NAME _____ DATE _____ CLASS _____

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The Scientific Revolution and the Enlightenment

Lesson 1 The Scientific Revolution

ESSENTIAL QUESTION

How do new ideas change the way people live?

GUIDING QUESTIONS

1. ***How were the scientific ideas of early thinkers passed on to later generations?***
2. ***Why did European ideas about the universe change during the 1500s and 1600s?***
3. ***Which discoveries did scientists make during the 1600s and 1700s?***
4. ***How did Europeans of the 1600s and 1700s develop new ways of gaining knowledge?***

Terms to Know

geocentric an earth-centered theory; having or relating to the earth as the center

Scientific Revolution a period from the 1500s to the 1700s in which many scientific advances changed people's traditional beliefs about science

heliocentric having or relating to the sun as the center

ellipses shapes like stretched circles; ovals

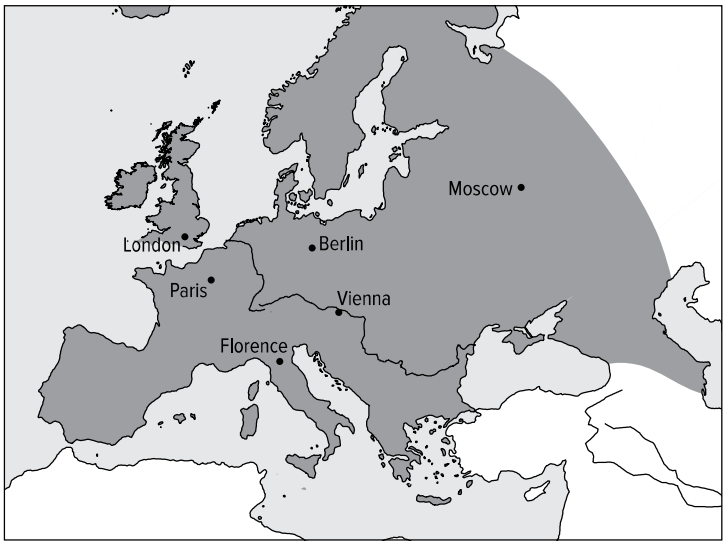
gravity the attraction that the Earth or another celestial body has on an object on or near its surface

elements substances that consist of atoms of only one kind

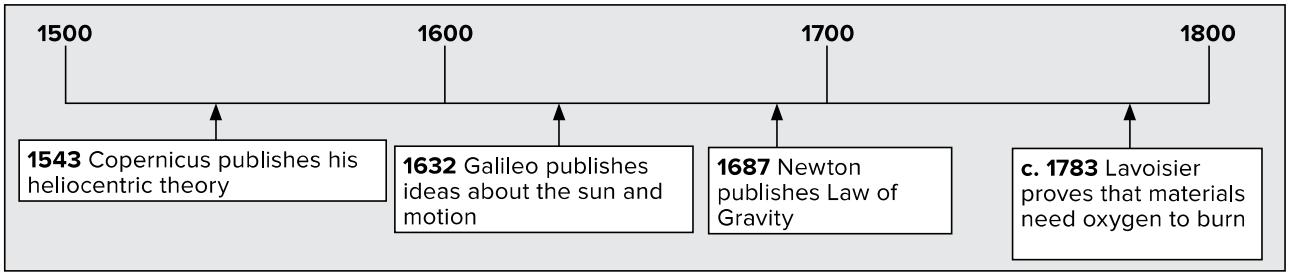
rationalism the belief that reason and experience must be present for the solution of problems

scientific method the steps for an orderly search for knowledge

Where in the world?



When did it happen?



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Lesson 1 The Scientific Revolution, *Continued*

Early Science

Science is any organized study of the natural world. During ancient times, people used science to solve problems. For example, they used mathematics to keep records.

The ancient Greeks used reason to learn about nature. They also used common sense. As they studied the world, they developed theories, or ideas about how and why things worked. However, a theory is not always correct. It must be proven many times. The Greeks did not use experiments to test their theories. As a result, many of their theories were wrong. For example, Ptolemy said that the sun and the planets move around the Earth. People believed this **geocentric,** or Earth-centered, theory for 1,400 years.

During the Middle Ages, most Europeans were interested in religion. Not many people wanted to learn about nature. They did not think they needed to do research. They relied on copies of old writings that sometimes contained errors.

Outside of Europe, in the Islamic Empire, Arabs and Jews had saved much Greek knowledge. They also learned a number system used in India. This system is called the Indian-Arabic system. Also, Arabs and Jews built on Greek ideas to make their own advances in science.

During the 1100s, thinkers in Europe began to have more contact with the world of Islam. As a result, they became interested in science again. Some thinkers showed that Christianity and reason could work together. One of these thinkers was Thomas Aquinas. Students began to study science. They did this at schools called universities.

theory an explanation of how or why something happens

experiment a test to see if a theory is true

research the collection of information on a certain subject

In the 1400s, people started to explore the world. Because of this, Europeans were able to make better maps. These maps helped explorers reach far-away lands. They brought back new information about oceans, continents, animals, plants, and diseases. Scientists organized it all.

Glue Foldable here

FOLDABLES®

Describing

1. Place a three-tab Foldable along the dotted line to cover the text titled *Early Science*. Label the three tabs *Advancements*, *Losses*, and *Advancements*.

   Use both sides of the tabs to explain how the study of science advanced, lost ground, and advanced again over hundreds of years.

Identifying

2. In what way was the geocentric theory of the universe incorrect?

   _____

   _____

   _____

Reading Check

3. How was science practiced in ancient and medieval times?

   _____

   _____

   _____

Lesson 1 The Scientific Revolution, *Continued*

Visualizing

4. Below, draw the sun and the elliptical path of a planet around it.

Reading Check

5. How did Galileo go about making scientific discoveries?

_____

_____

_____

Identifying

6. What scientific contribution did Robert Hooke make?

_____

_____

_____

New Ideas About the Universe

In the 1500s, scientists in Europe began to experiment and started the **Scientific Revolution.** The Scientific Revolution changed how Europeans understood science.

Astronomy is the study of planets, stars, and other bodies in space. Astronomer Nicolaus Copernicus disagreed with Ptolemy's theory. Copernicus believed that the Earth and other planets moved around the sun. This sun-centered view is called **heliocentric.**

Johannes Kepler corrected some of the findings of Copernicus. Kepler said that the planets move in oval paths. Such paths are called **ellipses.**

Galileo Galilei believed that conducting experiments was the correct way to achieve scientific knowledge. He developed a telescope that allowed him to find evidence that supported the heliocentric view. He also proved that all objects fall to the ground at the same speed.

Contributions in Astronomy	
Nicolaus Copernicus	• Stated that the Earth and other planets move around the sun
Johannes Kepler	• Stated that planets move in ellipses
Galileo Galilei	• Used telescope to support the heliocentric view of the universe

New Scientific Advances

Isaac Newton figured out some scientific laws. In science, laws are well-tested theories. Newton came up with the law of **gravity.** Gravity is the pull of the Earth and other bodies in space on objects that are on or near them.

Andreas Vesalius studied how the human body works by dissecting, or cutting open, dead bodies. His findings replaced many wrong ideas about the human body.

Robert Hooke began to use a microscope. A microscope makes large images of small objects. Hooke discovered cells, which are the smallest units of living matter.

Antonie van Leeuwenhoek improved the microscope by adding more powerful lenses. He became the first person to see bacteria. Bacteria are tiny living organisms.

Lesson 1 The Scientific Revolution, *Continued*

Robert Boyle proved that matter is made up of **elements.** An element is a basic material that cannot be broken down into simpler parts.

In the 1700s, scientists in Europe discovered gases, such as oxygen and hydrogen. French scientist Antoine Lavoisier showed that materials need oxygen to burn.

The Triumph of Reason

René Descartes studied the problem of knowing what is true. He used mathematics and reason to search for truth. In mathematics, the answers are always true. Descartes' ideas became known as **rationalism.** This is the belief that reason is the source of learning.

Blaise Pascal thought that reason and science could be used to solve problems in everyday life. Yet, he thought that Christianity must be used to find spiritual truth.

Francis Bacon came up with the **scientific method**. This method is an orderly way to collect and study facts.

Steps of the Scientific Method

- **Observation:** The scientist collects facts by studying an aspect of the world.
- **Hypothesis:** The scientist explains these facts with a theory.
- **Prediction:** The scientist makes a prediction.
- **Experiment:** The scientist does experiments to prove that the theory is true.
- **Theory:** If the theory seems true, the scientist develops it into scientific law.

Check for Understanding

Name two important astronomers during the Scientific Revolution.

1. _____

2. _____

List two advances made during the Scientific Revolution that are still taught today.

3. _____

4. _____

Reading Check

7. According to Newton, how are the planets held in orbit?

_____

_____

_____

Reading Check

8. Why did Descartes believe that mathematics is the source of scientific truth?

_____

_____

_____

FOLDABLES®

9. Place a three-tab Foldable to cover the Check for Understanding. Write *Scientific Revolution* on the anchor tab. Label the three tabs *1500s*, *1600s*, and *1700s*.

Use both sides of the tabs to record information you remember about the Scientific Revolution during these centuries.

Glue Foldable here