

The Scientific Revolution & Enlightenment

California Content Standards:

10.2 Students compare and contrast the Glorious Revolution of England, the American Revolution, and the French Revolution and the enduring effects worldwide on the political expectations for self-government and individual liberty

1. Compare the major ideas of philosophers and their effect on the democratic revolutions in England, the United States, France, and Latin America(e.g. biographies of John Locke, Charles-Louis Montesquieu, Jean-Jacques Rousseau, Simon Bolivar, Thomas Jefferson, James Madison).
2. List the principles of the Magna Carta, the English Bill of Rights(1689), the American Declaration of Independence(1776), the French Declaration of the Rights of Man and the Citizen(1789), and the U.S. Bill of Rights(1791).
3. Understand the unique character of the American Revolution, its spread to other parts of the world, and its continuing significance to other nations.

HISTORY AND SOCIAL SCIENCE ANALYSIS SKILLS

Chronological and Spatial Thinking

1. Students compare the present with the past, evaluating the consequences of past events and decisions and determining the lessons that were learned.
2. Students analyze how change happens at different rates at different times; that some aspects can change while others remain the same; and understand that change is complicated and affects not only technology and politics but also values and beliefs.
3. Students use a variety of maps and documents to interpret human movement, including major patterns of domestic and international migration, changing environmental preferences and settlement patterns, the frictions that develop between population groups, and the diffusion of ideas, technological innovations, and goods.
4. Students relate current events to the physical and human characteristics of places and regions.

Historical Research, Evidence, and Point of View

1. Students distinguish valid arguments from fallacious arguments in historical interpretations
2. Students identify bias and prejudice in historical interpretations.
3. Students evaluate major debates among historians concerning alternative interpretations of the past, including an analysis of authors' use of evidence and the distinctions between sound generalizations and misleading oversimplifications.
4. Students construct and test hypotheses; collect ,evaluate, and employ information from multiple primary and secondary sources; and apply it in oral and written presentations.

Historical Interpretation

1. Students show the connections, casual and otherwise, between particular historical events and larger social, economic, and political trends and developments.
2. Students recognize the complexity of historical causes and effects, including the limitations of determining cause and effect.
3. Students interpret past events and issues within the context in which an event unfolded rather than solely in terms of present day norms and values.
4. Students understand the meaning, implication, and impact of historical events while recognizing that events could have taken other directions.
5. Students analyze human modifications of a landscape, and examine the resulting environmental policy issues.

6. Students conduct cost/benefit analyses and apply basic economic indicators to analyze the aggregate economic behavior of the U.S. economy.

Read Spielvogel pp. 448-501

Scientific Revolution

Science had remained remarkably uniform since Aristotle & Galen
their theories supported the Christian view of the universe
Renaissance brought some ancient critics back to light
17th century thinkers realized not everyone agreed with Aristotle
Renaissance artists also brought focus back to observation of nature
Criticism of Roman Catholic Church encouraged thinkers to challenge all
If religion is wrong, why not the science based on it?
Hermetic Magic also encouraged exploration of physical mysteries

Revolution in Astronomy

Aristotle and Ptolemy had developed an accepted universe system
Earth was center of Universe
planets, sun, and stars revolved around Earth
revolved in perfect circles
see pg. 452
Gods lived beyond the stars
“Heavenly Bodies” were made of different solid substance

Nicolaus Copernicus

Polish astronomer is the first to disagree with ancient system
1543 - *On the Revolution of Heavenly Spheres* published
so controversial, waited for death to publish
first astronomer to argue that sun is center of universe
still believes in perfect circles and heavenly bodies

Tycho Brahe

state astronomer for King Frederick II of Denmark
spent 20 years observing stars and recording their positions
laid foundation for the work of Kepler

Johannes Kepler

became Brahe's assistant shortly before he died
will become imperial mathematician to Rudolf II of Austria
Kepler will publish three laws of planetary motion based on Brahe

1. planets orbit in the shape of an ellipse, not circle
2. speed of planet increases closer to sun
denies divine perfect motion
3. planets with larger orbits revolve slower

Galileo Galilei

Italian astronomer, inventor, and mathematician
first to develop the telescope to study the stars
1610 - publishes *The Starry Messenger*
discovered mountains and craters on moon, moons around Jupiter
destroys Aristotle's notion of perfect heavenly bodies
planets clearly made of physical matter like Earth
agrees with Copernicus' sun-centered universe theory

Galileo taken to face Roman Inquisition
forced to recant belief in sun-centered universe
Church feared destruction of theological universe
see quote pg. 456
Galileo agrees to not discuss Copernicanism
1632 - publishes(in Italian) *Two Chief World Systems: Ptolmaic and Copernican*
argued for Copernican system
Galileo place under house arrest for remainder of life
Galileo also made two contributions to laws of motion
1. proved that a body accelerated when force was applied
2. proved that uniform motion is as likely as uniform rest

Isaac Newton

English scientist will tie together work of previous scientists
invented calculus
1686 - publishes *Principia*
last serious scientific work written in Latin
proved mathematical laws of gravitation
est. three principles of motion
1. a body in motion remains in motion
2. a body at rest remains at rest
3. for action, an equal and opposite reaction
Newton demonstrated his laws applied to planetary bodies
created a brand new model for the universe
Newton believed that God created system and was everywhere

Medicine

Galen had taught that the body consisted of four competing humors
blood, yellow bile, phlegm, black bile
disease caused by lack of balance
also believed in two separate blood systems based in liver
Paracelsus
physician who turned off many with arrogant nature
pioneered disease diagnosis and treatment
claimed that the body was made of chemical reactions, not humors
disease caused by chemical imbalance that is treatable

Andreas Vesalius

1543 - publishes *On the Fabric of the Human Body*
est. that medicine should be based on dissection of the body
corrected Galen's error on blood system

William Harvey

English physician
demonstrated blood circulates through whole body from heart

Women

Since universities were centers of Jesuit learning, SR happens outside
women become more involved as assistants/educators/pioneers
Maria Sibylla Merian

- assisted her father who dissected insects and plants
- drew illustrated diagrams of various species

Maria Winkelmann

- assisted her husband as an astronomer
- discovered her own comet

Women were largely misunderstood by scientists

- female images had been shaped by male scientists

- William Harvey argued men provided “spark” for life over “matter”

- the uterus had been portrayed as a reversed penis

 - later redefined as perfect instrument for child bearing

 - used to reinforce traditional gender roles

- female skeletons were portrayed having smaller skulls

- Midwives lost prestige as medicine moved into childbirth

 - midwives still served the poor

 - see Spinoza pg. 463

Rene Descartes

- fundamentally changes the way humankind is perceived

- 1637 - publishes *Discourse on Method*

 - see quotes on pp. 464

 - argues that all senses are not reliable

 - “I think therefore I am”

 - Only reason can be used to determine truth, not faith or Scripture

 - see Descartes pg. 475

 - Cartesian Dualism

 - argued that mind and matter are two separate substances

 - both created by God, but separate

 - all matter can be understood by reason and examination

 - condemned by Church, place on Index of Forbidden Books

Scientific Method

- new method of approaching problems based on reason

Francis Bacon

- English lawyer argued for experimentation before theory

- believed science should be used to maximize “human utility”

 - in other words, to conquer nature

- Descartes argued that all elements of an argument must be true for the conclusion to be true

- Scientific Method: Hypothesis leads to experimentation to fact

Science and Religion

- The SR brings science in direct conflict with religion

 - Galileo quote pg. 467

Benedict de Spinoza

- did not accept Descartes separation of mind and matter

- argued that God was in everything

- believed that most people misunderstand God for their own interest

- argued that morality was part of nature, not religion

Blaise Pascal

French scientist who attempted to unite religion and science
The Thoughts is published upon his death
argued that humans were capable of greatness, yet weak
Christianity was the only religion that presented this dualism
Original Sin and Salvation
see quotes pg. 469
Argued that man was not capable of perceiving “everything”
God is infinite, so can not be perceived by reason

Scientific Societies

Science is able to spread much quicker in the 17th century
1662 - English Royal Society formed
recognized but not supported by government
1666 - French Royal Academy formed
run and paid for by government
both societies interested in practical inventions for good of the state
science was encouraged by political leaders for more power
Scientific journals helped to spread knowledge throughout Europe

The Enlightenment

The Scientific Revolution had far reaching affects
higher literacy rates spread new discoveries throughout Europe
18th century philosophes rejected 17th century religious base
wanted to see reason applied to religion and Bible
Travel literature supported fact that there were many options
Newton and Locke provided new universal foundation
Newton described a universe described purely by reason
Heavenly bodies no longer exist
Locke argued that all people are born with blank minds
knowledge is attained solely through experience
Reason can be used to fill in all knowledge gaps
not just of physical world, but all knowledge

Philosophes

Group of intellectuals who pushed the growth of reason/secularism
mostly educated upper-middle class
wanted to use new philosophy to change the world to a better place
called for religious toleration and freedom of expression
constantly hiding from state and religious authorities
Paris will be center of the Enlightenment
Philosophes tried to find “natural laws” in all areas of knowledge
Diderot

French writer who decided to compile knowledge
publishes *Encyclopedia* in 28 volumes
many philosophes made contributions
much information was very controversial
French Gov. forced him underground

Montesquieu
French Noblemen

1748 - publishes *The Spirit of Laws*
argues for checks and balances in government
power split between executive/legislative/judicial

Voltaire

French writer and philosopher
argued for complete freedom of expression
“I do not agree with what you say, but I will defend to the death your right to say it.”
Condemned religious fanaticism as destructive
see Voltaire pg. 479
see Diderot pg. 480
argued that God created world but is not active
Deism

Jean-Jacques Rousseau

1762 - publishes *The Social Contract*
submitted that men were happy & free in natural state
argued that government evolved to protect private property
see quote pg. 483
admitted that it was impossible to return to natural state
therefore, men must take back their liberty
direct democracy

Economics

Physiocrats argued that Mercantilists were wrong
wealth is not finite based on gold and silver
wealth is based land, agriculture, and mining
argued that economics is natural and should not be
influenced by government

Adam Smith

Scottish philosopher - “father of economics”
1776 - publishes “Wealth of Nations”
Laissez-faire economics
based on laws of supply and demand
natural forces
“free hand of the market”
trade is always beneficial
Government should never interfere in economy

Paul Holbach argues for pure atheism

humans are machines

Marie Jean de Condorcet argues that mankind is on the way to perfection

sees history as a course of progress that is nearly complete

Women were not granted equal consideration under the

Enlightenment by men and argued differently

Mary Wollstonecraft

argued that if women possess reason, they must be equal
obedience to men in contrast to philosophes

see Wollstonecraft pg. 485

Salons

sitting rooms in the houses of wealthy women nobles
organized as meeting places for intellectuals and politicians
prestige based on who attended your salon
gave women access to influencing policy

Culture and Society in Enlightenment

Rococo

new art form that emphasized grace, gentle lines, and curves
in contrast to grandeur of Baroque
very secular - reflected pursuit of worldly happiness
used by many European courts "keeping up with the Bourbons"
see pg. 486

Music

classical music develops during the Enlightenment
opera, sonata, concerto, symphony

Johann Sebastian Bach

composed both secular and religious music
Coffee Cantata and St. Matthew's Passion

George Frederick Handel

wrote large operas known for spectacular displays
better known for his religious works
Messiah

Franz Joseph Haydn

composed 104 symphonies for Esterhazy Bro. of Austria
also composed The Creation and The Seasons
made for public

Wolfgang Amadeus Mozart

child prodigy who composed first opera at age 12
first to extensively use the piano
very eccentric composed on verge of poverty in Vienna
The Marriage of Figaro, The Magic Flute, Don Giovanni

Novel develops in Great Britain during the Enlightenment

History becomes almost completely secularized, no religious explanations

Edward Gibbon: *Rise and Fall of the Roman Empire*

Law was organized and ruled by national courts

punishment was swift and severe for many offenses
some philosophes begin to argue for rehabilitation

Religion and the Enlightenment

Most Europeans were still very religious in their daily lives

Christianity was becoming increasingly weak in political affairs

Pope was increasingly powerless over affairs of state

Toleration for different religions was growing, but not complete

Jews lived mainly in Eastern Europe and were singled out
special penalty taxes and pogroms

Protestant Revivalism

many Protestants felt that their faith had stagnated

John Wesley

developed a more emotional, mystical version of Anglicanism

begins Methodist Church

more good works and emotional conversions