Chapter 19 – Stars, Galaxies, and the Universe

Section 1

Objectives

- **Describe** how color indicates the temperature of a star
- **Explain** how a scientist can identify a star's composition
- **Describe** how scientists classify stars.
- **Compare** absolute magnitude with apparent magnitude.
- **Identify** how astronomers measure distances from Earth to stars.
- **Describe** the difference between the apparent motion and the actual motion of stars.

Color of Stars

- Because a _____ flame is hotter than a yellow or red flame, we can conclude that blue _____ are hotter than yellow or red stars.

Composition of Stars

- A star is made of different _____ in the form of _____.
- The gases in the atmosphere of a star _____ different wavelengths of light depending on which elements make up the gases.
- The _____ from a star indicates which elements make up that star.
- **The Colors of Light** A _____ breaks white light into a rainbow of colors called a **_____.**
- An instrument called a spectrograph is used to break a star's light into a spectrum. The spectrum of a star will vary depending on which _____ are present.
- **Making an ID** Emission lines are lines made when certain wavelengths, of light, or colors, are _____ by hot gasses.
- Each element produces a unique set of _____ lines, which allows them to be used to identify the elements in a star.
- **Trapping the Light—Cosmic Detective Work** A star's spectrum is made of dark emission lines. A star's atmosphere _____ certain colors of light, which causes _____ lines to appear.
- **Identifying Elements Using Dark Lines** Because a star's atmosphere absorbs some colors of light, the spectrum of a star is called an *absorption spectrum.* It can be used to identify some of the elements in a star's atmosphere.

Classifying Stars

- **Differences in Temperature** Stars are now classified by how _____ they are.
- **Differences in Brightness** The brightest star, _____, has a magnitude of -1.4. The dimmest star that can be seen with a microscope has a magnitude of _____.

How Bright Is That Star?

- **Apparent Magnitude** The _____ of a light or star is called apparent magnitude.
- **Absolute Magnitude** Absolute magnitude is the _____ brightness of a star.

Distance to the Stars

- Because stars are so far away, astronomers use _____ to measure the distances from Earth to the stars. A **light year** is the distance that light travels in a year.

- **Parallax** is the apparent _____ in the position of an object when viewed from different _____. Measuring parallax enables scientists to calculate the distance between a star and the Earth.

Motions of Stars

- **The Apparent Motion of Stars** If you look at the night sky long enough, the stars also _____ to move.
- **The Actual Motion of Stars** The apparent motion of the sun and stars in our sky is due to _____. But each star is also moving in space. Their actual movements, however, are _____ to see.

Section 2

Objectives

- **Describe** different types of stars.
- **Describe** the quantities that are plotted in the H-R diagram.
- **Explain** how stars at different stages in their life cycle appear on the H-R diagram.

The Beginning and End of Stars

- **The Beginning** A star enters the first stage of its life cycle as a ball of _____ and dust. _____ pulls the gas and dust together, and hydrogen changes to _____ in a processes called *nuclear* _____.
- **The End** Stars usually lose material slowly, but sometimes they can lose material in a big _____. Much of a star's material returns to space, where it sometimes forms _____.

Different Types of Stars

- Stars can be classified by their _____, mass, brightness, color, temperature, spectrum, and age. A star's _____ can change as it ages.
- **Main-Sequence Stars** After a star forms it enters the second and longest stage of its life cycle known as the _____. Energy is generated in the core as hydrogen atoms fuse into helium atoms.
- **Giants and Supergiants** After the main-sequence stage, a star can enter the third stage of its life cycle. A _____, as it is know known, is a large, reddish star late in its life cycle.
- In this third stage, a star can become a red giant. As the center of the star _____, the atmosphere of the star grows very _____ and cools to form a red giant or a red supergiant.

A Tool for Studying Stars

- **The H-R Diagram** the **H**ertzprung-**R**ussell diagram is a graph that shows the relationship between a star's surface _____ and absolute _____.
- **Reading the H-R Diagram** The diagonal pattern on the H-R diagram where most stars lie is called the _____. Find the diagonal pattern in the H-R Diagram on the next two slides.

When Stars Get Old

- **Supernovas** A **supernova** is a gigantic _____ in which a massive blue star collapses.
- **Neutron Stars and Pulsars** A star that has collapsed under gravity to the point at which all of its particles are _____ is called a **neutron star**. If a neutron star is _____, it is called a **pulsar**.
- **Black Holes** Sometimes the leftovers of a supernova are so massive that they _____ to form a black hole**.** A **black hole** is an object that is so massive that even _____ cannot escape its gravity.

Section 3

Objectives

- **Identify** three types of galaxies.
- **Describe** the contents and characteristics of galaxies.
- **Explain** why looking at distant galaxies reveals what young galaxies looked like.

Galaxies

- A **galaxy** is a collection of _____, dust, and gas held together by _____.
- **Spiral Galaxies** have a bulge at the center and _____ arms.
- **The Milky Way** Astronomers think that _____ solar system is in a spiral galaxy.
- **Elliptical Galaxies** About _____ of all galaxies are simply massive _____ of stars. These are called elliptical galaxies.
- **Irregular Galaxies** Galaxies that do not fit into any other class are called _____ galaxies.

Contents of Galaxies

- **Gas Clouds** A large clouds of gas and dust in interstellar space is called a **_____**.
- **Star Clusters** A **_____** is a tight group of stars that looks like a ball and contains up to 1 million stars.
- An **open cluster** is a group of stars that are _____ together relative to surrounding stars.

Origin of the Galaxies

- Because if takes light _____ to travel through space, looking at distant galaxies reveals what _____ galaxies looked like.
- **Quasars** A very _____, starlike object that generates energy at a _____ is called a

quasar. Some scientists think that quasars may be the _____ of young galaxies that are in the process of forming.

Section 4

Objectives

- **Describe** the big bang theory.
- **Explain** evidence used to support the big bang theory.
- **Describe** the structure of the universe.
- **Describe** two ways scientists calculate the age of the universe.
- **Explain** what will happen if the universe expands forever.

Cosmology

- **Cosmology** is the study of the _____, properties, processes, and evolution of the _____.

Universal Expansion

- **Galaxy Movement** To understand how the universe _____, scientists study the movement of galaxies.

- **A Raisin-Bread Model** The universe, like the rising raisin bread dough, is _____. Think of the raisins in the dough as galaxies. As the universe expands, the galaxies move _____.

The Big Bang Theory

- **A Tremendous Explosion** The theory that the universe began with a tremendous _____ is called the big bang theory.

- **Cosmic Background Radiation** In _____, two scientists using a huge _____ accidentally found radiation coming from _____ in space. One explanation for this radiation is that it is cosmic _____ radiation left over from the big bang.

How Old Is the Universe?

- **Age of the Universe** Scientist use to methods to study the _____ of the universe.

- By measuring the _____ between Earth and various galaxies, scientists can predict the rate of _____ and calculate the age of the universe.

- Because the universe must at least be as old as the _____ it contains, the ages of the stars provide a clue to the age of the universe.

A Forever Expanding Universe

- The expansion of the universe depends on the amount of _____ it contains. A large enough quantity of matter would cause _____ to stop the expansion. The universe could start collapsing.

- Scientist now think that there may not be _____ matter in the universe, so the universe would continue to expand _____ and become cold and dark as all the stars _____.