The Scientific Revolution

The Scientific Revolution began during the Renaissance and continued through the 17th and 18th centuries. It rejected traditional authority and church teachings in favor of a new scientific method, in which scientists observed nature, made hypotheses (educated guesses) about relationships, and tested their hypotheses through experiments. During this period, scientists invented new scientific tools and new ways of looking at the world. Scientists invented the telescope and many other instruments that helped them observe and measure the natural world. Scientists like Galileo Galilei used the telescope to observe the planets. Galileo concluded that a previous scientist’s (Copernicus’) theory that the planets revolved around the sun was correct. The Catholic Church believed that the planets revolved around the earth and imprisoned Galileo for such heretical beliefs! Galileo Galilei also tested the movements of falling objects. However, the most influential thinker of the Scientific Revolution was Sir Isaac Newton.

Newton developed a theory to explain both the movements of planets and how objects fall on earth. Newton reduced all these patterns to a single formula: the law of gravity. Newton’s discovery raised hopes that the entire universe acted according to certain fixed and fundamental laws. It seemed that all scientists had to do was to apply observation, experimentation, and mathematics to understand and predict the natural world. The Scientific Revolution greatly changed the way people thought.

Questions:
1. Why do you think the Scientific Revolution began during the Renaissance?

2. Describe the scientific method or the scientist’s way of reaching conclusions about the natural world?

3. Why was the Roman Catholic Church threatened by the Scientific Revolution?

4. Who was Galileo and why was he important?

5. Who was Sir Isaac Newton and why was he important?
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Throughout the Middle Ages, Europeans’ scientific knowledge had experienced little change because the Catholic Church had preserved the acceptance of a system of beliefs based on the teachings of the ancient Greeks and Romans which it had incorporated into religious doctrine. During this period there was little scientific inquiry and experimentation. Rather, students of the sciences simply read the works of the alleged authorities and accepted their word as truth. However, during the Renaissance, this passivity began to change. The quest to understand the natural world led to the revival of the sciences.

These scientific observers were surprised to find that their conclusions did not always match up with the accepted truths, and this finding inspired others to delve further into the study of the world around them. Scientific study quickly extended from the earth to the heavens, and Nicolas Copernicus, upon examining the records of the motions of heavenly bodies, soon discarded the old geocentric theory that placed the Earth at the center of the solar system and replaced it with a heliocentric theory in which the Earth was simply one of a number of planets orbiting the sun. Though this scheme seemed to comply better with the astronomical records of the time, Copernicus had little direct evidence to support his claims. However, eventually through the use of a telescope, Galileo Galilei was able to prove Copernicus’ theory.

**Question: How did scientific thinking differ from the religious thinking of the medieval period?**

1. 
2. 
3. 
4. 

**Practice Questions: Read the annotations and answer each question!**

Both Scientists in S.R = Scientific Method

Francis Bacon, Galileo, and Isaac Newton promoted the idea that knowledge should be based on

1. the experiences of past civilizations
2. experimentation and observation
3. emotions and feelings
4. the teachings of the Catholic Church
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During the Scientific Revolution and the Enlightenment, one similarity in the work of many scientists and philosophers was that they

1. relied heavily on the ideas of medieval thinkers
2. favored an absolute monarchy as a way of improving economic conditions
3. received support from the Catholic Church
4. examined natural laws governing the universe

Which statement best describes the effects of the works of Nicolaus Copernicus, Galileo Galilei, Sir Isaac Newton, and René Descartes?

1. The acceptance of traditional authority was strengthened.
2. The scientific method was used to solve problems.
3. Funding to education was increased by the English government.
4. Interest in Greek and Roman drama was renewed.

Spotlight: Galileo Galilei

Galileo Galilei, (1564-1642) the gifted and extremely curious Italian scientist, made great use of the telescope to discover such unsettling things as the irregularities of the moon’s surface; it was believed at the time to be perfectly smooth, a belief which conformed to Catholic dogma. Moreover, Galileo’s observations with the telescope led him to the conclusion that Nicholas Copernicus (1473-1543) was right: the earth did indeed orbit around the sun and not vice versa. Such a viewpoint cast great doubt on the accepted natural philosophy (first enunciated by Aristotle) of a geocentric universe and thus of human beings’ centrality in the universe. Thus the conflict between religion and science in the seventeenth century was begun. Galileo also discovered the moons of Jupiter from January to March, 1610. This discovery cast even greater doubt on the perfection of the Aristotelian universe which had been described by the Egyptian astronomer Ptolemy in the second century, A.D.

In the 1633 trial of Galileo Galilei, two worlds come into cosmic conflict. Galileo’s world of science and humanism collides with the world of Scholasticism and absolutism that held power in the Catholic Church. The result is a tragedy that marks both the end of Galileo’s liberty and the end of the Italian Renaissance.

Galileo Galilei was born in 1564 - the same year that Shakespeare was born and Michelangelo died. From an early age, Galileo showed his scientific skills. At age nineteen, he discovered the isochronisms of the pendulum. By age twenty-two, he had invented the hydrostatic balance. By age twenty-five, Galileo assumed his first lectureship, at the University of Pisa. Within a few more years, Galileo earned a reputation throughout Europe as a scientist and superb lecturer. Eventually, he would be recognized as the father of experimental
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physics. Galileo's motto might have been "follow knowledge wherever it leads us."

At the University of Padua, where Galileo accepted a position after three years in Pisa, he began to develop a strong interest in Copernican theory or the revolutionary idea that the Sun was at the center of the universe and that the Earth--rotating on an axis--orbited around the sun once a year. Copernicus' theory met mostly with skepticism. Skeptics countered with the "common sense" notion that the earth they stood on appeared not to move at all--much less at the speed required to fully rotate every twenty-four hours while spinning around the sun. Sometime in the mid-1590s, Galileo concluded that Copernicus got it right.

Galileo's discovery of the telescope in 1609 enabled him to confirm his beliefs in the Copernican system and emboldened him to make public arguments in its favor. Galileo decided that Copernicus was worth a fight. He decided to address his arguments to the enlightened public at large, rather than the academics. Galileo published a book involving a debate between a supporter of Copernicus and a supporter of the Church. The Church was angered by Galileo's book and brought him to trial. Galileo was found guilty of heresy and placed under house arrest. Eventually, Galileo went blind from looking at the sun through his telescope. While the Church temporarily succeeded in silencing scientists, science could not be permanently silenced.

Would you have challenged the Church as Galileo did? Explain your answer using evidence from the reading to support your reasoning.