

Chapter Summary

Section 1: The Renaissance in Italy

The Renaissance, or rebirth, began in the rich trading cities of northern Italy. The Renaissance was a humanist movement that focused on realism in art, science, and society.

Section 2: The Renaissance in the North

The printing press led to a tremendous spread of knowledge and learning. The northern Renaissance began in Flanders. The work of artists such as Rubens and writers such as Shakespeare reflected classical and universal themes.



Chapter Summary (continued)

Section 3: The Protestant Reformation

Angered by the sale of indulgences, Martin Luther nailed a list of complaints to a church door, starting a firestorm that led to a new religion. John Calvin added the idea of predestination.

Section 4: Reformation Ideas Spread

New sects such the Anabaptists appeared. Henry VIII took England out of the Catholic Church. Many changes and reforms were made in the Catholic Church as well.

Chapter Summary (continued)

Section 5: The Scientific Revolution

Despite opposition from the Church, a Scientific Revolution began. Copernicus discovered that the Earth was not at the center of the universe. A step-by-step scientific method was developed.

Objectives

- Describe the characteristics of the Renaissance and understand why it began in Italy.
- Identify Renaissance artists and explain how new ideas affected the arts of the period.
- Understand how writers of the time addressed Renaissance themes.



Terms and People

- **humanism** – the Renaissance intellectual movement that studied classical cultures to increase understanding of their own times
- **humanities** – subjects such as grammar, poetry, rhetoric, and history
- **Petrarch** – Florentine humanist, poet, and scholar who assembled a library of Greek and Roman manuscripts to encourage learning
- **Florence** – an Italian city-state that produced many gifted artists, scholars, scientists, and architects

Terms and People (continued)

- **patron** – person who provides financial support for the arts
- **perspective** – the artistic technique that allows an artist to portray depth and three-dimensional qualities by making distant objects smaller
- **Leonardo** – artist, scientist, and inventor best known for the *Mona Lisa* and *The Last Supper* and sketches of inventions such as flying machines
- **Michelangelo** – artist; created sculpture of *David* and painted the ceiling of the Sistine Chapel

Terms and People (continued)

- **Raphael** – painter; blended Christian and classical styles; famous works include *The School of Athens* and his portrayals of the Madonna
- **Baldassare Castiglione** – wrote the *Book of the Courtier* describing the manners and qualities aristocratic men and women should display
- **Niccolò Machiavelli** – wrote *The Prince*, describing how to rule in an age of ruthless power politics



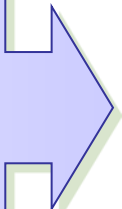
What were the ideals of the Renaissance, and how did Italian artists and writers reflect these ideals?

A new age dawned in Western Europe, given expression by remarkable artists and thinkers. This age is called the Renaissance, meaning “rebirth.” It began in the 1300s and reached its peak around 1500.

The Renaissance marked the transition from medieval times to the early modern world.

The Renaissance began in Italy in the 1300s.

During the Renaissance, people:



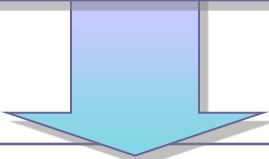
- Sought to bring their age out of disorder and disunity
- Placed a greater emphasis on individual achievement
- Tried to understand the world with more accuracy

Renaissance thinkers evolved a new worldview and reawakened interest in classical Greek and Roman learning.


During the Renaissance there was a new spirit of adventure and curiosity.

- Trade assumed greater importance than before.
- Navigators sailed across the oceans.
- Scientists viewed the universe in new ways.
- Writers and artists experimented with new techniques.

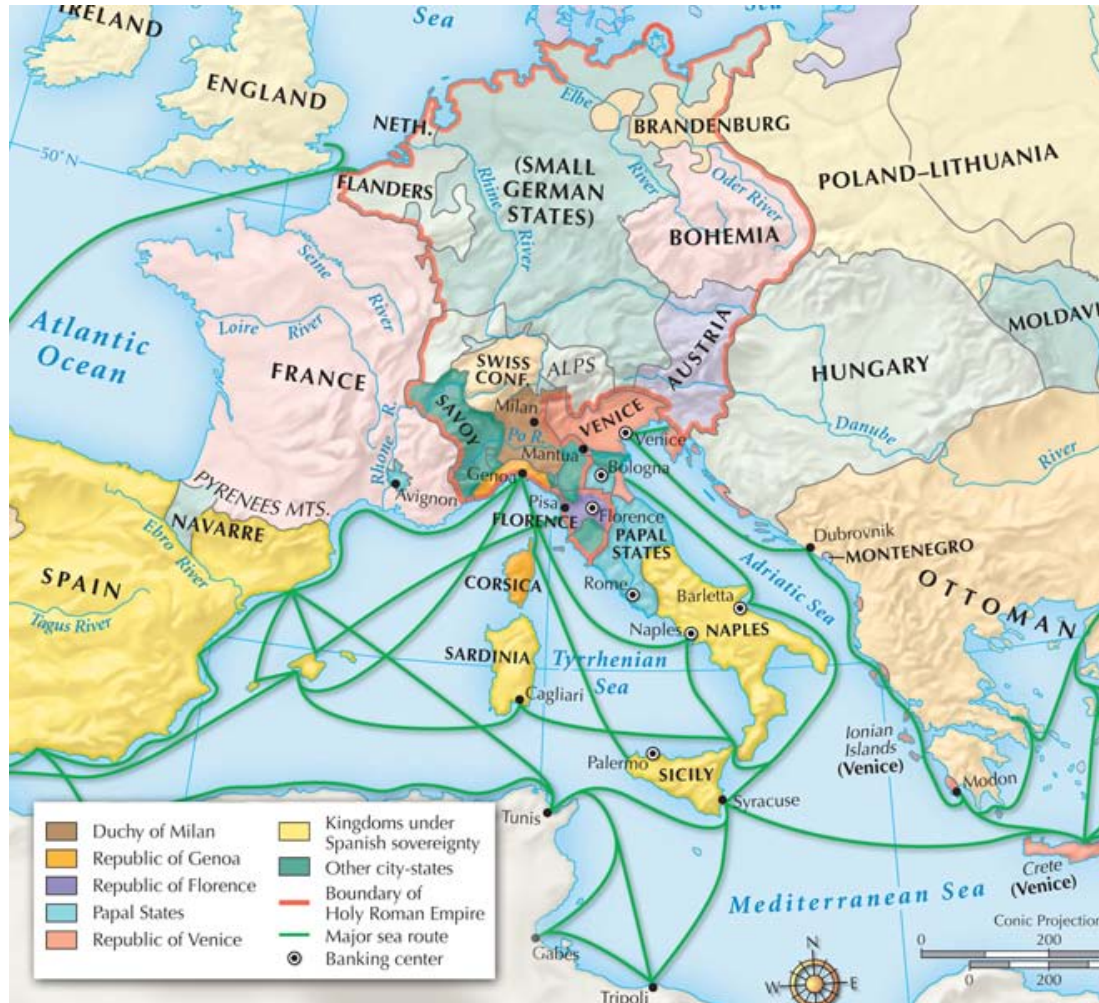
Italy's central location in the Mediterranean helped encourage trade.



Banking, manufacturing, and a merchant network provided the wealth that fueled the Renaissance.



Trade routes carried new ideas from Asia and Muslim scholars.



Europe in 1500

Italy's central location helped make it a center for the trade of goods and ideas.

The heart of the Italian Renaissance was **humanism**.

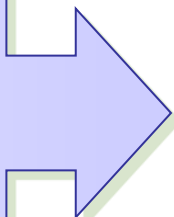
Humanists: 

- Focused on worldly issues, not religion
- Believed education should stimulate creativity
- Emphasized the **humanities**, such as grammar, rhetoric, poetry, and history

Humanists studied the works of Greece and Rome to learn about their own culture.

Italy's city states played an important role in the Renaissance.

Each city was dominated by a wealthy and powerful merchant family.



- These families brought trade and wealth, and provided leadership.
- They were interested in art and emphasized personal achievement.
- They were **patrons** of the arts and supported artists, writers, and scholars.

The Medici family of merchants and bankers controlled **Florence** after 1434.

- Lorenzo d'Medici invited poets, philosophers, and artists to the city.
- Florence became a leader, with numerous gifted artists, poets, architects, and scientists.

Ordinary people began to appreciate art outside of the Church.

Artists continued to portray religious themes, but they did so against classic Greek and Roman backgrounds.

- Donatello created a life-size soldier on horseback, the first sculpture of this size since ancient times.
- In *The School of Athens*, **Raphael** painted a gathering of Greek and Roman scholars that included the faces of Michelangelo, Leonardo, and himself.

Renaissance artists used new techniques, leading to greater realism.

They returned from the stylized forms of the medieval period to the realism of classic Greece and Rome.

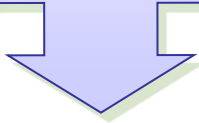
They used new techniques to represent both humans and landscapes.

Perspective allowed
more realistic art.

Distant objects
appeared smaller.

One new technique was
perspective, credited to
Filippo Brunelleschi.

Artists also used new oil paints that reflected light, and used shading techniques to make objects look more real.



- Objects were portrayed in a three-dimensional fashion.
- Painters studied human anatomy and drew from observing models, resulting in more accuracy.

Leonardo da Vinci was an artist and inventor. He studied botany, optics, anatomy, architecture, and engineering.



He used
perspective
in painting
"The Last Supper."

He left sketchbooks filled with ideas for inventions, including submarines and flying machines.

Michelangelo Buonarroti was a sculptor, engineer, painter, architect, and poet.

- He is best known for sculptures such as *David* and for painting the ceiling of the Sistine Chapel.
- He also designed the dome for St. Peter's Cathedral.

Writers were also humanists. Some described how to succeed in the Renaissance world.

Baldassare Castiglione's *Book of the Courtier* described the manners and behavior of the ideal aristocratic man and woman.

- Men played music and knew literature and history, but were not arrogant.
- Women were kind, graceful, and lively, and possessed outward beauty.

Niccolò Machiavelli's *The Prince* was a guide for rulers to gain and maintain power.

- Rather than discuss high ideals, he stressed that the ends justify the means.
- “Machiavellian” has come to refer to the use of deceit in politics. He was attacked as cynical.
- Others said he was simply providing a realistic look at politics.

Objectives

- Explain how the printing revolution shaped European society.
- Describe the themes that northern European artists, humanists, and writers explored.



Terms and People

- **Johann Gutenberg** – in 1455, printed a complete Bible on a printing press with movable type
- **Flanders** – a prosperous region of cities in the present-day Netherlands, France, and Belgium, where the northern Renaissance began
- **Albrecht Dürer** – applied painting techniques to engraving; spread Renaissance ideas in northern Europe
- **engraving** – a technique in which an artist etches a design on a metal plate using acid; the plate is then used to make prints

Terms and People (continued)

- **vernacular** – the everyday spoken language of the common people
- **Erasmus** – an important religious scholar; called for the translation of the Bible into the vernacular
- **Thomas More** – wrote *Utopia*, which describes an ideal and peaceful society in which people live in peace, all are educated, and crime is eliminated
- **utopian** – idealistic or visionary, usually to describe a perfect society
- **Shakespeare** – the leading English language poet and playwright of the Renaissance



How did the Renaissance develop in northern Europe?

As the Renaissance began to flower in Italy, northern Europe was still recovering from the ravages of the Black Death.

But by the 1400s, the cities of the north began to enjoy economic growth and the wealth needed to develop their own Renaissance.

In 1455 **Johann Gutenberg** printed the first complete edition of the Bible using a printing press with movable type.

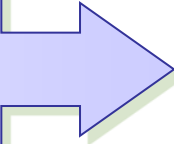
The printing revolution transformed Europe.



- Printed books were far easier to produce than hand-copied books.
- More people had access to a broad range of learning.
- From a few thousand, the number of books in Europe rose to between 15 and 20 million by 1500.

The Northern Renaissance began in the cities of **Flanders**.

From Flanders ideas spread to Spain, France, and England.



- Many painters focused on the common people, creating scenes of everyday life.
- Many writers also focused on the common people, writing in the vernacular.

Northern Renaissance painters focused on realism in their art.

- New oil paints were made using oils from linseed, walnuts, or poppies.
- More realistic colors reflected light, adding depth and glow.
- In the 1400s the paintings of Van Eyck were filled with rich and realistic detail.
- Pieter Bruegel used vibrant colors to portray scenes of peasant life.

Peter Paul Rubens blended the realistic tradition of Flemish painters with classical themes.

A humanist, Rubens used themes from classical history and mythology.

Albrecht Dürer applied Renaissance painting techniques to **engraving**.

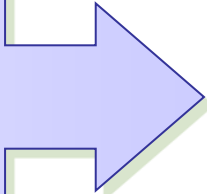
Dürer's engravings and paintings often portrayed religious upheaval or were quite realistic.

Northern humanist scholars stressed education and classical learning.

- They hoped to bring about religious and moral reform.
- Some began writing in the **vernacular**, the everyday language of ordinary people.
- This appealed to the new middle class that was arising in northern towns and cities.

Desiderius **Erasmus** was one of the major religious scholars of the age.

Born in 1466, Erasmus wrote texts on many subjects, including a new Greek edition of the Bible.



- Erasmus called for translation of the Bible into the vernacular.
- He was also disturbed by corruption in the church and sought religious reforms.

Sir Thomas More was an English humanist who pushed for social reforms.

In *Utopia* he described an ideal society where all are educated and justice is achieved for all.

Francois Rabelais was a French humanist who used comedy.

In *Gargantua and Pantagruel*, two giants on a comic adventure offer opinions on religion and education.

The towering figure of northern Renaissance literature is William **Shakespeare**.

- Between 1590 and 1613 he wrote 37 plays, many of which are still performed today.
- He explored Renaissance ideals such as the complexity of the individual.
- He used common language understood by all, and added 1,700 words to the English language.

Objectives

- Summarize the factors that encouraged the Protestant Reformation.
- Analyze Martin Luther's role in shaping the Protestant Reformation.
- Explain the teachings and impact of John Calvin.



Terms and People

- **indulgences** – in the Roman Catholic Church, pardons for sins committed during a person's life
- **Martin Luther** – the German monk who triggered the revolt against the Roman Catholic church in 1517
- **Wittenberg** – city in northern Germany where Luther drew up his 95 Theses
- **Charles V** – the Holy Roman emperor who ordered Luther to recant his 95 Theses

Terms and People (continued)

- **diet** – assembly or legislature
- **John Calvin** – a reformer who preached predestination and the living of a saintly life
- **predestination** – the idea that God had predetermined who would gain salvation
- **Geneva** – the Swiss city where, in 1541, John Calvin was asked to establish a Christian community
- **theocracy** – a government run by religious leaders



How did revolts against the Roman Catholic Church affect northern European society?

In the 1500s, the Renaissance in northern Europe sparked a religious upheaval. Northern European calls for church reform eventually unleashed forces that would shatter Christian unity.

This movement is known as the Protestant Reformation.

The early 1500s were uncertain times in northern Europe.

Disparities in wealth, a new market economy,
and religious discontent all bred uncertainty.

The printing
press spread
knowledge
quickly.

Humanist
ideas for
social
reform
grew in
popularity.

Increasingly,
people
questioned
the central
force in their
lives—the
Church.

Increasingly, the church had become involved in worldly politics.


- Popes competed with Italian princes for political power.
- They plotted against powerful monarchs who sought to control papal lands.
- They lived lavish lifestyles and hired artists to beautify churches.

To finance their lifestyles, church officials charged fees for services such as baptisms and marriages.

Some clergy also sold **indulgences**.
Only the rich could afford to buy them.

- An indulgence lessened the time one spent in purgatory before going to heaven.
- In the Middle Ages, they were often granted for doing good deeds.
- Many Christians, including Erasmus, objected to their sale.

Christian humanists called for a less worldly church, one based more on Bible study.

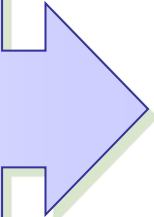


As early as the 1300s, John Wycliff had begun protests against the Church in England.



Jan Hus led a similar protest, for which he was executed, in what is today the Czech Republic.

The German monk and professor, **Martin Luther**, sparked a revolt in 1517.



- Angered by the sale of indulgences in Wittenberg, Germany, Luther drew up his 95 Theses.
- He argued that indulgences had no place in the Bible, and Christians could only be saved by faith.
- Rather than recant, Luther rejected the authority of Rome.

Overnight, copies of Luther's 95 Theses spread and sparked debate across Europe.

In 1521 Pope Leo X excommunicated Luther.

The Holy Roman emperor, **Charles V**, declared Luther an outlaw and ordered his books to be burned.

But many agreed with Luther and became his followers.

Luther's teachings differed from the Roman Catholic Church

- He believed that all Christians had equal access to God, and did not need a priest to intervene.
- He wanted ordinary people to study the Bible.
- He banned the granting of indulgences, prayers to saints, pilgrimages, and confession.

The printing press quickly spread Luther's writings throughout Germany and Scandinavia.

- His followers took on the name "Protestants" because they were in protest against papal authority.
- Luther simplified the mass, but emphasized the sermon. Ministers used their sermons to attack corruption in the Roman Catholic Church.

Some German princes saw Lutheranism as a chance to throw off the rule of both the Church and the Holy Roman emperor.

Some saw an opportunity to seize Church property in their territories.

Others embraced the new church out of nationalistic loyalty.

Many were tired of paying to support clergy in Italy.

In 1524 a peasants' revolt erupted across Germany.

The people demanded an end to serfdom.

Luther denounced the violence, favoring respect for political authority.

With his support, the nobles suppressed the uprising. Thousands died as a result.

Charles V tried to force the German princes to return to the Catholic Church.

In 1555, after several brief wars, Charles and the princes signed the Treaty of Augsburg.



Each prince chose a religion for his realm—either Catholic or Lutheran.



In the north most chose Lutheranism;
in the south most chose Catholicism.

Reformers in Switzerland also challenged the authority of the Catholic Church.

- Ulrich Zwingli, an admirer of Erasmus, also stressed the importance of the Bible and rejected elaborate Church rituals.
- The city council in Zurich adopted his ideas.

John Calvin, a French-born priest and lawyer, was strongly influenced by these Reformation ideas.

Calvin accepted most Lutheran beliefs but added his own belief in **predestination.**

He preached that God had long ago determined who was, and was not, going to gain eternal salvation.

There were two kinds of people, saints and sinners.

Only the saved could live a truly Christian life.

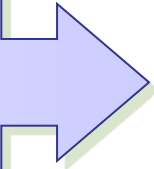
Calvinists attempted to live saintly lives to demonstrate that they were among those God had selected.

The people of **Geneva**, Switzerland, invited Calvin to lead their community.

- He established a **theocracy**. Religious leaders felt entrusted by God to build a Christian society based on hard work, discipline, thrift, and honesty.
- Offenses such as swearing, laughing in church, or fighting resulted in fines or worse. Many Protestants saw Geneva as a perfect Christian community.

By the late 1500s, Calvinism had spread throughout northern Europe.

Challenges to the Catholic Church set off a series of religious wars.



- In Germany, Lutherans and Catholics fought Calvinists.
- In France, Calvinists battled Catholics.
- In Scotland, John Knox, a Calvinist preacher, helped overthrow a Catholic queen.

To escape persecution in England, groups of Calvinists sailed for America in the early 1600s.

Objectives

- Describe the new ideas that Protestant sects embraced.
- Understand why England formed a new church.
- Analyze how the Catholic Church reformed itself.
- Explain why many groups faced persecution during the Reformation.



Terms and People

- **sect** – a subgroup of a major religious group
- **Henry VIII** – king of England; caused England to break away from the Catholic Church
- **Mary Tudor** – daughter of Henry and Catherine of Aragon; as queen she tried to restore Catholicism in England
- **Thomas Cranmer** – first archbishop of the Church of England, wrote *The Book of Common Prayer*

Terms and People (continued)

- **Elizabeth** – daughter of Henry VIII; queen for 45 years, brought compromise between Catholics and Protestants
- **canonize** – to recognize someone as a saint
- **compromise** – an acceptable middle ground
- **Council of Trent** – appointed by the pope in 1545; over 20 years, advised about reforms to answer the Protestant challenge

Terms and People (continued)

- **Ignatius of Loyola** – the Spanish knight who founded the Society of Jesus, or Jesuits
- **Teresa of Avila** – began an order of nuns, reformed Spanish convents and monasteries
- **ghetto** – a separate section of a city where members of a minority group are forced to live



How did the Reformation bring about two different religious paths in Europe?

Throughout Europe, Catholic monarchs and the Catholic Church fought back against the Protestant challenge. They took steps to reform the Church and to restore its spiritual leadership of the Christian world.

Still, Protestant ideas continued to spread.

As the Reformation continued, hundreds of new Protestant **sects appeared.**

- Some broke away from the mainline churches.
- Many followed the teachings of Luther, Calvin, or Zwingli, but some were more radical.

One new sect was the Anabaptists.

- Anabaptists rejected the baptism of infants.
- Some radical Anabaptists favored the abolition of private property and sought to speed up God's judgment day.
- But most Anabaptists were peaceful, calling for religious toleration and separation of church and state.

Today's Baptists, Mennonites, and Amish all have Anabaptist origins.

The English Reformation was not due to reformers, but rather to a king—Henry VIII**.**

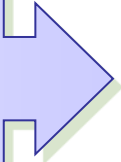
In 1527 Henry sought an annulment from his wife Catherine, who had only borne a daughter, **Mary Tudor**.

He wished to marry a young noble-woman, Anne Boleyn. He hoped she would bear him a male heir.

When the pope refused to annul the marriage, **the king took over the English Church.**

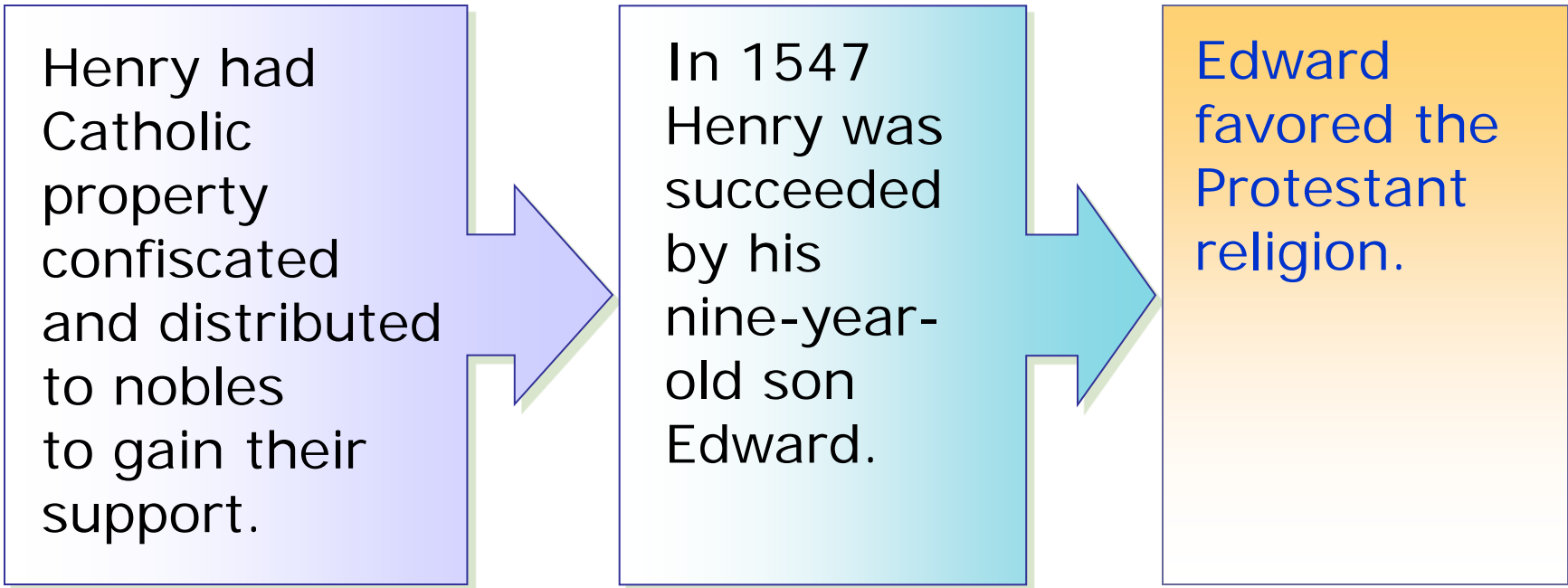
Parliament placed the Church of England under Henry VIII's control.

Thomas Cranmer was appointed archbishop.



- Archbishop Cranmer annulled the marriage.
- Henry married Anne Boleyn. They had a daughter, Elizabeth.
- Catholics who opposed Henry were executed.
- The Catholic Church **canonized** Sir Thomas More, one of those killed.

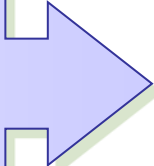
Henry had Catholic property confiscated and distributed to nobles to gain their support.



In 1547 Henry was succeeded by his nine-year-old son Edward.

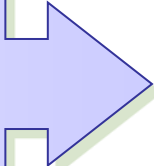
Edward favored the Protestant religion.

Parliament passed several laws to make the English or “Anglican” Church more Protestant.



Thomas Cranmer drew up *The Book of Common Prayer*, which became required reading at all Anglican services.

While still in his teens, young Edward died and was succeeded by Mary Tudor.



Mary tried to restore Catholicism and had many Protestants burned at the stake for heresy.

In 1558 25-year-old Elizabeth took the throne. The “Elizabethan era” would unite England and avoid future religious wars.

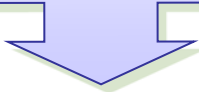
- She compromised between Catholics and Protestants.
- She did not allow herself to be put at the head of the Anglican Church.

The service was translated from Latin to English.



Major European Religions About 1600

From 1530 to 1540, Pope Leo led a movement to reform the Catholic Church.



This effort was also called the Counter-Reformation.

- In 1545 Pope Leo called the **Council of Trent** to end corruption and worldliness in the Church and settle issues of doctrine.
- The Council declared that salvation comes through both faith and good works.

Pope Leo also strengthened the Inquisition to fight against Protestantism.

The Inquisition was a special court set up during the Middle Ages.

- The Inquisition used secret testimony, torture, and executions to root out Protestant heresy.
- It prepared a list of immoral or irreligious books Catholics could not use, including the writings of Calvin and Luther.

In 1540, the Pope recognized a new religious order, the Society of Jesus, or Jesuits.

Ignatius of Loyola, a Spanish knight, founded the order as “soldiers of God.”

- Jesuits followed strict moral and spiritual rules.
- Their rigorous training included complete obedience to the Church.
- They ran schools and traveled to distant lands as missionaries.

Teresa of Avila established an order of nuns.

- Her order lived in isolation, eating and sleeping little.
- They dedicated themselves to prayer and meditation.
- After her death, Teresa was canonized.

During the Counter-Reformation, many Catholics felt renewed feelings of intense faith.

By 1600, a majority of Europeans remained Catholic, but Protestantism had a major foothold on the continent.

- The Catholic Reformation succeeding in bringing back many Protestants and in reforming the Church.
- Religious conflict influenced political debate, which erupted into war throughout much of Europe.

Heightened passions about religion also resulted in intolerance and persecution.



- Between 1450 and 1750, tens of thousands were killed as witches, especially in the German states, Switzerland, and France. Most were women.
- Belief in witchcraft represented twin beliefs in Christianity and magic. Witches were seen as agents of the devil and thus anti-Christian.

Jews faced increasing persecution and restrictions during the Reformation.

From the 1550s, many Jews migrated to the Ottoman empire or the Netherlands.



- They were expelled from Spain in 1492.
- In 1516 Venice ordered Jews to live in a separate part of the city called a **ghetto**.
- Luther called for their expulsion in the north.
- In the 1550s, the Pope added new restrictions.

Objectives

- Explain how new discoveries in astronomy changed the way people viewed the universe.
- Understand the new scientific method and how it developed.
- Analyze the contributions that Newton and other scientists made to the Scientific Revolution.



Terms and People

- **Nicolaus Copernicus** – Polish astronomer who proposed a heliocentric model of the universe
- **heliocentric** – Copernicus's idea that the sun and not the Earth was at the center of the universe
- **Tycho Brahe** – Danish astronomer who collected data to prove that Copernicus was correct
- **Johannes Kepler** – mathematician who plotted the orbits of planets and discovered they are elliptical
- **Galileo** – the scientist who proved that the Earth moves around the sun; in 1633, the Inquisition forced him to recant his heliocentric views

Terms and People (continued)

- **Francis Bacon** – with Descartes, rejected the assumptions of Aristotle; viewed the scientific goal as improving technology, not supporting the Bible
- **René Descartes** – proposed the need to search for provable knowledge; the only assumption he could not question was doubt itself
- **scientific method** – a step-by-step process of discovery requiring the collection of accurately measured data
- **hypothesis** – a logical or possible explanation to a problem to be tested using the scientific method

Terms and People (continued)

- **Robert Boyle** – explained all matter as being composed of tiny particles that behave in knowable ways; proposed laws governing gases
- **Isaac Newton** – argued that there were uniform laws of nature and that all motions could be measured mathematically
- **gravity** – proposed by Newton as the force that keeps planets in orbit
- **calculus** – a branch of mathematics partially developed by Newton



How did discoveries in science lead to a new way of thinking for Europeans?

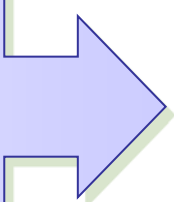
In the mid-1500s, a profound shift in scientific thinking brought the final break with Europe's medieval past. At the heart of this Scientific Revolution was the assumption that mathematical laws governed nature and the universe.

People, therefore, could know, manage, and shape the physical world.

Until the mid-1500s, Europeans accepted Ptolemy and Aristotle, who believed the Earth was the center of the universe.

This view had become Church doctrine.

In 1543, Polish astronomer **Nicolaus Copernicus** challenged this view.



- Copernicus proposed a **heliocentric** or sun-centered model.
- The Earth was just one of a number of planets revolving around the sun.

Copernicus's revolutionary theory was rejected.

If the classic scholars were questioned, then all knowledge might be called into question.

But careful observations by **Tycho Brahe** supported Copernicus.

Johannes Kepler used Brahe's data to calculate the orbits of the planets.

Kepler found that the planets don't move in perfect circles as earlier believed.

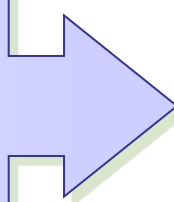
In Italy **Galileo** Galilei built a telescope and observed several moons in orbit around Jupiter.

He said these movements were the same as those of the planets around the sun.

This contradicted Church doctrine that the Earth was the center of the universe.

Galileo was forced to recant his theories before the Inquisition.

Despite opposition from the Church, a new approach to science emerged during the early 1600s.



Scientists rediscovered Greek philosopher Plato, who saw mathematics as the key to learning about the universe.

Francis Bacon and **René Descartes** challenged medieval scholarship that sought only to make the world fit into the teachings of the Church.

Bacon and Descartes argued that truth is not known at the beginning of the inquiry, but rather at the end.

- Bacon stressed observation and experimentation.
- He wanted science to be useful in people's lives.

Descartes emphasized human reasoning as the best road to understanding.

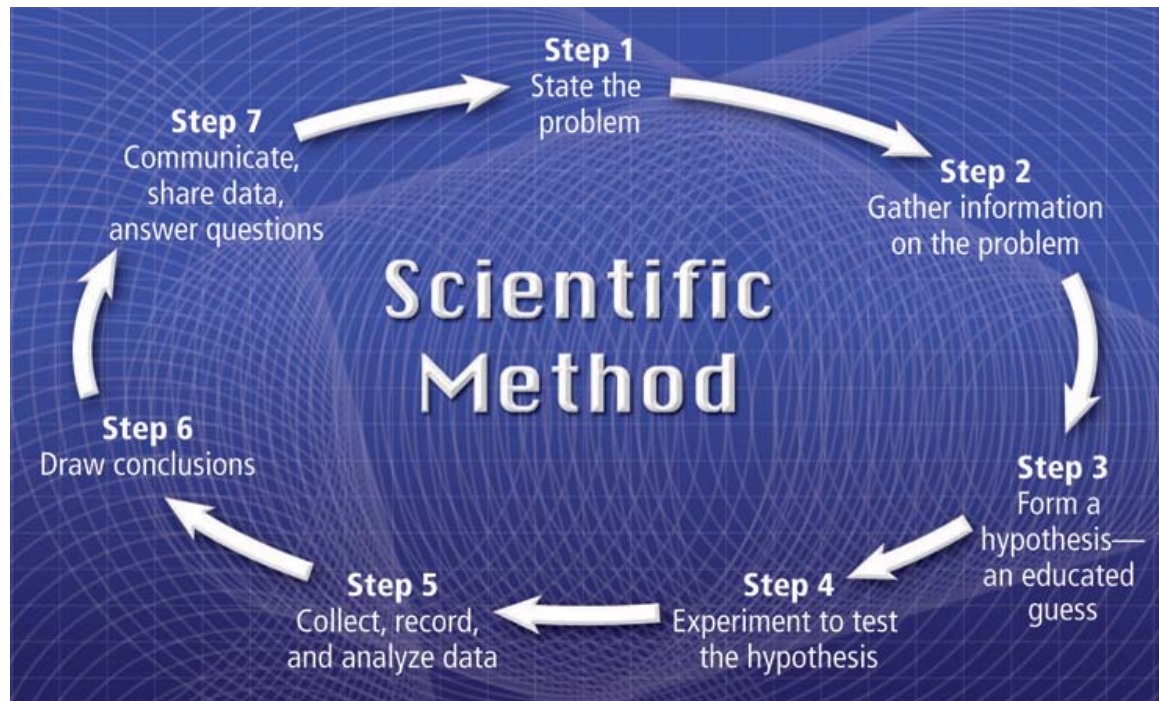
In his *Discourse on Method* (1637), he discarded all traditional authorities to search for knowledge that was provable.

The only thing he could not question was doubt.

*"I think,
therefore I am."*

—Descartes

Over time, a step-by-step **scientific method** was developed. It required the collection of accurate data and the proposal of a logical **hypothesis** to be tested.



There were dramatic advances in medical knowledge in the 1500s and 1600s.



- Andreas Vesalius published *On the Structure of the Human Body* in 1543, the first accurate and detailed study of human anatomy.
- Anton van Leeuwenhoek perfected the **microscope** and became the first person to see cells and microorganisms.

There were dramatic advances in medical knowledge in the 1500s and 1600s.



- **William Harvey** described the circulation of blood, showing that the heart was a pump.
- **Ambroise Paré** developed new surgical techniques, tools, artificial limbs, and ointments to prevent infection.

Chemistry was transformed by the Scientific Revolution.

Medieval alchemists tried to transform ordinary metals into gold.

Robert Boyle:

Explained that all matter is composed of tiny particles that behave in knowable ways

Defined the difference between individual elements and compounds

Explained the effect of temperature and pressure on gases

Isaac Newton linked science and mathematics.

Newton theorized that **gravity** was the force that controls the movements of the planets.

He believed that all motion in the universe can be measured and described mathematically.

He contributed to the development of **calculus**, a branch of mathematics, to help explain his laws.