#1

Name Beede/Gardner write on seperate paper Date 8/28/17 M

pg 188-194

CHAPTER 6

Section 1

GUIDED READING *The Scientific Revolution*

A. Determining Main Ideas As you read about the revolution in scientific thinking, take notes to answer the questions.

How did the following help pave the way for the Scientific Revolution?	
1. The Renaissance p. 189	
2. Age of European exploration p. 190	

What did each scientist discover about the universe?	
3. Nicolaus Copernicus p. 190	
4. Johannes Kepler p. 190	
5. Galileo Galilei p. 191	
6. Isaac Newton p. 192	

What important developments took place in the following areas?	
7. Scientific instruments p. 193	
8. Medicine p. 193	
9. Chemistry p. 194	

B. Determining Main Ideas On the back of this paper, explain how the **scientific method** is based on the ideas of Francis Bacon and René Descartes.

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CHAPTER 6

Section 1

SKILLBUILDER PRACTICE *Clarifying*

You can clarify information you read by looking up the meaning of unfamiliar terms and summarizing the main ideas in your own words. As you read the passage below, make notes of the main ideas. Look up any unfamiliar or technical terms you do not understand. Then complete the activities that follow. (See Skillbuilder Handbook)

Galileo Galilei was an Italian mathematician, astronomer, and physicist. As a physicist, he began a whole new field of scientific investigation—the modern science of dynamics.

As a youth of 18, Galileo watched the movements of a cathedral's chandelier as it swung back and forth on its chain. Aristotle had written that a pendulum swings more slowly as it approaches its resting point. Galileo tested this idea and found it incorrect. Feeling his pulse to keep time, he found that each oscillation of the pendulum took exactly the same amount of time.

Galileo's observation led to a new method of measuring time. In the 1200s and 1300s European inventors had built clocks that were driven by weights. In the 1400s, they turned to spring-driven clocks. But none of these timepieces were very accurate. In 1656, a Dutch astronomer built a clock using a pendulum. It proved to be more accurate than earlier ways of measuring time. In fact, pendulum clocks were not surpassed in accuracy until the introduction of electricity.

In addition to discovering the law of the pendulum, Galileo performed other experiments in physics. For days he rolled balls down a slope and measured the speed at which they moved. His data led him to conclude that freely falling bodies, heavy or light, had the same, constant acceleration. He also discovered that an object moving on a perfectly smooth horizontal surface would neither speed up or slow down.

1. Define each of the following terms:

Physicist: _____

Dynamics: _____

Oscillation: _____

2. Identify the main idea of the passage. _____

_____

_____

_____

3. Write a paragraph summarizing the main idea and key details in this passage. Remember to restate information in your own words.

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CHAPTER 6

Section 1

GEOGRAPHY APPLICATION: LOCATION

Three Theories of the Solar System

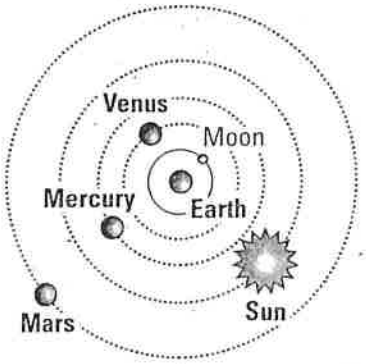
Directions: Read the paragraphs below and study the illustrations carefully. Then answer the questions that follow.

In the second century A.D., Claudius Ptolemy, an astronomer who lived in Egypt, claimed that the sun, stars, and other planets revolved around the earth. These ideas were unchallenged nearly 1,300 years until Nicolaus Copernicus, a Polish astronomer, discovered his revolutionary theory about the sun.

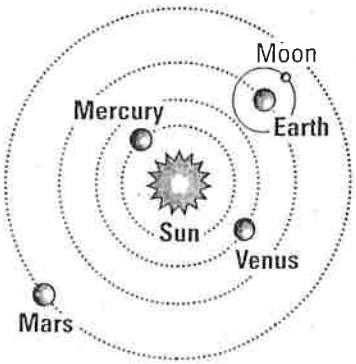
Ptolemy had believed in his geocentric or earth-centered view for several reasons. First, because of gravity all objects were attracted to the earth, which suggested to him that the earth must be the center. Second, he thought that the earth did not move. He showed how an object is thrown in the air and falls in practically the same place. If the earth moved, he theorized, that object should fall in a different place. Even today, these arguments would be difficult to disprove by observation. As a result, Ptolemy's views remained undisputed for centuries.

During the 1500s, Copernicus did not accept the Ptolemaic view. He became convinced that a different explanation of the solar system existed. After 25 years of observation, Copernicus concluded that the sun was the center of the solar system and that the planets, including the earth, revolved around the sun in "perfect divine circles."

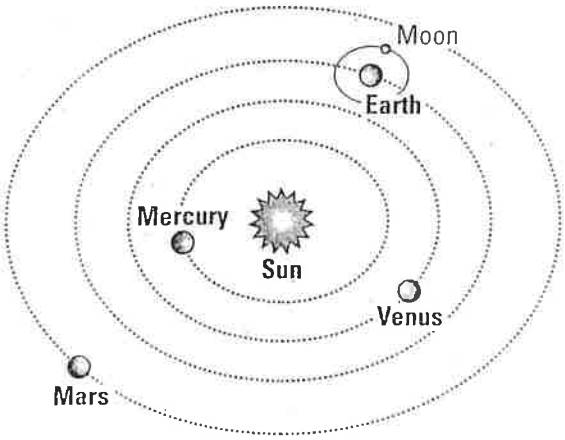
Copernicus's conclusion at first went practically unnoticed. However, in the 1600s a German astronomer, Johannes Kepler, supported Copernicus's belief with mathematics. He also proved that the planets travel in ellipses (ovals), not perfect circles, around the sun. Both Copernicus's and Kepler's breakthroughs laid the foundation of modern day knowledge of the solar system.



PTOLEMY



COPERNICUS



KEPLER

Interpreting Text and Visuals

1. What object did Ptolemy claim was at the center of the universe? _____

2. What object did Copernicus conclude was actually at the center of the universe? _____

3. What object is farthest from the center in all three systems? _____

4. What object is closest to the earth in all three systems? _____

_____

5. According to Ptolemy, where was the sun in relation to Earth and the other planets? _____

_____

6. According to Copernicus, what planets are located between the sun and the Earth? _____

_____

7. What is the main difference between Kepler's system and the Copernican system? _____

_____

8. Compare the way Ptolemy provided proof for his theory with the way Kepler provided proof for his theory. _____

_____

_____

_____

Do you think Ptolemy's proof of his beliefs would be acceptable today? Why or why not?

_____

_____

_____

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CHAPTER 6

Section 1

HISTORYMAKERS

Nicolaus Copernicus

Earth-Shaking Scientist

"We revolve about the sun like any other planet." —Copernicus,* A Commentary on the Theories of the Motions of Heavenly Objects *(1514)

Watching the sun travel through the sky each day and seeing the stars and planets glide across the sky each night, Europeans concluded that these heavenly bodies revolved around the earth. As a result, they made the logical conclusion that the earth was the center of the universe and did not move. This view also became part of the teaching of the Catholic Church. Nicolaus Copernicus changed all this.

Born in 1473, Copernicus became a learned man. He was trained in Church law, medicine, and mathematics. His main interest, though, was astronomy. After more than 25 years of observations, he reached a startling conclusion: the earth itself moved and revolved around the sun.

In 1514, Copernicus wrote a pamphlet outlining his ideas and passed it around to friends, but he delayed making it widespread. In the 1530s, his views were presented to Pope Clement VII, who had no objection to this new theory. Finally, a former student of Copernicus's persuaded him to publish his ideas. As a result, *On the Revolutions of Heavenly Bodies* became available in 1543, the year its author died.

Copernicus argued that the earth moved in three ways. It spun on its axis every day, it rotated around the sun over the course of a year, and it moved up and down on its axis to cause the change of seasons. His new system put the planets in their proper order: sun, Mercury, Venus, Earth and moon, Mars, Jupiter, and Saturn.

Copernicus's bold idea solved several problems. The order of Mercury and Venus had always been disputed, and his new system settled that. His idea also gave a simpler explanation of the motion of the planets. Because the planets sometimes seem to stop and move backward, the old theory had required a complex structure of circles within circles. Copernicus reasoned that these movements occurred because the earth also orbits the sun. Furthermore, the earth and the other planets orbit at different speeds. His view was not perfect, though. He believed the planets moved in circles around the sun, but it was later proven that they move in ellipses, or ovals.

Copernicus's theory raised two questions. If the earth moves, why do the stars not appear in different positions? The stars, he said, were so far away that their changes in position could not be noticed. In other words, he suggested that the universe was vast. Copernicus was right, although his argument could not be proven for three centuries. Only then did scientists have telescopes powerful enough to detect that the stars did indeed move.

The second question asked why objects in the air tend to fall to the ground. When the universe was seen as moving around the earth, it was logical to think that objects would fall to the center of the universe. Now that the earth moved, it was no longer the center. However, Copernicus believed that an object tended to fall to the center of its home. Thus, articles on Earth would be pulled to Earth, and those on the moon would be pulled to the moon. He suggested the basics of gravity about 100 years before Isaac Newton.

Copernicus's views did not cause much of a stir at first. Although his idea challenged Catholic teaching about the universe, the Church did not object to the new theory. However, Martin Luther and John Calvin, leaders of the Reformation, both objected strongly. Calvin asked, "Who will venture to place the authority of Copernicus above that of the Holy Spirit?" Over time, though, Catholics objected as well. By 1616, the Church officially called his idea false. The work of later astronomers, however, showed that Copernicus drew an accurate picture of the solar system.

Questions

1. ***Determining Main Ideas*** According to Copernicus, what were the ways in which the earth moved?
2. ***Making Inferences*** Since Copernicus's theory was not perfect and could not explain all observations of the heavens, why did some people accept it?
3. ***Clarifying*** How did Copernicus use the idea of bodies tending toward different centers to support his theory?

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CHAPTER 6

RETEACHING ACTIVITY *The Scientific Revolution*

Section 1

Determining Main Ideas The following questions deal with new theories of scientific exploration of the mid-1500s. Answer them in the space provided.

1. Explain the differences between the geocentric theory of the universe and the heliocentric theory.

_____

_____

2. What are two factors that contributed to the rise of a Scientific Revolution in Europe in the mid-1500s?

_____

_____

3. How did Galileo's work come into conflict with the Church, and how was that conflict resolved?

_____

_____

4. List three new scientific instruments that were invented as a result of the Scientific Revolution.

_____

_____

Reading Comprehension Find the name or term in the second column that best matches the description in the first column. Then write the letter of your answer in the blank.

____	5. Aristotle's earth-centered theory of the universe	a. Scientific Revolution
____	6. A new way of thinking about the natural world based on careful observation and a willingness to question accepted beliefs	b. Galileo Galilei
		c. scientific method
____	7. Copernicus's sun-centered theory of the universe	d. geocentric theory
____	8. Italian scientist whose findings in the field of astronomy supported Copernicus's theory	e. Isaac Newton
____	9. A logical procedure for gathering and testing scientific ideas	f. heliocentric theory
____	10. English scientist who explained the law of gravity	