CHAPTER : 2
THE ORIGIN AND EVOLUTION OF THE EARTH

EARLY THEORIES REGARDING THE ORIGIN OF THE EARTH

1) **NEBULAR HYPOTHESIS**
   - Put forward by Immanuel kant, a German philosopher.
   - Revised by Laplace in 1796.
   - According to this hypothesis, planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating.
   - Otto Schmidt in Russia and Carl Weizascar in Germany revised nebular hypothesis in 1950.
   - According to them, solar nebula consists mainly of hydrogen and helium, along with dust.

2) **BINARY THEORIES**

   a) **Planetesimal hypothesis**
      - proposed by Chamberlain and Moulton in 1900.
      - According to them, a star which was wandering approached the sun resulted in the separation of a cigar shaped material from the solar surface.
      - As the passing star moved away, the material separated from the solar surface continued to revolve around the sun and it slowly condensed into planets.

   b) **Tidal hypothesis**
      - by James Jeans and Harold Jeffrey.
      - Large star came near the sun.
      - Due to the gravitational pull a gaseous tide was raised on the surface of the sun.
      - Gaseous tide detached when star move away.
      - It broke into pieces forming planets in the solar system.

MODERN THEORIES ON THE ORIGIN OF THE UNIVERSE

a) **Big Bang Theory**

   ➔ also called expanding universe hypothesis.

   ➔ By Edwin Hubble in 1920.

   ➔ According to them, the distance between the galaxies is found to

be increasing and thereby, the universe is considered to be expanding.

➔ Around 13.7 billion years ago, the tiny ball consisted of all matter exploded violently at the 'Big bang' which led to the formation of universe.

b) **Steady State Theory**

➔ put forward by Hoyle.

➔ It considered the universe to be roughly the same at any point of time.

Galaxy

- A galaxy contains a large number of stars.
- There are millions of galaxies in the universe.
- Milky Way or Akash Ganga is the galaxy in which our solar system exists.

Formation of Star

- A galaxy starts to form by the accumulation of hydrogen gas in the form of a very large cloud called nebula.
- Eventually, growing nebula develops localised lumps of gaseous bodies, giving rise to the formation of stars.
- Stars were formed during 5-6 billion years ago.

Light Year

- It is the unit for measuring distances in the universe.
- It is the distance the light will travel in one year.
- This equals to 9.461×10^{12} km.
- Distance between the sun and the earth is 8.31 light year.

OUR SOLAR SYSTEM

- The Solar system is formed about 5- 5.6 billion years ago.
- The planets were formed about 4.6 billion years ago.
- The solar system refers to the heavenly bodies which belong to the sun's family.

- They are held in places by the gravitational pull of the sun.
- Our solar system consists of the sun, 8 planets, 63 moons, millions of smaller bodies like asteroids and comets and huge quantity of dust grains and gases.

PLANETS

- The planets rotate around their axes and revolve around the sun.
- 8 planets are grouped into two categories- Terrestrial and Jovian.

Terrestrial planets	Jovian Planets
• Mercury, Venus, Earth, Mars	• Jupiter, Saturn, Uranus, Neptune
• Inner planets	• Outer planets
• Earth like	• Jupiter like
• Made up of rocks and metals	• Gas giants
• High density	• Low density
• Small in size	• Larger than terrestrial planets
• Nearer to the sun	• Farther from the sun
• Low gravity	• High gravity
• Hotter	• Colder

Pluto

- ✗ Till August 2006, Pluto was considered as a planet.
- ✗ In 2006, the International Astronomical Union decided to de-promote Pluto into the category of 'dwarf planet'.

Facts about Planets

1. Nearest planet to the sun – Mercury
2. Farthest planet from the sun – Neptune
3. smallest planet – Mercury
4. Largest planet – Jupiter
5. Densest planet – Earth
6. Least dense planet – Saturn
7. planets without natural satellites – Mercury, Venus
8. Planets with large number of satellites – Saturn(18)

THE MOON

- Only natural satellite of the earth.
- It is believed that the moon is formed as a result of a giant impact called '**the Big Splat**'.
- A body much bigger than Mars collided into the earth about 4.44 billion years ago.
- It blasted a large part of the earth into space which continued to orbit the earth as Moon.

Notes:

1. AGES
   - ✔ Universe – 13.7 billion years
   - ✔ Stars – 5 to 6 billion years
   - ✔ Solar system – 5 to 5.6 billion years
   - ✔ Planets or Earth – 4.6 billion years
   - ✔ Moon – 4.44 billion years
   - ✔ Oceans – 4 billion years
   - ✔ Life – 3.8 billion years

2. Why are the terrestrial planets rocky?
   - ➢ The terrestrial planets were formed in the close vicinity of the parent star where it was too warm for gases to condense to solid particles.
   - ➢ The intense solar winds blew off lots of gas and dust from the terrestrial planets.
   - ➢ The terrestrial planets are smaller and their lower gravity could not hold the escaping gases.

3. What is meant by the process of differentiation?
   - Differentiation is a process through which the earth forming materials got separated into different layers according to their density, such as crust, mantle and core.
   - From the crust to the core, the density of the material increases.

4. Mention the stages in the evolution of atmosphere.
    i. Loss of primordial atmosphere which consists of hydrogen and helium.
    ii. Degassing – the process through which the gases were outpoured from the interior during the cooling of the earth.
    iii. Modification of the atmosphere by the living world through the process of photosynthesis.

5. What was the nature of the earth surface initially?
    - The planet earth initially was a barren, rocky and hot object with a thin atmosphere of hydrogen and helium.