CHAPTER 17
The Scientific Revolution and the Enlightenment

The Scientific Revolution took place from about 1500 to 1700. It was a time of many advances in astronomy, medicine, mathematics and many other areas of science. People began using new methods to gather information and prove their ideas.

The scientific method is a method of gathering information through observation and reasoning. It was developed as an aid to proving scientific theories. The scientific method involves experimenting and observing, interpreting results through reasoning and using mathematics to prove theories.

Copernicus was a Polish astronomer who helped to develop the scientific method. He wrote a book called *On the Revolutions of the Heavenly Bodies*. In this book he disputed Ptolemy’s beliefs about the universe. He argued that the earth was not the center of the universe. He tried to prove Ptolemy wrong by using mathematics to prove his own ideas about the universe. Most people didn’t accept his new ideas because he couldn’t gather enough proof to back them up.

Tycho Brahe was a Danish astronomer. He made very accurate observations about the universe before the invention of the telescope. Brahe built his own observatory on an island. He crafted instruments, which he used to observe the planets and stars. When Brahe died, his observations were passed on to Johannes Kepler. Kepler used this information to show that the planets revolve around the sun in elliptical orbits.

When Galileo, an Italian astronomer, used a telescope to observe the universe, he was able to back up Kepler’s work. He also made other discoveries that aroused much debate. For example, he found that there were spots on the sun and craters on the moon. Because other scientists were upset about his views, they convinced the Church to try him as a heretic.
Copernicus, Brahe, Kepler and Galileo were all astronomers who challenged traditional views of the universe. They worked hard to prove the existing theories about the universe wrong. Even with proof from the telescope and mathematics, many people did not want to believe their new ideas.

Sir Isaac Newton, an English mathematician, made many contributions to the worlds of science and mathematics. Newton’s greatest achievement was the law of gravity. Gravity is a force that attracts all objects in the universe. The force of attraction between objects increases as the objects move closer to each other. He also invented a form of mathematical calculation called calculus.

Paracelsus, Andreas Vesalius, Ambroise Pare and William Harvey all made advancements in medicine. Paracelsus conducted experiments in chemistry and ridiculed the ideas of ancient authorities such as Galen. In On the Structure of the Human Body, Vesalius made exact drawings that corrected earlier errors made in the study of anatomy. Pare developed an ointment to keep infections from occurring in wounds. He also developed a technique of stitching to close wounds. Harvey demonstrated that the heart pumped blood through the veins and arteries of the body.

The Enlightenment was an intellectual movement that took place from about 1650 to 1800. This time period was also called the Age of Reason. The thinkers of the Enlightenment were dedicated to using reasoning to learn about the natural laws that controlled behavior.

Thomas Hobbes was a philosopher from England. He believed that rulers needed absolute power to establish order. He thought that if people were left without a government they would do nothing but fight. He didn’t believe that under any case should a person rebel against the government.

Another group of philosophers helped to create the foundations of the United States government, as well as the governments of other countries. Their ideas played a part in the creating of the Declaration of Independence. They believed that the use of science and reason would lead to human advancement. They were called philosophes, which was the French word for philosopher. They had a strong influence on the leaders and
founders of new countries. These men were John Locke, Baron de Montesquieu, Voltaire and Jean Jacques Rousseau.

Most of Locke’s ideas were quite different from Hobbes. He agreed with Hobbes that the government was an agreement between the ruler and his subjects, but unlike Hobbes, he believed that it was all right to rebel if the ruler was a tyrant. He thought that people had the right to life, liberty and property. He also felt that, in general, people were sensible and cooperative.

Montesquieu thought that the government should have three branches, the legislative, executive and judicial branches, so that power was separated and no one branch could do anything without the approval of the other branches. He thought there should be a system of checks and balances, to make sure that no one branch held all the power.

Voltaire believed that people ought to be free to worship and think as they chose. He once said, “I do not agree with a word you say, but I will defend to the death your right to say it.” He believed that a strong and enlightened ruler was important.

Jean Jacques Rousseau thought that humans were basically good, and that the natural goodness of people could be sheltered from the corrupting influences of society with a little work. He believed that people could live in harmony without a ruler. He thought that decisions should be made based on what the majority of people felt, and if someone didn’t agree, they should give up their freedom for the “general will,” which was what he called the decision of the majority. He thought that people should make a contract with each other to abide by the will of the majority. He argued that all people were created equal, and therefore titles of nobility should be gotten rid of. Rousseau thought that “Man is born free, and everywhere is in chains.” He looked highly upon people who lived in a natural state. He called these people “noble savages.”

Physiocrats were philosophes who looked for natural laws to explain the economy. They didn’t believe in mercantilism. They believed in free market enterprise. A free market is a market in which all goods are bought and sold without restrictions.
The ideas of the Enlightenment were circulated in many ways. The educated elite helped to make ideas known. Printing presses were another way to spread information. Denis Diderot assembled the Encyclopedia to cause “revolution in the minds of men to free them from prejudice.”

A great many rulers in Europe wanted to put the ideas of the Enlightenment into effect. They hoped they would improve their countries. Maria Theresa was one such ruler. Her son, Joseph II, built upon her plans and took them a step further. He put an end to serfdom, permitted freedom of the press and put an end to religious persecution in Austria.

There were also many advances in music during the enlightenment. Franz Joseph Haydn created symphonies that were a sign of the times. George Frederick Handel’s operas became very well known in England, where he took up residence. Wolfgang Amadeus Mozart was a child genius who wrote 600 musical works before his death at age 35. He started writing music before the age of five. Johann Sebastian Bach wrote many different kinds of music, but is most well know for his religious music.

On the time line above, letter A represents the Scientific Revolution, and letter B represents the Enlightenment, or Age of Reason. It shows that Copernicus and Galileo were not alive during the Enlightenment, and that Bach, Montesquieu, Rousseau and Mozart lived only during the Enlightenment. The American Revolution took place between the lives of Rousseau and Mozart.