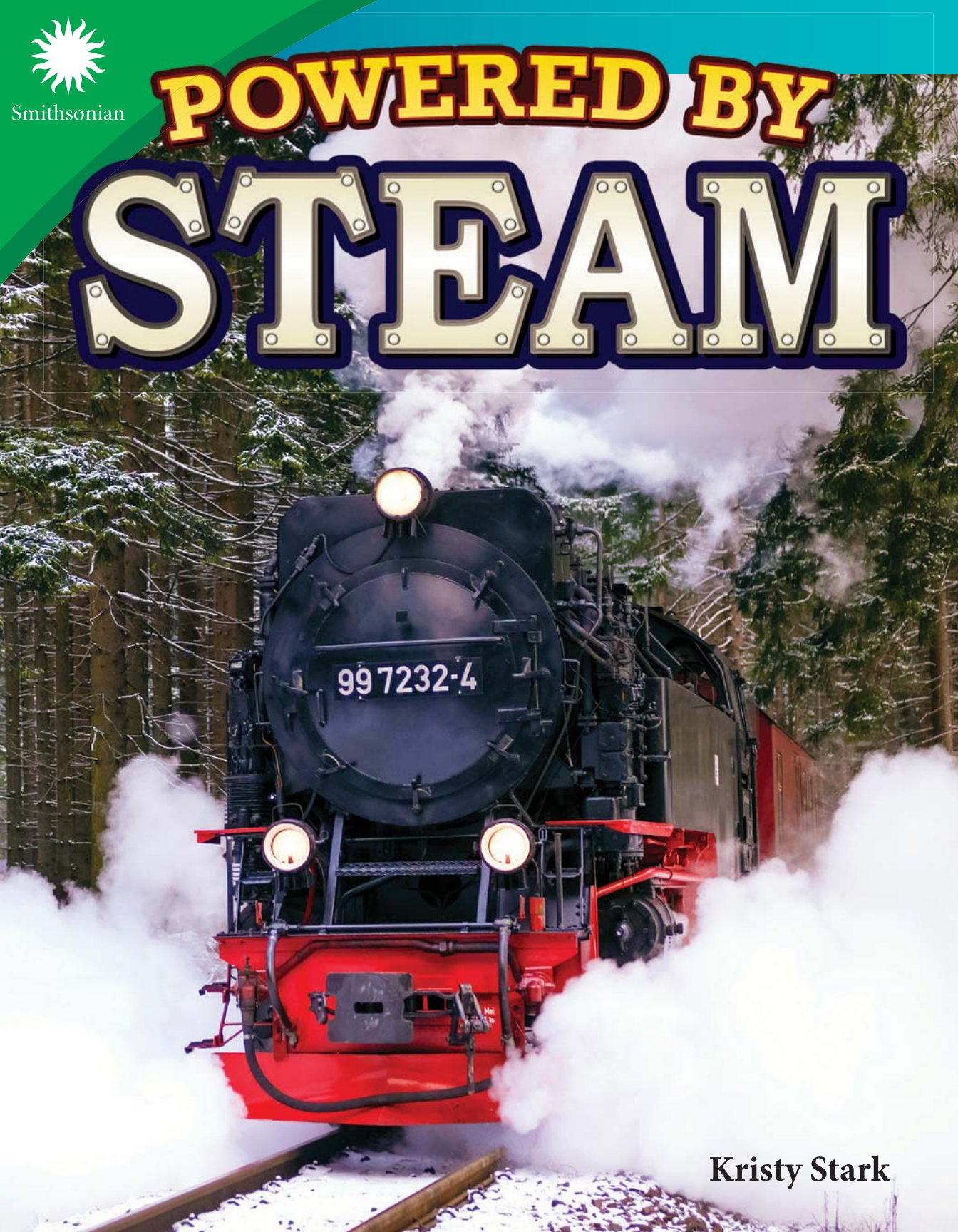
Smithsonian

POWERED BY STEAM



Kristy Stark

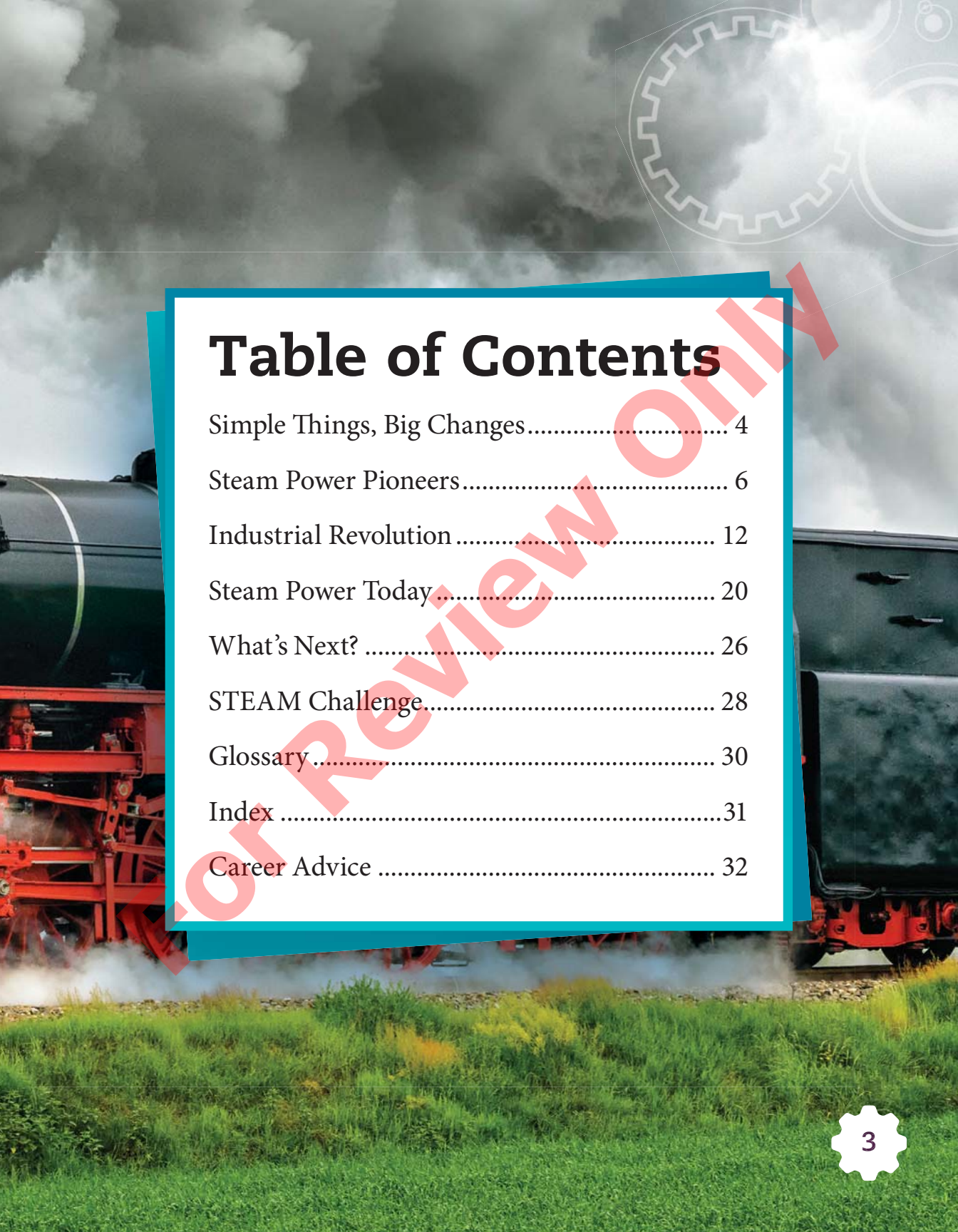


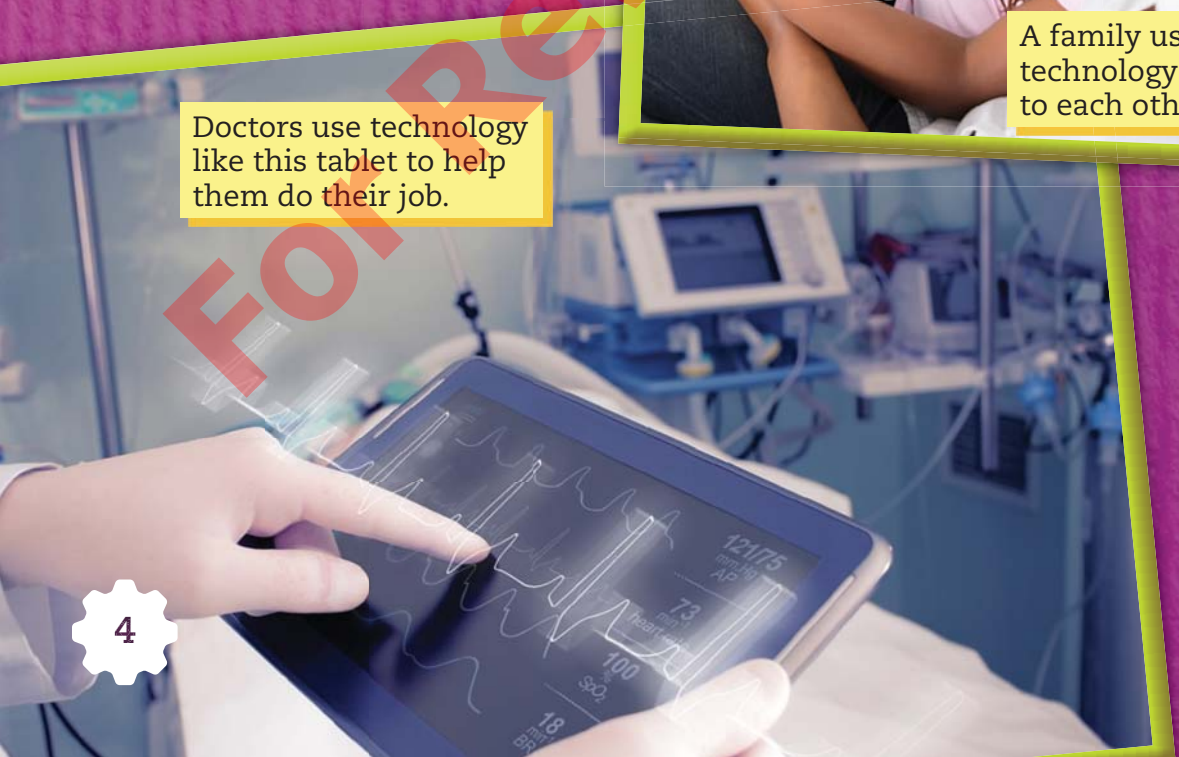
Table of Contents

Simple Things, Big Changes

People use devices and tools that make life easier. Computers and smartphones have changed the way people live. Technology has made our lives easier in many ways. But technology needs power.

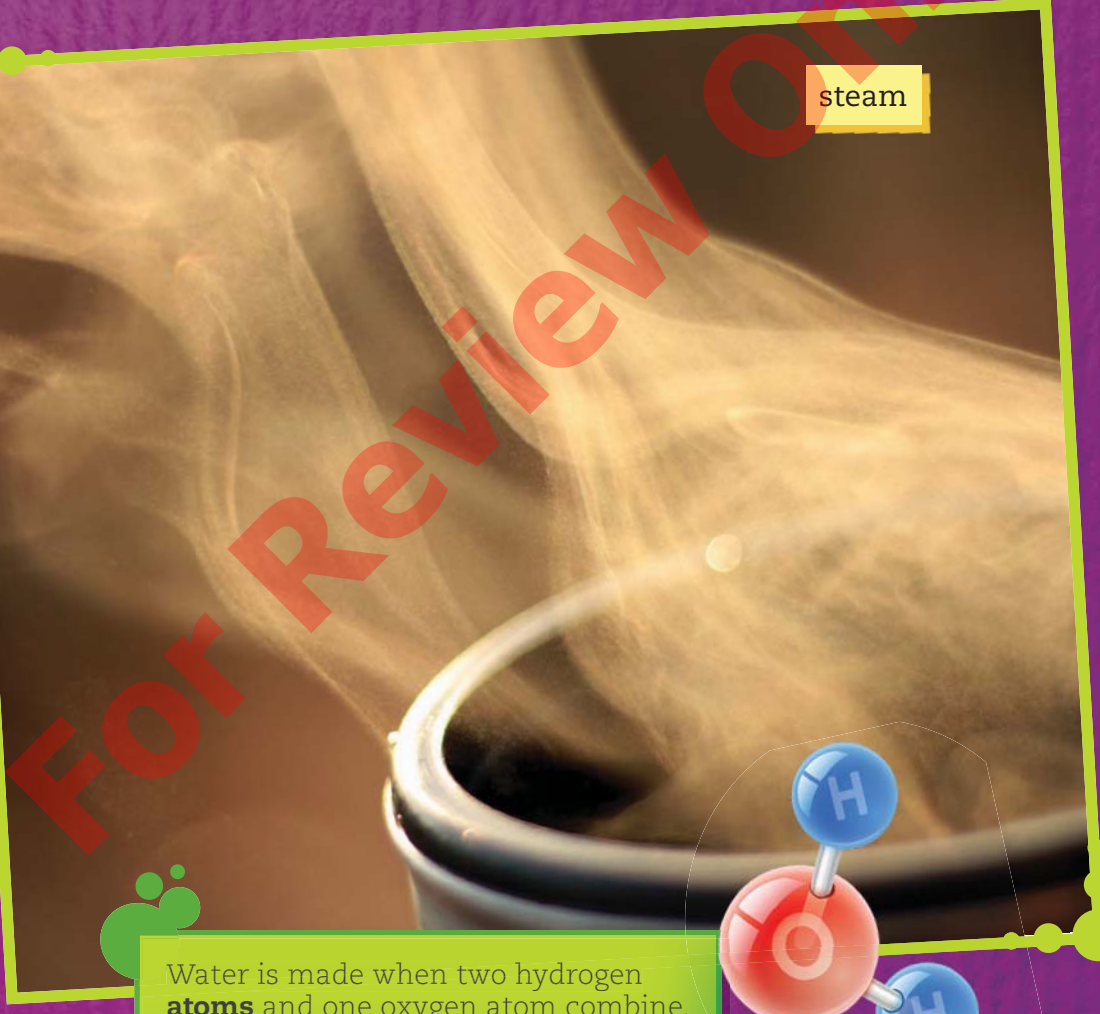
Early technology was powered by people. Later, animals were used. But, the amount of power they produced was limited. In the late 1600s, scientists and engineers found that steam could be used to power new technology.

A family uses technology to talk to each other.



Doctors use technology like this tablet to help them do their job.

Steam is the gaseous form of water. It is made when water boils. This happens at 100° Celsius (212° Fahrenheit) at sea level. A lot of energy is produced when water turns to steam. People found that this energy could be stored and used to power machines and devices.

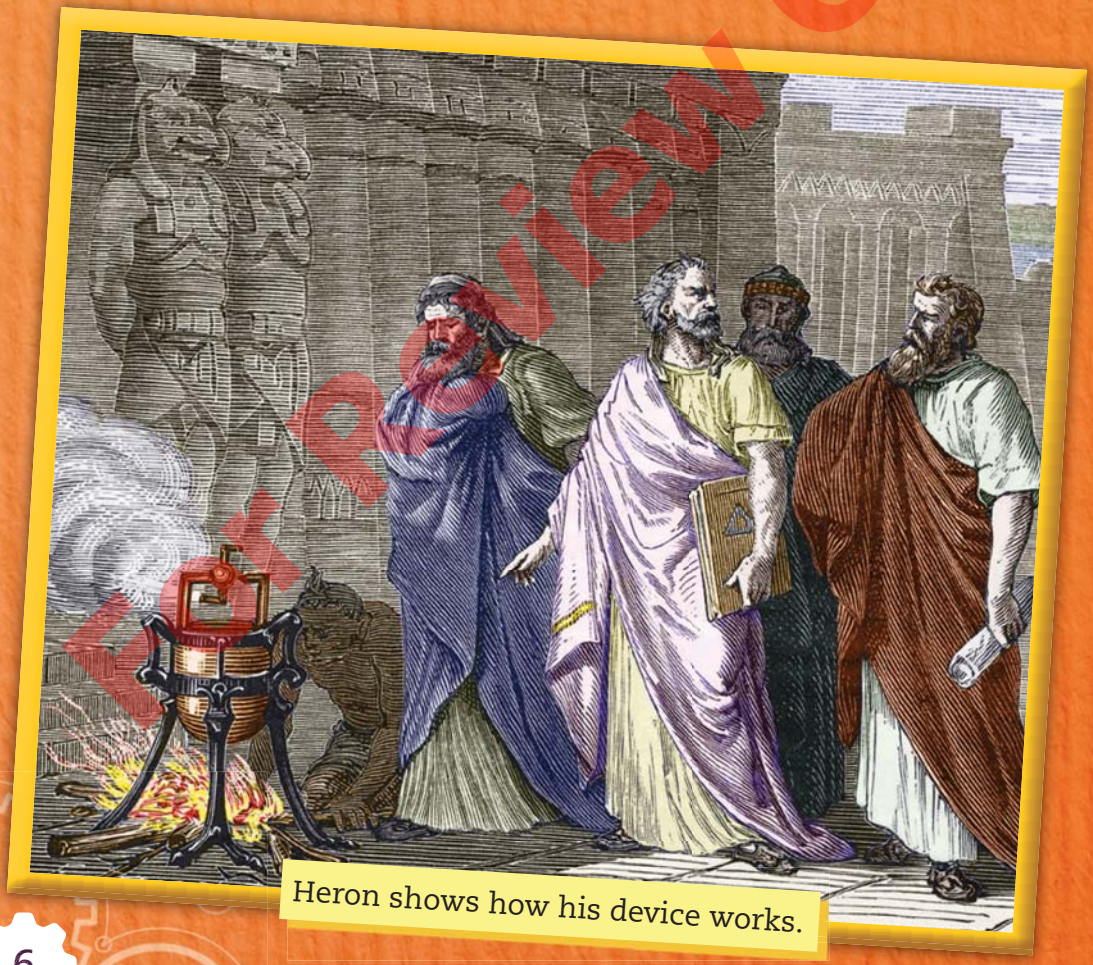


Water is made when two hydrogen **atoms** and one oxygen atom combine. That is why it is referred to as H_2O!

Steam Power Pioneers

Steam power has been used for a long time. In fact, it was used in the first century. Heron of Alexandria made a device that used steam to turn a sphere. But his device did not do much more than that. It served as a toy to amuse his friends.

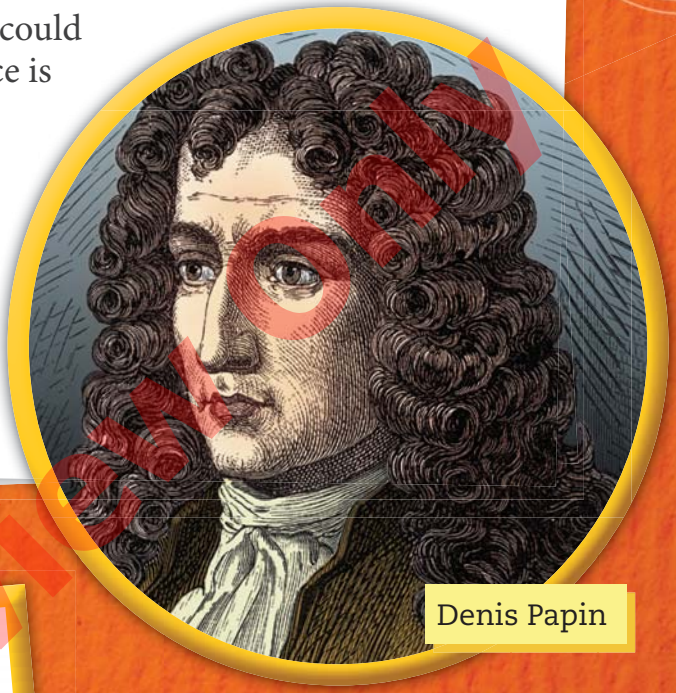
There was a lot of progress in steam engineering in the seventeenth century. Many people were drawn to science. They developed new **theories** and tested their ideas.



Heron shows how his device works.

Denis Papin

Denis Papin (deh-NEE pa-PEEN) was a French inventor. He studied the **properties** of steam and air. He was one of the first people to know that air contained **matter**. Papin also proved that a space could have no matter in it. That space is called a vacuum. He believed that if air had matter, it could create pressure, especially within a vacuum. He experimented with steam, air, and vacuums. He wanted to use these ideas to build a machine.



Denis Papin

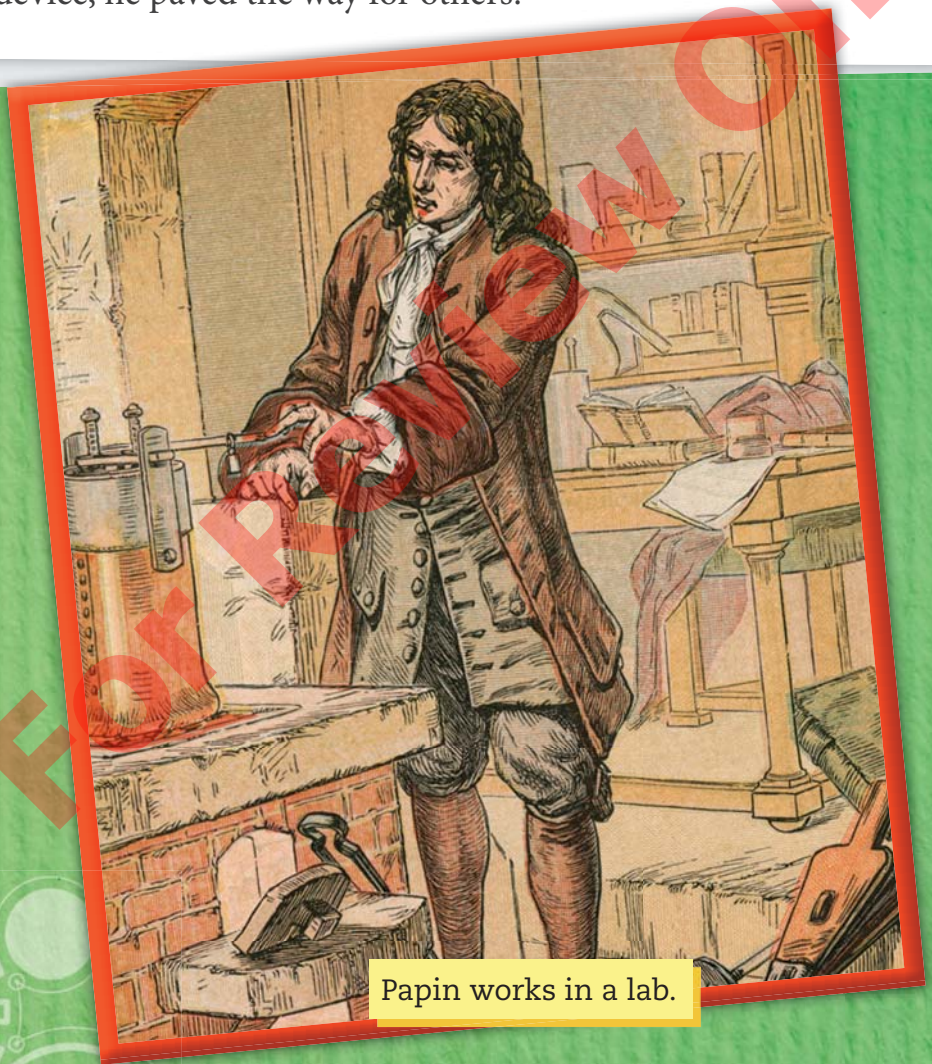
SCIENCE

The Air We Breathe

When we breathe, our lungs fill with air. Air is made up of matter. Matter is anything that takes up space and has weight. We can't see air, but it uses space and has weight. You can see this when you blow air into a balloon!

Papin's machine used steam to create a vacuum. It started by heating water to make steam. The steam was stored under pressure. This pressure created enough energy to move the parts of the machine.

Papin thought that steam would one day be used to power ships and factories. He dreamed of building a larger machine that would power them. Although he never built this bigger device, he paved the way for others.



Papin works in a lab.

Thomas Savery

Thomas Savery was an English engineer. He worked to build a steam-powered pump. The pump would remove water from coal mines. Water in mines was a big problem. It kept workers from being able to access coal.

The pump heated water in a boiler. Then, the steam was sprayed with cold water in another container. This made the steam **condense**. As the steam condensed, it made a vacuum. The vacuum pushed the water up and out of the mine to reveal precious coal and minerals.

Savery's machine

Savery called his machine the "Miner's Friend."

STEAM CHALLENGE

Define the Problem

Heat loss can be a problem when powering a steam engine. It can also be a problem in everyday life. Your task is to alter a container's design to keep water hot longer than a regular container.

Constraints: You may not use more than five materials to alter your container. The container must hold a $\frac{1}{2}$ liter (about 2 cups) of liquid.

Criteria: Your altered container must keep a $\frac{1}{2}$ L (about 2 c.) of hot water at a higher temperature than a $\frac{1}{2}$ L (about 2 c.) of hot water in a similar but unaltered container after 10 minutes.

Research and Brainstorm

How can you limit the amount of heat water loses over time? What kinds of materials can stop heat from escaping?

Design and Build

Sketch your design. What materials will work best? Why did you choose these materials? Alter the container.

Test and Improve

Pour $\frac{1}{2}$ L (about 2 c.) of hot water into your altered container and the same amount into a similar but unaltered container. Measure the temperature every 2 minutes for 10 minutes. Did it work? Modify your design and try again.

Reflect and Share

How would the challenge change if you wanted to keep water cold rather than hot? Would your design change? Why or why not?