

# PHYSICS

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**Physics is the study of the properties of matter and energy.**

## MOTION

- ▶ The length of the path between two points is the **distance** between them.
- ▶ Physical quantities that have only magnitude and no direction are called **scalar quantities**.

Eg: Distance, speed, time, work, mass, density, temperature etc.

- ▶ Physical quantities that have both magnitude and direction are called **vector quantities**.  
Eg: Displacement, weight, velocity, acceleration etc.
- ▶ **Speed** is the distance travelled by a body in unit time. It is a scalar quantity. Its unit is m/s.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

- ▶ **Velocity** is the displacement per unit time. It is a vector quantity and its unit is m/s.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

- ▶ **Acceleration** is the rate of change of velocity. It is a vector

quantity and its unit is  $\text{m/s}^2$ .

- ▶ A decrease in the velocity with time is called deceleration or retardation. It is otherwise known as negative acceleration.

- If the acceleration remains constant, i.e., it does not change with time it is said to be uniform acceleration.

- The earth attracts every-body towards its centre. The acceleration with which freely falling bodies are attracted towards the earth is called the acceleration due to gravity. It is same for all bodies and its value is  $9.81 \text{ m/s}^2$ .

- ▶ **Inertia** is the tendency of a body to continue in its state of rest or the state of uniform motion along a straight line.
- ▶ **Galileo** discovered law of inertia.
- ▶ An athlete runs some distance before taking a long jump, by running the athlete gives himself larger *inertia* of motion.
- ▶ As the train starts moving, a man sitting inside leans backwards because of inertia of rest.

- ▶ The branch of science which deals with the study of relative movement of interacting surfaces is called **tribology**.

- ▶ In order to increase stability, a person climbing a hill bends forward.

- ▶ The flying of birds is a consequence of Newton's third law of motion.

## Equations of Motion

- ▶ There exists some relation between velocity, acceleration and the time intervals during which we study the motion of a body. These relations are called equations of motion.

They are:

$$V = u + at$$

$$S = ut + \frac{1}{2} at^2$$

$$2as = v^2 - u^2$$

where  $v$  - final velocity

$u$  - initial velocity

$t$  - time interval

$a$  - uniform acceleration

$s$  - displacement

- ▶ The force required to stop a moving body depends on its mass and also on its velocity.
- ▶ Momentum ( $P$ ) is defined as the product of mass and velocity of a body i.e.,  $P = mv$

- ▶ Momentum is a vector quantity
- ▶ Unit of momentum is Kg m/s.

## FORCE

- ▶ Force is any influence that tends to change the state of rest or the uniform motion in a straight line of a body.
- ▶ Unit of force is **Newton**
- ▶ The force of attraction between like molecules is called cohesion.
- ▶ The force of attraction between *unlike* molecules is

called **adhesion**.

- ▶ Weight can be defined as the force with which earth attracts a body.

$$\text{Weight, } w = m \times g$$

- ▶ *Mass* remains constant while *weight* varies from place to place.
- ▶ **Friction** is a force that resists the movement of one surface over another.
- ▶ The force required by a revolving body is called centrip-

etal force.

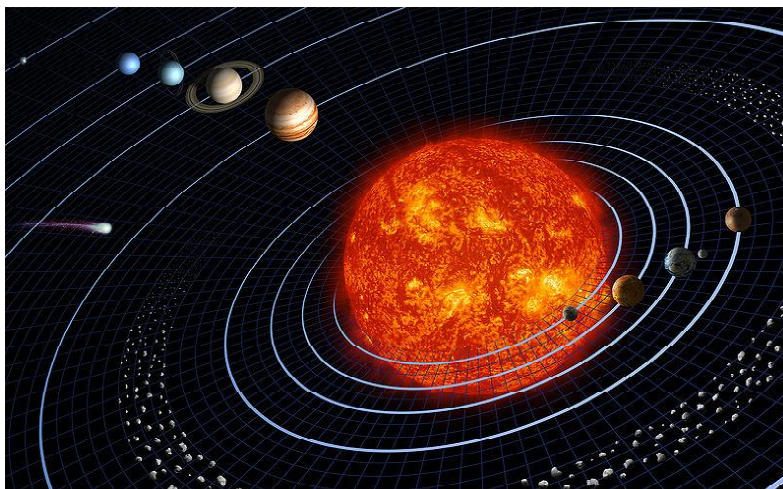
- ▶ Friction can be reduced by changing over from **sliding to rolling**
- ▶ When a man circles round the earth in a spacecraft, his **mass remains constant but weight becomes zero**
- ▶ Two object losing the same weight when immersed in water must have the same **density**
- ▶ **Centrifugal force** helps to separate cream from milk.

## GRAVITATION

- ▶ The attractive force of earth, or other celestial body, on an object is called gravity.
- ▶ The earth attracts everybody towards its centre. The acceleration with which the freely falling bodies are attracted towards the earth is called the acceleration due to gravity (g).

$$\text{Value of } g = 9.8 \text{ m/s}^2$$

- ▶ The value of g at the centre of earth is zero.
- ▶ The value of g is very high at polar region.
- ▶ The value of g is very small at equatorial region.
- ▶ The weight of a substance is zero at the centre of earth. As the mass of the substances increases the gravitational force between them also increases.
- ▶ The weight of a body in earth is very high in the polar



**Gravitation keeps the planets in orbit around the Sun.**

region and low in the equatorial region.

- ▶ The weight of a body on the moon will be less than its weight on the earth. This is so because the mass of the moon is  $\frac{1}{81}$  of the mass of the earth its radius is  $\frac{1}{3.66}$  of the radius

of the earth. Therefore, the acceleration due to gravity experienced on the moon will be less than the acceleration due to gravity experienced on the

earth. This will be about  $\frac{1}{6} g$ .

- ▶ On the moon an astronaut cannot drink lemonade with the help of a straw because - There is no atmosphere on the moon.

- ▶ The mass of a body which determines the gravitational force of attraction due to earth is called **gravitational mass**.
- ▶ **Escape velocity** is the minimum speed which a spacecraft must have to escape from the earth's gravitational force. It is 7 miles/s. (or 11.2 km/s)
- ▶ The escape velocity of a body is different and different celestial bodies.
- ▶ In the absence of an effective force of gravity, bodies become weightless in artificial satellites.
- ▶ Gravitational field is the space around a massive body in which gravitational force of attraction is felt.
- ▶ Planets move slower along their orbits when they are farthest from the sun (at apogee) and they move faster along their orbits when they are nearest to the sun (at perigee)
- ▶ Gravitation is responsible for keeping the Earth and the other planets in their orbits around the Sun; for keeping the Moon in its orbit around the Earth; for the formation of tides; for natural convection, by which fluid flow occurs under the influence of a density gradient and gravity; for heating the interiors of forming stars and planets to very high temperatures; and for various other phenomena observed on Earth.

- ▶ The line on earth's surface passing through the places having zero dip is called the magnetic equator. It passes through Thumba.

## VISCOSITY AND SURFACE TENSION

- ▶ Capillary action is responsible for the absorbance of water by the plants and oils by the wick of lamps.
- ▶ Fluids flow with zero viscosity is called *superfluids (anti-gravity property)*.
- ▶ The force within the liquid which opposes the relative motion of one layer over the other is called **viscosity**.
- ▶ Venturimeter is used for measuring the rate of flow of liquids.
- ▶ Viscosity is the internal fluid friction.
- ▶ Surface tension is the property possessed by a liquid surface whereby they appear to be covered by a thin elastic membrane.
- ▶ Surface tensions is caused by unbalanced molecular cohesive force.  
Unit of surface tension is N/m.
- ▶ When the temperature of fluids increases viscosity decreases.
- ▶ The surface tension decreases with rise of temperature.
- ▶ Surface tension is a property of a liquid by which the free surface of a liquid behaves like a stretched elastic membrane, having contractive tendency.
- ▶ The larger the surface, the more energy there is. To minimize energy, most fluids assume the shape with the

smallest surface area.

- ▶ The spherical shape of rain drops and mist drops are due to surface tension. The spherical shape is attained to maintain equilibrium.
- ▶ Soap bubbles also tend to form themselves into shapes with minimal surface area.
- ▶ Soap is added to water to reduce the surface tension, so clothes (or whatever else) get much cleaner.
- ▶ Water has a fairly low viscosity; things like shampoo or syrup have higher viscosities.
- ▶ Viscosity also depends on temperature : engine oil, for instance, is much less viscous at high temperatures than it is in a cold engine in the middle of winter.

## ELASTICITY

- ▶ **Elasticity** is the ability of a body to return to its original shape and size on the removal of the deforming force.
- ▶ Glass is more elastic than steel and steel is more elastic than rubber.
- ▶ If a body does not regain its original size and shape after the removal of deforming force, it is called a plastic body and this property is called **plasticity**.  
Eg: Clay, Plasticine etc.

## DENSITY & PRESSURE

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Relative density} = \frac{\text{Density of a body}}{\text{Density of water}}$$

## Eye Opener

When a bird sits on a very high voltage cable without having any insulation cover on it, its feathers tend to spread out due to electrostatic repulsive force. i.e; feathers on either side of the bird become charged of like nature. (either both become positively charged or both become negatively charged). Hence repulsion takes place.

- ▶ The amount of water vapour in the air is termed as humidity.
- ▶ When a piece of ice floating on the surface of water in a bucket melts completely, the water level will remain the same.
- ▶ An iron nail floats on mercury but sinks in water because the specific density of iron is lower than that of mercury and higher than that of water.
- ▶ A petrol fire cannot be extinguished by throwing water on it since the density of water is more than the density of petrol, water sinks below the petrol when it is poured over a petrol fire.
- ▶ The density of sea water is higher than the density of river water, therefore it is easier to swim in the sea than in river. This is why a ship entering from river mouth to sea rises up a little.
- ▶ Ice floats on water because its weight is less than the weight of an equal volume of water.
- ▶ Ice floats on water but sinks in alcohol because the density of alcohol is lower than that of water.
- ▶ **The density of water is maximum at 4°C**
- ▶ The pressure at a point on a surface is the thrust acting normally per unit area around that point.

$$\text{Pressure} = \frac{\text{Thrust}}{\text{Area}} \text{ N/m}^2 \text{ or Pascal}$$

- ▶ The total normal force exerted by a fluid on a surface is called thrust. Its unit is Newton (N).
- ▶ Pressure increases with depth
- ▶ The pressure inside a barometer remains high under a calm climate.
- ▶ Mercury is used as the liquid in thermometers as it does not wet glass.
- ▶ **Pascal's law** states that pressure in a fluid in equilibrium is the same everywhere.
- ▶ Water distribution in cities, flush tank, hydraulic brake, hydraulic lift, hydraulic press etc are working based on Pascal's law.
- ▶ The lactometer used to test the purity of milk is based on the principle that the greater density of a liquid, the lesser will be the immersion of an object.

## WORK, ENERGY AND POWER

- ▶ Work refers to an activity involving a force and movement in the direction of the force. A force of 20 newtons pushing an object 5 meters in the direction of the force does 100 joules of work.
- ▶ Energy is the capacity for doing work. You must have energy



**Rock climbers do a lot of work at a slow rate; their power is small.**

to accomplish work - it is like the "currency" for performing work. To do 100 joules of work, you must expend 100 joules of energy.

- ▶ Power is the rate of doing work or the rate of using energy, which are numerically the same. If you do 100 joules of work in one second (using 100 joules of energy), the power is 100 watts.
- ▶ **Unit of energy is joule.**
- ▶ The energy possessed by a body due to its position in a field of force or configuration is called **potential energy**.

$$P.E = mgh$$

m = mass      g = gravity  
h = height (distance between the body and the surface)

- ▶ Energy of a body due to its motion is called **kinetic energy**.

$$\text{Kinetic energy} = \frac{1}{2}mv^2$$

(m = mass, v = velocity)

- ▶ The change in the kinetic energy of an object is equal to the net work done on the object.
- ▶ Mechanical energy can be either kinetic energy (energy of motion) or potential energy (stored energy of position). Objects have mechanical

energy if they are in motion and/or if they are at some position relative to a zero potential energy position

- ▶ Rate of doing work is called power. Its unit is watt

$$Power = \frac{work}{time}$$

- ▶ Escape velocity is the velocity with which a projectile must be projected in order that it may escape the earth's gravitational pull.
- ▶ The escape velocity from the surface of the earth is 11.2 kms
- ▶ The escape velocity from the planet, Jupiter is 61 km/second. For Mercury it is 42 km/second.
- ▶ According to **law of conservation of energy of Albert Einstein**, energy can neither be created nor be destroyed but it may be transformed from one form to another.
- ▶ The energy possessed by the water collected in the reservoir of a dam is **potential energy**
- ▶ When a force acts upon an object causes a displacement then, it is said that work was done upon that object.
- ▶ There are three key ingredients to work - force, displacement, and cause.
- ▶ The work done by a force on a body is defined as the product of the magnitude of the force and the distance moved in the direction of force.
- ▶ Work done = force  $\times$  distance
- ▶ A boy, swinging a stone, tied to a string, with a uniform

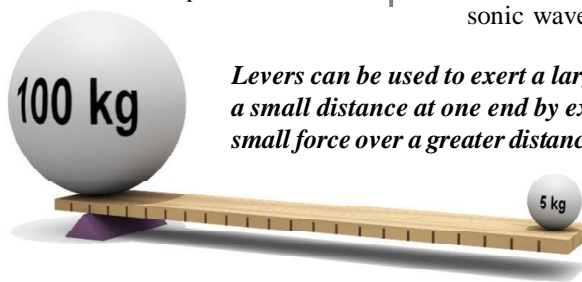
speed in a circle in a horizontal plane over his head, does no work.

- ▶ Unit of work is Newton metre (Nm).

## LEVERS

- ▶ A lever is a simple machine consisting of a rigid rod pivoted at a fixed point called the fulcrum. It is used for shifting or raising a heavy load or applying force in a similar way.
- ▶ A body in which a force is felt is called resistance (R) and the force applied here is called effort (E).
- ▶ If the fulcrum comes in between resistance and effort such levers are called I<sup>st</sup> order levers.  $\overbrace{R \quad F \quad E}$   
Eg: balance, nail puller see-saw, a pair of scissors etc.
- ▶ If resistance comes in between effort and fulcrum then such levers are called II<sup>nd</sup> order levers.  $\overbrace{E \quad R \quad F}$   
Eg: Wheel barrow, nut cracker etc.
- ▶ If effort is between resistance and fulcrum such levers are called III<sup>rd</sup> order levers.  $\overbrace{R \quad E \quad F}$   
Eg: Pincers, Ictongs etc.
- ▶ Efficiency of a machine

$$= \frac{Power\ output}{Power\ input}$$



*Levers can be used to exert a large force over a small distance at one end by exerting only a small force over a greater distance at the other.*

- ▶ Mechanical advantage of a

$$machine = \frac{load}{effort}$$

## WAVES

- ▶ Electromagnetic waves are coupled periodic electrical and magnetic disturbances created by oscillating electric charges.
- ▶ All waves of the electro magnetic spectrum travel at the same velocity, a quantity known as the speed of light. The speed of light is approximately  $3 \times 10^8$  m/s (about 186,000 miles per second).
- ▶ Electromagnetic waves can travel through vacuum.
- ▶ Transverse wave is a type of energy wave in which motion of the particles is perpendicular to the motion of the wave.
- ▶ Wave on a rope and waves on the surface of water are transverse.
- ▶ If the motion of the particles is along the direction of motion of waves, it is called a longitudinal wave.
- ▶ Sound waves in a medium (solid, liquid or gas) are longitudinal.
- ▶ Transverse waves travel in the form of crests and troughs while longitudinal wave travels in the form of compressions and rarefactions.
- ▶ Earthquake waves are infrasonic waves.

- ▶ The property which distinguishes transverse waves from longitudinal waves is polarization.
- ▶ Diffraction is the property in waves of turning round the edges of an obstacle.
- ▶ Sound can be heard around a corner due to diffraction.
- ▶ When a wave strikes a surface of separation of two different media, some of it is thrown back into the original medium. This property of bouncing of the waves is called reflection.
- ▶ The property of sound reflection is used by bats (which cannot see in the dark) for flying during night .
- ▶ Visible light is electromagnetic wave in the range of frequencies  $4.3 \times 10^{14}$  to  $7 \times 10^{14}$  Hz. Electromagnetic waves do not require any material medium for their propagation, they can travel in vacuum.
- ▶ RADAR is the abbreviation of Radio detection and ranging.

## SOUND

- ▶ Sound is a travelling wave.
- ▶ Sound requires medium to travel.
- ▶ Sound cannot travel through vacuum.
- ▶ Study of sound is known as **Acoustics**.
- ▶ Echo and reverberation are due to the reflection of sound. For the production of echo there should be a minimum distance of 17m between us and the reflecting surface.
- ▶ Bats can fly in the dark because they can generate ultrasonic sound and if there is any hindrance in their way

the sound waves get reflected and they can change their direction. They use this method to catch insects also.

- ▶ Since sound waves need a medium to travel they cannot be transmitted through vacuum.
- ▶ The audible frequency of human ear is between 20 hertz and 20,000 hertz (20 KHz).
- ▶ A speed greater than the speed of sound is referred to as supersonic.
- ▶ Velocity of sound in the air is 340 m/s.
- ▶ Sound consists of waves of alternate compression and rarefaction that transmit kinetic energy through a medium.
- ▶ Frequency of a sound wave is the number of wavelengths (vibrations) that are completed in a given period of time.
- ▶ Doppler effect is the change in a sound wave's frequency (and wavelength) that is caused when the hearer and sound source move relative to each other.
- ▶ Sounds are distinguished from each other by pitch (frequency), loudness (intensity) and quality.
- ▶ We can recognise our friends from their voices due to the quality of sound.
- ▶ Phonogram is a machine to reproduce sound.
- ▶ The speed of sound depends on the medium the waves pass through.
- ▶ Sounds with frequencies lower than the lowest limit of human hearing (about 20

Hz) are called **infrasonic waves**.

- ▶ Sounds of frequency higher than 20,000 Hz are known as ultrasonic and are inaudible.
- ▶ **SONAR** stands for Sound Navigation And Ranging. It uses **ultrasonic waves**.
- ▶ Sound travels faster through solids, especially, through metals.
- ▶ The intensity of sound is measured in decibel.
- ▶ The intensity of polite conversation is 40 db-30 db.
- ▶ During night the allowed intensity of sound in a hospital area is 40 db.
- ▶ The reverberation of sound in a hall results due to continued **reflection**
- ▶ Sound travels faster in **steel**
- ▶ Sound can travel only through a medium. It cannot travel through vacuum. It travels through solids, liquids and gases.
- ▶ Equipment for generating or using sound includes musical instruments, hearing aids, sonar systems and sound reproduction and broadcasting equipment. Many of these use electro-acoustic transducers such as microphones and loud speakers.

## How do bats fly at night?

Bats can fly in the dark because ultrasonic waves produced by them during flying are reflected back to them from the obstacles in their way and hence they can fly with out difficulty.

## LIGHT

- ▶ ‘**The corpuscular theory**’ related to light was proposed by **Issac Newton** in 1675.
- ▶ Study of light is known as *optics*.
- ▶ Light an electromagnetic radiation.
- ▶ Through vacuum electro magnetic waves travels with a speed of  $2.9979 \times 10^8$  m/s.
- ▶ Paper, cardboard and stone are examples for **opaque substances** (substance which do not passess light).
- ▶ Substances which allow the light to pass through are called **transparent substances**.  
Eg: glass
- ▶ The particle which is supposed to travel faster than light is **tachyon**
- ▶ Tachyons were discovered by E.C.G Sudarshan.
- ▶ On a rainy afternoon a rainbow is seen in the east
- ▶ A rainbow is always seen in the opposite direction of the sun.
- ▶ Rainbow is caused by reflection, refraction and dispersion of light by the water particles present in the atmosphere.
- ▶ **LASER** is **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation.
- ▶ Laser is the surface intense radiation.

### Eye Openes:

If two bulbs of power 40w and 100w are joined in series and connected to the domestic electric supply terminals, the 40w bulb glows much more brighter than the 100w bulb.

- ▶ LASER is a source of intense monochromatic light in the ultraviolet, visible or infrared region of the spectrum.
- ▶ LASER beams are used in the medical field to perform minute operations.
- ▶ LASER was discovered by Theodore Maiman in 1960.
- ▶ **Visible spectrum** is the band of colours obtained when a ray of light passes through a prism.
- ▶ Spectrum consists of seven colours viz Violet, Indigo, Blue, Green, Yellow, Orange and Red (VIBGYOR).
- ▶ Violet light is scattered most, blue somewhat less, and green, yellow and orange still less, in that order.
- ▶ Red light is scattered least.
- ▶ The beautiful colour of the soap foam and oilspread water is due to **interference of light**.
- ▶ Red, green and blue are the primary colours.
- ▶ Green objects placed in red light will appear black.
- ▶ In the spectrum violet light has short wave length and high frequency. While red light has the highest wave length and the least frequency.
- ▶ A diamond sparkles due to total internal reflection because it has a high refractive index.
- ▶ Scattering of light is responsible for sky being seen as blue. This is because blue and violet colour have short wave length and hence scatter more.
- ▶ **MASER** is Microwave Amplification by Stimulated Emission of Radiation. It was discovered by Charles H. Towns.
- ▶ **Refraction** is the sudden

- ▶ ***James Clark Maxwell** founded that lights are electromagnetic waves.*
- ▶ **Wave theory** of light was discovered by **Christian Huygens**.
- ▶ Microwave Amplification by Stimulated Emission of Radiation was discovered by Charles H. Towns.

change of direction of light when passing from one transparent substance to another. When we put a stick in water it seems to be bended. It is due to refraction.

- ▶ Diffraction is the spreading out of waves of light as it passes through a narrow aperture. The spreading of light rays towards the screen from a projector in film theatre is due to diffraction.
- ▶ Dispersion is the splitting up of light ray into different colours. Rainbow is formed due to dispersion. The seven colours of light has different wavelength. Hence when light passes through a prism each colour gets refracted at different angles.
- ▶ A bubble of water shines because of total internal reflection.
- ▶ Refraction of light through air having very large temperature gradients causes a mirage.
- ▶ A periscope is a device which works by the principle of reflection and refraction.
- ▶ When there is thunder we see the lightning first and hear the thunder later because the velocity of light is greater than the velocity of sound.



- ▶ The term light year is a unit employed in measuring Distance.
- ▶ The rays which appear to originate outside the earth - **The cosmic rays**
- ▶ In a Doctor's stethoscope the sound is intensified because of **reflection of sound**
- ▶ Light from the sun reaches the earth in 8 minutes.
- ▶ Light travels fastest through vacuum. Through vacuum light travels with a speed of  $3 \times 10^8 \text{ m/s}$ .
- ▶ The shortest distance for clear vision is 25 cm.
- ▶ **Myopia** or *short sightedness* is such a type of defect in which one can see nearby objects clearly but is difficult to see objects at long distances. Here image of the substance falls in front of the retina.
- ▶ *Myopia can be corrected by using a concave lens.*
- ▶ **Hypermetropia** or *long sightedness* is such a type of defect in which one can see distant objects clearly whereas nearby objects look blurred. Here the image of the substance falls behind the retina.
- ▶ *Hypermetropia can be corrected by using a convex lens of appropriate focal length.*
- ▶ *Persons suffering from both myopia and hypermetropia use bifocal lenses to withstand the condition.*
- ▶ **Astigmatism:** This defect is due to the cornea not being spherical. This defect can be corrected by using a cylindrical

cal lens, instead of a spherical lens.

- ▶ As the age advances, the elasticity of eye becomes very much reduced. As a result the near point of eye recedes gradually resulting in presbyopia. It can be corrected by convex glasses.
- ▶ When we observe distant objects, the focal length of the eye lens increases and if we observe the objects near by, the focal length of eye lens decreases.
- ▶ Twenty - Twenty means perfect vision.
- ▶ The image formed on the retina of the human eye is **real and inverted**.
- ▶ The lens in the human eye is convex.
- ▶ **Pigments** are substances used to colour paints, filters, plastics and other materials.
- ▶ The sky generally looks blue because the blue colour of short wave length is scattered more than the longer waves of red light.
- ▶ *It is true that the violet waves are dispersed, even more than the blue. However, the sky does not appear violet because the sunlight is relatively weak in violet light.*
- ▶ Red colour has the longest wavelength and shortest frequency whereas violet colour has the highest frequency and shortest wave length.
- ▶ The formation of brilliant colours in soap film is a conse-

quence of the phenomenon of **multiple refraction and interference**

- ▶ An astronaut on an earth satellite will observe the sky as **Black**.
- ▶ The shortest height of a plane mirror required to show the full size image of a person of height 'L' cm is  $\frac{L}{2} \text{ cm}$ .
- ▶ Dioptre is the unit of power of lenses.
- ▶ Concave mirror is used as a burning glass.
- ▶ For the rear view, motorists use convex mirror.
- ▶ To concentrate light on the teeth, the dentists use concave mirrors.
- ▶ Film is a part of the camera which is analogous to the retina in the human eye.

## HEAT AND THERMODYNAMICS

- ▶ **Absolute zero** is the lowest possible temperature which is equal to 0K or  $-273.16^\circ\text{C}$  or  $-459.69^\circ\text{F}$ .
- ▶ **Temperature** is the degree of hotness and **heat** is a form of energy which increases the temperature of a body.
- ▶ **Specific heat capacity** of a substance is the amount of heat required to raise the temperature of the substance through  $1^\circ\text{C}$
- ▶ As we go up in the atmosphere, the temperature decreases.
- ▶ Plasma is the fourth state of matter. Solid, liquid and gas are other three states of matter.



- ▶ A black surface absorbs heat more than other colours.
- ▶ **Cryogenics** is concerned with the production, control and application of extremely low temperatures.
- ▶ At ultra high temperature matter exist in plasma form 99% of matter in the Universe is in plasma form.
- ▶ One **calorie** is the amount of heat needed to raise the temperature of 1gm of water by 1°C.
- ▶ Steam causes more severe burns than water of the same temperature because steam possess more heat energy due to latent heat than water.
- ▶ Transmission of heat from one point to another without heating the medium is called radiation.
- ▶ **Cotton** dresses are safe for wearing while cooking.
- ▶ **Conduction** is the process of net energy transfer through a substance without the movement of the substance itself, but by molecular collisions.
- ▶ Very poor conductor, such as glass are called Insulators. Air is a good insulator.
- ▶ Mica is a good conductor of heat, but a bad conductor of electricity.
- ▶ Perspiration is maximum, when temperature is high and air is humid.
- ▶ Evaporation takes place at all temperatures and is accompanied by cooling.
- ▶ Melting point of ice can be raised by the decrease of pressure.

### Eclipse

Lunar eclipse occurs when the earth comes between the sun and the moon. While solar eclipse occurs when the moon comes between the sun and the earth.

- ▶ Water has maximum density at 4°C. Water expands when it freezes. Water occupies maximum volume at 0°C.
- ▶ The Clinical Thermometer is specially designed to measure human body temperature. Normal human body temperature is 36.9°C (or 98.4°F)
- ▶ Melting point of mercury is -39°C and that of alcohol is -115°C.
- ▶ The main source of energy in the biosphere is solar energy which reach earth by means of radiation.
- ▶ Water expands on freezing. Due to this reason when water is filled in a bottle and is allowed to freeze the bottle breaks, and during winter water pipes break in cold regions.

### MAGNETISM

- ▶ **‘Lodestones’**, are natural magnets.
- ▶ Magnetic lines of force cannot penetrate certain materials as easily as they can penetrate air or vacuum. Such materials are called **“diamagnetic.”**
- ▶ Diamagnetic materials have negative susceptibility.
- ▶ Bismuth, antimony, zinc, silver, copper, gold, lead, water, alcohol, hydrogen and the inert gases are diamagnetic.

- ▶ The law of magnetic poles states that like poles repel, unlike poles attract.
- ▶ A freely suspended magnet stands vertical at magnetic south pole
- ▶ **“Ferromagnetic”** substances are those which can be magnetised to a great extent.
- ▶ Iron steel, nickel, cobalt, alloys of these substances, and gadolinium are ferromagnetic substances.
- ▶ **Paramagnetic** materials have feeble magnetic properties. Platinum, solutions of salts of iron, oxygen, manganese, palladium, osmium etc are examples of paramagnetic substances.
- ▶ Inside a magnet, direction of magnetic lines of force is from south to north.
- ▶ **Tesla is the unit of strength of magnetic field.**
- ▶ The instruments which are dependent of magnetic power of electricity are fan, telephone receiver, Dynamo etc.

### ELECTRICITY

- ▶ Laws of electrolysis were formulated by **Michael Faraday (Father of electricity)**.
- ▶ Electric fittings are *earthed* because in case of a short circuit, the current passes to the earth to overcome the damages.
- ▶ Filtered water at normal temperature is better conductor of electricity than filtered hot water and distilled water.
- ▶ **Conductors** are substances that allow electric charges to flow through it.

- ▶ Metals and graphite are good conductors of electricity.
- ▶ Silver is the metal having lowest resistance.
- ▶ The best conductor of electricity is **silver**.
- ▶ Free electrons constitute current in a conductor.
- ▶ **Insulators** do not allow current to flow through it.
- ▶ Current through a conductor is the flow of electrons through it.
- ▶ Rubber, plastic, paper, glass, mica etc are insulators.
- ▶ Elements such as silicon and germanium allow feeble currents to pass through them and they are known as **semi-conductors**.
- ▶ Air without moisture (dry air) is an insulator.
- ▶ The unit of electric charge is Coloumb. It is equal to the charge of  $6.25 \times 10^{18}$  electrons.
- ▶ 
$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$
- ▶ A high current is produced in a low resistance circuit when two wires of main comes in contact with each other. This is called **short circuiting**.
- ▶ Electric bulbs are filled with gases like **argon, neon, nitrogen** etc.
- ▶ When an isolated conducting sphere is given a positive charge, its mass decreases. This is because, 'giving positive charge' means 'taking electrons out of it'.
- ▶ The principle on which quartz crystal in watch works is **piezo electricity**. Piezo electricity is the property of some crystals to develop an electromotive

force or voltage **across opposite forces** when subjected to a mechanical strain and conversely, to expand or contract in size when subjected to an electromotive force.

- ▶ 220-230 volt is the voltage at which the alternate current (a.c) is supplied for house hold use in India.
- ▶ The frequency of household a.c in India is 50 hertz.
- ▶ An inductor is a device which passes dc but blocks ac.
- ▶ Alternating current is used more widely than Direct Current.
- ▶ ac (alternating current) is more dangerous than dc (direct current).
- ▶ Usually the air inside an electric bulb is removed because when the filament (tungsten) is heated in the presence of air, it forms oxide by combining with oxygen present in the air and readily gets fused.
- ▶ **Nichrome** is used as a heating element in many appliance because it has high resistivity and it resists oxidation in air when red hot.
- ▶ An electric bulb makes a bang when it is broken because there is a vacuum inside the electric bulb. When the bulb is broken air rushes in at a great speed from all sides to fill the vacuum and this produces the sound.
- ▶ To avoid overloading, a device called a '**fuse**' is inserted in **series** with the circuit.
- ▶ The fuse is a piece of wire made of financial Lead.
- ▶ The fuse offers a great deal of

Conductors	Insulators
silver	glass
copper	rubber
gold	oil
aluminum	asphalt
iron	fibre glass
steel	porcelain
brass	ceramic
bronze	quartz
mercury	(dry) cotton
graphite	(dry) paper
dirty water	(dry) wood
concrete	plastic, air, diamond, pure water

resistance to the electric current and melts at a fairly low temperature. The fuse wire must have a low melting point.

- ▶ A fuse wire is used to prevent an unduly high electric current to pass through a circuit.
- ▶ Capacitor is a device used to store electrical energy but it is not a device to store electric charge.
- ▶ The emf or potential difference measured in volt is called **voltage**.
- ▶ A convenient unit to measure electric power is the **kilowatt hour (kwh)**. This is often simply called a **unit**.
- ▶ **1 kwh = 1000 watt x 3600 seconds**
- ▶ In our houses, electric wiring is done in parallel connection so that all instruments in the house could get equal supply of electricity.
- ▶ when two cells of e.m.f 'V' volts each are connected in series the effective emf is  $V+V=2V$  volts

- ▶ When one cell is reversed ,the effective emf is  $V-V=0$  volts, ie, zero volts.
- ▶ In parallel connection of equal emf cells,whatever be the number of cells used the effective emf will be equal to the emf of a single cell.
- ▶ When we want a stronger current for a longer time parallel connection is used.
- ▶ A source of emf containing two or more cells is called a **battery**.
- ▶ In a dry cell the negative electrode(cathode) is zinc and positive electrode(anode) is carbon rod.
- ▶ The emf of a voltaic cell is 1volt.
- ▶ The emf of a dry cell is 1.5 volts.
- ▶ Colour of the light of sodium vapour lamp is yellow.
- ▶ Colour of the light of chlorine vapour lamp is green.
- ▶ Light of nitrogen vapour lamp is red.
- ▶ Light of mercury vapour lamp is white.
- ▶ Light of neon vapour lamp is orange red.
- ▶ Light of hydrogen vapour lamp is blue.
- ▶ In our houses we get 220V ac.The value 220 represents **effective voltage**
- ▶ The advantage of ac over dc is that **it can be transmitted over long distances with minimum power loss**
- ▶ Resistance of carbon decreases with increase of temperature.
- ▶ In an electrical circuit a fuse

is connected **in the live wire**  
Along with fluorescent tubes are fitted with a choke. Here the choke coil steps up the line voltage.

- ▶ An electrical appliance is earthed to **prevent shock**
- ▶ One should not connect a number of electrical appliances to the same power socket because **this can damage the domestic wiring due to over heating**
- ▶ A capacitor (condenser) is used to **store electric charge**
- ▶ "Hydro Power" is the term used for electricity produced through **water**
- ▶ Electricity for domestic purpose is measured in **kWh**
- ▶ The power of ordinary torch cell is 1.5 volt.
- ▶ In the rechargeable batteries used in touch light, electric-shavers etc. nickel and cadmium are used as electrodes.

## ELECTRONICS

- ▶ Electronics is the study of nature, control and application of electrons.
- ▶ Modem is *Modulator Demodulator*.
- ▶ **Rectifiers** are used to convert Alternating Current (AC) to Direct Current (DC).
- ▶ An electronic oscillator is a device which converts DC energy into AC energy.
- ▶ Silicon is used in solar cells.
- ▶ Materials whose resistivity lies in between conductors and insulators are called **semi conductors**.

- ▶ Germanium, silicon, carbon *etc* are semi conductors.
- ▶ A **transistor** transfers a signal from a low resistance to high resistance .
- ▶ The word **transistor** came from the process of **transfer and the resistor**.
- ▶ **ELINT** is electronic intelligence.
- ▶ Triode was invented by Lee De Forest.
- ▶ IC chip is a circuit which performs the functions of transistors, diodes, resistors, condensers etc altogether.
- ▶ The largest IC chip manufacturing company in the world is INTEL.
- ▶ Electrons are carriers of current in a npn transistor. Holes are the carriers of current in a pnp transistor.
- ▶ The frequencies transmitted by a TV station is called channel.
- ▶ Soft X-rays are X-rays having high wavelength and low energy. As these are absorbed by body tissues they are not used in taking photographs of internal organs.
- ▶ X-rays having short wavelength but high energy are called hard X-rays. These are used in the photography of internal organs.
- ▶ In order to study internal atomic structure of crystals, we use **X-rays**
- ▶ "IC" chips for computers are usually made of **Silicon**
- ▶ The process which makes the current to pass in the same direction is called **rectification**

## TELECOMMUNICATION

- ▶ A revolution in wireless telecommunications began in the first decade of the 20th century, with Guglielmo Marconi winning the Nobel Prize in Physics in 1909 for his pioneering developments in wireless radio communications.
- ▶ The first commercial electrical telegraph was constructed by Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use began on 1839.



*In 1901, Guglielmo Marconi established wireless communication between St. John's, Newfoundland and Poldhu, Cornwall (England), earning him the Nobel Prize in Physics for 1909*

### The Nobel Prize in Physics 2010

The Nobel Prize in Physics 2010 was awarded jointly to Russian born scientists, Andre Geim and Konstantin Novoselov “for ground breaking experiments regarding the two dimensional material graphene”, a super-thin and strong form of carbon with high conductivity that can be used for touch screens and light panels.

- ▶ **Alexander Graham Bell** invented the telephone.
- ▶ The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic.
- ▶ Telex means Teleprinter Exchange.
- ▶ INTELSAT (International Telecommunication Satellite Organisation), with its headquarters in Washington DC, was established on February 12, 1973. It operates space equipment and earth stations owned by telecommunication entities in each country. INTELSAT'S 13 satellite system provides about two-thirds of the world's international telecommunication services to more than 140 countries including India.
- ▶ Father of cybernetics - **Norbert Weiner**
- ▶ RADAR is Radio Detection and Ranging.
- ▶ RADAR is a device that uses radio waves to detect the position of objects such as aeroplanes, missiles etc.
- ▶ Radar was invented by Albert H. Taylor and Leo C. Young.
- ▶ The first telecommunications device was the **telegraph**.
- ▶ A television camera takes 25 or 30 electronic photographs (called frames) of a scene every second.
- ▶ Hybrid computers are a combination of the analog and digital computers.



Optical fibre provides cheaper bandwidth for long distance communication

### Samuel Morse

Samuel Finley Breese Morse was an American contributor to the invention of a single-wire telegraph system based on European telegraphs, co-inventor of the Morse code.

## NUCLEAR PHYSICS

- ▶ A **Geiger Counter** or Geiger-Muller Counter is used for detecting and measuring radiation.
- ▶ **Radio-Carbon Dating** or **Carbon dating**, widely employed to determine the age of fossils of animals or plants. The radio-isotope carbon-14 is used in Carbon dating process.
- ▶ **Chain reaction** is a self sustaining series of nuclear fissions, each one started by

## Nuclear Fusion and Fission

The process of formation of a heavily weighed nucleus by the fusion of two or more low weighed nucleus is called **nuclear fusion**. On earth, the most likely fusion reaction is Deuterium–Tritium reaction. Deuterium and Tritium are both isotopes of hydrogen. The splitting of nucleus of an atom into two pieces having equal weight is called **nuclear fission**. **Otto Hahn** in 1939 discovered nuclear fission. Nuclear fission is the splitting of a massive nucleus into photons in the form of gamma rays, free neutrons, and other subatomic particles. The main difference between these two processes is that fission is the splitting of an atom into two or more smaller ones while fusion is the

neutrons emitted in a previous fission.

- ▶ Proton was discovered by Rutherford.
- ▶ Electron was discovered by J.J.Thomson.
- ▶ James Chadwick discovers the neutron.
- ▶ Out of the three radiations - alpha, beta, and gamma, **gamma radiation** is most penetrating.
- ▶ **Enriched uranium** is uranium with more of the isotope of **Uranium - 235**.
- ▶ The age of rocks may be calculated through **radioactive dating** using uranium isotopes.

- ▶ Alpha particles ( $\alpha$ ) are positively charged. Basically  $\alpha$  – rays are Helium nuclei.
- ▶ Gamma rays are electromagnetic radiation emitted by the nuclei of radioactive elements.
- ▶ A **tracer** is minute amount of a radioisotope, added to a large amount of non-radioactive isotopes of elements.
- ▶ **Half-life** is the time taken for half of any amount of a radioactive isotope to decay.
- ▶ Radiocarbon '*carbon - 14*' has a half-life of 5,730 years.
- ▶ Isotopes used in dating rocks include Uranium-235 which becomes lead-207; thorium-

232 which becomes lead-208; rubidium-87 which changes into strontium-87; and potassium-40 which changes into argon-40.

Nuclear fusion is also known as thermo-nuclear reaction because it demands extremely high temperatures.

A breeder reactor is that which produces more fissionable material than it burns.

- ▶ The enormous energy released in an atomic explosion is due to the conversion of mass into energy.
- ▶ **Neutron** is used to trigger-off the nuclear fission reaction.
- ▶ *Atom bomb* is an example of nuclear fission reaction, while *Hydrogen bomb* is that of nuclear fusion reaction.
- ▶ More energy is produced in a fusion reaction than fission reaction.
- ▶ The monozite found abundantly in coastal areas of Kerala contains thorium.
- ▶ The temperature required for the maintenance of fusion is about 350000000°C.

## ATOMIC REACTORS

- ▶ Nuclear power is the fourth-largest source of electricity in India after thermal, hydro and renewable sources of electricity.
- ▶ In 2010, India has 19 nuclear power plants in operation generating 4,560 MW while 4 other are under construction.
- ▶ The first atomic reactor in India is 'Apsara' in Trombay (Maharashtra)

### Power Plant

Narora Atomic Power Station  
Rajasthan Atomic Power Station  
Tarapur Atomic Power Station  
Kakrapar Atomic Power Station  
Kudankulam Nuclear Power Plant  
Madras Atomic Power Station  
Kaiga Nuclear Power Plant

### Location

Narora  
Rawatbhata  
Tarapur  
Kakrapar  
Kudankulam  
Kalpakkam  
Kaiga

### State

Uttar Pradesh  
Rajasthan  
Maharashtra  
Gujarat  
Tamilnadu  
Tamilnadu  
Karnataka

## NPCIL

Nuclear Power Corporation of India Limited is a Public Sector Enterprise under the administrative control of the Department of Atomic Energy (DAE), Government of India. The main objective of NPCIL is operating the atomic power stations and implementing the atomic power projects for generation of electricity

- ▶ India's first breeder reactor is set up at the place known as Kalpakkam in Tamil Nadu.
- ▶ The early reactors were known as Atomic Piles.
- ▶ Heavy water, graphite and neutrons are used as **moderator** in nuclear reactors.
- ▶ Coolant is a fluid used in nuclear reactors to remove the heat produced in the core.
- ▶ The coolant used in fast breeder reactors is generally liquid sodium.
- ▶ Heavy water is used as a *coolant* as well as a *moderator* for nuclear reactors.
- ▶ The moderator in a nuclear reactor slows down the fast moving neutrons.
- ▶ The commonly used moderators are graphite, heavy water and berilium.
- ▶ The main source of solar energy is nuclear fusion.
- ▶ The **fast breeder reactor** gets its name from the fact that it utilizes excess free neutrons to breed new fissionable material.

- ▶ The original fuel in the fast breeder reactor is plutonium and uranium oxides or carbides.
- ▶ Cadmium rod is used in a reactor to absorb neutrons.
- ▶ **Willers Frank Liby** discovered carbon dating.
- ▶ **Coal** is the most important raw material for thermal power plant.
- ▶ **Flyash** is a waste product of thermal power plants.
- ▶ Cobalt-60 is commonly used in radio therapy because it emits beta rays which has more energy than the X-rays.

## SPACE PHYSICS

- ▶ Space exploration began with the launching of Russia's Sputnik-1 into space on October 4, 1957.
- ▶ Sputnik-2 carried a dog 'Laika' to space.
- ▶ The U.S.A. entered the space arena on January 31, 1958 with the launching of the Explorer-1. This satellite is credited with making the important discovery of the Van Allen radiation belts around the earth, where electrons and protons from the sun are trapped by earth's magnetic field.
- ▶ The extremely large distances between the various heavenly bodies like the stars and planets can be expressed in terms of two units namely light year and parsec.
- ▶ One light year is the distance

travelled by light in one year through space.

- ▶  $1 \text{ light year} = 9.46 \times 10^{12} \text{ Kilometres}$
- ▶  $1 \text{ Parsec} = 3.26 \text{ light years}$
- ▶ A galaxy is a vast collection of billions of stars, dust and hydrogen gas isolated in space from similar systems.
- ▶ Galaxies are the building blocks of the universe.
- ▶ The sun and the eight planets belong to the milky way galaxy, whose Indian name is Akash-Ganga.
- ▶ Milky way is a spiral shaped galaxy. There are nearly  $10^{11}$  stars in the galaxy.
- ▶ Among numerous dim stars in the sky, there are some groups of bright stars. These groups of stars forms certain shapes or patterns and are called constellations. The constellations were given the name of the figures they resembled.
- ▶ There are 89 constellations. The largest of these is Hydra, which contains at least 68 stars visible to the naked eye.
- ▶ A satellite is a heavenly body that rotates around a planet.
- ▶ Venus is the brightest object in the night sky, leaving out the moon. It is visible either in the early morning in the eastern sky or in the early evening in the western sky and is called "morning star" and "evening star".
- ▶ Sun is our nearest star. It is a hot sphere of gas - 74% hydrogen, 25% helium and 1% other elements.
- ▶ The sun is at a distance of 8

light minutes from the earth. ie, it takes about 8 minutes for light to travel from the sun to the earth.

- ▶ An asteroid is an irregular, rocky hunk, small both in size and in mass compared to a planet.
- ▶ In the belt which lies between Mars and Jupiter there are thousands of minor planets or asteroids.
- ▶ Ceres is the largest known asteroid.
- ▶ Meteor is the streak of light observed in the sky. They are formed when a particle of matter enters the earth's atmosphere and become incandescent as a result of friction with atmospheric atoms and molecules. Meteor are also called shooting stars.
- ▶ Stars twinkle because of refraction of light.
- ▶ The tail of a comet points away from the sun. This is due to radiation pressure.
- ▶ The colour of a star is an indication of its temperature.
- ▶ The planet that has got a well developed set of rings is saturn.
- ▶ India's satellite launching station is situated at Sriharikota.
- ▶ When a person is orbiting in a satellite, his weight becomes zero.
- ▶ The ink of the pen leaks out in an aeroplane because pressure of ink inside is more than the ambient pressure.
- ▶ The Space Application Centre for training in Satellite

Communication Technology is located at Ahmedabad.

- ▶ The credit for starting space science research in India goes to Vikram Sarabhai.
- ▶ Moon has no atmosphere because its gravity is not sufficient for any atmosphere to hold on to it.
- ▶ All stars have identical chemical composition but they differ in surface temperatures. This is the reason for the difference in spectra of stars.
- ▶ The outward stream of protons and electrons on the surface the sun during solar flares and sun-spot activity constitute the solar wind.

## UNITS AND MEASUREMENTS

- ▶ The purest form of gold is 24 carats. Ornaments are usually made of 22 carat gold. One metric carat is equal to 200 milligram.
- ▶ **The weight of precious gems are also measured in carat.**
- ▶ One gallon is equal to 4.546 litres.
- ▶ One horse power is equal to 746 watts.
- ▶ Light year is a unit of distance used in astronomy.
- ▶ Light year is the distance that

light travels in one year at the speed of 3,00,000 km/sec.

- ▶ **Astronomical Unit** is another unit of distance in space. It is the mean distance between earth and Sun. One light year contains nearly 63282 Astronomical Units.
- ▶ Par sec (Parallaxic second) is yet another unit of distance in space. One par second is equal to  $3.08 \times 10^{16}$  m.
- ▶ **Lambert** is the unit of intensity of light.
- ▶ **Pascal** is the unit of pressure.
- ▶ **Angstrom** is the unit of the wave length of light.
- ▶ **Poise** is the unit of viscosity of fluid.
- ▶ **Curie and Rutherford** are unit of radio activity.
- ▶ Unit of Plane angle is radian
- ▶ Unit of solid angle is steradian
- ▶ Newton is the unit of force
- ▶ Joule is the unit of energy and work
- ▶ Unit of power is watt
- ▶ Hertz is the unit of frequency
- ▶ Coulomb is the unit of electric charge
- ▶ Unit of electric capacitance is farad
- ▶ Ohm is the unit of electric resistance
- ▶ Becquerel is the unit of radio activity
- ▶ Henry is the unit of inductance

Several systems of unit have been in use for describing measurement. The common systems are the C.G.S. system (centimeter, gram, second); the F.P.S. system (foot, pound, second) which is the British system, the MKS system (meter, kilogram & second) and now internationally accepted is the System International Units, abbreviated as S.I. units.



Quantity	Unit
Length .....	Metre (m)
Mass .....	Kilogram (kg)
Time .....	Second (s)
Electric Charge .....	Ampere (A)
Temperature .....	Kelvin (K)
Frequency .....	Hertz (Hz)
Force, Weight .....	Newton (N)
Work, Heat .....	Joule
Power, Radiant flux .....	Watt (W)
Pressure, Stress .....	Pascal (Pa)
Electric charge or flux .....	Coulomb (C)
Electrical potential difference, Electromotive force (emf) .....	Volt (V)
Electric resistance, .....	Ohm
Electric capacitance .....	Farad (F)
Magnetic flux .....	Weber (Wb)
Magnetic flux density, magnetic induction .....	Tesla (T)
Inductance .....	Henry (H)
Electrical conductance .....	Siemens
Radioactivity .....	Becquerel (Bq)
Catalytic activity .....	Katal
Thermodynamic temperature .....	Degree Celsius
<b>Derived Units</b>	
Area .....	square metre (m <sup>2</sup> )
Volume .....	cubic metre
Speed, velocity .....	metre per second (m·s <sup>-1</sup> )
Acceleration .....	metre per second squared (m·s <sup>-2</sup> )
Jerk .....	metre per second cubed (m·s <sup>-3</sup> )
Angular velocity .....	radian per second
Momentum .....	Newton second (N·s)
Torque, moment of force .....	Newton metre
Wavenumber .....	Reciprocal metre
density, mass density .....	kilogram per cubic metre (kg·m <sup>-3</sup> )
specific volume .....	cubic metre per kilogram
entropy .....	joule per kelvin (J·K <sup>-1</sup> )
electric field strength .....	volt per metre
magnetic field strength .....	ampere per metre
molar energy .....	joule per mole
specific energy .....	joule per kilogram
energy density .....	joule per cubic metre
surface tension .....	newton per metre
thermal conductivity .....	watt per metre kelvin
dynamic viscosity .....	pascal second
electric charge density .....	coulomb per cubic metre
electric current density .....	ampere per square metre
radian .....	rad
steradian .....	rad <sup>2</sup>

- ▶ Weber is the unit of magnetic flux
- ▶ Lumen is the unit of luminous flux
- ▶ Lux is the unit of illuminance
- ▶ Unit of electric conductance is Siemens
- ▶ **Joule** is the unit of work.
- ▶ **Dyne** is the unit of force.
- ▶ Newton is yet another unit of force.
- ▶ One newton = 10<sup>5</sup> dynes
- ▶ **Centigrade, Fahrenheit** are the units of temperature.
- ▶ Degree is the unit of angle.
- ▶ **Mho** is the unit of conductance.
- ▶ **Fathom** is the unit of depth of the sea. One *fathom* is equal to 6 feet.
- ▶ In India, National Physical Laboratory of New Delhi is responsible for the maintenance and improvement of physical standards of length and time.
- ▶ Solar day is the period between noons of two consecutive days.

## BRANCHES OF SCIENCE

### Actinology

A branch of science which deals with the chemical effects of electromagnetic radiation.

### Aerodynamics

The study of the motion and control of solid bodies (eg. air craft, rockets, missiles etc) in air.

### Aeronautics

A branch of science which deals with flight through air.

### Astro physics

The branch of physics con-

cerned with the physical properties of celestial bodies and the interaction between matter and energy with them.	forces which change their motion.	which deals with effect of motion without reference to mass or force.
<b>Astronautics</b> The scientific study of travel outside the Earth's atmosphere.	<b>Electronics</b> A branch of science dealing with the study and development of circuit involving thermionic valves, semi conductors and other electrical components like resistance, capacitors, inductances etc.	<b>Optics</b> It is the branch of physics dealing with the study of light.
<b>Audiology</b> The science of hearing	<b>Electrostatics</b> The study of the effects associated with electric charge at rest.	<b>Rheology</b> The study of the deformation and flow of matter.
<b>Ballistics</b> The study of path (motion) of projectiles.	<b>Fluidics</b> The study and use of fluid flow through pipes in an analogous way to the flow of electric current through circuits.	<b>Solid state Physics</b> The branch of physics which deals with the nature and properties of matter in the solid state.
<b>Cosmology</b> The science of the nature, origin and history of the universe.	<b>Holography</b> Science of recording three dimensional image of an object.	<b>Statistical Mechanics</b> The study of the mechanical properties of large assemblies of particles or components in terms of statistics.
<b>Crystallography</b> The study of structure of crystals.	<b>Kinematics</b> The branch of mechanics	<b>Tribogy</b> The study of friction and lubrication.
<b>Dynamics</b> The study of the behaviour of bodies under the action of		

### Famous scientists and invention

GalileoGalilei .....	Discovered the phases of Venus, the four satellites of Jupiter Io, Europa, Callisto, and Ganymede	Alessandro Volta .....	Battery (Electric)
Christiaan Huygens .....	Wave theory	Kirkpatrick Macmillan .....	Bicycle
Sir Isaac Newton .....	Newton's Laws of Motion, Universal gravitation, Calculus	Tennant .....	Bleaching Powder
Benjamin Franklin .....	Discovered the two electric charges, 'positive' and 'negative'.	Edwin T. Holmes .....	Burglar Alarm
James Watt .....	Modern condenser steam engine	John Harrison .....	Chronometer
Michael Faraday .....	Electro magnetic induction	Nicolas & Jean Lumiere .....	Cinema
Sir Chandrasekhara Raman .....	Scattering of light and found the Raman effect	Wilmot .....	Cloning, (Mammal)
Nikola Tesla .....	Alternating current	Rudolf Diesel .....	Diesel Engine
Daniel Gabriel Fahrenheit .....	Determined the temperature scale called Fahrenheit scale	Thomas Alva Edison .....	Electric Lamp
Christian Doppler .....	Doppler effect	Henry W. Seely .....	Electric Iron
James Chadwick .....	neutron	J.J.Thomson. ....	Electron
J. Robert Oppenheimer .....	Atom Bomb	Lewis E. Waterman .....	Fountain Pen
Dalton .....	Atomic Theory	Thomas Alva Edison .....	Gramophone
Carrier .....	Air Conditioning	Denis Gason .....	Holograph
Evangelista Torricelli .....	Barometer	Edward Teller .....	Hydrogen Bomb
		Sir Frank Whittle .....	Jet Engine
		Theodore Maiman .....	Laser
		Elisha G. Otis .....	Lift (Mechanical)
		Benjamin Franklin .....	Lighting Conductor
		John Logie Baird .....	Mechanical Television
		Rutherford .....	Proton-