

Enlightenment and Revolution**Section 1****The Scientific Revolution****Terms and Names**

Scientific Revolution New way of thinking about the natural world based on careful observation and a willingness to question

heliocentric theory Theory that the sun is at the center of the universe

geocentric theory View which held that the earth was the center of the universe

Galileo Galilei Scientist who was forced by the Catholic Church to take back scientific ideas that disagreed with the church's view

scientific method Logical procedure for gathering and testing ideas

Isaac Newton Scientist who discovered laws of motion and gravity

Before You Read

In the last chapter, you learned about wars and political changes in Europe.

In this section, you will read how the Enlightenment transformed Europe and helped lead to the American Revolution.

As You Read

Use a web diagram to record the events and circumstances that led to the Scientific Revolution.

THE ROOTS OF MODERN SCIENCE

(Pages 189–190)

How did modern science begin?

During the Middle Ages, few scholars questioned beliefs that had been long held. Europeans based their ideas on what ancient Greeks and Romans believed or on the Bible. People still thought that the earth was the center of the universe. They believed that the sun, moon, other planets, and stars moved around it.

In the mid-1500s, attitudes began to change. Scholars started what is called the **Scientific Revolution**. It was a new way of thinking about the natural world. It was based on careful observation and the willingness to question old beliefs. European voyages of exploration helped to

bring about the Scientific Revolution.

When Europeans explored new lands, they saw plants and animals that ancient writers had never seen. These discoveries led to new courses of study in the universities of Europe.

1. What was the Scientific Revolution?

A REVOLUTIONARY MODEL OF THE UNIVERSE (Pages 190–191)**How did new ideas change accepted thinking in astronomy?**

The first challenge to accepted thinking in science came in astronomy. In the early 1500s, Nicolaus Copernicus, a Polish astronomer, studied the stars and planets.

Section 1, *continued*

He developed a **heliocentric theory**. Heliocentric meant sun-centered. It said that Earth, like all the other planets, revolved around the sun. Copernicus did not publish his findings until just before his death. He had been afraid that his ideas would be attacked because they went against the **geocentric theory**. This theory held that the earth was at the center of the universe. In the early 1600s, Johannes Kepler used mathematics to prove that Copernicus's basic idea was correct.

An Italian scientist—**Galileo Galilei**—made several discoveries that also undercut ancient ideas. He made one of the first telescopes and used it to study the planets. He found that Jupiter had moons, the sun had spots, and Earth's moon was rough. Some of his ideas about the earth, the sun, and the planets went against the teaching of the Catholic Church. Church authorities forced Galileo to take back his statements. Still, his ideas spread.

2. What old belief about the universe did the new discoveries destroy?
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THE SCIENTIFIC METHOD

(Pages 191–192)

Why was the scientific method an important development?

Interest in science led to a new approach, the **scientific method**. With this method, scientists ask a question based on something they have seen in the physical world. They form a hypothesis, or an attempt to answer the question. Then they test the hypothesis by making experiments or checking other facts. Finally, they change the hypothesis if needed.

The English writer Francis Bacon helped create this new approach to knowledge. He said scientists should base their thinking on what they can observe

and test. The French mathematician René Descartes also influenced the use of the scientific method. His thinking was based on logic and mathematics.

3. What thinkers helped advance the use of the scientific method?
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NEWTON EXPLAINS THE LAW OF GRAVITY; THE SCIENTIFIC REVOLUTION SPREADS

(Pages 192–194)

What scientific discoveries were made?

In the mid-1600s, the English scientist **Isaac Newton** described the law of gravity. Using mathematics, Newton showed that the same force ruled both the motion of planets and the action of bodies on the earth.

Other scientists made new tools to study the world around them. One invented a microscope. Others invented tools for understanding weather.

Doctors also made advances. One made drawings that showed the different parts of the human body. Another learned how the heart pumped blood through the body. In the late 1700s, Edward Jenner first used the process called vaccination to prevent disease. By giving a person the germs from a cattle disease called cowpox, he helped that person avoid getting the more serious human disease of smallpox.

Scientists made progress in chemistry as well. One questioned the old idea that things were made of only four elements—earth, air, fire, and water. He and other scientists separated oxygen from air.

4. How did the science of medicine change?
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Section 1, *continued*

As you read about the revolution in scientific thinking, take notes to answer the questions.

| How did the following help pave the way for the Scientific Revolution? | | |
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| 1. The Renaissance | | |
| 2. Age of European exploration | | |

| What did each scientist discover about the universe? | | |
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| 3. Nicolaus Copernicus | | |
| 4. Johannes Kepler | | |
| 5. Galileo Galilei | | |
| 6. Isaac Newton | | |

| What important developments took place in the following areas? | | |
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| 7. Scientific instruments | | |
| 8. Medicine | | |
| 9. Chemistry | | |