Chapter Six: The Scientific Revolution

* What are the historical origins of the Scientific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
* How does scientific and technological innovation alter the course of human existence?

Introduction: Essential Understandings

* “Scientific Revolution” coined in the 18th century (overly positivistic?)
* As much a revolution in ways of “thinking about” and “doing” science as the actual scientific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* LONG time frame and geographic scope
* Social, economic, political, cultural changes as well
* Scientific and technological innovations of the 17th , 18th , and 19th centuries \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ altered the course of human existence
* Helped lay the foundations of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ “scientific” world

**“From a closed world to an infinite universe”**

1. Define the scientific revolution (p. 203):

Introduction: The Question that Transcends The Centuries

Religion, politics, science often in overlapping spheres - creates both conflict and cooperation within society

**Can Religion and Science co-exist?**

* Why does this question still dominate intellectual and spiritual authorities?
* What, in your opinion, are the historical origins of this debate?

Creation of a New Worldview

First the “old” worldview:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Start with pre-determined sources and outcomes
    - The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Classical antiquity
      * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (384-322 BCE)
      * Ptolemy (83-161 CE)
      * Galen (129-200 CE)
  + The great “Chain of Being”
* Renaissance, Reformation, and Exploration began \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of old knowledge & assumptions
* Gradual replacement of religious & \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ presumptions
* Gradual rise of science & \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Weakening authority of the R.C.C
* Concept of “natural philosophy” (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* Changes began in the areas of physics, astronomy and math - the “hard” sciences

The Ptolemaic/Aristotelian System (see Emperors Astronomy on Webpage)

* Based on the calculations of early astronomers as well as “common sense” (heaviness of objects)
* Assumed the Earth was the center of the universe (*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*)
* Fluid spheres contained moon, sun, planets and stars, God and angels
* State of rest was natural

Emerging Skepticism

* Michel de Montaigne (1533-1592)
  + "*Que sais-je*?" (What do I know?)
    - Nothing

Scientific Issues with the Ptolemaic model:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ motion (appearance of planets moving backward) because of the different speeds of planets – the model didn’t work.

Galileo Galilei (see Closer Look: Copernican Universe on Webpage)

* 1609 - Turned an advanced Dutch telescope towards the heavens
* Saw all sorts of wonders (sun spots, moon mountains, moons orbiting planets, etc.)
* Argued that these proved \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ model
* Court mathematician, astronomer, and philosopher. Very self-promoting
* Argued that universe was subject to rational mathematical laws
* He was condemned by the Catholic Church, investigated by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, his books placed on the *Index of Prohibited Books*, and held under house arrest for years (see Galileo: To the Grande Duchess on webpage)

1. Get into Groups of 6

2. Each person chooses a philosopher (scientist) from the following – Copernicus, Brahe, Kepler, Galileo, Newton, Bacon

3. Fill out your chart

4. Share with the group

|  |  |
| --- | --- |
| **Copernicus**  **Contribution to Scientific Revolution:** | **Brahe**  **Contribution to Scientific Revolution:** |
| **Kepler**  **Contribution to Scientific Revolution:** | **Galileo**  **Contribution to Scientific Revolution:** |
| **Newton**  **Contribution to Scientific Revolution:** | **Bacon**  **Contribution to Scientific Revolution:** |

**5. Discuss – Which of the scientists made the most significant contribution to the scientific revolution? Why? (Be prepared to share with the class)**

**New Directions in Astronomy and Physics**

* Important question: how do the planets and heavens move in such an orderly way?
* Isaac Newton 1687 - *Mathematical Principles of Natural Philosophy* (the *\_\_\_\_\_\_\_\_\_\_\_\_*)
* Planets and other bodies moved through gravity (mutual attraction) according to the rules of mathematics
* Formed the basis of modern physics until Einstein
* Also responsible for modern \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Newton’s Three Laws of Motion:

1. An object in motion will remain in motion unless acted upon by a net force, and an object at rest will remain at rest unless acted upon by a net force; this is also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. Force equals mass multiplied by acceleration.

3. For every action there is an equal and opposite reaction.

* The “Other” Sciences
* Rationalism of math and physics influences other sciences
* Use of the microscope (mid 17th century) opens up new avenues for discovery

**Biology**

* Santorio Santorio – begins examining chemical processes in human body
* William Harvey – discovers blood circulation
* Giovanni Alfonso Borelli – mechanisms of muscular motion
* Edme Mariotte – plants and sap
* Linnaeus – systematic classification

**Chemistry**

* Antoine Lavoisier – explains oxidation
* Henry Cavendish - isolates hydrogen
* Joseph Priestly - discovers oxygen
* Novum Organum: New Instruments
  + "\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: These three have changed the whole face and state of things throughout the world; the first in literature, the second in warfare, the third in navigation; whence have followed innumerable changes, in so much that no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these mechanical discoveries.“

* + What three innovations have changed our modern world?