

- A galaxy contains a large number of stars.
- A light year is a measure of distance and not of time. The distance the light will travel in one year is taken to be one light year. Distance between the Sun and the Earth in terms of light years is 8.311 minutes.
- Planetesimals are a large number of smaller bodies.

Origin of the Earth – early theories

- One of the earlier and popular hypotheses was given by German philosopher Immanuel Kant & Laplace in 1796. It is known as **Nebular Hypothesis**. The hypothesis considered that the planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating.
- In 1950, Otto Schmidt (Russian) and Carl Weizsacker (German) revised the 'nebular hypothesis'. They considered that the sun was surrounded by solar nebula containing mostly the hydrogen and helium along with what may be termed as dust. The friction and collision of particles led to formation of a disk-shaped cloud and the planets were formed through the process of accretion.

Origin of the Universe- most popular theory

- Edwin Hubble, in 1920, provided evidence that the universe is expanding. As time passes, galaxies move further and further apart.
- The **Big Bang Theory** considers the following stages in the development of the universe.
 - (i) In the beginning, all matter forming the universe existed in one place in the form of a "tiny ball" (singular atom) with an unimaginably small volume, infinite temperature and infinite density.
 - (ii) 13.7 billion years before the present, the "tiny ball" exploded. As universe grew, some energy was converted into matter, the first atom began to form.
 - (iii) The temperature dropped to 4,500K (Kelvin) and gave rise to atomic matter. The universe became transparent.

The Star Formation

- In the beginning the distribution of matter and energy was not even. Large accumulation of hydrogen gas called nebula formed.
- The density differences gave rise to differences in gravitational forces. Nebula develops localised clumps of gas and a core is formed. This core continues to grow into even denser gaseous body, giving rise to formation of star.
- The formation of stars is believed to have taken place some 5-6 billion years ago.

Formation of Planets- stages in the development of planets

- (i) The stars were formed as a localised core of a nebula. A huge rotating disc of gas and dust develops around the gas core.
- (ii) As the matter starts getting condensed and the matter in the disc develops into small rounded objects. These small-rounded objects by attraction of molecules develop into what is called planetesimals.
- (iii) In the final stage, these large number of small planetesimals accrete to form a few large bodies in the form of planets.

Evolution of Lithosphere -How was the layered structure of the earth developed?

- The earth was mostly in a volatile state during its primordial stage.
- Due to gradual increase in density the temperature inside has increased. As a result the material inside the earth started getting separated depending on their densities, it is called process of differentiation.
- With passage of time the earth cooled further and solidified and condensed into a smaller size. This led to the development of layers like the crust, mantle, outer core and inner core. From the crust to the core, the density of the material increases.

Evolution of Atmosphere and Hydrosphere – the three stages

- The first stage: The early atmosphere, with hydrogen and helium, is supposed to have been stripped off as a result of the solar winds.
- The second stage: During the cooling of the earth, gases and water vapour were released from the interior solid earth, this is called process of degassing. At that time the atmosphere largely contained water vapour, nitrogen, carbon dioxide, methane, ammonia.
- Formation of Ocean: As the earth cooled, the water vapour in the atmosphere started getting condensed. The temperature further decreased causing more condensation and more rains. The rainwater falling onto the surface got collected in the depressions to give rise to oceans. Carbon dioxide of atmosphere got collected into new oceans.
- The Third stage: As the process of photosynthesis evolved in oceans, it began to flood oxygen into the atmosphere. Around 3,800 million years ago, life began to evolve. Life was confined to the oceans for a long time.

Origin of Life

- Modern scientists refer to the origin of life as a kind of chemical reaction, which first generated complex organic molecules and assembled them.
- This assemblage was such that they could duplicate themselves converting inanimate matter into living substance.
- The record of life that existed on this planet in different periods is found in rocks in the form of fossils. The microscopic structures closely related to the present form of blue algae have been found.