

Chapter 18 – Space

Section 1

Objectives

- **Identify** the units of a calendar.
- **Describe** two early ideas about the structure of the universe.
- **Describe** the contributions of Brahe, Kepler, Galileo, Newton, and Hubble to modern astronomy.

Astronomy

- People in ancient cultures used the _____ cycles to determine when they should _____ and _____ crops. They built observatories to study the night sky.
- Over time, the science of astronomy developed. **Astronomy** is the study of the _____.

Our Modern Calendar

- **What Is Our Calendar Based On?** The years, months, and days of our modern calendar are based on the _____ of _____ in our solar system.

Who's Who of Early Astronomy

- **Ptolemy: An _____-Centered Universe** Ptolemy thought that the Earth was at the center of the universe and that the other planets and the sun revolved around the Earth.
- **Copernicus: A _____-Centered Universe** Copernicus thought the sun is at the center of the universe, and all of the planets—including the Earth—orbit the sun.
- **Tycho Brahe: A Wealth of Data** In the late-1500s, Danish astronomer Tycho Brahe made the most detailed _____ that had ever been recorded.
- **Johannes Kepler: Laws of Planetary Motion** Johannes Kepler stated _____ laws of planetary motion. These laws are still used today.

Section 2

Objectives

- **Compare** refracting telescopes with reflecting telescopes.
- **Explain** how the atmosphere limits astronomical observations, and explain how astronomers overcome these limitations.
- **List** the types of electromagnetic radiation that astronomers use to study objects in space.

Telescopes

- A **Telescope** is an instrument that gathers electromagnetic _____ from objects in space and _____ it for better observation.
- There are _____ different types of telescopes.

Optical Telescopes

- **Refracting Telescopes** Telescopes that use _____ to gather and _____ light are called refracting telescopes. A refracting telescope is shown on the next slide.

- **Reflecting Telescope** A telescope that uses a _____ mirror to gather and focus light is called a reflecting telescope. A reflecting telescope is shown on the next slide.
- **Very Large Reflecting Telescopes** In some very large reflecting telescopes, _____ mirrors work together to collect light and focus it in the _____.
- **Optical Telescopes and the Atmosphere** The light gathered by telescopes on the Earth is affected by the _____.
- **Optical Telescopes in Space** To avoid _____ by the atmosphere, scientists have put telescopes in space

The Electromagnetic Spectrum

- **What Is the Electromagnetic Spectrum?** The electromagnetic spectrum is made up of all of the _____ of electromagnetic radiation.
- **Detecting Electromagnetic Radiation** _____ light is only a small band of the electromagnetic spectrum. Radio waves, _____, infrared light, ultraviolet light, X rays, and gamma rays— are _____ to the human eye.

Nonoptical Telescopes

- **Radio Telescopes** Radio telescopes detect radio waves. Because radio wavelengths are much larger than optical wavelengths, radio telescopes must be _____.
- **Linking Radio Telescopes** Astronomers can get more detailed images of the universe by _____ radio telescopes together. Working together, the telescopes function as a single _____ telescope.
- **Nonoptical Telescopes in Space** Because most electromagnetic waves are blocked by the Earth's atmosphere, scientists have placed _____ telescopes, infrared telescopes, _____ telescopes, and X-ray telescopes in _____.

Section 3

- **Explain** how constellations are used to organize the night sky.
- **Describe** how the altitude of a star is measured.
- **Explain** how the celestial sphere is used to describe the location of objects in the sky.
- **Compare** size and scale in the universe, and explain how red shift indicates that the universe is expanding.

Patterns in the Sky

- **Constellations Help Organize the Sky** A constellation is a _____ of the sky. Each constellation shares a _____ with neighboring constellations.
- **Seasonal Changes** As Earth revolves around the sun, the apparent locations of the constellations

_____ from season to season.

Finding Stars in the Night Sky

- You can describe the _____ of a star or planet by using an instrument called an _____ and the following points of reference:
 - The _____ is the point in the sky directly above an observer on Earth.
 - The _____ is the angle between an object in the sky and the horizon.
 - The _____ is the line where the sky and the Earth appear to meet.
 - Using an astrolabe allows you to describe where a star or planet is relative to _____. Scientists need a different method that describes location independently of the observer's location.
- Astronomers describe the location of a star or planet in terms of the _____ sphere.

The Size and Scale of the Universe

- In the _____, Nicolaus Copernicus noticed that the planets appeared to move relative to each other but that the _____ did not. Thus, he thought that the stars must be _____ away than the planets.
- **Measuring Distance in Space** A _____ is a unit of length equal to the distance that light travels in 1 year.
- It is important to consider _____ when thinking about the universe. Although stars look tiny in the night sky, remember that they are actually a lot _____ than Earth.

The Doppler Effect

- What Is the Doppler Effect? Have you ever noticed that when a driver in an approaching car blows the horn, the horn sounds _____ pitched as the car approaches and _____ pitched after the car passes? This effect is called the Doppler Effect.
- This effect not only works with sound but also with _____.
- As a light source such as a star or galaxy is moving _____ from an observer, the light emitted looks _____ than it normally does. This effect is called **redshift**.
- If a light source is moving _____ an observer then the light looks _____ than it normally does. This effect is called **blueshift**.
- **An Expanding Universe** The Doppler Effect has been used to discover that _____ are rapidly moving _____ from each other.