

The Age of Revolutions Study Guide

Name: _____

Directions - Answers all starred questions.
Part 1: The Scientific

Revolution

TERMS & NAMES
Scientific Revolution
heliocentric
universal gravitation
scientific method

Build on What You Know Influenced by humanism, scholars began to question classical scientific ideas and Christian beliefs. This new spirit of questioning accepted views of the world became known as the **Scientific Revolution**.

New Scientific Theories

1 ESSENTIAL QUESTION What new ideas did scientists develop?

In the 1500s, scholars began to look at old scientific beliefs in a different way. This change led to an explosion of new ideas.

A Heliocentric Universe In the early 1500s, a Polish astronomer named Nicolaus Copernicus (koh•PUL•Rennuh•kuhs) challenged Ptolemy's geocentric theory. Copernicus reasoned that the stars, Earth, and other planets revolved around the sun, which did not move. This view of the universe is called **heliocentric**, or sun-centered.

Almost 100 years later, German astronomer Johannes Kepler refined and built on Copernicus' theories. He used mathematical laws to prove that the planets did indeed move around the sun. One law showed that the planets revolved in elliptical orbits, and not circular orbits as Copernicus believed. Elliptical orbits are oval in shape.

A Demonstration
In this painting,
Galileo shows the
ruler of Venice how
to use a telescope. ▼



New Scientific Inventions

2 ESSENTIAL QUESTION What new inventions helped scientists make more precise observations and measurements?

In the 1600s and 1700s, scientific investigation was made easier by the invention of such instruments as the microscope, the thermometer, and the barometer.

The Microscope In the 1670s, a Dutch amateur scientist named Anton van Leeuwenhoek (LAY•vuh•HOOK) built a microscope. This brass tube containing curved glass lenses magnified objects between 250 and 300 times. Using the microscope, van Leeuwenhoek observed bacteria, or tiny moving matter, in fluids. He also observed the flow of blood through tiny blood vessels called capillaries.

The Thermometer In the early 1600s, Galileo invented the thermometer, an instrument that measures temperature. Galileo's thermometer was an open glass tube with a bulb containing water at the bottom. The water rose in the tube as it warmed and sank as it cooled. Some 100 years later in 1714, German scientist Gabriel Daniel Fahrenheit (FAR•uhn•HYT) made the first mercury thermometer. He also proposed the first formal temperature measurement system. Fahrenheit's measurement scale showed water freezing at a temperature of 32° and boiling at 212°.

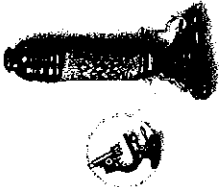
The Barometer In 1643, a friend and supporter of Galileo, Evangelista Torricelli (TAWR•uh•CHEHL•ee), invented the barometer. This instrument measures the pressure of Earth's atmosphere. Later, scientists used the barometer to predict the weather.

REVIEW Why might instruments such as the microscope and the thermometer be useful to scientists?

Three Scientific Inventions

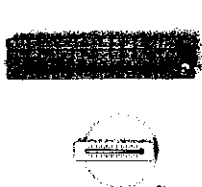
Microscope

Zacharias Janssen (YAHN•suhn), a Dutch maker of eyeglasses, invented the microscope in 1590. Anton van Leeuwenhoek, however, was the first person to observe microscopic life. A microscope made in the late 1600s is shown here.



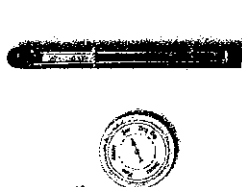
Thermometer

A Swedish astronomer, Anders Celsius, created a thermometer measurement scale in 1742 that showed water freezing at 0° and boiling at 100°. One of the first thermometers to use the Celsius scale is shown here.



Barometer

The barometer is useful in predicting the weather because it measures changes in air pressure, which signal changes in the weather. Rising air pressure usually indicates good weather. Falling air pressure tends to be a sign of bad weather. A replica of Torricelli's barometer is shown here.



History Makers

Sir Francis Bacon (1561–1626)

For Francis Bacon, science was a hobby. He was a politician. Bacon wanted to incorporate rational thinking into politics and science. His writings helped the English legal system set a world standard for fairness. Bacon was among the first to show that rationalism worked in government as well as in science.

Bacon was determined to pursue his passion for scientific experiments even if it killed him. In the end, it did. Bacon became sick and died after testing a theory that snow can actually insulate against the cold. The theory was later proved true.



The Scientific Method

3 ESSENTIAL QUESTION What new ways of viewing the universe did philosophers propose?

In the 1600s, two philosophers, René Descartes (day•KAHRT) and Francis Bacon, had a huge impact on how scientists studied the world.

Descartes and Rationalism Frenchman René Descartes believed in questioning the opinions of recognized authorities. He also believed that every idea should be doubted until it had been proved through reason. Descartes based his approach on a simple statement: "I think, therefore I am." He argued that God created two realities. The first was physical reality. The other was the mind, or what people think. Descartes claimed that people could use their rational mind to understand the "truths" of the physical world.

Bacon and the Scientific Method Englishman Sir Francis Bacon also believed in using rational, organized thought. However, Bacon felt that scientists should use experiments and observation rather than abstract reasoning to understand the world. This approach, called the **scientific method**, had specific steps.

1. Observing and describing a subject
2. Forming a hypothesis—an unproved assumption about the subject
3. Testing the hypothesis in an experiment
4. Interpreting results to draw a conclusion

head all directions!

Name _____ Date _____

DBQ 10: Causes of the French Revolution

Historical Context:

The French Revolution of 1789 had many long-range causes. Political, social, and economic conditions in France contributed to the discontent felt by many French people—especially those of the third estate. The ideas of the intellectuals of the Enlightenment brought new views of government and society. The American Revolution also influenced the coming of the French Revolution.

◆ **Directions:** The following question is based on the accompanying documents in Part A. As you analyze the documents, take into account both the source of the document and the author's point of view. Be sure to:

1. Carefully read the document-based question. Consider what you already know about this topic. How would you answer the question if you had no documents to examine?
2. Now, read each document carefully, underlining key phrases and words that address the document-based question. You may also wish to use the margin to make brief notes. Answer the questions which follow each document.

◆ **Part A:** Examine each document carefully, and answer the questions that follow.

Document 1

This excerpt is adapted from *Travels in France* by Arthur Young, who traveled through France from 1787 to 1789.

In the south of France there is a taille [tax on the land and its produce]. There is an injustice in levying the amount each person must pay. Lands held by the nobility are taxed very little. Lands held by commoners are taxed heavily. . . .
 September 5, 1788: The poor people seem very poor indeed. The children are terribly ragged.
 June 10, 1789: The lack of bread is terrible. Stories arrive every moment from the provinces of riots. . . . The price of bread has risen above people's ability to pay. This causes great misery.
 July 1789: . . . I was joined by a poor woman who complained of the hard times. "The tailles and feudal dues [rents owed the lords] are crushing us," she said.

* List three observations this traveler made about the life of the peasant in France between 1787 and 1789.

The Impact of Scientific Rationalism

The ideas of Descartes and Bacon became known as scientific rationalism. By the 1700s, the influence of scientific rationalism had begun to erode the power of the Church. Why did this happen? Scientific rationalism encouraged people to think for themselves instead of relying on church authority. Some political thinkers applied scientific rationalism to government. For example, political thinker John Locke believed people have the natural ability to be in charge of their own affairs. He viewed this ability as a natural law or right. Such beliefs planted seeds of democracy that soon blossomed in nations such as the United States.

* **REVIEW** What are the four steps involved in the scientific method?

Lesson Summary

- Scientists developed new theories about the universe.
- The invention of new scientific instruments helped to prove new theories and to change some old beliefs.
- The scientific rationalism of Descartes and Bacon had a major impact on religion and politics.

Why It Matters Now . . .

The Scientific Revolution established a rational method of looking at scientific questions that is still used today.

2 Lesson Review

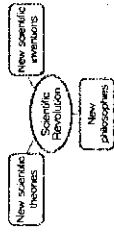
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Terms & Names

1. Explain the importance of Scientific Revolution heliocentric universal gravitation scientific method

Using Your Notes

2. What idea or event do you think had the strongest impact on the Scientific Revolution? Explain. (7.10.2)



Main Ideas

- * 3. How do the geocentric and heliocentric theories differ? (7.10.2)
- * 4. What was the importance of the new scientific instruments discussed in this lesson? (7.10.2)
- * 5. How did scientific rationalism affect European religion and politics? (7.10.3)

Critical Thinking

- * 6. **Making Inferences** Why do you think church authorities forced Galileo to deny his ideas on the universe? (7.10.2)
- * 7. **Drawing Conclusions** Why was the law of universal gravitation such an important step in understanding the universe? (7.10.2)

Activity

Creating an Experiment Devise an experiment to test a hypothesis. (For example, a feather holds more weight than a piece of cardboard.) Use the scientific method to conduct research and determine your answer. (7.10.3)

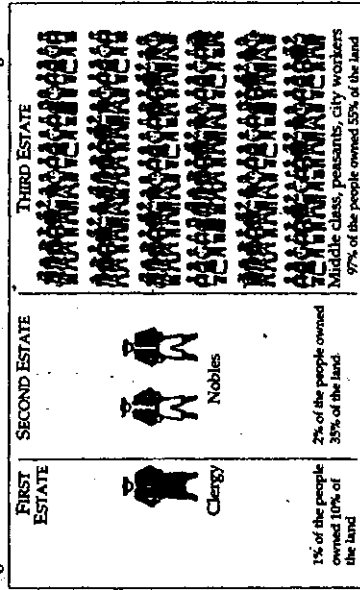
Name _____

Date _____

DBQ 10: Causes of the French Revolution (continued)

Document 2

This diagram illustrates the three estates in 1789 and the land each held during the Old Regime.



*What conclusions can you draw about the relationship between the percentage of the population in each estate and the percentage of land owned by that estate? _____

*What unfair conditions existed in pre-revolutionary France? _____

Document 3

These are excerpts from the cahiers (lists of grievances about the king, taxing, and voting in the Estates General) brought to the Estates General.

That the king be forced to reform the abuses and tyranny of lettre de cachet.
 That every tax . . . be granted [by the Estates General] only for a limited time.
 That the taille [a tax on land] be borne equally by all classes. . . .
 The meetings of the Estates General . . . shall be scheduled for definite times . . . in order to assure the third estate the influence it deserves because of its numbers . . . its votes in the assembly should be taken by head. . . .

*What three changes did the third estate demand be made in the French government? _____

Name _____

Date _____

DBQ 10: Causes of the French Revolution (continued)

Document 4

In *The French Revolution*, historian Albert Mathiez claims that leadership fell to the middle class with their knowledge of the ideas of the Enlightenment.

The Revolution had been accomplished in the minds of men long before it was translated into fact. . . .
 The middle class . . . was sensitive to their inferior legal position. The Revolution came from them—the middle class. The working classes were incapable of starting or controlling the Revolution. They were just beginning to learn to read.

*What was the result of the middle class's knowledge of the ideas of the Enlightenment? _____

Document 5

Lord Acton suggested another point of view.

The condition of France alone did not bring about the overthrow of the monarchy . . . for the suffering of the people was not greater than they had been before. The ideas of the philosophes were not directly responsible for the outbreak . . . [but] the spark that changed thought into action was supplied by the Declaration of American Independence. . . . The American example caused the Revolution to break out. . . .

*What did Lord Acton believe caused the French Revolution? _____

DBQ 12: The Industrial Revolution: Beginnings (continued)

According to the map, what resources did England have that were needed for industrialization?

Document 2

This excerpt is from a witness's description before the Factory Commission in 1833.

You have been a witness of the operative [working] class in these parts; you have seen it grow from nothing into a great body in the space of a few years: how was it recruited? ... A good many from the agricultural parts ... People left other occupations and came to spinning for the sake of the high wages.

Why were factory workers available?

Document 3

The following excerpt from Adam Smith's *Wealth of Nations* written in 1776 describes the assembly line used in factories.

I have seen a small manufactory [factory] of this kind where ten men only were employed, and where some of them performed two or three distinct operations. ... They could ... make among them ... upwards of 48,000 pins in a day. ... But if they had all wrought [worked] separately and independently ... they certainly could not each of them have made twenty ... in a day.

According to Smith, why were workers in a factory so productive?

Document 4

Here is an excerpt from *Landmarks in English Industrial History*, a book written by George Warner in 1899 (London: Blackie and Son, 1924).

England ... has been fortunate in possessing the natural conditions necessary to success. ... We recognize that England is rich in these advantages, that she has coal and iron lying close together, that her sheep give the best wool, that her harbors are plentiful, that she is not ill-off for rivers, and that no part of the country is farther than seventy miles from the sea.

How did geography help England industrialize?

DBQ 12: The Industrial Revolution: Beginnings (continued)**Document 5**

This excerpt is from *The Industrial Revolution* by Thomas S. Ashton (Oxford University Press, revised edition, 1962).

... systematic thought lay behind most of the innovations in industrial practice. Invention ... rarely thrives in a community of simple peasants or unskilled manual laborers: only when division of labor has developed ... does it come to harvest. The stream of English scientific thought was one of the main tributaries [causes] of the industrial revolution ... discoveries in different fields of activity were linked together. ...

How did innovation lead to the Industrial Revolution in England?

Document 6

Changes in textile machinery		
Inventor	Invention	Importance
John Kay	flying shuttle	Increased speed of weaving
James Hargreaves	spinning jenny	Spun 8-10 threads at a time; used at home
Richard Arkwright	water frame	Large spinning machine driven by water in factory
Edward Cartwright	power loom	Water powered; automatically wove thread into cloth
Eli Whitney	cotton gin	Separated seed from raw cotton

Which three inventions were most important in increasing textile production? Explain your answer.

Name _____

Date _____

DBQ 12: The Industrial Revolution: Beginnings *(continued)***Document 7**

Changes in agriculture		
Inventor	Invention	Importance
Jethro Tull	horse-drawn seed drill	Planted seeds in straight rows
Robert Blakewell	stock breeding	Improved quality of animals to produce more meat, milk, and wool
Cyrus McCormick	mechanical reaper	Made grain harvesting easier

What was the result of these changes in agriculture in England? _____

Document 8

The following excerpt is from *The Farmer's Tour Through the East of England* by Arthur Young, 1771.

As I shall leave Norfolk, it is proper to give a review of the farming methods which have made . . . this country so famous in the farming world. . . . The great improvements have been made by the following methods.

- By enclosing without the help of Parliament
- By the introduction of a four year rotation of crops
- By growing turnips, clover, and rye grass
- By the country being divided chiefly into large farms

How did these four changes in agriculture enable England to industrialize more easily?

Document 9

This excerpt is from *The Industrial and Commercial Revolutions in Great Britain During the Nineteenth Century* by L.C.A. Knowles (E. P. Dutton & Co., 1921).

When one realizes the thousands of internal tariffs that obstructed [slowed down] traffic in Germany up to 1834 and the innumerable tolls and charges that hindered trade in France before 1789 . . . it is clear that the political and economic freedom in England was one of the causes of her industrial expansion.

What were two reasons cited by Knowles to explain industrialization in England? _____

◆ Part B—Essay