Science Matters

MOBILE MUSEUM

Our world is in trouble...

Taking a cue from A Mad Scientist's Handbook for World Domination, the evil Dr. Mundane has set his sights on the schoolchildren of the world—inundating classrooms with a barrage of tedious texts and routine rote memorizations that transform budding scientists into an army of mindless zombies.

Never fear...

His arch-nemesis, the eccentric Dr. Cy N. Tist, has developed the Science Matters device to thwart these dastardly schemes. Filled with an array of gadgets and gizmos, Science Matters is designed to actively engage and nurture inquiring minds, instilling a passion for wonder, discovery and science. With the assistance of his loyal lab techs, the good doctor employs ten interactive exhibits to introduce students to the amazing world of science. Here, among the pulsing lasers and bubbling flasks, students are encouraged to ask questions, make mistakes, experiment and explore. The hands-on activities empower students to practice problem solving skills, observe outcomes, draw conclusions and share what they've learned. Come aboard if you dare to break the boring, obliterate the ordinary, and mash Mundane's plan by experiencing this sensational science spectacular!

OKLAHOMA MUSEUM NETWORK

FUNDED BY THE DONALD W. REYNOLDS FOUNDATION

Table of Contents

Summary of Exhibits

EXHIBIT	CONCEPTS	EXHIBIT DESCRIPTION
Cranial Crossfire	• General science knowledge • Teamwork	It's time to fire up your neurons, crank up your cranium and go head-to-head with Science Matters' brightest lab assistant, the sensational Gray Matter, in the Battle of the Brains. Assemble your team and press any button to engage the brain. After careful contemplation, he'll send the first of five fascinating science questions to your screen. Choose your answer by pushing the corresponding button. The faster you answer, the more points you get. Cooperation is essential. Every team member can answer and points are awarded for each correct choice. Challenge your team to master all ten. Complete the course and your points are added to the team's total. Whose team will reign supreme?
Lab Animator	• Process control • Melody and rhythm • Inquiry	IT'S ALIVE!!!!! (cue the lightning and diabolical laughter). Well.....at least it will be once you step up to the controls. It's an assembly line of air and sound and you engineer the outcome. The music and gas that emerge from four flasks are activated through a series of markers on the screen below. Touch the circles on the screen to turn markers on or off. The arrows are used to adjust the tempo. Manufacture your own unique scientific melody by directing the computer when and where to produce notes and bubbles.
Pressure Flasks	• Air pressure • Energy transference • Displacement • Inquiry	Let's put Dr. Mundane on notice - the pressure's on and change is in the wind! Can you summon up the force needed to move water through the tubes from one flask to other using only the power of air? The four valves at the front of the exhibit allow you to control the airflow into the flasks; some increase it while others decrease it. Cover two of the valves and observe what happens. Does the water level change? What combination will give you the push you need to get things flowing in the right direction?
Magnet Sculpture	• Magnetism • Ferromagnetic and non-magnetic properties • Magnetic fields • Inquiry	Dr. Mundane wants everyone to think alike. But you know that it's our differences that make us stronger, pull us together and create a magnetic environment for.......art! Each of the three metal domes houses strong magnets. The bin below them is filled with a myriad of materials. Some you'll find attractive, while others will refuse to be drawn in. Push aside your inhibitions and build a one-of-a-kind sculpture that will bridge the gap between art and science.

EXHIBIT	CONCEPTS	EXHIBIT DESCRIPTION
Ferrofluid	• Magnetism • Magnetic fields, • Nano-scale • Inquiry	Dr. Cy knows that sometimes it's important to see past the big picture, to look closer, delve deep into the details and uncover the amazing attributes of our world on an infinitely, smaller scale. To demonstrate, the dedicated doctor lingered in his lab forging a fiendishly fascinating formula. By suspending nano-sized iron particles in oil and placing them in a liquid carrier, he created Ferrofluid. It sits motionless, contained in a clear canister and pinned in by two powerful magnets. Adjust the positions of the magnets by turning the knobs. In the process, you'll discover how a little science knowledge and the magic of magnetic fields can bring this boring, black blob to life!
Hack The System	• Science vocabulary • Teamwork • Introduction to lasers	Breaking into the evil Dr. Mundane's lair isn't going to be easy. It's going to take a total team effort, some serious science savvy, and a set of fairly flexible friends. Step into the chamber and locate the keypad. For this mission to succeed, you'll have to get past the secret security code. Mundane changes his codes frequently, pulling them from a vast list of vocabulary words. Fortunately, he's forgetful, so he leaves himself a clue. Focus on the clue's meaning and use it to decipher the code. Enter your letter choice on the keypad, but beware, each wrong selection will trigger a laser. A warning horn will sound before a laser is deployed and flashing lights will help you to predict it's path. Avoid the lasers! If any member of your team crosses a beam, the computer will initiate a system shutdown.
Light Wheel	• Persistence of vision • Optical illusions	Mundane's plan for world domination hinges on his ability to keep your thoughts focused on the ordinary, never looking beyond the obvious. To his delight, Dr. Cy N. Tist's Light Wheel appears to be nothing more that a repeating set of red lights - repetitive, boring, monotonous.......... perfect! But, Dr. Cy's got a few optical tricks up his sleeve. All you have to do is give the wheel a good, hard spin and keep your eyes focused on the lights. Your eyes see the dots as they move and send images to your brain. Dr. Cy knows that your brain holds onto each image for a split second, while your eyes process the next one. When the images change quickly, instead of seeing a series individual dots, your brain sees one continuous movement, allowing you to find the important message he's hidden inside.

EXHIBIT	CONCEPTS	EXHIBIT DESCRIPTION
Obstacle Course	• Fitness • Overcoming obstacles • Graphing	In your attempts to unravel the secrets of the world, you often encounter obstacles in your way. Dr. Cy advises all budding investigators to use these stumbling blocks to open up new roads of exploration and different ways of thinking. To prepare your mind and your body for the challenge, he created the Obstacle Course. Press the start button and wait for the "GO." Dive into the portal and race against the clock as you climb over, around and through obstructions in your path. Once you've successfully navigated the perils and pitfalls, climb out and stop the clock. Flex your brain a bit more and graph your time.
Gear Wall	• Complex machines • Gear trains • Gear ratios • Work • Energy transference • Inquiry	Here's a challenge with teeth. Each of the grid panels has a fixed gear at the top and another on the bottom. Your objective is to select additional gears from the barrel and engineer a combination that will connect the two together. The correct train of thought will generate bells of celebration for all the world (okay, just the people next to you) to hear!
Pulley Chair	• Complex machines • Work • Energy transference	Have you ever found yourself weighed down by heavy thoughts? Dr. Cy N. Tist suggests a session or two on his uplifting apparatus, The Pulley Chair. Pulleys and ropes intertwine to block those weighty problems, tackle your doubts and lighten your workload. Sit in the chair, grasp the rope and pull yourself up into a world where science makes almost anything possible.

PASS Standards

GRADE 5
LANGUAGE ARTS - READING/LITERATURE
3.2a Apply prior knowledge/experience to make inferences
3.3.a Summarize and paraphrase information
3.3.b Make generalizations with information from text
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.1 Observe and measure
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.1 Report using tables and graphs
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
5.4 Share results of investigation
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred
GENERAL MUSIC
1.1 Experiment with variations in tempo, tone, dynamics and phrasing
PHYSICAL EDUCATION
4.1 Participate in moderate to vigorous activities.
5.1 Remain on task without close supervision
5.3 Show respect for others in physical activities
6.1 Show respect for persons from different backgrounds/cultures
6.2 Recognize differences among individuals associated with physical ability
7.1 Participate in activities that are challenging

Science Matters

PRE-VISIT ACTIVITIES

OKLAHOMA museum NETWORK

FUNDED BY THE DONALD W. REYNOLDS FOUNDATION

Demonstration:
Under Pressure
Teacher Demonstration

CONCEPTS
This demonstration introduces the concepts that air takes up space, has mass and weight, and exerts a force on everything around it. This is a good lead in for the air lift activity

SCIENCE MATTERS EXHIBIT TIE-IN
Pressure Flasks

MATERIALS NEEDED FOR DEMONSTRATION
3 Balloons
3 18" pieces of string or yarn
Ruler or dowel rod
Tape

BACKGROUND INFORMATION
The world is surrounded by a blanket of air we call the atmosphere. Although we can't see it, the air in our atmosphere is made up of a mixture of colorless gases.

GASES THAT COMPOSE OUR ATMOSPHERE	
GAS	PERCENT OF "DRY" AIR (BY VOLUME)
Nitrogen (N)	~78%
Oxygen (O)	~21%
Argon (Ar)	~.93%
Carbon Dioxide (CO_2)	~.34%
Neon (Ne)	~.0018%
Helium (He)	~.0005%
Methane (CH_4)	~.00015%
Krypton (Kr)	~.000114%
Hydrogen (H)	~.00005%
Ozone (O_3)	<.00005%

If we can't see it, how do we know it's there?

Demonstration

Air takes up space, is made up of matter and has weight.

MATERIALS NEEDED

3 Balloons
3 18" pieces of string or yarn
Ruler or dowel rod
Tape

WHAT TO DO—AIR TAKES UP SPACE AND IS MADE UP OF MATTER

1) Blow up a balloon and ask what's inside it.

2) Let the air out and ask where it went.

3) Blow it up again a little bit at a time. Ask the students to explain what's happening?

Air is made up of matter—in this case, atoms and molecules of gases. Matter takes up space. The molecules in the air are always moving - pushing and pressing on each other and on the surfaces they contact. There's a lot of "empty" space between the air molecules. When you inflate the balloon, you force a lot of air into a small space. This decreases the space between the molecules, compressing the air, making it denser.

WHAT TO DO—AIR HAS WEIGHT

1) Tape a string to each end of the ruler, equal distance from the center. Tie the third string to the middle of the ruler. Hold it up and make sure it's balanced. (Depending on how your ruler is constructed, you may need to adjust the center string to balance the device.)

2) Tie a deflated balloon to each of the end strings.

3) Hold it up and ask the students if it's balanced. How do they know?

4) Remove one of the balloons and inflate it until it is **tight**. Tie it back on the string.

5) Hold up the center string and have the students observe what happens. Is it still balanced? Ask them why the side with the inflated balloon dips down.

Air has weight—Gravity pulls the atmosphere towards the ground, causing the air molecules above to press against those below. It's the reason the air in the atmosphere is densest near the ground (where the pull of gravity is greatest). The higher you go, the thinner the air becomes. Air pressure is the weight of air resting on the earth's surface.

At sea level, there are 14.7 pounds of pressure every square inch of your body. On the entire human body surface, the total air pressure varies from 10 to 20 tons! Just as ocean animals are not crushed by the weight of water above them, we're not crushed by the weight of the air because the inner pressure of our bodies pushing out equalizes the air pressure pushing down on us.

Activity:

Air Lift

Teachers Reference Page

CONCEPTS

Visually expand on the concepts of air pressure, displacement.

SCIENCE MATTERS EXHIBIT TIE-IN

Pressure Flasks

MATERIALS NEEDED FOR ACTIVITY (per student group)

Quart or gallon zip top bag
Straw
Duct tape
Pencil
Books

MATERIALS NEEDED FOR INQUIRY CHALLENGE

Straws
Plastic bags of various sizes and shapes
Duct tape
Platform for teacher to sit on (examples: wood square, table top, folded box)

PASS Standards for "Air Lift"

GRADE 5
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS STANDARDS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
5.4 Share results of investigation
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

If air has weight and mass, can it be used to move objects?

MATERIALS NEEDED (per student group)

Quart or gallon zip top bag
Straw
Duct tape
Pencil
Books

WHAT TO DO

1) Poke a hole in the bag near the top and insert a straw.

2) Cover the hole with duct tape to keep air from escaping. Zip the top of the bag closed.

3) Place a book on top of the bag.

4) Blow into the straw to Inflate the bag.

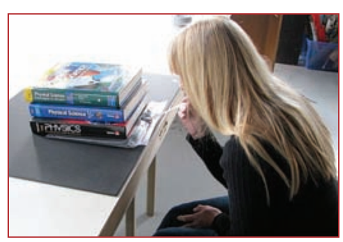
5) Unzip the bag to release the air. Add more books to your pile. How many books can you lift?


1

2

3


4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Inquiry Challenge Page

The power of air is amazing! But can you use it lift your teacher and the platform he/she's sitting on?

MATERIALS NEEDED

Straws
Plastic bags of various sizes and shapes
Duct tape

Devise a plan that will allow you to lift your teacher and the platform he/she's sitting on off the ground using only the power of air.

WRITE OUT YOUR PLAN.

____
____
____
____
____
____

MAKE A LIST OF MATERIALS YOU'LL NEED.

____
____
____

DRAW A DIAGRAM OF THE DEVICE YOU'RE PLANNING ON USING.

Continued on next page

TEST YOUR PLAN WITH BOOKS OR A MEMBER OF YOUR TEAM. DID YOUR DESIGN WORK? WHY OR WHY NOT?

DID YOU NEED TO MODIFY IT? LIST ANY CHANGES YOU MADE.

TEST IT ON YOUR TEACHER. WAS THE DESIGN A SUCCESS?

SHARE WHAT YOU'VE LEARNED WITH YOUR CLASS.

Activity:

Coming Attractions

Teachers Reference Page

CONCEPTS

Visually introduces the concepts of magnetism, ferromagnetic and non-magnetic properties.

SCIENCE MATTERS EXHIBIT TIE-IN

Magnetic Sculpture
Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

Several magnets
Recording sheet

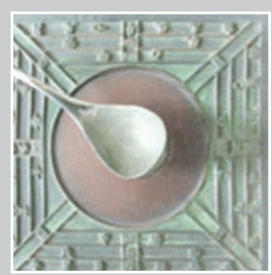
BACKGROUND INFORMATION

An ancient Greek story recounts the tale of a humble shepherd named Magnes. According to the legend, about 4000 years ago, Magnes was herding his sheep in an area of northern Greece. Suddenly, the nails in his shoes and the metal tip of his staff became firmly stuck to the large, black rock on which he was standing. The type of rock was named *magnes,* after *Magnes* himself.

A more accurate, if less interesting, origin of the word, magnet, comes from the area in northern Greece where the black rock (an iron oxide, Fe_3O_4 with a magnetic orientation we know as magnetite or lodestone) was originally found. The area was know as Magnesia, so the Greeks called these curious stones *"magnítis líthos,"* which meant "stone from Magnesia." Eventually, through Latin and French, *magnítis líthos* was worn down to magnet.

For many years following its discovery, magnetite was just a curious phenomenon steeped in superstition. It was thought to have a soul and possess magical powers. People believed that there were whole islands of magnetite that would attract ships because of the iron nails used in their construction. Ships that disappeared at sea were believed to have been mysteriously pulled by these islands.

The attractive power of magnetite was also discovered independently by the Chinese, where it was known as "the stone that snatches iron". The Chinese were the first people to identify its directional properties. They found that if a piece of ore was allowed to rotate freely, it would point in a north-south direction. The first mariner's compass was developed about 2000 years ago. A needle made from splinter of the ore floated on the surface tension of water, pointed north.



Before the introduction of the compass, sailors determined their location by sighting landmarks and by observing the position of stars and planets. Ancient seafarers usually kept within sight of land.
The invention of the compass allowed sailors to determine a ship's heading even when the sky was dark or cloudy. More importantly it enabled ships to navigate safely away from land, bringing about the great Age of Discovery.

PASS Standards for "Coming Attractions"

GRADE 5
LANGUAGE ARTS - READING/LITERATURE
3.2a Apply prior knowledge/experience to make inferences
3.3.a Summarize and paraphrase information
3.3.b Make generalizations with information from text
LANGUAGE ARTS - WRITING/GRAMMAR/USAGE/MECHANICS
1.1 Use writing process to improve composition skills
1.4.a Proofread writing
2.2 Write narrative stories
3.1 Demonstrate appropriate grammar usage in writing
3.3 Demonstrate appropriate punctuation in writing
3.4.a Create interesting sentences that describe/explain
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
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4.2 Make predictions based on patterns
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5.3 Formulate general statement for data
5.4 Share results of investigation

Activity Page

MATERIALS NEEDED (per student group)

Several magnets
Recording sheet

WHAT TO DO

You're going on a magnetic hunt. Walk around the area set aside by your teacher. Predict whether or not the items you find will be attracted to a magnet. Record your predictions and your findings on the chart below.

Things that are attracted to magnets are know as ferromagnetic materials. Nonmagnetic materials do not stick to magnets.

CAUTION! DO NOT TEST computer/TV screens, audio or video tapes, watches, floppy disks, credit or ID cards.

ITEM DESCRIPTION	MY PREDICTION: MAGNETIC	MY PREDICTION: NON-MAGNETIC	RESULTS

SHARE WHAT YOU'VE LEARNED WITH YOUR CLASSMATES.

Language Arts Tie-in

TRAVEL BACK TO THE ANCIENT WORLD…

While traveling through the Greek countryside, you encounter a strange black rock with even stranger powers. The metal tip of your walking stick and the nails in your shoes stick to the rock as you try to climb over it. It's almost as if the rock reaches out to grab you! With effort you manage to pull yourself free. Smaller chunks of the stone lie scattered about. You cautiously pick up a few. A student of scientific study, you pack them away and take them home for further examination.

WRITE A STORY ABOUT WHAT YOU DISCOVERED.

Activity:

Poles Apart

Teachers Reference Page

CONCEPTS

Visually explore magnetic fields.

SCIENCE MATTERS EXHIBIT TIE-IN

Magnetic Sculpture
Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

Bar magnets
Piece of string

PASS Standards for "Poles Apart"

GRADE 5
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

If you took a typical bar magnet and broke it into pieces, over and over and over…you'd end up with millions of microscopic magnets. Each of them would have two poles—a north pole and a south pole. What role do these poles play? Why are these poles important to a magnet's function?

MATERIALS NEEDED (per student group)

Bar magnets
Piece of string

WHAT TO DO

1) Tie a string around the center of one of the bar magnets. Hold the string up, so that the magnet dangles in the air below. Have a partner hold the other magnet so that the north pole of the magnet is about a foot away from the north pole of the magnet on the string. Slowly move the magnets towards each other. Record your findings.

2) Repeat the process with the south poles facing each other. Record your findings.

3) Predict what will happen if you try it again with a north pole facing a south pole.

4) Try it. What happened?

5) How is this similar to a "force field" in a science fiction movie?

Activity:

Nano-Size It!

Teachers Reference Page

CONCEPTS

Visually introduce the concept of nanosize.

SCIENCE MATTERS EXHIBIT TIE-IN

Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

Strip of paper (dimensions 216mm x 5mm) **(pre-cut strips prior to activity)**
Scissors
Tape
Pencil
Metric ruler

BACKGROUND INFORMATION

"Understanding Nanoscale"
This exercise is designed to help students visualize the smallness of nanoscale.

Nanoscience is the study of the behavior of objects at a very small scale. In today's world, nanoscience and technology are the subject of intense research and development with millions of dollars spent annually. This research has already yielded breakthroughs in medicine and technology.
While a relatively new science, nanotechnology will be very important in the workplace by the time your students enter it. One of the most difficult aspects for students to grasp is the concept of nanoscale or just how small the nano-world is.

What does "nano" mean? Anything that is a nanometer in size is tiny - really, really, really tiny. The prefix "nano" means one-billionth. One nanometer is one-billionth of a meter.

Some Size Comparisons:
DNA strand is approximately 2.3 nanometers wide.
A typical virus is about 100 nanometers across.
Human red blood cell is about 10,000 nanometers wide
Human hair is about 73,000 nanometers wide

Answer to Exercise Question:

It takes 26 cuts to make a 10 namometer long piece.

PASS Standards for "Nano-Size It!"

GRADE 5
LANGUAGE ARTS - READING/LITERATURE
3.2a Apply prior knowledge/experience to make inferences
3.3.a Summarize and paraphrase information
3.3.b Make generalizations with information from text
LANGUAGE ARTS - WRITING/GRAMMAR/USAGE/MECHANICS
1.1 Use writing process to improve composition skills
1.4.a Proofread writing
2.2 Write narrative stories
3.1 Demonstrate appropriate grammar usage in writing
3.3 Demonstrate appropriate punctuation in writing
3.4.a Create interesting sentences that describe/explain
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.1 Observe and measure
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties

"Understanding Nanoscale" Exercise Page

What does "nano" mean?

Anything that is a nanometer in size is tiny—really, really, really tiny. The prefix "nano" means one-billionth. One nanometer is one-billionth of a meter.

WHAT TO DO

1) With a metric ruler draw a line that is one centimeter.

2) One centimeter is one-hundredth of a meter. There are 100 centimeters in 1 meter.

   If you divide this centimeter into 10 equal pieces, each piece will be one millimeter. One millimeter is one-thousandth of a meter. A dime has a thickness of about one millimeter. We still have quite a ways to go to get to nanoscale.

3) Predict how many times will you have to cut a piece of paper, to get it down to between 1 and 10 nanometers in size?

Activity Page

MATERIALS NEEDED (per student group)

Strip of paper (dimensions 216mm x 5mm)
Scissors
Tape
Pencil
Metric ruler

WHAT TO DO

1) Knowing that the strip of paper is 216 millimeters long, and 5 millimeters wide, predict how many times you'll have to cut the strip of paper before you end up with a piece that's 1 to 10 nanometers in length.

   Prediction: ______________________________

2) How many times do you think you can cut the paper before it becomes too small for you to cut with your scissors?

   Prediction: ______________________________

3) Cut the paper in half. Tape one half to the back of this worksheet. Make a tally sheet to keep track of how many times you cut the paper.

4) Cut the half you have left in half again. Tape one of the cut piece to the back of the worksheet and mark your tally.

5) Keep cutting, taping and marking until you can't cut the piece any smaller.

6) Answer the following questions after you have finished cutting.

   Were your predictions accurate? ______________________________

   How many times were you able to cut the paper? ______________________________

   Why did you have to stop cutting? ______________________________

   ____

   Scissors are macroscale items. Did they make it difficult to cut the paper small enough?______________________________

   ____

   Can you think of another way to cut the paper smaller? ______________________________

   ____

Language Arts Tie-In

"THE INCREDIBLE SHRINKING CAPER" or "HELP! I'VE BEEN NANO-SIZED!"

I've got to stop going to visit my crazy uncle in his lab. At least, that's what I'm telling myself now. "Help me test my new shrinking machine," he had said. It sounded like a exciting way to spend a Saturday morning. . .

Uncle Cy was definitely excited about the new chip he'd made. He called it his "Nano Navigator". He said that it nano-sized things. When I asked him what that meant, he only smiled and said, "You'll see."

According to Uncle Cy, he'd installed the chip on Friday and spent the night testing it. He even tried it out on his dog, K-nine. "Unfortunately, I seem to have lost track of him somewhere. But not to worry, that's where you come in."

Minutes later I found myself inside a glowing box.

"We're going to take you down in stages," Uncle Cy began. "Let's start with a thousand."
A bright flash of light later, I was the size of an ant!
"Two more to go!" he called over the hum of the machine.
Another flash and I was a thousand times smaller still. "Stop! I'm the size of an amoeba," I screamed. I don't think he heard me. I'm sure my mouth was too small.

"Another thousand and you're there!" Uncle Cy thundered. To me, he was bigger than a skyscraper! "Don't forget to find K-nine."

"If he makes me any smaller there won't be anything left!"
Well, that's what I thought until he pushed the button again and made me smaller still.

When I looked around. . .

FINISH THE STORY, AFTER ALL, IT IS ABOUT YOU...

SCIENCE MATTERS

POST-VISIT ACTIVITIES

OKLAHOMA museum NETWORK

FUNDED BY THE DONALD W. REYNOLDS FOUNDATION

Activity:

R.O.V. Expedition

Teachers Reference Page

CONCEPTS

Visually expand on the concepts of air pressure, displacement, buoyancy. Review magnetic properties of objects.

SCIENCE MATTERS EXHIBIT TIE-IN

Pressure Flasks
Magnetic Sculpture

MATERIALS NEEDED FOR ACTIVITY (per student group)

- Small (8-16 oz.) clear plastic water/soda bottle
- 2 pieces of clear acrylic aquarium tubing:
  - (1) length of bottle + 6 inches
  - (1) 18 - 24" long
- 2 small strong neodymium magnets
- 4 - 6 marbles
- Duct tape
- A mixture of metal and plastic items for the R.O.V. to pick up (paper clips/washers/screws/keys etc...)
- Tub of water
- Drill with 7/32" drill bit

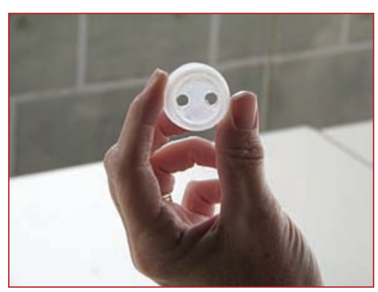
BACKGROUND INFORMATION

What is a R.O.V.?

A Remotely Operated Vehicle (R.O.V.) is an underwater mobile robot designed for aquatic work environments. It's used in underwater exploration, recovery, search and rescue, inspections, cable burial and many other things. The R.O.V. operator sits in a control center that is usually based above the surface of the water, on a boat or shore-based station, and watches displays that show what the robot "sees." The operator can also maneuver the robot. The R.O.V. and control center are attached to each other by an "umbilical" cable or tether. The "umbilical" provides the power and data uplink between the control center and R.O.V. All the communication between the operator and the R.O.V. is sent through the "umbilical" wiring.

BEFORE SESSION

Drill two 7/32" holes in the bottle cap



PASS Standards for "R.O.V. Expedition"

GRADE 5
LANGUAGE ARTS - READING/LITERATURE
3.2a Apply prior knowledge/experience to make inferences
3.3.a Summarize and paraphrase information
3.3.b Make generalizations with information from text
LANGUAGE ARTS - WRITING/GRAMMAR/USAGE/MECHANICS
1.1 Use writing process to improve composition skills
1.4.a Proofread writing
2.5 Write informational pieces with multiple paragraphs
3.1 Demonstrate appropriate grammar usage in writing
3.3 Demonstrate appropriate punctuation in writing
3.4.a Create interesting sentences that describe/explain
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

MATERIALS NEEDED (per student group)

Small (8-16 oz.) clear plastic water/soda bottle (with pre-drilled bottle cap)
2 pieces of clear acrylic aquarium tubing:
- (1) length of bottle + 6 inches
- (1) 18 - 24" long

2 small strong neodymium magnets
4 - 6 marbles
Duct tape
A mixture of metal and plastic items for the R.O.V. to pick up (paper clips/washers/screws/keys etc...)
Tub of water

WHAT TO DO—CONSTRUCTING YOUR R.O.V.

1) Thread the short hose through one of the holes in the cap to the bottom of the bottle.
2) Thread 1" of the long hose through the other hole.
3) Drop one magnet into the bottle and place the other one on the bottom of the outside of the bottle, so that they connect through the plastic.
4) Drop 4-6 marbles into the bottle and screw on the lid.
5) Tape the short hose to the side of the bottle. Do not cover the end.

1


2


3


4


5


Continued on next page

WHAT TO DO—TESTING YOUR R.O.V.

1) Fill a tub with water and drop in objects for your R.O.V. to retrieve.

2) Place the R.O.V. inside the tub with the short hose in the water. Suck in on the long hose.


1


2

3) What happened inside the bottle?

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____
____

4) Blow into the hose. What happened?

____
____
____
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5) Without touching the bottle, devise a way to collect the items from the bottom of the tub. Write down your plan.

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____
____

6) Did it work? Why or why not?

____
____
____
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Continued on next page

7) Collect as many items as you can. Make a list of the items collected and items left behind.

R.O.V. RETRIEVAL LOG

ITEM	COLLECTED	NOT COLLECTED	MATERIAL ITEM IS MADE OF

SUMMING IT ALL UP!

1) Why were some items collected while others were not?

2) When you blew into the hose, what did you add to the bottle? What happened to the water in the bottle?

3) When you sucked in on the hose, what did you take from the bottle? What happened to the water in the bottle?

4) What did air pressure have to do with the way your R.O.V. performed?

Library Tie-In

A STEP FURTHER

Air pressure can have a significant effect on health especially at high elevations and underwater.

A CASE OF THE BENDS

Decompression sickness or the bends is a medical condition that occurs when the pressure surrounding a person's body drops too quickly. It can happen if a diver resurfaces too fast.

Inside the human body, nitrogen is dissolved in various tissues and liquids, like blood. If the body depressurizes too quickly, some of that nitrogen is released as a gas in the body causing the bends. Depending on how severe the decompression is, the victim may experience symptoms that range from mild pain and itching to paralysis or death.

Can you get the bends without being in the water?
Could you get it in a mine or in on a plane?

YOUR CHALLENGE:

Use your internet and library resources to find out more about the bends, or choose another pressure related illness to research. Find out how and where it occurs, its causes, symptoms and suggested treatments.

EXAMPLES OF OTHER PRESSURE RELATED CONDITIONS

- Hypoxia
- High Altitude Periodic Breathing
- High Altitude Pulmonary Edema
- Acute Mountain Sickness
- Ear Popping or Barotrauma
- Skin Squeeze

Activity:

Paper Clip Caper

Teachers Reference Page

CONCEPTS

Visually explore magnetic force to determine what kind of objects it can travel through.

SCIENCE MATTERS EXHIBIT TIE-IN

Magnetic Sculpture
Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

Magnet
4″ x 8″ piece of cardboard
Clear plastic cup or jar/beaker
Water
Paper clips

MATERIALS NEEDED FOR INQUIRY CHALLENGE

Strong magnet (one per group)
Paper clips (20 per group)
Assorted pieces of cardboard, plastic, wood
Assorted containers
Water
Dirt or sand

PASS Standards for "Paper Clip Caper"

GRADE 5
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
5.4 Share results of investigation
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

Can a magnetic force travel through objects?

MATERIALS NEEDED (per student group)

Magnet
4" x 8" piece of cardboard
Clear plastic cup or jar/beaker
Water
Paper clips

WHAT TO DO

1) Draw a track or maze on one side of a piece of cardboard. Put a paper clip at the beginning.

2) Hold a magnet underneath the cardboard and see if you can guide the paperclip through the course.

What happened? ______________________________

____

____

What do you think would happen if you used a thicker piece of cardboard? ______________________________

____

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3) Fill the cup with water. Drop a paper clip to the bottom.

4) Keeping the magnet on the outside of the glass, can you rescue the paperclip without getting wet?

What happened? ______________________________

____

____

Do you think you'd get the same results with more or less water? Why? ______________________________

____

____

Inquiry Challenge

You have been selected as the royal paper clip protector. Create a chamber that will keep the magnet thieves from kidnapping your collection.

MATERIALS NEEDED

Strong magnet (one per group)
Paper clips (20 per group)
Assorted pieces of cardboard, plastic, wood
Assorted containers
Water
Dirt or sand

DESCRIBE YOUR DESIGN. DRAW A DIAGRAM OF IT.

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Continued on next page

WHY DO YOU THINK THIS DESIGN WILL WORK?

MAKE A LIST OF MATERIALS YOU'LL NEED.

BUILD YOUR DEVICE AND HAVE SOMEONE ELSE TEST IT.

SUMMARIZE WHAT YOU'VE LEARNED.

SHARE WHAT YOU'VE LEARNED WITH YOUR CLASS.

Activity:

I Can't Believe My Eyes!

Teachers Reference Page

CONCEPTS

Visually introduces the concept of persistence of vision. Reviews basic eye anatomy and function.

SCIENCE MATTERS EXHIBIT TIE-IN

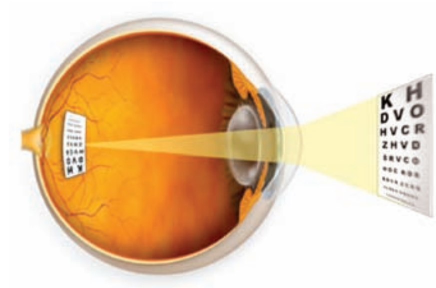
Light Wheel

MATERIALS NEEDED FOR ACTIVITY (per student group)

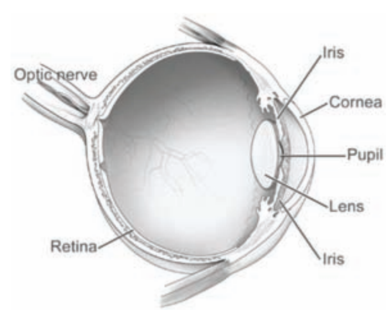
2 blank index cards or a piece of cardstock
Compass, cup or pattern for tracing a 3 inch circle
Pencil or 8" length of dowel rod
Tape/glue
Markers, colored pencils or crayons for coloring

BACKGROUND INFORMATION

Your eyes have special characteristics that allow you to process light so that your mind can create meaning from it. In order for you to "see" the world you need both your eyes and your brain.



So, how does that work? Light bounces off objects around you and then enters your eye. It passes through the pupil and lens to the retina at the back of the eye, where it makes a backward, upside-down picture of the object. The retina holds that image for about a tenth of a second while light sensitive cells, called rods and cones, chemically change it into messages for the brain. These travel up the optic nerve to the brain. There, they are translated into what you "see".



Can you believe what you "see"? Well, not always. Optical illusions are images that play tricks on your eyes and confuse your brain. The human eye is capable of perceiving light that only last one-millionth of a second. Remember that tenth of a second image hold in the retina? Even though the rods and cones start processing light as soon at it hits them, it takes them at least a tenth of a second before they stop. This delay causes an image to persist, or stay, in the eye, and therefore the brain, even after you've stopped looking at it.

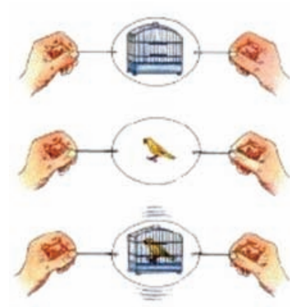
So, your eyes can't distinguish changes in light that happen faster than a tenth of a second. These changes either go unnoticed or they appear to be one continuous picture. Writing your name in the sky by moving a burning stick or a flashlight around in the dark is an example of this "persistence of vision".

PASS Standards for "I Can't Believe My Eyes"

GRADE 5
SCIENCE - PROCESS SKILLS
1.1 Observe and measure
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
5.4 Share results of investigation
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.3 Energy can be transferred

Activity Page

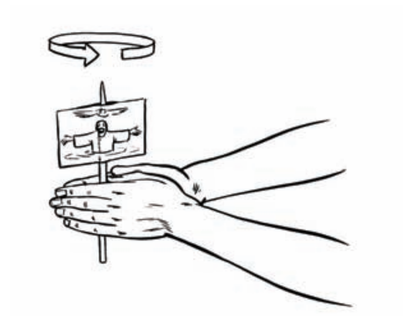
Create Your Own Thaumatrope



In the early 1820's, Dr. J.A. Paris began selling a toy that used the principle of "persistence of vision." He called it a thaumatrope, which is Greek for "wonder turner". The thaumatrope was a wooden disk with strings attached to either side. Each side had an image on it, one right-side-up and the other upside-down. When the disk was spun between the strings the two images blended together to form a single picture.

MATERIALS NEEDED (per student group)

2 blank index cards or a piece of cardstock
Compass, cup or pattern for tracing a 3 inch circle
Pencil or 8" length of dowel rod
Tape/glue
Markers, colored pencils or crayons for coloring



WHAT TO DO

1) Cut out two 3-inch circles from cardstock or index cards.

2) Decide on two images that you think go well together (example: fish/bowl, bird/cage)

3) Draw the two pictures—one on each circle. Try to get them centered, so that they line up when the two disks are placed back to back.

4) Tape the pencil to the back side of one of the pictures (like a lollipop).Use plenty of tape and press it down really well.

5) Tape or glue the second circle on the backside of the first, so that you see a picture on both sides.

6) Once it's dry, hold the stick in your hands. Rub your hands together quickly, so that stick and the images on the twirl around.

How fast do you have to twirl the thaumatrope before the pictures blend together? ______________________________

____

What happens to the images when you turn the thaumatrope at different speeds? ______________________________

____

____

Develop another way that you can demonstrate the concept of persistence of vision? Share your findings with the class.

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Activity:
Fun with Faux Ferrofluid

Teachers Reference Page

CONCEPTS

Visually explores the magnetic properties of ferrofluid.

SCIENCE MATTERS EXHIBIT TIE-IN

Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

Flat bottomed petri dish or small plate
Corn syrup
Iron filings
Wooden craft stick
Strong magnet

PASS Standards for "Fun with Faux Ferrofluid"

GRADE 5
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.2 Make predictions based on patterns
5.3 Formulate general statement for data
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

MATERIALS NEEDED (per student group)

Flat bottomed petri dish or small plate
Corn syrup
Iron filings
Wooden craft stick
Strong magnet

WHAT TO DO

1) Pour a thin layer of corn syrup (~ 1 teaspoon) into the dish.

2) Add a small amount of iron filings (~ 1/8 teaspoon) and stir.

3) Put the magnet under the dish and move it around.

4) Describe what happens:

____

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5) Experiment with different amounts of iron filings. Add a small pinch at a time. How many pinches of iron produce the best results? The best iron to syrup ratio will make a tiny, but amazing hedgehog of silvery spikes.

IS THIS THE SAME STUFF THAT'S ON SCIENCE MATTERS?

No, not really. In the high-tech version we call ferrofluid, the iron particles are much, much smaller. They are nanoparticles that are about 10 nanometers across.

WHAT IS FERROFLUID? IS IT A LIQUID MAGNET?

No. So far scientists haven't found a way to make a liquid magnet. Ferrofluid is made with solid nano-size magnetic particles that are suspended in a liquid. The mixture has magnetic properties. Ferrofluids move like a liquid and have the magnetic properties of a solid.

WHAT IS FERROFLUID USED FOR ?

NASA first developed ferrofluid in the 1960's as a way to control liquid fuel in low gravity. They added magnetic particles to the fuel and then manipulated it with magnets. Magnets and ferrofluid are used in DVD players and speakers to control unwanted vibrations. Ferrofluid is sandwiched between magnets to form an air tight seal to keep the dust out of computer hard drives and x-ray machines.

Activity:

Strange Attractions

Teachers Reference Page

CONCEPTS

Visually explore magnetic fields. Introduces the properties of pendulums and chaotic movement.

SCIENCE MATTERS EXHIBIT TIE-IN

Magnetic Sculpture
Ferrofluid

MATERIALS NEEDED FOR ACTIVITY (per student group)

1/2" steel washer
9" piece of string
3 - 6 circle or doughnut magnets
Box (at least 10" wide x 8" tall)
Wooden skewer cut in half, a sharpened pencil, or a 6" piece of dowel rod that has been sharpened to a point on one side.
10 x 12" or 18 x 10" piece of Foamcore, Styrofoam or thick cardboard
Tape

BACKGROUND INFORMATION

Pendulums are strangely hypnotic, swinging backward and forward, to and fro, their movement rhythmic and repetitive. In a perfect mathematical universe, they'd continue on indefinitely. But in the real world of air and gravity, stubborn friction forces eventually slow them down.

In this exercise, we complicate the pendulums movement by adding in the variable of multiple magnetic fields.

When placed between two equally spaced magnets, a pendulum rhythmically moves back and forth. The picture changes dramatically when a pendulum is forced to move between three magnets. In this case, the simple, back and forth system becomes questionable. If you move the pendulum ever so slightly over three magnets, its swing will still be regular and repetitive, with the pendulum focusing over two of the magnets at a time. With a stronger release, the pendulum will start to swing wildly and chaotically between all three magnets. It will move without any apparent rhythm or particular direction: now the previously regular behavior of the pendulum is chaotic. Moving the positions of the magnets, even slightly, will have a profound effect on the pendulum's path.

In physics, the term chaos refers to whether or not it's possible to make accurate predictions about the behavior of a system.

Until very recently, the laws of physics reflected the complete connection between cause and effect in nature. It was assumed that it was always possible to make accurate long-term predictions of any physical system as long as one knew the starting conditions well enough. The discovery of chaotic systems in nature about 100 years ago questioned that notion.

PASS Standards for “Strange Attractions”

GRADE 5
LANGUAGE ARTS -ORAL LANGUAGE/LISTENING/SPEAKING
3.1 Show respect, consideration in verbal/physical communication
SCIENCE - PROCESS SKILLS
1.2 Compare and contrast characteristics of objects
3.1 Ask questions/form investigative plans
3.3 Design, conduct investigation
3.4 Practice safety, recognize hazards
4.2 Make predictions based on patterns
4.4 Communicate results/explanations of data
5.3 Formulate general statement for data
SCIENCE - CONTENT - PHYSICAL SCIENCE
1.1 Matter has physical properties
1.3 Energy can be transferred

Activity Page

MATERIALS NEEDED (per student group)

1/2" steel washer
9" piece of string
3 - 6 circle or doughnut magnets
Box (at least 10" wide x 8" tall)
Wooden skewer cut in half, a sharpened pencil, or a 6" piece of 3/8" dowel rod that has been sharpened to a point on one side.
10 x 12" or 18 x 10" piece of Foamcore, Styrofoam or thick cardboard
Tape

WHAT TO DO—CONSTRUCTING YOUR PENDULUM

Option 1: Tape a 10" x 12" piece of Foamcore or cardboard to the front of the box with the longest side (12") vertical.

Option 2: *(Recommended if you're working off the floor)* Score a 18" x 10" piece of Foamcore or cardboard at 6" on the 18" side. Fold it to form an "L" shape and tape it to the box.

1) Tie a 9" piece of string to the blunt end of the skewer/pencil/rod.

2) Tie the other end of the string to a 1/2" steel washer.

SET UP NOTES:

If the tables/desks are a dark color, or if a dark color was used for base, cover it with a piece a white paper so that the movement of the pendulum easier to see.

When student first insert the skewer into the backboard, the bottom of the washer should be about an inch off the floor.

If the magnets on the floor shift or move when the pendulum passes over them, have the students tape the magnets in place.

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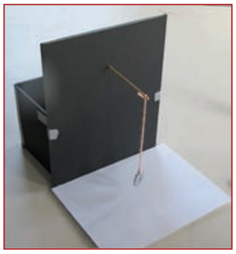
2 

3 

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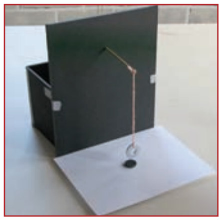
WHAT TO DO—INVESTIGATE HOW MAGNETIC FIELDS AFFECT A PENDULUM.

1) Insert the pendulum near the top and center of the backboard so that the bottom of the washer is about an inch off the floor. Lift the washer to the right, up about 3 inches from the center and release it. Describe the pendulum's movement and pattern.

Repeat the procedure from the left side. Is the movement the same? ______________________

2) Place a circle magnet on the center of the floor directly underneath the pendulum. Predict what will happen when you release the pendulum. *(If your magnet moves when the pendulum passes over it, tape the magnet in place.)*

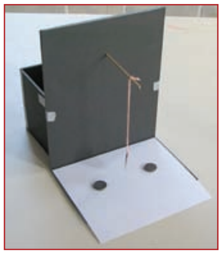


Test it from the right and from the left. Was your prediction correct? ______________________

3) What would happen if you changed the position of the pendulum? Pull the skewer out and move it to another place on the backboard. Leave the circle magnet on the center of the floor. Predict what will happen when you release the washer.

Test it from the right and from the left. Was your prediction correct? ______________________

4) Move the pendulum back to its original center position. Place two circle magnets on the floor—one about two inches from the edge of the right side and the other about two inches from the left side. Will the movement change? Predict what will happen.



Test it from the right and from the left. Was your prediction correct? ______________________

5) Would the movement be the same if the strength of the magnets were different? How could you test your hypothesis?

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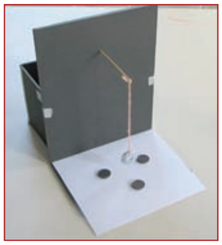
6) Add a third magnet to the floor. Will the movement change? Predict what will happen.



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Test it from the right and from the left. Was your prediction correct? ____________________

7) The position of the skewer, the number of magnets, the strength of the magnets are all variables. What other variables are there?

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8) Pick a variable that you'd like to change and plan an investigation. Write out your plan.

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9) How do you think your pendulum will react? What will its path be?

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10) Test your hypothesis. Describe your findings.

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11) Summarize your thoughts and share them with the class.

Fiction

Cal and the Amazing Anti-Gravity Machine

Richard Hamilton, Sam Hearn (Illustrator)

Publisher: Bloomsbury USA
Pub. Date: April 2006
ISBN-13: 9781582347141
Age Range: 7 to 10
128pp

Cal and his talking dog, Frankie, are new to the neighborhood, and everyone in his family is having a hard time adjusting to the neighbor, Mr. Frout. His sleep-interrupting inventions wake everyone up and infuriate Cal's mother. What is Frout doing? Cal and Frankie are intrigued, especially when they see Frout's newest contraption, a giant magnet attached to some wires. And, when Frout arrives, clad in a knight's costume, they can't keep away. Whether Frout sticks to the magnet or accidentally reverses the gravitational pull of the earth in their neighborhood, Cal and Frankie are part of the excitement of weightlessness. But, as bugs and worms and humans wake up for the day, the unexpected implications of anti-gravity are obvious. Hilarious situations accompanied by lively spot illustrations make this an appealing offering for new readers, especially ones who are interested in science.

How Do You Lift a Lion?

Robert E. Wells

Publisher: Albert Whitman
Pub. Date: October 1996
ISBN-13: 9780807534212
Age Range: 9 to 12
32pp

This book aims to introduce some of the theories of physics to young readers. The concepts are those of gravity, leverage, friction, and pulleys. Each is accompanied by some physical problem involving animals. For example, the book starts out by asking how one might lift a lion. Answer: put him on a platform and use a lever. Then, if one wants to lift more lions, one would need a longer lever. This is a clever book, with nice pictures.

Jungle Gym Jitters

Chuck Richards

Publisher: Walker & Company
Pub. Date: October 2004
ISBN-13: 9780802789310
Age Range: 4 to 9
32pp

Jerry's father is a creative genius, always thinking of ways to make life more interesting. But when he starts building a jungle gym that gets taller and taller, twisting all the way up to the sky, the soaring spectacle makes Jerry seriously squeamish. Jerry's jungle gym jitters get worse when he sees fearless friends and acrobatic animals hanging from tires and riding through tunnels. The overgrown obstacle course is scary enough for Jerry, but when a fire traps his daredevil sister in the towering contraption, only Jerry can save her. Can he summon the courage to rise to the occasion, or will the jungle gym jitters paralyze him?

Magic School Bus and the Science Fair Expedition

Joanna Cole, Bruce Degen (Illustrator)

Publisher: Scholastic, Inc.
Pub. Date: August 2006
ISBN-13: 9780590108249
Age Range: 7 to 10
32pp

Ms. Frizzle's students are starting their science fair projects, but Ralphie's ants have escaped and many of the children are lacking ideas for their own projects. Arnold is greatly relieved when the unorthodox teacher suggests a walking trip to a nearby museum for inspiration. There, in the museum is a cardboard school bus (for photo opportunities?) and it is immediately evident that the class will be soon be off on yet another wild (but extremely educational) trip. Cole and Degan have augmented the "Magic School Bus" series' stature with this ambitious exposition of "famous scientists." The class visits Copernicus, Leeuwenhoek, Sir Isaac Newton, Galileo, Louis Pasteur, Pierre and Marie Curie, Barbara McClintock, Irene Joliot-Curie, Lise Meitner, Michael Faraday, Charles Darwin, and Albert Einstein (also sporting "weird" hair). The usual dialog bubbles are filled with humorous quips, lots of details, and information. The scientists interact with the class and teach lots of science facts along the way.

Marta's Magnets

Wendy Pfeffer, Gail Piazza (Illustrator)

Publisher: Silver Burdett Press
Pub. Date: June 1995
ISBN-13: 9780382249303
Age Range: 5 to 7

Marta is a collector...of keys, paper clips, gum wrappers, and magnets. When she moves to a new neighborhood, she uses her magnet collection to make friends and to help her older sister's best friend retrieve a key that has fallen through a sidewalk grate. Directions are included for making a refrigerator magnet. Large, understated, but realistic colored-pencil drawings depict attractive multiethnic youngsters. A pleasant but slight story about fitting in that could also be used to introduce a unit on magnetism.

Miss Malarkey's Field Trip

Judy Finchler

Publisher: Walker & Company
Pub. Date: June 2006
ISBN-13: 9780802789174
Age Range: 5 to 9
32pp

Miss Malarkey is leaving the building. A field trip is the highlight of every school year. Students everywhere look forward to this break from the regular class routine. Miss Malarkey has never been in charge of running a class trip before. Bringing her students to the Science Center is a real adventure. The class really digs the dinosaur exhibit. Exploring the electricity room is a hair-raising experience for Miss Malarkey. And the phrase "stick it in your ear" takes on new meaning in the human body display. But the most important thing Miss Malarkey and her students learn on the trip is to expect the unexpected as they experience a day full of surprises and discoveries.

Science Verse

Jon Scieszka, Lane Smith (Illustrator)

Publisher: Penguin Young Readers Group
Pub. Date: September 2004
ISBN-13: 9780670910571
Age Range: 7 to 10
40pp

When the teacher tells his class that they can hear the poetry of science in everything, a student is struck with a curse and begins hearing nothing but science verses that sound very much like some well-known poems.

What's the Matter in Mr. Whiskers' Room?

Michael Elsohn Ross, Paul Meisel (Illustrator)

Publisher: Candlewick Press
Pub. Date: August 2007
ISBN-13: 9780763635664
Age Range: 6 to 10
48pp

Mr. Whiskers, the teacher, has that wild look in his eyes again. That's the look that means, Get ready for hands-on science! This time the subject matter is . . . matter. Using seven science stations, Mr. Whiskers encourages his kids to use all their senses to make observations and draw conclusions. Everyone's a scientist in Mr. Whiskers' class, where hands-on mini-experiments lead to Big Ideas—and promote an ongoing passion for independent, open-ended discovery.

Who Can Fix It?

Leslie Ann MacKeen, Nancy R. Thatch (Editor)

Publisher: Landmark Editions, Inc.
Pub. Date: October 1989
ISBN-13: 9780933849198
Age Range: 9 to 12
28pp

When Jeremiah's car breaks down on the way to his mother's house, several animals stop by to offer amusing solutions to his problem.

Non-Fiction

Awesome Experiments In Electricity & Magnetism

Michael Anthony Anthony DiSpezio, Matt LaFleur (Illustrator)

Publisher: Sterling Publishing
Pub. Date: June 2000
ISBN-13: 9780806998206
Age Range: 8 to 12
160pp

Over 70 experiments that explore electrical charges, static electricity, currents, circuits, switches, and magnetism. Each one includes a brief introduction, a list of materials, directions, and a scientific explanation of the results. Thought-provoking questions for further investigation appear in a "Check It Out" section. The experiments are informative and, given the readily available parts and simple assembly, occasionally amazing. The author's entertaining comments make it clear that science can be fun. The black-and-white illustrations will assist students constructing buzzers, "anti-gravity disks," meters, and more. Safety reminders and suggestions for adult supervision are included.

Awesome Experiments in Force and Motion

Michael Anthony Anthony DiSpezio, Catherine Leary (Illustrator),

Publisher: Sterling Publishing
Pub. Date: June 1999
ISBN-13: 9780806998213
Age Range: 9 to 12
160pp

Demonstrate inertia with a Card Shot trick. Use a cardboard rocket ship to find the center of gravity, and your own "great salt lake" to display buoyancy. Crush an empty can with the power of air pressure. Other experiments include a water tower that shows the push and pull of air currents, and balloon cars that create motion madness. Ordinary, easy-to-find materials are all you need to get moving on these fun-filled investigations.

How to Think Like a Scientist: Answering Questions by the Scientific Method

Stephen P. Kramer, Felicia Bond (Illustrator)

Publisher: HarperCollins Publishers
Pub. Date: March 1987
ISBN-13: 9780690045659
Age Range: 8 to 12
48pp

Every day you answer questions-dozens, even hundreds of them. How do you find the answers to questions? How can you be sure your answers are correct? Scientists use questions to learn about things. Scientists have developed a way of helping make sure they answer questions correctly. It is called the scientific method. The scientific method can help you find answers to many of the questions you are curious about. What kind of food does your dog like best? Is your sister more likely to help you with your homework if you say please? Can throwing a dead snake over a tree branch make it rain? The scientific method can help you answer these questions and many others. Stephen Kramer's invitation to think like a scientist, illustrated by Felicia Bond's humorous and appealing pictures, will receive enthusiastic response from young readers, scientist and nonscientist alike.

Loco-Motion: Physics Models for the Classroom: 25+ Hands-On Science Projects

Ed Sobey

Publisher: Zephyr Press AZ
Pub. Date: August 2005
ISBN-13: 9781569761939
Age Range: 12 and up
208pp

Using the concept of "learning by doing," this classroom activity book contains an impressive collection of instructions and guidelines for building physics models that fly through the air, drive on the ground, or paddle through water. Students will use experimentation and analysis in these intriguing physics projects to inspire new and improve upon old designs. Each model is presented in a specific educational context, so teachers can instruct with hands-on experimentation. Students will explore science concepts such as gravity, air pressure, kinetic energy, Newton's laws, electrical circuitry, buoyancy, and inertia. Detailed materials lists and step-by-step directions for building models are structured so that the teacher becomes the director of research and development in a classroom of young engineers. The models discussed in the book include gravity-powered cars, balloon racers, hovercrafts, gravity ball launchers, flying saucers, catapults, chemical mini-rockets, swamp boats, and submarines. Kids are encouraged to test, modify, and redesign based on observation of their models in action, while working cooperatively and learning from one another's successes and failures. The engaging material in these activities promote the understanding of science not as a collection of facts to be studied for a test, but as a learning process to be actively experienced.

Mighty Machines

Shar Levine, Leslie Johnstone, Steve Harpster (Illustrator)

Publisher: Sterling Publishing
Pub. Date: August 2006
ISBN-13: 9781402740510
Age Range: 9 to 12
48pp

How do machines work? Kids will have a blast constructing a mini-seesaw to illustrate the way a lever operates or creating their very own pulley from an empty spool, string, ribbon, pails, pennies, a broom, and two chairs. They'll find out why they can't put in a screw using only their fingers and examine the different parts of compound machines. In another experiment, a child's bicycle becomes a laboratory for understanding whether wheels have to be smooth to run.

Pulleys and Gears

David Glover

Publisher: Heinemann Library
Pub. Date: April 2006
ISBN-13: 9781403485939
Age Range: 7 to 9
24pp

Introduces the principles of pulleys and gears as simple machines, using examples from everyday life.

Science Magic with Water

Chris Oxlade, Ian Thompson (Illustrator)

Publisher: Barron's Educational Series, Incorporated

Pub. Date: August 1994

ISBN-13: 9780812064483

Age Range: 9 to 12

32pp

Teaches about the properties of water, its reaction to air pressure and more. Ideas include using water to turn a white rose to red and creating a magic glass that never fills.

Sensational Science Projects with Simple Machines

Robert Gardner, Tom LaBaff (Illustrator)

Publisher: Enslow Publishers, Incorporated
Pub. Date: January 2006
ISBN-13: 9780766025851
Age Range: 8 to 9
48pp

How can a 50-pound boy lift a 200-pound man? How does a wheelbarrow work? Is it easier to roll a toy truck up an inclined plane or just pick it straight up? The experiments in this book will show how simple machines work and explain some elementary principles of physical science. All you need are some simple materials, most of which can be found around your home, school, or neighborhood.

Website Selections

SUPPLIES

http://www.arborsci.com

Arbor Scientific

Physical science supplies. Includes a teacher resource section with downloadable labs. Each lab includes teacher's notes with a brief concept review, lab tips, applicable National Science Content Standards, and a list of equipment.

http://www.carolina.com

Carolina Biological Supply

Supplies, specimens, chemicals for all areas of science. Include a teacher resource section with background information and lesson plans

http://www.fishersci.com

Fisher Scientific

Scientific research, laboratory testing and life science research

http://www.flinnsci.com

FLINN SCIENTIFIC, INC

Science and demonstration supplies, excellent customer service and offers great teacher resources online

http://www.magnetsource.com/

Master Magnetics, Inc.

Magnet suppliers

http://www.mcmaster.com/

McMasters-Carr

Large selection of tools, supplies, hardware

http://www1.mscdirect.com

MSC Industrial Supply Company

Over 500,000 tools and supplies

http://www.stevespanglerscience.com/

Steve Spangler Science

Fun and innovative science supplies. Includes downloadable activities and experiments that are teacher-developed and kid-tested

MAGNETS/MAGNETISM

http://www.coolmagnetman.com/magindex.htm

Cool Magnet Man

Rick Hoadley's site on magnetism. Includes background information and experiments with permanent magnets and electro-magnets. Materials lists, instructions and demos included.

http://science.howstuffworks.com/magnet.htm

How Stuff Works

How magnets work.

http://www.rare-earth-magnets.com

Magcraft

Magcraft's Magnet University site with extensive background information on the history, types and uses of magnets

http://www.school-for-champions.com/SCIENCE/magnetism.htm

School for Champions

Ron Kurtus's overview of magnetism with great illustrations

FERROFLUID

http://www.ferrotec.com/technology/ferrofluid.php

Ferrotec

Great site about ferrofluid properties, characteristics, and applications.

http://www.instructables.com/id/Make-your-own-ferrofluid-in-5-minutes/

Instructables

Quick recipe for making "ferrofluid" using MICR ink and oil

http://www.mrsec.wisc.edu/Edetc/background/ferrofluid/index.html

University of Wisconsin

University of Wisconsin's Exploring the Nanoworld site includes sections on ferrofluid properties, characteristics and applications. Great resource section

OPTICAL ILLUSIONS

http://bizarrelabs.com/persist.htm

Bizzare Stuff You Can Make In Your Kitchen

Historical background for persistence of vision toys and plans for a make-it-yourself zoetrope.

http://www.michaelbach.de/ot/

Michael Bach, Frieburg University

80 optical illusions and visual phenomena divided by category.

www.epicant.com/Fall06/privatelessons_EarlyAnimation.pdf

Digital Directions, Private Lessons Channel

2-D Animation and persistence of vision online lesson

http://www.visualillusion.net/

Visual Illusion

Visual Illusions: Their Causes, Characteristics and Applications on-line book by Matthew Luckiesh. Includes over 100 illustrations and an excellent section on the eye and optical illusions

LASERS

http://science.howstuffworks.com/laser.htm

How Stuff Works

How lasers work.

https://lasers.llnl.gov/education/how_lasers_work.php

National Ignition Facility NIF's educational site on how lasers work. Great illustrations.

http://spaceplace.nasa.gov/en/kids/laser/index.shtml

National Aeronautics and Space Administration (NASA)

NASA's kid friendly site about lasers.

PULLEYS AND GEARS

http://www.colby.edu/cpse/equipment2/simple/simple.html

Colby Partnership for Science Education

Simple Machines with Lego Dacta Kits has a variety of pulley and gear activities that don't require Lego accessories and several that do.

http://auto.howstuffworks.com/gears.htm

How Stuff Works

Overview of the different types of gears and a good explanation of gear trains and gear ratios

http://www.sciencetech.technomuses.ca/english/schoolzone/machines2.cfm

Canada Science and Technology Museum

CSTM's School Zone website with background information and student activities on pulleys and gears.