

## Challenging the Norm: The Scientific Revolution, 1543-1700s



What were some of the major achievements of scientists during this period?  
 Why has this period been labeled a “revolution?”  
 Why was the Scientific Revolution seen as threatening by the Catholic Church?  
 How did the Scientific Revolution impact intellectual thought in Europe?

## Main Themes:

- **1. The Renaissance and Reformation paved the way for the new science and philosophy of the 17c and 18c.**
- **2. The transition from the Middle Ages to early modern times represented a shift in emphasis from authoritative truth to factual truth.**

## I. Framework for Early Scientific Thinking:

Ancient Greek Thought

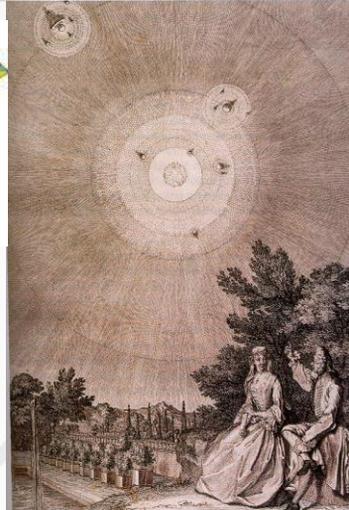
Logic

Christian Thought



## II. The Origins of the Scientific Revolution:

- Trade
- Medieval Universities
  - Medieval alchemists had combined science, magic and philosophy and believed all matter was made from four elements: earth, air, fire and water.
- Renaissance thought
  - use of reason and logic to explain things
- Religious Conflicts



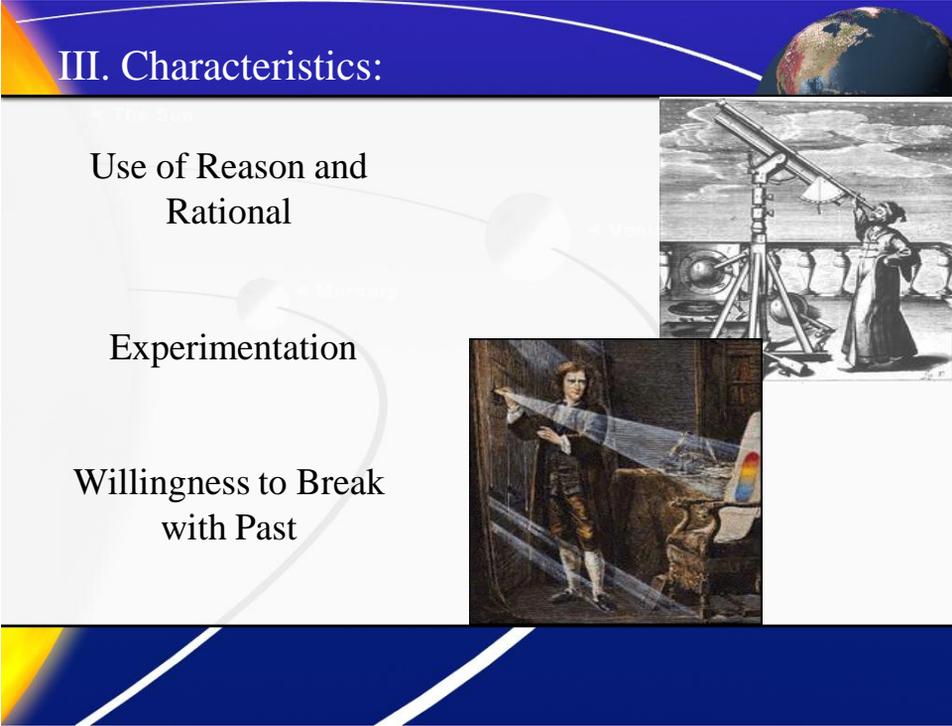
A Teacher Explains the Solar System to a Noble Women

### III. Characteristics:

Use of Reason and Rational

Experimentation

Willingness to Break with Past



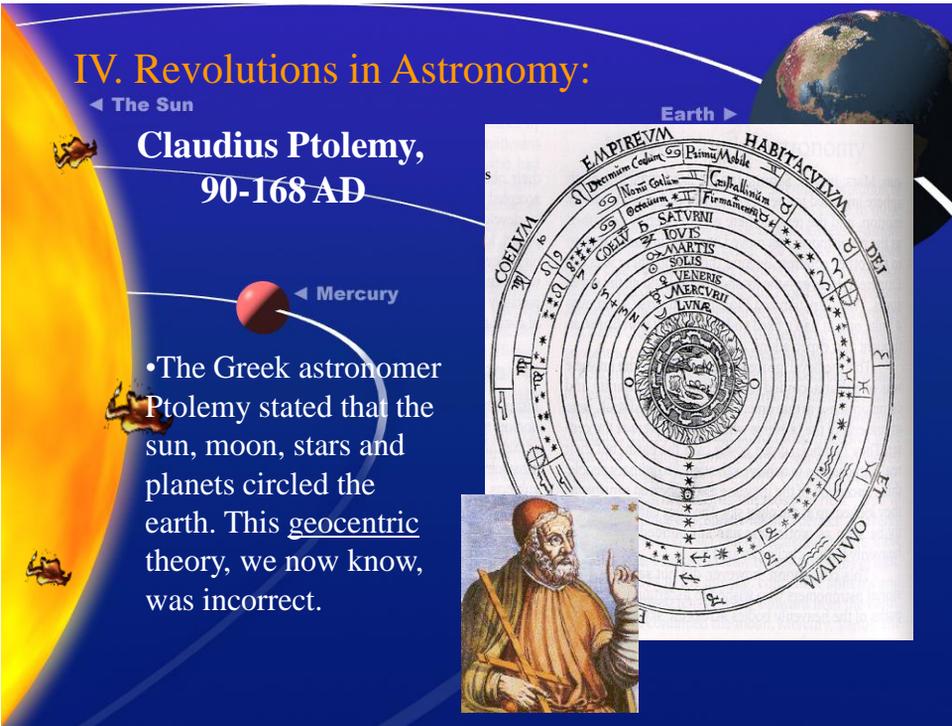
### IV. Revolutions in Astronomy:

◀ The Sun

**Claudius Ptolemy, 90-168 AD**

◀ Mercury

• The Greek astronomer Ptolemy stated that the sun, moon, stars and planets circled the earth. This geocentric theory, we now know, was incorrect.



## IV. Revolutions in Astronomy:

### Nicolaus Copernicus,

1473-1543

- First described our heliocentric solar system with the sun at its center.
- He also identified earth's axis and yearly revolution around the sun.
- *On the Revolution of the Heavenly Spheres*, 1543



## IV. Revolutions in Astronomy:

Tycho Brahe, 1546-1601

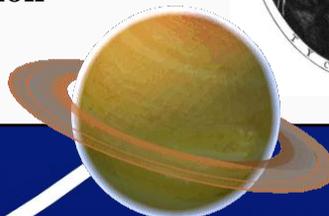
### Johannes Kepler,

1571-1630

### Elliptical Motion



Brahe



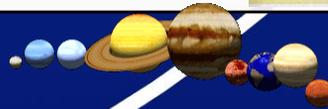
## IV. Revolutions in Astronomy:

**Galileo Galilee,**  
1564-1630

First Telescope

Moon and Sun not  
Perfect

*Starry Messenger*, 1610

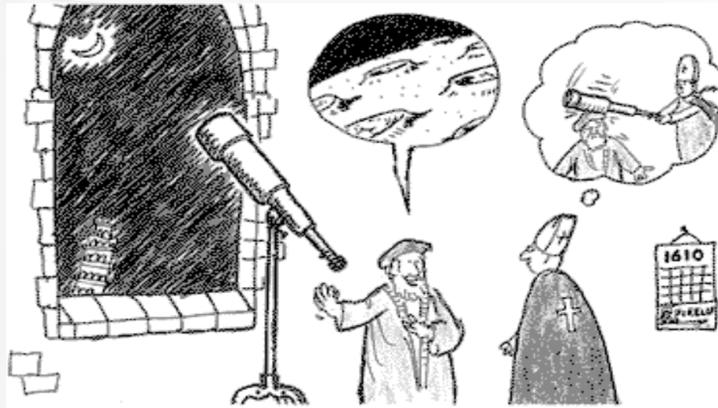


- Why was Galileo put on trial by the Catholic Church?
- What did the Catholic Church demand that he do?
- What was his decision?

Galileo before the Inquisition, 1633

## VI. Science and the Church:

Protestant Church | Catholic Church



Galileo discusses his discoveries with the church.

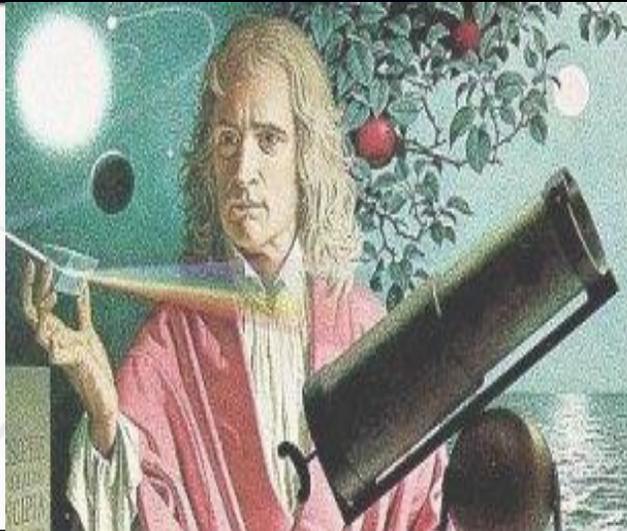
## IV. Revolutions in Astronomy:

**Sir Isaac Newton,**  
1642-1727

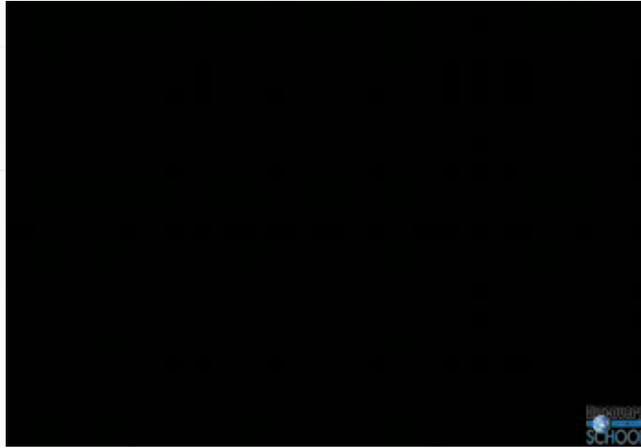
Synthesized  
Kepler and Galileo

Laws of Gravity

*Principia,*  
1687

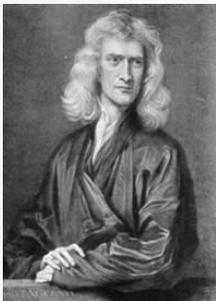


## Video Clip: Newton's Accomplishments



Name some of contributions which Newton made to modern science.

### Summary: Newton's Laws of Motion

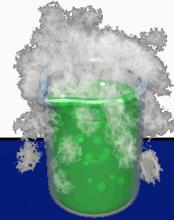


- D. Isaac Newton (1643-1727) identified three main laws of motion that apply to the entire universe.
- 1. An object moves straight unless forced to change direction.
- 2. Outside force moves an object in the direction of the force.
- 3. For every action there is an equal and opposite reaction.

### Other Famous Scientists:



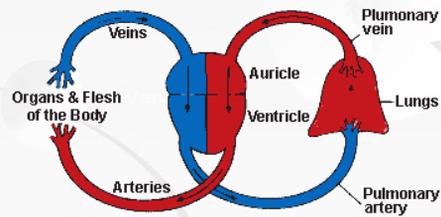
- **Robert Boyle** (1627-1691) in The Skeptical Chemist disproved the alchemists; elements are substances that cannot be broken down by chemical means.



### Other Famous Scientists:

- **William Gilbert** (1544-1603) in *On The Magnet* described the earth as a large magnet, explaining how a compass needle works.





- **William Harvey (1578-1657)** learned that blood moves in the circulatory system with the heart as the central pump.



- **Anton van Leeuwenhoek (1632-1723)** saw and described many tiny forms of life from bacteria to red blood corpuscles, opening the way for the discovery of germ-caused diseases.

## V. Science and Government

Royal Society of London – England (1660)  
 Royal Academy of Sciences – France (1666)  
 Dutch Government funds Kepler



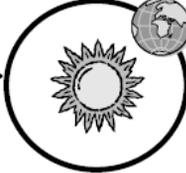
## The Scientific Revolution's Influence in America



- **H. Benjamin Franklin** (1706-1790) proved lightning was an electric spark with his wire-tipped kite flying (during a thunderstorm) experiment. 

1. 

2. 

3. 

Each set of pictures represents a person of the Scientific Revolution. Write which person each set represents and tell why.

4. 

5. 

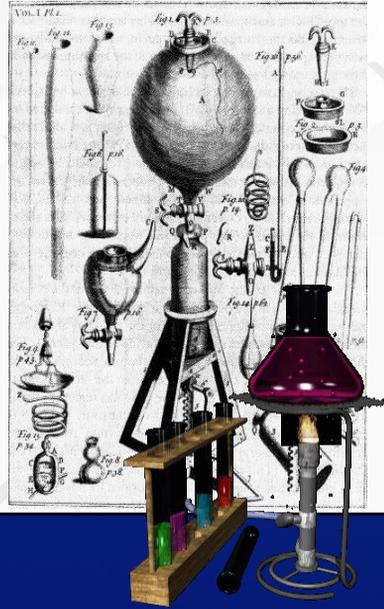
6. 

## People of the Scientific Revolution

 Copernicus	<b>Poland</b>	-reasoned the heliocentric theory - sun is center -kept ideas to himself b/c of Catholic Church (heresy)
 Bacon	<b>England</b>	-scientific method - use reason & observation to prove things - not superstition -changed the way people thought
 Kepler	<b>HRE</b>	-used reason & math to prove Copernicus right -used reason & math to discover laws of planetary motion
 Galileo	<b>Italy</b>	-used reason & telescope to prove heliocentric theory -declared heretic - took back what he said
 Newton	<b>England</b>	-used reason to discover Laws of Gravity, Laws of Motion, & calculus
 Harvey	<b>England</b>	-used reason to discover circulation of blood -used reason to study the human body

## VI. Results of the Scientific Revolution:

- A. Fundamentally changed the way Europeans thought and lived.
- B. The Scientific Method was applied to social relations and government.
- C. New philosophers in England, France, and throughout Europe began to challenge traditional ideas about the role of government. Ideas of natural rights of citizens and government's job to safeguard those rights.
- D. Absolute monarchies were challenged



## Food for Thought and Discussion:

- Some people are expressing new alarm concerning the unchecked progress of scientific knowledge.
- Now it is not the church but the state that feels morally obliged to impose external limitations upon the freedom of scientific inquiry.
- Are the fears of those today better grounded than those who opposed scientific advancement in the 17<sup>th</sup> and 18<sup>th</sup> Centuries?

