The Age of Reason
Europe After the Renaissance
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Teacher’s Guide

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THE AGE OF REASON
1642-1800

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THE AGE OF REASON
1642-1800
Viewing Time: 22 Minutes

PROGRAM SUMMARY

This program, filmed both in Europe and America, uses historical locations, renactments, and artwork to provide 8th through 12th grade students with a glimpse of some of the most important cultural and intellectual changes that occurred during the Age of Reason.

The program opens with a review of the Renaissance trends that ultimately gave rise to the Age of Reason. Students learn about the life of Isaac Newton, who is considered to be the major figure behind this era.

Students then discover two very important innovations that resulted in new ways of organizing a growing body of knowledge: Namely, the development of encyclopedias and the development of a system for classifying living things into distinct groups.

Next, students discover that the pursuit of science became a popular pastime during the Age of Reason and that both Benjamin Franklin and Thomas Jefferson were avid amateur scientists. A connection is made between the 18th century mania for science and the invention of important new machines that led to the Industrial Revolution.

To develop a sense of appreciation for “The Quest for Beauty” that was of considerable cultural importance during this era, students tour the grand country estate of the Duke of Devonshire and, as a result, learn how seriously this quest was taken in the mid-18th century.

Students then learn how many of the grandest European homes were built, in part, from money their owners derived from investments in the colonies. Finally, students discover how the American colonists were
greatly inspired by certain prevalent ideals of the Age of Reason when they wrote the Declaration of Independence.

**STUDENT OBJECTIVES**

After viewing this video and participating in the lesson activities, students should be able to:

- Explain the historical meaning of the term "Age of Reason."

- Describe how the work of Sir Isaac Newton led to a flowering of the Age of Reason.

- Summarize the most important historical events that took place in England during Newton’s childhood.

- Explain the historical importance of the work of Denis Diderot and Carl Linnaeus.

- Evaluate the role of amateur scientists in the creation of an Industrial Revolution.

- Explain the ways that colonies created wealth for their mother countries and analyze why a colonist might feel resentment toward the mother country.

- Analyze the connection between the scientific revolution of the 17th and 18th centuries and the American Revolution of 1776.

**TEACHER PREPARATION**

Before presenting this program to your students, we suggest that you preview the video and review this guide, along with the blackline masters that accompany it, in order to familiarize yourself with their contents. You may decide to duplicate some or all of the blackline masters before the presentation of this program.
As you review the instructional program outlined in this guide and the accompanying blackline masters you may decide to make certain additions, deletions, or substitutions to meet the specific needs of your class. We encourage you to do so, for only by tailoring this program to your students will they obtain the maximum instructional benefits afforded by these materials.

**INTRODUCING THE PROGRAM**

Introduce this program by stating that much of the way we think about things in the late 20th century has its roots firmly embedded in the great work of Isaac Newton. Before Newton’s time there was no method to science and science and Christianity often came into conflict (Galileo is a good example). Newton gave us the rational, mechanistic view of the universe that most people of today still unconsciously embrace. As a result of Newton’s development of the scientific method, science flourished and has, for the most part, assumed the role of “giver of truth”—a role that belonged almost entirely to religion up until the Age of Reason.

Newton’s great scientific insights were embraced not only by other scientists, but by musicians, artists, philosophers, politicians, and ordinary people as well. Toward the second half of the end of the 18th century, the Age of Reason became known as “The Enlightenment,” for it was believed that civilization had reached a point where reason had finally triumphed over superstition. This belief brought a growing sense of the limitlessness of human possibility. And this new sense brought with it demands for greater freedom and equality—demands clearly expressed in the American Declaration of Independence.

Introduce the concept of Deism as it was embraced by Benjamin Franklin, Thomas Jefferson, and Thomas Paine, i.e. a rejection of most conventional forms of religion, accepting reason as the only guide to truth;
the view of God as the master clockmaker who builds the clock, sets it in motion, and then refuses to intervene in its actions. This Deist view of the universe has its roots in the scientific work of Isaac Newton.

Present the Video. Viewing time: 22 minutes.

FOLLOW UP ACTIVITIES

Discussion: After the video presentation, you can lead a discussion based on the following. The script of the video is provided on page 9 of this guide for reference for many of the suggested discussion questions. Other questions are designed to inspire a great deal of thought and perhaps debate. You may even choose to use some of the questions for homework assignments or to choose teams in class for debate.

1. Discuss first the historical meaning of the term “Age of Reason” and make sure students fully understand its significance in history.

2. Discuss how the work of Sir Isaac Newton led to a flowering of the Age of Reason.

3. What importance did the work of Denis Diderot and Carl Linnaeus have during this period in history?

4. What role did amateur scientists have in the creation of an Industrial Revolution?

5. In the modern industrial world, most people tend to look toward science to solve problems; for example, controlling disease, increasing food production, improving transportation, communication, and factory output. To what degree can science be relied upon--and not relied upon--to solve the social and moral problems of our modern world?

6. Using the Timeline provided on Blackline Master 3, review some of the important historical events that took place during the Age of Reason.
7. What is the value of religion in our modern civilization as compared to the value of science?

8. Why do science and religion often seem to be at odds with one another--for example, evolution versus creationism?

9. During the Age of Reason, many political leaders were also amateur scientists, poets and musicians. Today most American politicians are lawyers. Discuss the implications of this.

10. Discuss ways that colonies created wealth for their mother countries. Why might a colonist have felt resentment toward the mother country?

11. What was the connection between the scientific revolution of the 17th and 18th centuries and the American Revolution of 1776?

**Research Topics:** The following are suggestions for oral and/or written reports. They can be used as individual or group assignments.

1. The Life of Isaac Newton
2. Deism
3. The Work of Voltaire and Rousseau
4. Painting and Sculpture During the Age of Reason.
5. Samuel Pepys
6. Neoclassicism
7. Samuel Johnson
8. 18th Century Science
9. Alexander Pope
10. Thomas Jefferson
11. Benjamin Franklin
12. The European Colonial Empires During the 17th and 18th Centuries.
Extra Credit Report: Assign individuals or groups of students to read the Declaration of Independence, using an encyclopedia or other source in your library, and to write how they feel the American colonists were inspired by certain prevalent ideals of the Age of Reason when they wrote the Declaration of Independence.

BLACKLINE MASTERS/ANSWER KEY

• Blackline Masters 1 and 2, LIST OF TERMS AND IMPORTANT PEOPLE, will help students become familiar with some of the terms and the people important to this time in history.

• Blackline Master 3, AGE OF REASON TIMELINE, shows the years that correspond to specific events in the period covering the Age of Reason. This blackline master is to be used for reference and discussion.

• Blackline Master 4, CROSSWORD PUZZLE, will test student knowledge of the words introduced in the program.
• Blackline Master 5 is the QUIZ for this video presentation. Below is the answer key for the quiz.

1. calculus, method
2. classifying
3. encyclopedias
4. civil war
5. the Black Plague
6. Puritans
7. machines
8. Hudson's Bay Company
9. Thomas Jefferson
10. Ben Franklin
Script of Video Narration
THE AGE OF REASON
1642-1800

The AGE OF REASON--the period of European history that dawned in the mid 1600s, developed largely as a result of several important scientific advances that had taken place late in the Renaissance--the historical era that came before it.

Among other things, the Renaissance had given rise to two new scientific instruments--the microscope and the telescope.

And, as these devices came into widespread use during the 1600s, many educated people began to see their world in a new light, and as a result, they began to question the old explanations about how the universe functioned. This was due in part to the fact that their ability to see had been remarkably expanded--outward, by the telescope, into the dark reaches of space; and inward, by the microscope, into the fantastic miniature world contained in a drop of pond water.

Each new scientific discovery, whether it was in chemistry, physics, astronomy, or biology, added to a growing conviction that the unique human ability to solve problems in a logical way held the key that would, in time, unlock all the secrets of the universe.

As faith in the power of reason and science grew, certain individuals began to rebel against the dogmatic beliefs and authoritarian political systems they believed were obstructing the free flow of human thought and expression.

In the year 1776, a desire to realize the noblest ideals of the Age of Reason--those of freedom, of equality, and of the pursuit of happiness--led to the revolution of thirteen American colonies against the English throne. And, as
a result, the world's first modern republic was born. Now let us take a closer look at this fascinating period of history by finding out how it developed and learning about the great contributions that certain people who lived during the Age of Reason made to our civilization.

**The Renaissance: The Historical Foundations of the Age of Reason**

The Age of Reason grew out of the cultural Renaissance which began in Italy around 1350 and that slowly spread northward across Europe.

The Renaissance had been an era of rebirth and rediscovery; for during this time artists, scholars, and even politicians had tried to recreate the same level of cultural greatness that had once existed in the ancient civilizations of Greece and Rome. And, although the Renaissance was a time of great religious devotion when many fine churches were built, the people of the era were not involved in religion in quite the same way as their medieval predecessors had been, for growing numbers of people found themselves caught up in a new fascination with the physical world.

As a result of this new fascination, ships sailed out from Renaissance ports on voyages of world exploration. Cities grew, trade increased and created new wealth that occasionally matched the wealth of the land-owning aristocracy.

The invention of the printing press resulted in inexpensive books that allowed new ideas to rapidly spread.

Christianity underwent a movement of reform, and eventually, near the end of the Renaissance, the foundations of modern science were laid down as a result of the research of men like Nicholas Copernicus and Galileo Galilei.

These Renaissance trends, namely the growth of science, of cities, of trade, and of political and religious freedom,
as well as an intense fascination with ancient civilizations, were the raw materials from which the Age of Reason was shaped.

Isaac Newton and the Scientific Revolution
A logical date for the start of the Age of Reason is 1642, the year of the birth of Sir Isaac Newton, the single-most important figure of this new historical era, and the same year that the great Renaissance scientist, Galileo, died.

However, some historians prefer to say that the Age of Reason actually began in the year 1686--the year that Isaac Newton published what many consider to be the greatest scientific book ever written: the "Philosophiae Naturalis Principia Mathematica"--the mathematical principles of natural philosophy--a book that was to radically change both scientific thought and method for centuries to come.

In order to get a feeling for this era, let us discover what was happening in England during Newton's childhood.

Isaac Newton was born in this house near the English village of Grantham in the year 1642. At the time of Newton's birth, 35 years had gone by since the founding of the colony of Virginia, and 22 years had passed since the pilgrims landed at Plymouth Rock.

The year of Newton's birth was the year that the English Civil War began that saw the parliament locked in a deadly battle with the crown, and that turned into an economic class struggle led by wealthy merchants and puritans against the monarchy.

By the time Isaac Newton reached the age of seven, the English Civil War had ended with the execution of King Charles I, and for most of Newton's youth, England was ruled by a puritan named Oliver Cromwell, who governed under the title of "Lord Protector."
The monarchy was finally restored in the year 1660, just one year before Isaac Newton entered Trinity College, here at the University of Cambridge.

Immediately after finishing his university studies, Newton decided to return to his rural home to escape from a re-emergence of the Black Plague that was starting to spread outward from London to other English towns.

By the year 1665, this most dreaded of diseases had taken tens of thousands of lives in England alone. But, in spite of this fact, Isaac Newton experienced a burst of scientific insight never matched before or since in human history.

During a brief 18-month period, he worked out the basics of a new branch of mathematics called calculus.

He made the crucial discovery that all the colors of the rainbow are invisibly present in ordinary white light and wrote out the mathematical explanations for this effect.

He was able to understand and mathematically formulate the principles of gravity while watching an apple fall from a tree here in his garden.

And, at the same time, he described the physical laws that govern the motion of objects, calculated the masses of the sun and planets, and predicted the paths of comets--and all of these discoveries were also written down in precise mathematical language.

But perhaps Newton's greatest achievement was the approach he developed for solving problems that we now call the scientific method.

Before Newton's time, science consisted largely of a mixture of observation combined with religious mysticism. And this approach rarely yielded predictable
results--in fact, the lack of a consistent, logical method to science accounts for its slow rate of progress up to this time.

However, in contrast to the old ways, Newton's scientific method was based on three essential points: observation, generalization, and experimentation. By using this method, the facts were allowed to speak for themselves in a pure, simple, and, above all, rational way.

And so it was that Isaac Newton completed a scientific revolution begun in the late Renaissance by Nicholas Copernicus and, as a result, gave birth to a new era that we now call the Age of Reason.

The Organization of Knowledge: Encyclopedias
As scientists began to use Newton's method and to fully grasp his other scientific insights, the flood of new knowledge they generated was so enormous that a few people dedicated most of their lives simply to collecting and organizing information.

To this end, the Frenchman, Denis Diderot, began to publish the first encyclopedias in the year 1751. These books were an instant success, for by using both words and illustrations, information gleaned from nearly every branch of human knowledge was made easily accessible to the common person. And the political views expressed in these early encyclopedias were to become a major force behind the Revolution that would begin here in the streets of Paris at the end of the 18th century.

The Organization of Knowledge: Biological Classification
A few decades before the French encyclopedists began publishing the information they had collected, a man from Sweden named Carolus Linnaeus had undertaken a task of equal difficulty.

Linnaeus sought to develop a method whereby the bewildering array of living things could be separated
into distinct groups; in other words, could be classified in a logical and systematic way.

It was Linnaeus' hope that if such a system of biological classification could be developed, a much deeper understanding of the relationships between living things, and even of the nature of life itself, might be achieved.

To accomplish this goal, he developed a system whereby living creatures were grouped according to their similarities and differences. Going from the creature's most generalized characteristics--those that defined its kingdom whether it was an animal or a plant--down through several intermediate categories, to its most specific characteristics: those that defined its single, unique species.

Besides actually developing this system for biological classification, Linnaeus also undertook another enormous task--that of actually assigning scientific genus and species names to over 12,000 different types of living things.

The task begun by Linnaeus in the early 1700s still continues, and today over one million, four hundred thousand different species of living things have been named and classified.

**Popular Science**

By the time Linnaeus published his famous book on biological classification, the fascination with science had filtered down to a popular level and people from all walks of life, including several famous political leaders, had started to carry out amateur experiments and to invent all sorts of strange new machines.

Benjamin Franklin's experiments with electricity are quite well known.
And, as can be seen by looking at the array of scientific instruments here in Thomas Jefferson's bedroom, it is clear that he, too, was a devoted amateur scientist. And he would no doubt have owned one of these popular 18th century scientific toys, called an orrery, that mimicked the movement of heavenly bodies with clocklike precision.

But Jefferson's interest in science had a practical side as well, for he sought to exploit scientifically-acquired information as a means of establishing a new farwestern frontier for America. For this reason, in 1804, he instructed the Lewis and Clark expedition to keep a detailed record on all of the plants, animals, and minerals they encountered on their journey.

**New Machines: The Birth of an Industrial Revolution**

With the amount of popular interest in science that existed throughout the Age of Reason, it is not at all surprising that some very useful new machines were invented--machines that very soon would dramatically change the way that people worked and lived.

Steam engines similar to this one were in use as early as 1727, and by the end of the 18th century they were occasionally being used as sources of power for certain new machines used in cloth making, such as the Spinning Jenny that spun raw fibers into thread and the the power loom that wove the threads into finished cloth.

Machines like these were to become the new work horses of a growing movement towards industrialization--where machines did the work that had previously always been done by hand.

**A Quest for Beauty**

A premonition that industrialization would soon cause handmade things to disappear may be the force that drove many people of the Age of Reason on a truly
remarkable quest for beauty that come to be epitomized in the fine English country houses of the era.

The enormous mansion seen here, called Chatsworth, is the central home of the Dukes of Devonshire, the first-born sons of the powerful Cavendish family, and its history is very interesting.

The original house built on this land was constructed during the Renaissance, in the mid 1500s, according to the plans of an earl's wife named Bess of Hardwick, so that it would resemble her other house, Hardwick Hall, seen here.

Then, 134 years later, Bess's grandson decided to redesign his Renaissance house in order to reflect a more modern, more enlightened point of view.

Accordingly, Chatsworth House was rebuilt to look as it does today, that is along the lines of an ancient Roman temple ornamented with statues and pillars—an architectural trend known as Neoclassicism.

Under its new one and one-third acre roof were contained 175 rooms, most of them ornately decorated, that were connected by over three-quarters of a mile of passageways and 17 staircases.

By looking at this drawing done in 1699, we can see that at that time Chatsworth was surrounded by over one thousand acres of geometrically planted gardens, which no doubt reflected the duke's fascination with a rational and orderly mind.

However, just 57 years later, his grandson, the fourth duke, decided that these formal gardens were too harsh and unnatural, so he ordered that most of them should be removed. In their place, trees were planted in precisely chosen locations that would be the most pleasing to the eye and yet appear to be natural. Among these trees sheep and cattle grazed assuring that the lawn would always be properly trimmed.
Near the house, colorful flower gardens were planted to reflect the more natural mood of his surroundings, and through his windows the duke could now enjoy his new fountain spewing water far up into the air.

Feeling that he still had not created a perfect environment for himself, the duke then had the course of the river changed to achieve the most graceful possible appearance, and then had this attractive new bridge constructed to reach the house. And, feeling he had somehow neglected his horses, he had these enormous stables built, whose roof alone covers almost an acre of land.

With an estate of this size, over one hundred servants were needed to keep things running smoothly. These servants lived in three different villages on the estate that looked a lot like this one. But because one of these servant villages was located uncomfortably close to the duke’s house, he decided that the entire village should be relocated so that all he had to see of it was the steeple of its church. And this beautiful servants' village, called Edensor, is the result of the Duke's relocation efforts.

Today we may think that the job of being a rich man’s servant would be quite a miserable one, but, in truth, being a servant in a great house such as Chatsworth was one of the best jobs available to a common person during this era, and the servants who worked here usually came from the same families generation after generation.

**Colonies and Wealth**

During the Age of Reason, besides Chatsworth, many other magnificent homes were constructed in England—always with an eye toward beauty coupled with a deep sense of order—and each one of them took a fantastic amount of money to build.

It is safe to say that nearly all of these houses were paid for, at least in part, by the wealth their owners derived
from England's colonies. For at that time England was the most powerful country on earth—ruling colonies not only in America, but on every other continent as well.

Spain, too, possessed a vast colonial empire, and by the 1770s was busily establishing a chain of missions in her North American province of Alta California.

These missions were intended not only to bring Christianity to the native people, but also served as schools, factories, and colonial military bases.

Colonies produced wealth for their mother countries in several ways—either in the form of the taxes the colonists were required to pay on imported goods, or directly from the sale of items produced in the colonies, no matter whether these were raw materials, agricultural products, or finished goods.

It should also be noted that during the Age of Reason, a large portion of world trade was in the hands of a few great chartered companies established by certain European monarchs purely to exploit the wealth of their colonial lands.

For example, the farflung outposts of the Hudson's Bay Company were established because, in 1670, the King of England saw to it that company shares were made available to his wealthy friends.

Under its royal charter, the Hudson's Bay Company was given the exclusive right to trap and trade in an area of unexplored land larger than today's United States, so when groups of Hudson's Bay Company trappers out on the frontier of North America sold beaver pelts, a small percentage of each sale went into the pockets of the wealthy shareholders back in Europe and helped to pay for their lavish homes and furnishings.
The American Colonies: The Movement Toward Political Independence

The movement toward political independence by 13 English colonies in America stemmed in part from a deep resentment of colonial exploitation at the hands of what many of the colonists considered to be foreign government that, in their opinion, consisted mostly of rich spendthrift aristocrats who could both tax them and, at the same time, deprive them of proper representation under the law.

But an equally important force behind the American revolution can be found in a marvelous ideal that grew out of revolution in thought inspired by Sir Isaac Newton nearly one hundred years before--namely, the unshakeable belief that if equality and freedom were allowed to flourish in an atmosphere of reason, respect, and faith in God, there were few limits to what a human being might achieve.

THE END