small and on the ground, like worms or chipmunks. They can be large and in trees, like birds.
- 3 Draw a map to show where to walk to find wild animals.
- 4 Make an X at each place you can stop and observe animals.
- 5 Label your map to tell what to look or listen for at each stop.
- 6 Share your wildlife trail map with your family and friends.



You can carry out investigations to answer science questions.
You can also solve problems with the help of investigations.



Investigation steps tell what to do and in what order.
They tell what materials to use.
They tell when to record observations.

You can also plan your own investigations.

Write steps using numbers to show their order.

After you try the investigation, give the steps to someone else.

Then they can repeat the steps in the same order.

You can talk and compare what they observed to what you observed.

Look at these photos of an investigation.

They are not in the correct order.

How would you order them?



Main Science Idea

Investigations follow a series of steps.

Data and Predictions

Dr. Fuertes is visiting Riverside School today to talk about healthy hearing.

She brings a diagram showing sounds that are softer and louder.



Dr. Fuertes explains where the data, or information, come from.

Scientists pointed a tool at a sound maker.

The tool measured the loudness of the sound.

They wrote down each measurement.

Then they arranged them on a line from softest to loudest.

Dr. Fuertes explains that very loud sounds can harm people's hearing.

Person
breathing



Softer



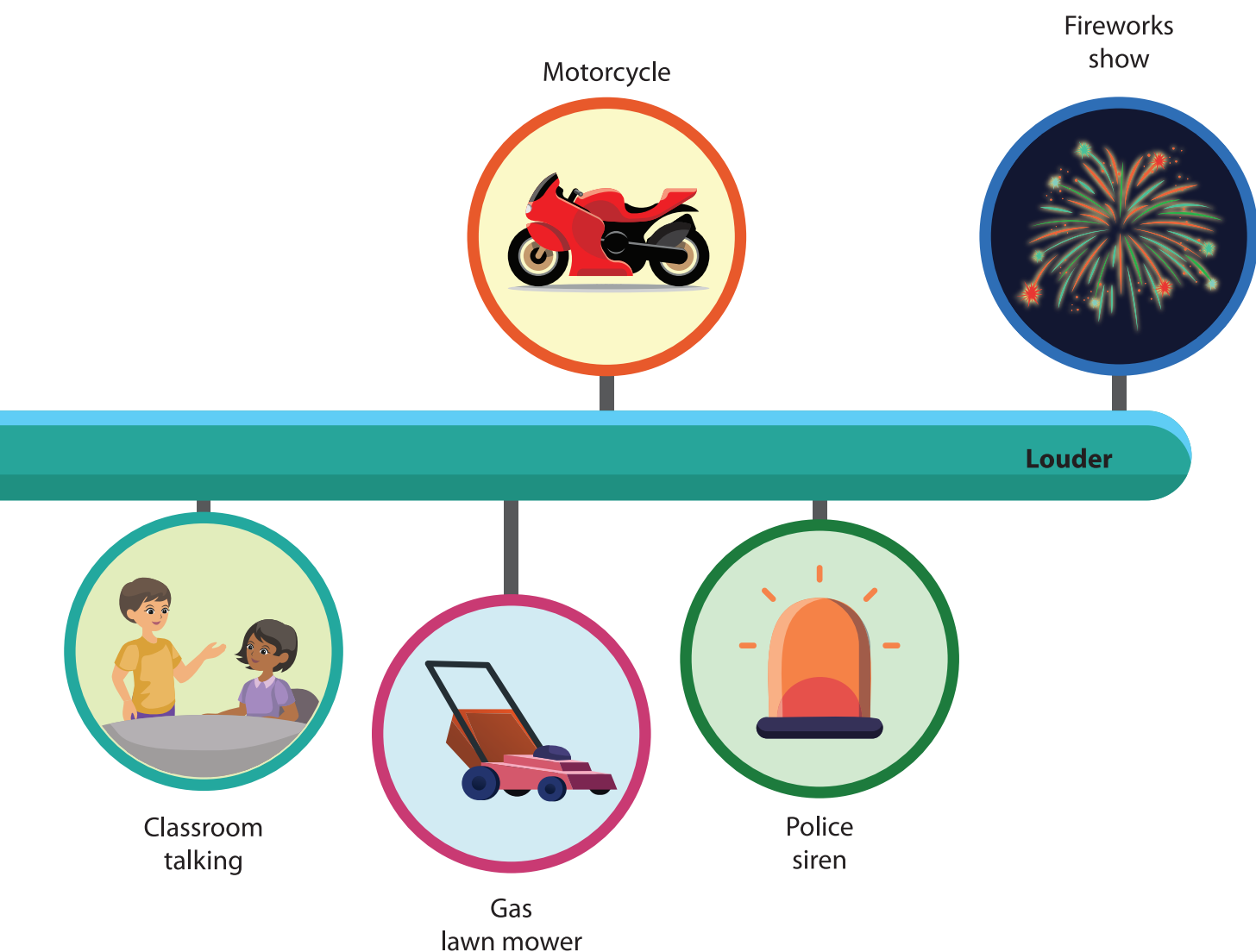
Whisper

Predict where on the loudness graph your school's cafeteria at lunchtime should be.

To do this, think about the sounds on the diagram.

Compare them to what you know about the loudness of your lunchtime cafeteria.

Think about how your prediction could be checked.





The Wilson family is car camping.

They set up their tent right next to their parked car.

Mr. Wilson puts out the campfire at bedtime.

But the kids want to read comic books before they go to sleep.

It would be useful to know about light sources.

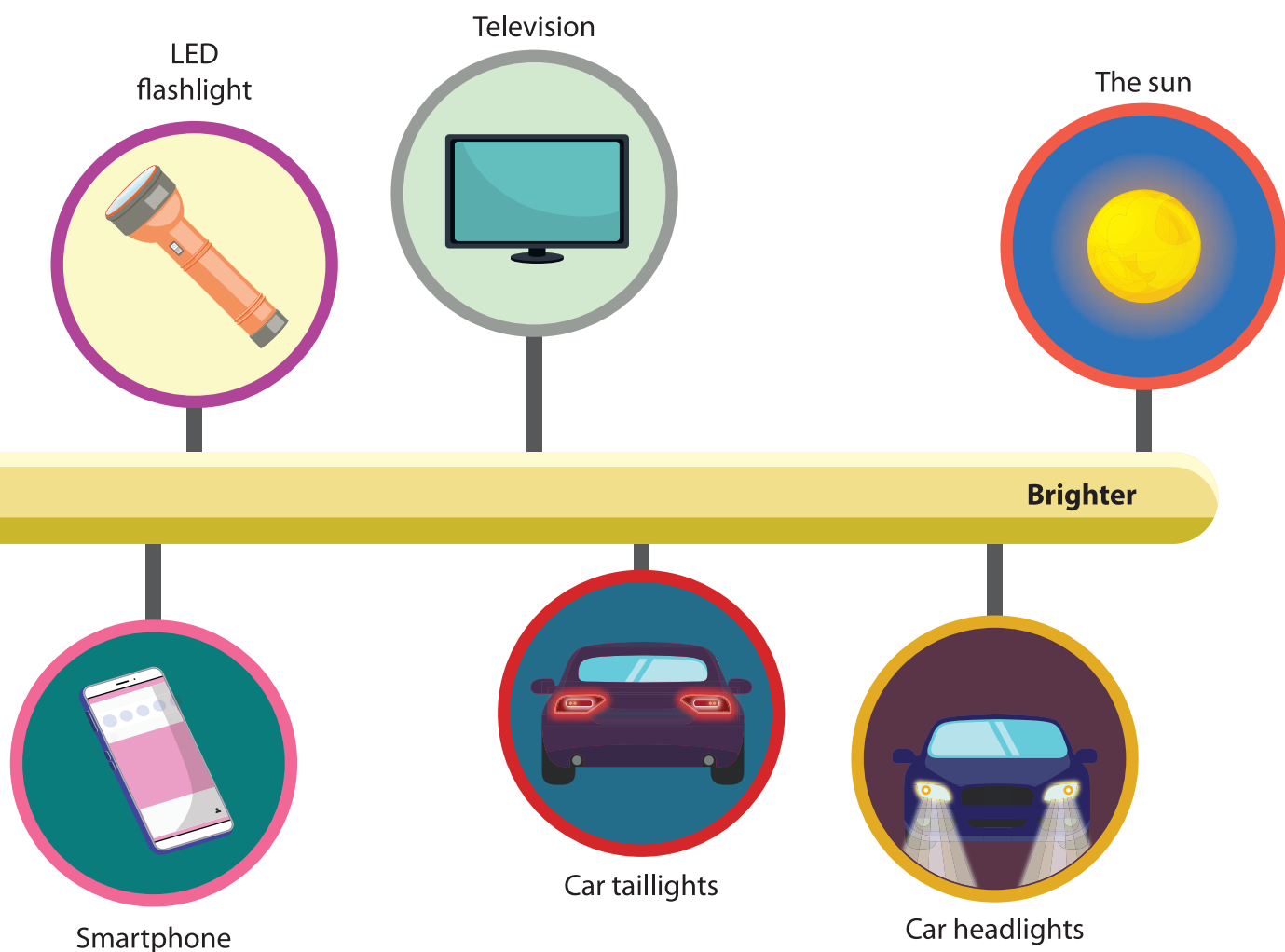
Which sources of light are dimmest and brightest?

Dimmer



Candle

Think about the sources of light at the campground.
Think about the brightness of light needed to read.
Use the data in the diagram to compare.
Predict which source would be best for reading
comic books.
How would you check your prediction?



This desert tortoise is only a couple of years old.
It is about 3 inches in length.
It will grow a little more each year, until it is an adult.



The chart shows how many inches long this little fellow will be from ages 5 to 7 years.

Age	5 Years	6 Years	7 Years	8 Years
Inches	6	7	8	?

What length do you predict it will be at 8 years old?
How did the data in the chart help you answer?

A tree grower sells young white oak trees for planting. The trees are 6 feet tall when they are sold to buyers.



The chart shows how tall the tree will be in the first three years after it is planted.

	First Year	Second Year	Third Year	Fourth Year
Feet	6	8	10	?

How tall do you predict it will be after the fourth year?

How do you know?

Main Science Idea

Data are information. Data can help you predict some things. You can check to see if your prediction was correct.

How Much and How Many

In science, we use numbers to measure.

We can measure length, weight, time, and more.

Think about things that can be measured.



What's the distance around a tree trunk?



How long does it take to win a race?



How many meercats are keeping watch?

Quantity means how much or how many of something.
The number of units helps us tell sizes and amounts.



How many people are in line?



How tall is the plant?



How much liquid
is in the flask?

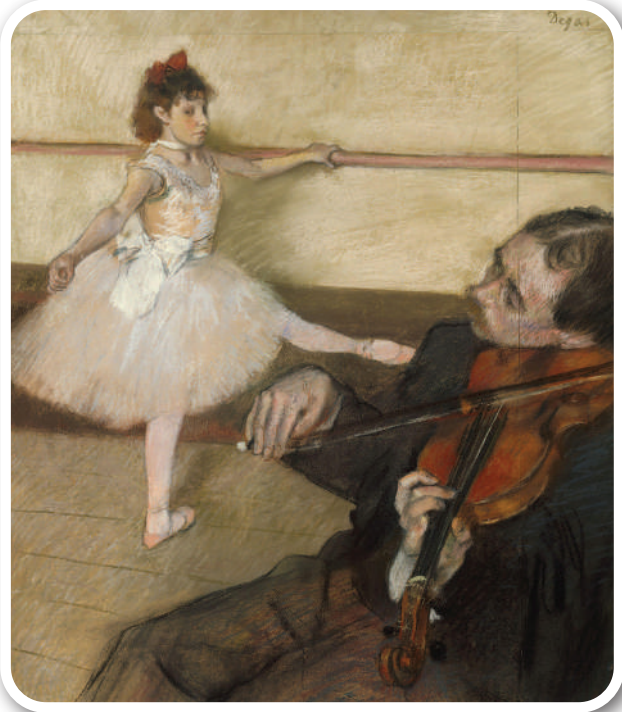
Some things cannot be measured with numbers.
How something looks, tastes, or feels can't be measured.



How good does
breakfast taste?



Which stuffed animal
feels nicest?



How beautiful is a painting?

Some things about nature can be measured.

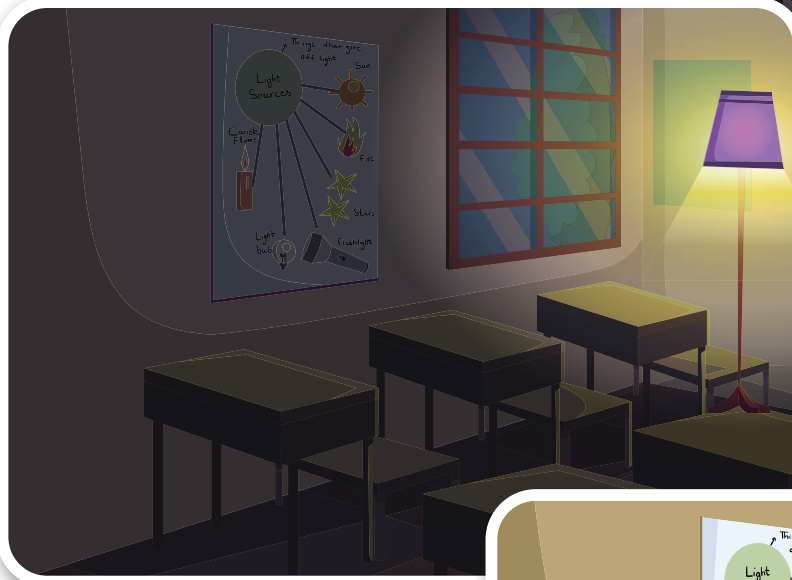
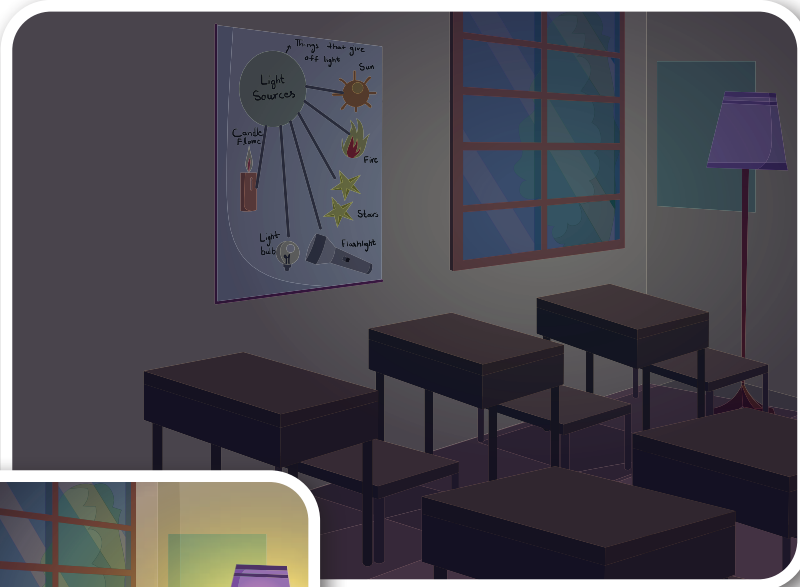
Others cannot.

We cannot measure how pretty a flower is.

But we can measure how many bees collect nectar from it.



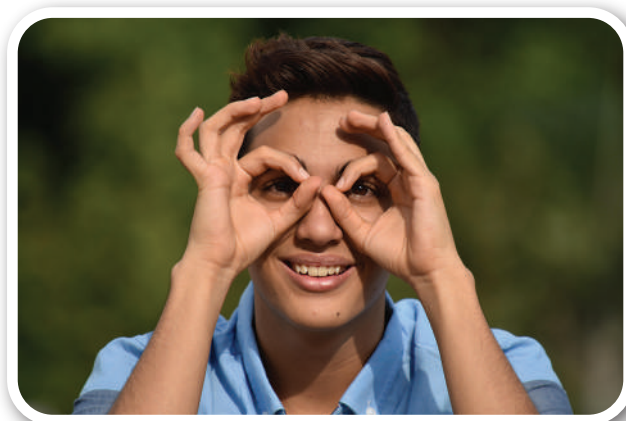
You can measure how bright each of these classrooms is.
How close you must stand to see the poster in each light can
be measured, too.
But how nice this
classroom looks
with different types
of light cannot be
measured.



Let's practice sorting things into groups.
Which are details that can be measured?
Which show details that cannot be measured?



A thermometer can measure
how hot it is.



But you can't measure how
happy a person is.



A scale can measure
how heavy a puppy is.



But we can't measure how beautiful
the sunset is.

Main Science Idea

Quantity means how much or how many of something.
Some things can be counted or measured precisely. Other
things cannot.

Super Solver!

Inventor Kid is here to save the day!

There's no problem too big for me to solve!



Oh no!

My toy car keeps getting stuck under my bed!



I made this Handy Helper to pick things up.
Could I use it to save my car?



I might need to change it a bit.
If I add wheels and make it longer, it just might work!

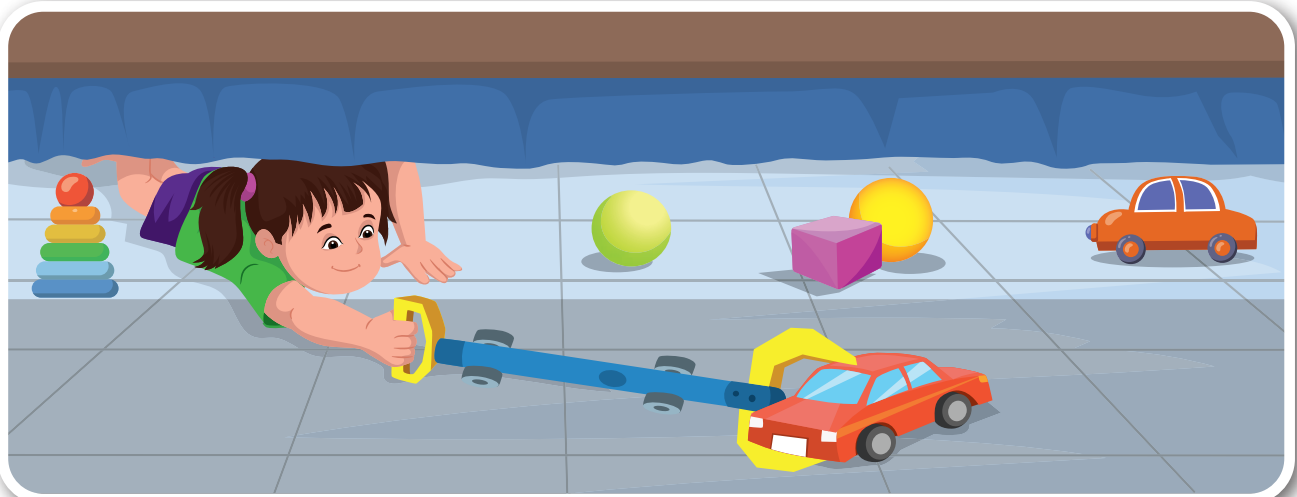


Time to transform my Handy Helper into a Toy Rescuer!



It works!

This Toy Rescuer is a solution for the car stuck under my bed.



My Reach-O-Matic can reach high places.
I wonder if it can also reach far underneath my bed.



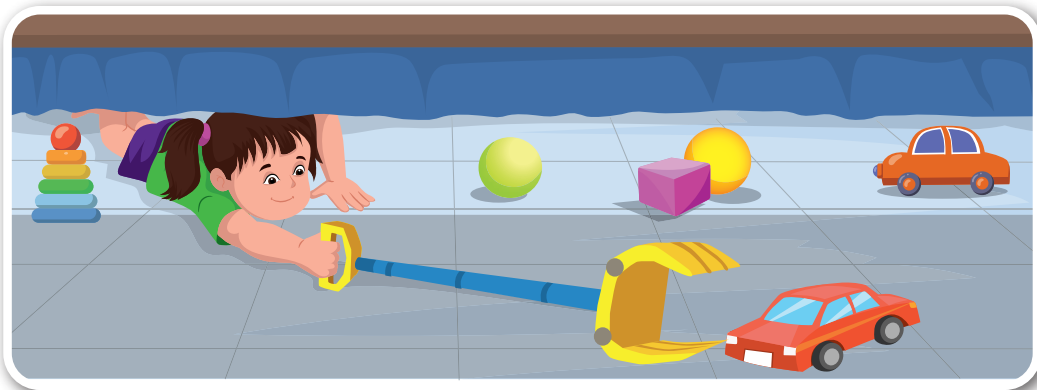
By making it shorter and adding a claw, it might just do the trick!



Let's try this new and improved Reach-O-Matic to solve the problem.



Oops! This version of the Reach-O-Matic didn't work to rescue the car.



That's OK. Sometimes, inventions don't work as planned.
Time to think of another solution!



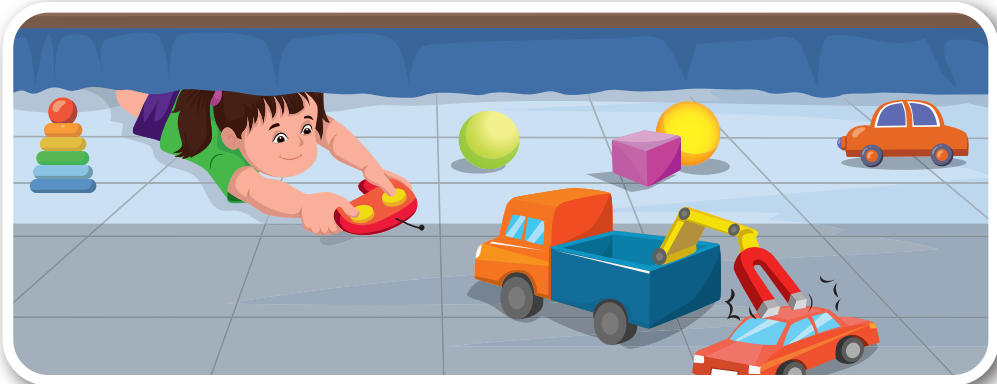
My remote-controlled truck zips around.
Could it solve my toy car problem?



Maybe if I add a
magnetic attachment,
the truck could save
my toy car.



Hooray! The changes to my remote-controlled truck worked, too!
Inventor Kid saves the day!



Main Science Idea

People can design inventions to solve problems.

Tulip Mystery

Kai spent hours caring for his backyard garden.

But one morning, he woke up to an unhappy surprise—his tulips were gone!

They had disappeared during the night!

Kai was curious.

He needed to solve this backyard mystery.

Kai spotted his friend Maya over the fence.

He called, “Maya, I think bugs ate my tulips.”



Maya joined Kai's investigation.

They found holes where the tulip bulbs had been planted.

But bugs couldn't create such large holes

They could not carry away an entire tulip bulb.

"I don't think the evidence supports my claim," Kai admitted.

"Maybe it wasn't bugs that ate my tulips."



Kai made a new claim.

"I think rabbits are eating my tulips!"

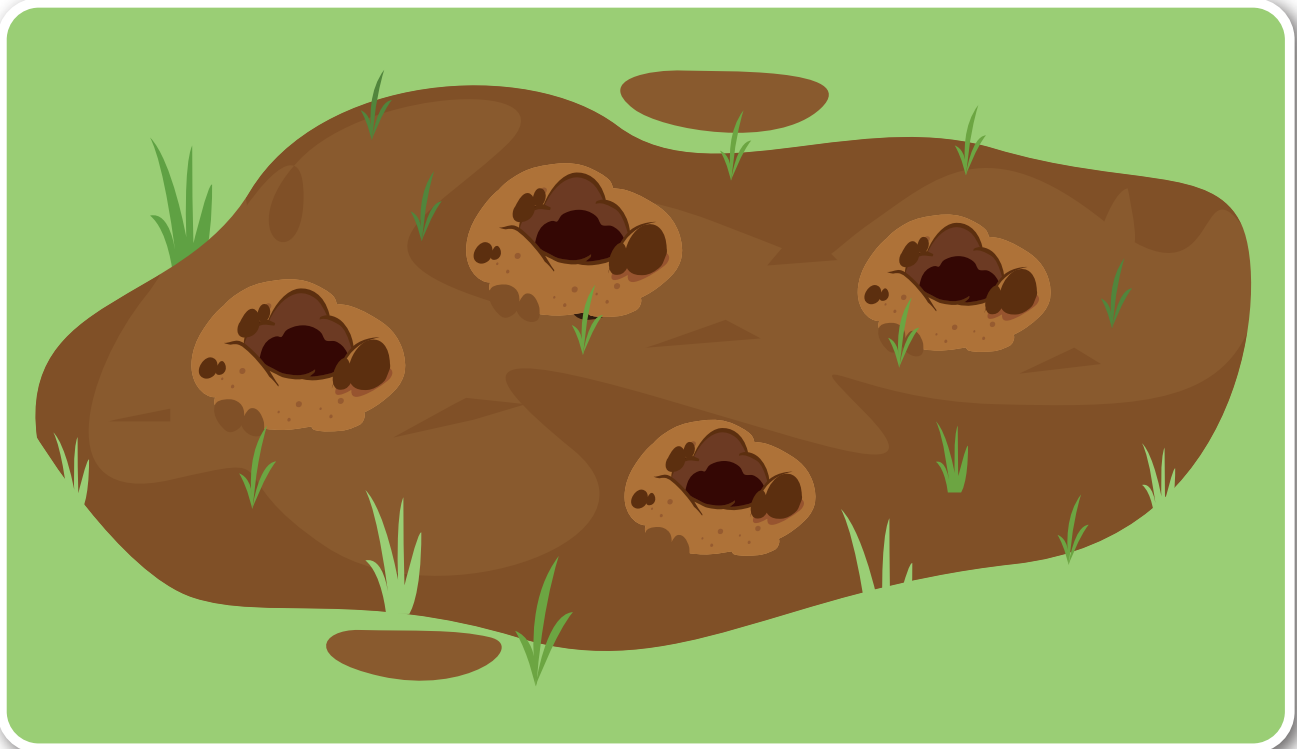
Maya asked, "What evidence do you have?"

Kai pointed at the holes in the soil.

"Look at these holes!" he replied.

"Everyone knows rabbits love to nibble on things in gardens.

They must have dug up my tulip bulbs!"



Kai and Maya looked for more evidence.

Maya spotted soil on top of the fence.

There were even a few pieces of tulip stem.

Kai and Maya shared a look.

Something had climbed the fence while carrying a tulip plant.

Maya said, "Hold on! Rabbits don't climb fences!

Their paws aren't the right shape."



Kai and Maya thought carefully about all the evidence.
“Hmm,” Maya said. “What other creatures around here
can climb?”

Kai exclaimed, “I’ve seen squirrels climb really well!”

A spark lit up Maya’s eyes.

“You’re right! Think about squirrel paws.

They are built for climbing *and* digging!”



Kai made one more claim about his backyard mystery.

“Squirrels are eating my tulips!”

Kai and Maya spotted some squirrels playing nearby.

All the evidence put together supported Kai’s claim this time.

Squirrels had been the problem all along!



Main Science Idea

Good evidence comes from facts. Strong evidence can help us see when we are wrong and make us change our minds about things.

Science Information

Max is a boy who loves science.

He also loves to visit the school library.

He spots a rainbow poster on the library wall.

April has arrived.

Rainy days bring colorful surprises . . . like rainbows!

Ms. Parker, the librarian, invites Max to a special learning station all about rainbows.



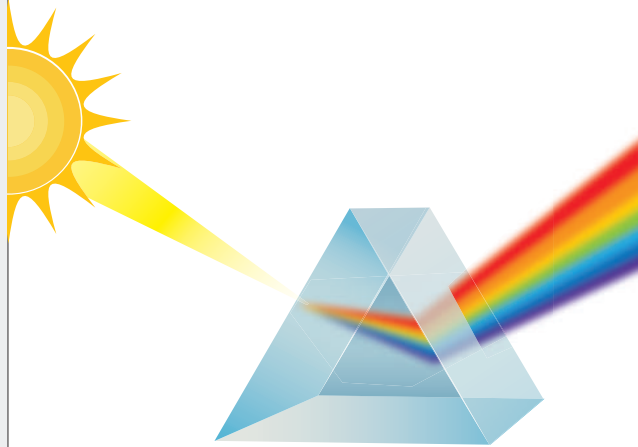
Max gets a close look at the poster.
It shows a rainbow stretching from the trees to the sky.
He sees that the colors are next to one another.
Max reads the poster's caption to learn about rainbows.



A rainbow is a beautiful and colorful arch that appears in the sky after it rains. It happens when light from the sun shines through and bounces off raindrops in the air. Rainbows have different colors, including red, orange, yellow, green, blue, indigo, and violet.

Near the rainbow poster, another poster catches his eye. Its diagrams explain how light separates into colors.

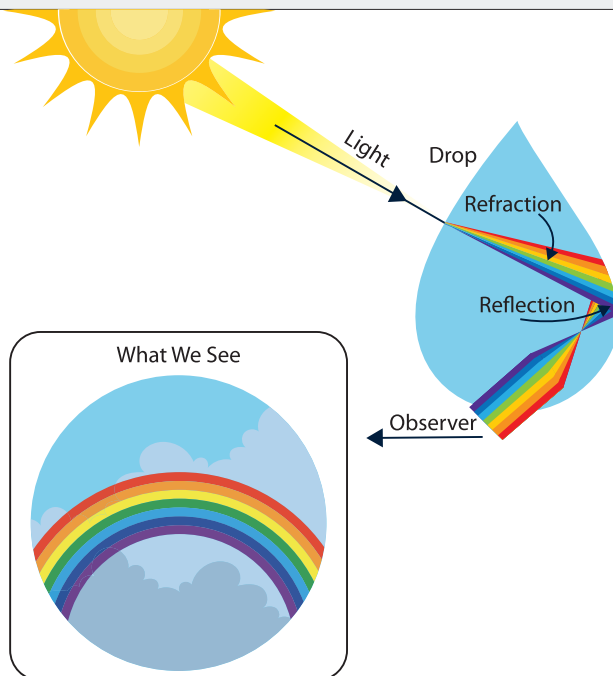
How Are Rainbows Formed?



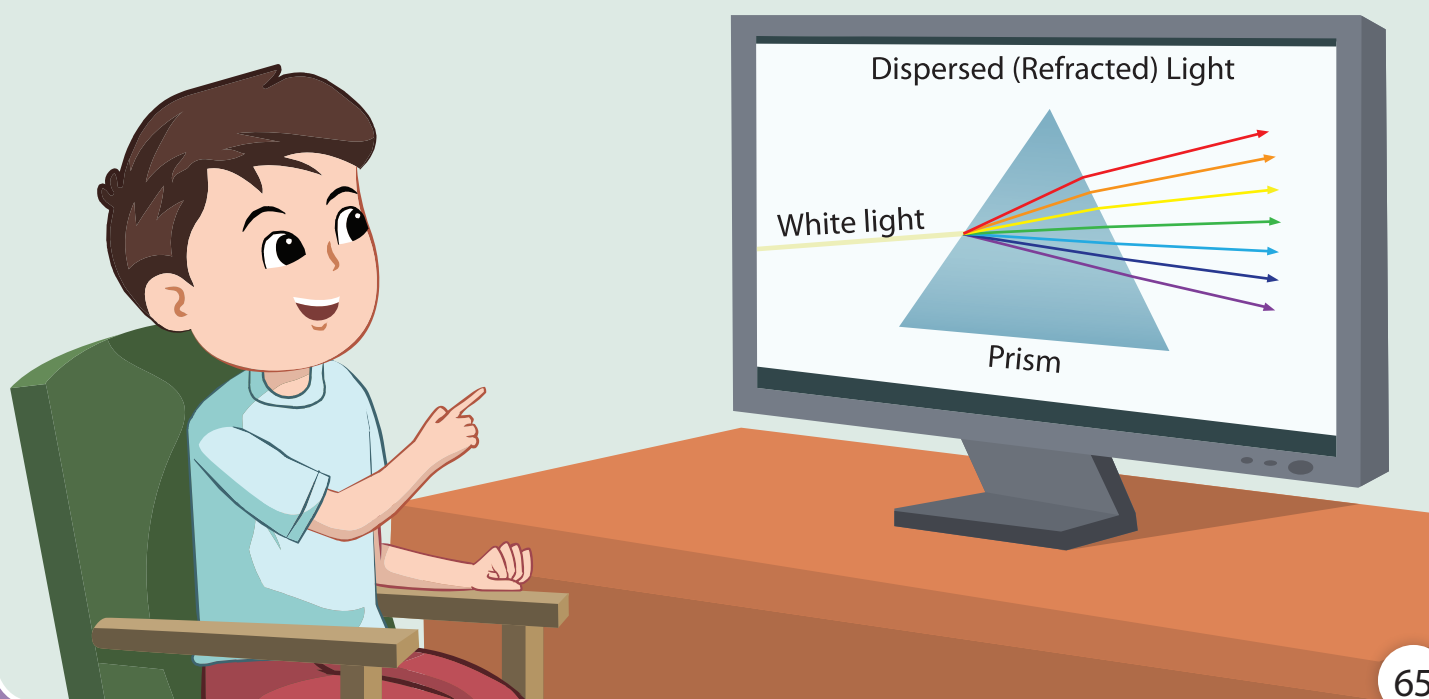
A **prism** is an object made of see-through material, like glass. When light passes through a prism, it bends. This makes the light split into different colors.

When the sun comes out after it rains, something amazing happens.

1. Sunlight enters the raindrops.
2. Raindrops are prisms that bend the light.
3. The sunlight separates into colors.
4. What we see is a **rainbow**!



Ms. Parker points out a video at the learning station.
As Max watches it, he learns how sunlight and raindrops
create rainbows in the sky.
Colorful moving images help him see how light bounces,
bends, and spreads out.
The behavior of light can make beautiful rainbows in
our world.



Max still has one question.

He knows he can ask Ms. Parker.

“Why does a rainbow make a curved shape instead of a straight line?”

Ms. Parker smiles.

“That’s a great question, Max!” she replies.

“The sun hits the water droplets in the air at different angles, from low in the air to high in the air.”



Max got details about rainbows from different places today.

- He learned from posters with words and photos.
- The posters had titles and drawings, too.
- Max got information from a video.
- He listened to the narrator speaking in the video.
- He also got information from Ms. Parker.

Max put all the pieces of information together.

Now he understands much more about rainbows than he did before!



Main Science Idea

Information can come from printed words, pictures, and voices that we hear. Pictures can be diagrams, photos, or icons. We put all the information together to understand new things.

Learning from Patterns

Have you ever noticed the spots on a ladybug's back? The spots are arranged in a pattern on the bug's body.

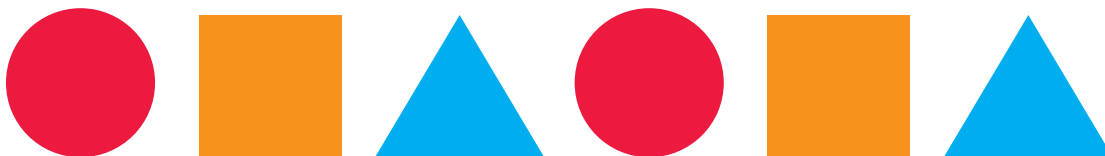
One side of the bug's body is a mirror image of the other.

That's a pattern.



When things repeat or happen in the same way over and over again, that's a pattern.

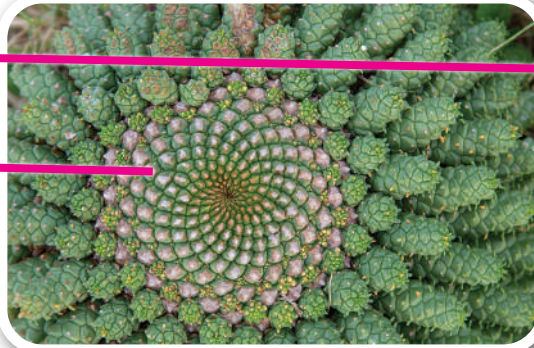
What repeats in this pattern?



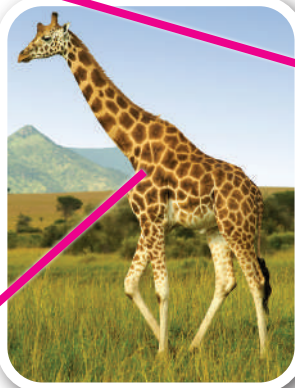
Patterns can be found all over nature.

You can find patterns by looking at plants and animals. You can find some patterns by listening.

Parts arranged
in circles, around
and around



Dark stripe then
light stripe, over
and over



Yellow outlines
around brown
spots, from
bottom to top



TAP, TAP, TAP,
TAP, TAP!!!

CROAK! (Then a quiet pause) CROAK! (Then quiet)

When we notice a pattern, we can figure out what will come next. Patterns helps scientists understand things better and make predictions.

Numbers can also make patterns.

Can you see the pattern
in the pink numbers?



How about the pattern
in the orange numbers?



Have you ever seen a group of birds flying together in a V shape?

That's a pattern that birds use when they migrate.

How would you describe the pattern?



Humans follow patterns, too.

The watchers keep
the rhythm.
CLAP, CLAP, CLAP!!!

The jump rope makes a sound
each time it hits the ground.
SNAP, SNAP, SNAP!!!



How does the pattern help the jumper?

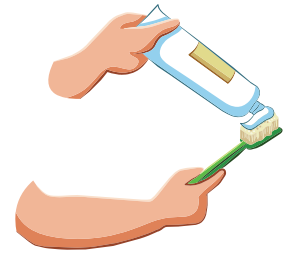
Can you think of a pattern that helps you do something?

Think about an activity you do every day,
like brushing your teeth.

You follow a pattern of steps.

The steps happen in the same order every
time you brush.

1. What do you do first?
2. What do you do next?
3. What do you do after that?
4. How do you finish the task?



Main Science Idea

Noticing and studying patterns can help you figure things out.

Demi's Difficult Day

Demi's bathtub won't drain.

What causes this problem?

Something must be clogging the drain.

Demi is a curious kid.

She loves to figure things out.

Demi needs to find the cause so she can fix it.

She reaches her hand into the bathwater.

A sponge toy is stuck in the drain.

That's the cause of the problem!

Demi pulls out the toy, and the water drains.



Oh no!

Next, Demi sees milk has spilled all over the table and floor.

It's easy enough to clean up the milk.

But Demi is already thinking about the cause of the spill.

What made it happen?

The table tilts when she leans on it.

The wobbly table is the cause of the spill.



Demi's bike has a flat tire.
There are so many problems to solve today!
What is the cause of the flat tire?
The tire has a nail in it.
This problem is a little harder to fix.
Demi will need the help of a grown-up.
But she knows what caused the problem.



Demi is experiencing causes and effects today!

Knowing the causes of things can be helpful.

Spotting something that could cause a problem can help us keep the effect from happening.

Demi notices nails on the driveway.

Nails caused her flat bike tire!

She uses a magnet to collect the nails before Mom gets home.

Now Mom's car won't get a flat tire.



Demi thinks about other difficult parts of her day.
She knows what caused her problems.
Now she can change the outcomes for tomorrow.
The next time Demi takes a bath, she will take her toys out of
the tub.
That way, the drain won't get plugged.



The next time Demi puts a glass on the wobbly table, she won't put it near the edge.

Better yet, until she can figure out the cause of the wobble, she will put her glass on the counter where it won't spill.

Now to investigate the wobbly table!

- What is the cause?
- What is the effect?
- How is that a problem?

How can knowing the cause of the problem help Demi fix it?



Main Science Idea

Understanding causes and their effects can help with solving problems.

Counting Quantities

Counting is something we do every day.
The number of something is its quantity.
You can compare quantities.



How many prairie dogs do you count? Are there more prairie dogs or alligators?

Counting things can be useful.

A farmer counts the baby chicks.

She needs to know how many hatched.

There are two baby chicks!

All the chicks need to eat.

Counting chicks tells the farmer how much food to buy.

Counting helps the farmer, and the chicks get fed!



Not everything needs to be counted, though.

Counting how many spots are on the puppies doesn't matter too much.

But you can notice one puppy has more spots than another. It can help you tell them apart.



A young baker makes cookies.

She must count how many cups of flour to add to the bowl.

She must use the correct amount of flour.

Adding more or less of an ingredient affects how a food turns out.

Quantities matter in baking recipes.

A scientist who is mixing chemicals must count.

The quantity of one chemical must be exact.

The quantity of another must be exact, too.

Counting is not only helpful, but it also can be necessary.



To care for a plant, you must figure out how much water it needs.

You can count the number of days that you water a plant in a week.

You can keep track of the amount of water you pour over the plant.

This will help you make sure the plant gets enough water and not too much.



You could also count how many leaves grow on your plant.
But is knowing that quantity useful for keeping the plant alive?

Scientists pay attention to quantities.

They count and measure everything they study.

Elephants are an endangered species.

That means the number of living elephants is getting too low.

There could end up being no elephants at all.

Keeping track of the number of elephants is important.

It lets scientists know if things people do to protect elephants are helping.

It's hard to know the exact quantity of elephants, though.

They move around over vast areas



This is an elephant nursery.

The keepers care for orphaned elephants.

The keepers count the elephants.

They know exactly how many young elephants they need to feed.

They know exactly how much food they feed each one.

They keep track of how much the elephants grow.

When the elephants have grown enough, they can survive on their own.

They will go into the wild again.

Saving the lives of elephants involves knowing how to count.



Main Science Idea

Knowing quantities in science is helpful. It is not always important to know the exact numbers of things, though.

Systems Art Show

STUDENT ART SHOW

W E L C O M E to the student art show!
You can see pictures that students worked on during the year.

The theme of this year's art show is systems. Each picture in the gallery is about a system. What is a system? A system is a set of parts that work together. The parts affect each other.

E N J O Y T H E S H O W !

See what systems and their parts you can find along the way!





Theo Milbury

Blooms

Crayons on Paper

This drawing shows a plant with its flower. The artist drew a stem, a leaf, and petals. The stem sends water from the roots to the rest of the plant. The leaves help the plant make food. Petals on the flower attract bees to spread pollen around. This helps plants make seeds to grow new plants. These parts work together as a system. They help the flower grow and survive.



Vanessa Valquez

Hive City

Colored Pencils on Paper

Buzz, buzz, buzz. The bees in this picture are very busy. They are working in a beehive! A beehive is where bees live and work. Each bee plays an important part in the system. Some bees collect pollen to bring back to the hive. Other bees protect the hive and guard the queen.

The queen bee lays eggs and makes new bees. All these bees work together. It's a system



Luca Helman

Far Out

Crayons on Paper

The solar system has eight planets. Some of them have moons. The planets move around the sun. Gravity keeps the planets and moons in place.



Story Miraldi

See the Sea

Watercolor

This artist drew an aquarium. An aquarium is an underwater system designed by humans. It has parts that provide all the things aquatic animals need to live. These parts are meant to be like their natural habitats. The main part of an aquarium is water. Rocks or sand at the bottom of the aquarium give animals a place to rest or walk, just like in an ocean. Pretend plants and other objects give animals places to hide. Some aquariums have machines that keep the water at a good temperature. They are designed to imitate how the sun heats water in nature. Finally, fish, starfish, and all the creatures in the tank are part of an aquarium.



Dina Horowitz

Jars of Green

Colored Pencils on Paper

A terrarium is like a self-contained garden. It is a system with living and nonliving parts. A terrarium is a closed container with soil, plants, and air in it. Water moves from the air to the soil and back again.

Main Science Idea

Things that work together and affect each other form a system. There are many kinds of systems.

Fascinating Fasteners

It's show-and-tell day in Ms. Pei's class!

The students have been asked to bring in objects that use fasteners.

A fastener is a small part that helps larger parts stay closed or connected.

Nuts and bolts, nails, screws, and rivets are all fasteners. If you look carefully around you, you can almost always find some of these.

Let's see what some of the students brought to share with the class!

Show and Tell



Ricardo is sharing a wooden birdhouse with the class.
Several flat pieces of wood are held together with nails.
Nails are pointy metal fasteners.
They are hammered into place.
Usually, nails are used to hold together wood parts.
Many objects are built with nails.



Emily brought in a picture frame to share.
The corners of the picture frame are held together with tiny nails.
They are smaller than the nails holding Ricardo's birdhouse together.



Olga brought in a plastic flashlight to show the class.
The outer parts of the flashlight are held together by screws.



Bennett is sharing his eyeglasses.

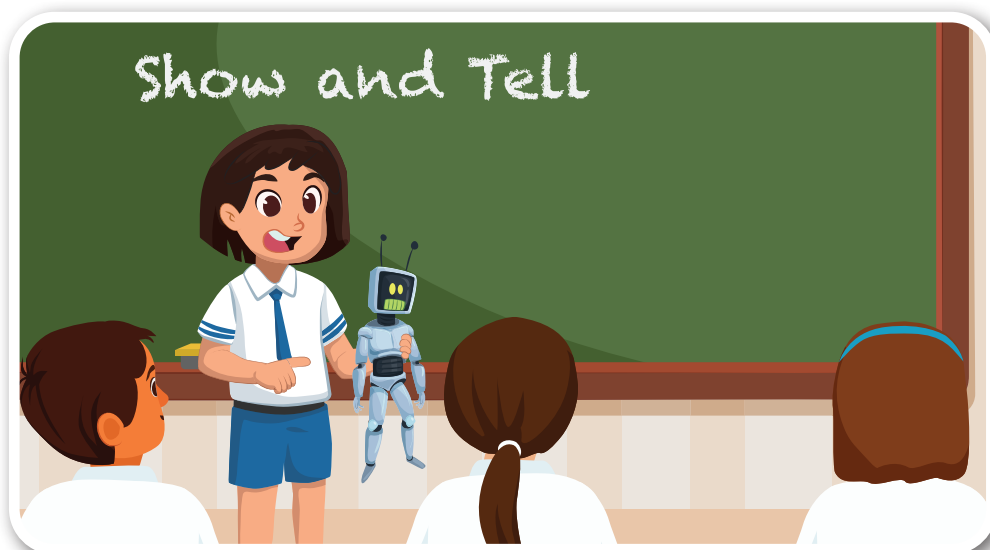
Eyeglasses use tiny screws to connect the parts of their frames.
Screws are commonly found holding bigger parts together.
They can be used with wooden, plastic, or metal materials.
They twist into the parts instead of being banged in like nails.



Felix is showing the class his guitar.
Some of its parts are held together with small screws.
Now he plays the class a song!
Strum, strum, strum.



Coop brought her metal robot toy to show to the class.
The metal body parts are connected by screws.
They attach the head, arms, and legs to the robot's torso.



Penny is sharing her toy car.

The underside of the car uses rivets to hold the outer parts together.

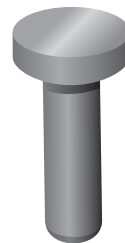
Rivets are small metal fasteners, too.

They are often used in cars, planes, rockets, ships, and buildings.

But they can also be used in smaller objects, too.

A rivet is like a nail that isn't pointy.

It's thin shape gets smashed to hold it in place and fasten materials together.



Show and Tell



Theo rode his bicycle to school.

He shows it to the class.

Nuts and bolts hold the handlebars and pedals in place.

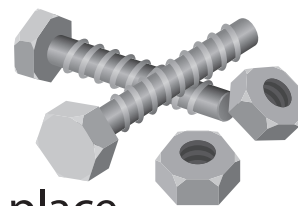
They connect parts to the bike's frame.

Sonja shows the class her skateboard.

The wheels are attached to the board using nuts and bolts.

A bolt is like a screw without a pointy end.

The nut is the part that twists onto the thin shaft.



You can probably find these types of fasteners in the room you are in right now.

Give it a try!

Main Science Idea

One design for fastening materials together can be used in many different objects.

The Right Material for the Job

Diego enjoys building things.

Today he needs to design a space diorama for school.

He looks through his craft closet for materials.

Material is what an object is made of.

Diego's closet is filled with all kinds of materials!

He is excited to pick out the best ones to use for his space diorama.



Diego takes out his liquid materials first.

Liquid does not hold its shape.

A liquid will fill the space in a container.

It will take the shape of the container.

A few liquids can be used for his diorama.

He can use liquid glue to stick other materials together and hold things in place.



Liquid paint will be good for painting the planets, moons, and space scenery.

When these materials dry, they won't be liquids anymore.

As water evaporates from the liquid, a solid will remain.



Diego sorts through his clay. Clay is tacky and thick. It can be shaped and molded to add thickness to the diorama's landscape.

He decides he will use clay to make textured surfaces like rocky terrain on the moon or the crust of planets.



Diego has a lot of solid materials. Solid materials hold their shapes. He can use them in many ways for his diorama.

Cardboard is hard and sturdy. Diego can use it to make the bottom of the diorama. Paper wouldn't be as good of a choice because paper folds and flops too much.

He will also use cardboard tubes to make a rocket ship.



Foam balls can be painted to look like planets and moons. They are of different sizes.



Diego has a box filled with scraps of fabric. Fabric is soft, even though it is a solid. It can be twisted, folded, cut, stitched, and glued!

Diego thinks he can use gold fabric to cover his rocket ship. Then he can cut strips of orange fabric to use as the fire on his rocket's engine.



Diego pulls out a box of wires and rubber bands.

Wires are lightweight and flexible. Diego can use them to make antennae on satellites and connector parts for his rocket ship.



Elastic rubber bands stretch and return to their original size. Diego decides to use elastic to make the astronauts in his diorama look like they are bouncing in space.

With all of these materials, Diego feels ready to start building his diorama!

Main Science Idea

Describing materials can help you decide how they can be useful.

Things That Change

Some things in nature change, and other things stay the same.

When something changes, it means that it becomes different.

You are taller now than you were when you were born.

Your height changed as you got older.



The height of the hills around where you live won't naturally change much in your lifetime.

Things that stay the same are stable.

Hills are most often very stable.

Everything in motion
has speed.

Some motion seems
very fast.

Some motion is
very slow.

The runner and the
tortoise can change
speeds, too.

They can go faster
or slower.



This sandcastle at the beach was far away from the ocean water at the beginning of the day. After a few hours, the waves started washing the sandcastle away.



What quickly changed?

The tide came in.

The ocean always has waves.

In repeating cycles, the waves move higher onto the shore.

The tide changed.

And the castle changed, too.

This adult orangutan didn't always look this way.



When it was a baby, it was also much smaller. Its muscles were small. It didn't have too much hair. These are some of the physical traits that changed.

There are also traits that stayed the same. The overall structure of the legs and arms never changed. Some things change a lot. Some things change less.

People have been growing food for a long time.
We must eat to stay alive.
Our need for food is something that never changes.
People always need to do things to help them eat.
Even the ancient Egyptians grew food to eat.



But things change.
Farming systems have changed to improve how food grows.
Humans developed machines to do work.



Here are a couple more examples of things that change in nature.

Earth's surface is always changing. Some changes happen too slowly to notice. When wind blows sand to the same area over time, it can form sand dunes. The formation of sand dunes is a slow change. But it is fast compared to the time it takes for a mountain to form.



Clouds change in the sky. Their shapes change as they float by. Sometimes the sky is full of clouds. Other times there are no clouds in sight.



Main Science Idea

Many things are changing all the time.

Invention and Discovery



Step right up! Welcome to the Inventor's Fair!

Today you can learn about some scientists, engineers, and inventors.

You can learn about how they made discoveries.

Some inventors spent many years researching and testing their inventions.

Others made accidental discoveries.

There are different ways to discover things in science.

Enjoy the fair!

Meet Alexander Fleming.

He's a scientist.

He accidentally discovered a type of mold that is now used as medicine.

It is called penicillin.

It kills some kinds of germs.

It helps people feel better when they are sick.

He was doing an experiment in his lab.

When he checked on his experiment later, he found mold growing.

And nothing else grew around it.

He took a very close look at it.

Was something in the mold killing germs?

That is when he discovered that the mold could be used for medicine.

It was a very surprising, and important, discovery.



Meet George de Mestral and his dog, Milka.

After taking Milka for a walk one day, George noticed burrs stuck to her fur.

He observed the burrs closely.

They had tiny hooks in them.

They could hook onto fur and fabric.

This inspired George's invention.

What did he invent?

Hook-and-loop fasteners.

It was a solution to fastening shoes, clothing, and even backpacks.



Meet David Misell.

He's an inventor.

Have you ever tried to see in the dark?

If so, then maybe you've used his invention:
the flashlight!

It took him a long time to invent the flashlight.

First, he had to produce light.

In his day, that wasn't so easy!

Then, he had to research how to direct light waves.

Sometimes his designs failed.

It wasn't easy, but he kept trying.

He came up with many designs until he found the one that
worked the best.



Meet Stephanie Kwolek.

She's an engineer.

She invented an important material called Kevlar.

Kevlar is a strong, lightweight fiber.

It is five times stronger than steel but light enough to wear!

Today we use it in things like body armor and helmets.

It helps save lives.

Stephanie discovered Kevlar by accident.

She was working on an experiment for tires.

When she mixed certain materials in the lab, she made this strong fiber.

It was a very happy accident!



Meet George Washington Carver.
He's a scientist who works with plants.
He spent long years researching different ways to use peanuts.
And he kept discovering more and more along the way.
He discovered something else in his research, too.
It was how to keep farm soil healthy.
He taught farmers how to rotate their crops.
It helped their crops grow better.
His solutions are still used in farming today.



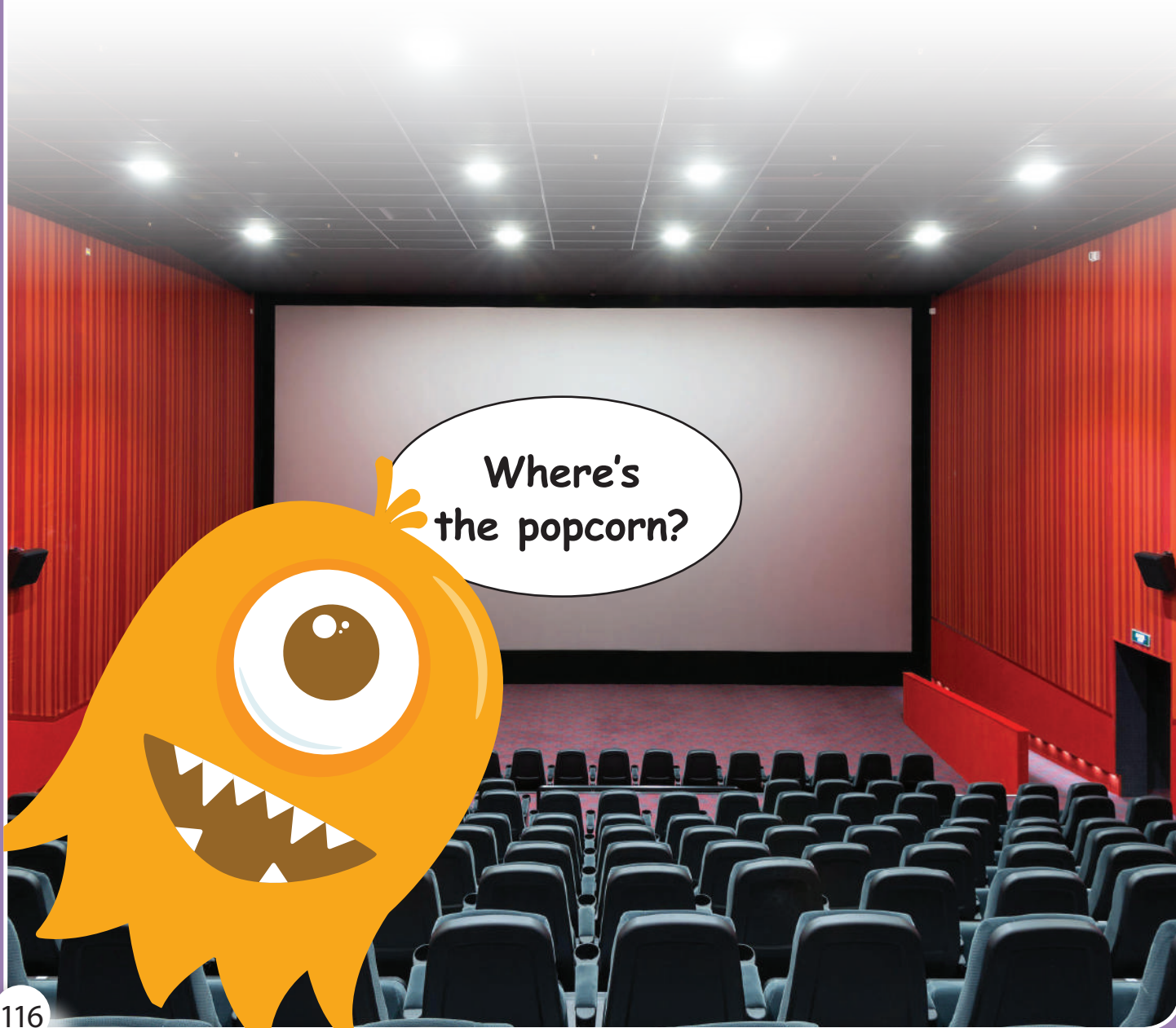
Main Science Idea

Sometimes people work hard for a long time to solve a problem or invent something new. Sometimes they discover something new unexpectedly while they are working on something else.

How Do They Do That?

Have you ever been to a movie theater? If so, you've experienced a sensation of light and sound!

Seeing a film on a big screen is possible because of engineers. Engineers are people who study problems. They seek solutions. They figure out how to use materials and processes to make new things.



Engineers come up with designs. Designs are the plans for a solution.

Engineers designed, or planned, a way to show movies on big screens. They used special materials for the screen. The screen reflects light. A certain coating makes sure the light is spread evenly. This lets you see the movie no matter where you sit.

Sometimes engineers have to come up with a solution for making a gigantic screen.

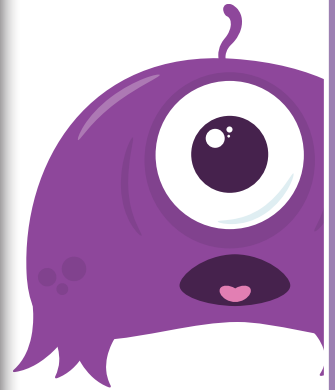


Popcorn,
please.



Engineers also design screens that can fit in smaller rooms and even in homes.

Some engineers design amusement park rides. They come up with ways for people to have safe but thrilling fun.



Engineers think about speed. They design rides that are safe for going fast or safe for going slow.

Wheeee!!!



Engineers think about directions. They design rides that are safe for making twists, turns, or drops.



When designing amusement park rides, engineers also must think beyond the ride itself.

Engineers think about what material to use. They have to test every part of the roller coaster to make it safe.



Keeping animals safely in a zoo is a problem.

When designing zoos, math helps engineers figure out how tall to make the enclosures. This way the animals will not escape.

Problem solved!

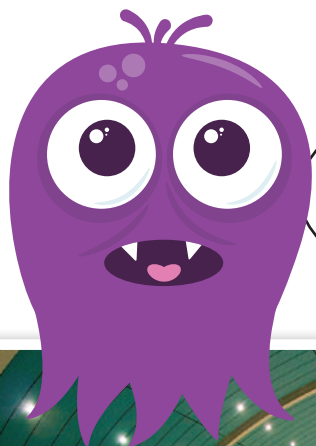


When designing roads, engineers use math to figure out how wide the roads should be and how to curve the roads so cars can turn one way or another.



Engineering uses science. Engineers need to know how things work in the natural world.

If the problem is how to fly safely in bad weather, an engineer can figure out a solution.



Let's travel!

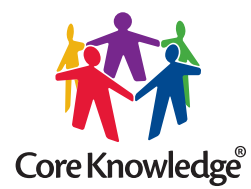


Want to make a train without wheels? That is a problem that needs a solution.

Knowing about magnets helps engineers design superfast trains that glide above their tracks.

Main Science Idea

To design something means to make a plan for a solution. Engineers are people who study problems and figure out how to use materials and processes to make solutions.



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Editorial Director
Daniel H. Franck

Subject Matter Expert

Terri L. Woods, PhD
Associate Professor (ret.)
Department of Geology
East Carolina University
Greenville, NC

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