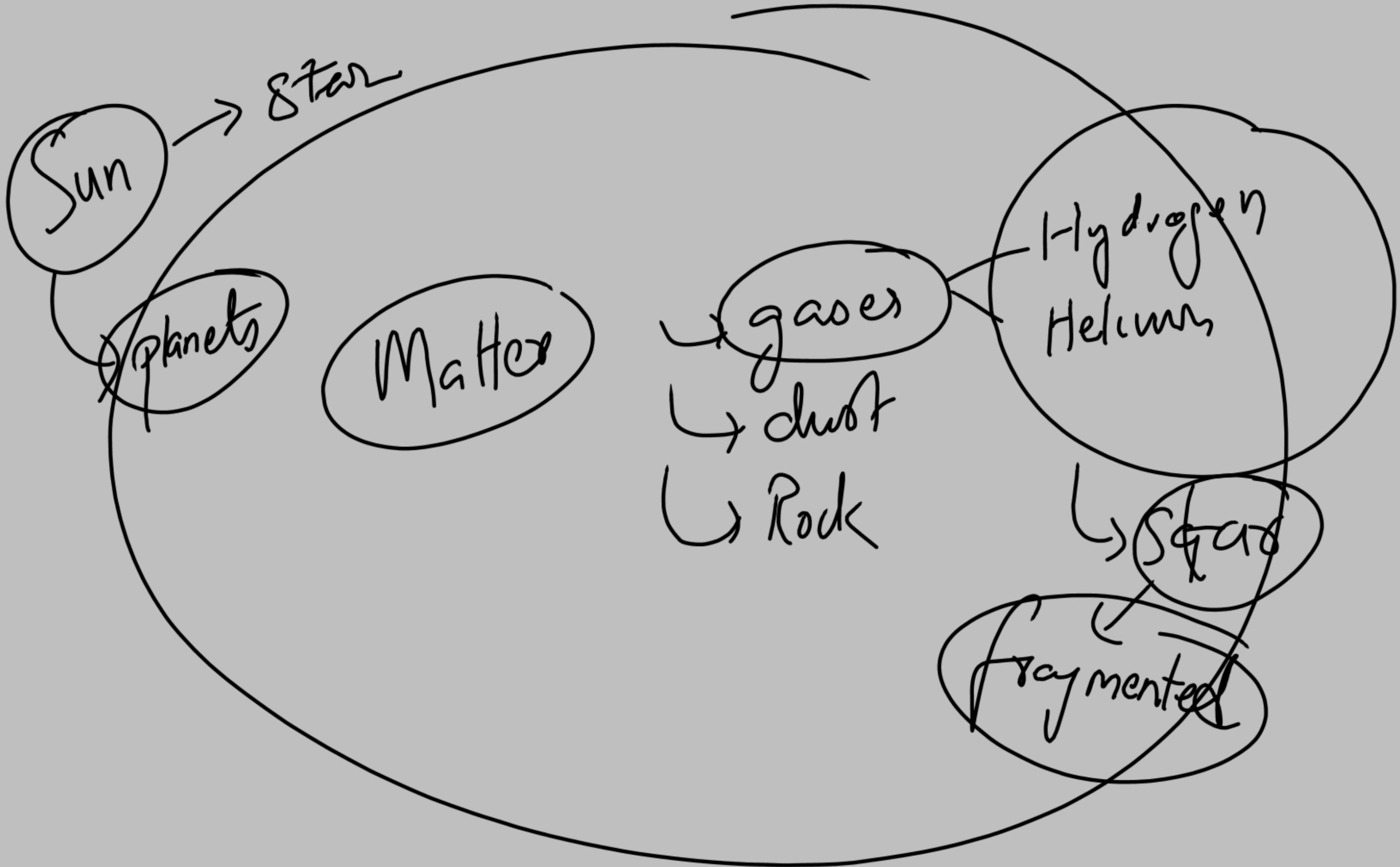




Most Trusted Learning Platform





Sun

→ star

planets

Matter

gases

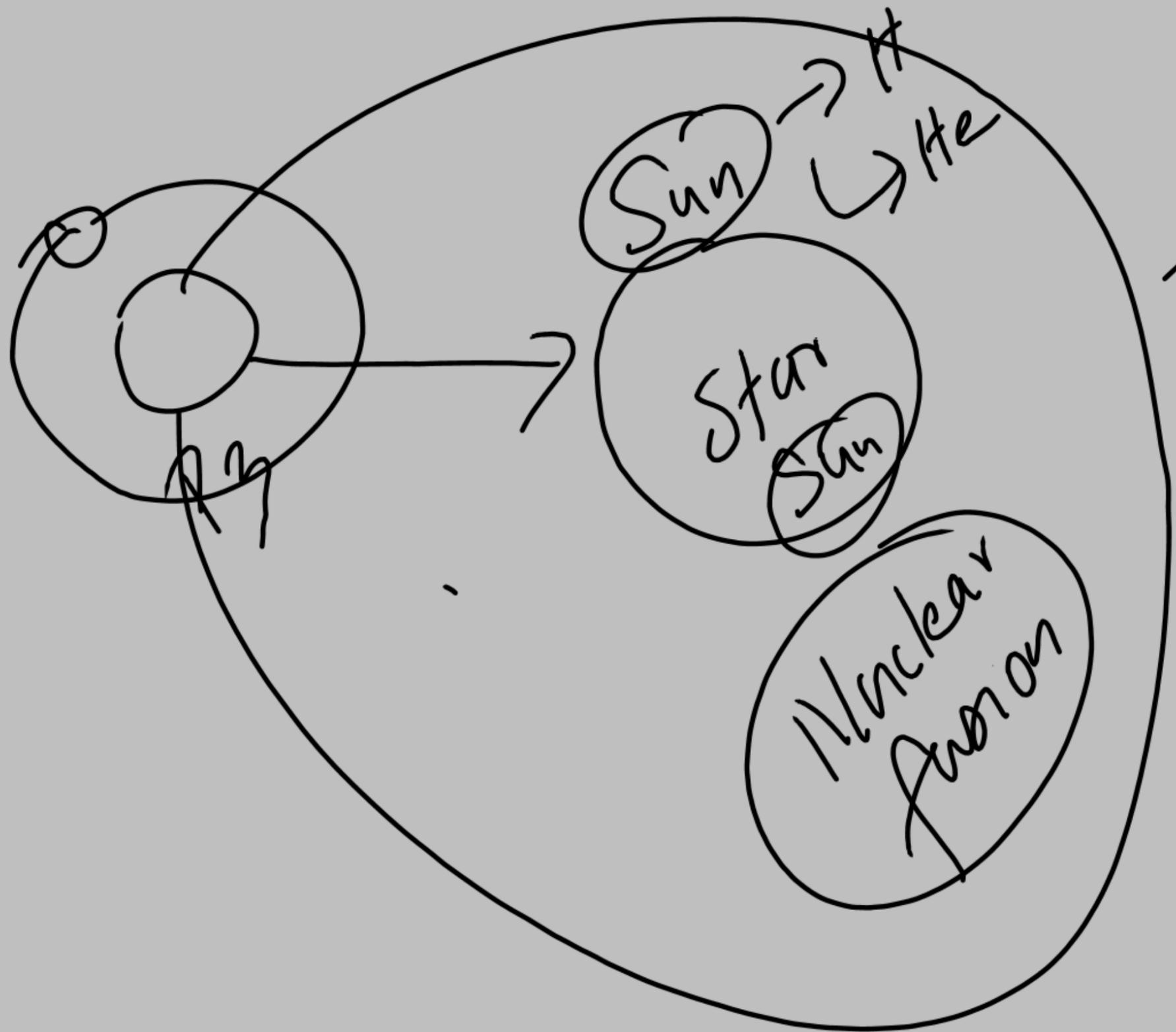
↳ dust

↳ Rock

Hydrogen
Helium

↳ gas

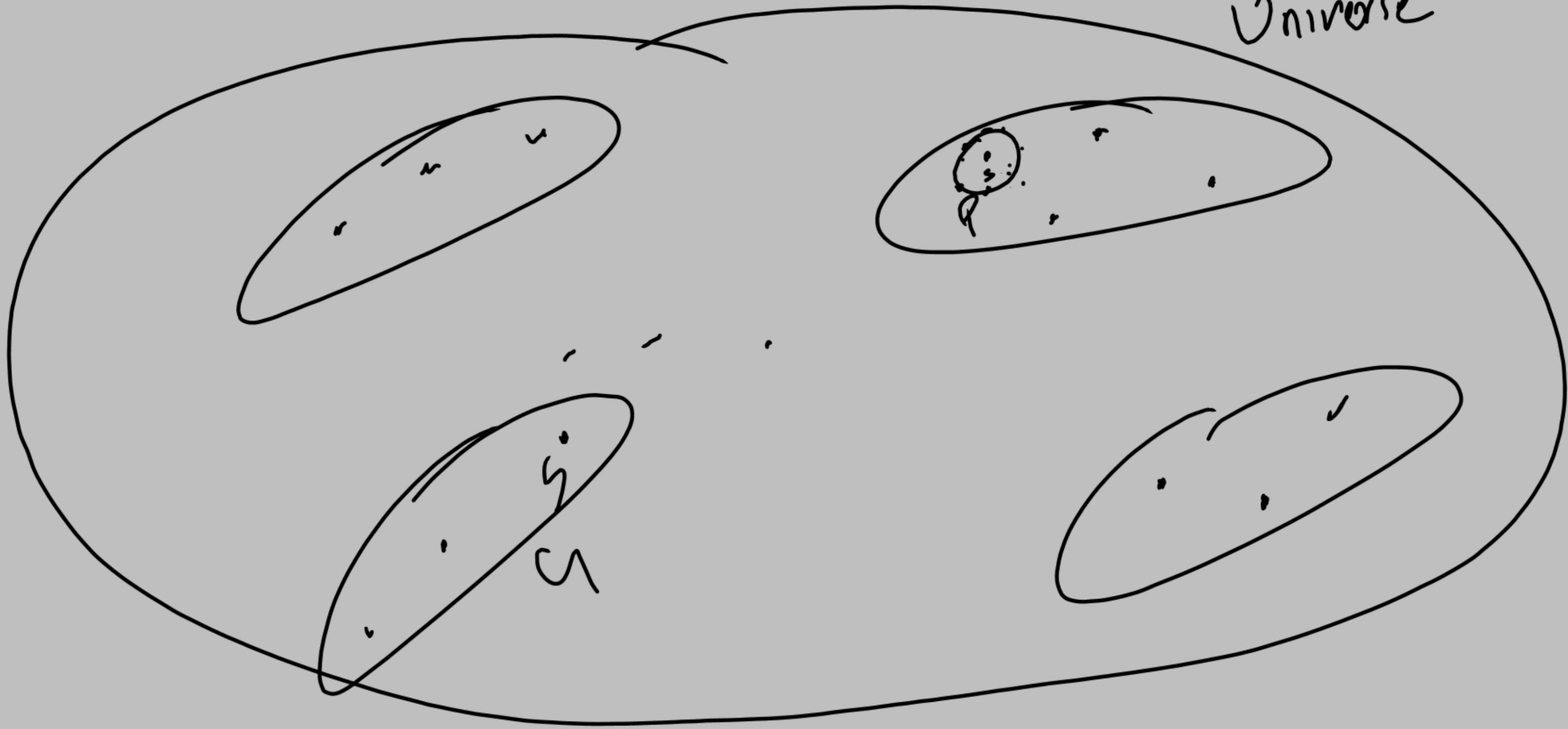
fragmented



92
P1

P2

Universe



Universe

How do stars originate?

Stars are constantly being born from clouds of dust and gas.

It happens over millions of years.

Stars are balls of gas mainly hydrogen & helium.

What are Planets?

It has been derived from the Greek word Planetai.

Planetai means wanderer.

Planets are so named as they revolve around the sun.

These celestial bodies don't have their light.

They shine due to the reflection of light from stars such as the Sun.

Planets are made up of solid material and gases

Universe

Process of Formation of Planets, Sun & Asteroids

Our solar system began about 4.6 billion years ago when a big cloud of gas and dust collapsed.

When this happened, most of the material fell to the center of the cloud and formed the sun.

Some of the condensing dust in the cloud became planets.

The objects in the asteroid belt never had the chance to be incorporated into planets.

Universe

Planets of Solar System

There are 8 planets in our solar system

Yes, Pluto is now considered a dwarf planet.

There are four inner planets often called terrestrial planets.

Mercury, Venus, Earth & Mars

They are called terrestrial as they have rocky surfaces.

Four other outer planets are called Jovian Planets.

Jupiter, Saturn, Uranus, and Neptune

They're also mostly made of gases

Like hydrogen, helium, and ammonia rather than of rocky surfaces



Universe

What is the definition of a Planet?

The IAU defines a true planet as a body that circles the sun without being some other object's satellite;

is large enough to be rounded by its own gravity (but not so big that it begins to undergo nuclear fusion, like a star); and

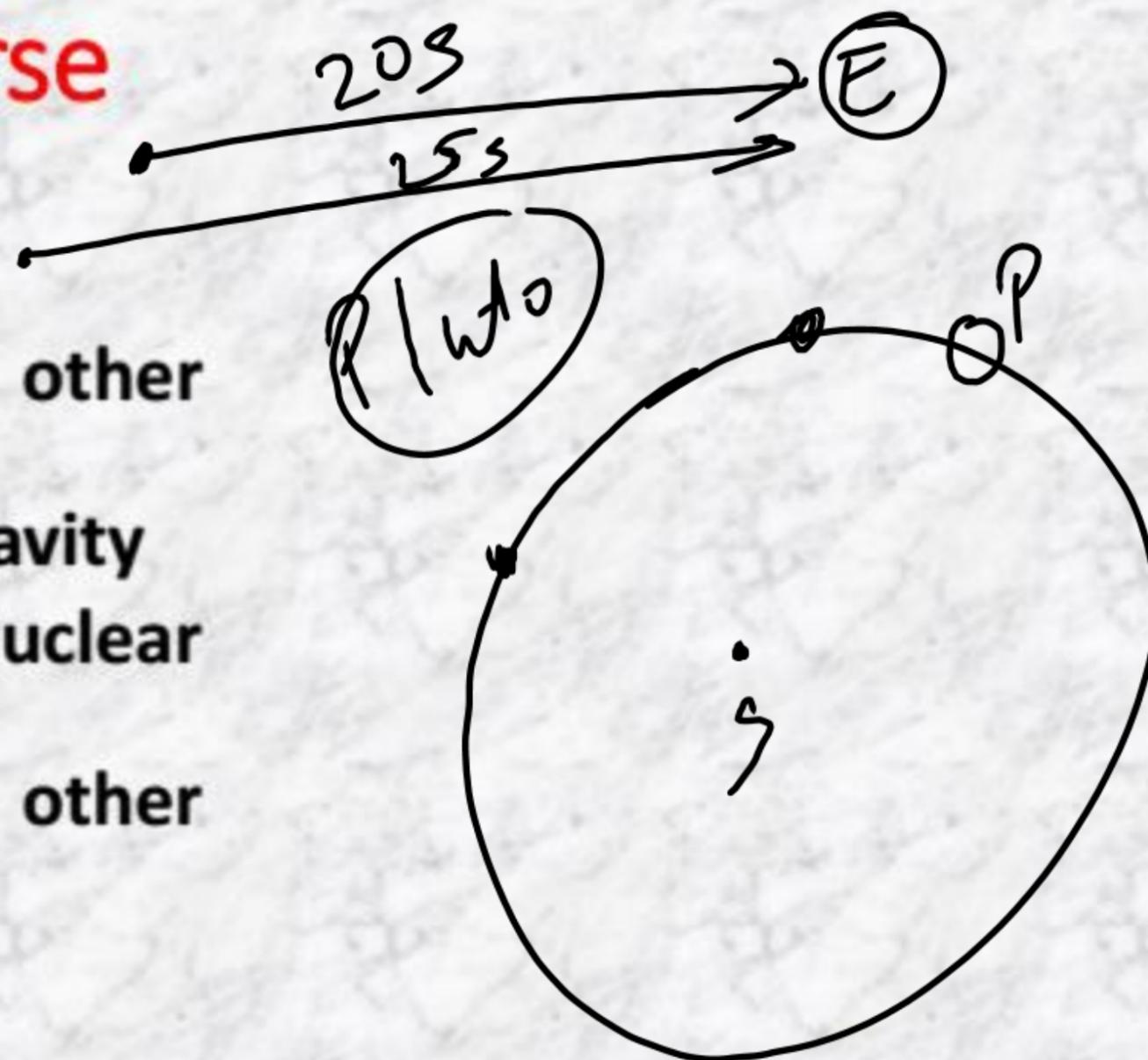
has "cleared its neighborhood" of most other orbiting bodies.

The problem with Pluto

its small size and offbeat orbit,

it doesn't clear its neighborhood of debris

it shares its space with lots of other objects in the Kuiper Belt.



Universe

Wohn

Rogue planets

Star

Exoplanets?

An exoplanet is any planet beyond our solar system.

Exoplanets are made up of elements similar to those of the planets in our solar system.

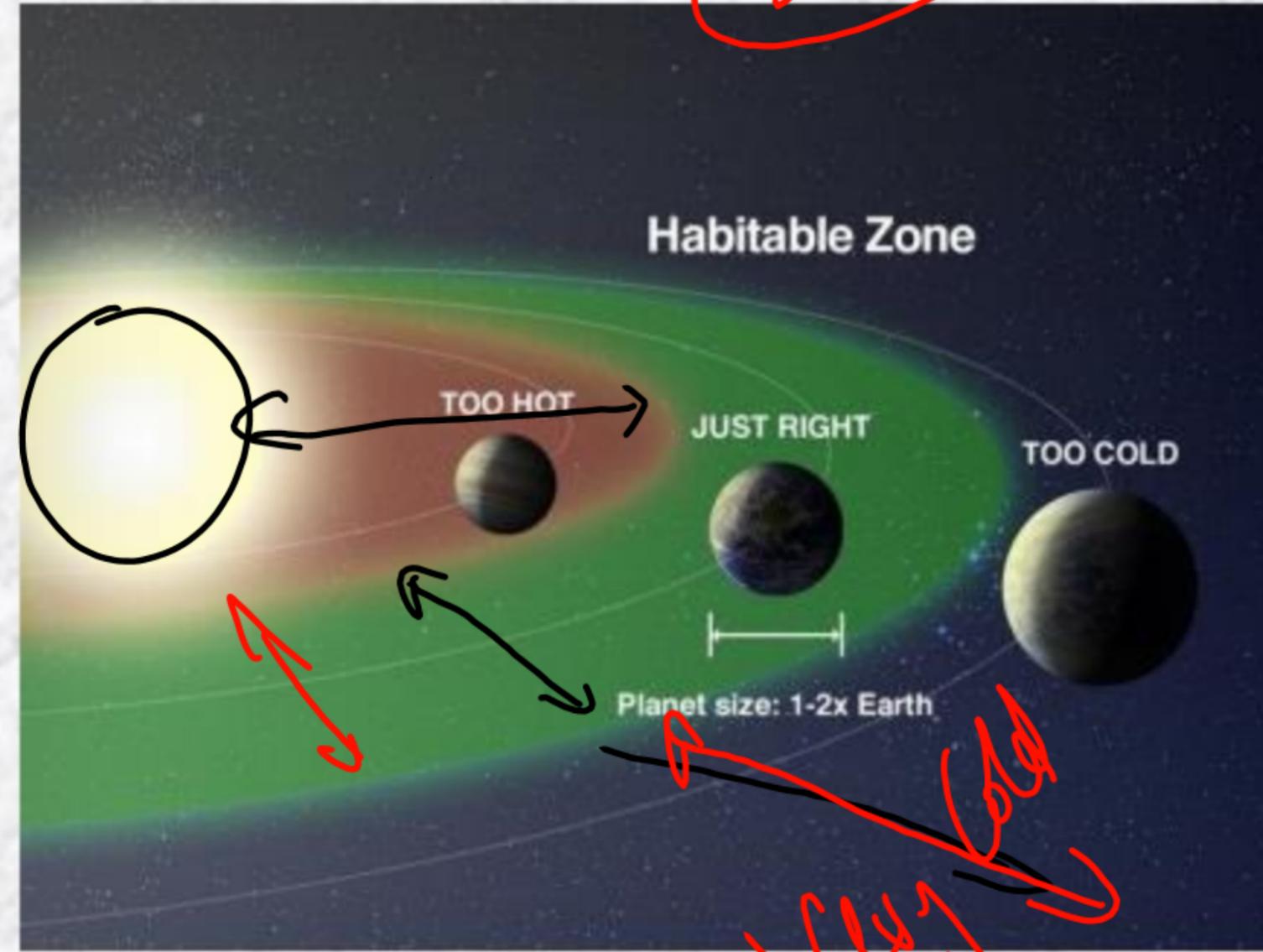
However, their mixes of those elements may differ.

Most orbit other stars, but free-floating exoplanets, called rogue planets, orbit the galactic center and are untethered to any star.

What is Goldilocks Zone?

It is a region of space in which a planet is at just the right distance from its home star so that its surface is neither too hot nor too cold.

According to various reports, there are about 40 billion Earth-Sized planets orbiting in the habitable zone



Universe

Our star- Sun

The closest star to our planet.

It is a ball of hydrogen gas that radiates heat and light.

It generates power by nuclear fusion (smaller nuclei combined to form larger nuclei and produce energy).

Sun was born under five billion years (approximately) ago.

It is composed of about 74 percent hydrogen and 25 percent helium, with traces of iron, carbon, calcium, and sodium.

Like other planets in the solar system, the Sun spins on its axis.

The Sun takes up to 250 million years to complete one revolution around the Milky Way

5 bn

Universe

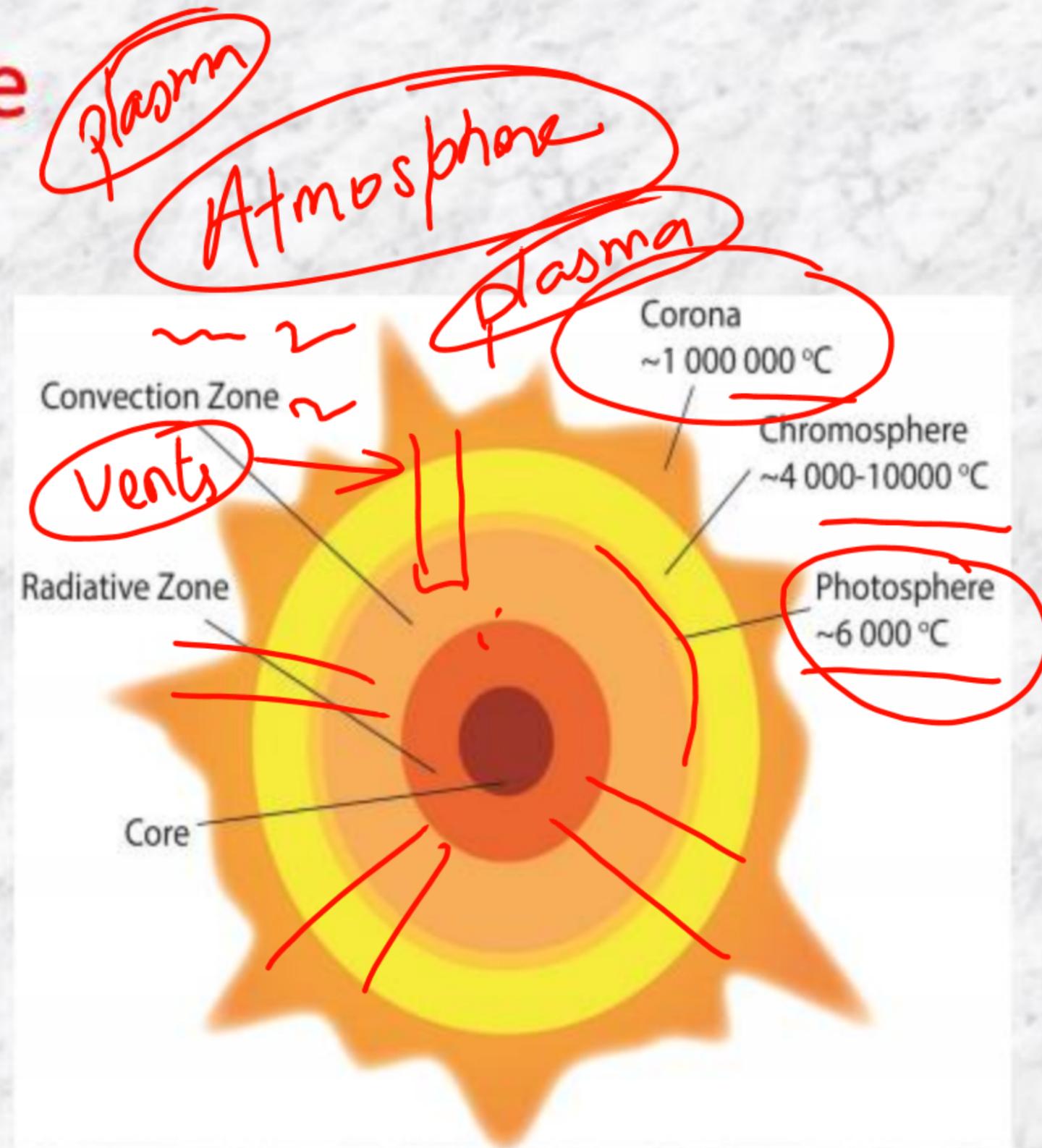
Layers of Sun

It has three layers - photosphere, chromospheres and corona

The photosphere is the visible surface of the Sun, from which the emitted sunlight reaches Earth.

The chromosphere is the layer above the photosphere and below the corona.

Corona is the outermost region of the Sun's atmosphere (consisting of plasma or hot ionized gas), which is visible as a white halo during a solar eclipse.



Universe

What is Solar Wind?

The solar wind is created by the outward expansion of plasma (a collection of charged particles) from the Sun's corona (outermost atmosphere).

This plasma is continually heated to the point that the Sun's gravity can't hold it down.

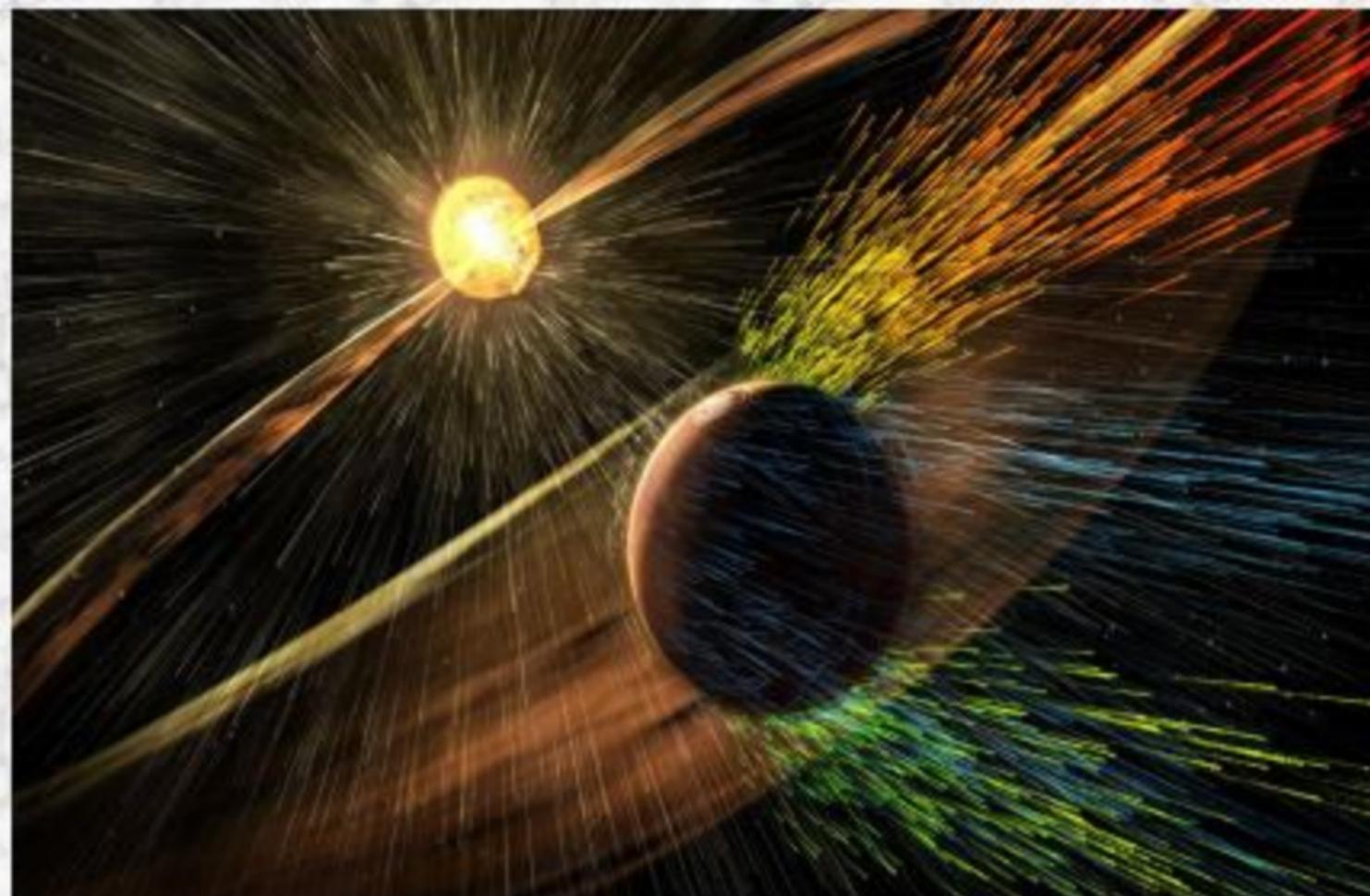
It then travels along the Sun's magnetic field lines that extend radially outward.

When the solar wind encounters Earth, it is deflected by our planet's magnetic shield, causing most of the solar wind's energetic particles to flow around and beyond us.

This region that meets and blocks the solar wind is called the magnetosphere.

The space around our atmosphere is alive and dynamic because Earth's magnetosphere reacts to the Sun's activity.

They can severely damage our communications, navigation, and electrical power systems; oil drilling processes and pipelines; and spacecraft and orbiting satellites.



Corona

Solar wind

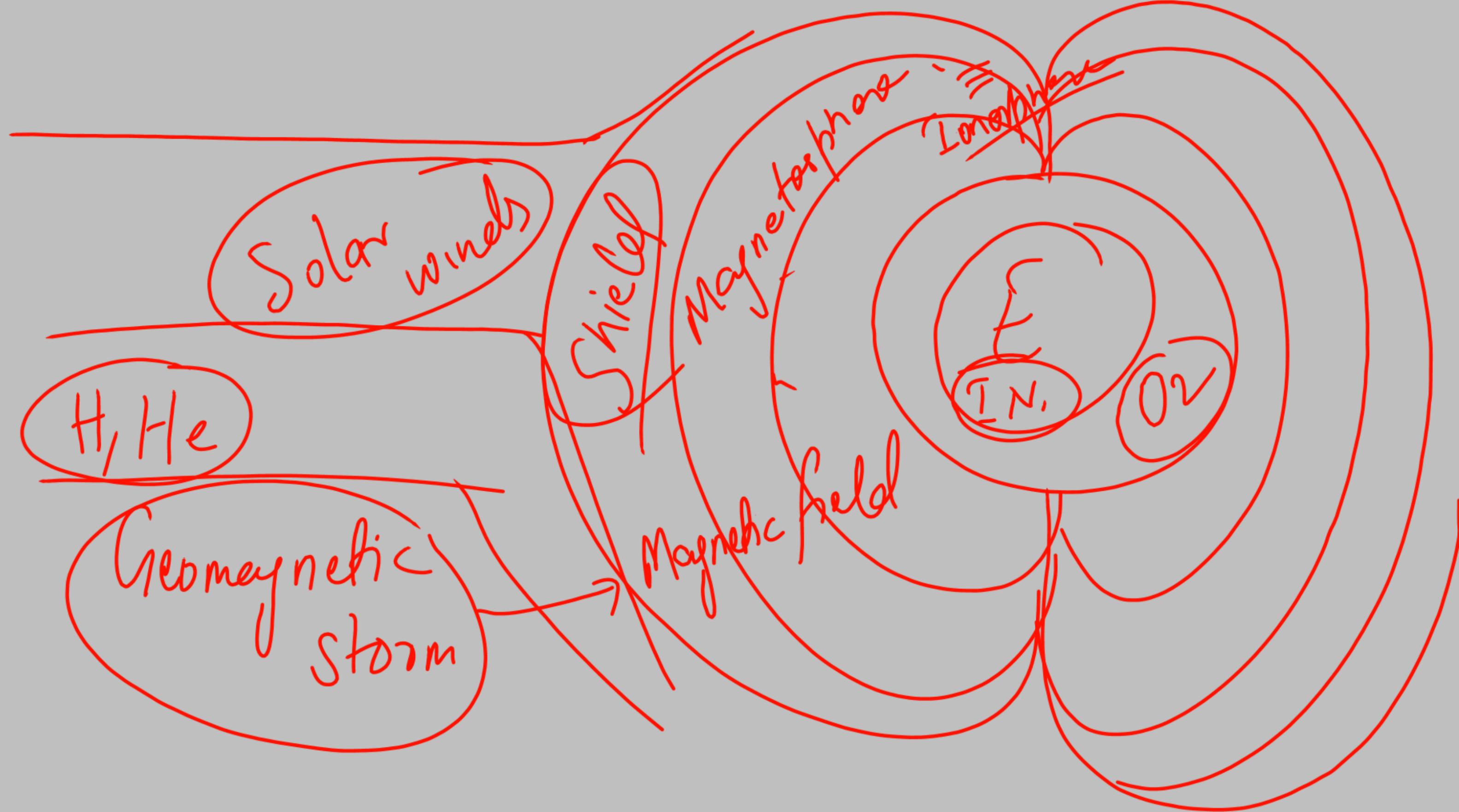
Plasma - Ionised gases

Released in
Solar system

Expands outward

Violent explosion

Solar storm / Tsunami



Solar winds

H, He

Geomagnetic storm

Shield

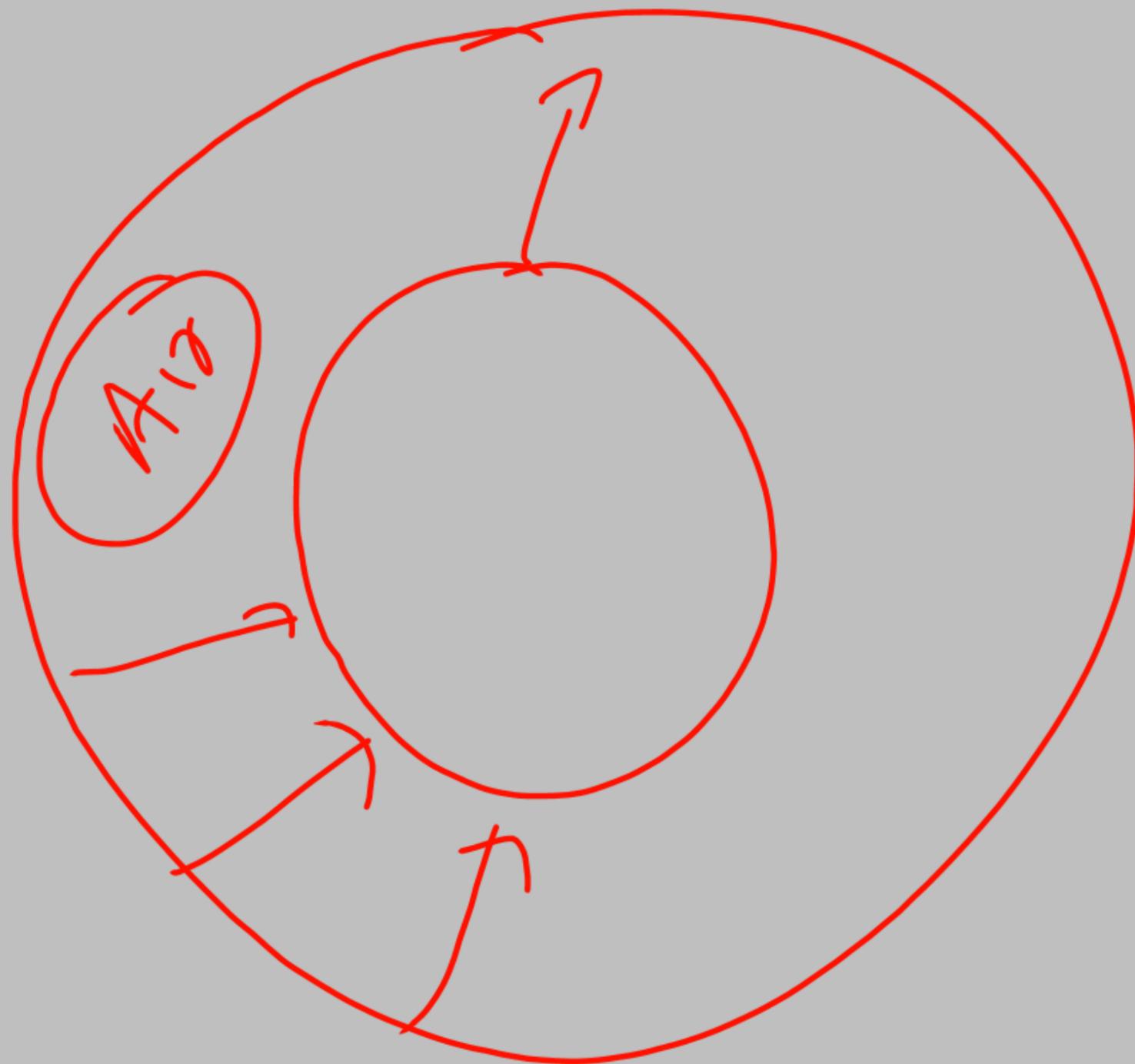
Magnetic field

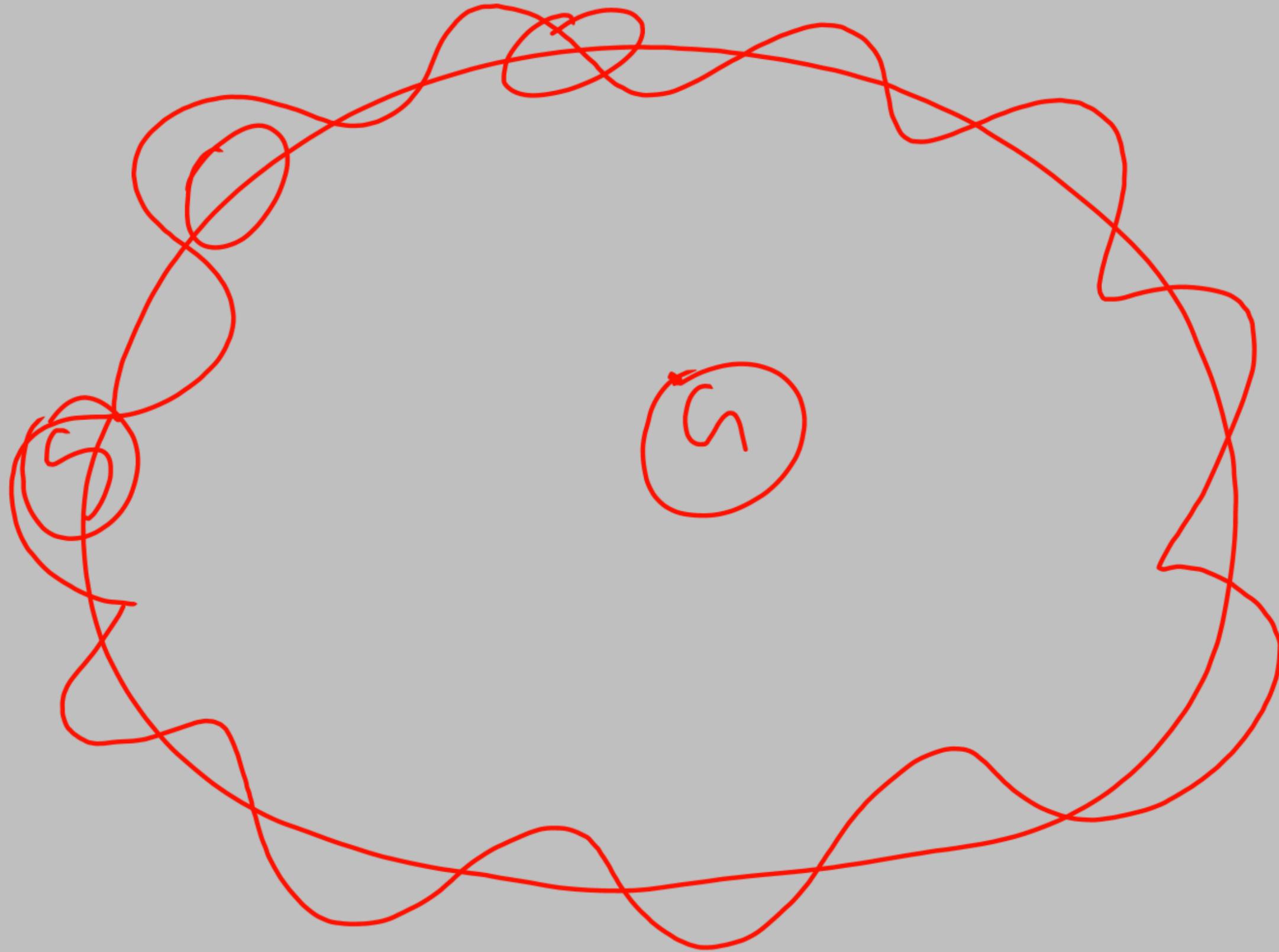
Magnetosphere

Ionosphere

N_2

O_2





Universe

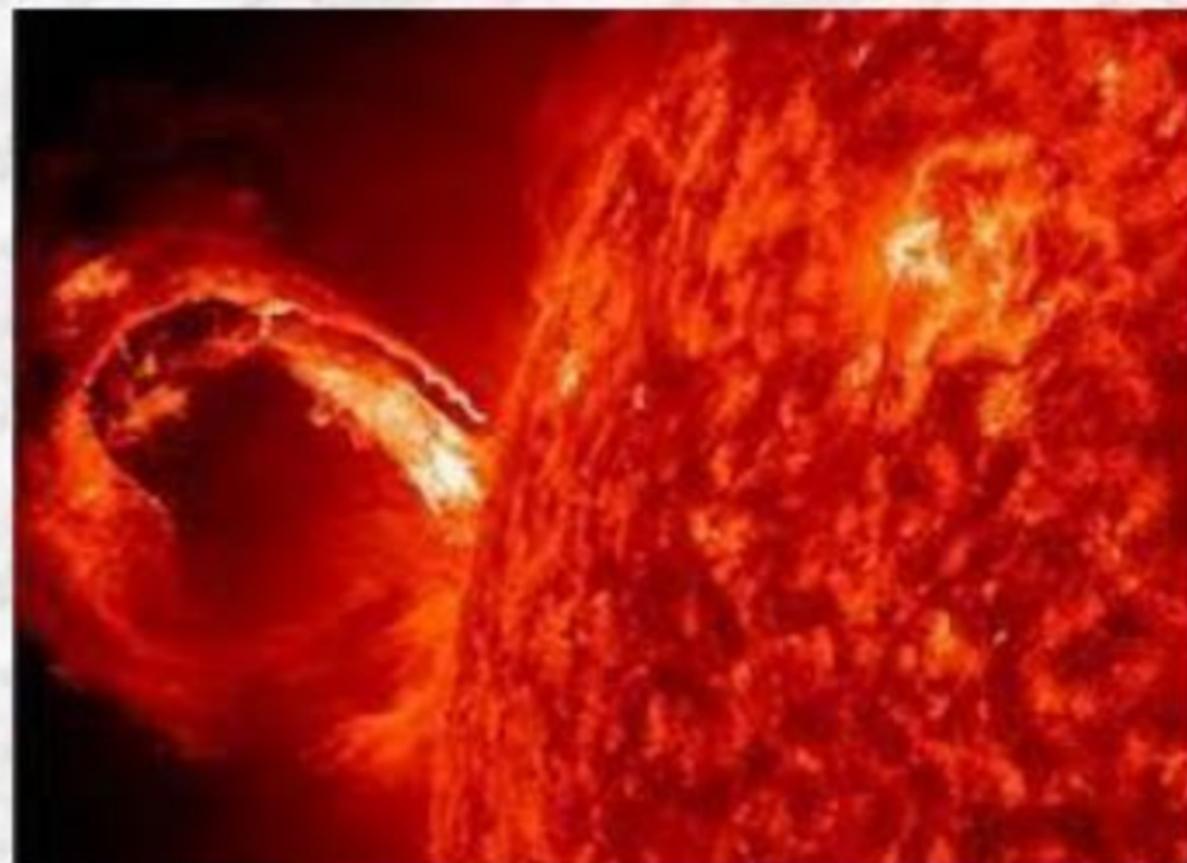
Solar Tsunami?

A solar tsunami is a powerful shockwave on the Sun's surface.

It is triggered by explosions in the Sun's atmosphere

This explosion results in large amounts of superhot plasma, containing electrically charged particles, being expelled into space.

They can have a significantly disastrous impact on our communications, navigation, and electrical power systems; oil drilling processes and pipelines; and spacecraft and orbiting satellites.



Sun Spot?

Interaction with magnetic field

Universe

60000°C

Sun spots

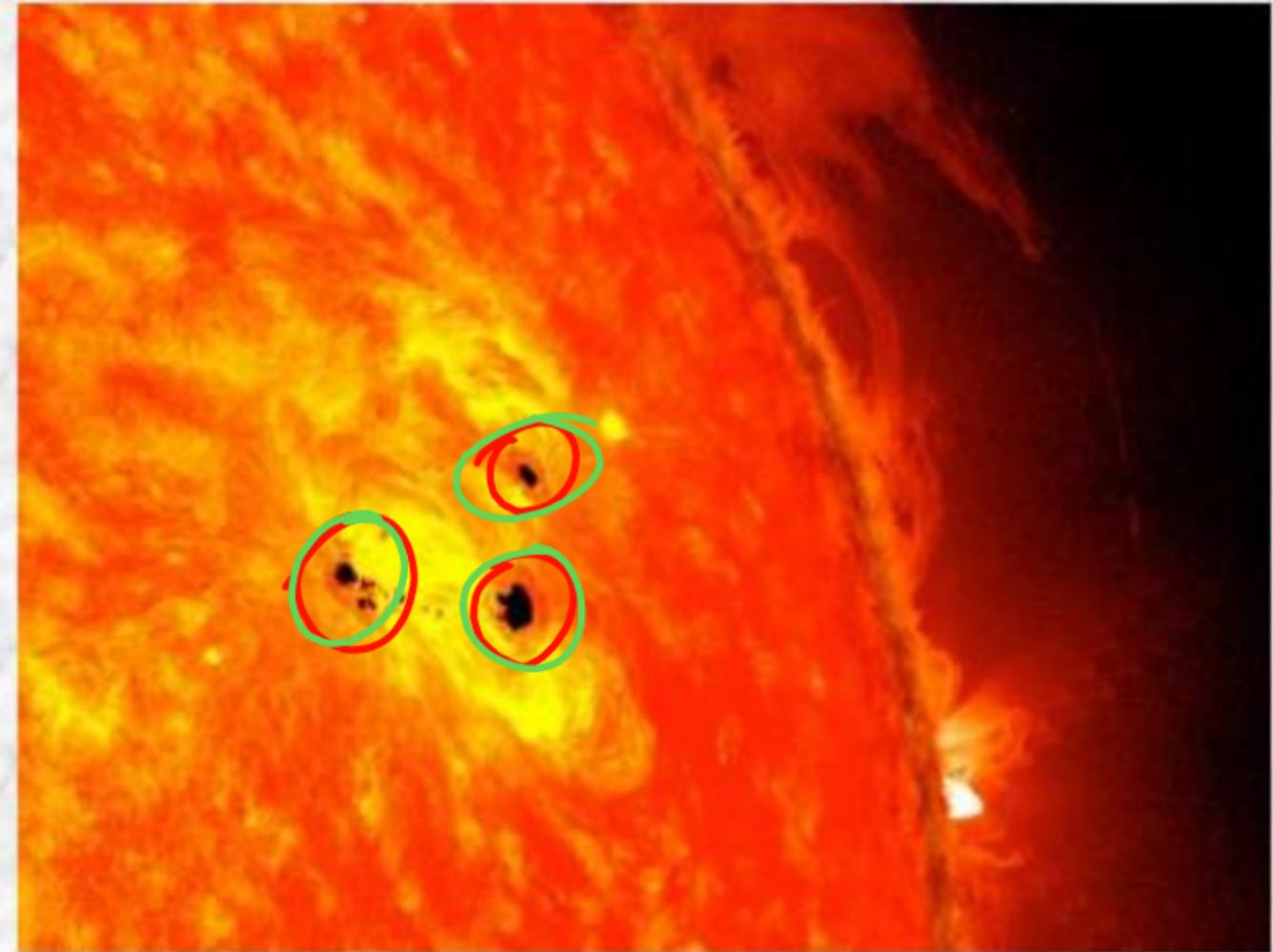
Sunspots are darker, cooler areas on the surface of the sun in photosphere

They look dark only in comparison with the brighter and hotter regions of the photosphere around them.

Sunspots can be very large, up to 50,000 kilometers in diameter.

They are caused by interactions with the Sun's magnetic field.

Sunspots occur over regions of intense magnetic activity, and when that energy is released, solar flares and big storms called coronal mass ejections erupt from sunspots.



6
4500°C

6000°C

Universe

Orbit

What are asteroids?

Asteroids are small, rocky objects that orbit the Sun

Although asteroids orbit the Sun-like planets, they are much smaller than planets.

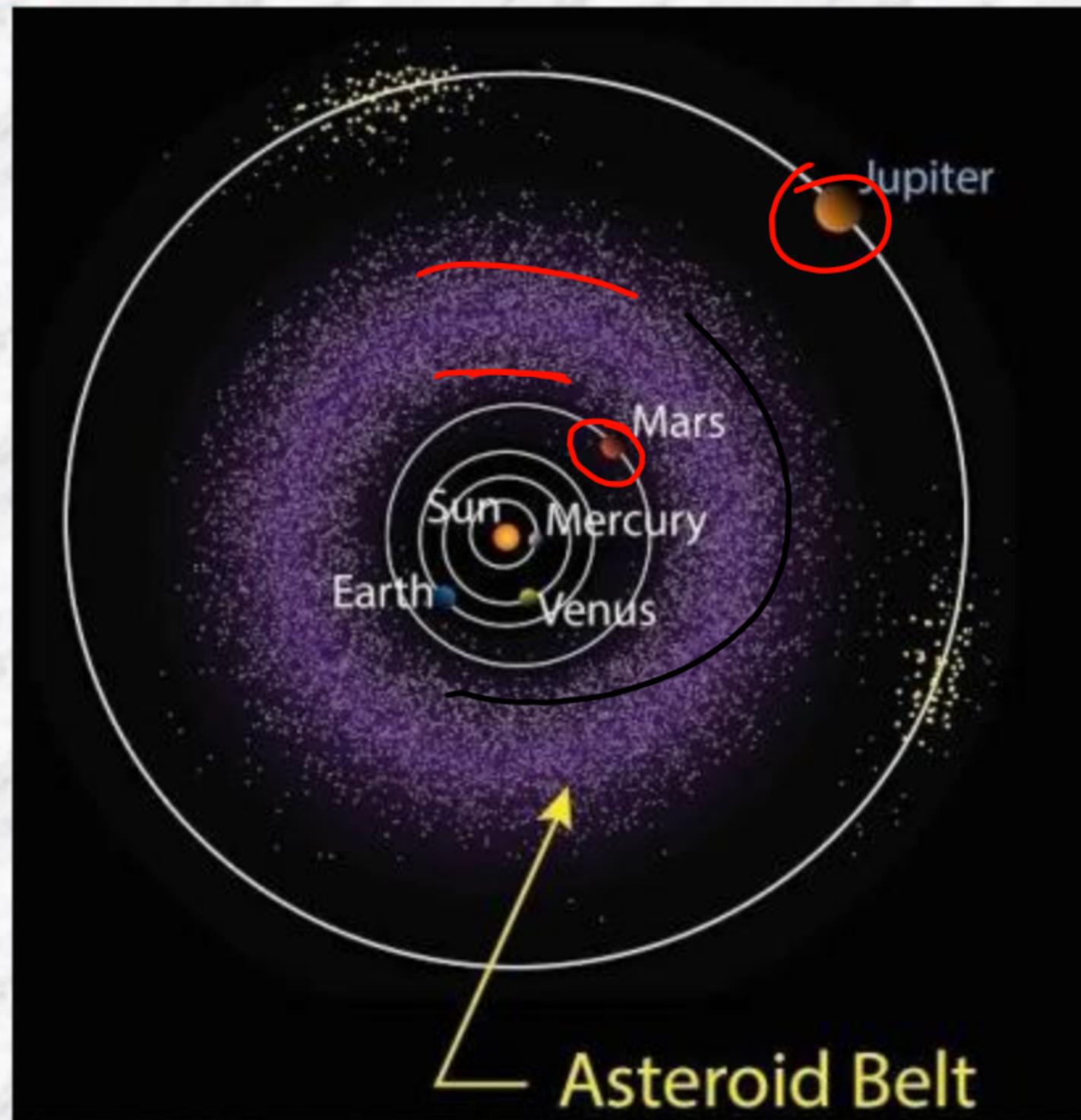
There are lots of asteroids in our solar system.

Most of them live in the main asteroid belt—a region between the orbits of Mars and Jupiter.

Some asteroids are found in the orbital path of planets.

This means that the asteroid and the planet follow the same path around the sun.

Asteroids are leftover from the formation of our solar system.



Universe

What are Meteors, Meteoroids, Meteorites?

Meteoroids are objects in space that range in size from dust grains to small asteroids. Think of them as “space rocks.”

When meteoroids enter Earth’s atmosphere (or that of another planet, like Mars) at high speed and burn up, the fireballs or “shooting stars” are called meteors.

When a meteoroid survives a trip through the atmosphere and hits the ground, it’s called a meteorite

What are comets?

Comets are cosmic snowballs of frozen gases, rock, and dust that orbit the Sun.

When frozen, they are the size of a small town.

When a comet's orbit brings it close to the Sun, it heats up and spews dust and gases into a giant glowing head larger than most planets.

The dust and gases form a tail that stretches away from the Sun for millions of miles.

→ small brothers of asteroids
distant part
frozen gas
↳ comets



Chemistry

What is matter?

Matter is anything that has mass and takes up space. At a minimum, matter requires at least one subatomic particle, although most matter consists of atoms.

Examples That Are Not Matter

Not everything we can perceive consists of matter. If it does not have mass or volume, it's not matter. Examples of things that aren't matter include:

- Photons (light)
- Heat
- Thoughts
- Microwaves (the radiation, not the appliance)

2087 cloud

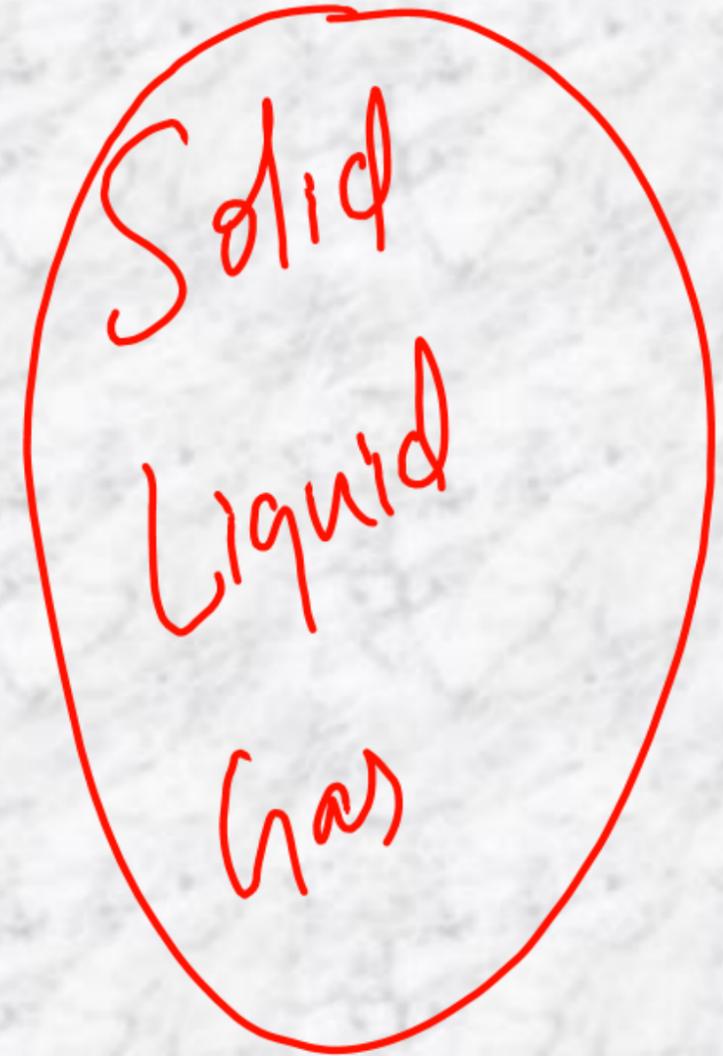
Chemistry

States of Matter:

The matter around us exists in three different states—solid, liquid and gas. These states of matter arise due to the variation in the characteristics of the particles of matter.

Other states of Matter:

Plasma: The state consists of super energetic and super excited particles. These particles are in the form of ionised gases. The fluorescent tube and neon sign bulbs consist of plasma. Inside a neon sign bulb there is neon gas and inside a fluorescent tube there is helium gas or some other gas. The gas gets ionised, that is, gets charged when electrical energy flows through it. This charging up creates a plasma glowing inside the tube or bulb. The plasma glows with a special colour depending on the nature of gas. The Sun and the stars glow because of the presence of plasma in them. The plasma is created in stars because of very high temperature.



Plasma

~~Stars~~
~~Neutral~~

Neon bulb

→ Ionised gases

→ H_2 gas

H^+

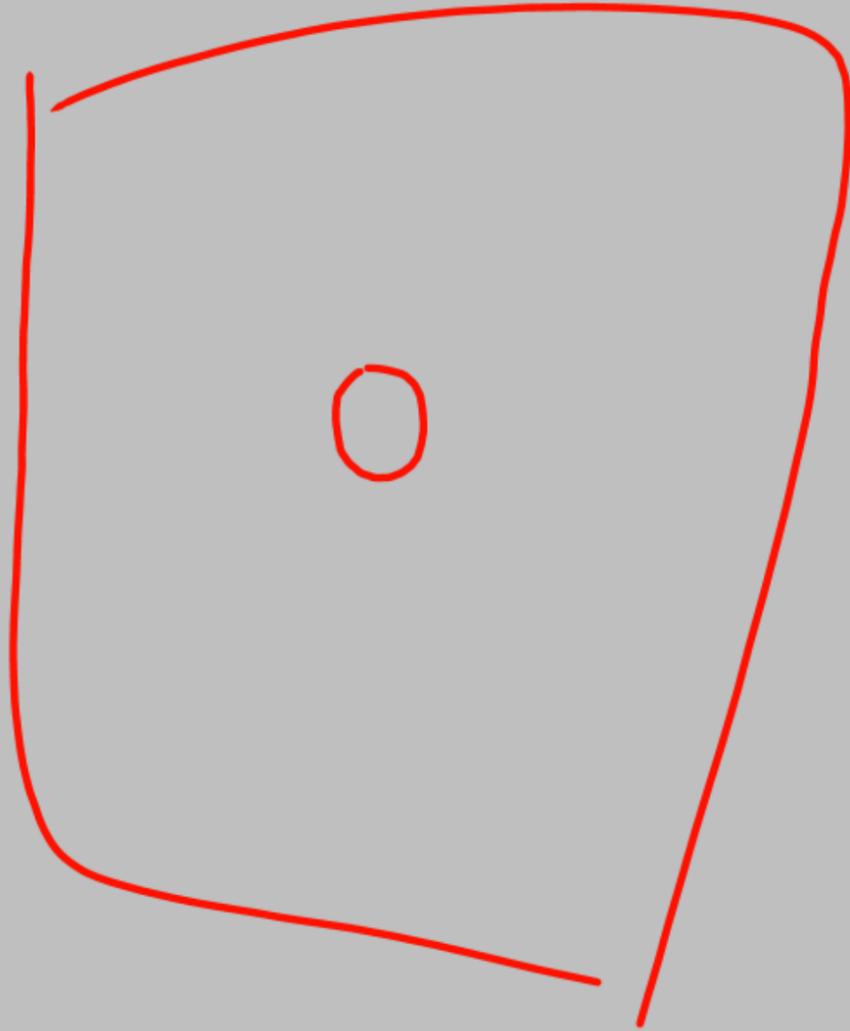
Bose E Condensate

↳ fifth state of matter

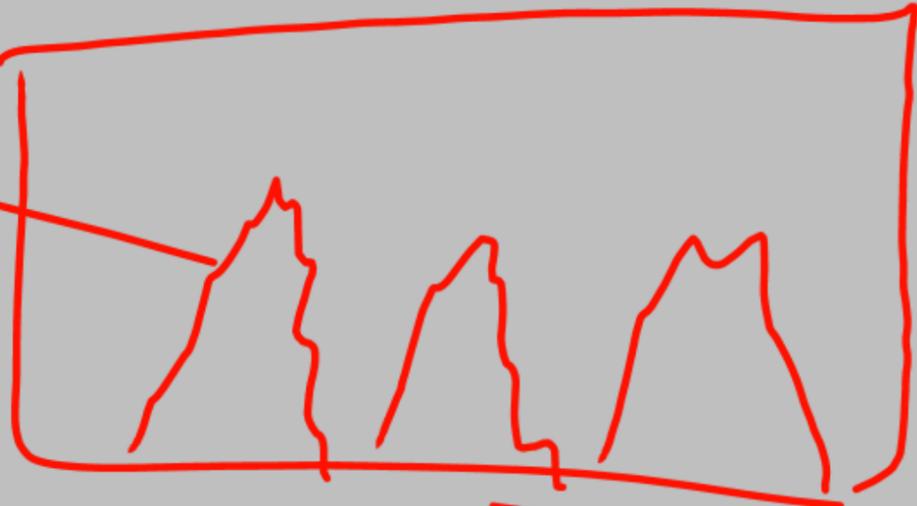
↳ labs $1/1000$ of air

↳ a gas with very low density.

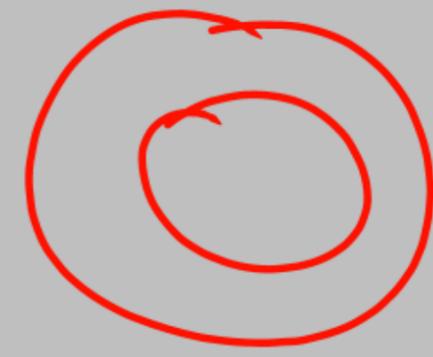
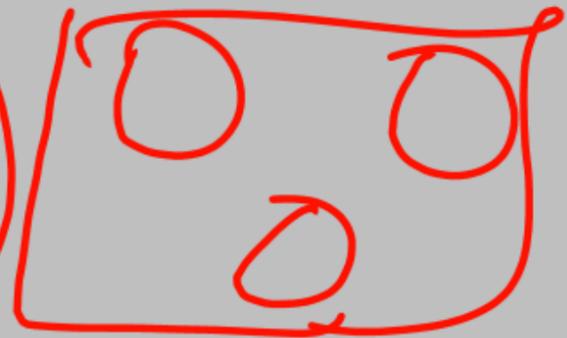
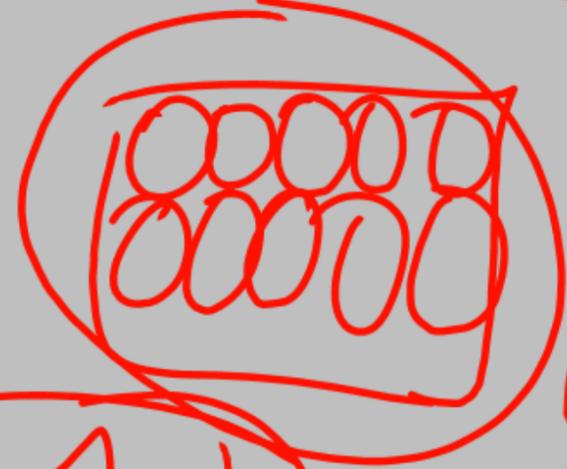
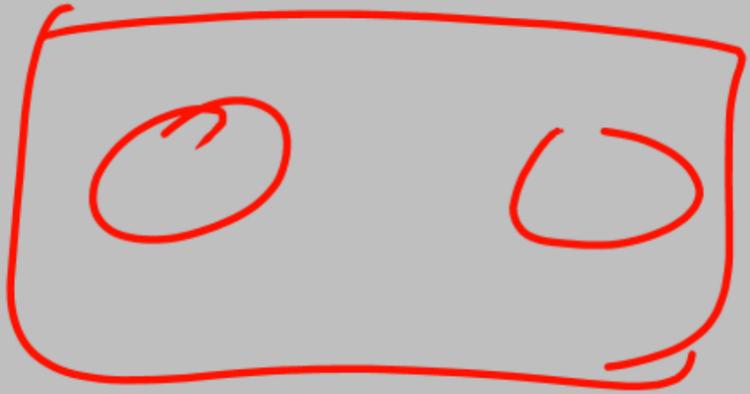
↳ Very low temp.



light



Atomic clock



de-orbit

Chemistry

Properties of Plasma

- Because plasma consists of charged particles, plasma reacts to electromagnetic fields and conducts electricity. In contrast, most gases are electrical insulators.
- Like a gas, plasma has neither a defined shape nor volume.
- When plasma is exposed to a magnetic field, it may assume structures, including layers, filaments, and beams. A good example of some of these structures can be observed in a plasma ball.

Uses of Plasma:

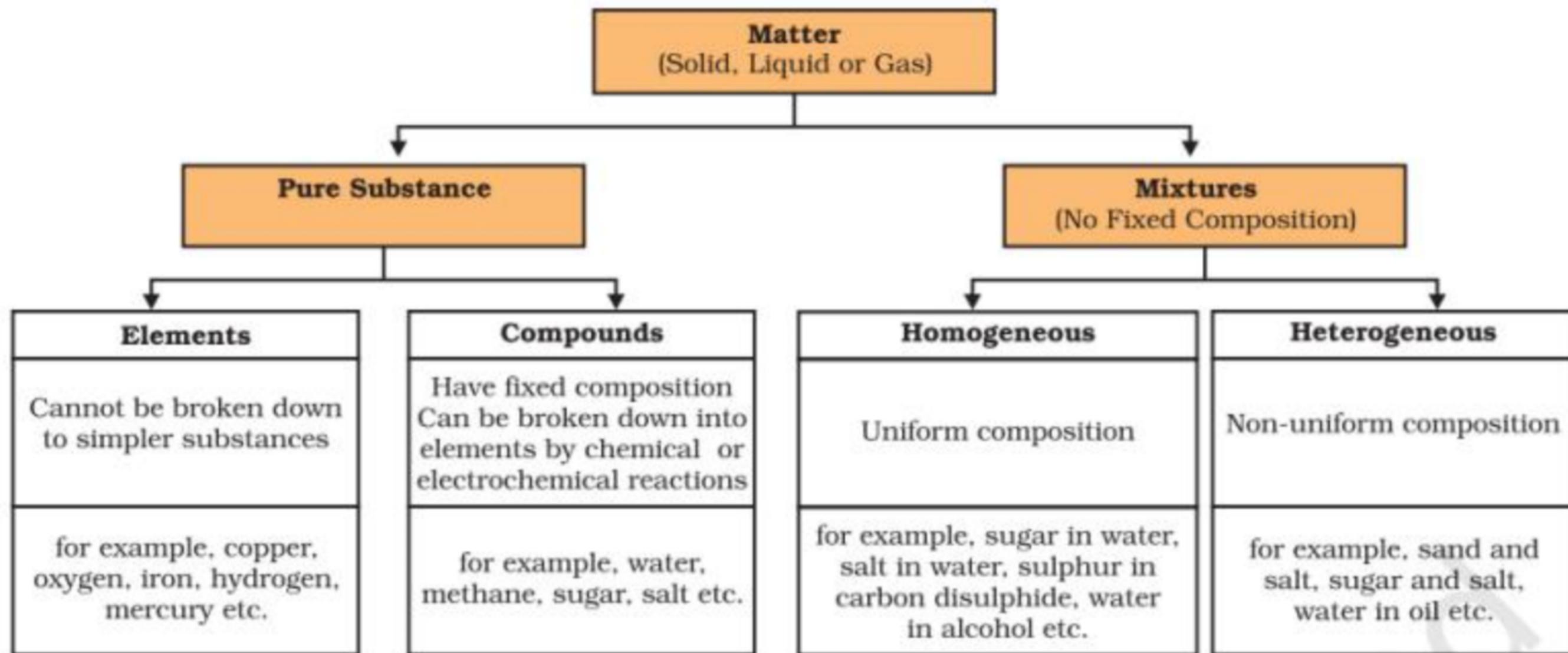
Plasma is used in television, neon signs and fluorescent lights. Stars, lightning, the Aurora, and some flames consist of plasma.

Chemistry

Bose-Einstein Condensate: In 1920, Indian physicist Satyendra Nath Bose had done some calculations for a fifth state of matter. Building on his calculations, Albert Einstein predicted a new state of matter – the Bose-Einstein Condensate (BEC). In 2001, Eric A. Cornell, Wolfgang Ketterle and Carl E. Wieman of USA received the Nobel prize in physics for achieving “Bose-Einstein condensation”. The BEC is formed by cooling a gas of extremely low density, about one-hundred-thousandth the density of normal air, to super low temperatures.

Uses:

BECs have also been used to create atom lasers, atomic clocks and gravitational, rotational or magnetic sensors with excellent sensitivity.



Chemistry

The number of elements known at present are more than 100.

Ninety-two elements are naturally occurring and the rest are manmade.

Majority of the elements are solid.

Eleven elements are in gaseous state at room temperature.

Two elements are liquid at room temperature—mercury and bromine.

Elements, gallium and cesium become liquid at a temperature slightly above room temperature (303 K).

Chemistry

Alloys: Alloys are mixtures of two or more metals or a metal and a non-metal and cannot be separated into their components by physical methods. But still, an alloy is considered as a mixture because it shows the properties of its constituents and can have variable composition. For example, brass is a mixture of approximately 30% zinc and 70% copper.

In alloys the chemical properties of the component elements are retained but certain physical properties are improved.

Metal alloys are stronger than pure metals

Metal alloys are more versatile than pure metals

Metal alloys are more resistant to corrosion than pure metals

Chemistry

most common metal alloys?

- 1. Brass**
- 2. Carbon Steel**
- 3. Stainless Steel**
- 4. Bronze**
- 5. Aluminum Alloy**

Chemistry

Physical & Chemical Change:

The interconversion of states is a physical change because these changes occur without a change in composition and no change in the chemical nature of the substance. Although ice, water and water vapour all look different and display different physical properties, they are chemically the same.

Chemical change brings change in the chemical properties of matter and we get new substances. A chemical change is also called a chemical reaction. Burning is a chemical change. During this process one substance reacts with another to undergo a change in chemical composition.

Chemistry

Evaporation:

We know that particles of matter are always moving and are never at rest. At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy. In the case of liquids, a small fraction of particles at the surface, having higher kinetic energy, is able to break away from the forces of attraction of other particles and gets converted into vapour. This phenomenon of change of a liquid into vapours at any temperature below its boiling point is called evaporation.

Chemistry

FACTORS AFFECTING EVAPORATION:

The rate of evaporation increases with–

- **An increase of surface area:** We know that evaporation is a surface phenomenon. If the surface area is increased, the rate of evaporation increases. For example, while putting clothes for drying up we spread them out.
- **An increase of temperature:** With the increase of temperature, more number of particles get enough kinetic energy to go into the vapour state.
- **A decrease in humidity:** Humidity is the amount of water vapour present in air. The air around us cannot hold more than a definite amount of water vapour at a given temperature. If the amount of water in air is already high, the rate of evaporation decreases.
- **An increase in wind speed:** It is a common observation that clothes dry faster on a windy day. With the increase in wind speed, the particles of water vapour move away with the wind, decreasing the amount of water vapour in the surrounding.

Chemistry

HOW DOES EVAPORATION CAUSE COOLING?

In an open vessel, the liquid keeps on evaporating. The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation. This absorption of energy from the surroundings make the surroundings cold.

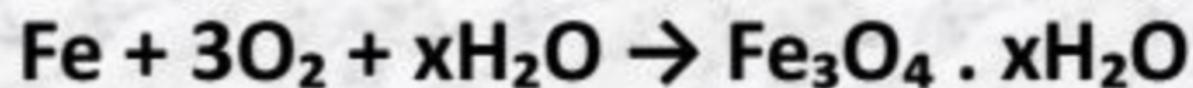
After a hot sunny day, people sprinkle water on the roof or open ground because the large latent heat of vaporisation of water helps to cool the hot surface.

Chemistry

Chemical Change Examples:

1. Rusting

Rusting is the process of oxidation, which is the result of a reaction that takes place because of oxygen. It gives a flaky brown layer that gathers over iron surfaces, this layer is formed due to the oxidization of the topmost layer, leading to the formation of metal oxide. It is just not with iron but these layers forms on other metals as well, like copper, silver, and gold.



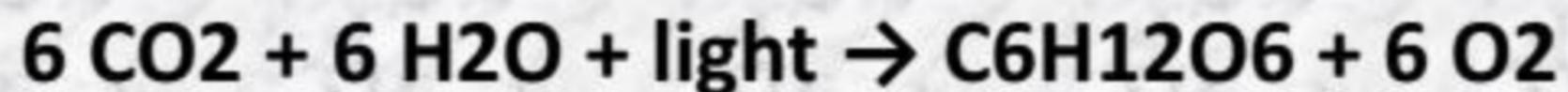
2. Digestion

Did you know? Every time we eat something, a chemical reaction is simultaneously taking place to digest it. Digestion is also a complex process, in which thousands of chemical reactions take place. For example, when you eat something, the water and enzyme named amylase breaks down carbohydrates and sugar into simple molecules.

Chemistry

3. Photosynthesis

Just like humans, several chemical reactions take place in plants as well, a chemical reaction called photosynthesis converts carbon dioxide and water into plant food – glucose, and oxygen. It is one of the major chemical reactions as it leads to the generation of oxygen and provides food for both plants and animals.



4. Combustion: Every time you strike a match, burn a candle, build a fire, or light a grill, you see the combustion reaction. Combustion combines energetic molecules with oxygen to produce carbon dioxide and water.

Chemistry

A chemical process in which a substance reacts with oxygen to give off heat is called combustion. The substance that undergoes combustion is said to be combustible. It is also called a fuel. The fuel may be solid, liquid or gas. Sometimes, light is also given off during combustion, either as a flame or as a glow.

Chemistry

Extinguishing Fire:

The most common fire extinguisher is water. But water works only when things like wood and paper are on fire. If electrical equipment is on fire, water may conduct electricity and harm those trying to douse the fire. Water is also not suitable for fires involving oil and petrol.

Do you recall that water is heavier than oil? So, it sinks below the oil, and oil keeps burning on the top.

For fires involving electrical equipment and inflammable materials like petrol, carbon dioxide (CO₂) is the best extinguisher. CO₂, being heavier than oxygen, covers the fire like a blanket.

Since the contact between the fuel and oxygen is cut off, the fire is controlled. The added advantage of CO₂ is that in most cases it does not harm the electrical equipment.

Chemistry

5. When a candle burns, both physical and chemical changes occur.

Physical Changes: On heating, candle wax gets melted. Since it again turns into solid wax on cooling. So, the melting of wax and vapourisation of melted wax are physical changes.

Chemical Changes : The wax near flame burns and gives new substances like carbon dioxide, carbon soot, water vapour, heat and light.

6. LPG is another example of a familiar process in which both the chemical and physical changes take place. LPG is present in liquid form in the cylinder. When it comes out of the cylinder, it converts into gaseous form which is a physical change. It undergoes chemical change when gas burns in air.

UPSC



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