NATIONAL GEOGRAPHIC

SCIENCE

STEM INQUIRY
ACTIVITY SAMPLES

How Scientists Work
Inventions: Putting Things Together
GRADES 1–2

Science and Technology
Using Solar Energy
GRADE 3

Directed Inquiry
Investigate Circuits
GRADE 4

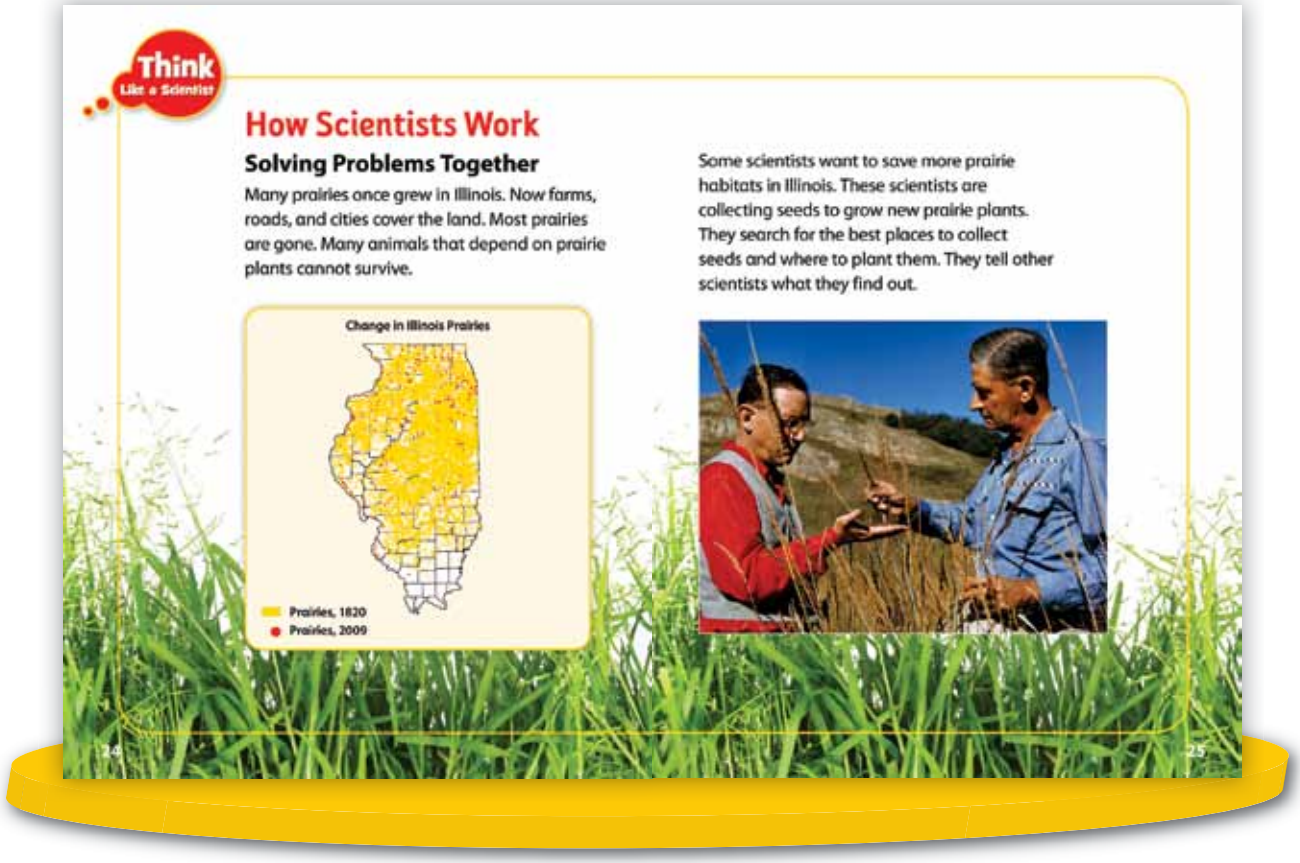
How Scientists Work
Designing Machines to Solve Problems
GRADE 5

NATIONAL GEOGRAPHIC Science

Revealing the Nature of Science

In ***National Geographic Science,*** process skills build at each grade level to ensure a complete understanding of the Nature of Science. Throughout the program, process skills and the Nature of Science work together to help students think and act like scientists.

PROCESS SKILLS	Kindergarten OBSERVE	Grades 1 & 2 OBSERVE & INFER
Nature of Science	• Science knowledge is based on evidence. • Science knowledge can change based on new evidence.	• Science conclusions are based on observation and inference. • Science theories are based partly on things that cannot be observed.



Immerse Students in the Nature of Science and Inquiry

Modeling Real Scientists in the Field

Grade 3	Grade 4	Grade 5
CLASSIFY	**PREDICT/HYPOTHESIZE**	**DESIGN EXPERIMENTS**
• There is often no single "right" answer in science.	• Scientific theories provide the base upon which predictions and hypotheses are built.	• There is no single, scientific method that all scientists follow. • There are a number of ways to do science.

Think Like a Scientist

Grades 1-2

How Scientists Work

Inventions: Putting Things Together

Look at the parts in the picture. How would you put the parts together to invent a racer? Think about what the parts can do together that they cannot do alone.

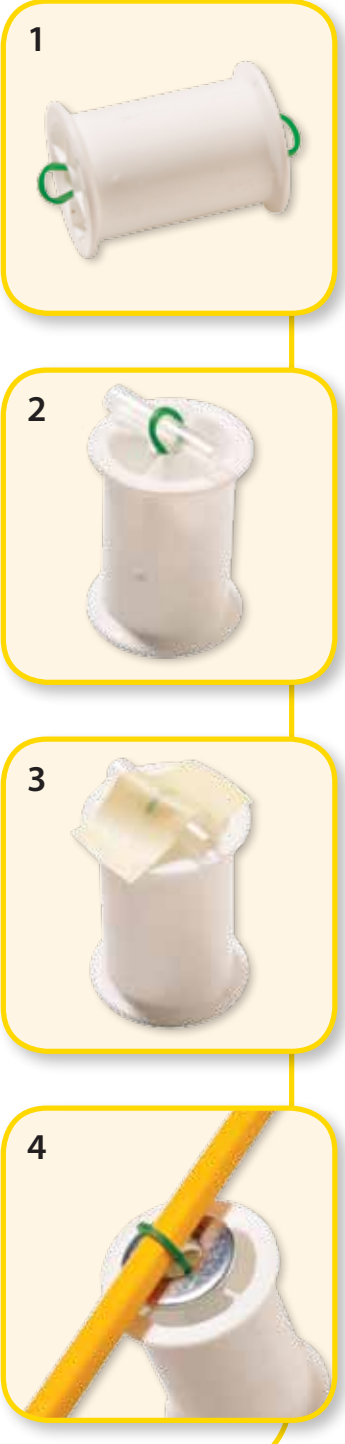
Here is one way you might use the parts in the picture to make a racer.

1. Slip the rubber band in the hole of the spool.

2. Put the piece of straw in one loop of the rubber band.

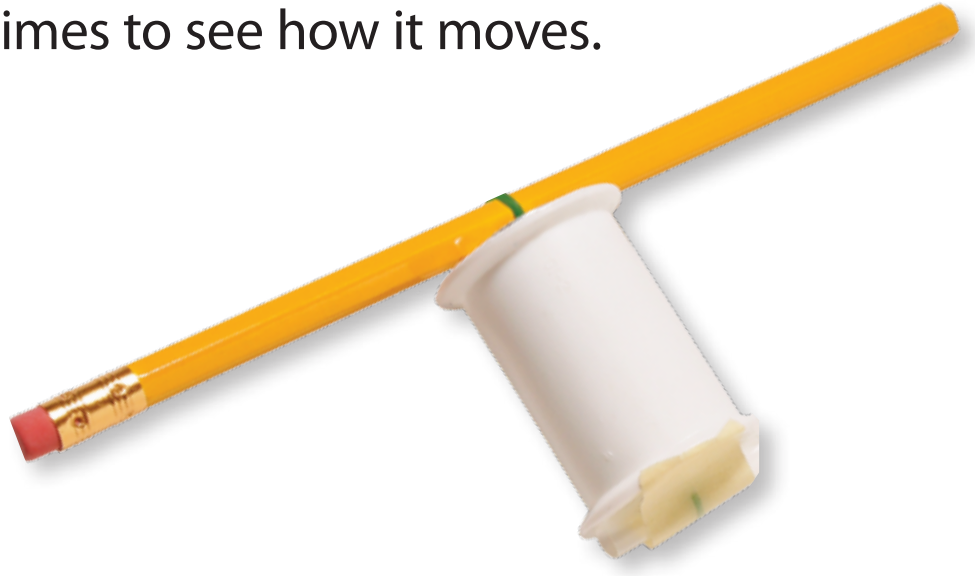
3. Tape the straw to the spool.

4. Slip the washer over the loop on the other side of the spool. Put the pencil in the loop.



continued

You have made a racer! Now you need to test it. Twist the pencil 20 times. Place the racer on the floor. Watch it move across the surface! Test it 3 more times to see how it moves.



▶ What Did You Find Out?

1. What could the parts do together that they could not do alone?
2. What made the racer move?

Put Things Together

1. Look at the parts above. What parts can you use to make your racer better? Can you make it go faster? Can you make it go farther?
   - What parts will you use to change your racer?
   - How will you put the parts together? List the steps.
2. Try your new racer again and again. How does the racer move now?

Think Like a Scientist

Grade 3

Science and Technology

Using Solar Energy

Solar energy is energy from the sun. It is Earth's most plentiful energy source. Solar energy is a renewable energy source. A renewable energy source is a resource that will not run out.

Energy from the sun can be changed into other forms of energy, such as heat and electricity.

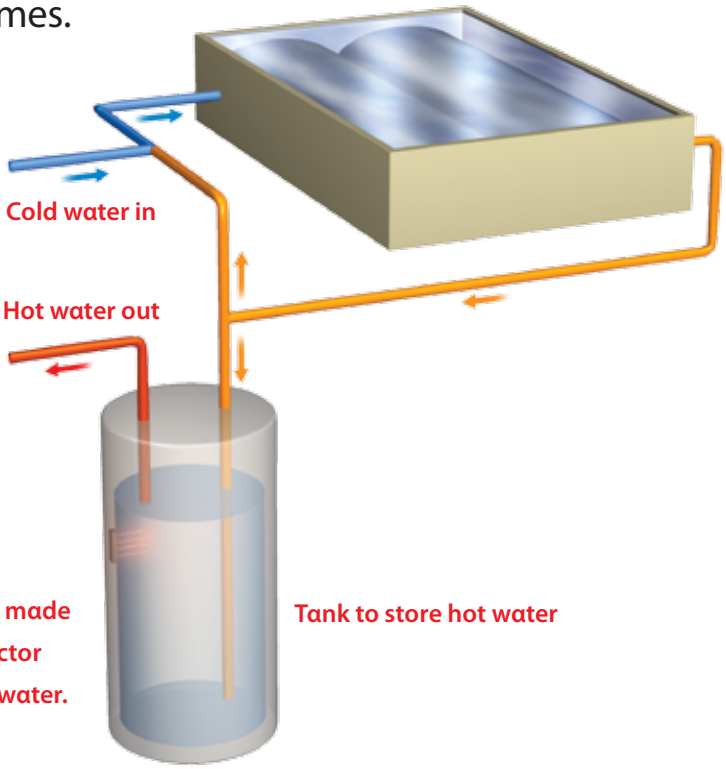
Solar energy can be changed into electricity using a solar cell. Most calculators contain a small solar cell.

The small, flat solar cell can change solar energy into electricity to run a calculator.

Solar Power Plants Some sunny, warm states are developing solar energy power plants. These power plants use solar energy to make electricity.

This solar farm in Arcadia, Florida, can make electric power for many homes.

Solar Water Heating Solar energy is also used to heat water in people's homes. The simplest solar water heating systems are called passive solar water heaters. This type of solar heater is most common in places without long periods of freezing temperatures, such as in much of the southern United States.



Passive solar water heaters are made of two main parts: a solar collector and a tank to store the heated water.

People use a solar cooker to cook rice in a village in Zambia, Africa.

Solar Ovens You may know that sunlight can make objects warm, or even hot. Hundreds of years ago, people used sunlight to start fires. Then about 200 years ago, a scientist built a solar oven.

Today different kinds of solar ovens and solar cookers are used all over the world. Solar cookers are cheap to make and easy to use. People can easily carry them from one place to another. Most importantly, solar cookers can heat food and water hot enough to make them safe to eat and drink.

SUMMARIZE

What Did You Find Out?

1. What is solar energy?
2. Why is solar energy a good source of energy?
3. How is solar energy used?

Observe Solar Energy

You can observe how the sun's energy heats objects. Follow the steps below using 3 smooth black rocks.

1. Build a "house" for 1 of the rocks. Place a small box inside a larger box. Use paper towels to fill the spaces between the boxes.

2. Put the rock inside the house and cover the opening with plastic wrap and a rubber band. Place the house in a sunny spot so that the sunlight shines directly on the rock.

3. Place the other 2 rocks in the sunlight next to the house. Cover 1 rock with a clear plastic cup.

4. After 30 minutes, feel each rock. Which rock feels the warmest? Explain why you think this is so.

Directed Inquiry

Investigate Circuits

Grade 4

Question How are series circuits and parallel circuits different?

Science Process Vocabulary

predict verb

You **predict** when you tell what you think will happen.

compare verb

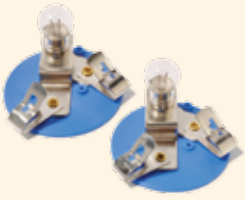
When you **compare,** you tell how objects or events are alike and different.

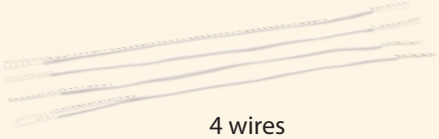
Materials


safety goggles


battery

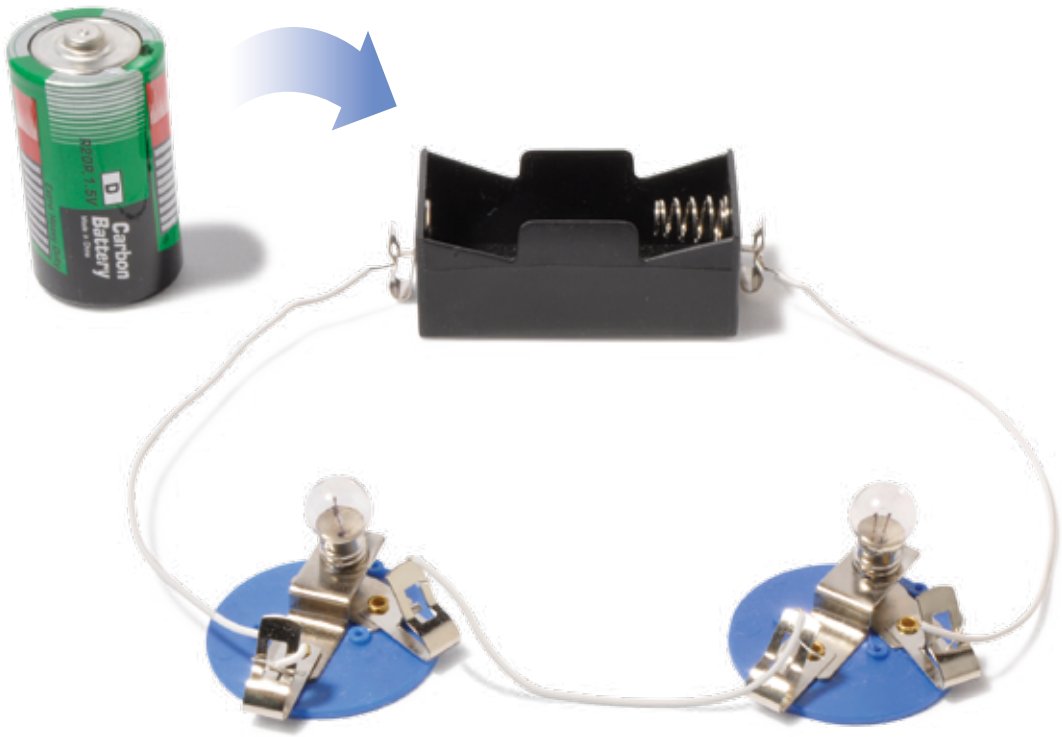

battery holder


2 light bulbs and holders


4 wires

What to Do

1. Put on your safety goggles. Use 3 wires to make a series circuit. Connect the wires to the light bulb holders and the battery holder. Then put the battery in the battery holder.



2. **Observe** what happens when all the parts of the circuit are connected. Record your observations in your science notebook. Draw a diagram that shows the parts of your series circuit.

3. What do you think will happen if you unscrew 1 light bulb? Record your **prediction.** Then remove a light bulb from the series circuit and record what happens.

What to Do, continued

4. Take apart the series circuit. Use 4 wires to make a parallel circuit. Record what happens when all the parts of the circuit are connected. Draw a diagram of your parallel circuit.

5. Predict what will happen if you remove 1 light bulb from the parallel circuit. Record your prediction. Then remove a light bulb from the parallel circuit and record what happens.

Record

Write and draw in your science notebook.
Use a table like this one.

my SCIENCE notebook

Series and Parallel Circuits

Type of Circuit	Observations: Circuit With All Parts Connected	Prediction: What Will Happen If a Light Bulb Is Removed?	Observations: Circuit With Light Bulb Removed
Series			
Parallel			

Series Circuit Diagram

Parallel Circuit Diagram

Explain and Conclude

1. Did your **observations** support your **predictions?** Explain.
2. **Compare** your observations of the two circuits after you removed a light bulb. How is the parallel circuit different from the series circuit?
3. Why do you think parallel circuits are more commonly used than series circuits?

Think of Another Question

What else would you like to find out about series and parallel circuits? How could you find an answer to this question?

Complex circuits like this one can carry electrical energy to hundreds or even thousands of homes.

Think Like a Scientist

Grade 5

How Scientists Work

Designing Machines to Solve Problems

Scientists and engineers often design and build machines that solve a problem. Every machine does work, and usually this work makes tasks easier for humans. Sometimes, though, machines are designed to help people have fun! For instance, a machine can solve the problem of how to fit a 30-meter water slide in an area 6 meters wide and 9 meters long.

The spiral water slide is a ramp.

Most of the machines you use are compound machines made up of several simple machines. The simple machines work together so that the compound machine can do a job with the least amount of work.

A pizza cutter is a compound machine that solves the problem, "How can you slice a pizza with a diameter that is greater than the length of most knives?"

The pizza cutter is made up of a wedge and a wheel-and-axle.

Robotic arms are compound machines that include wedges, levers, wheels-and-axles, pulleys, and screws. These machines are widely used in manufacturing. They complete repetitive or unsafe tasks.

Once scientists saw how useful robotic arms were, they turned to a new problem: developing a robot that looks and moves like a human. Early robots called Robot Assistants could sweep the floor, collect dirty dishes, load the dishwasher, and move chairs. Scientists tested the robots by giving them simple tasks to perform.

Now scientists are working to adapt the Robot Assistant to be a caregiver for people who need extra help. Scientists want the Robot Assistant to keep track of a patient's vital signs, make sure a patient takes medicines properly, and alert medical staff in case of an emergency.

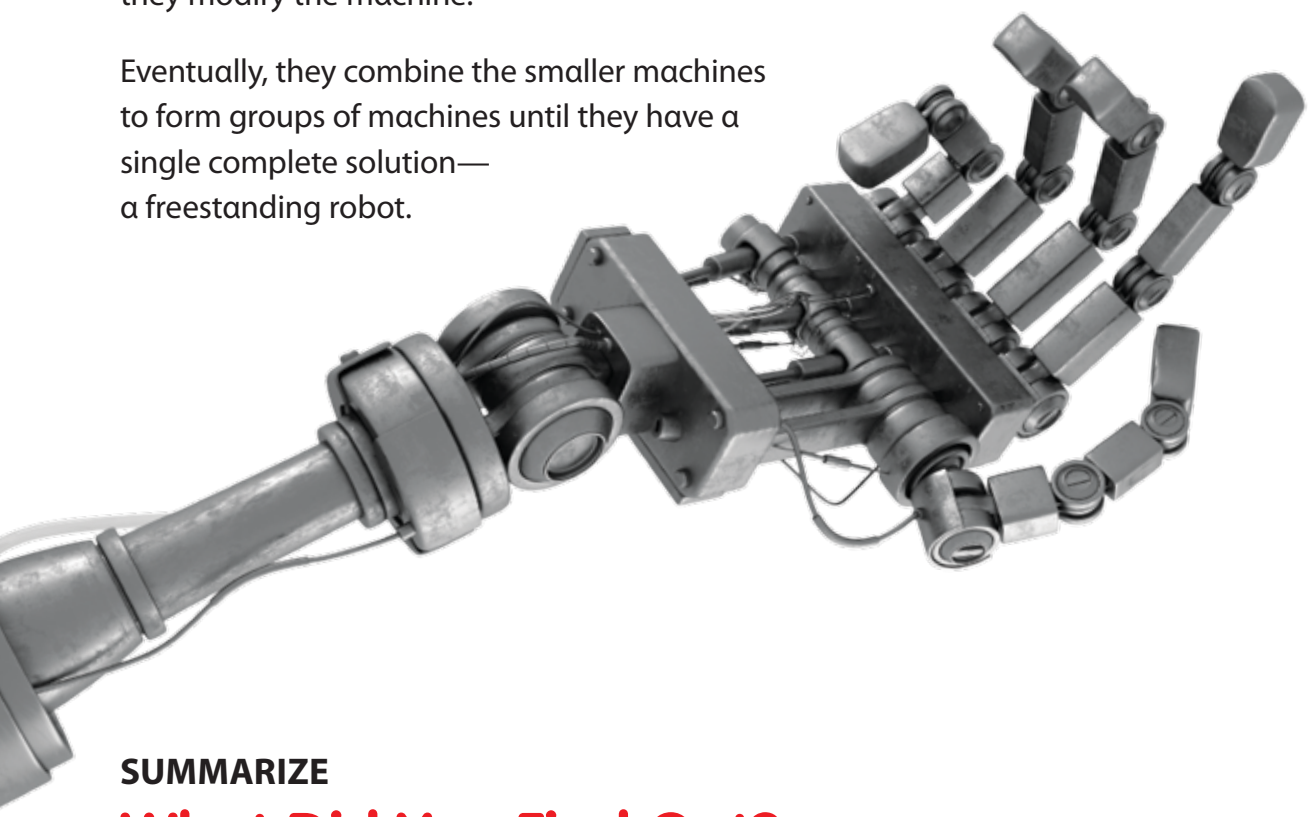
A robotic arm

Scientists are developing walking, talking robots that look like humans. These robots could act as caregivers for people who need help.

Scientists and engineers use a number of steps when they develop a machine to solve a problem. Many times, they break up the problem into simpler problems. Then they generate solutions for each of the simpler problems.

For example, one step in designing an entire robot was to develop a machine that worked like a forearm. In another step, scientists developed a lever system that functions like our thumb and index finger. Scientists may build and test hundreds of smaller machines. They test each machine using suitable instruments and techniques. They record measurements and other data. Then they assess results and the effectiveness of the machine. If necessary, they modify the machine.

Eventually, they combine the smaller machines to form groups of machines until they have a single complete solution—a freestanding robot.

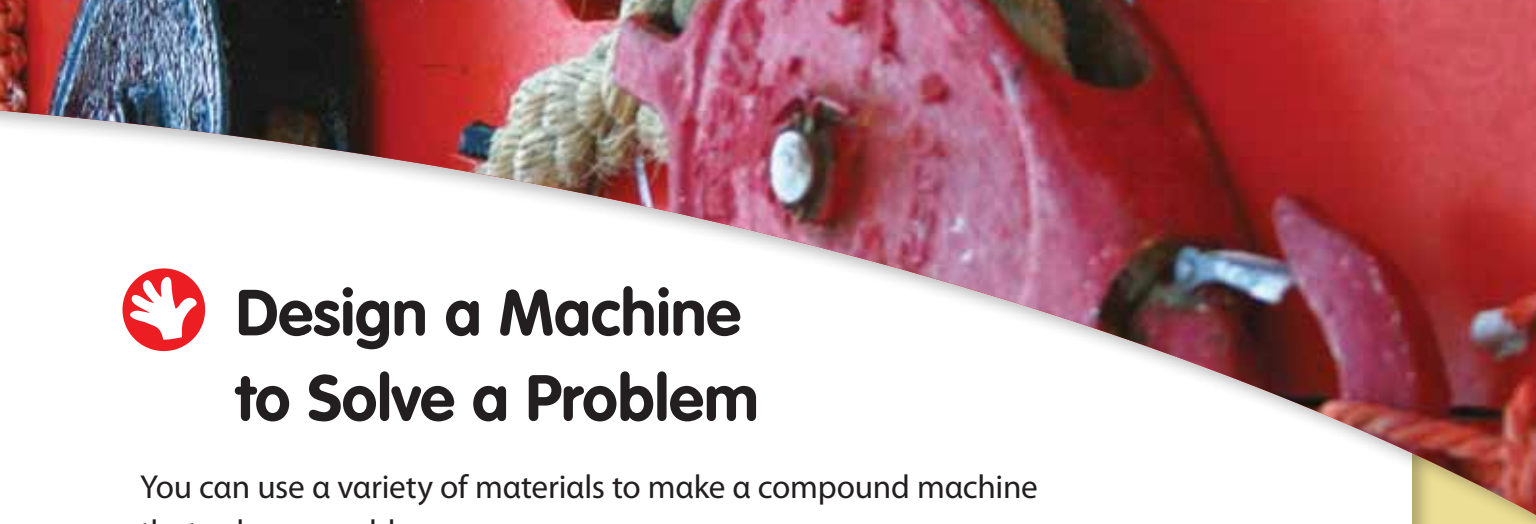


SUMMARIZE

What Did You Find Out?

1. Why do scientists design machines?

2. What is one step scientists might take when they start to design a machine to solve a problem?



Design a Machine to Solve a Problem

You can use a variety of materials to make a compound machine that solves a problem.

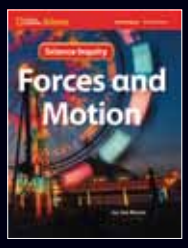
- Choose a problem to solve.
- Design a compound machine that solves the problem. Tell what the machine must do. Describe anything the machine must *not* do.
- Draw a diagram of your design. Label the simple machines that make up your compound machine.
- Record and collect the materials and tools you need to build your machine.
- Build and test your machine.
- Discuss your results with others.
- Change or rework your design to make your machine work better.
- Test again. Record your results.

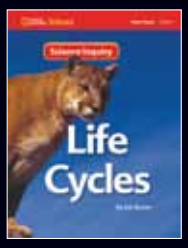
Name of Machine _____

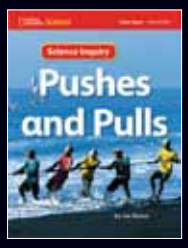
Problem to solve	
What the machine must do	
What the machine must not do	
Materials used	
First test results	
Changes needed	
Second test results	

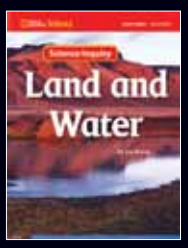
NATIONAL GEOGRAPHIC SCIENCE

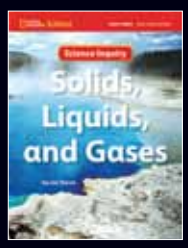
Kindergarten Science Inquiry Books











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