A. Physical Science: Constituents and Structure

1. **Universe**

- Age of the universe is about 4.6 Billion years age and human came quite later about a few million years ago.
- Astronomers have found two different methods to find age of the universe

I. Finding the age of oldest star

- Astronomers have to find the age of globular Clusters i.e. group of million stars
- Their densities are measured to determine their age
- The age of globular cluster is around 11 and 18 billion
- Globular Cluster is old as universe
- But, there are some uncertainties in these measurements

II. Expansion rate of the universe

- Another way to measure age of universe is the Hubble Constant
- It tells that at what rate universe is expanding

2. **Galaxy**

- A galaxy is a system of stars, stellar remains, dust, dark matter and interstellar gas that are bound together by gravity

- Some are dwarf galaxies, with only few thousand stars
- Some are Giant galaxies with some hundred trillion stars
- Each galaxy is orbiting around its own center of mass
- It is thought that some galaxies have black hole at their active center
- According to BBC , currently scientist have discovered about 2 trillion galaxies

I. Categorization of galaxies

- Categorization of galaxies is based upon their appearance
- Elliptical Galaxies, Spiral Galaxies or Irregular Galaxies
- Space between galaxies is filled with an unknown gas which has density of one atom per cubic meter

II. Interaction of Galaxies and their Evolution

- Galactic evolution is important phenomenon that occurs when two different galaxies interact
- Sometimes, two different galaxies also merge together to form bigger one
- Most of galaxies are organized by the force of gravity into clusters or super clusters
- Since there is no visible wall between the galaxies, they can easily interact with each other and do so quite frequently

i. Types of Interaction between the galaxies

a. Near Miss

In near miss interaction, there is exchange of gases and dust particles between the galaxies

b. Head on Collision

In such type of collision, galaxies surpass through each other without interacting

III. Cannibalism Effect of Galaxies:

- Cannibalism is a phenomenon in which one giant galaxy swallows the smaller one

E.g. Sagittarius Dwarf Elliptical Galaxy and Canis Major Dwarf Galaxy have almost been swallowed by the Milky Way

3. **Galaxy: The Milky Way**

- The Milky way is the galaxy that contains our solar System
- It name is derived on the basis of it appearance as a dim glowing band arching across the night sky in which naked eye cannot distinguish individual stars
- out of 170 billion galaxies of universe, Milky way is the galaxy that contains our solar system
- Finding of our solar system in the Milky Way that contains billion of stars was a milestone achievement in the field of astronomy

4. Solar System:

Our solar comprises of A Sun, Nine Different Planets as well as some dwarf planets, and some other objects that are continuously orbiting around the sun

i. Composition of our solar System

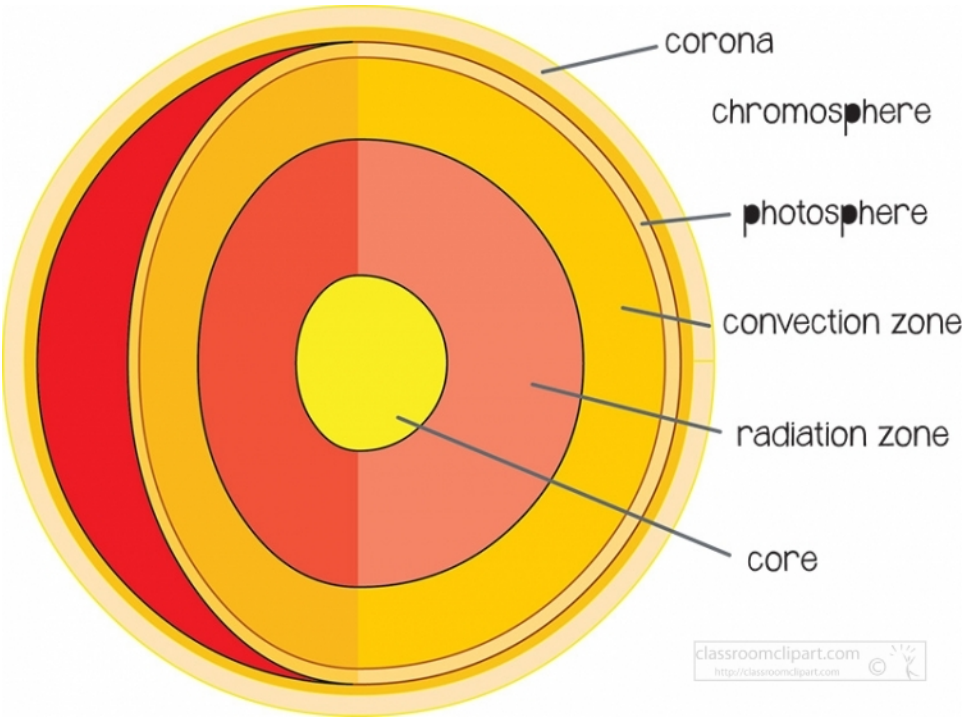
- A vast amount of mass is contained by the sun and rest is occupied by Jupiter
- four inner planets ; Mercury, Venus Earth and Mars these are called inner planets and relatively smaller in size as compare to outer planets. Talking about composition of these Planets they are made of solid material like rock and iron. However, out of these four planets, earth is the only planet that has life on it because of its atmosphere which favors the existence of living organisms
- Four Outer Planet: Jupiter, Saturn, Uranus and Neptune are outer planets. These four planets exist in the gaseous form. Beside that, Out of these four planets Jupiter and Saturn contain mostly helium and hydrogen in their atmosphere. However, Uranus and Neptune contain materials that have high melting point as compare to hydrogen and helium which are usually called as ices such as ammonia , water and methane and are commonly referred as ''ICE GIANTS".

5. Sun

The Sun:

- The sun is average middle aged star that is about 4.5 billion years old. Talking about the composition of sun, there are three different gases of which sun is made up off. The first one is hydrogen which shares 72 pc, the second is helium with 26 pc and 2pc are other gases, among these gases oxygen is prominent. Furthermore, atomic structure of sun belongs to the fourth state of plasma.
- The source of Sun's brightness- that of other planets- is the nuclear chemical reaction in its innermost layer, where the temperature remains about 15,000,000 Kelvin (27,000,000 Fahrenheit)

Internal structure of the Sun



Internal Structure of the Sun

I. It is the most inner layer of the sun. It is consist of Plasma and it is the region where reactions take place which causes the conversion of hydrogen gas into helium. These reaction are called nuclear fusion reaction. A huge amount of energy is produced due to this conversion. This energy moves towards the outer layer of the sun

- Here, temperature remains about 27 million degree Celsius

II. Radioactive Zone

- The energy from the core of the sun gradually moves towards radioactive zone. The energy is in the form of photon- particle of lights-. These photon are absorbed and released frequently because the collide other particles present in radioactive zone of sun. A photon may take 50 million year to travel in radioactive zone
- The existence of temperature in radioactive zone is 7 million degree Celsius

III. Convection Zone

- it is present outer to the layer of radioactive zone
- Here hot material coming out from the radioactive zone gets cooler and then moves back to the radioactive zone
- this results in the formation of sunspots and flares

Atmosphere layers of the Sun

- These are the layer of the sun which are directly connected with atmosphere

I. The photosphere

- It emits light. Temperature is more cooler here which is about 6700C

II. The Chromosphere

- it is located around the photosphere. Chromosphere gets energy from photosphere and it glows red. Over here, the temperature remains around 4000 to 10000 degree C

III. The Corona

- outer most layer of the sun and also known as crown of the Sun
- During the solar eclipse it is the corona that is seemed to be shinning out
- Temperature 2 to 5 million C

6. Earth: Atmosphere

- An envelope which contains the mixture of different gases, dust particles, and water vapors that are bounded by the gravitational pull of earth is called atmosphere

- In gaseous mixture, there are several kinds of gases. Moreover, these gases have different percentages such as:
- Composition of gases in atmosphere

Nitrogen	N2	78.084%	
Oxygen	O2	20.947%	
Argon	Ar	0.934%	
Carbon dioxide	CO2	0.035%	
Neon	Ne	18.182 parts per million	
Helium	He	5.24 parts per million	
Methane	CH4	1.70 parts per million	
Krypton	Kr	1.14 parts per million	
Hydrogen	H2	0.53 parts per million	
Nitrous oxide	N2O	0.31 parts per million	
Carbon monoxide	CO	0.10 parts per million	
Xenon	Xe	0.09 parts per million	
Ozone	O3	0.07 parts per million	
Nitrogen dioxide	NO2	0.02 parts per million	
Iodine	I2	0.01 parts per million	
Ammonia	NH3	trace	

- Atmosphere plays an important role to protect life on earth, by absorbing UV rays coming from solar radiation, Warming the surface of earth through heat retention (Green House) and reducing temperature extreme between day and night

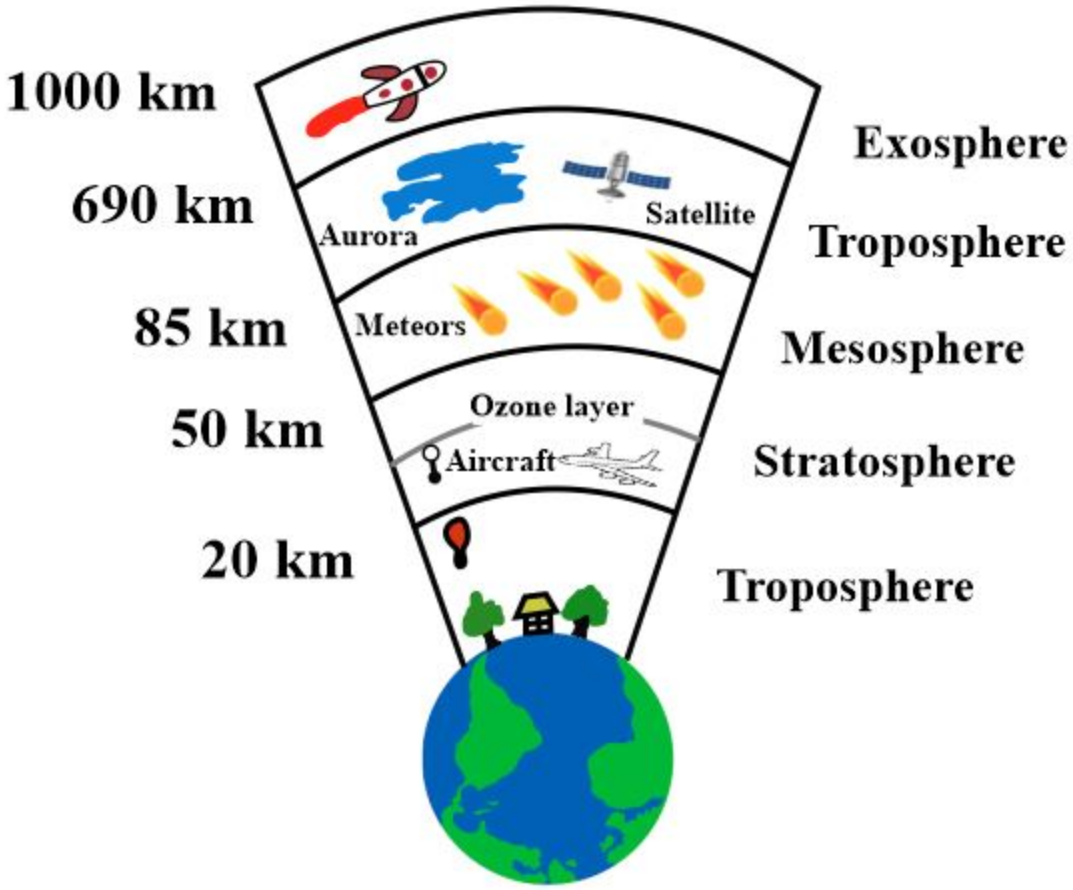


Figure 6.1 layers of earth atmosphere

Atmosphere is consist upon different layers which are discussed below:

Ionosphere

The ionosphere is the part of atmosphere that is ionized by solar radiation. It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance too because among other functions, it influences radio propagation to distant places on the Earth

II. Mesosphere

The mesosphere is the layer of Earth's atmosphere that is directly above the surface of the Stratosphere and directly below the ionosphere. The mesosphere is located about 50 to 85 km (30 to 50 Miles) above the Earth's surface. The Ionosphere and Mesosphere both referred as middle layers of the atmosphere.

III. Ozone

Ozone is a gas that exists in both upper layers well as lower layer of earth' atmosphere. Ozone can be good or bad for people and environment, depending upon its location in the atmosphere

III.A Ground-Level Ozone

In troposphere, closer to the earth's atmosphere ozone is harmful. At this level, Ozone has significant negative impacts on all living organisms including animals, plants and for humans to. In humans, it is mainly dangerous for children as it causes asthma diseases in them. It also damages crops, trees and other vegetation. It is a main ingredient of urban smog.

III.B Stratospheric Ozone

The stratosphere or '' good'' ozone layer extends upward from about 6 to 30 miles and protects life from sun's UV rays. This natural shield has been gradually depleted by man-made chemicals like Chlorofluorocarbons (CFCs). A depleted ozone layer allows more UV rays to reach on the Earth' s ground, leading to more case of different diseases like skin cancer, cataracts- disease in which lens of the human eye turns into a cloudy like structure- and other health and environmental problem.

IV.Stratosphere

Stratosphere is the second most important layer of the atmosphere, just above the troposphere and below the mesosphere. In terms of temperature it is stratified, with warmer layers higher up and cooler layer farther down.

Troposphere

Troposphere is the lowest layer of the Earth' atmosphere and site of all weather on the earth. Troposphere is bounded on the top by a layer of air called tropopause, which separates the troposphere from the stratosphere, and on the bottom by the surface of the Earth. The troposphere is wider at the equator about 10 miles than the poles about 5 miles. The troposphere contains 70 pc of atmosphere's mass. The troposphere contains 99pc of water vapours in the atmosphere. Due to uneven heating of different regions of the troposphere by the sun(the sun warms the air at equator than the poles causes the convention of currents, a larges scale of pattern winds that move heat and moisture around the globe

7. Earth: Tectonic Plates

- The earth layer is made up of a series of large plates (like pieces of jigsaw puzzle). These plates are in continues motion, covering the distance of a few centimeter every year. The ocean floor are continually moving, spreading from center and sinking at the edges.
- Convection current moves the plate in different directions
- The source of heat driving the convection current is radioactive decay which is happening deep in the Earth

The movement of plates creates three types of tectonic boundaries

Convergent; plates move towards each other

Divergent; Plates move apart from each other

Transform; Pates move side ways relative to each other

8. Physical science topic; Astronomical Units

This is specially designed system used to measure astronomical quantities.

- Three quantities are generally measured, using this astronomical system i.e. time, length and mass

I. Astronomical Unit of Mass

- Solar mass is the standard unit of mass in astronomical system
- Mass of stars and galaxies are measured with the reference to the mass of Sun
- Solar Mass is denoted by MO and is equal to 1.98892X10^19 which is about 333,000 times greater than the mass of earth
- Whereas, the mass of earth is 5.974X10^24 kg
- It is often used to express the mass of rocky terrestrial planets

II. Astronomical Unit of Time

- Day is the standard unit of time in astronomical system
- Denoted by D
- Equal to 86400 seconds

- 365 days are equal to One Julian year

III. Astronomical Unit of Length

- The unit of length is simply called astronomical unit
- it is described as distance between sun and earth which is equal to one astronomical unit
- that astronomical unit is equal to 8 light years
- Parsec and light years are commonly used to describe distance or length in Astronomical System

IV. Light Year

- unit of distance in Astronomical Systems of units
- Defined as; distance travelled by light in vacuum in one Julian year
- used to express the distances to stars and other bodies in popular science publications and professional astronomy
- the unit of distance is parsec and one parsec is equal to 3.26 light year