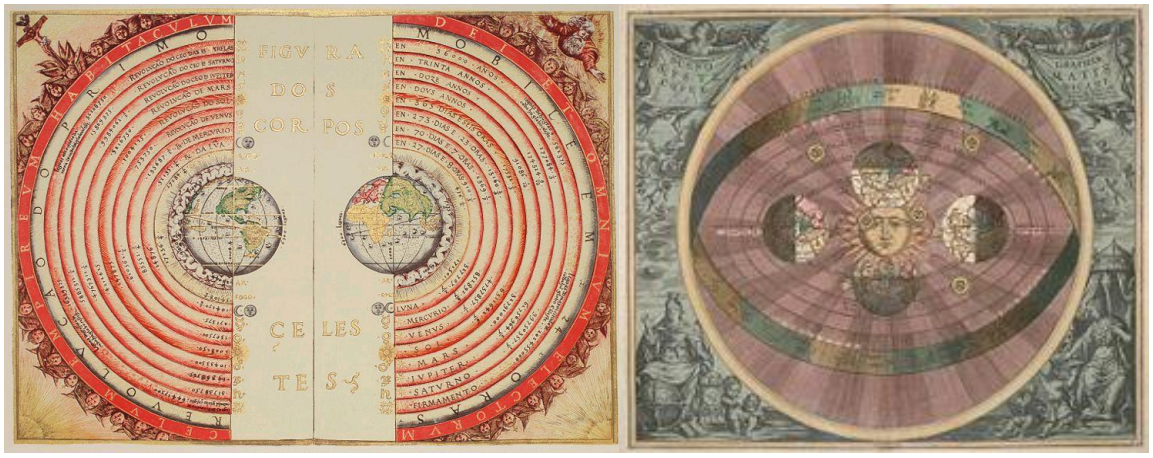
Geocentric Theory



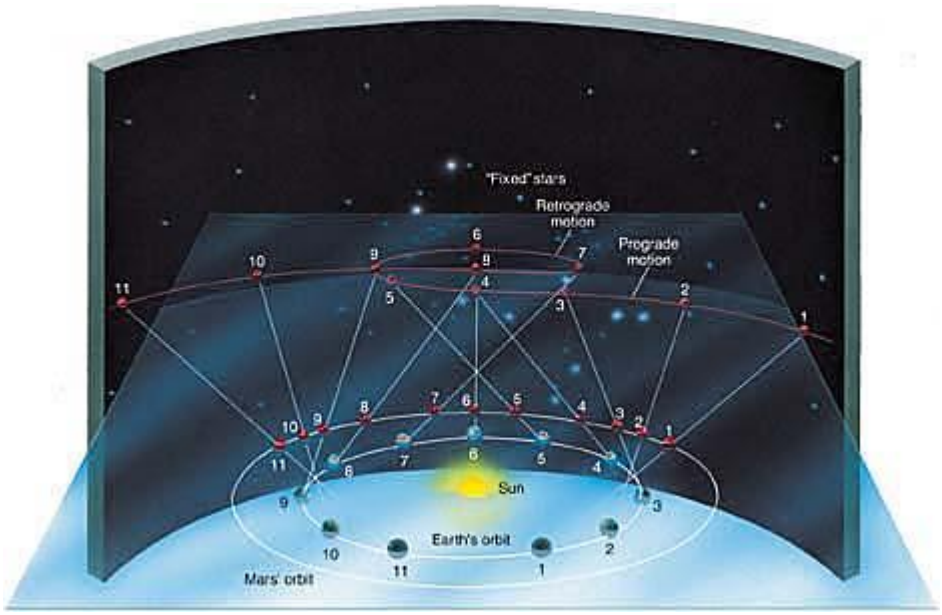
In astronomy, the **geocentric theory** of the universe is the idea that the Earth is the center of the universe and other objects go around it. Belief in this system was common in ancient Greece. It was embraced by both Aristotle and **Ptolemy**, and most Greek philosophers assumed that the Sun, Moon, stars, and visible planets circle the Earth.

Christianity taught that God placed the earth in the center of the universe and this made earth a special place to watch human life unfold.

Two common observations were believed to support the idea that the Earth is in the center of the Universe. The first is that the stars (including the Sun and planets) appear to revolve around the Earth day as seen by the sun rising in the east and setting in the west every day. The second is the common sense perception that the Earth is solid and stable; it is not moving but is at rest.

The geocentric is often referred to as the Medieval view of the universe and it dominated thinking into the early modern age. From the late 16th century onward it was gradually replaced by the **heliocentric model** of Copernicus, Galileo, and Kepler.

Heliocentric Theory



In astronomy, the **heliocentric theory** is the idea that the **Sun** is at the center of the Solar System. This theory explained many of the observations of astronomers. Some of its revolutionary ideas were that the Earth rotates on its axis daily and revolves around the Sun once a year.

The word came from the Greek *Helios* = sun and *kentron* = center. Historically, **heliocentrism was opposed to geocentrism**, which placed the earth at the center. It was not until the 16th century that the Polish mathematician and astronomer **Copernicus** presented a mathematical model of a heliocentric system which was later elaborated and expanded by Kepler, and later defended by Galileo. The **heliocentric theory** became the center of a major dispute between the Roman Catholic Church and scientists.

Scientific Method

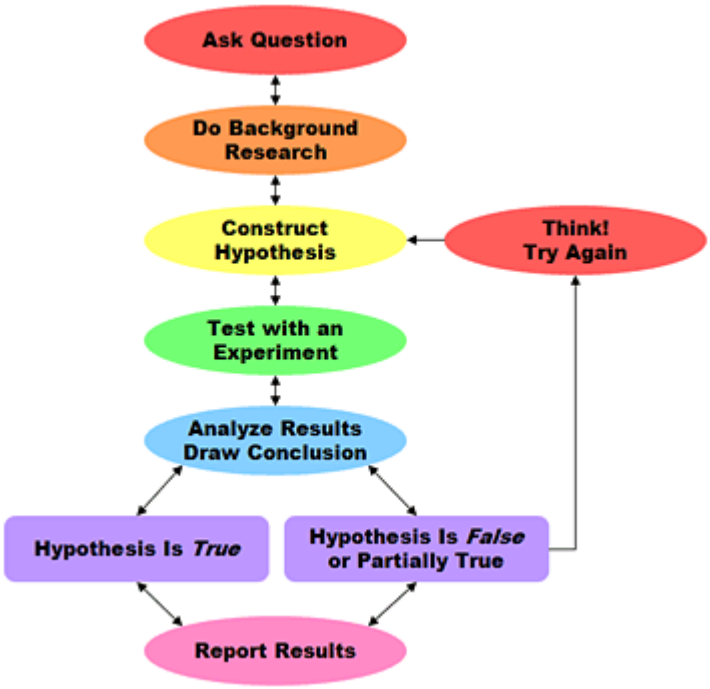
The revolution that began with Copernicus, Kepler and Galileo eventually developed into a new and logical approach to science called the Scientific Method.

The scientific method is a way to ask and answer scientific questions by making observations and doing experiments.

Scientists use the scientific method to search for **cause and effect** relationships in nature. In other words, they design an experiment so that changes to one item cause something else to vary in a predictable way.

Just as it does for a professional scientist, the scientific method will help you to focus your science fair project question, construct a hypothesis, design, execute, and evaluate your experiment.

It is important for the experiment to be a fair test. A "fair test" occurs when only one factor (variable) is changed and all other conditions are kept the same.



Scientific Revolution

The period which many historians of science call the **scientific revolution** can be roughly dated as having begun in 1543, the year in which Nicolaus Copernicus published his book, On the Revolutions of the Heavenly Spheres and Andreas Vesalius published his book, On the Fabric of the Human body.

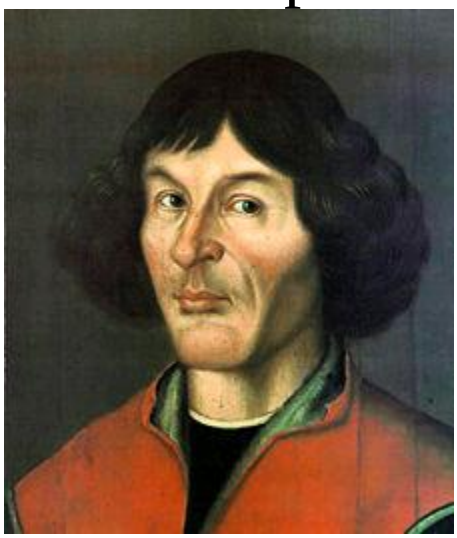
There is general agreement however, that the intervening period saw a fundamental transformation in scientific ideas in physics, astronomy, and biology, in institutions supporting scientific investigation, and in the more widely held picture of the universe. As a result, the scientific revolution is commonly viewed as a foundation and origin of modern science.

The significance of the Scientific Revolution of the late Renaissance was significant in establishing a base for many modern sciences as well as challenging the power of the Church. The renaissance enabled a scientific revolution which let scholars look at the world in a different light. Religion, superstition, and fear were replaced by reason and knowledge. Despite their challenge to Church dogma, however, many notable figures in the Scientific Revolution - Copernicus, Kepler, Newton, and even Galileo - remained devout in their faith.

Brilliant minds started to question all manners of things and it was this questioning that lead to the Scientific Revolution, which in turn formed the foundations of all modern sciences. Many of these new ideas contradicted previous ideas that had been supported by the church.

When **theology became subordinate to science** meaningful human advancement became a possibility". The Scientific Revolution led to the establishment of several modern sciences, as well as the understanding that the church was also fallible.

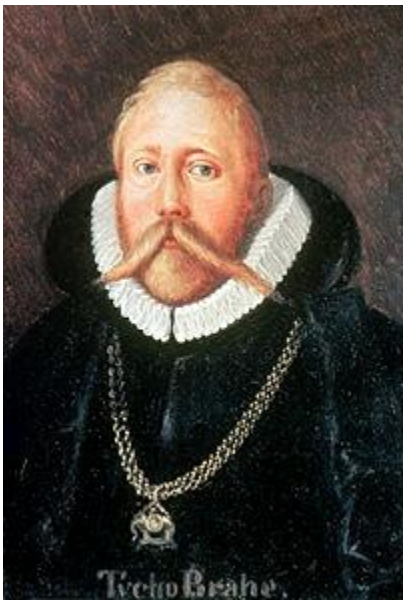
Nicholas Copernicus



Nicolaus Copernicus was a Polish astronomer who is best known for the astronomical theory that the Sun was near the center of the universe and that the Earth and other planets rotated around the center. He also stated that the Earth spinning on its axis, rotates once daily and makes a full revolution around the Sun in a year. Copernicus believed that the Sun was located near the center of the universe. It was this center of the universe which influenced those bodies and caused them to revolve. This theory is called the heliocentric or sun-center theory of the universe.

Copernicus began work on his major work, "On the Revolutions of the Celestial Spheres," which he did not complete until 1530. However, it was not published until 1543, just before Copernicus died.

Tycho Brahe



Tycho Brahe was a Danish nobleman famed for his accurate and comprehensive astronomical and planetary observations. Brahe was well known in his lifetime as an astronomer and alchemist.

Tycho Brahe built large astronomical instruments and took many careful measurements.

He is credited with the most accurate astronomical observations of his time. No one before Tycho had attempted to make so many redundant observations, and the mathematical tools to take advantage of them had not yet been developed. He did what others before him were unable or unwilling to do — to catalogue the planets and stars with enough accuracy to determine whether the Ptolemaic or Copernican system was more valid in describing the heavens.

From 1600 until his death in 1601, he was assisted by Johannes Kepler, who would later use Tycho's astronomical information to develop his own theories of astronomy

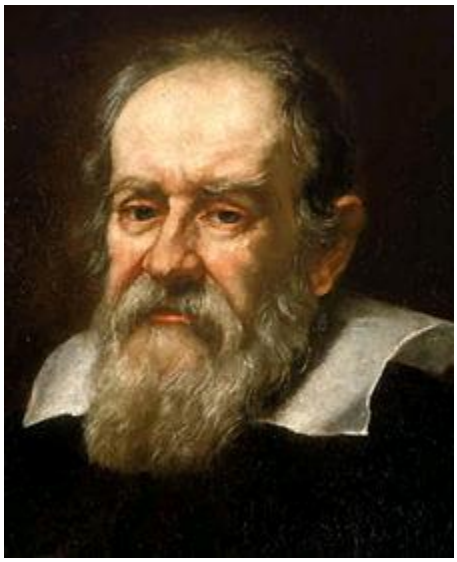
Johannes Kepler

Johannes Kepler was a German mathematician, astronomer and astrologer, and key figure in the 17th century astronomical revolution. He is best known for his **laws of planetary motion**, based on several books he wrote. Kepler's ideas and books provided one of the foundations for Isaac Newton's theory of universal gravitation.

During his career, Kepler was an assistant to astronomer Tycho Brahe,. He also did fundamental work in the field of optics, invented an improved version of the refracting telescope (the Keplerian Telescope), and helped to legitimize the telescopic discoveries of his contemporary Galileo Galilei.

Kepler lived in an era when there was no clear distinction between astronomy and astrology, but there was a strong division between astronomy (a branch of mathematics within the liberal arts) and physics (a branch of natural philosophy). Kepler also incorporated religious arguments and reasoning into his work, motivated by the religious conviction that God had created the world according to an intelligible plan that is accessible through the natural light of reason.

Galileo Galilei



Galileo Galilei was an Italian physicist, mathematician, astronomer, and philosopher who played a major role in the **scientific revolution**. His achievements include improvements to the telescope, astronomical observations, and support for Copernicanism (heliocentric theory). Galileo has been called the "father of modern observational astronomy", the "father of modern physics", the "father of science", and “the Father of Modern Science.” His contributions to astronomy include the telescopic confirmation of the phases of Venus, the discovery of the four largest satellites of Jupiter, named the Galilean moons in his honor, and the observation and analysis of sunspots. Galileo also worked in applied science and technology, improving compass design.

Galileo's championing of Copernicanism was controversial within his lifetime. The geocentric view had been dominant since the time of Aristotle, and the controversy of defending **heliocentrism** as proven fact resulted in the Catholic Church's prohibiting it as a proven fact, because it was not proven at the time and was contrary to the literal meaning of Scripture.[7] Galileo was eventually forced to recant his heliocentrism and spent the last years of his life under house arrest on orders of the **Inquisition**.

Francis Bacon

Sir Francis Bacon (was an English lawyer, statesman, essayist, historian, intellectual reformer, philosopher, and champion of modern science. Early in his career he claimed "all knowledge as his province" and afterwards dedicated himself to a wholesale revaluation and re-structuring of traditional learning. To take the place of the established tradition that relied on Scholasticism, humanism, and natural magic, **he proposed an entirely new system based on empirical and inductive principles.** He urged scientists to experiment and draw conclusions from their observations—called empirical understanding or the experimental model. Bacon encouraged the active development of new arts and inventions, whose ultimate goal would be the production of practical knowledge for "the use and benefit of men" and the relief of the human condition.

Rene Descartes

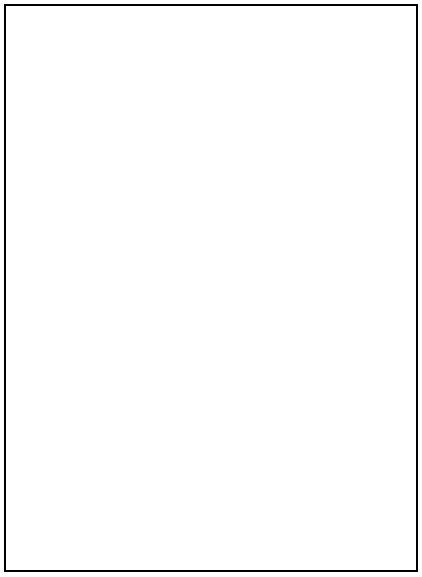
René Descartes was a highly influential French philosopher, scientist, mathematician, and writer. He has been dubbed the "Father of Modern Philosophy." He was one of the key figures in the Scientific Revolution.

He differed from the classical Greece and Roman thought on two major points: First, he rejected the analysis of physical substances into matter and form; second, he rejected any appeal to God or nature when it comes to explaining natural phenomena. **He insisted on the absolute freedom of God's act of creation.** This was a call to not rely on the Church authorities to decide on human events, but on science to explain life.

As the inventor of the Cartesian coordinate system, Descartes founded analytic geometry, the bridge between algebra and geometry, crucial to the invention of calculus and analysis. Descartes' ideas about the mind and how it works contibuted to machine intelligence (computers).

His most famous statement is: **I think, therefore I am**; or I am thinking, therefore I exist

Isaac Newton



Sir Isaac Newton, was an English physicist, mathematician, alchemist, astronomer, natural philosopher, theologian. His *Philosophiæ Naturalis Principia Mathematica*, published in 1687, is considered to be the most influential book in the history of science.

Newton described universal gravitation and the three laws of motion, laying the groundwork for classical mechanics, which dominated the scientific view of the physical universe for the next three centuries and is the basis for modern engineering.

Newton showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws by demonstrating the consistency between Kepler's laws of planetary motion and his theory of gravitation, thus removing the last doubts about heliocentrism and advancing the scientific revolution.

Newton invented the reflecting telescope and developed a theory of color using a prism and studied the speed of sound.

Newton was also highly religious—he wrote more about the Bible than about science.

You must look up the following using the Textbook.

- Scientific Instruments
  - Zacharius Jannsen
  - Anton von Leeuwenhoek
  - Evangelista Torricelli
  - Gabriel Fahrenheit
  - Anders Celsius
- Medicine & the Human Body
  - Galen
  - Andreas Vesalius
  - Edward Jenner
- Discoveries in Chemistry
  - Robert Boyle

What effect did the Scientific Revolution have on thinkers across Europe?