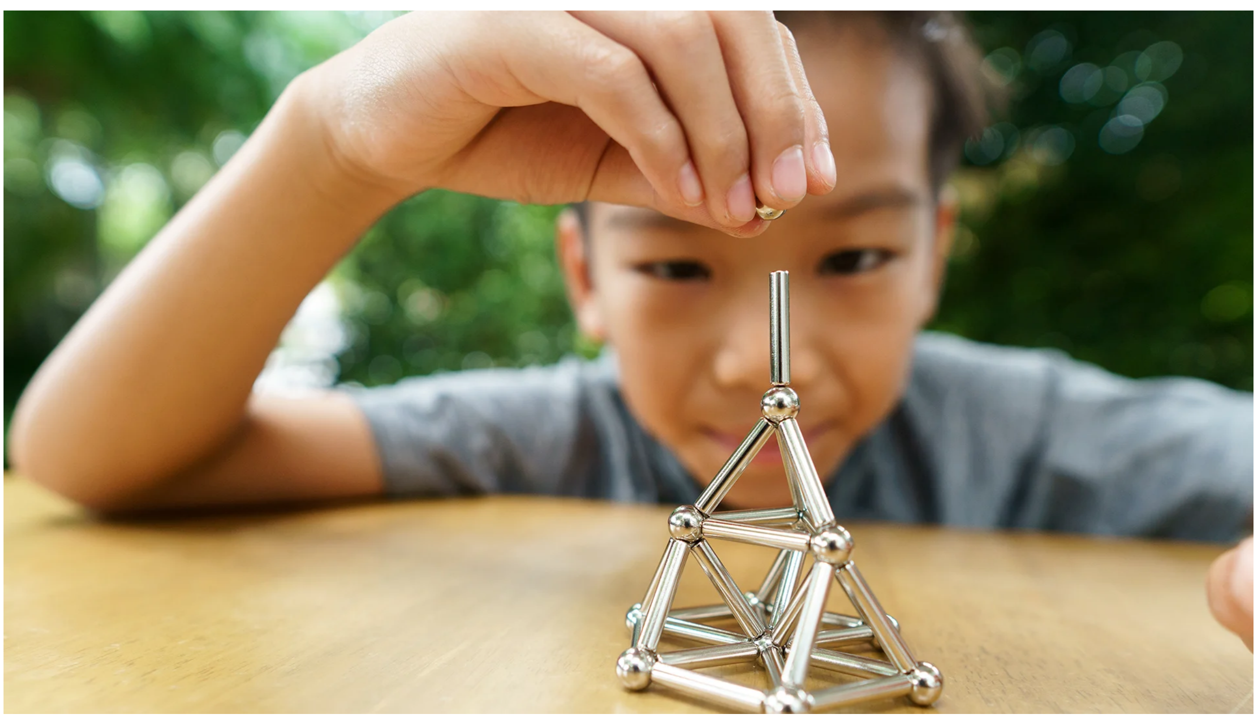
Third Grade **Science**, Spring 2021

MYSTERY science

Invisible Forces

STUDENT PACKET



TACOMA PUBLIC SCHOOLS
EVERY STUDENT. EVERY DAY.

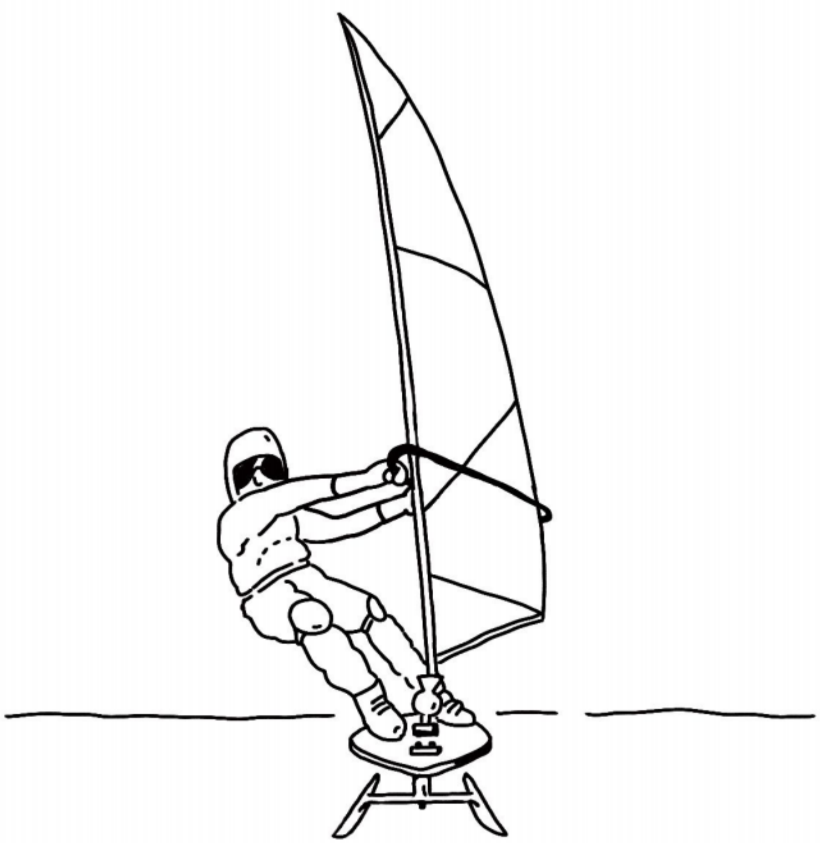
Ice Board

Directions:

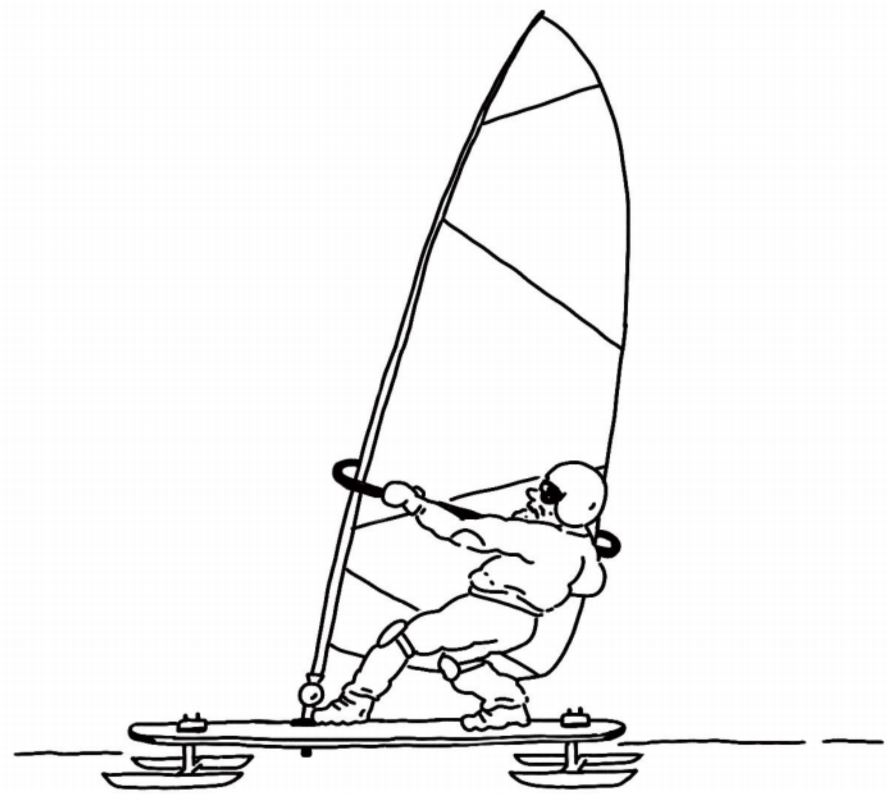
Add labels to these drawings to explain how the ice board works.

Name: ____________________

Front View



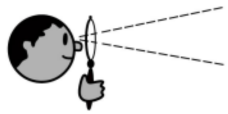
Side View



MYSTERYscience

See-Think-Wonder Chart

Name: ______________________________

See What did you observe? 	**Think** How can you explain what is happening? 	**Wonder** What questions do you have? 

Name ______________________

The Biggest Magnet in the World

Suppose you are lost in a snowstorm. You have a map. It shows where you are. It also shows a ranger station that's not far away.

The ranger station is north of you. If you walk north, you will get to safety. That should be easy enough. But there's a problem. You don't know which way is north. All you can see is falling snow. There's nothing to tell you which way to go.

Luckily, you have a compass in your pocket. A compass has a magnetic needle that always points north. The compass needle points the way to the ranger station.

When the compass was invented, no one knew why it worked. For hundreds of years, people tried to figure it out. They played with magnets. They knew that magnets did strange things. Two magnets could pull on each other, even when they weren't touching.

People also made some discoveries about the Earth. They found out that the Earth isn't flat like a dinner plate. The Earth is round, like a rubber ball.

Then they discovered something really strange. They discovered that the compass needle points north because the biggest magnet in the world is always pulling on it.

Do you know what the biggest magnet in the world is?

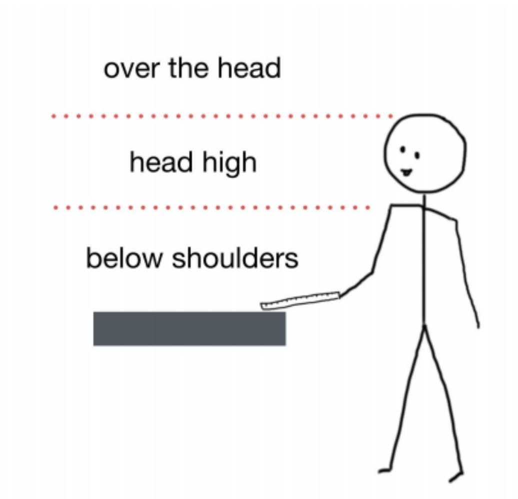
The biggest magnet in the world <u>is</u> the world. The planet Earth is a magnet. The giant magnetic Earth pulls on the tiny magnetic compass needle. That makes the needle point north and shows you the way to go.

High Hop Scorecard

Name: _______________

1. Work with your partner to *estimate* how high your hopper hops (that means you'll make a very good guess). While the LAUNCHER makes their hopper jump, MISSION CONTROL will carefully watch how high it goes--over the launcher's head, about head high, or below the launcher's shoulders.

   Launch 4 times and write your results on the chart below. Then switch jobs.



	Below shoulders	**Head high**	**Over the head**
Launch 1			
Launch 2			
Launch 3			
Launch 4			
Total number			

2. How do you think you could change the hopper to make it go higher?

   ____

   ____

3. Try your idea. What happened?

   ____

   ____

4. Based on what you observed, how else would you like to change/improve your hopper?

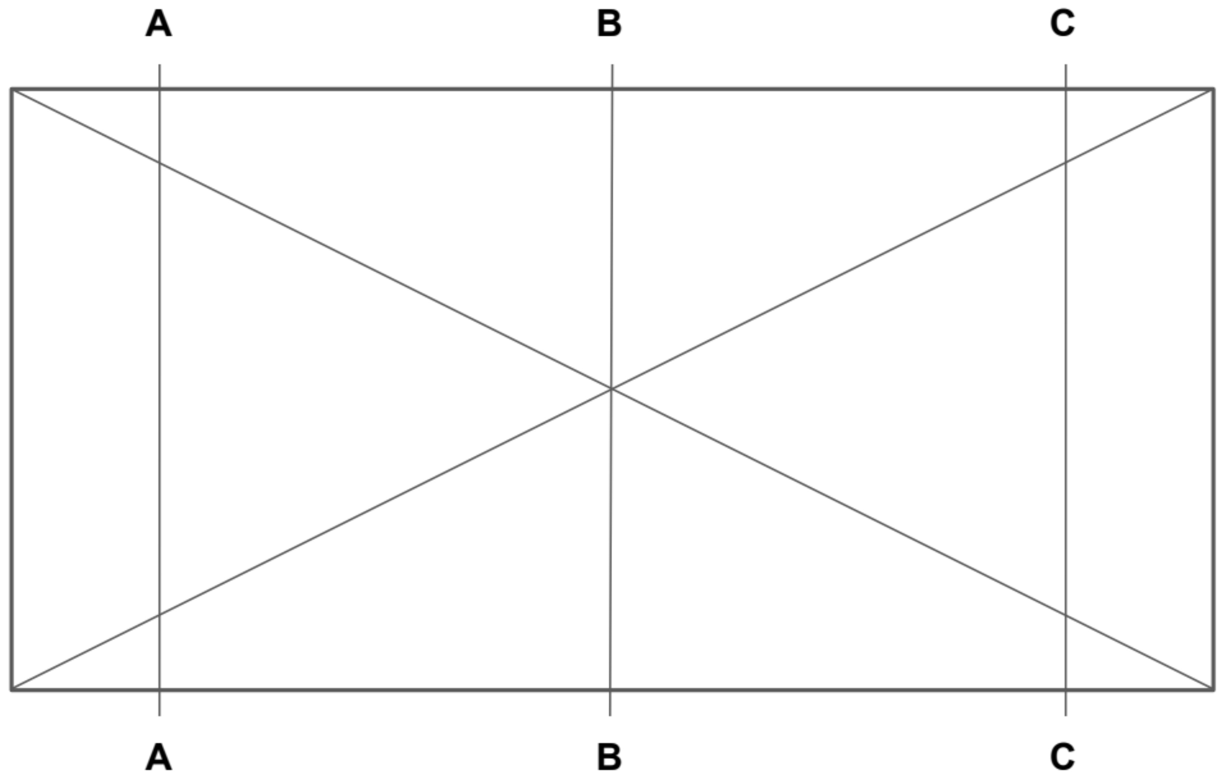
   ____

   ____

1 MAKE IT

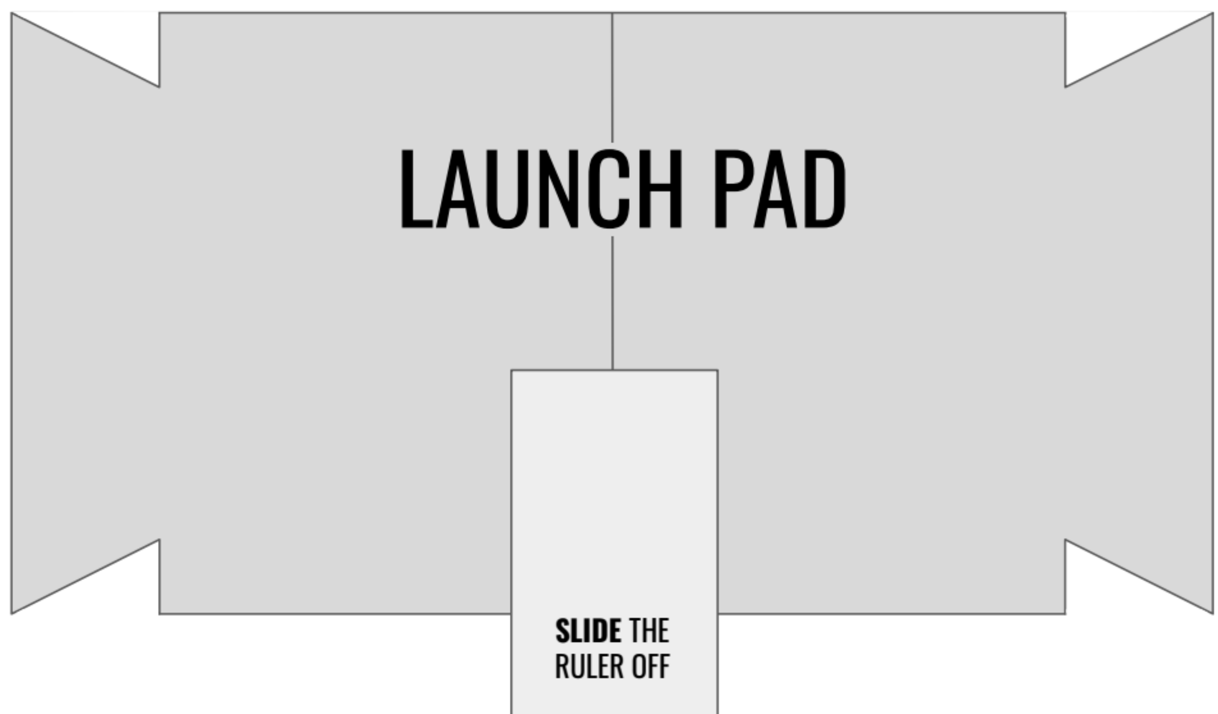
Follow the steps in the video.

MYSTERY science



2 LAUNCH IT

Mission Control: Unfold the hopper until it's flat. **Launcher:** Lay the ruler down on top. When it's launch time, SLIDE it off!



Bridge Challenge

The problem:
Using only two sheets of paper, build a strong bridge that will reach across a 6-inch gap. The bridge must be at least 3 inches wide.

The test:
How many pennies will your bridge hold before it collapses?

You need:

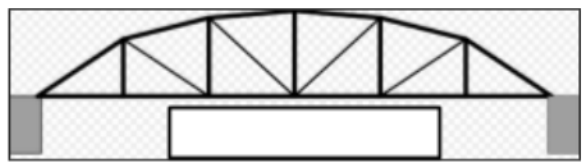
- paper
- scissors
- pennies
- a pencil
- two stacks of books of about the same height
- a ruler
- a Bridge Designer’s Notebook sheet

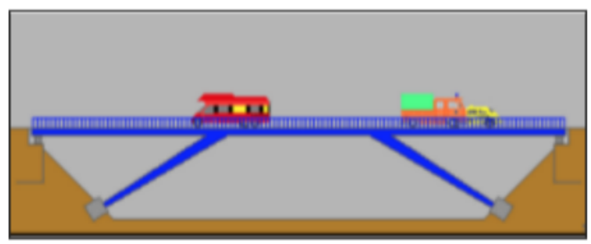
Here’s what you do:

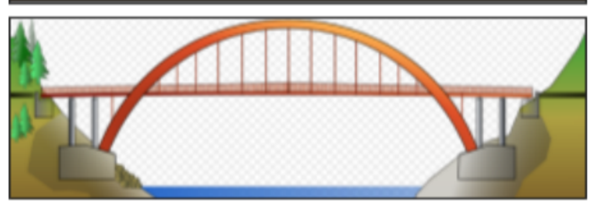
1 Place the stacks of books 6 inches apart, using your ruler to measure the gap.

2 Think about bridges that you have seen.

Can you make something that has the same shape out of paper?







3 Experiment!

- Make a paper bridge across the gap between the books.
- Put pennies on your bridge, one by one. Watch what happens when pennies push downward.
- Keep adding pennies until the bridge collapses.
- Think about how you could change your bridge so it’s better at fighting the downward push.
- Change your bridge and try again. Build at least three different designs.

4 Keep track of your experiments on your Bridge Designer’s Notebook**.**

Name:________________________________

Bridge Designer's Notebook

My Bridge Design Build a bridge, then draw it here.	**Changes** Write down what you want to try next.
Bridge #1 How many pennies did this bridge hold? ______	To make a stronger bridge, I will____________________
Bridge #2 How many pennies did this bridge hold? ______	To make a stronger bridge, I will____________________
Bridge #3 How many pennies did this bridge hold? ______	To make a stronger bridge, I will____________________

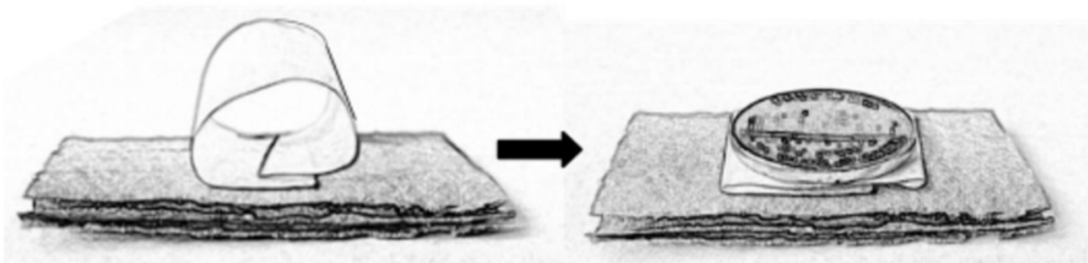
You can use lots of paper when you are experimenting -- as long as your final bridge has only two pieces of paper.

Try This!

Name: ______________________________

Make some sliders — Construction Tips

- To get a slider moving, add some weight to the material you're testing. We suggest using pennies. How many pennies you use on each slider is up to you.



You can use a loop of tape to add a penny, like this.

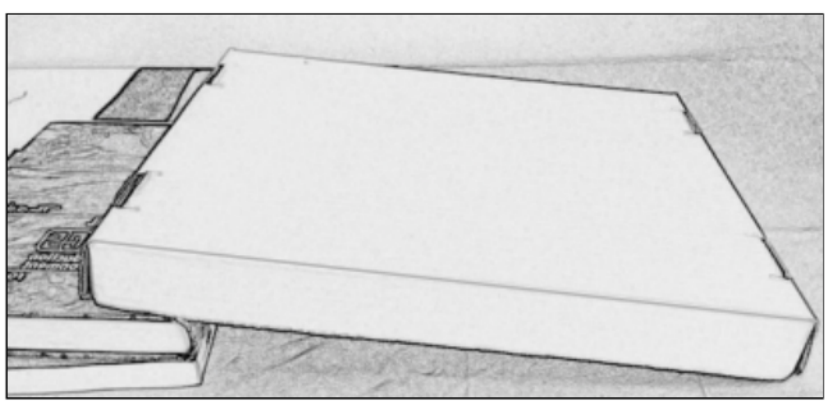
Or you can put a strip of tape over the pennies like this.

- You're testing the material, not the tape you use to hold the weight on. Make sure you don't cover the bottom of the slider with tape.

Make a slide

To make your cardboard into a slide, set one end on a stack of books and the other on the table.

You can change how steep a slide is by adding more books.



Try This! (page 2) **Name: ______________________________**

Experiment with your sliders and write down what you see.

1. What happens if I put all my sliders on the slide when it's flat, and then slowly raise one end of the slide?

Answer: ____

2. What happens if I race a cardboard slider with 5 pennies against a cardboard slider with no pennies at all?

Answer: ____

Come up with at least 3 questions and answers of your own.

3. What happens if I ____

Answer: ____

4. What happens if I ____

Answer: ____

5. What happens if I ____

Answer: ____

(If you have more questions, write on them on the back of this page.)

If you get stuck, think about:

- how many pennies will you put on each slider?
- how you will start the sliders moving? (by setting them on a steep slide? by raising the slide?)
- how steep you will make your slide?
- how many sliders you will test at a time?
- how will you decide which slider has the least friction?

Friction Investigation Worksheet

Name: ___________________________

1. Experiment to find the answer to this question: Which materials have the MOST friction and which materials have the LEAST friction?

2. Method:

We built sliders like this: (draw a picture of a slider)	**We set up each trial like this:** (draw your slide)

3. Describe what you will do in each trial:

- How will you start your sliders sliding? ___________________________________

  ____

- How many sliders will you test together? ________________________________

- How will you decide which slider has the least friction? ____________________

  ____

- How will you decide which has the most friction? ___________________________

  ____

Friction Investigation Worksheet

Name: ________________________

4. Data Collection:

Complete four trials of your experiment.

Trials	Observations / Measurements
In each box below, write down the materials you tested.	Write down observations or measurements for each trial. For example, *"We observed that the cardboard began sliding first.."*
Trial 1:	
Trial 2:	
Trial 3:	
Trial 4:	

Friction Investigation Worksheet

Name: ___________________________

5. Claims and Evidence

Our claim: We think ______________________ has the **most** friction.
(material)

Evidence that supports this claim: ____

____

Our claim: We think ______________________ has the **least** friction.
(material)

Evidence that supports this claim: ____

____

Our claim: We think ____ (list materials)

have more friction than _______________________________________ (list materials).

Evidence that supports this claim: ____

____

6. Additional Investigation

Next time, we want to try ____

____

because____

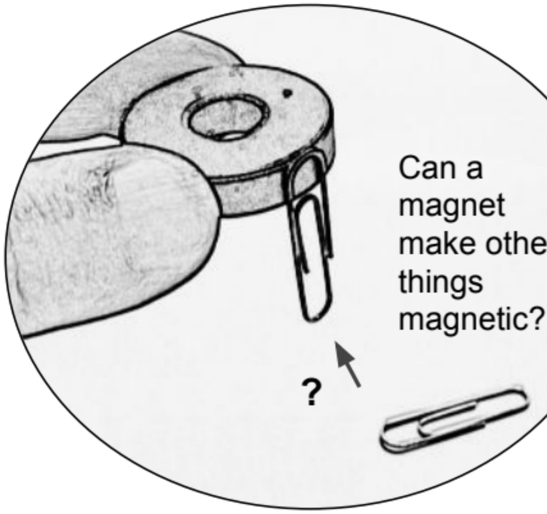
____

Magnets Are Weird

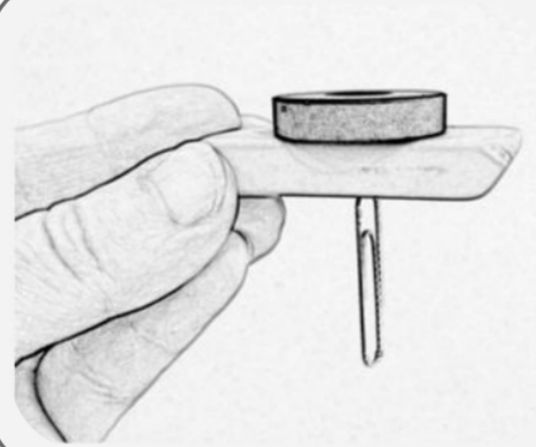
Name: ______________________

Questions:	My drawing of what I tried:	What happened:
1. Will a magnet's pull go through paper? Will it go through cardboard? Other materials?		______ ______ ______ ______ ______
2. Can you make a paperclip float? Can you make a magnet float?		______ ______ ______ ______ ______
3. Write your own question:		______ ______ ______ ______ ______

Ideas for Experimenters



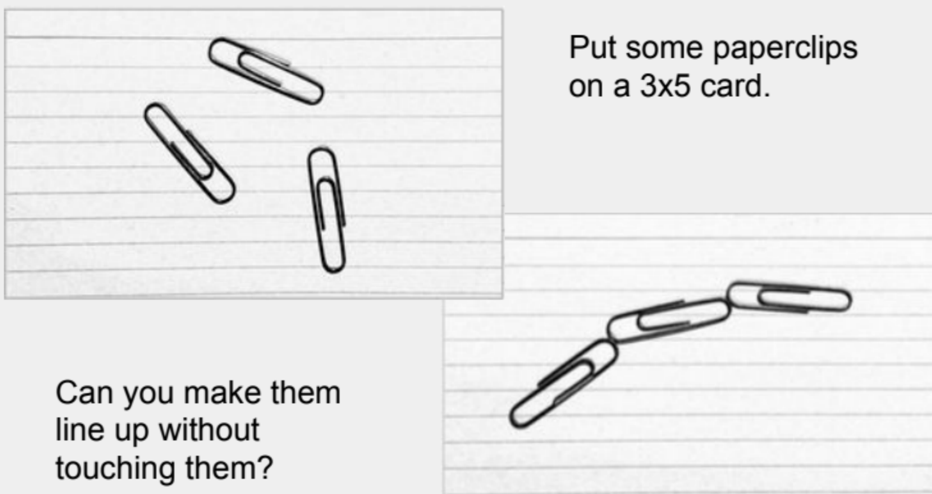
Can a magnet make other things magnetic?



How can you find out if a magnet's pull will go through paper?

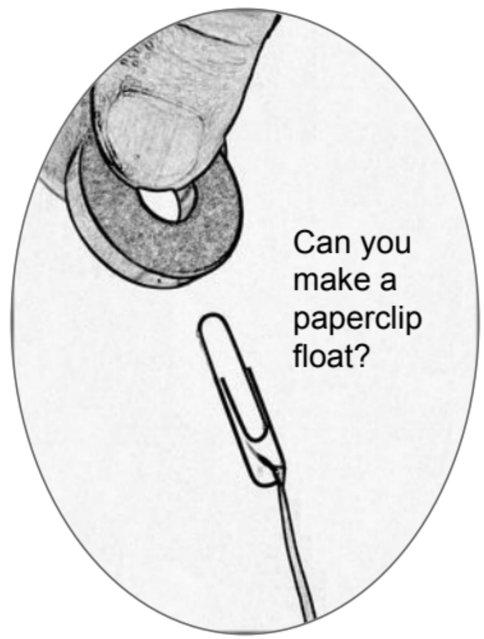
Will it go through cardboard?

Will it go through an eraser?



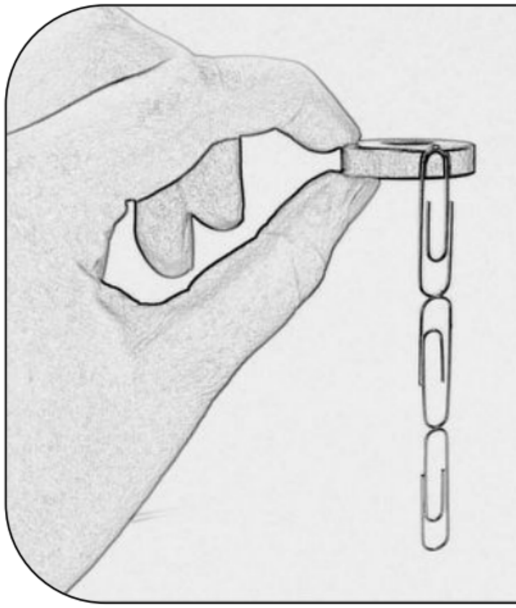
Put some paperclips on a 3x5 card.

Can you make them line up without touching them?



Can you make a paperclip float?

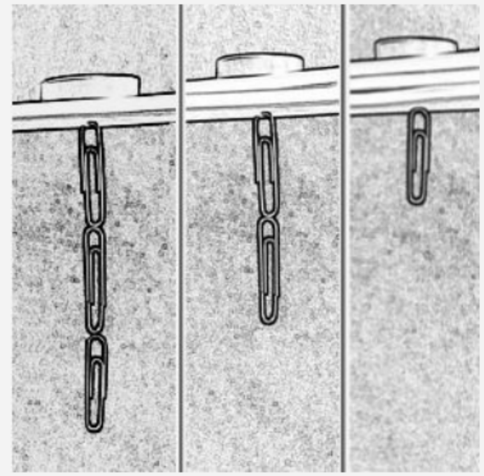
More ideas

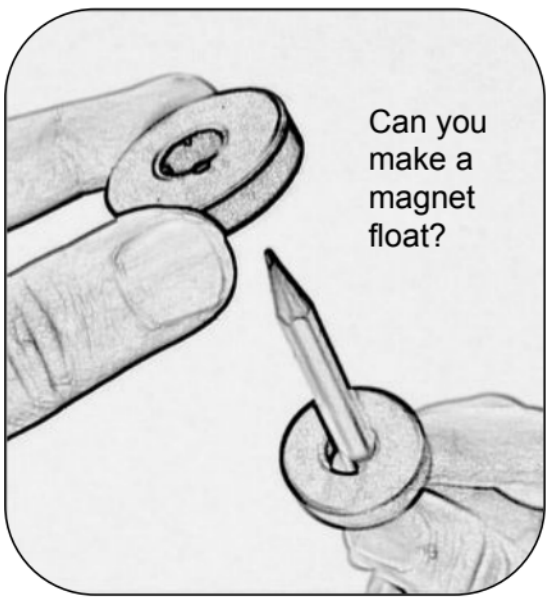


How many paperclips can you hang from a magnet?

What happens if you stack up more magnets?

How can you make a magnet's pull weaker?

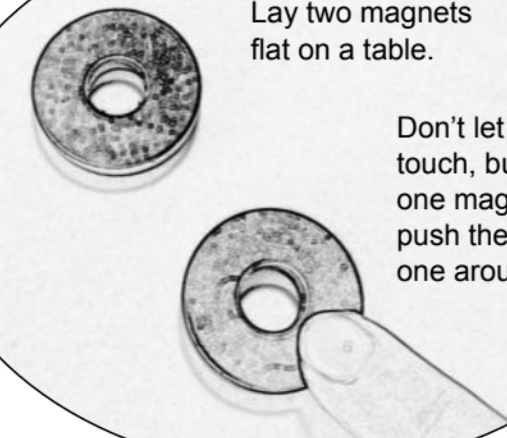




Can you make a magnet float?

Lay two magnets flat on a table.

Don't let them touch, but use one magnet to push the other one around.



Ice Board Designer

Name: ____________________

The ice board rider is going to take a trip to Lake Baikal! This lake is huge. He needs a new ice board design to get ready for such a big lake. Can you design a new ice board and build a model of it?

1. Read the design goals. Your design must:

- include a seat so the ice board rider is comfortable, sitting up, and facing forward
- include a sail that won't fall over when you blow on it (you might have to build something to hold the sail up, too)
- fit the cutout of the ice board rider— not too big, and not too small
- cost as little as possible

2. Come up with a plan for your model.

Explain your plan on the lines below. Draw your plan in the box to the right.

____

____

____

____

____

____

____

Ice Board Designer

Name: ____________________

3. Build a model of your new ice board.

As you build, you may find that you have to change your plan. That's okay! Be sure to test it to make sure it won't fall over if you blow on it. If it does fall over, keep improving your design so that it doesn't. When you are finished go back and make sure you have met all of the design goals!

4. Check your work.

When you are done, look back at step 1. Make sure your design meets all of the design goals.

5. Calculate the total cost of your design.

Use this table to help you figure out the cost.

Material	How many does your design use?	Multiply to calculate the cost of each type of material
Note card		______ x $5 each = ______________
Paper clip		______ x $5 each = ______________
Tape strip		______ x $10 each = ______________

Total cost of all items (add them up): $

6. Improve your design.

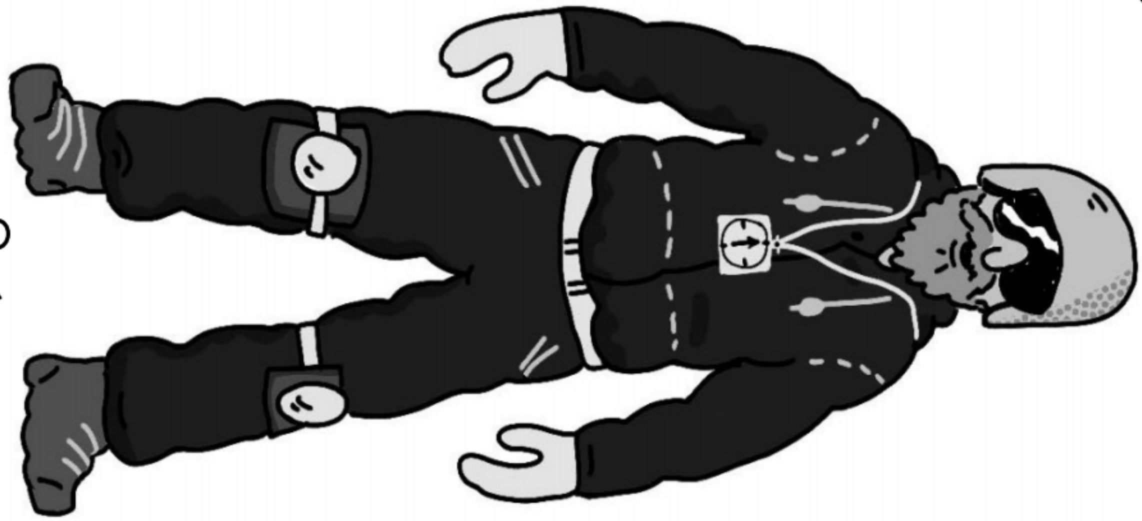
Think of something creative you can add to your design that will make it even better for the ice board rider. You might add something to make it more comfortable, faster, easier to use, or something else. You might remove certain parts to reduce the cost. Describe what you came up with in the space below. If you have time, you can build it on your actual model.

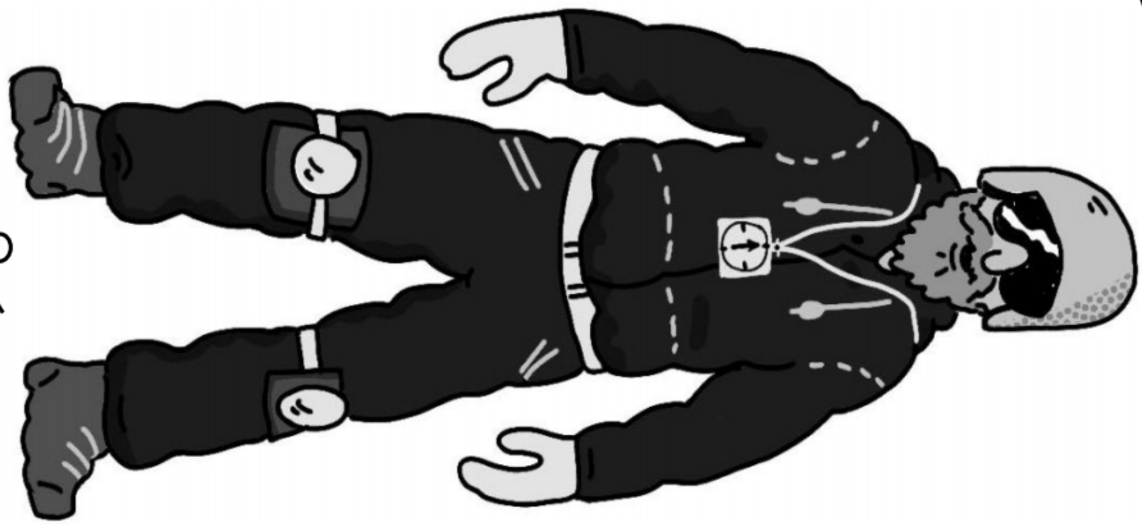
On my design, I added ____

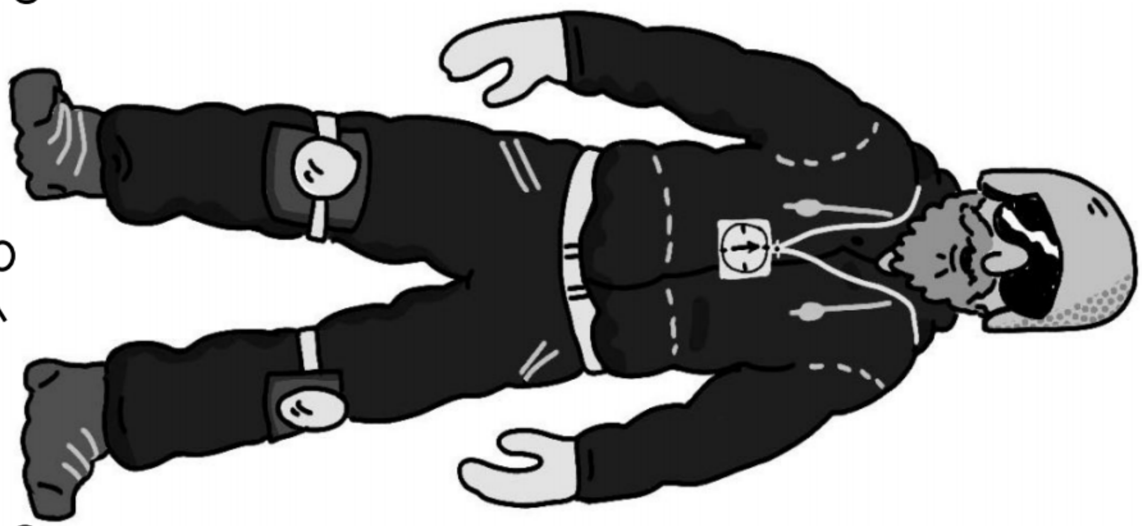
____

____

Ice Board Rider — 1 Rider/Group







Fishing for Forces
by Pat Murphy

It was a beautiful sunny day at the lake. Emma was going fishing with her dad and her best friend, Chloe. They were walking from the car to the dock when Emma's dad asked a question. "What did you girls learn in school yesterday?" he asked.

Emma sighed. Her dad asked a lot of questions. Fortunately, Chloe liked to answer questions.

"In science class we learned about forces," Chloe said. "That's a fancy word for pushes and pulls."

"We played a game of tug of war," Emma added. "We all pulled on the rope. The teacher said that there were lots of forces pulling and pushing in the world around us, but I couldn't see them."

They had reached the end of the dock where their rowboat was tied up. "Hmm," her dad said. "I wonder if we could find some of those forces today. How about you yank on that rope to pull the boat to the dock."

"Yank and pull." Emma made a face. "Very cute, Dad."

Emma's dad held the rowboat against the dock while the girls climbed in. Then he stepped down into the boat, making it rock beneath them.

"There are lots of forces that you can't see," he said as he untied the boat. "But if you think about it, you can see what those forces do."

"What do you mean?" Chloe asked. She was pretty good at asking questions, too.

"Anything that's moving gets started with a push or a pull," he said. "If you see something moving, look for the force that made it start moving."

In the distance, Emma saw a sailboat skimming across the lake. “There’s a sailboat that’s moving,” she said.

“What do you think made it move?” Dad asked.

“The wind pushing on the sail,” Chloe said.

“Good thinking,” he said.

A motor boat roared past.

“What do you think made that motorboat move?” Dad asked.

“The motor,” Emma said. That seemed easy enough.

“How did the motor make the boat move?” he asked.

Emma thought for a minute. In the parking lot, she had seen a motor boat that was out of the water, on a trailer towed behind a car. “The motor has a propeller. The motor turns the propeller.”

“That’s right. The propeller is underwater. When it turns, it pushes against the water to make the boat move forward.”

Dad was rowing. Emma watched his arms as he pulled back on the oars. She felt the boat speed up each time he pulled. “Your arms pull on the oars to make them move,” she said.

Chloe looked over the edge of the boat into the water. “The oars push on the water.”

“And that makes the boat move,” Emma said.

“You two are getting good at this,” Dad said.

For the rest of the afternoon, they all looked for pushes and pulls. Chloe saw a kite flying over the beach. “The wind is pushing it up,” she said.

“And the kite string is pulling to keep the kite from flying away,” Emma said.

When they stopped for a swim, Emma felt her feet push down as she jumped from the boat into the water. The boat rocked when the water pushed it back up. Her hands pushed against the water as she swam. She pulled herself out of the water into the boat and watched the clouds drift by, pushed by the wind.

They never did catch any fish. But by the end of the afternoon, Emma had decided that she didn't mind answering questions after all. She closed her eyes in the sunshine. The boat rocked beneath her. It's moving because the waves are pushing against it, she thought. Just one more push in a world filled with pushes and pulls.

Galloping Gertie
by Pat Murphy

On July 1, 1940, thousands of people gathered to celebrate the opening of a new bridge near the city of Tacoma in Washington state. Marching bands played and soldiers fired a 19-gun salute. The governor of Washington State drove the first car across the bridge.

Everyone praised the beauty of the bridge. Some called it the “baby brother” of the Golden Gate Bridge. In both bridges, great steel cables stretched over two tall towers. The roadway hung from these cables, free to move in strong winds.

People driving across the Golden Gate Bridge didn’t notice the bridge moving. But the bridge near Tacoma was a different story. The wind made the bridge bounce and ripple. Driving on it made some people seasick.

The bridge’s official name was the Tacoma Narrows Bridge. But people gave the bridge a nickname. They thought crossing this bridge was like riding a galloping horse. So they called the bridge “Galloping Gertie.”

Bridge engineers feared that the bridge might not be safe. So they built and tested a model of the bridge. When the wind blew on the model bridge in a certain way, roadway twisted back and forth. Bridge engineers said that the same twisting on the real bridge would be dangerous. The engineers figured out how to change the model bridge to prevent twisting. Then they started making those changes to the real bridge.

But time ran out on November 7, 1940. Early that morning, strong winds blasted the bridge from the side. The bridge began bouncing and rippling. At 10 AM, the roadway started twisting. It tilted up on one side and then on the other. A delivery van crossing the bridge tipped over, but the people inside got out before it fell. The State Police stopped everyone from crossing the bridge.

Finally, at 11 AM, the twisting of the roadway and the pushing of the wind tore the bridge to pieces. Great steel bars twisted like rubber and the cables snapped. Chunks of concrete tumbled into the chilly waters below. With a roar like thunder, the bridge collapsed into the water with a huge splash.

After that, some people worried about the Golden Gate Bridge, the “big brother” of the fallen bridge. They asked Charles Ellis, the man who designed the Golden Gate Bridge, to look at what had gone wrong with the Tacoma Narrows Bridge. Ellis explained that the Golden Gate Bridge had a much wider roadway. It would not twist in any wind.

Ten years after the collapse, a new bridge was built. The newspapers called it “Sturdy Gertie. The bridge has lived up to that name. Today, millions of cars cross it each year.

Scientists Solve a Sticky Problem

by Pat Murphy

Suppose your foot slipped every time you took a step. You would have a hard time walking. It would be like walking on ice.

The force that keeps your foot from slipping is called friction. You get friction when two things rub together. There's a lot of friction when a shoe rubs against the ground. There's less friction when a shoe rubs against ice.

You don't want your shoes to slip when you walk. But there are times that you want things to slip.

Have you ever tried to squeeze the last of the toothpaste out of the tube? You squeeze, but the toothpaste stays put. You want it to slip, but it won't.

A group of scientists solved this problem. They figured out how to make a super slippery surface. Toothpaste doesn't stick to it.

They made a toothpaste tube with this surface on the inside. Toothpaste slipped right out of that tube.

Think of all the ways this invention could help you. What if ketchup didn't stick to the bottle? What if grape jelly didn't stick to the jar. People would be able to use every last bit of toothpaste and ketchup and jelly.

Life is filled with sticky problems. This new invention will help solve some of them.

Hunting for Rocks from Outer Space
by Pat Murphy

Do you want your very own rock from outer space? If you have a strong magnet, you can hunt for space rocks wherever you live.

Every day, rocks from outer space rain down all over the Earth. When these space rocks are falling, they are called meteors. After they hit the ground, they get a new name. A fallen meteor is a meteorite.

Hundreds of thousands of meteorites fall to Earth every day. You don't see these falling rocks because they are tiny. Most meteorites are smaller than a grain of rice. In fact, most of them are about the size of a speck of dust. These are called micrometeorites. "Micro" means very small, so a micrometeorite is a very small meteorite.

A magnet makes it easy to search for these itty-bitty space rocks. Most micrometeorites are made of iron. That means they will stick to your magnet.

A great spot to look for micrometeorites is in a rain gutter on the edge of a roof. Micrometeorites fall on the roof, and rain washes them into the gutter.

But climbing up to the roof to look in the rain gutter could be dangerous. Instead of looking in the gutter, you can look in the water that pours out of that gutter. To make a trap for meteorites, paint your magnet white. Then leave the magnet where water from the rain gutter will flow over it. After a rainstorm, look for small black specks on your white magnet. Those specks are micrometeorites that the rain washed into your magnetic trap.

Some meteorite hunters go to distant places in search of space rocks. They search in the world's deserts, because dark meteorites show up well against pale desert sand. But meteors fall all over the Earth. So you don't have to go far to find a space rock to call your own.

Caption: This picture shows many micrometeorites. These were collected by a French astronomer named Lucien Rudaux.

Name ______________________

The Biggest Magnet in the World

Suppose you are lost in a snowstorm. You have a map. It shows where you are. It also shows a ranger station that's not far away.

The ranger station is north of you. If you walk north, you will get to safety. That should be easy enough. But there's a problem. You don't know which way is north. All you can see is falling snow. There's nothing to tell you which way to go.

Luckily, you have a compass in your pocket. A compass has a magnetic needle that always points north. The compass needle points the way to the ranger station.

When the compass was invented, no one knew why it worked. For hundreds of years, people tried to figure it out. They played with magnets. They knew that magnets did strange things. Two magnets could pull on each other, even when they weren't touching.

People also made some discoveries about the Earth. They found out that the Earth isn't flat like a dinner plate. The Earth is round, like a rubber ball.

Then they discovered something really strange. They discovered that the compass needle points north because the biggest magnet in the world is always pulling on it.

Do you know what the biggest magnet in the world is?

The biggest magnet in the world <u>is</u> the world. The planet Earth is a magnet. The giant magnetic Earth pulls on the tiny magnetic compass needle. That makes the needle point north and shows you the way to go.