

CHAPTER 22 Section 1 (pages 545–550)

The Scientific Revolution

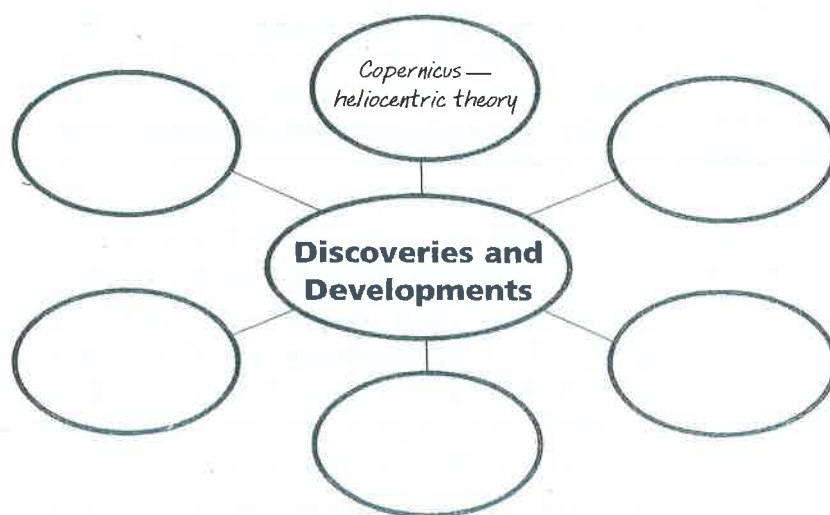
BEFORE YOU READ

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 the web diagram below to record important events that occurred during 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

Nicolaus Copernicus Astronomer who said the earth revolved around the sun

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

Johannes Kepler Mathematician who proved the accuracy of Copernicus's theory

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

Francis Bacon Writer who helped advance the scientific method

René Descartes Mathematician who helped promote the scientific method

Isaac Newton Scientist who discovered laws of motion and gravity

The Roots of Modern Science

(pages 545–546)

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 546–547)

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. He developed a **heliocentric theory**. Heliocentric meant sun-centered. It said that earth, like all the other planets, revolved around the sun. And the moon revolved around the earth. Copernicus did not publish his findings until just before his death. He had been afraid that his ideas would be attacked. They went against the accepted belief 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?

The Scientific Method (pages 547–548)

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?

Newton Explains the Law of Gravity; The Scientific Revolution Spreads (pages 548–550)

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 were able to separate oxygen from air.

4. How did the science of medicine change?

CHAPTER 22 Section 2 (pages 551–556)

The Enlightenment in Europe

BEFORE YOU READ

In the last section, you read how the Scientific Revolution began in Europe.

In this section, you will learn how the Enlightenment began in Europe.

AS YOU READ

Use the chart below to take notes on important Enlightenment ideas.

THINKER	IDEA
Hobbes	<i>social contract between people and government</i>
Locke	
Voltaire	
Montesquieu	
Rousseau	
Wollstonecraft	

TERMS AND NAMES

Enlightenment Age of Reason

social contract According to Thomas Hobbes, an agreement people make with government

John Locke Philosopher who wrote about government

natural rights Rights that John Locke said people were born with: life, liberty, and property

philosophe Social critics in France

Voltaire Writer who fought for tolerance, reason, freedom of religious belief, and freedom of speech

Montesquieu French writer concerned with government and political liberty

separation of powers Montesquieu's idea that power should be divided between different branches of government

Jean Jacques Rousseau Enlightenment thinker who championed freedom

Mary Wollstonecraft Author who wrote about women's rights

Two Views on Government

(pages 551–552)

What were the views of Hobbes and Locke?

The **Enlightenment** was an *intellectual* movement. Enlightenment thinkers tried to apply reason and the scientific method to laws that shaped human actions. They hoped to build a society founded on ideas of the Scientific Revolution. Two

English writers—Thomas Hobbes and John Locke—were important to this movement. They came to very different conclusions about government and human nature.

Hobbes wrote that there would be a war of “every man against every man” if there were no government. To avoid this war, Hobbes said, people formed a **social contract**. It was an agreement between people and their government. People gave up their rights to the government so they

could live in a safe and orderly way. The best government, he said, is that of a strong king who can force all people to obey.

John Locke believed that people have three **natural rights**. They are life, liberty, and property. The purpose of government is to protect these rights. When it fails to do so, he said, people have a right to overthrow the government.

1. How were Hobbes's and Locke's views different?

The Philosophes Advocate Reason (pages 552–555)

Who were the philosophes?

French thinkers called **philosophes** had five main beliefs: (1) thinkers can find the truth by using reason; (2) what is natural is good and reasonable, and human actions are shaped by natural laws; (3) acting according to nature can bring happiness; (4) by taking a scientific view, people and society can make progress and advance to a better life; and (5) by using reason, people can gain freedom.

The most brilliant of the philosophes was the writer **Voltaire**. He fought for tolerance, reason, freedom of religious belief, and freedom of speech. Baron de **Montesquieu** wrote about **separation of powers**—dividing power among the separate branches of government. The third great philosophe was **Jean Jacques Rousseau**. He wrote in favor of human freedom. He wanted a

society in which all people were equal. Cesare Beccaria was an Italian philosophe. He spoke out against *abuses* of justice.

2. Name the types of freedoms that Enlightenment thinkers championed.

Women and the Enlightenment: Impact of the Enlightenment (pages 555–556)

What were Enlightenment views about individuals?

Many Enlightenment thinkers held traditional views about women's place in society. They wanted equal rights for all men but paid no attention to the fact that women did not have such rights. Some women protested this unfair situation. "If all men are born free," stated British writer **Mary Wollstonecraft**, "how is it that all women are born slaves?"

Enlightenment ideas strongly influenced the American and French Revolutions. Enlightenment thinkers also helped spread the idea of progress. By using reason, they said, it is possible to make society better. Enlightenment thinkers helped make the world less religious and more worldly. They also stressed the importance of the individual.

3. Explain the influence of Enlightenment ideas.

Major Ideas of the Enlightenment

Idea	Thinker	Impact
Natural rights—life, liberty, property	Locke	Fundamental to U.S. Declaration of Independence
Separation of powers	Montesquieu	France, United States, Latin American nations use separation of powers in new constitutions
Freedom of thought and expression	Voltaire	Guaranteed in U.S. Bill of Rights and French Declaration of the Rights of Man and Citizen; European monarchs reduce or eliminate censorship
Abolishment of torture	Beccaria	Guaranteed in U.S. Bill of Rights; torture outlawed or reduced in nations of Europe and the Americas
Religious freedom	Voltaire	Guaranteed in U.S. Bill of Rights and French Declaration of the Rights of Man and Citizen; European monarchs reduce persecution
Women's equality	Wollstonecraft	Women's rights groups form in Europe and North America

Skillbuilder

Use the chart to answer these questions.

1. Which Enlightenment thinkers influenced the United States government?

2. Which Enlightenment ideas are in the United States Bill of Rights?

CHAPTER 22 Section 3 (pages 558–562)

The Spread of Enlightenment Ideas

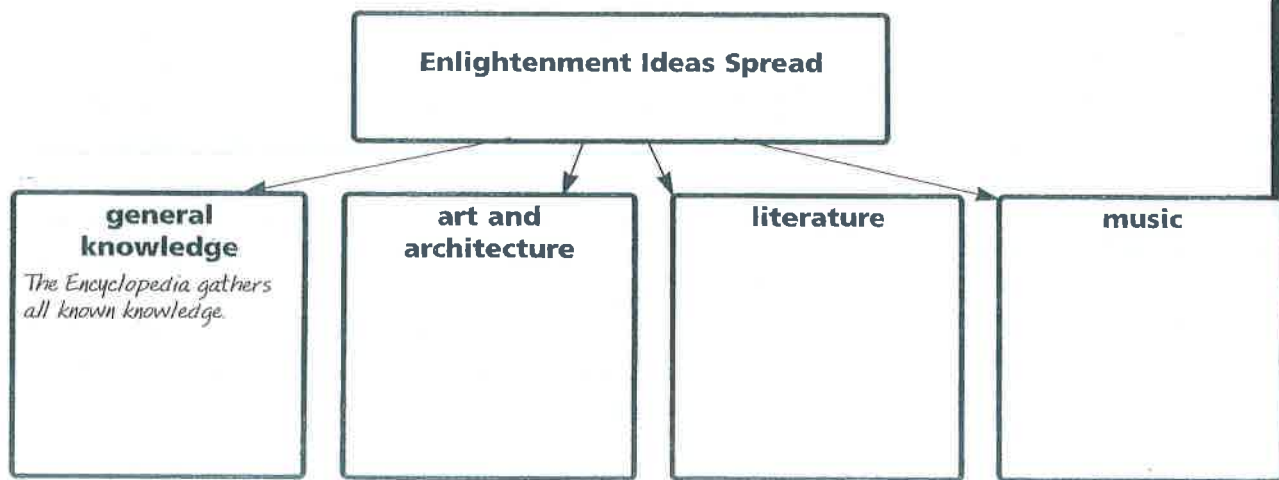
BEFORE YOU READ

In the last section, you read how Enlightenment ideas began.

In this section, you will learn about the spread of these ideas.

AS YOU READ

Use the chart below to take notes on how Enlightenment ideas were spread.



TERMS AND NAMES

salon Social gathering for discussing ideas or enjoying art

baroque Grand, ornate style

neoclassical Simple style that borrowed ideas from classical Greek and Rome

enlightened despot Ruler who supported Enlightenment ideas but did not give up power

Catherine the Great Russian ruler who took steps to reform and modernize Russia

A World of Ideas (pages 558–559)

How did ideas spread from individual to individual?

In the 1700s, Paris was the cultural center of Europe. People came there from other countries to hear the new ideas of the Enlightenment. Writers and artists held social gatherings called **salons**. A woman named Marie-Thérèse Geoffrin became famous for hosting these discussions.

Geoffrin also supplied the money for one of the major projects of the Enlightenment. With her

friends, Denis Diderot and other thinkers wrote and published a huge set of books called the *Encyclopedia*. Their aim was to gather all that was known about the world. The French government and officials in the Catholic Church did not like many of the ideas that were published in the *Encyclopedia*. They banned the books at first. Later, however, they changed their minds.

The ideas of the Enlightenment were spread throughout Europe by works like the *Encyclopedia* and through meetings in homes. The ideas also spread to the growing middle class. This group was becoming wealthy but had less social status than

nobles. They also had very little political power. Ideas about equality sounded good to them.

1. Why were salons important?

Art and Literature in the Age of Reason (pages 559–561)

How *did art and literature change?*

The arts—painting, architecture, music, and literature—moved in new directions in the late 1700s. They used Enlightenment ideas of order and reason.

Earlier European painting had been very grand and highly decorated. It was a style known as **baroque**. Now styles began to change. A new simpler, yet elegant, style of painting and architecture developed. This style borrowed ideas and themes from Classical Greece and Rome. That is the reason it was called **neoclassical**.

In music, the style of the period is called classical. Three important composers of the time were Franz Joseph Haydn, Wolfgang Amadeus Mozart, and Ludwig von Beethoven. They composed music that was elegant and original. New musical forms were developed, including the sonata and the symphony.

In literature, the novel became popular. This new form presented long stories with twisting plots. It explored the thoughts and feelings of characters. A number of European authors, including women, began writing novels. These books were popular with the middle-class. They liked entertaining stories in everyday language.

2. What new styles and forms appeared in art, music, and literature?

Enlightenment and Monarchy

(pages 561–562)

Who *were the enlightened despots?*

Some Enlightenment thinkers believed that the best form of government was a monarchy. In it, a ruler respected people's rights. These thinkers tried to influence rulers to rule fairly. Rulers who followed Enlightenment ideas in part but were unwilling to give up much power were called **enlightened despots**.

Frederick the Great of Prussia was an enlightened despot. He gave his people religious freedom and improved schooling. He also *reformed* the justice system. However, he did nothing to end *serfdom*, which made peasants slaves to the wealthy landowners. Joseph II of Austria did end serfdom. Once he died, though, the nobles who owned the lands were able to undo this reform.

Catherine the Great of Russia was another of the rulers influenced by Enlightenment ideas. She tried to reform Russia's laws but met resistance. She had hoped to end serfdom. But a bloody peasants' revolt persuaded her to change her mind. Instead, she gave the nobles even more power over serfs. Catherine did manage to gain new land for Russia. Russia, Prussia, and Austria agreed to divide Poland among themselves. As a result, Poland disappeared as a separate nation for almost 150 years.

3. In what way was Frederick the Great typical of an enlightened despot?

CHAPTER 22 Section 4 (pages 563–567)

American Revolution: The Birth of a Republic

BEFORE YOU READ

In the last section, you read about the spread of Enlightenment ideas in Europe.

In this section, you will learn how Enlightenment ideas influenced the American Revolution.

AS YOU READ

Use the web below to take notes on the influence of the Enlightenment on the early United States.

TERMS AND NAMES

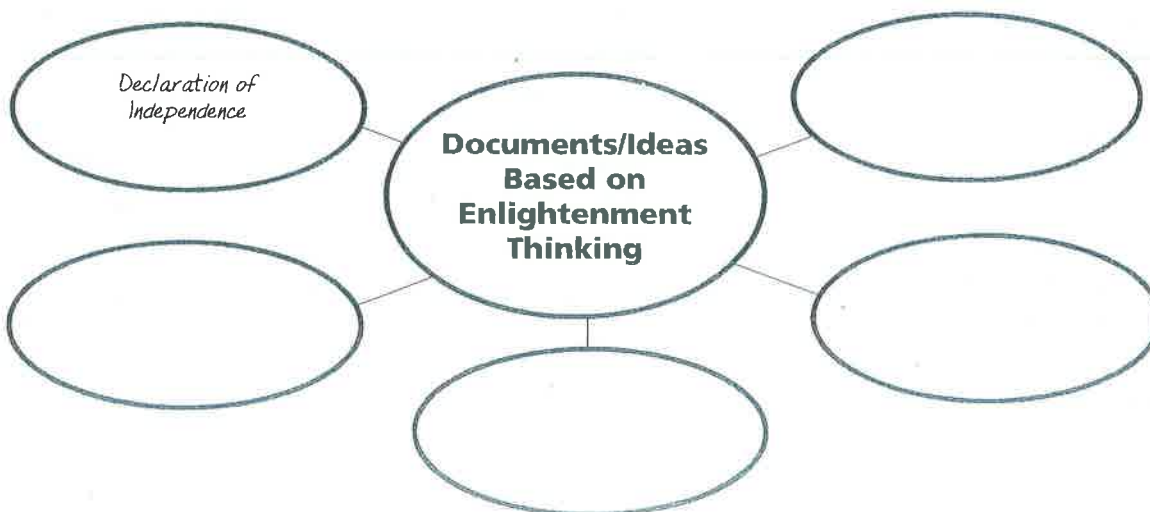
Declaration of Independence Document declaring American independence from Britain

Thomas Jefferson Author of the Declaration of Independence

checks and balances System in which each branch of government checks, or limits, the power of the other two branches

federal system System of government in which power is divided between the national and state governments

Bill of Rights First ten amendments to the U.S. Constitution; protections of basic rights for individuals



Britain and Its American Colonies

(page 563)

How were the colonies governed?

The British colonies in North America grew in population and wealth during the 1700s. Population went from about 250,000 in 1700 to 2,150,000 in 1770. Economically, they prospered on trade with the nations of Europe. The 13

colonies also had a kind of self-government. People in the colonies began to see themselves less and less as British subjects. Still, Parliament passed laws that governed the colonies. One set of laws banned trade with any nation other than Britain.

1. How did the colonists' image of themselves clash with their status as colonists?

Americans Win Independence

(pages 563–565)

What caused Britain and America to grow apart?

The high cost of the French and Indian War led Parliament to pass laws that put taxes on the colonists. The colonists became very angry. They had never before paid taxes directly to the British government. They said that the taxes *violated* their rights. Since Parliament had no members from the colonies, they said, Parliament had no right to tax them.

The colonists met the first tax, passed in 1765, with a *boycott* of British goods. Their refusal to buy British products was very effective. It forced Parliament to *repeal* the law.

Over the next decade, the colonists and Britain grew further apart. Some colonists wanted to push the colonies to independence. They took actions that caused Britain to act harshly. Eventually, the conflict led to war. Representatives of the colonies met in a congress and formed an army. In July 1776, they announced that they were independent of Britain. They issued the **Declaration of Independence**. It was based on Enlightenment ideas. **Thomas Jefferson** wrote it.

From 1775 to 1781, the colonies and the British fought a war in North America. The colonists had a poorly equipped army, and Britain was one of the most powerful nations in the world. However, in the end, the colonies won their independence.

The British people grew tired of the cost of the war and pushed Parliament to agree to a peace. The Americans were also helped greatly by aid from France. In 1783, the two sides signed a treaty. In it, Britain recognized the independent United States of America.

2. Name some of the steps that led to the American Revolution.

Americans Create a Republic

(pages 565–567)

What are some fundamental ideas in the U.S. Constitution?

The 13 states formed a new government under the Article of Confederation. This government was very weak. States held all the power and the central government had little. This proved unworkable. In 1787, American leaders met again. They wrote a new framework of government.

The Constitution of the United States drew on many Enlightenment ideas. It used Montesquieu's idea of separation of powers into three branches of government. Through a system of **checks and balances**, each branch was able to prevent other branches from abusing their power. The Constitution also set up a **federal system**. Under this system, power was divided between national and state governments.

The Constitution also used Locke's idea of putting power in the hands of the people. It used Voltaire's ideas to protect the right to free speech and freedom of religion. It used Beccaria's ideas about a fair system of justice.

Many of these rights were ensured in a set of additions to the Constitution called the **Bill of Rights**. The inclusion of a bill of rights helped win approval for the Constitution.

3. Explain how the Constitution divides power.
