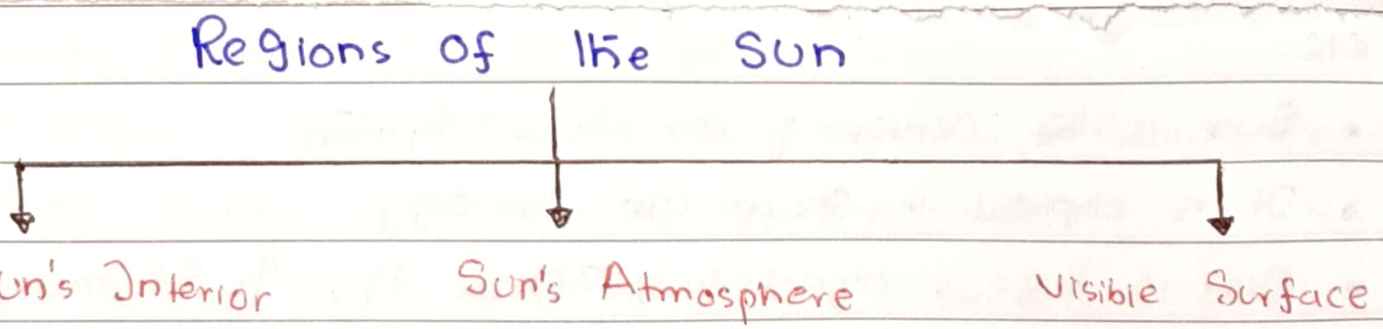
Q:01 Explain different regions of the Sun.

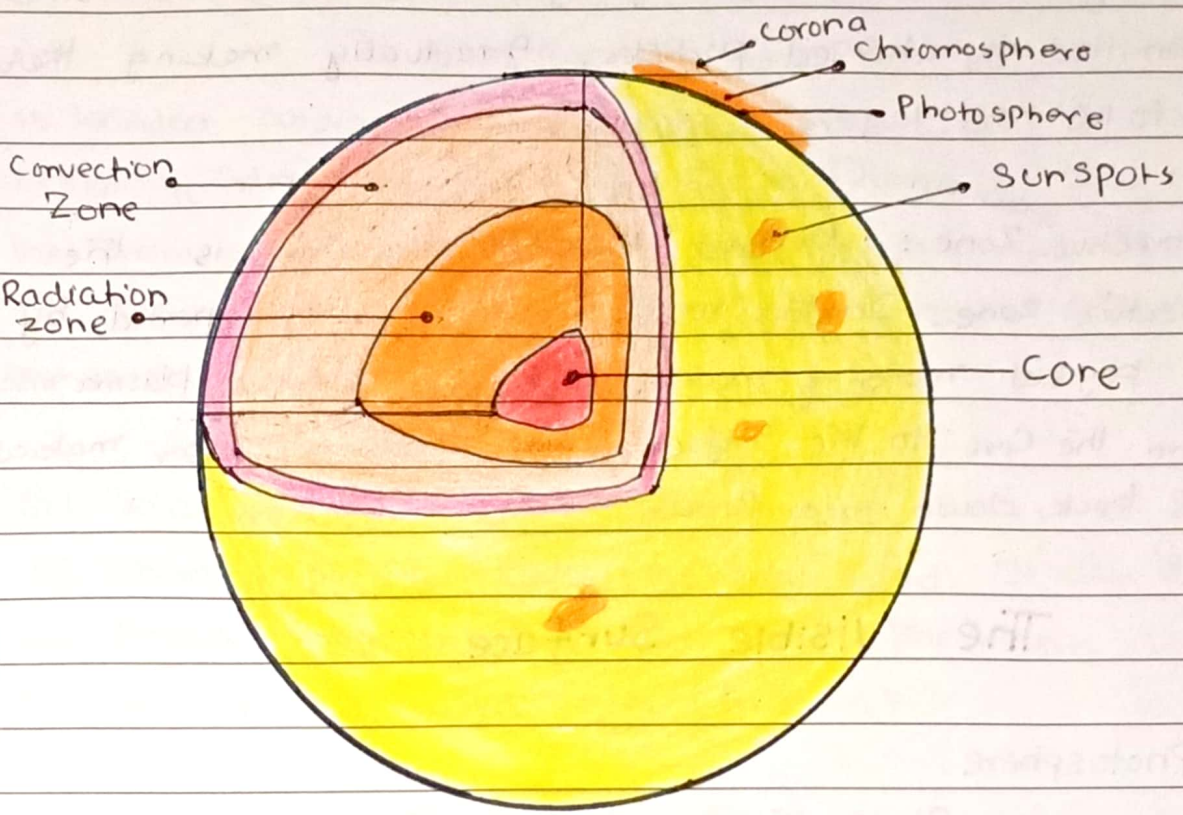
The SUN

The Sun is a star located at the Center of our Solar System. It is composed of a huge ball of gases which consists 74% Hydrogen, 24% Helium and 2% heavy metals.



Sun's Interior

- The Core
- Radiative Zone
- Convective zone



Core :

The Core is the innermost region of the Sun, where nuclear fusion reactions take place. It is the hottest part, with temperature exceeding 15 million degree Celsius. This high temperature and pressure cause hydrogen nuclei to fuse into helium, releasing a tremendous amount of energy in the form of light and heat. It is extended up to 25% of the solar radius.

- Radiative (OR Radiation) Zone : Surrounding the core is the radiative zone. In this region, energy generated in the core is transported outward primarily through the process of radiation. Photons of light are absorbed and re-emitted by charged particles, gradually making their way to the next layer.

- Convective (or Convection) Zone : Beyond the radiative zone is the convective zone. In this region, energy is transported by the physical motion of material. Hot, less dense plasma rises from the core to the surface, while cooler, denser material sinks back down in a process called convection.

The Visible Surface

(i) Photosphere

It is the boundary b/w Sun's interior and the solar atmosphere. It is the visible surface of the Sun that emits the light we see. It has an average temperature of around 5,500 degrees Celsius. It contains various features like sunspots, granules and supergranules, which are related to the Sun's magnetic activity.

(ii) Sunspots

Sunspots are dark, cooler regions on the Sun's surface caused by strong magnetic activity. They appear in ~~cycles~~.

in cycles.

Sun's Atmosphere

(i) Chromosphere

It is a layer of Sun's atmosphere which is located above the photosphere and it is the lower region of Solar atmosphere. During a Solar eclipse, the Chromosphere is visible as a reddish-pink ring around the dark disk of the Moon. This region is hotter than the photosphere.

(ii) Solar wind : The Sun continually emits a stream of charged particles called the Solar wind. It can affects the Earth's magnetic field and cause phenomena like the Northern and Southern lights. (Aurora)

(iii) Coronal Mass Ejections (CMEs) :

CMEs are massive eruptions of Solar material from the Sun's Corona. When directed toward Earth, they can disrupt satellites, power grids and Communication systems.

(iv) Prominences : Solar Prominences are enormous, arching structures of hot, glowing gas that extends from the Sun's surface into its outer atmosphere. They are often seen during total Solar eclipses.

(v) Solar flares : There are sudden and intense bursts of energy and radiation from Sun's surface, often associated with sunspots and magnetic activity.

(vi) Corona : The outermost part of Sun's atmosphere

Q:02 Write short note on formation of auroras-

An aurora is a natural light display that shimmers in the sky. There are visible only in night.

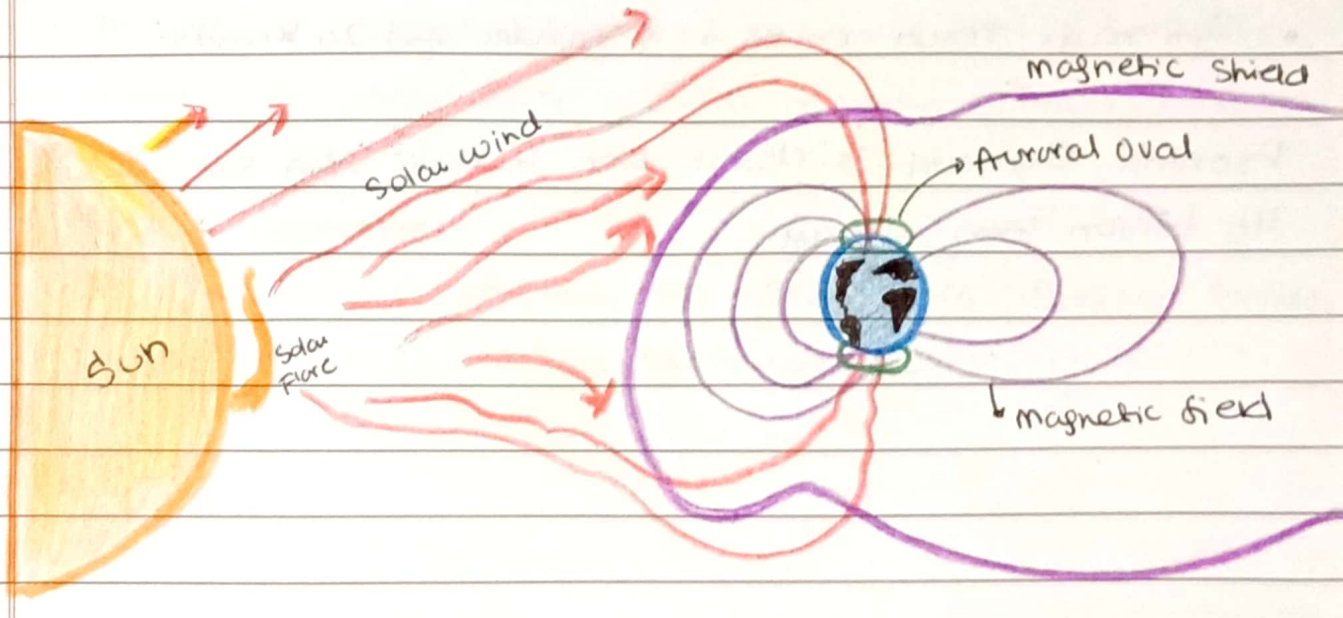
The activity that create auroras begins on the sun. Sun is a ball of super hot gases made of electrically charged particles. Sun is constantly sending heat ~~and~~ light, and small electrified particles to the earth. These electrified / charged particles are called solar winds. Earth has a magnetic field which protects us from most solar winds. But it also traps some of the electrified particles in the space around Earth. The sun doesnot always send the same amount of energy to earth. Sometimes, the sun has huge outbursts, and blasts more stuff into space than the usual solar wind. These events are called solar storms. When a solar ~~wind~~ storm reaches Earth, it dances with the Earth's magnetic field and some of the energy and particles that zip around the magnetic field dive into atmosphere near the north and south poles. The particles then bump into gases in our atmosphere. These interactions result in displays of light in the sky called as

Aurora -

- When particles bump into oxygen in our atmosphere, the reaction makes green & red light
- Nitrogen → blue & purple light

(Any planet have atmosphere & magnetic field will have auroras)

- Aurora Borealis — Auroras in northern hemisphere
- Aurora Australis — Auroras in southern hemisphere



Q:03 Explain life cycle of a star.

Life Cycle of a Star

Stars go through a natural cycle, much like any living beings. This cycle begins with birth, expands through a life span characterized by change and growth, and ultimately leads to death. Stars are of different masses and sizes, their mass and size determines how radiantly the star will shine and how long will it live.

- Following are the stages involved -

1. Giant Gas Cloud OR Molecular Cloud

A star originates from a large cloud of gas, rock and dust which forms a nebula.

2. Proto Star

When the gas particles in the molecular cloud run into each other, heat energy is produced. This results the conversion of nebula into proto star.

3. T-Tauri Phase

This phase begins when materials stop falling into the protostar and release tremendous amount of energy. Tauri star is not enough to support nuclear fusion. Thus it enters the most elaborated development phase, the main sequence phase.

4. Main Sequence

In this phase, fusion reaction occur. The protons of hydrogen are converted into atoms of Helium. This reaction is exothermic. The main sequence star will carry on fusion reactions until the hydrogen runs out in the core. (Sun at this stage)

The main sequence star will follow any of two paths.

Low & Medium Mass Stars	High Mass / Massive Stars
5. Red Giant The main sequence star will turn into a red giant as the surface of the star cools down. During this time, heavy metals elements are formed in the core, as a product of the lighter elements fusing together.	Red Supergiant The main sequence star will turn into a red supergiant, glowing and undergoing more fusion reactions in its core. During this time, very heavy elements are formed in the core.
6. White dwarf The red giant becomes unstable and fusion stops	

7. White dwarf

The star gets smaller and smaller, until it becomes a white dwarf, which is the dense core.

8. Black dwarf

The white dwarf emits energy in the form of light. Over time, the white dwarf emits less energy and gets called a black dwarf.

Supernova

The red super giant explodes into a supernova, where the outermost layers of dust and gas are flung into space.

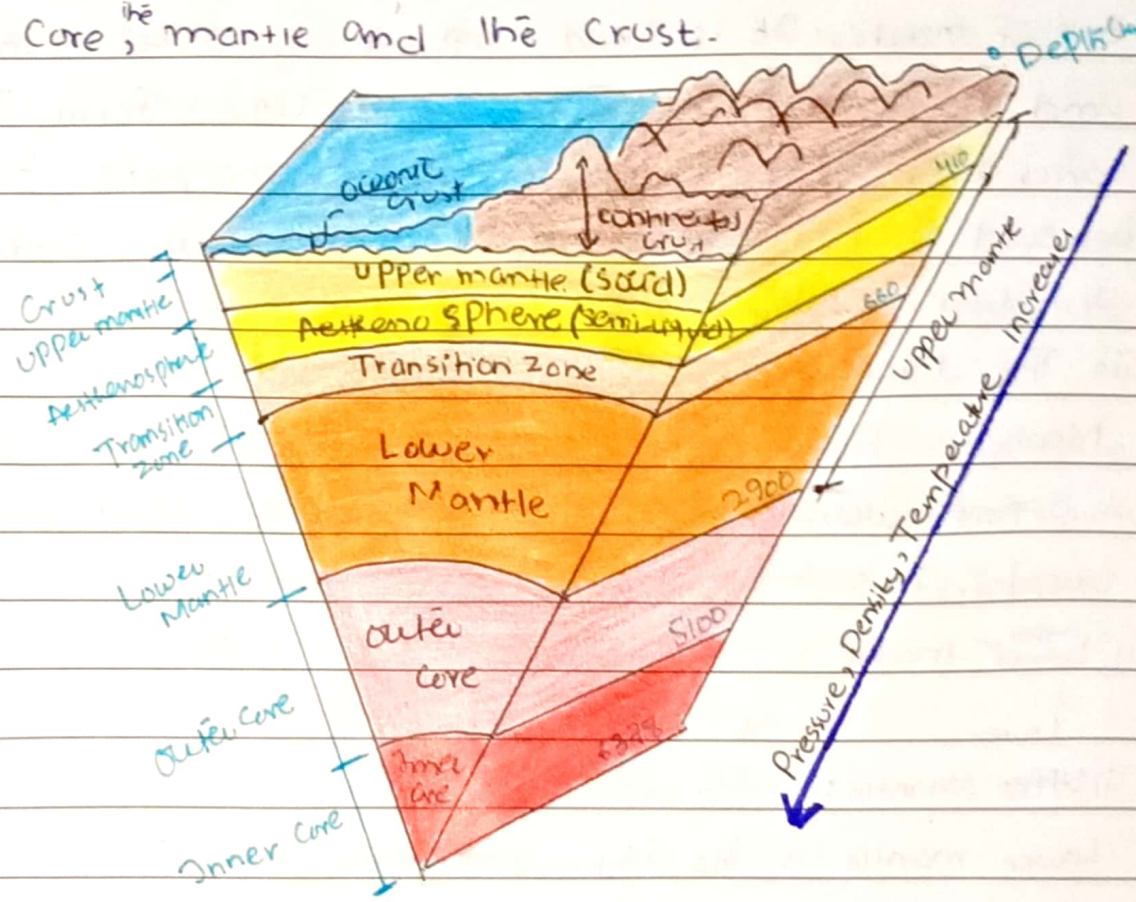
Supernova when explode will convert into ~~Passes~~ any of following ~~stage~~

Neutron star	Black hole
After explosion of supernova, left over core is called NS.	large stars do not become NS so → BH

Q:04 Explain Structure and Composition of Earth.

Earth's Structure & Composition

Earth is the planet we live on, the third of eight planets in our Solar system and the only known place in the universe to support life. The Structure of earth is divided into four major Components: the inner Core, the outer Core, the mantle and the Crust.



(This is chemical division, also mechanical division is present.)

(i) The Inner Core

It is the center and the hottest layer of the Earth. It is solid and made up of iron and nickel with temperature upto 5,500 °C. It is about 1200 km thick.

- Since pressure at center of earth is extremely high; it is because of this pressure that the iron in inner core can remain in solid state despite of high temp.

(ii) The Outer Core

The outer core of the Earth is similar to a very hot ball of metals. It is liquid composed of nickel-iron alloy and the metals inside it are in liquid form. The temp varies b/w 4500°C to 5500°C. Earth's magnetic field is believed to be controlled by the liquid outer core.

It is about 2200 km thick.

(iii) The Mantle

Mantle is the widest section of the Earth. Its thickness is approximately 2900 km. It is composed of ferro-magnesium silicates. It is di subdivided into three major layers.

(i) ~~Upper~~ Lower mantle (ii) Transition zone (iii) ~~Upper~~ lower mantle

Lower

(i) ~~Upper~~ mantle:

Lower mantle is the layer just above outer core. It is also known as mesosphere. It is composed of magnesium, silicon and iron. It is softer than upper mantle. Its temperature is about 3900°C. The thickness of lower mantle is 2230 km

(ii) Transition zone:

above

It is a zone of about 270 km thickness b/w lower ~~and~~ ~~upper~~ mantle. In this zone, the minerals, which make up the

Upper mantle undergo a process called "Phase transition" in which they change in structure & form other atomic arrangements.

(iii) Upper Mantle :

The upper mantle is the layer Sandwiched between lower mantle and Crust. It is about 640 km. thick. It is composed of iron and magnesium silicates. The temperature at this layer is about 230°C.

(iv) Earth's Crust

The Crust is the outermost layer of the earth where we live. The It is composed of three kind of Solid rocks - igneous, Sedimentary and metamorphic rock. Temperature within the deepest parts of the Crust may reach 870°C, which is sufficient to melt rocks. Its density is about 2-8 g/cm³.

Earth's Crust is divided into two types-

(i) Continental Crust: It covers the land with a thickness of about 40-70 km.

(ii) Oceanic Crust: It covers water- 5-10 km thick.

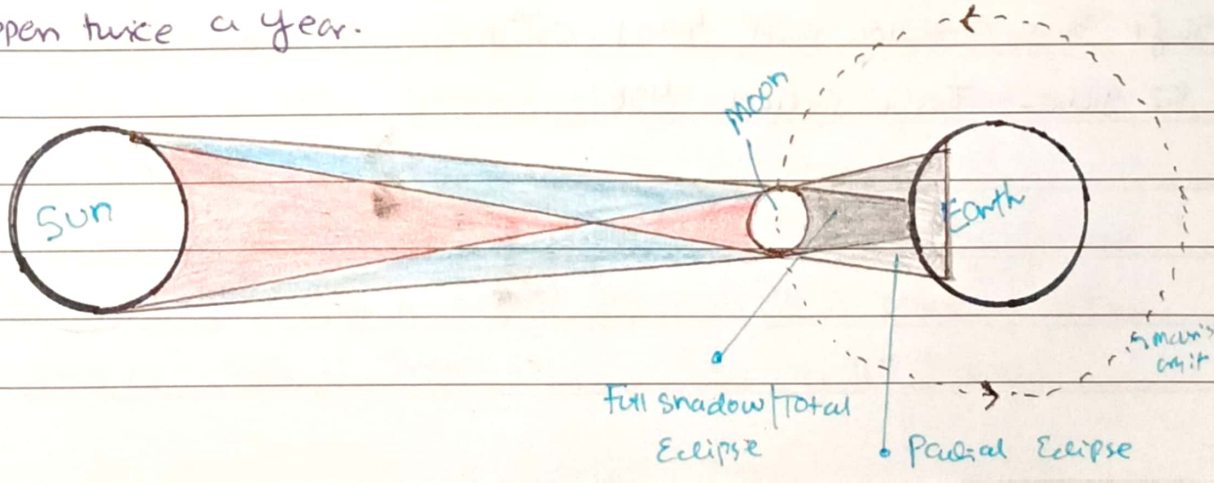
Q:05 Define Eclipse, Solar eclipse and its types-

Eclipse

It is an astronomical event that occurs when an astronomical object is temporarily obscured, by passing into the shadow of another body or by having another body passed b/w it and the viewer. This alignment of three celestial objects is known as Syzygy.

Solar Eclipse

A solar eclipse happens when the Moon passes b/w the Sun and Earth, casting a shadow on Earth that either fully or partially blocks the Sun's light in some areas. This only happens occasionally, because the Moon doesn't orbit in the exact same plane as Sun and Earth do. The time when they are aligned is known as eclipse season, which happen twice a year.



Types of Solar Eclipse

(i) Total Solar Eclipse (OR Umbra): It happens when the Moon passes b/w the Sun and Earth, completely blocking the face of the Sun.
- People located in the centre of moon's shadow when it hit's Earth will experience dark sky.

(ii) Partial Solar Eclipse OR Penumbra: It happens when the Earth, Moon and Sun do not align in a perfectly straight line, and moon only ~~covers~~ partially covers the disc of the Sun.

(iii) Annual Solar Eclipse: It happens when the Moon is at or near its farthest point from Earth. Because the moon is farther away from Earth, it appears smaller than the Sun and does not completely cover the Sun. As a result the Moon appears as a dark disk on top of a larger brighter disk, creating what looks like a ring around the Moon.

(iv) Hybrid Solar Eclipse:

Since Earth's surface is curved, sometimes an eclipse can shift b/w annular and total as the moon's shadow moves across the globe. This is called HSE.