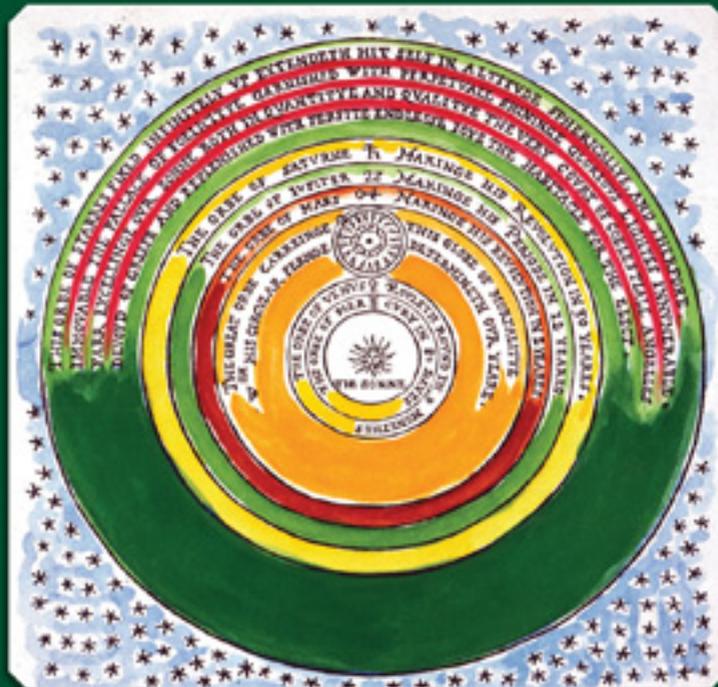


## DOCUMENTS

Interpreting Alternative Viewpoints  
in Primary Source Documents

# What Was Revolutionary About the Scientific Revolution?

*The breakthrough to modern science occurred after the 1400s. What made this science so revolutionary?*



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## *Debating* the DOCUMENTS

Interpreting Alternative Viewpoints  
in Primary Source Documents

# What Was Revolutionary About the Scientific Revolution?

The 2017 World History Course and Exam Description of the College Board Advanced Placement Program\* lists five themes that it urges teachers to use in organizing their teaching. Each World History *Debating the Documents* booklet focuses on one or two of these five themes.

### *The Five Themes*

- 1. Interaction between humans and the environment.** (demography and disease; migration; patterns of settlement; technology)
- 2. Development and interaction of cultures.** (religions; belief systems, philosophies, and ideologies; science and technology; the arts and architecture)
- 3. State-building, expansion, and conflict.** (political structures and forms of governance; empires; nations and nationalism; revolts and revolutions; regional, transregional, and global structures and organizations)
- 4. Creation, expansion, and interaction of economic systems.** (agricultural and pastoral production; trade and commerce; labor systems; industrialization; capitalism and socialism)
- 5. Development and transformation of social structures.** (gender roles and relations; family and kinship; racial and ethnic constructions; social and economic classes)

### *This Booklet's Main Theme:*

- 2** Development and interaction of cultures.

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# Teacher Introduction

## ★ Using Primary Sources

Primary sources are called “primary” because they are first-hand records of a past era or historical event. They are the raw materials, or the evidence, on which historians base their “secondary” accounts of the past.

A rapidly growing number of history teachers today are using primary sources. Why? Perhaps it's because primary sources give students a better sense of what history is and what historians do. Such sources also help students see the past from a variety of viewpoints. Moreover, primary sources make history vivid and bring it to life.

However, primary sources are not easy to use. They can be confusing. They can be biased. They rarely all agree. Primary sources must be interpreted and set in context. To do this, students need historical background knowledge. *Debating the Documents* helps students handle such challenges by giving them a useful framework for analyzing sources that conflict with one another.



*“Multiple,  
conflicting  
perspectives are  
among the truths  
of history.  
No single  
objective or  
universal account  
could ever put an  
end to this endless  
creative dialogue  
within and  
between the past  
and the present.”*

From the 2011 Statement on Standards of Professional Conduct of the Council of the American Historical Association.

## INTRODUCTION

### ★ *The Debating the Documents Series*

Each *Debating the Documents* booklet includes the same sequence of reproducible worksheets. If students use several booklets over time, they will get regular practice at interpreting and comparing conflicting sources. In this way, they can learn the skills and habits needed to get the most out of primary sources.

#### **Each *Debating the Documents* Booklet Includes**

- **Suggestions for the Student and an Introductory Essay.** The student gets instructions and a one-page essay providing background on the booklet's topic. A time line on the topic is also included.
- **Two Groups of Contrasting Primary Source Documents.** In most of the booklets, students get one pair of visual sources and one pair of written sources. In some cases, more than two are provided for each. Background is provided on each source. *Within each group, the sources clash in a very clear way.* (The sources are not always exact opposites, but they do always differ in some obvious way.)
- **Three Worksheets for Each Document Group.** Students use the first two worksheets to take notes on the sources. The third worksheet asks which source the student thinks would be most useful to a historian.
- **One DBQ.** On page 20, a document-based question (DBQ) asks students to write an effective essay using all of the booklet's primary sources.

### ★ *How to Use This Booklet*

#### **1. Have students read “Suggestions for the Student” and the Introductory Essay.**

Give them copies of pages 5–7. Ask them to read the instructions and then read the introductory essay on the topic. The time line gives them additional information on that topic. This reading could be done in class or as a homework assignment.

#### **2. Have students do the worksheets.**

Make copies of the worksheets and the pages with the sources. Ask students to study the background information on each source and the source itself. Then have them take notes on the sources using the worksheets. If students have access to a computer, have them review the primary sources digitally.

NOTE: If you are using these materials with an AP world history class, an honors class, or some other group of advanced and/or more knowledgeable students, you may want to make more written sources available to them on this topic. Do a basic Internet search for sources that provide additional perspectives and then add to the sources provided here.

### 3. “Debate the documents” as a class.

Have students use their worksheet notes to debate the primary source documents as a class. Urge students to follow these ground rules:

- Use your worksheets as a guide for the discussion or debate.
- Try to reach agreement about the main ideas and the significance of each primary source document.
- Look for points of agreement as well as disagreement between the primary sources.
- Listen closely to all points of view about each primary source.
- Focus on the usefulness of each source to the historian, not merely on whether you agree or disagree with that source’s point of view.

### 4. Have students do the final DBQ.

A DBQ is an essay question about a set of primary source documents. To answer the DBQ, students write essays using evidence from the sources and their own background knowledge of the historical era. (See the next page for a DBQ scoring guide to use in evaluating these essays.)

The DBQ assignment on page 20 includes guidelines for writing a DBQ essay. Here are some additional points to make with students about preparing to write this kind of essay.

#### **The DBQ for this Booklet (see page 20):**

The scientific revolution centered above all on new ideas about the solar system or the universe. Why do you think this subject was so important to the scientific revolution?

- Analyze the question carefully.
- Use your background knowledge to set sources in their historical context.
- Question and interpret sources actively. Do not accept them at face value.
- Use sources meaningfully to support your essay’s thesis.
- Pay attention to the overall organization of your essay.

## INTRODUCTION

### ★ *Complete DBQ Scoring Guide*

Use this guide in evaluating the DBQ for this booklet. Use this scoring guide with students who are already familiar with using primary sources and writing DBQ essays.

#### **Excellent Essay**

- Offers a clear answer or thesis explicitly addressing all aspects of the essay question.
- Does a careful job of interpreting many or most of the documents and relating them clearly to the thesis and the DBQ. Deals with conflicting documents effectively.
- Uses details and examples effectively to support the thesis and other main ideas. Explains the significance of those details and examples well.
- Uses background knowledge and the documents in a balanced way.
- Is well written; clear transitions make the essay easy to follow from point to point. Only a few minor writing errors or errors of fact.

#### **Good Essay**

- Offers a reasonable thesis addressing the essential points of the essay question.
- Adequately interprets at least some of the documents and relates them to the thesis and the DBQ.
- Usually relates details and examples meaningfully to the thesis or other main ideas.
- Includes some relevant background knowledge.
- May have some writing errors or errors of fact, as long as these do not invalidate the essay's overall argument or point of view.

#### **Fair Essay**

- Offers at least a partly developed thesis addressing the essay question.
- Adequately interprets at least a few of the documents.
- Relates only a few of the details and examples to the thesis or other main ideas.
- Includes some background knowledge.
- Has several writing errors or errors of fact that make it harder to understand the essay's overall argument or point of view.

#### **Poor Essay**

- Offers no clear thesis or answer addressing the DBQ.
- Uses few documents effectively other than referring to them in “laundry list” style, with no meaningful relationship to a thesis or any main point.
- Uses details and examples unrelated to the thesis or other main ideas. Does not explain the significance of these details and examples.
- Is not clearly written, with some major writing errors or errors of fact.

# Suggestions to the Student

## ★ *Using Primary Sources*

A primary source is any record of evidence from the past. Many things are primary sources: letters, diary entries, official documents, photos, cartoons, wills, maps, charts, etc. They are called “primary” because they are first-hand records of a past event or time period. This *Debating the Documents* lesson is based on two groups of primary source documents. Within each group, the sources conflict with one another. That is, they express different or even opposed points of view. You need to decide which source is more reliable, more useful, or more typical of the time period. This is what historians do all the time. Usually, you will be able to learn something about the past from each source, even when the sources clash with one another in dramatic ways.

## ★ *How to Use This Booklet*

### 1. **Read the one-page introductory essay.**

This gives you background information that will help you analyze the primary source documents and do the exercises for this *Debating the Documents* lesson. The time line gives you additional information you will find helpful.



### 2. **Study the primary source documents for this lesson.**

For this lesson, you get two groups of sources. The sources within each group conflict with one another. Some of these sources are visuals, others are written sources. With visual sources, pay attention not only to the image’s “content” (its subject matter) but also to its artistic style, shading, composition, camera angle, symbols, and other features that add to the image’s meaning. With written sources, notice the writing style, bias, even what the source leaves out or does not talk about. Think about each source’s author, that author’s reasons for writing, and the likely audience for the source. These considerations give you clues as to the source’s historical value.

### 3. **Use the worksheets to analyze each group of primary source documents.**

For each group of sources, you get three worksheets. Use the “Study the Document” worksheets to take notes on each source. Use the “Comparing the Documents” worksheet to decide which of the sources would be most useful to a historian.

### 4. **As a class, debate the documents.**

Use your worksheet notes to help you take part in this debate.

### 5. **Do the final DBQ.**

“DBQ” means “document-based question.” A DBQ is a question along with several primary source documents. To answer the DBQ, write an essay using evidence from the documents and your own background history knowledge.

## The Scientific Revolution

Up through the fourteenth century, Europe did not stand out in its mastery of astronomy, mathematics, geography, biology, human anatomy, or other fields of knowledge that we now call “science.” India and China and the Islamic societies had their own scientific traditions at that time. In many cases, they were ahead of Europe’s. European thinkers were often aware of that fact, and as they began to look outward from the twelfth century on, they turned to Muslim philosophers, medical writers, and mathematicians. Islamic scholars had preserved and commented on the works of ancient Greek thinkers, in particular Aristotle. When Europeans reacquired these works from Islam, they made Aristotle (and his Muslim commentators) the basis of all learning for university scholars.

Muslims had also preserved the work of Ptolemy (second century CE). Ptolemy’s earth-centered view of the universe was the most advanced thinking on the subject for centuries. But later Muslim astronomers even began to raise questions about Ptolemy’s complex planetary system of circular orbits and epicycles (orbits going around other orbits). This complicated system explained planetary movements in such a way as to keep the earth at the center of the universe. It also depicted all heavenly movements as exact circles, a “perfect” form of motion for the heavens, which were seen as a pure spiritual realm.

The problems with Ptolemy noted by Muslim astronomers were also ones that Nicolaus Copernicus tried to overcome with his book in 1543, *On the Revolutions of the Celestial Spheres*. It is this book more than any other that produced the scientific revolution. What made it so revolutionary?

Copernicus described a solar system with the sun at the center and the Earth and planets revolving around it. To claim this as actual fact

would be to reject Ptolemy, Aristotle, and the teachings of the Catholic Church. Copernicus merely suggested it as a mathematically simpler way to think about the heavens. Yet others soon did take his “heliocentric” theory as reality itself. When Galileo Galilei did this, he was put on trial by the Church and forced to recant his views. The Church was not the only force standing in the way of scientific advance. The heliocentric view itself raised many questions. For example, how could the Earth move without throwing everything on it into space? Why can’t we feel it moving? What force could possibly make it move?

Also, the Earth alone was thought to be made of heavy, ordinary matter. The heavens were not seen as empty space containing other ordinary objects. They were a pure, spiritual realm with points of light set in crystal spheres all moving with a perfect circular motion. Earth was the unmoved center of an orderly universe —logical, given that God created it as a home for man. In answering the questions raised by the Copernican system, this entire view of the universe had to be given up.

A line of development went from Copernicus, to Tycho Brahe and Johannes Kepler, to Galileo, and finally to Isaac Newton and his theory of universal gravitation. The result was an entirely new sense of the lawfulness and unity of nature. Galileo’s laws of motion for objects on Earth were adapted by Newton to explain the motions of planets as these had been described by Kepler. A limitless universe opened up, not centered on the Earth and not bound by spheres or the biblical Heaven above them. All this was both frightening and inviting.

In describing this universe, these men also passed on a new spirit and a far more disciplined method of scientific thinking to carry the quest for new knowledge forward. It was this that made the scientific revolution so revolutionary. In fact, it created a revolution that is still underway.

# The Scientific Revolution Time Line

83–161 CE

Lifetime of Claudius Ptolemy of Roman Egypt. His *Almagest* describes a “geocentric” universe—that is, one with the Earth at the center. He describes the universe as a series of nested spheres containing the planets and other heavenly bodies, all revolving around the Earth. In the Middle Ages, the *Almagest* was unknown in Europe but preserved in Arabic by Muslim scholars.

1100s

Gerard of Cremona translates the *Almagest* from Arabic. Europeans also translate the Greek philosopher Aristotle’s major works, preserved by Muslim scholars for centuries. Ptolemy and especially Aristotle become key intellectual authorities for Europe. Other ancient Greek and Islamic writers are translated in the twelfth and thirteenth centuries, including the works of Euclid on geometry, al-Khwarizmi on algebra, the physics of Archimedes, the medical works of al-Razi and Ibn Sina (Avicenna), etc.

1514–1554

Lifetime of Andreas Vesalius. As a lecturer in anatomy, he uses dissection as a teaching tool. He challenges some of the ideas of the ancient Greek physician Galen and the Muslim writers who based their views on Galen’s work.

1543

*On the Revolutions of the Celestial Spheres* by Nicolaus Copernicus is published. Its “heliocentric” theory places the sun—not the Earth—at the center of the universe. At first, the Catholic Church does not condemn the book.

1546–1601

Lifetime of Tycho Brahe. The king of Denmark gives him support as he devotes his life to compiling records of planetary movements that are far more accurate than any previously recorded.

1571–1630

Lifetime of Johannes Kepler. Kepler uses Brahe’s figures to discover that planetary motion is not perfectly circular but elliptical. He reluctantly gives up his geocentric beliefs and formulates laws of planetary motion that Newton will later explain.

1561–1626

Lifetime of Francis Bacon, who forcefully defended an early version of the scientific method, stressing the need to base reasoning and conclusions on careful observation and experiment.

1564–1642

Lifetime of Galileo Galilei. Galileo refines a telescope and uses it to see mountains on our moon and other moons revolving around Jupiter. This challenges the idea of the heavens as perfect and immaterial. In 1632, Galileo is put on trial by the Church and ordered to abandon his heliocentric views. His later work on the motion of objects lays the basis for modern physics.

1578–1657

Lifetime of William Harvey, whose discoveries about the role of the heart in the circulation of blood laid the foundation for modern medicine.

1596–1650

Lifetime of philosopher Rene Descartes. His strict mind-body dualism suggests that all matter, including the human body, is determined by impersonal natural laws. Whereas Bacon stresses observation and experiment as a way to knowledge, Descartes doubts what the senses alone tell us and sees deductive reasoning as the way to truth.

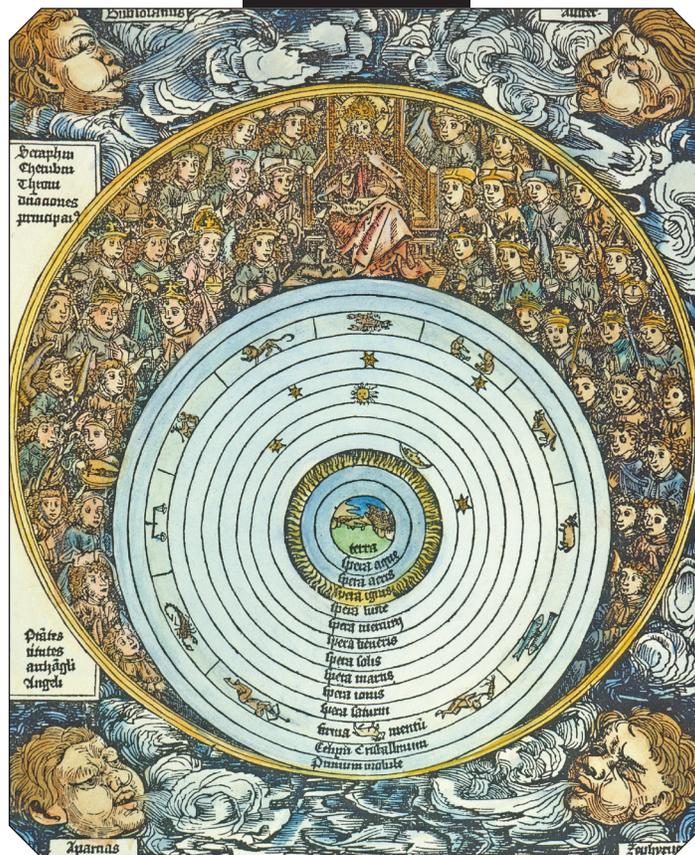
1643–1727

Lifetime of Isaac Newton, whose *Principia Mathematica* (1687) offered the theory of universal gravitation and the three laws of motion that tied together the work of Copernicus, Kepler, and Galileo and provided the foundation for modern physics and engineering.

DOCUMENT 1

# Primary Source Document 1

Document 1



The Granger Collection, New York

## Information on Document 1

**Document 1.** This 1493 woodcut diagram depicts the Christian–Ptolemaic view of the universe. The Earth, made of ordinary matter, is at the center. The sun, moon, planets, and stars all revolve around the

Earth within several perfect crystalline spheres of a pure, spiritual substance. Above these perfect spheres is the realm of God and his angelic court.