Smithsonian

The Science of Glass

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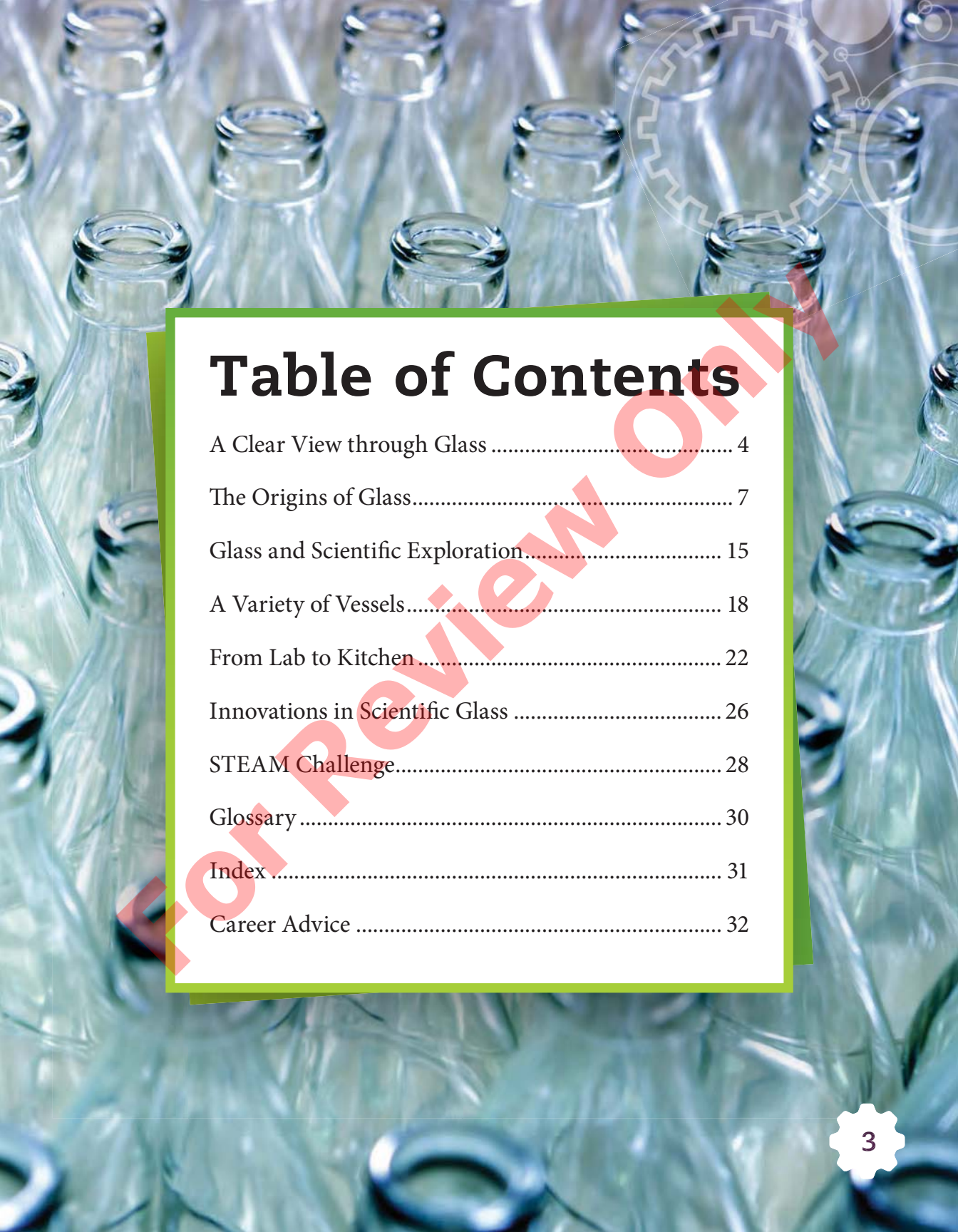


Table of Contents

A Clear View through Glass

A researcher looks at human cells under a microscope. A scientist studies bacteria in a Petri (PEE-tree) dish. A student boils liquid in a test tube. What do these activities have in common? They all involve items made of glass. For centuries, glass has been **essential** to scientific exploration. Every laboratory in the world contains shelves of glassware.

Glass containers used for science come in all shapes and sizes. Scientists use beakers, bottles, and test tubes. They use flasks, funnels, and dishes. Each glass item has been carefully designed. Each one has a purpose. Test tubes are used to hold and mix liquids. Funnels help transfer liquids. Graduated cylinders precisely measure volumes.

A scientist looks through a microscope at a specimen in a Petri dish.

Glass is the perfect material for science containers. It is clear, so scientists can see what is inside. Most glass melts at high temperatures. But some glass is heat resistant. That means applying heat will not break it or change its shape. Glass will also not react with or affect most chemicals used in experiments.

The next time you grab a glass of water, take a second to observe the amazing material in your hand. Thanks to glass, scientists can do research that makes the world a better place!

New York's Corning Museum of Glass has the largest collection of glass in the world with more than 45,000 pieces.

obsidian

This Aztec arrowhead is made from obsidian.

black obsidian necklace

The Origins of Glass

Although the glass we use today is man-made, the earliest example of glass on Earth occurs naturally. It is called obsidian. Obsidian forms when volcanoes erupt. **Molten** rock in the form of lava pours out. When lava cools quickly, it sometimes hardens as this smooth glass. It is usually black or green. It is also **translucent**.

Obsidian can be found in rock formations around the world. There is a large amount of the shiny glass on the Obsidian Cliff in Wyoming. People can pick up chunks of it at the base of the tall, black cliff.

Throughout history, people have used obsidian for many purposes. American Indians used it to make weapons, such as knives and arrows. It was easily broken into shapes for blades or arrowheads. People in ancient Greece used obsidian for mirrors.

Obsidian has many modern uses too. Some medical instruments, such as scalpels, can be made of obsidian. They are even sharper than steel. Jewelry made from obsidian is popular too. Some people believe the glass has healing properties. They also think that obsidian brings good luck to a person who wears it!

SCIENCE

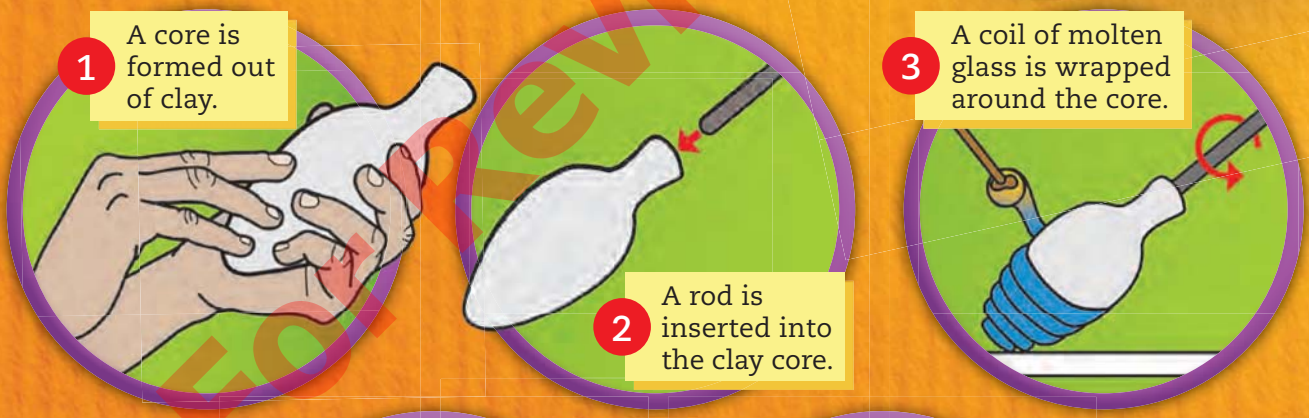
Molten Glass

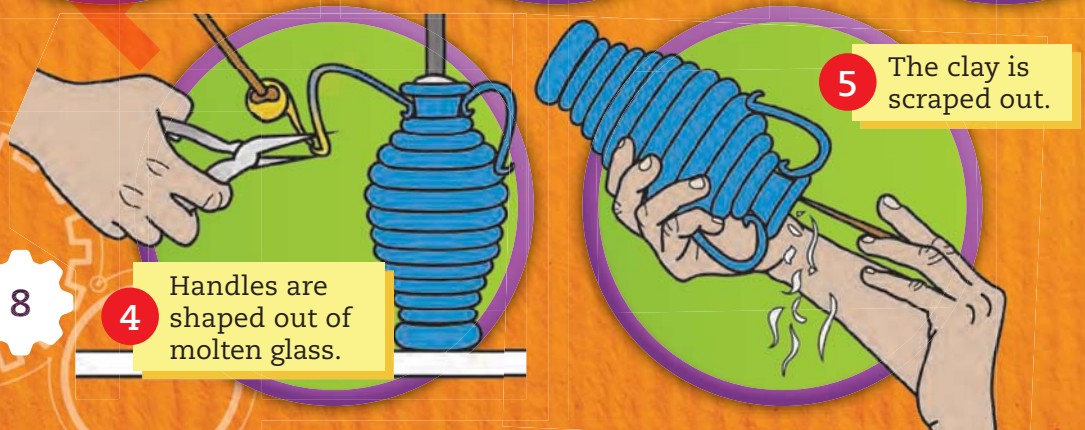
Glass is made by melting together several minerals. The main ingredient is usually silica. Silica often comes in the form of sand. The minerals are mixed together and melted in a furnace. Temperatures can go as high as 1,700° Celsius (3,100° Fahrenheit). The solids liquefy and form molten glass. The **malleable** molten glass is removed from the furnace. Then, it is shaped and allowed to cool and harden.

Archaeologists have found evidence that people began making glass around 1600 BC. Tiny glass objects were found during archaeological digs. Ancient people heated sand to a molten state. Then, they put the liquid into **molds** to make whatever they needed, such as simple tools and jars.

The first glass **vessels** were made through core-forming. People covered a clay core by winding a coil of molten glass around it. After the glass cooled, the clay was scraped out, leaving a hollow vessel. The vessels were small but useful and could hold perfume, medicine, or anything else people wanted to store. People could store many items in their dwellings. Many people wanted these glass vessels for themselves.

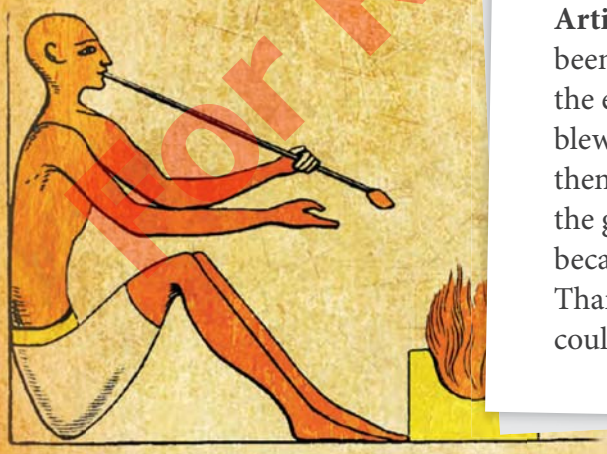
This ancient Roman glass vessel is from the first century AD.





Molten glass has the thickness of **molasses** and is usually a bright orange color.

This modern illustration shows an ancient Egyptian glassblower.



People in Syria invented the blowpipe around 300 BC. This simple tool revolutionized glassmaking. **Artisans** placed globs of glass that had been softened by the heat of a fire onto the ends of hollow pipes. Then, they blew into the pipes while they rotated them. The short puffs of air formed the glass into bubbles. This practice became known as glassblowing. Thanks to this technique, glassblowers could make vessels of any shape or size.

STEAM CHALLENGE

Define the Problem

Greenhouses are buildings designed to protect vegetables and other plants during cold seasons. They are built using glass or plastic, which trap radiation from the sun and increase the temperature inside the greenhouse. Your task is to design and build an effective greenhouse model for a small plant.

Constraints: Your model must be able to hold a small plant.

Criteria: The internal temperature of your model greenhouse must be higher than the starting temperature after 20 minutes under a light source.

Research and Brainstorm

How do different scientists use glass? How do scientists invent new types of glass to solve problems? What is the most important property of glass? Will the shape of a greenhouse affect the temperature?

Design and Build

Sketch your greenhouse design. What purpose will each part serve? What materials will work best? Build a model.

Test and Improve

Attach a thermometer to the inside of the model and place it under a light source. Record the starting temperature inside the greenhouse. Turn the light on and record the temperature every 5 minutes for 20 minutes. Did it work? How can you improve it? Modify your design and try again.

Reflect and Share

Collect data to figure out whether the shape of a greenhouse changes how effective it is. Which shape is most successful? How do you know? Can you think of another way to test your greenhouse model?