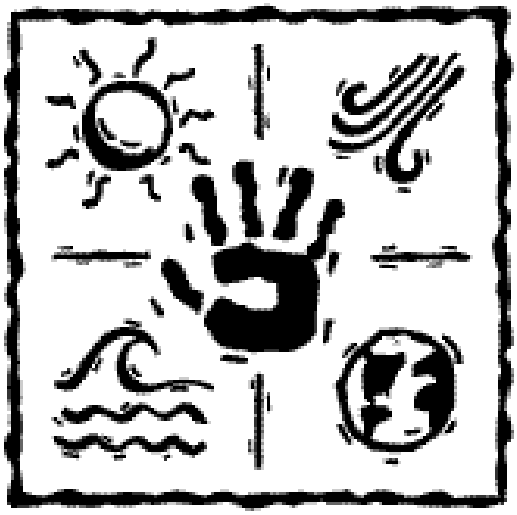

KidScience

THE ISLAND OF THE ELEMENTS

Activity Guide

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The Franklin Institute
Science Museum

KidScience
THE ISLAND OF THE ELEMENTS

KidScience: The Island of the Elements is a special experience at The Franklin Institute designed for children ages 5-8 (with their adult caregivers and families). It offers them a chance to explore the natural world through a unique environment created just for them. Here they can discover properties of the world around them by playing and experimenting in a storybook setting. As they explore the Ship, Cave, Lighthouse, and Pond on the Island, children will observe, interact with, and learn about some basic properties of Air, Earth, Light, and Water.

About the Story

KidScience is set on an island with four different environments. As you will learn on first entering KidScience, the four areas once were watched over by four individuals called the Power Keepers. They operated all the machines and stations on the Island, but are no longer here to do all that needs to be done to keep the island going. Now, children must use the machines and make the stations work. By using the different Air, Earth, Light, and Water interactive devices, they can gain Air, Earth, Light, and Water Points, and earn the title of "Power Keeper" in their own right. Making the task more urgent is the presence of Lord Chaos. His goal is to stop all of the machines on the island. If the secrets of the island are not mastered by the new Power Keepers, Lord Chaos will conquer the land and bring things to a halt.

The Science Behind KidScience: About the National Science Education Standards

KidScience activities have been created to align with the National Science Education Standards. These science guidelines were developed by the National Research Council, and detail what is most important for children to learn about science. The standards urge educators to replace teaching methods that rely on memorization with stimulating experiences that mirror the excitement of the scientific process itself. KidScience provides experiences that foster curiosity, experimentation, and investigation, while addressing standards that children ages 5-8 are developmentally ready to understand.

The activities in KidScience encourage children to ask—and answer—such questions as:

- How can water make things move?
- How can we describe solids?
- How does light behave?
- What creates sound?

The processes that scientists use to understand the world are the ones that children will experience in KidScience. They include asking questions, predicting, making models, measuring, observing, and describing those observations. You can help by encouraging these actions in the exhibit—and every day, anywhere!

Each of the stations in the exhibit has a panel explaining what to do there. Along with background information, you will find an example of how one National Science Education Standard applies to the activity. In fact, many Standards tie in to each activity

About This Guide

This Guide will help you and your children get the most out of your visit. The Guide includes:

- pre-visit suggestions for building interest and excitement about the upcoming trip;
- a map to familiarize yourself with the exhibit;
- suggestions for specific ways to interact with children in the exhibit;
- additional activities about Air, Earth, Light, and Water that you can do together before or after your visit;
- a list of further resources to seek out in the library or bookstore, and on the Web.

We hope your visit will be fun and filled with valuable science experiences. Get ready for your trip to the Island of the Elements, and be prepared for an adventure of exploration!

Before You Visit

Some things you might want to know!

Your children may enjoy their experience more if they are given a taste ahead of time of what they will see when they visit. They will be better equipped to participate if you have already explained the story, the four sections of the island, and the points they are trying to accumulate to earn the title of Power Keeper.

A day or two before your visit

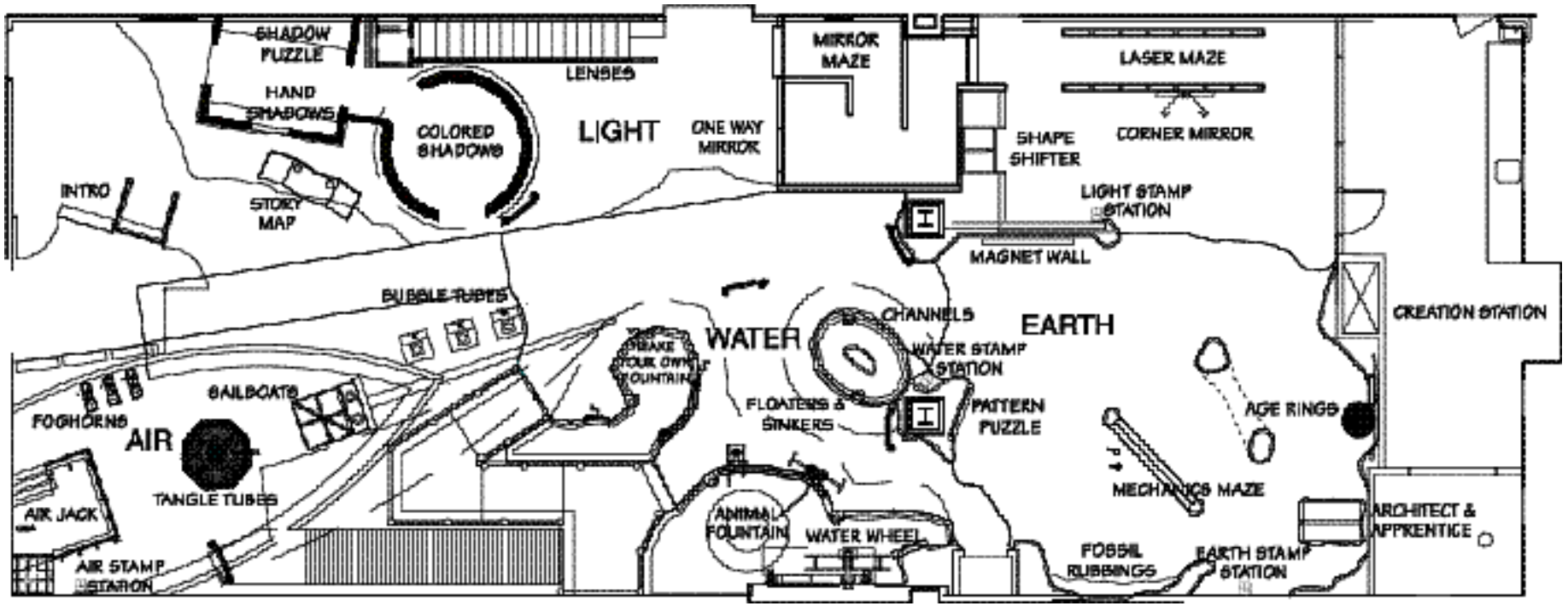
Because KidScience: The Island of the Elements is based around four large topic areas, Air, Earth, Light, and Water, you might want to talk about these topics ahead of time with your children. This can help them better relate to the experiences they'll have once inside the exhibit. Some questions you might want to ask to prepare them are:

- How are Air, Earth, Light, and Water different from one another?
- What are some objects found in the Air, in the Earth, and in the Water?
- What do people do with Air, with Water, and with Earth? How do they use Light?
- What have they themselves used Air, Earth, Light, and Water for?

On your way to the Franklin Institute

While you are on your way to the museum, use the following suggestions to focus your children on the four areas they are going to be playing and experimenting with:

- Before leaving, have them look for mirrors on the car or bus they'll be taking. How many can they find? What can they see when they look in those mirrors? What's useful about them?
- Ask them to find a part of the car/bus that contains Air.
- If it's a sunny day, have the children find a shadow. What does it look like? Can they make it bigger or smaller? Can they make it change shape?
- You may travel over or along a river on your trip. Have the children describe what they see on the river. What other things are sometimes found on rivers? At the edge of rivers? Where does the river go? How are people using it?
- Look for moving tree limbs or leaves blowing in the wind. Can the children tell you what is moving them? Encourage the children to look for other things in the air as you drive to the museum.

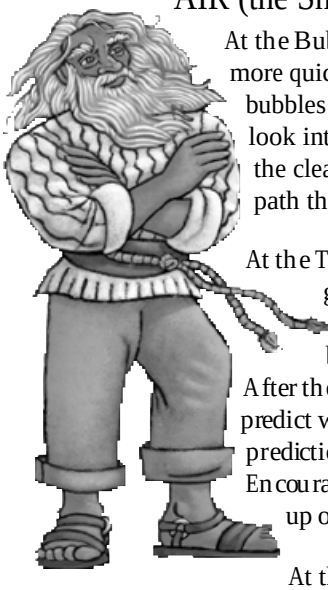


KidScience Floor Plan

In the Exhibit

Keep these guide sheets with you while you're in *KidScience*. They will provide you with other ideas to explore with your children, and help answer some questions asked at the machines and stations. However, do not feel limited to what is written here. Children are naturally curious, and you can encourage that curiosity by getting interested and involved in whatever intrigues them. At all of the stations, encourage conversation. Ask your children to describe, explain, and predict.

AIR (the Ship area)



At the Bubble Tubes, pressing the handles more quickly or more slowly will create large bubbles or small ones. With your children, look into the base of the pump—through the clear plastic sides—and try to trace the path that the air takes to enter the tube.

At the Tangled Tubes encourage them to guess where a ball will go before actually trying the device. Does a ball always pop out the same place? After they try several pathways, can they predict where the next ball will go? Making predictions is an important part of science. Encourage children to explore ways to speed up or trap a ball.

At the Sailboats station, explore how air can make a boat move. Challenge children to make the boat move sideways, away from the wind, and diagonally.

The Fog Horns are in the Air section because the sound is made by moving air. Play a game with your children by naming as many musical instruments that you blow into as possible.

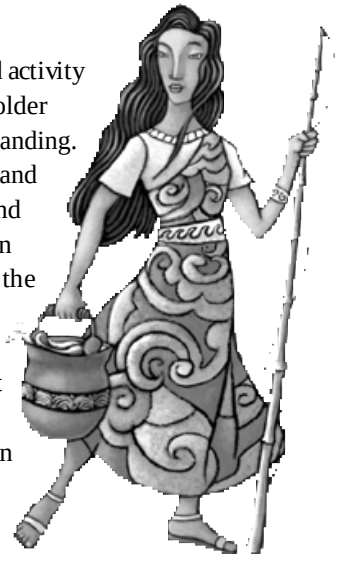
The Air Jack can be tricky for smaller children. If they can't pump hard enough to lift you, let them try to raise another child. Be sure the foot pedal is held down, or the air jack will deflate.

WATER

The Water area focuses on two facts about water: It takes effort to lift water (or anything else), and when water falls, it can do work. How many different places in this area can your children find where they have to do work to lift water? What do they think makes the waterwheel turn? Explain that a waterwheel can be used to turn motors or make machines run.

At Make a Fountain, give your children goals: What is the highest fountain they can make? How far can they make water travel? Can they make water go straight up? Can they have water come out of more than one opening at the same time?

There's more to do at the Boat Channels than building dams with the rocks. Suggest to them that building a channel with the rocks can make boats travel faster. Can they speed up the boats? [Children should discover that water will flow faster where the channel is narrow. But watch out—too narrow a channel and the boat will get stuck!]



Floating and Sinking Boats is a good activity to engage both younger children and older children at their own levels of understanding. Younger children can come to understand that weight makes a boat float lower and lower in the water, while older children may be interested in figuring out how the position of the weights can tip a boat over if they are not careful. [You might point out that an important part of loading an actual ship is making sure the cargo is balanced!] Ask children to describe what happens as they play.

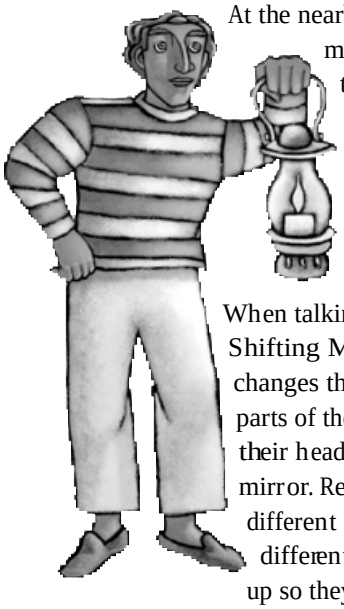
In the Exhibit (cont'd)

LIGHT (by the Lighthouse)

Make sure your children notice the Colored Shadows they cast when near the inside wall of the lighthouse. Children may want to know why these shadows are different colors. Have them look up and see what is special about the light. There are three lightbulbs shining on them, red, blue, and green. In some places their bodies will only block out one or two of these bulbs, letting some colored light reach the wall. The only places where their shadows will be black are where no light from any bulb can reach the wall.

At the Shadow Puzzle challenge children to make the Sun as big as possible, then as small as possible. You can make shadows bigger by bringing the slides nearer to the light. Try making some hand shadows on the wall—what different shadow shapes can your children make?

Children will be fascinated by the Mirror Maze; be sure to let them go through it several times to orient themselves. Younger children especially may need time to get familiar with it before they are ready to focus on any concrete questions. Once they have gotten used to the maze, ask them what is different about their reflections in the ceiling. [Those reflections, and the ones in the floor, are upside down. They seem to be hanging from their feet!]



At the nearby Laser Maze, you can point out that mirrors reflect light, and that light beams travel in straight lines. Remind children that they are trying to walk down the corridor without breaking the laser beams. The laser turns off the instant anything enters the path of the beam, so there is no danger to anyone's eyes.

When talking with children about the Shape Shifting Mirror, ask them to describe how it changes their body shapes. Can they still identify parts of their bodies? Have them point to where their head, knees, and shoulders are in the mirror. Remember that they are looking from a different angle than you are, and may see things differently than you do! If possible, lift them up so they see what the mirror looks like from your height. Also have them watch the mirror from the side, so they can see what happens to the mirror that makes the reflection change.

EARTH (in the Cave)

Only some of the objects at the Magnet Wall will actually stick to the wall. Those are the ones that have iron in them. Have children sort the objects into magnetic and nonmagnetic piles. Ask them to use one of the magnetic objects to hold up something non-magnetic, like an exhibit map.

If the Pattern Puzzle proves too hard for younger children, challenge them to put a part of the puzzle together, just four pieces or so.

Counting all of the Age Rings is tricky with the tree stump, because there are so many, spaced closely together. The rings on the turtle shell are easier to count once you know what to look for: the brown-and-white circles on the shell are its rings. There are many sets of rings all over the shell, but each set has four rings. This means this shell is four years old.

At Architect and Apprentice one person arranges some of their blocks in any pattern he or she likes. Then by describing how the blocks are arranged, he or she tries to get the person on the other side to create exactly the same pattern. The second person cannot look at the first person's blocks. This will give children practice with observing carefully, describing, listening, and following directions. Afterwards, switch roles. A variation to try after becoming expert at it: use only color words, not shape, size, or texture, to describe what you built.

The Mechanics Maze in the middle of the cave brings together many tools for pulling, pushing, and moving objects. Help your children move the balls all the way through to the end. In the center of the maze is a chute that can direct the balls onward only if it's turned to the correct position—ask your children to figure out which position it needs to be in. The muscle control needed to lift the magnetic elevator near the end may be more than small children are capable of; be ready to assist if necessary.

Fossil Rubbing gives kids a chance to experience something they might really discover in a cave. Ask if they can name something else that gets fossilized. [Dinosaur bones are a likely answer, but leaves, eggs, and even footprints can leave remnants or impressions in rock.]

Though these activities are divided into At Home and In School sections, many can be done either at home with a parent/caregiver or in a classroom of children. Look through both sections and decide which activities seem right for your situation.

In-School Air Activity:
Squeeze Box

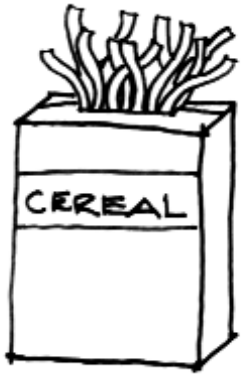
Science Concepts
Even though we can't see air, we know it is there because we can feel it as wind, and because it often has an effect on other things.

Skills
Observing, Drawing conclusions

National Science Education Standards include:
- Materials can exist in different states—solid, liquid, and gas.
- The position and motion of objects can be changed by pushing and pulling.

Suggested Time
20 minutes

Materials
Empty cereal box, crepe or tissue paper, scissors, tape for each group of four to six students.



Procedure
1. Cut a rectangular opening about 1/2 an inch wide and 5 inches long in the top of each box. It is easiest if you open the flaps of a box top and cut a hole in each flap. Before cutting the second flap, check to make sure that the holes will overlap when you put the two flaps together. Tape the flaps down so they cannot fly apart.
2. Divide the class into groups of 4-6 students.
3. Have each group make 2 dozen small streamers of crepe or tissue paper, about half an inch wide and 4 inches long.
4. For each group, tape the streamers to the edge of the hole so they hang down into the box.
5. Have each group pass their box around, feel it and shake it. What do they think is in the box, besides the streamers?
6. Then ask the students to squeeze the box by pushing in the center. (The streamers will stretch out from the box as the air escapes.) What does the class notice? Does this change their answer about what is in the box?

Students May Notice
Even if they thought the box had nothing in it besides the streamers, the fact that the streamers moved should help them realize that there is air in the box.

Extension
Ask what other ways the children know that air exists. Try using the squeeze box to move around other objects besides the streamers. How big or how heavy can something be and still be moved by the force of air from the box?

Connection to the KidScience Exhibit
At the Bubble Tubes you can see air as it rises through a liquid. The Tangled Tubes, Air Jack and Sailboats all use the force of blowing air to make things move.

In-School Air Activity:
Lift your teacher

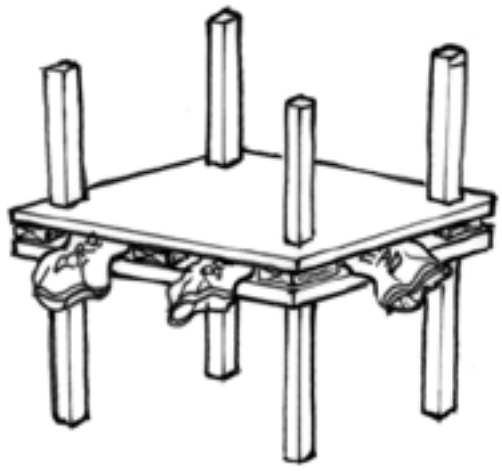
Science Concepts
Air can exert a great deal of pressure. That pressure can do work.

Skills
Observing, Describing, Measuring

National Science Education Standards include:
- The position and motion of objects can be changed by pushing and pulling

Suggested Time
15 minutes

Materials
Bread bags with no rips or holes in them (one per student), some small wooden blocks, rulers, two tables.



Procedure
1. Place a few wooden blocks on one table to act as shims.
2. Place all the bread bags in between the two tables, with the open ends of the bag hanging out over the edge.
3. Climb on top of the upside-down table.
4. Have each student inflate their bread bag by blowing into it at the same time.
5. Have some students measure how high the upper table rises.

Students May Notice
As the bags inflate, they push against the tables and actually manage to lift the upside-down table, even with the teacher sitting on it.

Extension
Have the class make predictions about how few bags are needed to lift the teacher and test them out. If the teacher climbs off the table, can they lift it higher? Ask the students to brainstorm some uses for this kind of air-lifter.

Connection to the KidScience Exhibit
Remind students about the Air Jack aboard the ship. What were they able to lift using that air pump?

In-School Earth Activity:
Measuring with Me

Science Concepts
There are many different units of measure for attributes like size, weight, and duration.

Rulers are a way for different people to measure the same way.

Skills
Measuring, Counting, Drawing conclusions

National Science Education Standards include:
- Use simple equipment and tools to gather data and extend the senses.
- Objects can be described through measurements.
- Rulers can measure the height, length, and depth of objects.

Suggested Time
30-45 minutes

Materials
Rulers or meter sticks, pencils and paper for recording results.

Procedure
1. Have each child in the class use the lengths of their feet as measuring instruments: Pick several distances to measure, such as the width of a door or the length of a carpet, and have each student measure how many of their feet, end-to-end one after another, it takes to measure each length. You can decide whether to have them round up or down, or use "and a half". Have them record their results on their papers.
2. Record each childs results on the board. Discuss the results. Why are there differences? Is one right and the others wrong? Talk about why rulers and metersticks are useful. What other units of measure can the children name?

Students May Notice
Everyone has a unique size and shape, so individuals' measurements will differ. Standard units like inches and feet are the same no matter who uses them. Besides length, we have units for weight, volume, duration, cost, and so on.

Extension
Try using the width or length of hands, or the children's armspans, to measure with. (Perhaps use the ancient measurement of a cubit—the length from elbow to longest fingertip.) Have children brainstorm ways they might use their whole body to measure other things than length, such as weight or time. If possible, test out their ideas to see if they work!

Connection to the KidScience Exhibit
In the exhibit, children measure how tall a magnetic sculpture they can make, and how high they can lift a person with the air jack.

Measuring devices are one type of tool. The Mechanics Maze in the Earth section of the exhibit lets children use many tools to move balls through a maze.

In-School Earth Activity:
Making Fossils

Science Concepts
A fossil is a remnant or impression of an object from long ago.

Skills
Model-making, Comparing, Describing

National Science Education Standards include:
- Fossils provide evidence about the plants and animals that lived long ago.
- Models help scientists understand how things work.

Suggested Time
Two 20-minute periods with an hour or more drying time in between.

Materials
Clay, small objects (shells and small toy animals work well), small plastic bowls or other containers, plaster of Paris.

Procedure
1. Have children take one bowl each and spread clay into the bottom to a depth of about an inch.
2. Give each child one object to create a fossil with. Have them press their object into the clay and then remove it, leaving an impression.
3. Mix the plaster of Paris yourself and pour it into the each bowl. Wait an hour for the plaster to set.
4. Have children carefully remove the plaster molds from the clay. How are the fossils they have made similar to the original objects? How are they different?

Students May Notice
The fossils do not actually contain any material that was in the original shells or toys from which they were made. Real fossils are sometimes just imprints of long-ago living things, but sometimes still contain material from the original creature. Children might observe that their fossils differ from the original objects in color, texture, and material. Also, the type of fossil they make shows only one side of the original object.

Extension
If some of the fossils break when "unearthed", have the children do what real fossil-hunters do: piece together the bits. Explain that this is much like a jigsaw puzzle. You might even make some fossils yourself, break them, and mix them together, then challenge the class to figure out what the "original creatures" looked like.

Connection to the KidScience Exhibit
You can make rubbings of our fossils inside the Cave. Have the children bring their fossils to KidScience and make rubbings of them.

In-School Light Activity:
Shadow Shapes

Science Concepts
Every object that is not transparent casts a shadow when light shines on it.

The shape of that shadow is related to the shape of the object, but its shadow may be different when the object is turned different ways.

Skills
Recognizing shapes, visualizing in three dimensions

National Science Education Standards include:
- Light travels in a straight line until it is blocked by an object.
- The form or shape of an objects is frequently related to its use.

Suggested Time
15-30 minutes

Materials
Flashlight, room that can be made fairly dark, objects with recognizable shapes (examples: scissors, spoon, shoe, flag, banana, book, etc.)

Procedure
1. Set up a flashlight about 15-20 feet from a wall, so it makes a bright spot partway up the wall. Darken the room so that when you hold an object a few feet in front of the flash light, it will cast a shadow in the light.
2. Have the class sit close to the wall so they can see the spot. Stand behind them but still several feet in front of the flashlight, so you can hold an object into the light's path without the children seeing what it is.
3. Stick one object at a time into the light and ask the class what they think you are holding up. Try holding some objects in positions that make their shadows less obvious (for example, scissors held edge-on will look like a straight line), and then slowly rotate the objects until their real identities become obvious.
4. Ask the class to predict what will happen to the shadow when you move an object closer to or farther from the wall. Try it.

Extension
The Sun Prints activity in this guide is a natural extension. After children have made sunprints, explore the differences between the shapes of the objects they used and the shapes of the shadows.

Connection to the KidScience Exhibit
When kids are inside the Lighthouse making colored shadows, challenge them to make shadows in as many different shapes as they can. At the Shadow Puzzle, ask the children what changes when they bring slides nearer to the wall.

In-School Light Activity:
Sun Prints

Science Concepts
Objects make shadows where they block light.

Sunlight has the power to change some materials.

Skills
Observing, Recognizing shapes, Drawing Conclusions

National Science Education Standards include:
- Light travels in a straight line until it is blocked by an object.

Suggested Time
30 minutes each on two successive days.

Materials
Construction paper that is NOT labeled "non-fading". If you prefer, special “sun print” paper is available in some craft stores. Small objects like shells, stones, and toys. Make a few of the objects transparent or translucent if possible.

Procedure
1. On a sunny day, spread the papers out near a window where sunlight will shine on them for several hours. If you can, open the windows or do the activity outdoors, so the sunlight is not shining through glass.
2. Assign each child a sheet of paper (or half-sheet, if space is limited) and allow them to choose one or more objects to place their sheets. Leave the sheets with their objects in place.
3. Make sure the objects are not touched. Check back the next day. If you use sunprint paper you will only need to wait a few minutes, not a day. Have the children lift the objects off the sheets and see what is left behind. What happened to the paper? Discuss the similarities and differences between the original objects and the shadow prints.

Students May Notice
Sunlight makes the paper fade and turn a lighter color. The shadow of an object is related to, but often not identical to, the shape of the original object. As sunlight falls on an object from different directions over the course of the day, its shadow will move around, which may bend or blur the shadow shape. The paper directly underneath the object receives no sunlight (provided the object is opaque), so that part of the paper will definitely not fade. Transparent objects may bend sunlight in different ways, resulting in interesting patterns on the paper.

Extension
Now that the children know what to expect, let them experiment. Can they position opaque and transparent objects to get a particular effect?

Look up *Lensless Photography* on the Web or at the library. Show the children pictures of some other ways of making pictures without a camera, similar to the ones they have just made. A particularly good site is at www.foto.no/nikon/farside2.html

In-School Water Activity:
Float a Boat

Science Concepts
Some shapes work well for boats, and others do not.
A boat can support objects that would not normally float by themselves.

The more weight a boat carries, the lower it will float, until it finally sinks!

Skills
Observing, Designing, Model-making, Counting

National Science Education Standards include:
- Design problems can require the implementation of ideas, the use of communication, and the application of procedures.

Suggested Time
30-45 minutes

Materials
Water table, fish tank(s) or sinkful of water to float boats, clay, weights (coins or stones work well).

Procedure
1. Hand out equal amounts of clay to every child, about a 2-inch sphere.
2. Have children work at the water stations to see whether their balls float or sink, and whether they can change the outcome by forming the clay into other shapes.
3. Once children have the idea of rafts or boats, hold a contest to see who can design the boat that will hold the most weight.
4. Allow 5-10 minutes design time, and then have the children test the ability of their boats to float. Make weights available to the children to use as cargo. Have them test their boats by adding weights to them until they sink, and counting how many the their boat could hold before it sank.
5. Discuss the testing process the class just did. What examples can the children think of in the real world where people test something they built? What kinds of tests might they make?

Students May Notice
Almost anything designed by people is tested: big objects such as planes and buildings, appliances such as refrigerators and TVs, personal items such as shirts and videotapes. Everything that is made is tested to make sure it can stand up to use. Reinforce the idea that building anything involves making sure it really does what its creator thinks it will.

Extension
Try other materials besides clay. Can the children make boats out of paper? Styrofoam? Straws and tape? What new problems arise when they use a different building material?

Connection to the KidScience Exhibit
Have the children try loading rocks into the boats floating in the KidScience stream. How many can they hold? Introduce the idea of placing the weights in the center of a boat so it won't tip to one side—does this make it easier for the boat to stay afloat?

In-School Water Activity:
Floating and Sinking

Science Concepts
Weight and size, flotation

Skills
Describing, Comparing, Predicting, Sorting

National Science Education Standards include:
- Understanding the properties of objects and materials

Suggested Time
20-30 minutes

Materials
Water table, fish tank, or sinkful of water, Small objects of different materials, (the more variety the better, for example marbles, corks, grapes, nails, paper clips, a ball of aluminum foil, plastic construction blocks, coins, pencils, etc.)

Procedure
1. Assemble a number of small objects of different materials. Distribute them to the class.
2. Have the children identify what each object is, and also what each is made of.
3. Ask the children to predict for each object whether it will float or sink in water. Then test each.
4. After each has been tested, discuss what common features all the items that sank have, and also the common features of these that floated.

Students May Notice
Some heavy things sink, but some light ones do, too. Most metal objects will sink, but a ball of aluminum foil will float. A big object such as a log can be heavy yet still float, while a tiny object must be very very light in order for it float. A paper clip, for example, is too heavy for its size to float. The actual term density, or the amount of material per volume, is a more advanced concept than appropriate for these ages, but this activity will start them thinking about the different factors that go into making something float or sink.

Extension
Test to see what items will float or sink in cooking oil (small cups of it will be enough). Can the children find anything that will float in one liquid but sink in the other?

Connection to the KidScience Exhibit
Find examples in the exhibit of objects that are sinking or floating (not just in the water area—look in the Air section as well). When you begin this activity, ask the children what they remember seeing sink or float in the exhibit.

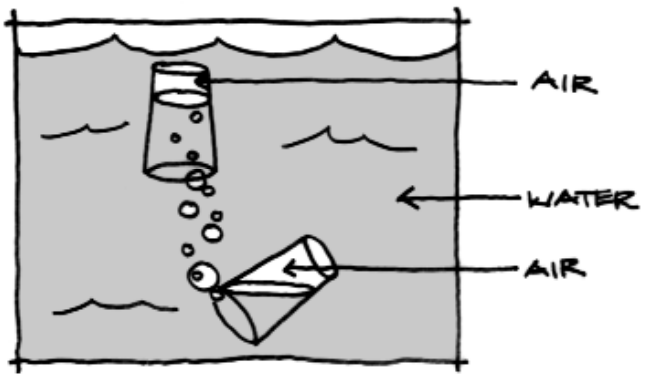
At-Home Air Activity:
Pouring Air

Science Concepts
Air is a substance. It can be moved, it takes up space, and water cannot enter a container unless the air leaves.

Skills
Observing, Motor coordination, Predicting

Suggested Time
15-30 minutes

Materials
Fish tank or dishpan filled with water, clear plastic cups, paper towel.



Procedure
1. Hold up a cup and ask your child if there is anything inside it.
2. Turn the cup upside down and lower it into the water. Keep the cup underwater and slowly turn it right-side-up and see what comes out.
3. Do the same thing, but this time have the child try to catch the air. Have them lower a cup of their own into the water, right-side-up so it fills with water. Then have them turn it upside down, still filled with water. If they hold their cup over yours, you can "pour" the air from your cup into theirs. Play pouring it back and forth for a while.

Students May Notice
Your child should notice that there is air in the upside-down cup. Air fills up part of the cup and keeps water from flowing into that part. Air keeps rising upwards in the water, so you can only "pour" air up, not down.

Extension
Take a dry cup and crumple up a big piece of paper towel in the bottom. Wedge the paper towel in, so it stays there when you turn the cup upside down. Lower the upside-down cup into the water and ask whether the paper is getting wet. Lift the cup back out (keeping it upside down so the air does not leave it), and check the towel. It will still be dry, because the air stayed in the cup, so the water could not get in.

Connection to the KidScience Exhibit
Make a connection with the tall Bubble Tubes near the entrance to KidScience. Can they remember what was different about the speed of those bubbles? [They moved more slowly through the thicker liquid]

At-Home Air Activity:
Bottle Blowers

Science Concepts
Sound is made by moving air.

A wind instrument can make lower or higher notes when you increase or decrease the amount of air in it.

Skills
Observing, Drawing conclusions

Suggested Time
10-15 minutes

Materials
Narrow-mouthed plastic soda bottle, water.

Procedure
1. Make sure the bottle is well cleaned.
2. Fill it about halfway with water. Have your child blow horizontally over the top of the bottle, like they were blowing out a candle on the other side. Can they hear the bottle making a musical note? Blowing in a steady stream may take some practice, so be ready to help show them how.
3. Add more water to the bottle so it's three-quarters full, and have your child blow again. Ask them what is different about the note. [It will be higher in pitch.]
4. Can they predict what will happen if most of the water is poured out and they try blowing again? Test their prediction, and keep experimenting to see what else they can find out.

Students May Notice
An empty bottle will make the lowest note, and the more water you add, the higher the note will become. A very full bottle may not make any note at all. It's the air inside the bottle that makes the music. A tall column of air will make a lower note, and a shorter one will make a higher note. A full bottle doesn't have any air inside, so no note is made at all!

Extension
Get several bottles and try to put the right amounts of water in each to play a series of notes, a scale, or "Mary Had a Little Lamb."

Connection to the KidScience Exhibit
The Fog Horns make noise when you push air into them. The shortest one makes the highest-pitch note, and the tallest one makes the deepest note. If your child has already done this Bottle Blowers activity, ask if he or she can predict ahead of time which horn will make the highest note.

At-Home Earth Activity:
Stone Safari

Science Concepts
Rocks vary by size, color, weight, texture, hardness, and other characteristics.

Skills
Observing, Comparing, Sorting, Describing

Suggested Time
30 minutes to 2 hours

Materials
Collecting box for storing rocks in (an empty egg carton works well), marker, magnifying glass (optional).

Procedure
1. Go on safari together around the block or in a park to look for different types of stones that your child thinks are "interesting". They might look for different colors, unusual shapes, patterns in the rock, or other features.
2. After you and your child have assembled a collection of a dozen or more, work together to arrange them in some sort of order. What different ways could the stones be arranged? Are there two or more stones that seem to be the same kind of stone? Which are the most different?
3. Have your child write, either on the egg carton sections or on small slips of paper, the features that distinguish each stone. Use these as labels.

Students May Notice
Your child may concentrate on one property of stones, such as color, in describing them. Help them to notice other features that differ from stone to stone.

Extension
Books and web sites can provide more information about common rocks and minerals that can help identify what you and your child have found.

Connection to the KidScience Exhibit
Inside the cave is the Architect and Apprentice Station, where being able to describe the features of different blocks is important. The skills your child practices in making observations of the stones will come in handy.

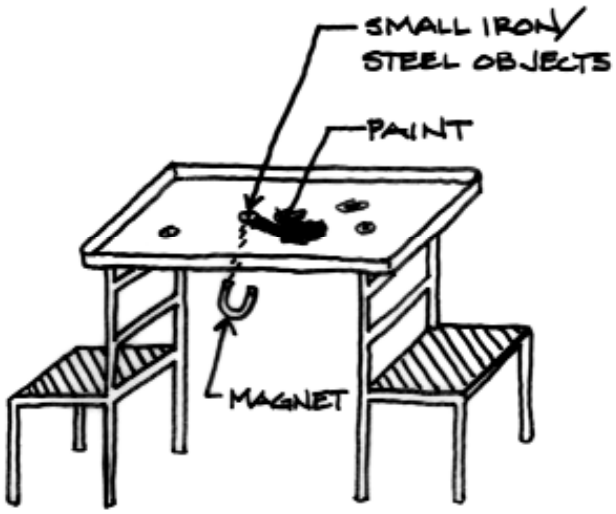
At-Home Earth Activity:
Magnet Paintings

Science Concepts
Magnets can attract pieces of iron or steel, even through other materials.

Skills
Using magnets, Creativity, Motor coordination

Suggested Time
15-30 minutes

Materials
One or more magnets (the stronger the better), aluminum pan or cardboard box lid, paper cut to fit exactly inside the pan or lid, tape, paint, small iron or steel objects such as paper clips, washers, etc.



Procedure
1. Have your child tape the paper in the pan or box lid. Then put a few drops of paint on the paper. Put a few metal objects on the paper.
2. Hold the pan or box lid by the ends, or support it between the backs of two chairs. Have your child hold a magnet under the pan or box lid and move the metal objects around through the paint to make a painting. If you have several magnets of different strengths, have your child try each of them.
3. Discuss what is happening. Why do the objects move? Can your child move just one at a time, or do all the objects move together?

Students May Notice
A magnet will pull some types of metal toward it, even through the pan. Once several objects are brought together, the magnet will pull all of them around at once. it will be difficult to separate them using the magnet alone. Fingers will still work, of course!

Extension
Challenge your child to control the magnet well enough to write his or her name on the paper.
You can mix some nonmagnetic objects in with the iron/steel ones, and explore what the magnet will move, and what it won't. Are there metals that a magnet won't pull? [Yes, including every US coin.] Put another magnet in the pan, and see if it can be repelled by the magnet underneath.

Connection to the KidScience Exhibit
Begin this activity by reminding your child about the wall in the cave where they could stick metal objects. Do they remember what held the objects there? What do they think was behind the wall?

At-Home Light Activity:
Reflection Maze

Science Concepts
Light travels in straight lines.

Light bounces off shiny surfaces.

Introduction to angles.

Skills
Observing, Motor coordination

Suggested Time
15-30 minutes

Materials
Flashlight, shiny flat object (mirror, lid of a tin, or a similar flat, reflective surface.)

Procedure
1. Experiment together with how a shiny object can bounce the flashlight around. It may help to darken the room.
2. Hold the flashlight in one direction (or place it on a table so it will not move), and have your child use the shiny object to guide the light's reflection along a "maze" on the wall. For example, your child could move the spot up one side of a door frame, across the top, and down the other side, or move it from a ceiling lamp to a smoke detector.

Students May Notice
The light will move based on the direction the shiny object is held. Light bounces off its surface like a ball bouncing off a wall. The direction it bounces is different if it hits the reflective surface straight on or at an angle.

Extension
Play a prediction game. Rest the flashlight on a table so it will not move. Then have your child hold the reflective surface in the beam. Switch the flashlight off, and have your child turn the surface to face in a slightly different direction. Ask them to predict where the flashlight's reflection will shine when you switch the light back on. Then test that prediction (being careful not to move the flashlight while turning it on). Do this several times to see if your child can improve his or her predictions and knowledge of reflections.

Connection to the KidScience Exhibit
When you're walking through the Mirror Maze, point out how light is reflecting off the shiny walls. Can your child trace how light from, for example, your shoes, bounces off walls before reaching their eyes?

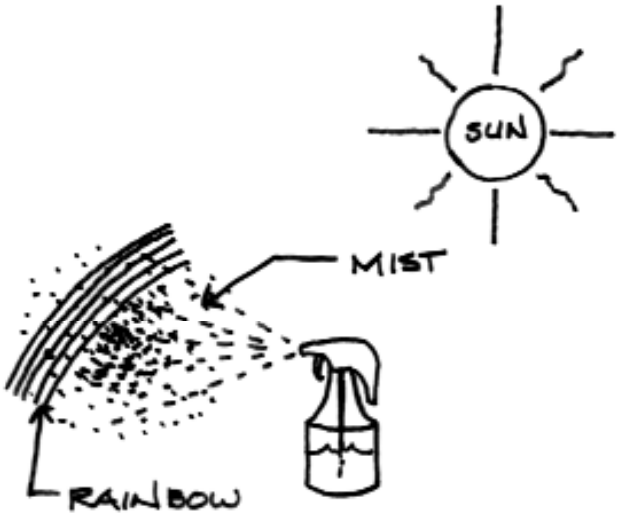
At-Home Light Activity:
Make Rainbows

Science Concepts
Sunlight contains a rainbow of colors mixed together. Those colors can be separated using water drops.

Skills
Observing, Describing, Drawing

Suggested Time
15-30 minutes

Materials
Warm sunny day, plant mister or spray bottle, paper and markers.



Procedure
1. Go outside to a place where the sun is shining. Have your child hold the spray bottle and stand facing his or her shadow (so the child's back is to the Sun).
2. Have your child spray the bottle into the air in front of and a little above him or her. Together, look into the spray and see if there are any colors in it. If sunlight is striking the water drops, they should create a rainbow, visible at least from where your child is standing.
3. Ask what colors they see in the mist. How long do they last? Can they be made brighter? Go back inside and ask your child to draw what he or she saw.

Students May Notice
The rainbow is created from sun lighting the tiny drops of water in the mist. Sunlight contains all the colors of the rainbow mixed together to make white light. The water drops can spread that light out into its separate colors. Once the mist stops, the rainbow disappears. A rainbow in the sky means there are water drops up in the air in that direction, bouncing sunlight around in the same way.

Extension
Get some bubble solution and blow bubbles, again in direct sunlight. Ask if there are similar patterns of color in the bubble. Soap film also breaks sunlight up into a rainbow of colors.

Connection to the KidScience Exhibit
The Lighthouse has three colored lights which together make white, the same way sunlight has a whole rainbow of colors. When you're in the exhibit, point out how the three lights make white when they shine together. When you do this activity, refer back to that experience with the lights.

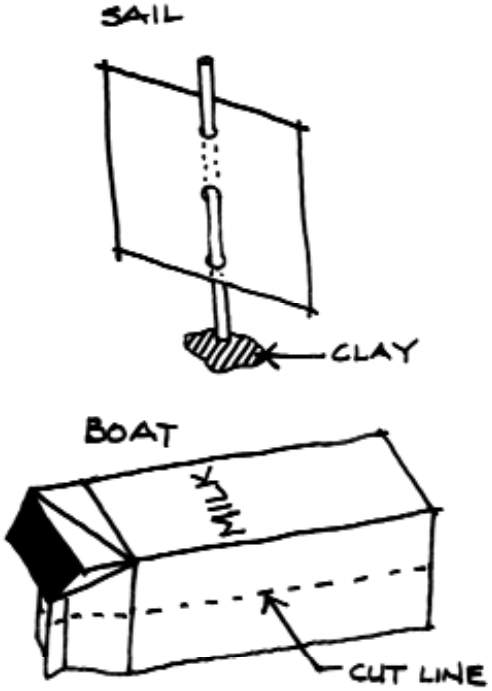
At-Home Water Activity:
Milk-Carton Boats

Science Concepts
Flotation, Stability, Wind power

Skills
Construction, Following directions

Suggested Time
30-45 minutes

Materials
Empty half-gallon milk carton, marker, scissors, pencil or soda straw, construction paper, hole punch, clay or tape (the kind that stays sticky when wet), coins.



Procedure
1. Lay the milk carton down on a table with the spout side facing up. Draw a line all the way around the carton, about two inches above the tabletop. Cut the carton in half along this line. The half without the spout will be the boat.
2. Have your child make the ship's sail by cutting a 6" square of construction paper, punching three holes in a line down the center, and weaving a pencil or straw in one hole and out the next, attaching the "sail" to the "mast". Then have your child put some clay in the center of the boat and stick the mast into it. You can also use tape to attach the mast to the boat.
3. Float the boat in a tub or basin. If it is unstable and keeps tipping over, experiment together to see how you can make the boat stay upright.
4. Use a fan, a newspaper, or just your breath to blow the boat around. Can you work together to make it go faster?
5. Add coins or small rocks to the boat until it starts to sink. How much weight can the boat carry? How does the boat's position in the water change as more weight is added?

Students May Notice
A 'tippy' boat can be fixed by adding more weight—clay, coins, or rocks. The heavier the boat gets, the lower it sits in the water, the slower it moves, and the easier it is for water to get in. However, it will also be harder for a wave to flip over a heavy boat.

Extension
Find books about different types of boats. Can your child modify your boat so it is more like a catamaran? A clipper ship? Some other type of boat?

Connection to the KidScience Exhibit
Bring this boat with you to The Franklin Institute and sail it in our pool. At the Floaters and Sinkers station your child can see how much weight different boats can carry.

Further Resources

The complete National Science Education Standards (NSES) is available free online, at: http://books.nap.edu/html/nses/html/index.html. Section 6 will be of most interest to parents/caregivers, whereas teachers will find the entire document of interest.

A supplement to the Standards talks about Inquiry-Based Learning, an important part of NSES that you've experienced by visiting KidScience. Inquiry involves experiments and explorations, letting a learner's natural curiosity guide their learning. This supplement is at: http://books.nap.edu/html/inquiry_addendum/

If you would prefer a physical copy of the book, it can be ordered from The National Academy Press, 2101 Constitution Avenue NW, Lockbox 285, Washington, DC 20055 1-888-624-8373 http://books.nap.edu/catalog/4962.html

The State of New Jersey has a specific Core Science Curriculum, located on the web at: http://www.state.nj.us/njded/cccs/10sciintro.html

Delaware also has state-specific standards for science education: http://www.doe.state.de.us/Standards/Science/science_toc.html

As of the creation of this Guide, state science education standards had not been officially adopted for Pennsylvania. However, a draft was available at: http://www.pde.psu.edu/standard/science.pdf

Also on the web, visit The Franklin Institute's site to view and download a huge collection of science activities to do on the web, at school, and at home: http://www.fi.edu/learning.html

The US Department of Education offers a site full of activities and information for helping parents help their young children learn science at home: http://www.ed.gov/pubs/parents/Science/

Recommended Books

For further activities and information on Air, Earth, Light, Water, and science in general:

Boston Children's Museum Activity Books, Bernie Zubrowski. Morrow Junior Books

Bubble Monster and Other Science Fun, John H. Falk, et. al. Chicago Review Press

An Early Start to Science, Roy Richards, Margaret Collis, and Doug Kincaid. Stanley Thornes

Mudpies to Magnets, Robert A. Williams, Robert E. Rockwell, and Elizabeth A. Sherwood. Gryphon House

Science Is..., Susan V. Bosak, Douglas A. Bosak, and Brian A. Puppa. Scholastic Canada

The Usborne Books of Science Activities series. Usborne Publishing

Magazines and Periodicals:

Science Weekly, Subscription Department, Science Weekly, P.O. Box 70154, Washington, DC 20088-0154. www.scienceweekly.com Published 16 times a year, this is designed for elementary classrooms

Scientific American Explorations, 415 Madison Avenue, New York, NY 10017. www.explorations.org A magazine of family science activities and science museums.