**Introduction to Astronomy:**

**Unit 4: Astronomy**

**Mini-Unit:** Astronomy Basics

**Goal 2: The student will demonstrate the ability to identify and describe the properties, natural forces, and theories of formation and operation of the solar system and universe**

Objectives – The student will be able to:

* + Describe current efforts and technologies used to study the universe, including optical telescopes, satellites, space probes, spectroscopes, high altitude platforms and explain how their research impacts human activity

**Textbook:** Unit 8, Chapters 26, pg. 658

History of Astronomy:

Astronomy: The scientific study of the universe

Originally suggested the universe had a large stationary Earth in the center, and the Sun, the Moon, and the stars were arranged around the Earth in perfect spheres orbiting in perfect circles at constant speeds

* As careful mathematical observations were made, they found the Sun, the Moon, and some of the “stars” did not follow paths that would suggest the above statement
* The “stars” that did not follow the predicted path, rather they “wandered” across the sky, and thus were called “planets”, the Greek word for “wander”



Aristotle’s Theories - ~350 B.C., Greek Philosopher

* The Earth was in the center, and the Sun, the Moon, the stars, and the planets orbited on separate spheres that encased each other and spun at different rates
* Motion caused by a supernatural being
* Earth was a sphere (could see shadow on moon during eclipse) and non-moving (because we could not feel it and falling objects would not drop straight down)

Geocentric Universe: Earth centered, model of the Universe

Retrograde Motion: A problem with Aristotle’s theory was that objects would travel one direction across the sky, stop, and go backwards.

Ptolemy’s Theories - ~150 A.D., Egyptian astronomer

* Geo-centric
* Each planet was fixed to a small sphere that was fixed to a larger sphere
* No changes made for a 1,000 years until the inaccuracies in predictions became to big to blame on primitive equipment



Copernicus’ Theories - ~1500’s A.D., Polish priest/mathematician

* Proposed a sun-centered universe with the Earth spinning on its axis once a day
* Orbits were perfect circles
* Did not publish his findings until his death because it contradicted the Church’s beliefs

Heliocentric Universe – sun-centered universe

Tycho Brahe’s Contribution - ~1500’s A.D., Danish nobleman

* Built a top of the line observatory, gathered and kept tremendous amounts of data



Johannes Kepler’s Theories - ~1600’s A.D., Assistant to Brahe

 Laws of Planetary Motion:

1. Each planet revolves around the Sun in an elliptical orbit with the sun at one of the foci
2. Planets do not move at a constant velocity (due to gravity pulling)
3. There is a mathematical relationship between the time it takes a planet to revolve around the sun and its average distance from the sun

Galileo Galilei’s Contribution - ~1600’s A.D., Italian astronomer

* Developed and refined the telescope for viewing distant objects

Astronomy Basics:

The Big Bang Theory: Explosion of matter that occurred 14 billion years ago, and thus has led to the universe expanding since that point

Universe: The entirety of what we call outer space

Galaxy: A collection of stars, dust, and gas bound together by gravity (Milky Way Galaxy)

Solar System: A collection of planets that revolve around a star (sun)

Astronomical Unit: The average distance between the Earth and the Sun; approximately 150 million kilometers

Light Speed: The speed of light is 300,000 km/s

Light Year: The distance that light can travel in one year (9.46 km x1012 or 9,460,000,000,000 km)

Observing Space:

Electromagnetic Spectrum: All of the frequencies or wavelengths of electromagnetic radiation (energy)

**Longer Wavelengths Shorter Wavelengths**

**Less Energy Most Energy**



Notes on the Electromagnetic Spectrum:

* What we see falls into the visible light spectrum
* Only stars emit visible light, everything else (planets & moons) are reflecting light
* Other instruments can detect the other electromagnetic waves

Telescopes: An instrument that collects electromagnetic radiation from the sky and concentrates it for better observation

Optical Telescopes: Telescopes that only collect visible light

 Refracting Telescope: Uses a set lenses to focus light

 Reflecting Telescope: Uses a set of mirrors to focus light

Invisible Electromagnetic Radiation Telescopes – used to detect radio waves, gamma rays, X rays, and infrared rays

Space Telescopes – Telescopes that were launched into space to escape obstruction from the Earth’s atmosphere (Hubble Telescope)