Chapter 11.1: Stars and Galaxies in the Universe

1. Introduction to the Universe

- **Definition**: The universe consists of everything around us, including many objects in space we may not be aware of.
- **Study of Astronomy**: Enhances awareness of the beauty and vastness of the universe.

Example Sentence: Astronomy allows us to appreciate the vastness and beauty of the universe.

2. Role of Technology

- **Technological Devices**: Crucial for studying outer space.
- **Hubble Space Telescope**: Launched on April 24, 1990, it can see a coin from 725 km away.

Example Sentence: Technological advancements, like the Hubble Space Telescope, provide clearer pictures of the universe.

3. Galaxies

- **Definition**: A galaxy is a set of bodies consisting of millions of stars, gas, and dust particles.
- **Types of Galaxies**:
  - **Spiral Galaxies**: Examples include Andromeda and The Milky Way.
  - **Elliptical Galaxies**: Examples include Ursa Major and Messier 87.
  - **Irregular Galaxies**: Examples include Small Magellanic Cloud and Large Magellanic Cloud.

Example Sentence: Our solar system is located in the Milky Way, a spiral galaxy.

4. The Milky Way

- **Description**: A medium-large spiral galaxy.
- **Location of Solar System**: At the edge of one of the spiral arms.
- **Composition**: Approximately 200 billion stars, including the Sun.

Example Sentence: The Milky Way contains around 200 billion stars, with our solar system located at its edge.

5. Life Cycle of Stars (Nebular Hypothesis)

- **Birth of Stars**:
  - **Formation**: From nebulae, large clouds of dust and gas.
  - **Process**: Gravitational force causes the gas and dust to form a globe, creating a core and eventually a protostar.
  - **Final Stages**: Becomes an average star or a massive star.

Example Sentence: Stars are born from nebulae and can evolve into either average stars like the Sun or massive stars.

- **Death of Stars**:
  - **Red Giant Stage**: Star expands and turns red.
  - **Final Stages**: Can become a white dwarf, supernova, neutron star, or black hole depending on its mass.

Example Sentence: A star's death can result in a supernova, forming either a neutron star or a black hole.

6. Characteristics of Stars

- **Classification Factors**:
  - **Color**
  - **Temperature**
  - **Size**
  - **Brightness**
  - **Distance from Earth**

- **Color and Temperature**:
  - **Red**: <3,500 K
  - **Orange**: 3,500-5,000 K
  - **Yellow**: 5,000-6,000 K
  - **Yellowish-white**: 6,000-7,500 K
  - **White**: 7,500-11,000 K
  - **Bluish-white**: 11,000-25,000 K
  - **Blue**: >25,000 K

Example Sentence: Stars can be classified by their color, which corresponds to their surface temperature.

- **Size of Stars**:
  - **Supergiant**
  - **Giant**
  - **Dwarf**

Example Sentence: The brightest stars, such as Sirius and Rigel, are often supergiant stars.

7. Relative Size Comparison

- **Hierarchy**: Earth < Solar System < Milky Way Galaxy < Group of Galaxies < Cluster of Galaxies < Universe
- **Earth's Position**: A small speck in the vast universe.

Example Sentence: The universe's vastness dwarfs the Earth, highlighting the immense scale of cosmic structures.

8. National Planetarium

- **Location**: Kuala Lumpur.
- **Purpose**: Space science education facility for the public.
- **Design**: Combination of Islamic architecture and astronomy.

Example Sentence: The National Planetarium in Kuala Lumpur is a unique blend of Islamic architecture and space science education.