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Tamil Nadu Public Service Commission

Volume – 1

GENERAL SCIENCE

SIERRA INNOVATIONS

TAMILNADU PUBLIC SERVICE COMMISSION

GENERAL SIENCE

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CHAPTER

The Nature of Universe

Origin of the Universe

Introduction

- The universe is **the vast expanse of space** that surrounds us.
- **Universe:** Everything that exists, including distant stars, planets, and satellites, as well as our own planet and all of its people.
- **Nobody knows** how big the universe is or if it has any limits.
- On the other hand, it is estimated that the Universe has 100 billion galaxies, each with 100 billion stars.
- Our world, Earth, is a microscopic speck in this vast expanse known as the universe, and the **sun**, which supports all life on our planet, is only **one of the billions of stars** that exist in this universe.
- The earth is one of the **eight planets** that orbit the **sun**, which is the **centre** of the solar system.
- The universe's **billions of stars** are not **uniformly distributed** throughout space. These stars form galaxies, which are billions of star clusters (or groupings).

Big Bang theory

- The Big Bang Theory is an **astrophysical model** of the universe that human senses may witness.
- The hypothesis **explains** the **universe's beginnings**, from its earliest forms **to** its **current evolutions**.
- The Big Bang Theory **explains** the observable phenomena of **radiation**, an abundance of light elements, and large-scale structures in order to explain **how the universe evolved from an initial state** of extremely high density and high temperature.

What is the Big Bang Theory's point of view?

- **After** its first period of **expansion**, the universe **began** to **cool down**.
- **Allowing** the **production** of **particles** that would eventually **become atoms**.
- **Hydrogen, Helium, and Lithium were the first** elements to condense, resulting in the formation of early stars and galaxies.

Common misconception about the theory:

- It **gives** the **complete origin of the universe but it does not** describe the energy, time and space involved in the creation of the universe.
- It only **explains** how the **universe emerged from its initial high-temperature state.**
- The theory **only describes the size of the observable universe** and not the universe as a whole

Pulsating theory

- The **universe is believed** to be **pulsing**, expanding and shrinking alternately, the universe is **currently growing.**

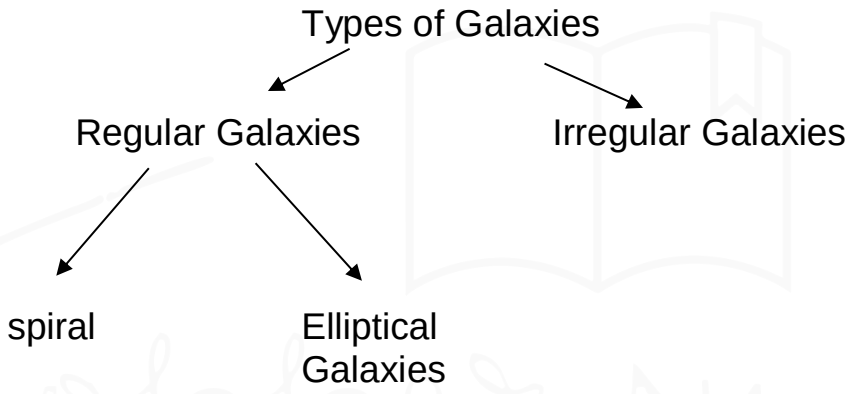
- According to **pulsating theory,** the universe's **expansion** may be **halted** by **gravitational attraction** at some point **in** the **future**, **causing** it **to compress** again.
- After it has been **constricted to a particular size**, it will **explode** again, and the **universe will begin to expand.**
- The **pulsating universe** is **created by** the **universe's parallel expansion** and **contraction**.

Components of the Universe

Galaxy

- A galaxy is a collection of millions or billions of stars, as well as gas and dust, bound together by gravity. They are the fundamental elements of the universe.
- The tiniest galaxies have roughly 100,000 stars, while the biggest have up to 3000 billion.

Classification of galaxies



Milky Way Galaxy

- It's a **spiral galaxy**, which means it's shaped like one.
- It has a disk-shaped structure with a diameter of roughly 100000 light years.
- Around its centre, the Milky Way galaxy **rotates** gently in a **counter-clockwise manner.**
- The Milky Way galaxy's **centre** is where **all of the stars** (including the sun and the solar system) **rotate.**
- The central star disc is relatively thick, indicating a **dense concentration of stars towards the galaxy's centre.**
- The Milky Way's centre is 27000 light years distant from the sun.
- Because it appears in the night sky like a river of light flowing from one corner to the other, the Milky Way galaxy is known as **Akash Ganga.**

Stars

- Stars, like the sun, are incredibly **hot celestial beings** that generate their **own light.**
- Stars are massive **clouds of hydrogen gas, helium, and dust.**
- Physical parameters such as size, colour, brightness, and temperature are used to classify stars.
- **Star can be divided into three as per their colour and temperature:**
  - **Red:** low surface temperatures
  - **White:** high surface temperatures
  - **Blue:** very high surface temperatures

- Pole (or Polaris), Sirius, Vega, Capella, Alpha centauri, Beta centauri, Proxima centauri, Spica, Regulus, Pleiades, Aldebaran, Arcturus, Betelgeuse, and, of course, the Sun are some of the most notable stars.
- In the night sky, all **stars** (save the pole star) **appear to travel from east to west**, this **apparent motion of the stars** in the sky is caused by the **earth's rotation** on its axis.
- The **monthly locations of the stars fluctuate**,Because of the interaction between the **rotation of the earth around its axis and the orbit** of the earth around the sun.

Birth and Evolution of a Star

- **Hydrogen** gas is the **primary raw material** for the formation of stars, with helium gas added in for good measure.
- The **formation of thick clouds of hydrogen and helium gas (i.e. Nebula)** in galaxies is the **beginning of a star's life** cycle.
- The **birth** of stars is caused by the **gravitational collapse** of these too thick **clouds of gases** in the galaxy.

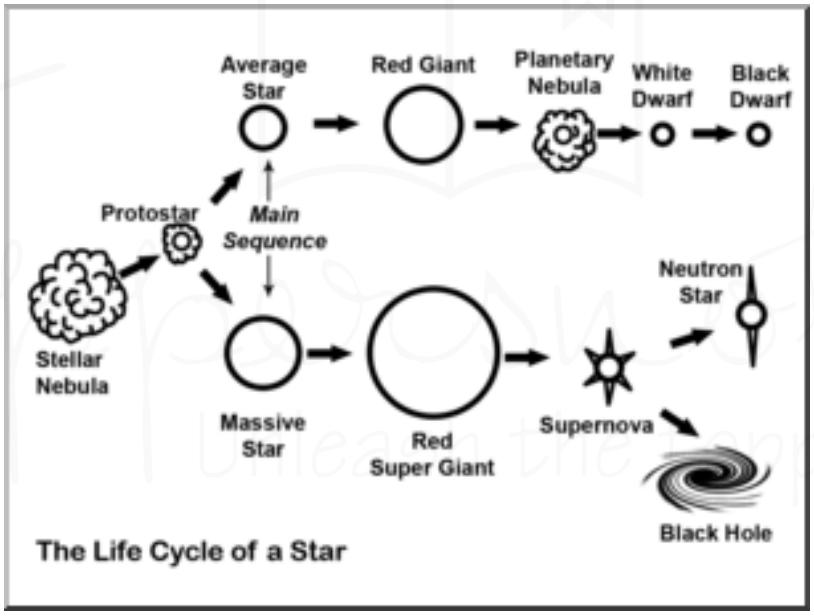


Fig: Evolution of Star

ProtoStar

- A protostar **resembles a star**,but its core is **not heated enough for nuclear fusion to occur.**
  - **Fusion** powers the stars as hydrogen atoms fuse together to form helium, and **matter is converted into energy.**
  - It occurs only when the **initial temperatures** are very **high** – a few million degree Celsius. That is why it is **hard to achieve and control.**
- Protostars are **difficult to view** in the visible spectrum because they are frequently covered by dust, which filters the light they emit.

T Tauri Star

- A very **young, light star** that is still **experiencing gravitational contraction**, less than 10 million years old.
- It is an **intermediate stage** between a **Protostar** and a low-mass main **sequence star** like the Sun.

Main sequence stars of fusion ignition

- **Hydrogen** atoms are **fused** to **form helium** atoms.
- **Main sequence stars** make up the vast **majority** of **stars** in the universe (about 90%).
- A **star like the Sun** swells up to **become** a **red giant** at the end of its life, **before shedding its outer layers** as a planetary nebula and finally decreasing to become a white dwarf.

Final Stages of a Star's Life

- A star enters the **red-giant phase**, where it becomes a **red-giant star**, in the initial portion of its final stage of existence.
- The **red-giant star** can then **die out** by becoming a **white dwarf star** or exploding as a **supernova star**,Resulting in the development of neutron stars and black holes, **depending on its mass**.

  Red- Giant Phase
  - The **fusion activities** in the core will **end** after **all** of the **hydrogen** in the star's core has been **converted to helium**.
  - As a result, the **star's core** would eventually be made entirely of **helium**.
  - **Reduced pressure** in the core will eventually **terminate fusion** activities and cause the **core to shrink** under its own gravity.
  - **Fusion** processes would continue to liberate energy, albeit at a much lesser intensity, because some hydrogen remains in the star's outer shell or envelope.
  - The star's overall balance has been broken as a result of all of these changes, and in order to restore it, the star must expand greatly in its outer regions (outer region).
  - As a result, the star grows in size (it becomes a giant), and its colour shifts to red. The star enters the red-giant phase at this point and is referred to as a red giant star. After around 5000 million years, our own star, the sun, will transform into a red-giant star.
  - The sun's growing outer shell will eventually engulf the inner planets, such as Mercury and Venus, as well as the earth. When a star enters the red-giant stage, its fate is determined by its starting mass.
    - **Two cases arise:**
      a) If the **star's initial mass is similar to that of the sun,** the red-giant star loses its growing outer shell and its core shrinks, forming a **white dwarf star** that eventually dies out as a dense lump of matter into space.
      b) If the **star's original mass is far greater than that of the sun**, the red-giant star that was born from it explodes as a **supernova star**, and the core of the bursting supernova star can shrink to form a neutron star or black hole.

White Dwarf

- A white dwarf is a **tiny hot star** that is at the end of its life cycle, **similar to the Sun.**
- White dwarfs are the **leftovers of regular stars** that have exhausted their nuclear energy reserves.
- Due to gravitational influences, white dwarf **consists of degenerate matter with an extremely high density**, i.e. one tablespoon has a mass of many tonnes.

NOVA

- In a binary system, it **occurs on the surface of a white dwarf.**
- If the two stars in the system are close enough together, material **(hydrogen)** from the partner star's surface **can be transferred onto the white dwarf.**
- When enough **material accumulates** on the surface of a white dwarf, **nuclear fusion occurs**, resulting in a dramatic brightening of the star.

Supernova

- A supernova is a **star's rapid death** that causes it to brighten to the **brightness of 100 million suns** for a **brief** period of **time**.
- The very bright **burst** of radiation **disperses** most or all of a star's **material at a high velocity**, causing a shock wave to propagate into the interstellar medium.
- These shock waves **cause condensation in a nebula,** opening the way for the formation of a new star. However, **a star must die in order for a new star to be created!**
- Supernovae are **responsible** for a **large amount of primary cosmic rays.**
- **Supernova** Are of two types:
  - **Type-1**: Formed due to triggered runaway nuclear fusion, completely disrupting the star
  - **Type-2:** Formed due to gravitational collapse of the core of a massive star.

Black Dwarf

- A black dwarf is the **last stage** of star development.
- A black dwarf is a **white dwarf that has cooled** to the point that no substantial heat or light is emitted.
- **No black dwarfs are projected to exist** in the universe yet since the time necessary for a white dwarf to achieve this condition is calculated to be greater than the universe's current age

Brown Dwarfs

- Brown dwarfs are objects that are **too big to be planets** but **not big enough to be stars.**
- Brown dwarfs are **considered to develop** from a collapsing cloud of gas and dust in the **same manner as stars do.**
- The **centre** of the cloud, however, is **not thick enough to start nuclear fusion** when the cloud falls.

Neutron Stars

- Neutron stars are stars that **emit neutrons.**
- These stars are mostly **made up of neutrons.**
- F**ormed during supernova** pushing protons and electrons to combine to form a neutron star.
- **High density stars** (A sphere with a diameter of merely 20 kilometres can hold three times the mass of the Sun).
- If it has a **larger mass**,and **intensely high gravity** shrinking it even further, eventually becoming a black hole.

Black Holes

- At the end of their lives, **big stars are believed to create black holes.**
- A black hole's gravitational pull is so strong that nothing, **not even light, can escape it.**
- A black hole's **matter density can't be measured** (it's infinite!).

- Black holes **warp space around them** and can pull nearby objects, including stars, into them.
- **Gravitational lensing**: occurs when light is twisted around a huge object, such as a black hole, causing it to behave as a lens for the objects behind it.

Dark matter

- Dark matter is a kind of matter hypothesised in astronomy and cosmology to account for a significant amount of the **universe's mass that appears to be absent.**
- Dark matter is **invisible to telescopes** because it does not emit or absorb significant amounts of light or other electromagnetic energy.
- **A black hole is not the same as dark matter.** The elements of cold dark matter are currently unknown. It might be a swarm of black holes, a dwarf, or a whole new particle.

The Solar System

- **Age**: 4.6 **billion years old**
- **Distance:** 27,000 light years from the Milky Way's centre.
- The solar system is made up of the **sun, eight planets and their satellites,** as well as thousands of other celestial bodies such as **asteroids, comets, and meteors.**
- The **sun**, which is at the **centre of the solar system**, revolves around all of these bodies.
- The sun's **gravitational influence maintains** the whole **solar system** rotating around it, as well as all planets and other objects.
- As a result, the sun's **gravitational pull determines** the **velocity** of all solar system **components**.
- The solar system revolves around the sun. Nearly **99.9% of the matter in the solar system originates from the sun.**
- The **sun** is the **source of all energy** in the solar system.

Sun

- **Age**: 4.6 billion years.
- **Diameter**: 1.39 million km.
- **Temperature**: 6000 °C on surface
  - **Temperature of Sun's core:** 16 million ^{0}C
- **Density**: 1.41 times that of water.
  - **Density of water = 999.97 kg/m³ = ~ 1 g/cm3;**
  - **Density of Iron = 7870 kg/m³.**
- **Rotation time**: 25 days and 9 hours.
- **Rotational speed:** 7179.73 km/h.
  - The **earth's rotational velocity** is 1675 kilometres per hour.
- **Mass**: 3,32,900 times of Earth masses.
- The solar system, or solar family, revolves around the sun. When compared to the millions of other stars, the sun is a medium-sized star with an average brightness.
- **Distance**: 150106 kilometres away from Earth
- **Speed of Light:**300,000 kilometres per second.

- **Time taken by light to reach earth**: 8 minutes and 20 seconds.
- **Time taken by light to reach earth from the closest star, proxima centauri :** 4.3 light years.

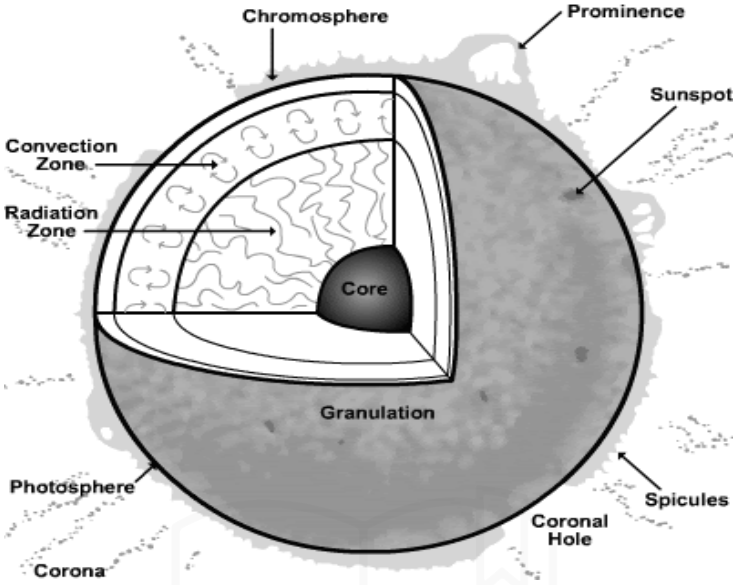


Fig:Internal structure of Sun

- The sun is a **hot sphere of gaseous matter**.
- **Hydrogen gas** makes up the majority of it.
- **Nuclear fusion** (the conversion of hydrogen to helium) at the sun's core **produces** a vast amount of energy in the form of **heat and light,** resulting in the **shining of the Sun**.
- From Earth, we can only get a glimpse of the sun's surface.
  - The **sun's shining surface** is known as the **photosphere**.
  - The photosphere appears to us as a brilliant disc, and it is also referred to as the **sun's disc.**
  - The **photosphere emits energy** and provides a source of energy for humanity.
- The **corona** is the thin, heated gases that make up the **outer layer of the sun's atmosphere.** The corona is **only visible during a total solar eclipse.**

Internal Structure and Atmosphere of the Sun

- **Internal structure**: The convection zone, The radiative zone,The core,
- **External Atmosphere**: The photosphere, chromosphere, and corona
- **The Photosphere:**
  - The photosphere is the **Sun's hot outer layer**, which emits the majority of its energy.
- **The Chromosphere:**
  - The chromosphere is a **small layer of burning gases** that sits just **above** the **photosphere**.
- **The Corona**
  - It is an **atmosphere of plasma** that surrounds The Sun and other celestial bodies.
  - The corona of the Sun stretches millions of kilometres into space and may be viewed best during a total solar eclipse.
- **Plasma**
  - Plasma is one of the **fundamental forms of matter** present, Solid, liquid, and gas are the other three.
  - Plasma is an **ionised gas** (atoms and molecules are often transformed to ions by removing one or more electrons from the outer shell).
  - **Lightning and electric sparks** are common examples of **plasma events.**

- **The Sunspots:**
  - A sunspot is a **black area** on the surface of the Sun.
  - Because sunspots are **500-1500°C colder** than the surrounding **chromosphere**, they **appear as black regions.**
  - The **lifespan** of a single sunspot varies from a **few days to a few months.**
  - Each area has a **black umbra** in the centre and a **lighter penumbra surrounding it.**
- **Solar Flares:**
  - **Magnetic anomalies** cause solar flares to form on the sun's surface.
  - They're **magnetic storms** that seem like brilliant spots with a **gaseous explosion on the surface.**
  - When solar flares **pass over the corona**, they heat the gas to temperatures ranging from 10 to 20 million °C.
- **Solar Winds:**
  - The solar wind is a stream of charged particles,mainly electrons and protons, that is ejected from the Sun at speeds of up to 900 km/s and a temperature of one million degrees (Celsius).
  - Plasma is used to make it (ionised atoms).
- **Effects of Solar winds– Aurora**
  - An aurora is a **natural light show** in the sky that is most commonly observed **in high latitudes** (Arctic and Antarctic). (This is due to the earth's magnetic field lines and the solar wind.)
  - Aurora is mainly **caused by Charged particles**, mostly **electrons and protons,** entering the atmosphere from above, **creating ionisation** and **excitation** of atmospheric elements, as well as **visual emissions.**
- **Effect of Solar wind — Some planets have atmospheres, while others don't.**
  - When **solar wind particles** with a **well-developed magnetic field** reach the planet they are **deflected**.
  - The **magnetosphere** is a zone that causes particles to travel the globe instead of assaulting the atmosphere or surface.
  - On the side **facing the Sun,** the **magnetosphere** is generally shaped **like a hemisphere**, while on the **opposite side, it is extended out in a lengthy trail.**
  - The **magnetopause** is the region's border, and certain **particles** are able to **infiltrate** the magnetosphere through it due to partial reconnection of **magnetic field lines.**
  - The **magnetosphere's overall shape** is determined by the **solar wind.**
  - Furthermore, **planets** with a **weak or non-existent magnetosphere** are **prone to solar wind** atmospheric stripping.

Planets

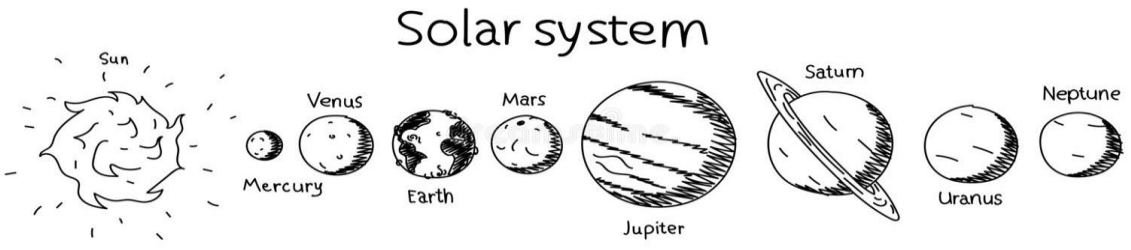


Fig: The solar system

- A planet is a **celestial body** that **orbits** a **star** in an **elliptical path.**
- The planets of our solar system are divided into **two groups:**
  - The **planets of the inner circle** or **inner planets** or the **'terrestrial planets**':
    - Mercury, Venus, Earth and Mars
    - They have smaller and denser bodies
      - ✓ **Mercury(Buddh):**
        - The **smallest** and **closest** to the sun.
        - **Distance from Sun**: 57.91 million km
        - **Orbital period:** 87.97 Earth days,(Shortest)
        - **Length of day: 58d** 15h 30m
      - ✓ **Venus (shukr):**
        - **Brightest** planet in the solar system**(morning/ evening star)**
        - Rotates in **anticlockwise direction**
        - The **hottest** planet in the Solar System due to high concentration of CO_2 and thick atmosphere.
        - **Distance from Sun**: 108.2 million km
        - **Orbital period:** 225 days
        - **Length of day: 116d 18h 0m**
      - ✓ **Earth(Prithvi):**
        - Only known celestial object to host and sustain life.
        - **Distance from Sun**: 149.6 million km
        - **Age**: 4.543 billion years
        - **Orbital period**: 365 days
        - **Natural Satellite:** MOON
      - ✓ **Mars(Mangal):**
        - **Red Planet:** Presence of iron oxide on surface
        - **Length of day:** 1d 0h 37m
        - **Distance from Sun:** 227.9 million km
        - **Orbital period**: 687 days
        - **Natural satellites:** Phobos, Deimos
  - T**he planets of the outer circle** or **outer planets** or the **'gas giant planets**' or the **Jovian planets** – Like-Jupiter.
    - Jupiter, Saturn, Uranus, and Neptune
    - They have a greater size and less dense materials.
    - They usually have a thick atmosphere, consisting of helium and hydrogen.
    - **Jupiter(Brhaspati):**
      - ✓ The latest probe to visit Jupiter is **Juno**.
      - ✓ **Largest planet** of the solar system
      - ✓ **Length of day:** 0d 9h 56m
      - ✓ **Distance from Sun:** 778.5 million km
      - ✓ **Age:** 4.603 billion years

- ✓ **Orbital period**: 12 years
- ✓ **Natural satellites**:Io, Europa, Ganymede, and Callisto(called the Galilean satellites because Galileo discovered them.)

- **Saturn (shani)**
  - ✓ **Saturn's rings** are probably made up of billions of **particles of ice and ice-covered rocks.**
  - ✓ **Length of day:** 0d 10h 42m
  - ✓ **Distance from Sun:** 1.434 billion km
  - ✓ **Orbital period:** 29 years
  - ✓ **Moons:** Titan, Enceladus, Mimas, Tethys, etc.
  - ✓ **Titan** is the **second-largest moon** in the Solar System (larger than Mercury)
  - ✓ **Only satellite** in the Solar System with a **substantial atmosphere** (nitrogen-rich).
- **Uranus(arun)**
  - ✓ **Rotates** in clockwise direction i;e opposite of the sun's rotation.
  - ✓ **Length of day:** 0d 17h 14m
  - ✓ **Distance from Sun**: 2.871 billion km
  - ✓ **Orbital period:** 84 Years
  - ✓ **Natural satellites**:Miranda, Ariel, Umbriel, Titania, and Oberon.
- **Neptune(Varun)**
  - ✓ **Farthest** known planet
  - ✓ Uranus and Neptune are called **Twin planets**.
  - ✓ **strongest sustained winds** (2,100 km/h) of any planet in the Solar System found here.
  - ✓ **Length of day:** 0d 16h 6m
  - ✓ **Distance from Sun:** 4.495 billion km
  - ✓ **Orbital period:** 165 years
  - ✓ **Natural satellites:** Triton, Hippocamp, Proteus, Nereid,etc.

Asteroids

- The asteroid belt is a **ring of asteroids .**
- **Planetary leftovers** that orbit the Sun in the region **between Mars and Jupiter.**
- These **leftovers failed to consolidate** due to Jupiter's **gravitational influence.**
- These are mostly made up of **refractory stony and metallic materials, with some ice.**
- Asteroids might be **hundreds of kilometres wide or microscopic in size.**
- **Except for Ceres, all asteroids** are considered as **tiny** Solar System bodies.
- **Ceres :** The **largest asteroid** (946 km in diameter), a protoplanet, and a dwarf planet.
- **Kuiper Belt:** A **circumstellar disc in the outer Solar System** that spans 30 AU from Neptune's orbit to around 50 AU from the Sun.

Comets

- An **ice tiny Solar System body** that warms up due to solar radiation begins to **release gases** (called Outgassing) producing a **visible atmosphere or coma, and sometimes also a tail.**
- **Planets** have **near-circular orbits**, whereas **comets** have very **elliptical orbits.**

- They are made up of microscopic fragments of **stony and metallic minerals held** together **by frozen gases** (water, ammonia, methane, and carbon dioxide).
- **Short-period comets** with an **orbital period of 100 years** generally **originate** in the **Kuiper belt.**
- **Long period comets** orbits of **thousands of years,** come from the more distant **Oort Cloud.**
    - **Oort cloud** is a giant shell of icy bodies that **encircle the solar system** occupying space at a distance between 5,000 and 100,000 AU.
- The orbit of **Halley's Comet** brings it close to the Earth every **76 years.** It was last visited in **1986**.

Meteoroid, Meteor and Meteorite

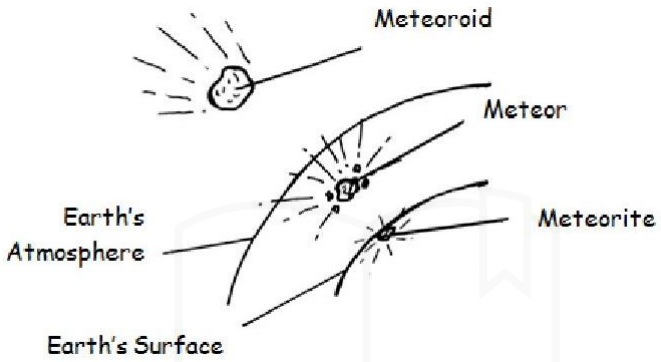


Fig: Meteoroid, Meteor and Meteorite

- **Meteoroid:** Any **solid debris** originating **from asteroids**, comets, or other astronomical objects that **drifts across interplanetary space.**
- **Meteor:** A **flash of light** that emerges in the sky when a **meteoroid hits the atmosphere** (mesosphere) at a high speed and **burns up due to friction**. **sometimes known as a 'shooting star' or a 'falling star.'**
- **Meteorite:** situations in which the **meteoroid does not entirely burn up** and lands on the surface of the Earth.
    - A **meteorite crater** is a circular **depression generated on the earth's surface** as a result of a **meteorite impact.**
    - Meteorite impacts are prevalent on all of the solar system's planets and moons.
    - The most **visible meteorite craters** may be seen on the **Moon and Mercury's surfaces** (because they are geologically inactive due to a negligible atmosphere).
- The **World's Largest Meteor Crater**: 1,300 metres deep Arizona(US).It dates back over 10,000 years.
- **Meteorite craters in India**
    - **Lonar Lake** (1.8 km in diameter) in Buldhana District of **Maharashtra.**
    - **Dhala crater** (14 km in diameter) in Shivpuri district, **Madhya Pradesh.**
    - **Ramgarh crater** (3.5 km in diameter) is a **potential meteorite** crater in Kota plateau in **Rajasthan**.

Meteor Showers

- **Meteors** are **Particles of rock and ice** that are Released by comets as they Move in their orbits around the sun.
- **Meteor showers,** on the other hand, **occur when the Earth passes through a comet's or asteroid's debris track.**

- A **meteorite** is a **meteor** that has landed **on Earth**, while a **meteor shower** is a **group of meteorites** that have **collided at the same time.**
- The **resistance by the atmosphere c**auses the **space rock to become extremely hot** as it approaches the Earth, and while passing through the atmosphere it leaves behind a **streak of hot luminous gas** that is visible to onlookers rather than the rock itself.

2

CHAPTER

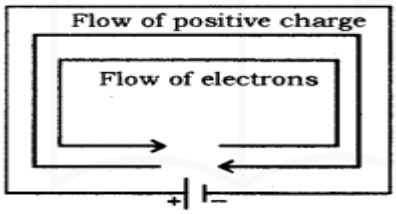
ELECTRICITY

- A controllable and convenient **form of energy** used in homes, schools, hospitals, industries,etc **for operating devices**.

Electric charge

- **Fundamental unit of electricity** (without charge, no electricity).
- **2 types:** Positive & Negative.
- **SI Unit**: Coulomb

Electric current



Conventional flow of electric charge.

- **Rate of flow of electric charges.**
- **Caused by moving electrons** through a conductor.
- **Flows** in the **opposite direction** to the **movement** of **electrons**.

$I = \frac{Q}{t}$ Where,

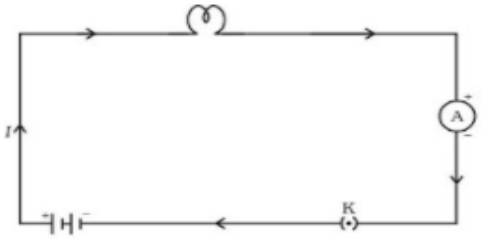
I= Electric current

Q= Electric charge

t= time

- **Unit** - ampere (A)
- **Measured**: Ammeter

Electric circuit



- **Closed conducting path** through which **current flows**.

Potential Difference

- **Work done to move a unit charge from one point to the other** within an electric field.

$$V = \frac{W}{Q}$$

- **SI unit:** volt (V)
- **When** the **cell** is **connected to** a **conducting circuit element**, the potential difference sets the charges in motion in the conductor and produces an electric current.

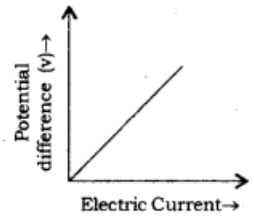
OHM'S LAW

- **Potential difference** between **two points** is **directly proportional** to **electric current**, at a **constant temperature**.

  $V \propto I$

  V = RI

  I = V/ R



- Here, R is the constant k/a resistance.

Resistance

- **Property** of a conductor to **resist flow of charges** through it.
- **SI Unit:** Ohm (Ω).

> **1 Ohm of resistance (R)**
> Equal to flow of 1A of current through a conductor between two points having a potential difference equal to 1V.

Factors on which Resistance of a Conductor depends:

1. **Nature of Material:**
   - **Conductors** & **insulators**.
   - **Silver** - best conductor of electricity.
2. **Length of Conductor:**
   - **Resistance increases** with **increase** in **length** of the conductor.
3. **Area of Cross Section:**
   - **Resistance decreases** with an **increase** in **area** of conductor and **vice versa**.

Resistivity

- **Resistance offered by a cube of a material** of side 1m **when current flows perpendicular to its opposite faces.**
- **SI unit** - ohm-meter (Ωm).
- **aka** specific resistance.
- **Depends** on the **nature of** the **material** of the conductor.
- **Varies** with **temperature**.

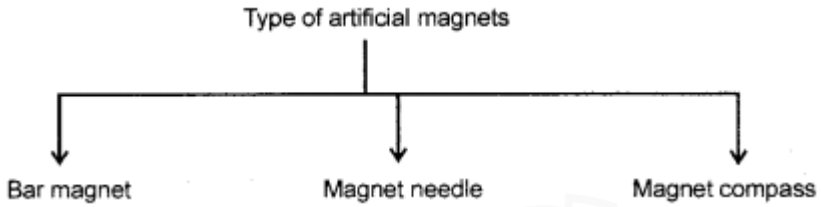
Heating Effect of Electric Current

- **When electric current passes** through a **purely resistive conductor**, **energy** of electric current is **dissipated** `entirely in the **form of heat** and as a result, **resistor gets heated**.
- **Eg**. light bulb

3
CHAPTER

MAGNETISM

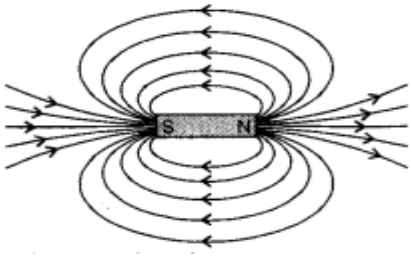
Magnet



- An **object that attracts objects** made **of iron**, **cobalt** and **nickel**.
- **Use**:
  - in refrigerators.
  - in radio and stereo speakers.
  - in audio and video cassette players.
  - in children's toys and;
  - on hard discs and floppies of computers.
- **Properties**:
  - A **freely suspended magnet** always **points** towards **north** and **south** direction.
  - **Pole** which points **toward north** direction **-north pole**.
  - **Pole** which points **toward south** direction - **south pole**.
  - **Like poles repel** each other while **unlike poles attract** each other.

Magnetic field

- **Influence of force surrounding** a **magnet**.
- **Force exerted** by a magnet in a magnetic field **detected using** a **compass** or any **other magnet**.
- **Represented** by **magnetic field lines**.



- A **quantity** that has **both direction** and **magnitude**.
- **Properties**:
  - **Inside magnet** - direction of field lines- **south pole to north pole**. Thus magnetic field lines are **closed curves.**
  - **Relative strength** of magnetic field is **shown by** degree of **closeness of field lines**.
  - **No two field-lines cross** each other.