

Q: Explain the life cycle of a star. Discuss

the different stages from its formation to its final fate, also the factors whether it becomes a white dwarf/black hole.

The life cycle of Star

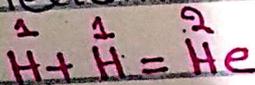
The life cycle of a star depends mainly on its mass. In simple words stars are born, live for billion of years and then die in different ways. A star begins its life in a nebula, which is a large cloud of dust and gas in space. Gravity pulls the gas and dust together.

Stages

main sequence stage:

A star spends 90% of its life in the main sequence stage.

It takes one hydrogen then collides with another hydrogen and nuclei fuse to make helium.



During the phase the protons of hydrogen are converted into atoms of helium. This reaction is **Exothermic** it gives off more heat than it requires and so the core of a main sequence star releases a tremendous amount of energy.

The Giant phase:

When a star finishes the hydrogen fuel in its center, it can no longer

Produce energy in the same way. Then hydrogen starts burning in a layer around the helium core. Because of this change the outer parts of the star expand outward and become cooler. At this stage the star turns into a **red giant**.

Red giant:

Look red because their surface temperature is lower than that of main sequence stars, which usually appear **yellow or white**.

In about 5 billion years when the sun enters the helium burning phase. It will expand to a maximum radius of roughly 1 astronomical unit (250 times its present size).

At this point the sun will swallow the inner planets and may even engulf the earth. However there is no need to worry because humans will not be alive by then. In fact about one billion years from now, the earth surface become so hot that it will no longer be suitable for human life.

Example:

Betelgeuse is the nearest red giant star.

What happens after giant star phase:

After giant star phase two main processes happen.

The carbon burning process

When helium is exhausted at the core of a massive star, the core contracts and the temperature and pressure rise enough to fuse carbon (Carbon burning process).

From here onwards a star may adopt any of the two paths depending on its size.

The neon, oxygen and Silicon burning process

This process continues with the successive stages being fueled by neon, oxygen and silicon.

Path 1

Supernova or black hole formation

- If a star is massive it will either burst and explode as supernova.

- After the supernova explosion the star's core is left behind.

Path: 2

The white dwarf formation

When a star whose mass is not high enough to explode as a supernova and form a black hole.

When a white dwarf is very dense its mass is comparable to sun while its volume comparable to

- The gravitational collapse of heavy star's nuclei is assumed to be responsible for the formation of Stellar mass black holes.

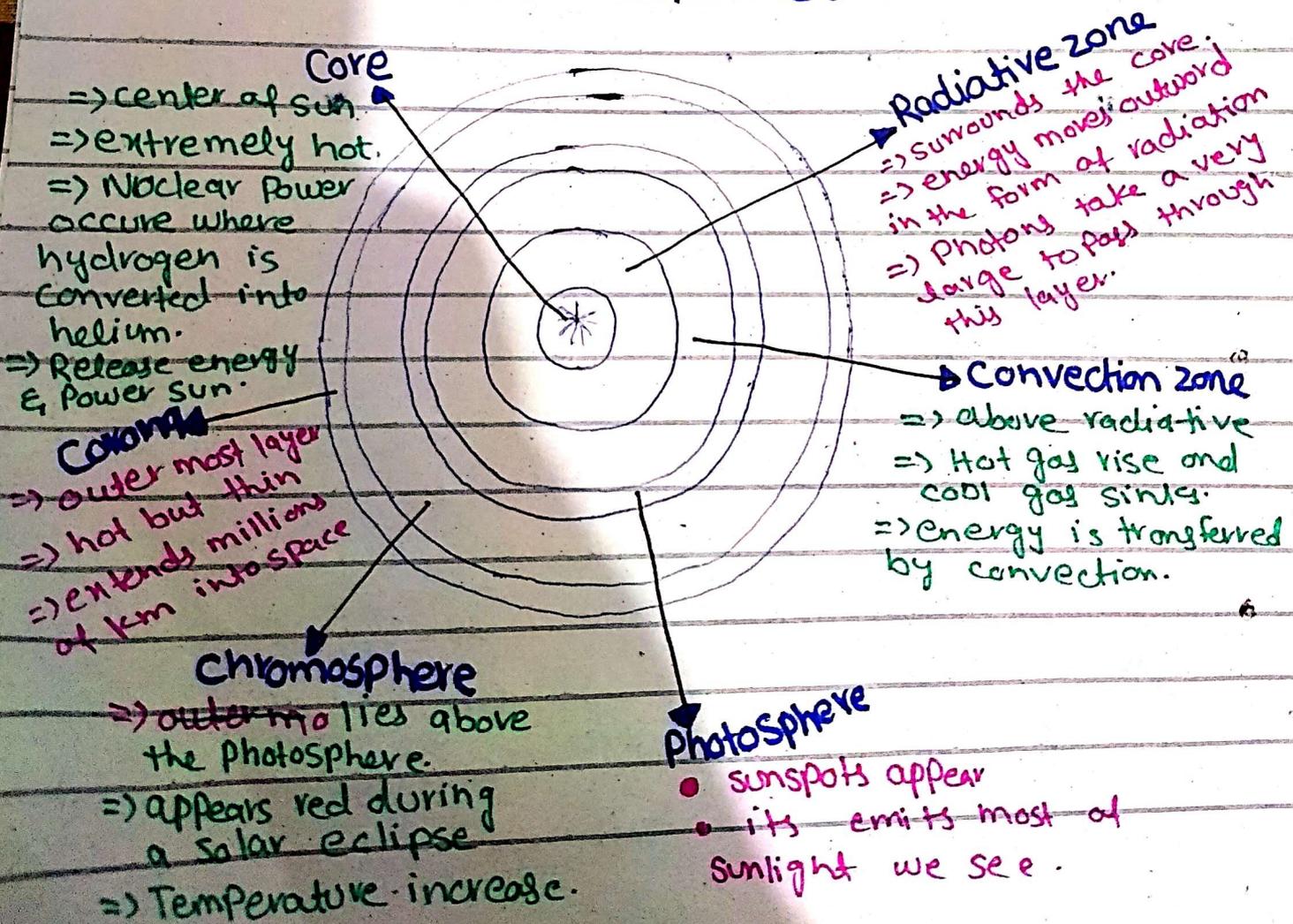
- once a black hole has formed it can continue to grow by absorbing additional matter. Any black hole will continually absorb gas and interstellar dust from its surroundings.

Earth's

A white dwarf's faint luminosity comes from the emission of residual thermal energy.

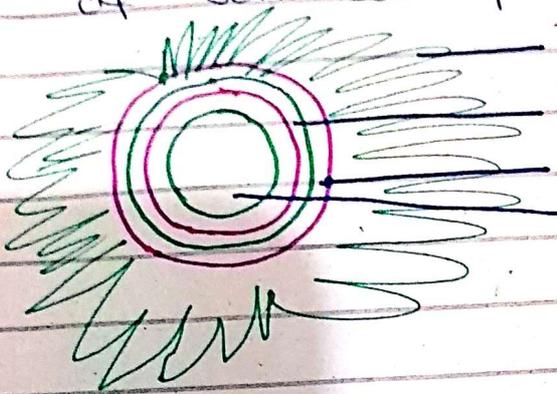
This includes over 97% of the other stars in the milky way

Atmosphere & Structure of A SUN



Atmosphere of Sun

in the give diagram the photosphere, chromosphere, and corona all are parts of Sun atmosphere.



The corona: about $100,000^{\circ}\text{C}$

The lower chromosphere: about 4000°C

The upper chromosphere: about $10,000^{\circ}\text{C}$

The photosphere: about 6000°C

Q: Explain solar winds and what are their impacts and also discuss auroras?

Solar winds

define:

Solar wind is a stream of charged particles emitted from the sun's corona that flows outward through the solar system.

\Rightarrow Its K.E is between 0.5 and 10 keV.

\Rightarrow Its particles can escape the sun's gravity because of their high energy.

Impact of solar winds:

\Rightarrow It strips planet bare of their atmosphere for example: e.g. Ciratia, mercury.

\rightarrow Solar storms are the sudden and powerful disturbance on the sun cause by the release of large amounts of energy from its surface & atmosphere. These storms send radiation and charged particle into space.

=> It can lead to power outage.

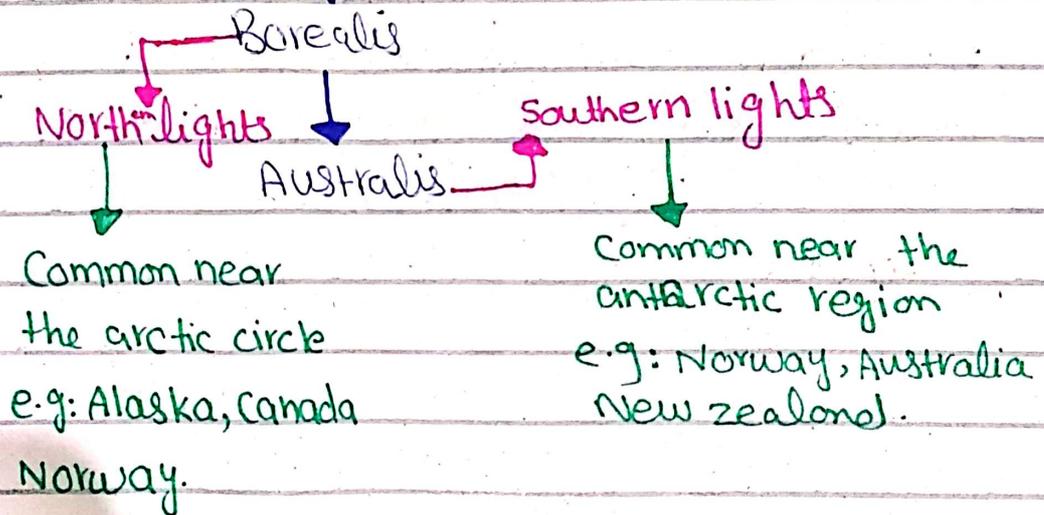
=> In 1859 Carrington event was caused by an extremely intense solar flare and coronal mass ejection (CME) from the Sun.

=> It can disrupt radio transmission and communication.

=> 3 Polar light / Auroras

An aurora are also called Polar lights.

two types of auroras



=> The earth has a magnetosphere. when the highly charged particles of the solar system ^{winds} cuts through the earth's magnetosphere. It produces electricity that travels along the lines of earth's magnetic field. And as this electricity travels, it knocks and causes ionization of mainly oxygen and nitrogen. During this process, light is emitted which can be seen as polar lights or an aurora.

Q: what are asteroids and also discuss its origin, Location and importance?

ASTEROIDS

Asteroids are made nebula debris

Define:

They are rocky (clay, silicate) and metallic (gold, platinum, silver etc) in nature. It is being as big as dwarf planets like Pluto and may be small as pebbles and any size in between. It is irregular in shape.

Theory of origin:

① In early solar system some debris never came together to form planets and dwarf planets. They remained out of the reach of gravity and are free floating since in the form of asteroids.

② In the early chaotic solar system large planetimals collided with one another and rocky chunks broke off forming asteroids.

Location of asteroids:

→ Asteroids belt in between Mars and Jupiter (which is the home to dwarf planet is Ceres) mainly as roughly 8 million.

→ Any asteroids sharing its orbit with a larger planet is called Trojan.



inner earth object: orbit is smaller than earth.



outer earth object: orbit is larger than earth.

Earth crossers: when these near earth object cross earth's orbit during their revolutionary course they are called earth crossers.



earth crosser



earth crosser

Importance of asteroids:

=> Pieces of asteroids breakdown and can be seen as a meteor shower (phenomenon called shooting star)

=> Sometimes, they collide with earth wrecking havoc.

=> Some asteroids of interest include asteroids

Apophis, Benu and PT5 mini moon

↓
2cd moon

↓
PTmoon

Conclusion:

it is vital remnants of the solar system that offer insight into cosmic history while also posing hazards to earth. understanding asteroids not only advances scientific knowledge but also strengthens planetary defense; highlighting their dual importance in astronomy and human safety.