

Emerging: The Baroque Era & The Enlightenment



- I. Balls are Heresy
- II. Cities- Structure twisted Straight
- III. Free Schools
- IV. Science, Sex, and Culture

The Age of Science: What came before?

Aristotle (384 BCE – 322 BCE):

❖ The classical elements & their properties

- I. Fire: Hot and dry.
- II. Earth: Cold and dry.
- III. Air: Hot and wet.
- IV. Water: Cold and wet.
- V. Aether: Divine substances



❖ Aristotelian Statics: Objects and their natural places

❖ Example: Rocks and Birds

❖ Aristotelian Kinematics:

When in motion, objects will slow down and stop unless a force acts upon them.

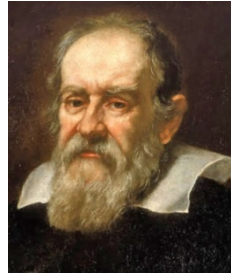
❖ Geocentric Universe and God: The procession of the heavens

❖ Doctrine & Policies of the Church

❖ “Is today a holiday?”: Birth of the Gregorian Calendar (1582 CE)

❖ “Baroque”-en Chemistry: Phlogiston and modifications to the elements

The Age of Science in Case Studies



I. Galileo Galilei (1564 CE – 1642 CE)

❖ Galileo's Inclined Plane Experiments:

- ❖ Balls on differently sloped planes: Up, Down, and Flat.
- ❖ Smooth vs. Bumpy: Observations about friction
- ❖ Is perpetual motion possible?
- ❖ Acceleration: Balls rolling down an inclined plane will pick up the same amount of speed in successive seconds. Maximum acceleration is achieved when the incline is tipped vertically.



❖ Galileo's hypothesis of Inertia:

No force is required to maintain a body in uniform (i.e. constant velocity) motion, just as none is needed to maintain it at rest.

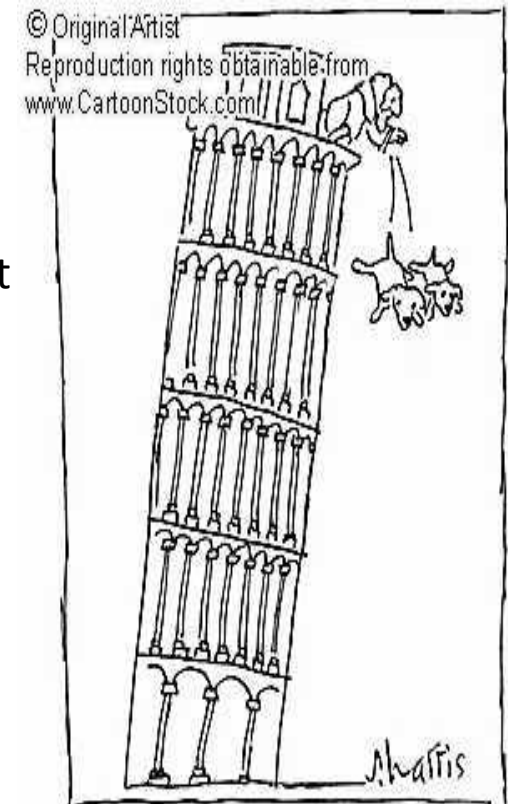
❖ Bad timing: Equipment & Research methodologies

❖ **Dropping things for fun and profit:** When dropped from a great height, all objects will fall at the same rate and hit the ground at the same time.

❖ **Confirmation:** 1969 Lunar Landing

❖ Controversy: Publications and the Church

- ❖ Dialogue Concerning the Two Chief World Systems (1632)
- ❖ Two New Sciences (1638)
- ❖ Astronomical observations & Heliocentrism
- ❖ House Arrest (1637?) and Death (8 January 1642)

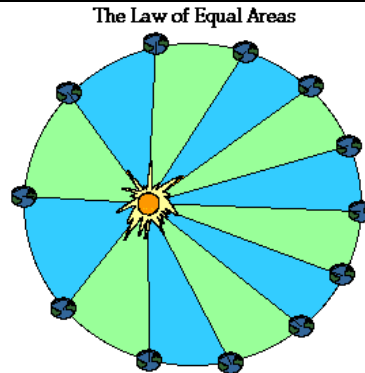
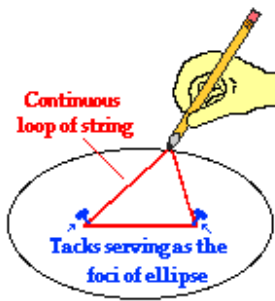


GALILEO'S ATTEMPT TO DISCOVER IF HEAVIER DOG FALLS FASTER THAN LIGHTER DOG.

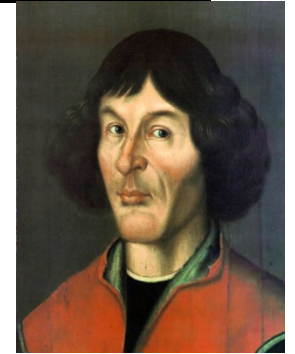
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The Age of Science in Case Studies

II. Tycho Brahe, Johannes Kepler, and Nicolaus Copernicus:



$$\frac{T^2}{R^3}$$



❖ Brief History of Heliocentrism

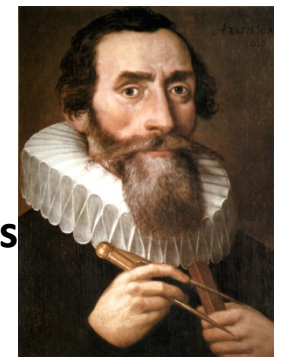
❖ The Three Laws:

- ❖ **The First Law:** A planet orbit the Sun in elliptical, not circular, orbits.
- ❖ **The Second Law:** A planet moves slower when it's away from the Sun.
- ❖ **The Third Law:** There exists a common relationship between the movements of all known planets in the solar system .



III. René Descarte (1596 – 1650):

- ❖ **Contribution to Mathematics & Logic : Deductive Reasoning**
- ❖ **Cartesian Coordinates: Algebraic and Geometric mathematics**
- ❖ **Existential Philosophy: "I think, therefore I am".**



The Age of Science in Case Studies

IV. Issac Newton (1642 – 1727):

❖ Finding what's unfounded: Development of the Calculus

❖ Goals and Applications & Fundamental concepts

❖ Controversy with Gottfried Leibniz

❖ Changing the Paradigm: Newtonian Physics

❖ The Three laws of Motion

1. **First Law:** Any isolated object that is at rest remains at rest, and any object in motion with constant velocity continues in motion if no force acts upon it.
2. **Second Law:** The acceleration of an object is proportional to the net force acting upon it and inversely proportional to its mass. $[\Sigma \mathbf{F} = m\mathbf{a}]$ Force is the cause of changes in motion.
3. **Third Law:** For every force applied on A by B, B receives an equal force in the opposite direction; every action has an equal and opposite reaction. $[\mathbf{F}_{AB} = -\mathbf{F}_{BA}]$

❖ Optics & The Nature of Light

❖ Action at a distance: Theory of Universal Gravitation & the Ether

Every object in the Universe attracts every other object with a force directed along the line of centers for the two objects.

❖ Publications:

1. *Philosophiae Naturalis Principia Mathematica* (1687)
2. *Opticks* (1704)

❖ Cults, the occult, later life, and Death

1687



$$F = -G \frac{m_1 m_2}{r^2}$$