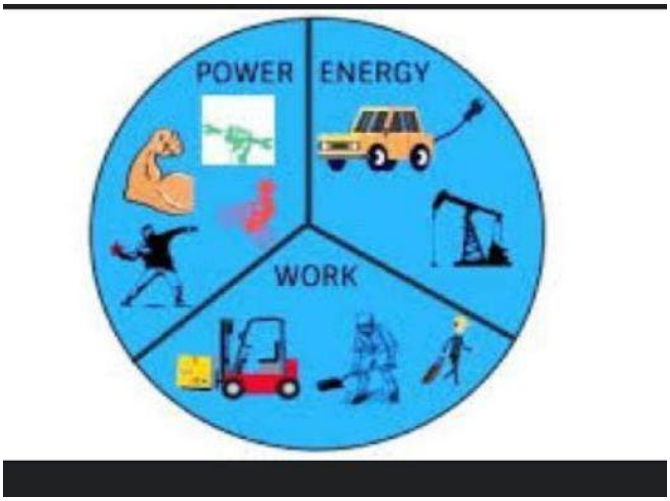
week 1 -2

WORK ENERGY AND POWER



Work is defined as the product of force and the distance moved in the direction

of force. This means that work is said to be done when a force moves a body in

its direction.Using formula Work =force (F) x distance (d)

Work= Fxd.the unit of work is joules (J)

Examples

1.Calulate the work done when a box of 2 kg is raised through a vertical height of 5m.

Acceleration due to gravity= 10 m/s')

Solution.

Mass= 2 kg, acceleration = 10 m/s Distance =5 m

work done =mx axd . work = 2 x 10 x5

work = 20x5

work = 100 J

POWER

Power is define as the rate of doing work.it can be express as power= Work done /time taken.

The unit of power is watts(W)

1 What is the power of a student that has done a work of 80 J in 8 seconds?

Solution

Work= 80 J, Time=8secods

Power =work/time power=80J/8sec ,power=10 watts

ENERGY.

Energy

Mechanical energy is the form of energy which a body has because of its position or motion. There are two forms of mechanical energy:

1. Potential energy (P.E):This is the energy a body has because of its position or height above

the ground. For example, if you raise your school bag 10 m high, it now has potential energy.

Potential energy (P.E) =mass of object× acceleration due to gravity × height or distance.

P.E=mgh

Worked examples

1. If a ball of 50 kg falls from a height 20 m to the ground. Calculate the P.E (g=10 m/s).

Solution

Given that h=20, m= 50 kg, g=10 m/s

P.E= mgh = 50 x 10 x 20 P.E= 10,000 J

2. Kinetic energy (P.E):This is the energy a body has because it is in motion, e.g. a flowing stream, air , rolling ball and moving car.

Kinetic energy (K .E) = $^{1}/_{2}$mv2

Example.A student of mass 60 kg walks home every day after school at a velocity of

10 m/s. What is its K.E?

Solution . Given that m=60kg V=10m/s

K.E=1/2m×v2

K.E=1/2×60×10×10

K.E=3000J.

Assignment

1.A car of weight 300 N moved through a distance of 10 m when pushed

by three students.Calculate the work done by the three students.

2. A lift carries 3 people of average weight 120 N to a height of 6 m in 60seconds. Calculate the power needed to do this.

week 3

CRUDE OIL AND PETROCHEMICAL

Crude oil is is also called petroleum which means rock oil in latin.crude oil is define as a naturally occurring dark,sticky viscous liquid found in huge underground deposits. It is formed from the remains of marine algae (plants) and animals.crude oil can be refined to obtain some chemicals called petrochemical.petrochemicals are products of crude oil examples are plastics products, polythene, detergent and chemicals for making paints, pesticides and drugs.Crude oil is composed of hydrocarbon, natural gas, bitumen,

Refining of crude oil

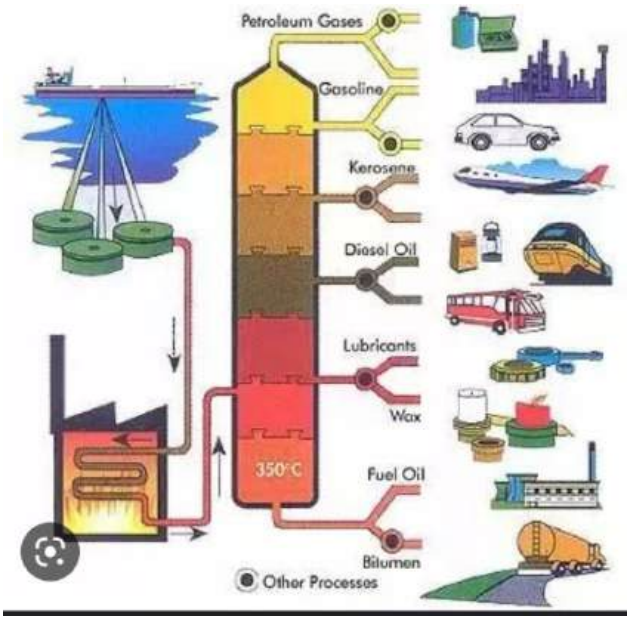
After obtaining crude oil from its source,it is transported to a refinery where it can be refined to make useful fuels and chemicals. Refining of crude oil involves three stages. These are

1.Separation

2.Conversion

3. Purification.

Crude oil can be separated by fractional distillation.it is a method that makes used of the difference in boiling point to split mixture into it's components.the fractions includes



1.Natural gas

2.gasoline

3.Kerosene

4.fuel oil

5.lubricants

6.bitumen

Uses of petrochemicals

petrochemicals are used as raw materials for different kinds of products in industries. These products include:

1. Pesticides 2. Insecticide 3. Fertilisers 4. Detergents 5. Plastics 6. Cosmetics 7. Paint materials 8. Rubber materials 9. Fibre materials 10. Food additives

Benefits or importance of crude oil and petrochemicals

Crude oil and petrochemicals help to improve the economy of many countries. In Nigeria, for instance, crude oil is our major source of revenue. Apart from fund generation for the country,the following are their benefits to the nation and individuals.

1. International relation

2.Employment

3.Revenue generation

4.As sources of energy

5.National building

week 4 -5

SOIL AND TYPES

Soil can be define as the top layer of the earth's crust on which plants grow.

soil is a mixture that contains minerals, organic matter, and living organisms. But broadly speaking, soil can refer to any loose sediment

There are many types of soil that are distributed around the world and these are generally classified into the following:

1.Clay Soil

2. Sandy soil

3. Loamy Soil

Component of the soil

1.Inorganic or mineral matter 45%

2. Organic matter 5%

3. Soil water 25%

4. Soil air 25%

5. Living Organism is negligible

Soil is formed by weathering of rocks.

WHAT IS WEATHERING?

Weathering is the breaking down or dissolving of rocks ,soil and minerals on the surface of the earth. Solid rock can weather away in one of the three ways into the soil, namely:

1.Mechanical Weathering

2. Chemical Weathering

3. Biological Weathering

Mechanical Weathering

This is commonly observed near the surface of the earth. Also called physical weathering, as this process is influenced by physical forces such as wind, water and temperature.

Chemical Weathering

chemical weathering occurs when rocks are broken down by chemical reactions. Often, such types of weathering can change the chemical composition of the soil.

Biological Weathering

Though not an actual weathering process, living organisms weaken and subsequently disintegrate rocks, often by initiating mechanical or chemical weathering. For instance, tree roots can grow into cracks in the rock, prying them apart and causing mechanical fractures. Microorganisms can secrete chemicals that can increase the rock's susceptibility to weathering.

Importance of Soil

Soil is an important element essential for the survival of living organisms.

1.The fertile soil helps in the growth and development of the plants.

2. It supports many life forms including bacteria, fungi, algae, etc. These microbes, in turn, maintain environmental balance by retaining the moisture and decaying the dead organisms.

3. The topsoil supports certain life activities such as reproduction, hatching, nesting, breeding, etc.

4. The organic matter present in the soil increases the fertility of the soil which is responsible for the growth of the plants.

5. Soil is used for making cups, utensils, tiles, etc. The contents in the soil such as gravel, clay and sand are used in the construction of homes, roads, buildings, etc.

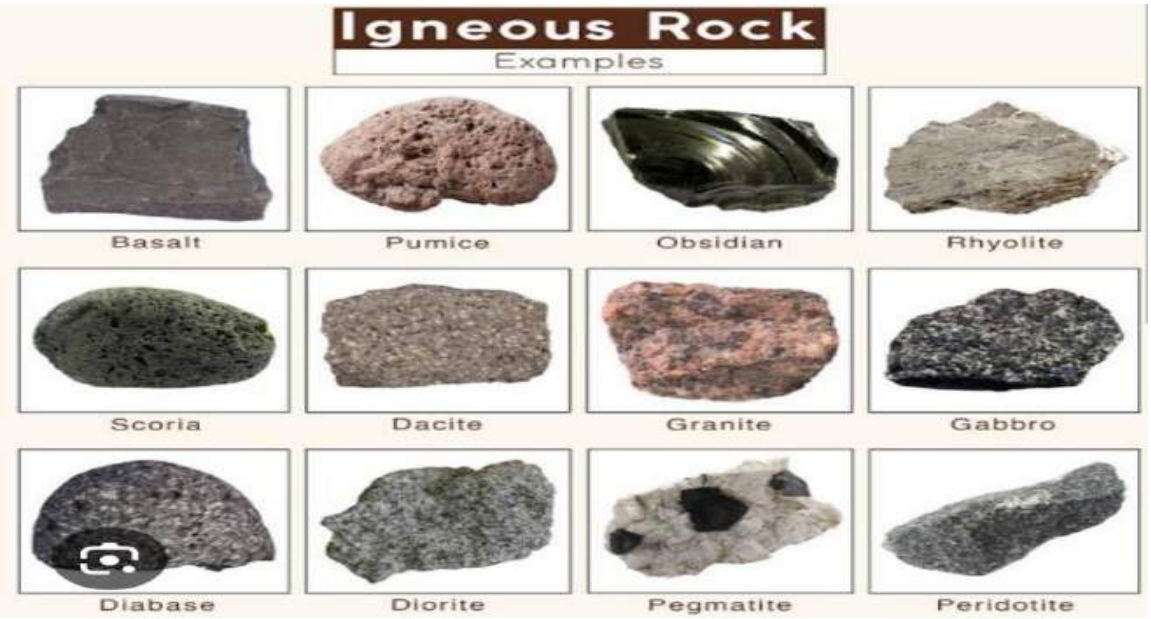
ROCKS

Rocks is any mineral material of the earth.there are mineral aggregates with a combination of silica which contains silicon and oxygen.

Types of Rocks

There are three types of rocks:

1. Igneous rock:Igneous rock is formed through the cooling and solidification of magma or lava. Igneous rock may form with or without crystallisation, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) examples Basalt ,Diorite ,Granite Mica and quartz.



2. Sedimentary Rock

The sedimentary rocks are formed by the deposition and subsequent cementation of that material within bodies of water and at the surface of the earth. The process that causes various organic materials and minerals to settle in a place is termed sedimentation.Sedimentary Rock Examples Halite ,Limestone,Sandstone ,Siltstone

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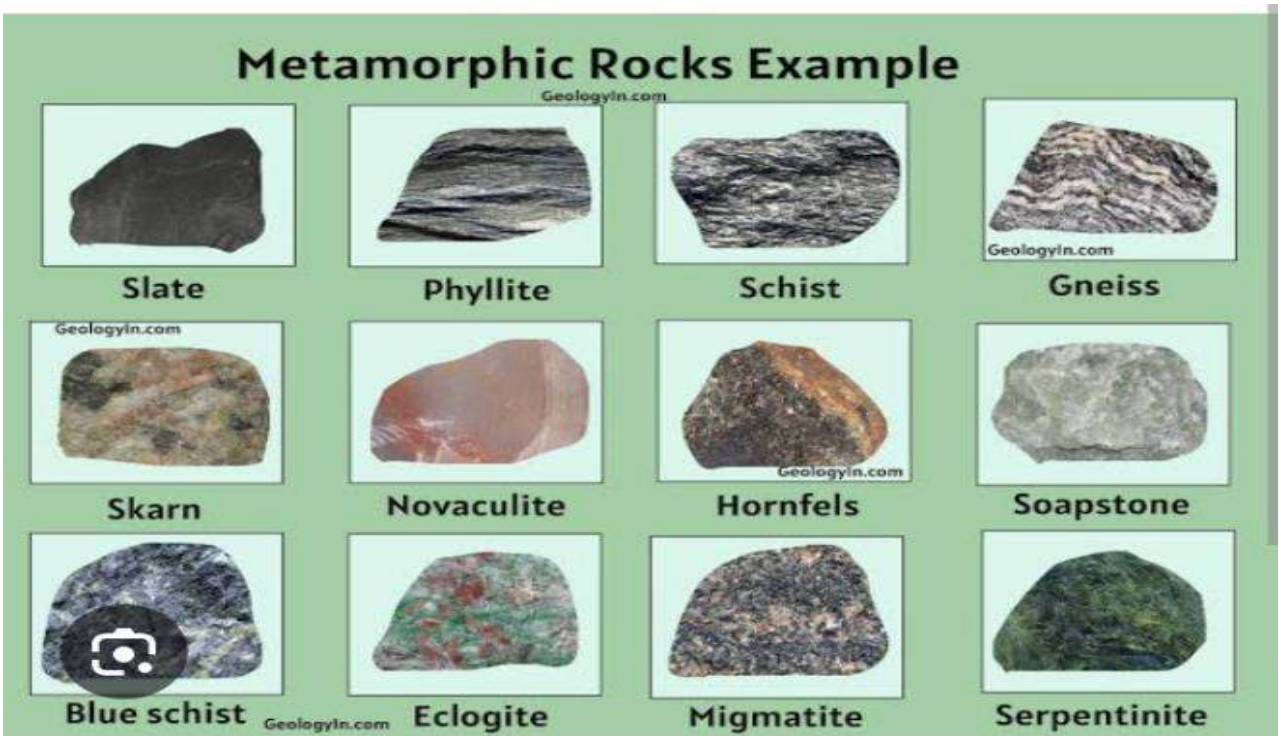
3. Metamorphic Rocks

The metamorphic rocks make up a large part of the Earth's crust and are classified by texture and by chemical and mineral assemblage. They may be formed simply by being deep beneath the Earth's surface, subjected to high temperatures and the great pressure of the rock layers.

Metamorphic Rock Examples Marble ,Quartzite ,Slate,Phyllite



Importance of rock

1.rock serves as industrial raw material.

2. Rocks serve as source of fuel

3. Soil are formed from the disintegrations of rocks

4.rocks are sources of metals which are derived from mines eg gold,silver,iron aluminum and copper.

5. Rocks serve as mineral nutrients.rock salt such as table salt is from sedimentary rock and is used in cooking.

Soil conservation and soil erosion

Soil Conservation is a combination of practices used to protect the soil from degradation.

REASONS TO PRACTICE SOIL CONSERVATION

1. To maintain an adequate amount of organic matter and biological life in the soil. These two components account for 90 to 95 percent of the total soil productivity.

2. To ensure a secure food supply at reasonable prices. Soil conservation is proven to increase the quality and quantity of crop yields over the long term because it keeps topsoil in its place and preserves the long term productivity of the soil.

3. To grow enough food not only for ourselves; but also for people in third would countries where there are food shortages.

4. To save farmers money. Erosion is currently costing farmers over million a year in lost income due to lower crop yields, and the loss of nutrients from the soil.

5. To save citizens money.

6.To improve water quality. All forms of life need clean water to survive. Agricultural and urban soil erosion are major sources of sedimentation and contamination of water supplies.

7. To improve wildlife habitat.

SOIL CONSERVATION TECHNIQUES

The following practices helps soil conservation

1.crop rotation

2.Reduce tillage

3 . Mulching

4.cover cropping

5.farmers should increase soil organic content.

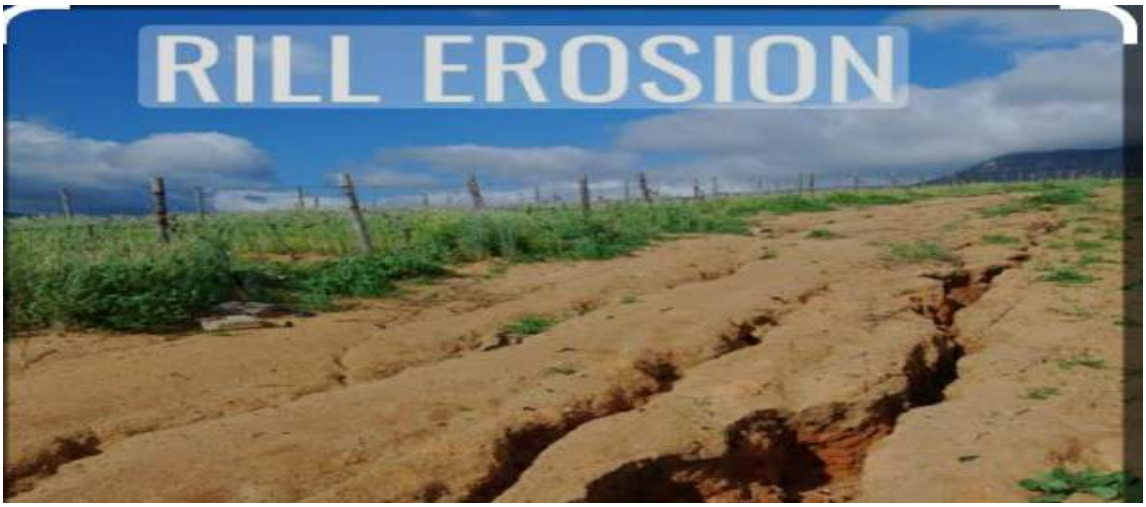
Soil Erosion

Soil erosion is the natural process in which the topsoil of a field is carried away by physical sources such as wind and water.

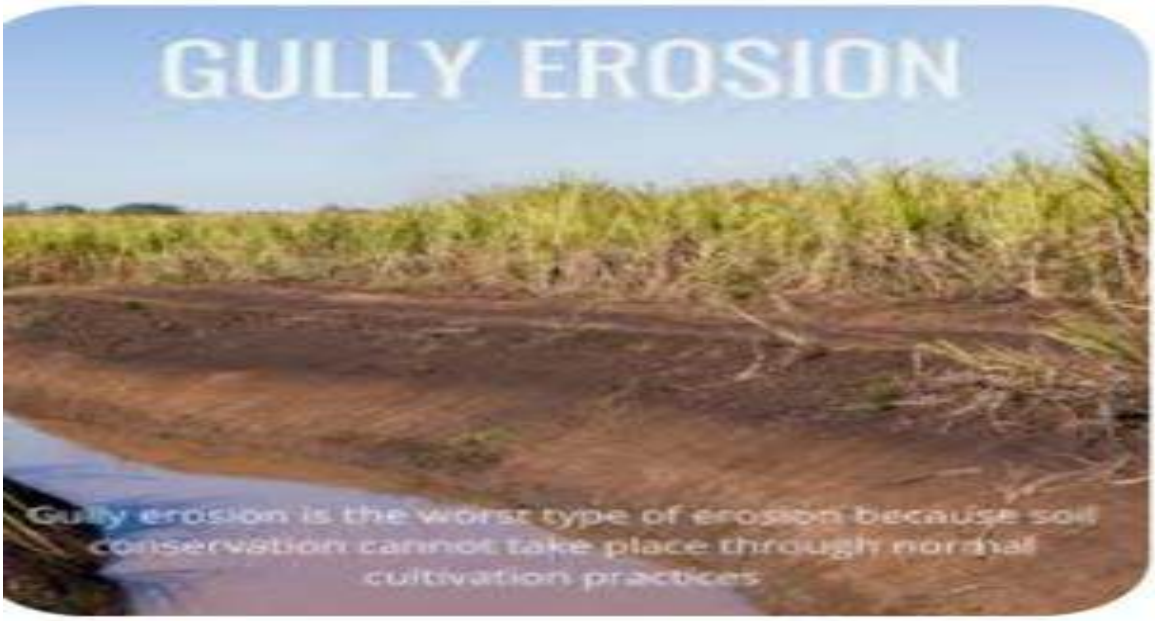
Soil erosion is a continuous process that occurs either slowly or at an alarming rate. It results in a continuous loss of topsoil, ecological degradation, soil collapse, etc.

Types of soil erosion

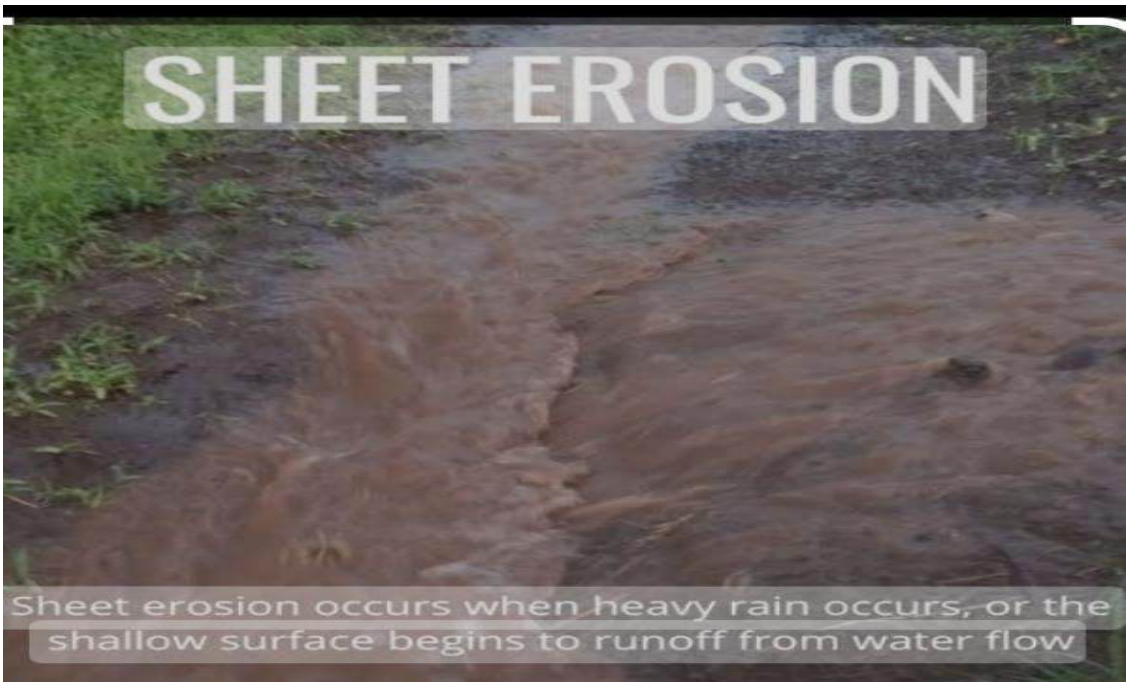
1. Rill erosion



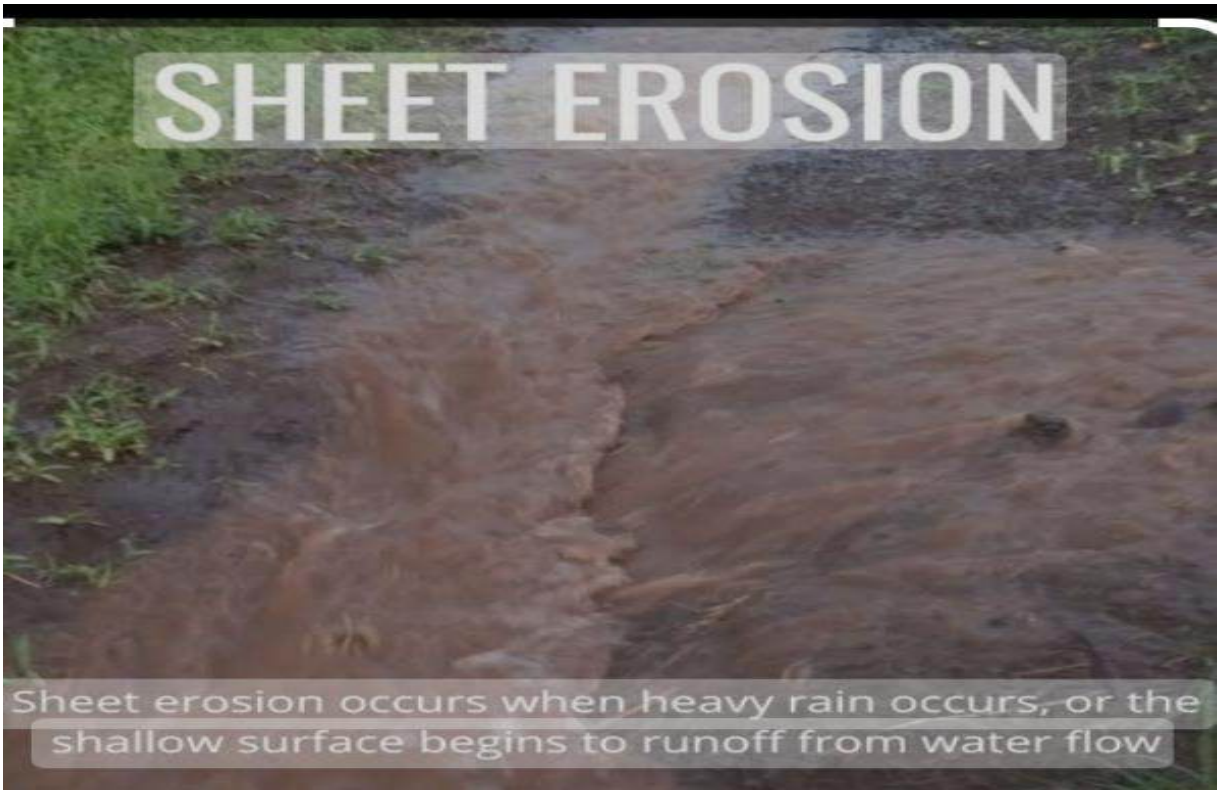
2. Gully erosion



3. Sheet erosion



4. Splash erosion



Cause of Soil Erosion

Following are the important causes of soil erosion:

1. Rainfall and Flooding

Higher intensity of rainstorms is the main cause of soil erosion. Four types of soil erosion are caused by rainfall,Rill erosion,Gully erosion,Sheet erosion,Splash erosion

The raindrops disperse the soil, which is then washed away into the nearby streams and rivers. Regions with very heavy and frequent rainfall face a large amount of soil loss. The flowing water during floods also erodes a lot of soil by creating potholes, rock-cut basins, etc.

2. Agriculture

The farming practices are the major cause of soil erosion. The agricultural activities disturb the ground. The trees are cleared and the land is ploughed to sow new seeds. Since most of the crops are grown during the spring season, the land lies fallow during winters. Most of the soil is eroded during winters. the tyres of tractors make grooves on the land, making a natural pathway for water. Fine soil particles are eroded by wind.

3. Grazing

The grazing animals feed on the grasses and remove the vegetation from the land. Their hooves churn up the soil. They also pull out plants by their roots. This loosens the soil and makes it more prone to erosion.

4. Construction

The construction of roads and buildings exposes the soil to erosion. The forests and grasslands are cleared for construction purposes, which exposes the soil making it vulnerable to erosion.

5. Rivers and Streams

The flowing rivers and streams carry away the soil particles leading to a V-shaped erosion activity.

6. Heavy Winds

During dry weather or in the semi-arid regions, the minute soil particles are carried away by the wind to faraway lands. This degrades the soil and results in desertification.

Effects of Soil Erosion

The major effects of soil erosion include:

1. Loss of Arable Land

Soil erosion removes the top fertile layer of the soil. This layer is rich in the essential nutrients required by the plants and the soil. The degraded soil does not support crop production and leads to low crop productivity.

2. Desertification

Soil erosion is a major factor for desertification. It transforms the habitable regions into deserts. Deforestation and destructive use of land worsens the situation. This also leads to loss of biodiversity, degradation of the soil, and alteration in the ecosystem.

3.Destruction of Infrastructure

The accumulation of soil sediments in dams and along the banks can reduce their efficiency. Thus, it affects infrastructural projects such as dams, embankments, and drainage.

Soil Erosion Prevention

Soil erosion is a serious environmental issue. Steps should be taken to curb this problem. Following are some of the methods of soil erosion prevention:

1.planting of cover crops

2. Mulching

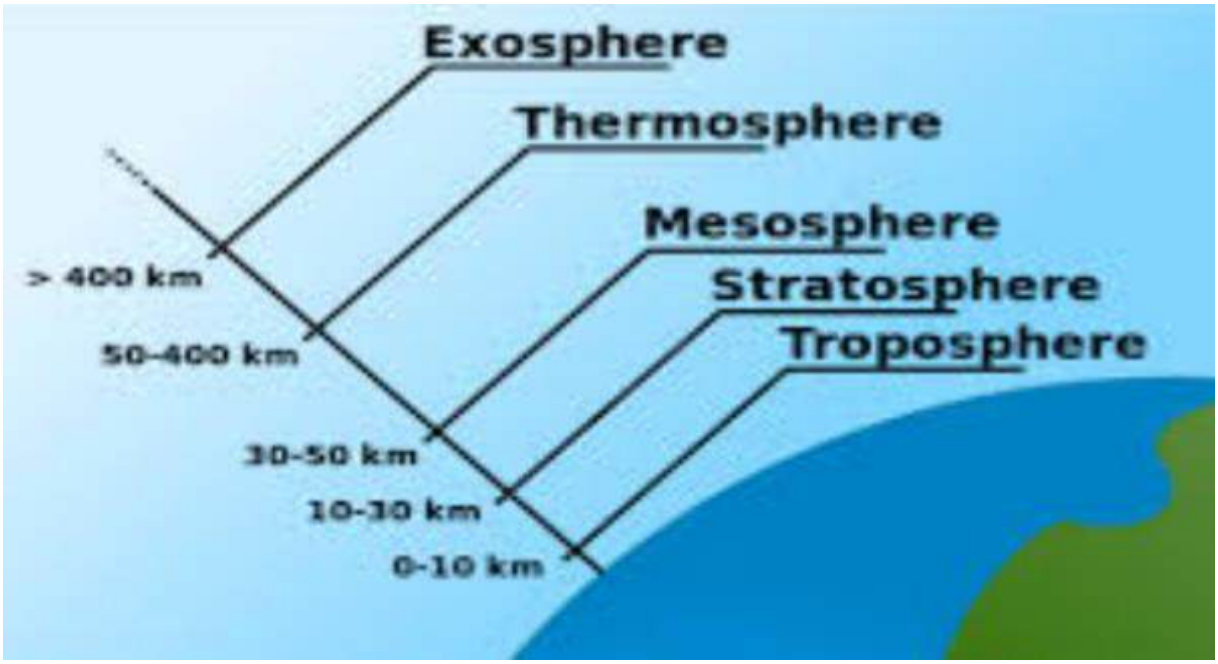
3. Planting of trees and grasses (afforestation)

4. Making of ridges along slopes

5. Terracing (a series of ridges or steps that looks like staircase)

Week 6 Note

The atmosphere



Atmosphere is a blanket of gases that surrounds Earth.

It is held near the surface of the planet by Earth's gravitational attraction. Argon, oxygen and nitrogen from the three main constituents of the atmosphere.

"Atmosphere is a protective layer of gases that shelters all life on Earth, keeping temperatures within a relatively small range and blocking out harmful rays of sunlight."

Features of the Atmosphere:

1. Helps retain the sun's heat and prevents it from escaping back into space.

2. Protects life from harmful radiation from the sun.

3. Plays a major role in Earth's water cycle.

4. Helps keep the climate on Earth moderate.

Layers of Atmosphere

The atmosphere has five distinct layers that are determined by the changes in temperature that happen with increasing altitude. Layers of Earth’s atmosphere are divided into five different layers as:

1. Exosphere
2. Thermosphere
3. Mesosphere
4. Stratosphere
5. Troposphere

Layers of Earth's Atmosphere

The hierarchical arrangement of various layers of the Earth’s atmosphere

Troposphere

The troposphere is the lowest layer in the atmosphere. It extends upward to about 10 km above sea level starting from ground level. The lowest part of the troposphere is called the boundary layer and the topmost layer is called the tropopause. The troposphere contains 75% of all air in the atmosphere. Most clouds appear in this layer because 99% of the water vapour in the atmosphere is found here.

Stratosphere

Above the troposphere lies the stratosphere which extends from the top of the troposphere to about 50 km (31 miles) above the ground. The ozone layer lies within the stratosphere. Ozone molecules in this layer absorb high-energy ultraviolet (UV) light from the Sun and convert it into heat. Because of this, unlike the troposphere, the stratosphere gets warmer the higher you go!

Mesosphere

Above the stratosphere is the mesosphere and it extends to a height of about 85 km (53 miles) from the ground. Here, the temperature grows colder as you rise up through the mesosphere. The coldest parts of our atmosphere are located in this layer and can reach –90°C.

Thermosphere

Thermosphere lies above the mesosphere and this is a region where the temperature increases as you go higher up. The temperature increase is caused due to the absorption of energetic ultraviolet and X-ray radiation from the sun. However, the air in this layer is so thin that it would feel freezing cold to us! Satellites orbit Earth within the thermosphere. Temperatures in the upper thermosphere can range from about 500° C to 2,000° C or higher. The aurora, the Northern Lights and Southern Lights, occur in the thermosphere.

Exosphere

Exosphere is the final frontier of the Earth's gaseous envelope. The air in the exosphere is constantly but gradually leaking out of the Earth's atmosphere into outer space. There is no clear cut upper boundary where the exosphere finally fades away into space.

Ionosphere

The ionosphere isn't a distinct layer unlike other layers in the atmosphere. The ionosphere is a series of regions in parts of the mesosphere and thermosphere where high-energy radiation from the Sun has knocked electrons loose from their parent atoms and molecules.

Summary of Layers of Atmosphere

Region.	(km)	Temperature Range	Important Characteristics
Troposphere	0-10	15 to -56	Weather occurs here

Stratosphere	10-50	-56 to -2	The ozone layer is present here
Mesosphere	50-85	-2 to -92	Meteors burn in this layer
Thermosphere	85-800.	-92 to 1200	Auroras occur here

Week 8

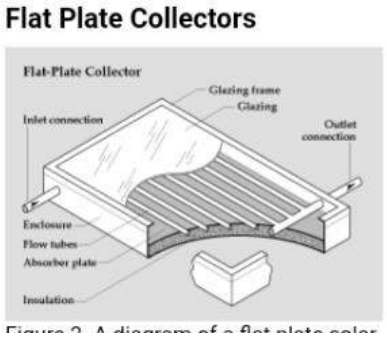
SOLAR COLLECTOR

A solar collector is a device that collects or concentrates solar radiations from the sun.There collectors are generally mounted on the roof and must be very sturdy as they are exposed to variety of weather conditions.

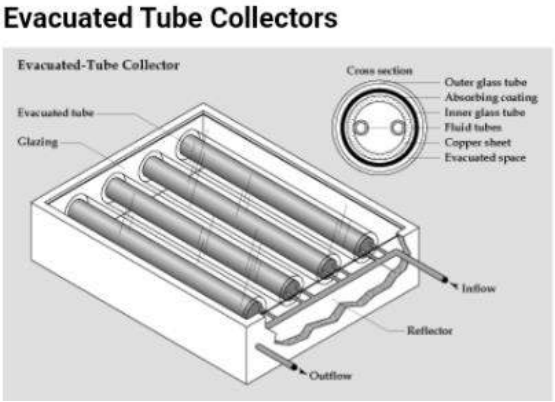
TYPES OF SOLAR COLLECTOR

There are many different types of solar collectors but all of them are constructed with thesame basic premise in mind

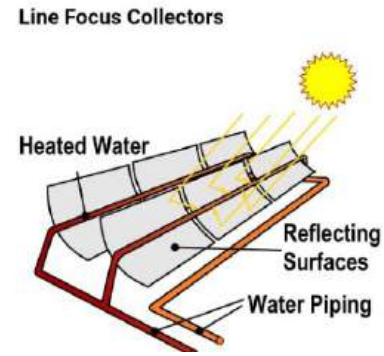
1. Flate plate collectors : These collectors are simply metal boxes that acts as a heat exchanger.It can gather solar energy and use it to heat water in the house for bathing ,washing and also to heat hot tubs and swimming pools



2. Evacuated tube collectors : This type of device that uses a series of evacuted tubes to heat water for use. The application of these tubes is to minimise heat loss.



3. Line focus collectors :These collectors uses highly reflective materials to collect and concentrate the heat energy from solar radiation.They are used to generate steam for solar thermal power plants .



4.Point focus collectors: These collector are large parabolic dishes composed of some reflective material that focus the sun's energy onto a single point .The heat from these collector is used for driving stirling engines or a gas turbine to produce electricity.

WEEK 9

BIOTIC AND ABIOTIC FACTORS

Biotic Factors

Biotic factors relate to all the living things in the ecosystem.Biotic factors refer to all living organisms from animals and humans, to plants, fungi, and bacteria. The interactions between various biotic factors are necessary for the reproduction of each species and to fulfil essential requirements like food, etc.

Examples of biotic factors include all the living components present in an ecosystem. These include producers, consumers, decomposers and detritivores.

Abiotic Meaning.

Abiotic Factors

Abiotic factors refer to all the non-living, i.e. chemical and physical factors present in the atmosphere, hydrosphere, and lithosphere. Sunlight, air, precipitation, minerals, and soil are some examples of abiotic factors. These factors have a significant impact on the survival and reproduction of species in an ecosystem.

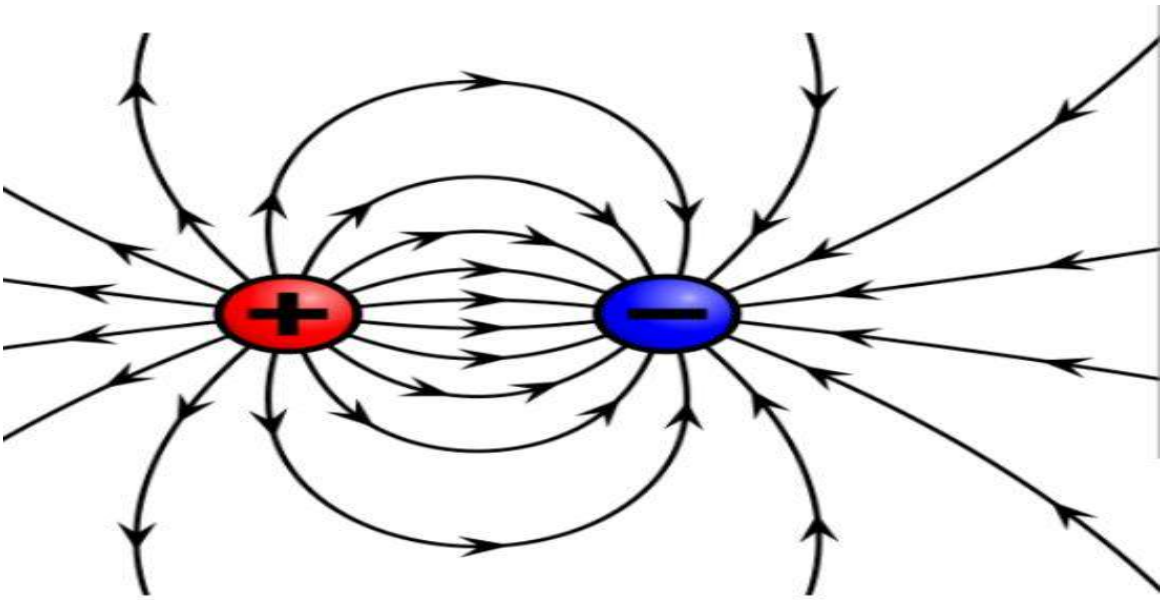
Examples of Abiotic Factors

Abiotic examples typically depend on the type of ecosystem. For instance, abiotic components in a terrestrial ecosystem include air, weather, water, temperature, humidity, altitude, the pH level of soil, type of soil and more. Abiotic examples in an aquatic ecosystem include water salinity, oxygen levels, pH levels, water flow rate, water depth and temperature.

week 10-11

Electric Charge Definition

Electric charge can be defined as a fundamental property of subatomic particles that gives rise to the phenomenon of experiencing force in the presence of electric and magnetic fields. These fields exert influence on charged particles, resulting in observable effects.



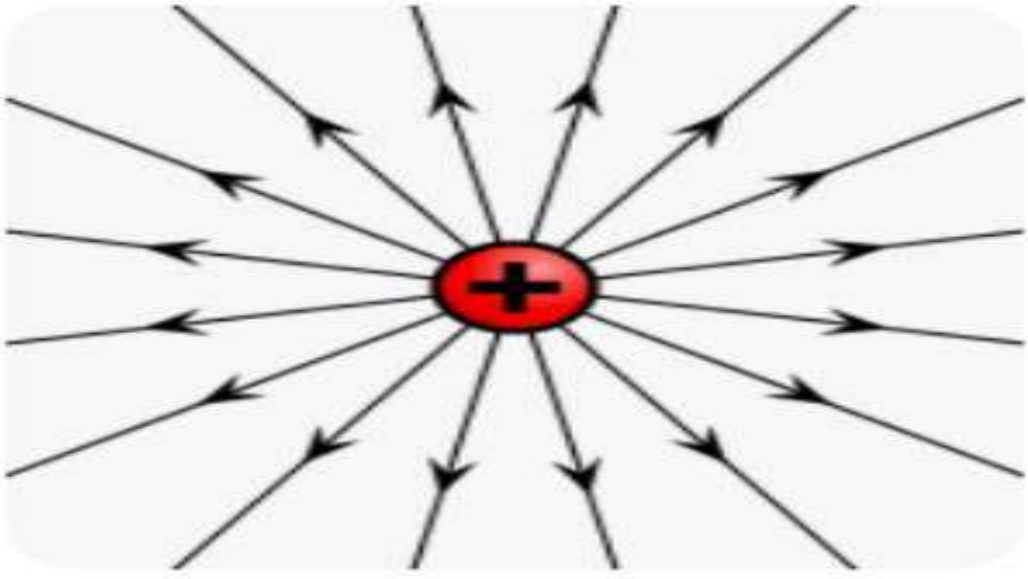
Types of Electric Charge

Electric charge comes in two main types:

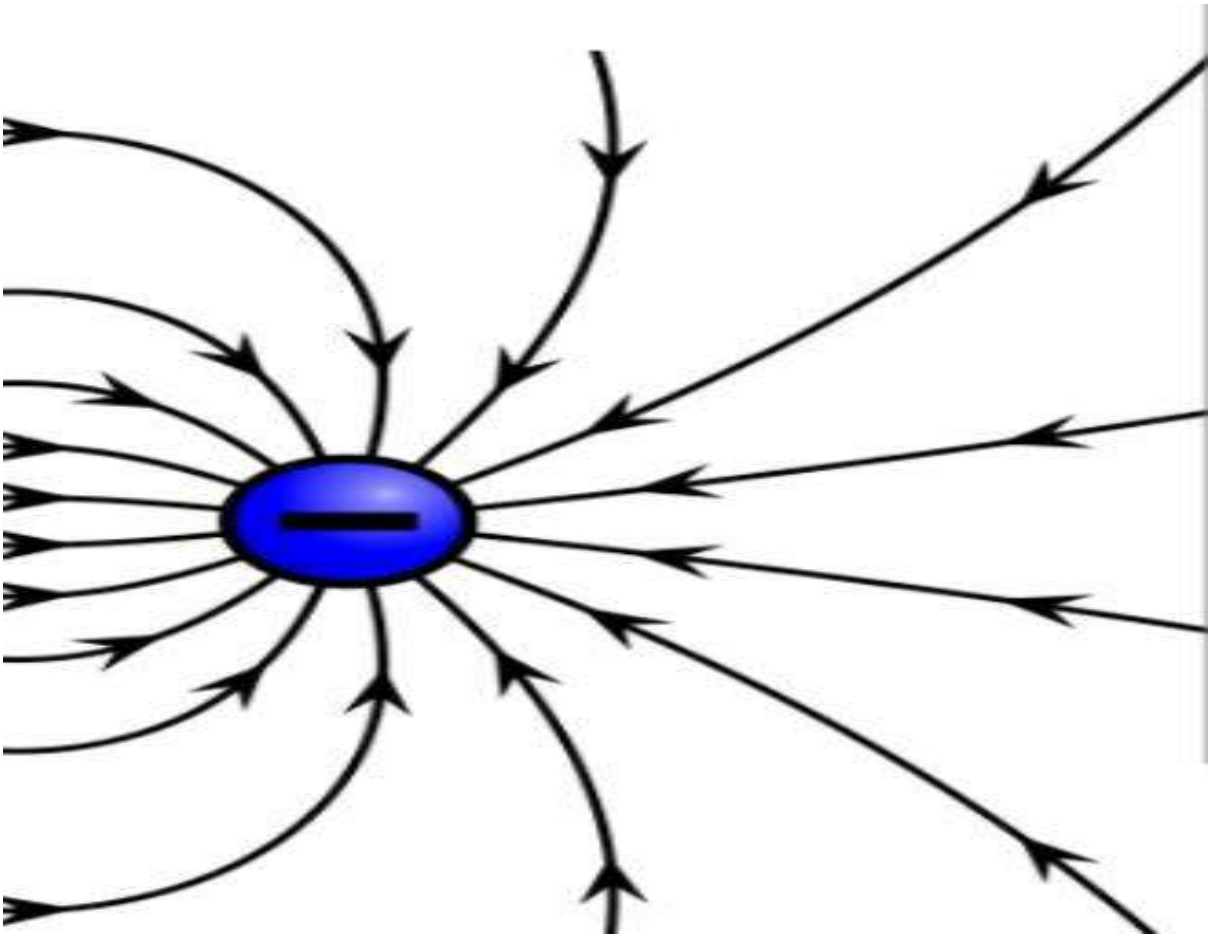
1. positive charge

2. negative charges.

Positive charges are associated with protons, which are subatomic particles residing in the nucleus of an atom. They are represented by the symbol “+”.



Negative charges are linked to electrons, which orbit the atomic nucleus and are denoted by the symbol (-)



Opposite charges, such as positive and negative, attract each other, while like charges, such as positive and positive or negative and negative, repel each other. This fundamental principle is the foundation for various concepts in electromagnetism and is pivotal in understanding the interaction of charged particles.

Electric Charge

When an object carries a negative charge, it possesses an excess of electrons compared to protons. Conversely, a positive charge indicates an excess of protons relative to electrons.

It's important to note that when an equal number of positive and negative charges are present, they cancel each other out, resulting in a neutral state for the object.

Note: In the context of electric charge, the terms "attraction" and "repulsion" are used to describe how charges interact with each other.

Measuring Electric Charge

Coloumb is the unit of electric charge.

“One coulomb is the quantity of charge transferred in one second.”

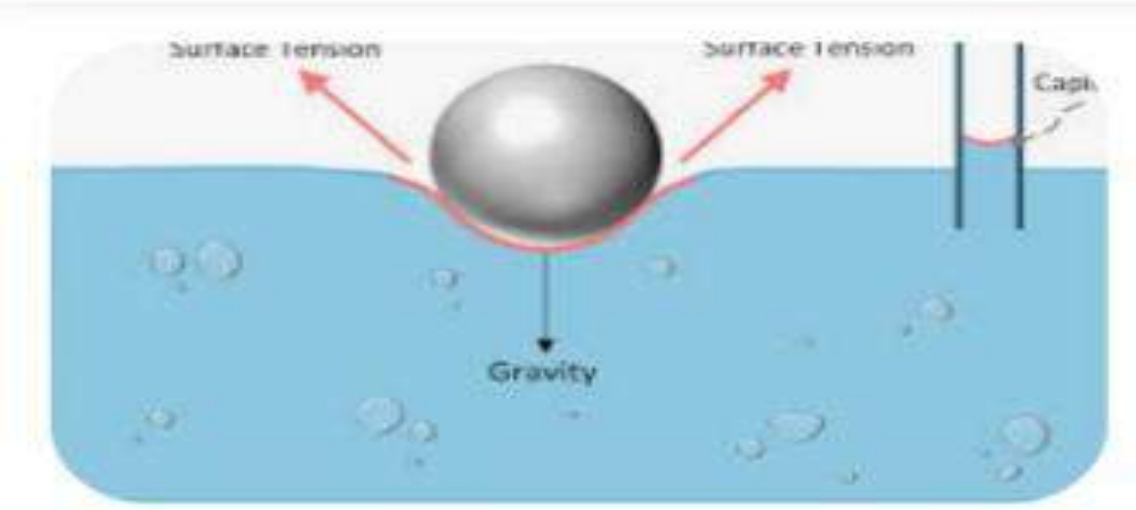
Mathematically, the definition of a coloumb is represented as:

$$Q = I.t$$

In the equation, Q is the electric charge, I is the electric current and t is the time.

What is Surface Tension?

Surface tension is the amount of energy required to increase the surface of the liquid by unit area. In other words, it is also the property of the liquid surface that resists force. Intuitively, it keeps a barrier between foreign materials and liquid, this is the force that holds the liquid molecules bound together.



For example, if we add soap to the water, its surface tension decreases, thereby enabling the liquid with soap to easily mix with dirt on hand and thus clean it. It is also the property of the liquid surface that it resists force.

Intuitively, it keeps a barrier between foreign materials and liquid. This is the force that holds the liquid molecules bonded together.

If we add soap to the water, its surface tension decreases, so the liquid soap easily mixes with the dirt on hand and cleans it.

Surface tension is sometimes seen in terms of energy. That is more is the surface tension, more is the energy and thus to minimize energy the fluids assume the shape with the smallest surface area. This is the reason behind the water droplets' being spherical. A sphere has a minimal surface area for a given volume.

What is Viscosity?

Viscosity is the resistance of a fluid to flow.

For example, oil has a high viscosity, but when we put it in the car and heat it up, it becomes less viscous and thus flows smoothly through the engine and other parts of the car. Higher the viscosity, the slower the liquid flow will be. Viscosity decreases with an increase in temperature, with some exceptions.

Viscosity is sometimes also understood as the frictional forces that act in between a fluid and the surface of contact. The surface can either be a solid surface like a pipe and water can be the fluid. Now the resistance provided by the pipe to the water flow is viscosity. However, viscosity can also arise in between two fluids flowing at different velocities.

The above phenomenon of viscosity is very much particular to liquid, to be precise Newtonian fluids. However, in the case of non-Newtonian fluids, the interactions are quite bizarre and are always hard to model and understand.