Physics – Focus Area
UNIT 1 Effects of Electric Current
Energy changes in the Electrical Devices

Device	Energy Change
Electric Bulb	**Electrical energy to Light Energy**
Induction Cooker	**Electrical energy to Heat Energy**
Storage Battery (while charging)	**Electrical energy to Chemical Energy**
Mixie	**Electrical energy to Mechanical Energy**
Soldering Iron	**Electrical energy to Heat Energy**
Electro Magnet	**Electrical energy to Magnetic Energy**
Electric Motor	**Electrical energy to Mechanical Energy**

Heating Effect of Electric Current

Joule Heating or Ohmic Heating

The process by which heat is developed in a circuit on passing current through it is known as the **Joule Heating or Ohmic Heating.**

Joule's Law

The heat generated (H) in a current carrying conductor is directly proportional to the product of the square of the current (I) in the conductor, the resistance of the conductor (R) and the time (t) of flow of current.

$$H = I^2Rt$$

Factors influencing the heat developed, when current passes through a conductor.

- ➔ **Intensity of electric current (Current)** (I) – When the current is doubled, heat becomes four times. When the current is halved, heat is reduced to 1/4.
- ➔ **Resistance of the conductor (R)** – When the resistance is doubled, without any change in the current, then the heat produced is also doubled. But in normal case, when the resistance is doubled, current is reduced by half. So heat is also reduced to 1/2.
- ➔ **Time of flow of current (t)** – When the time is doubled, heat is also doubled.

Equations for solving the mathematical problems by using Joule's Law.

$$H = I^2Rt$$
$$H = VIt$$
$$H = V^2t/R$$
$$R = V/I$$

H = Heat (unit-J), **I** = Current (unit -A), **V** = Potential Difference (Voltage) (unit -V), **t** = Time (unit- s), **R**= Resistance (unit- Ω).

Electric Power (P)

The amount of energy consumed by an electrical appliance in unit time is its **power.**

Unit -Watt **(W)**

Equations for solving mathematical problems

$$P = H/t$$
$$P = I^2R$$
$$P = VI$$
$$P = V^2/R$$

Factors influencing the power of an electrical device.

- ➔ **Resistance (R)** – When the resistance increases, power decreases. (When the resistance is doubled, power is halved)
- ➔ **Voltage (V)** – When the voltage increases, power also increases. (When the voltage is doubled, power becomes four times and when the voltage is halved, power is reduced to 1/4)

Electric heating appliances

- ➔ Electric heating appliances are instruments that make use of the heating effect of electricity - **Electric Iron, Soldering Iron, Electric Heater, Immersion Heater.**

Heating Coil.

- ➔ The part in which electrical energy changes in to heat energy is called the **heating coil** of an electrical heating appliance.
- ➔ **Nichrome** is used as the heating coil. (Alloy of nickel, chromium and Iron)

Peculiarities of Nichrome

- ➔ High resistivity.
- ➔ High melting point.
- ➔ Ability to remain in red hot condition for a long time without getting oxidised

Safety Fuse

- ➔ **Safety fuse** is a device which protects us and the appliances from danger when an excess current flows through the circuit.
- ➔ Safety fuse is a device that works on the **heating effect** of electric current.
- ➔ Fuse wire, an **alloy of tin and lead,** is the main part of safety fuse.
- ➔ Fuse wire has **low melting point.**

Circumstances that cause high electric current in a circuit.

- ➔ **Over loading**- A circuit is said to be overloaded if the total power of all the appliances connected to it is more than what the circuit can withstand.
- ➔ **Short Circuit** -If the positive and the negative terminals of a battery or the two wires from the mains come into contact without the presence of a resistance in between, they are said to be short- circuited.

Working of a fuse

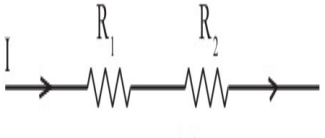
When the current that flows into the circuit exceeds the permissible limit, the heat generated becomes excessive. Because of it's low melting point the fuse wire melts and break the circuit.

Precautions to be taken, while connecting a fuse wire in a circuit.

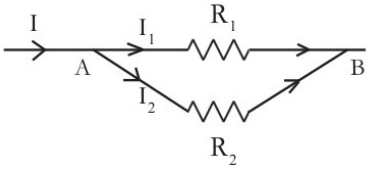
- ➔ The ends of the fuse wire must be connected firmly at appropriate points.
- ➔ The fuse wire should not project out of the carrier base.
- ➔ Use fuse wire of appropriate amperage.
- ➔ Fuse wire is connected in series.

Arrangement of Resistors

- ➔ **Series Connection** -When a circuit is completed by connecting the resistors one after the other, it is called series connection



➔ **Parallel Connection** -*In parallel method the ends of resistors are commonly connecting together at points A and B as shown in the fig*



	Series Connection	Parallel Connection
Effective Resistance	Increasing.	Decreasing.
Current	Current is same for all resistors.	Current is different for each resistor. More current is flowing through the resistor with low resistance and less current is flowing through the resistor having high resistance.
Voltage	Voltage is different for each resistor. Resistors having high resistance gets more voltage and low resistance gets less voltage.	Voltage is same (supply voltage) for all resistors.
Equations for calculating the effective Resistance.	$R = R_1 + R_2 + R_3$	$I/R = 1/R_1 + 1/R_2 + 1/R_3$
When the bulbs are connected in the circuit.	Bulbs of less power glows with more brightness.	Bulbs of more power glows with more brightness.

Lighting effect of electric current

Incandescent lamps

In normal voltages, the filament becomes white hot and gives out light. Such bulbs are the incandescent (glowing with heat) lamps.

➔ Filament is made with the metal- **Tungsten.**

Properties of tungsten

➔ High resistivity.
➔ High melting point.
➔ High ductility.
➔ Ability to emit white light in the white hot condition.

- To avoid the oxidation of the filament – **Bulb is evacuated.**
- Vaporisation of the filament can be reduced by - **Filling the bulb with inert gas or nitrogen at low pressure.**

➔ **Drawback -**A major part of the electrical energy supplied to an incandescent lamp is **lost as heat**. Hence the efficiency of these devices is less.

Unit-2, Magnetic Effect of Electric Current

➔ A magnetic field is developed around a current carrying conductor.
➔ Direction of the magnetic field is from the north pole to the magnet to its south pole.

➔ **Magnetic compass** is used to identify the presence and direction of the magnetic field. Direction in which the north pole of the magnetic needle deflects indicates the direction of the magnetic field.

Right Hand Thumb Rule of James Clark Maxwell

➔ **Right hand thumb rule** is used to find the direction of the magnetic field formed around a current carrying conductor.

➔ Imagine you are holding a current carrying conductor with the right hand in such a way, that the thumb points in the direction of the current. The direction in which the other fingers encircle the conductor gives the direction of the magnetic field.

Magnetic field developed around a current carrying straight conductor.

➔ Magnetic field developed around a current carrying straight conductor is the circular shape.

When the current is passed from South to North through a conductor

➔ Direction of the magnetic field above the conductor – **West to east.**

➔ Direction of the magnetic field below the conductor **– East to west.**

When the current is passed from North to South through a conductor

➔ Direction of the magnetic field above the conductor – **East to west.**

➔ Direction of the magnetic field below the conductor **– West to east.**

Magnetic field around a current carrying circular loop

➔ The end of the coil at which current flows in the clockwise direction -**South Pole.**

➔ The end at which current flows in the anticlockwise direction- **North Pole.**

Solenoid

A **solenoid** is an insulated conducting wire wound in the shape of helix.

Magnetic field around a current carrying solenoid

➔ The end of the solenoid at which current flows in the clockwise direction -**South Pole**

➔ The end at which current flows in the anticlockwise direction**- North Pole.**

To increase the strength of the magnetic field produced on a solenoid

➔ Increase the intensity of the electric current.

➔ Increase the no of turns in the solenoid.

➔ Use soft iron as the core of the solenoid.

➔ Increase the area of cross section of the soft iron core.

Motor principle

➔ A conductor, which can move freely and which is kept in a magnetic field, experiences a force when current passes through it and it moves.

DC Motor

Parts

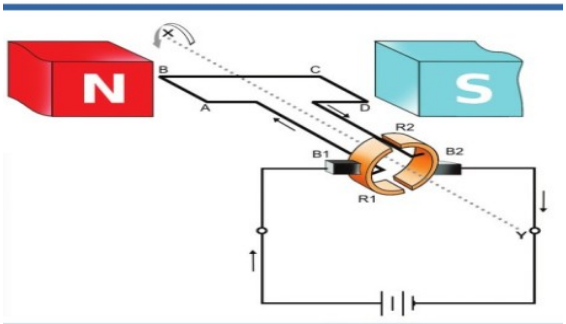
➔ **NS** -Magnetic Poles

➔ **XY**- Axis of rotation of the motor

➔ **ABCD** - Armature

➔ **B_1, B_2** - Graphite brushes

➔ **R_1, R_2** - Split rings



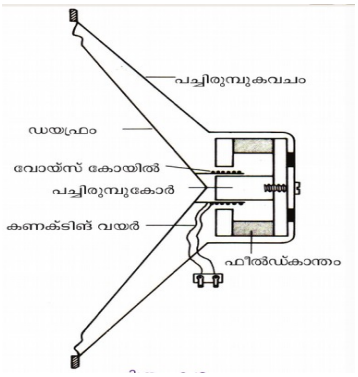
Working

- ➔ When electricity is passed through the armature of an electric motor, a force is experienced on the armature and it rotates its axis based on Fleming's left hand rule
- ➔ **Split ring commutator** helps to change the direction of current through the armature after every half rotation.
- ➔ Energy Change – **Electrical energy is converted to mechanical energy.**
- ➔ Working principle – **Motor principle.**

Moving coil loud speaker

Parts

- ➔ Field magnet
- ➔ Voice Coil
- ➔ Diaphragm
- ➔ Soft iron core
- ➔ Soft iron shield
- ➔ Connecting wire.



Working

- ➔ The electrical pulses from a microphone are strengthened using an amplifier and sent through the voice coil of a loudspeaker. The voice coil, which is placed in the magnetic field, moves to and fro rapidly, in accordance with the electrical pulses. These movements make the diaphragm vibrate, thereby reproducing sound.
- ➔ Energy Change – **Electrical energy is converted to sound energy.**
- ➔ Working principle **– Motor principle.**

Unit - 3 Electromagnetic Induction

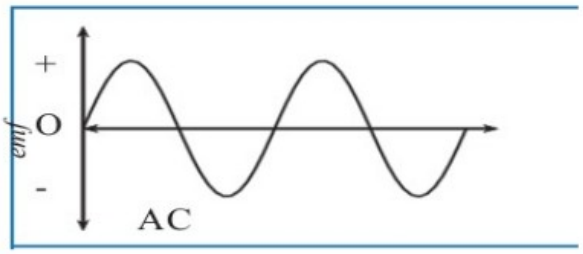
Electromagnetic Induction.

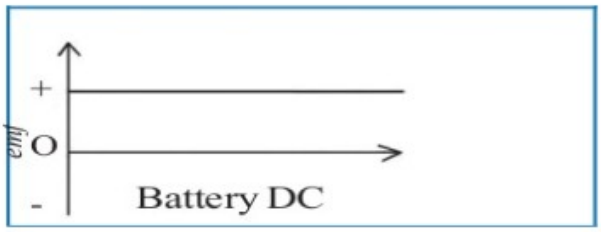
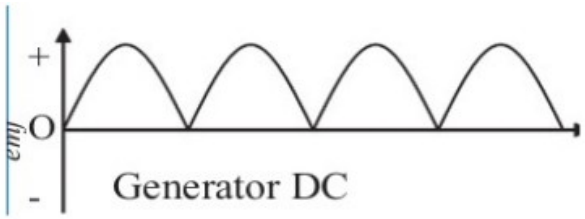
Whenever there is a change in the magnetic flux linked with a coil, an emf is induced in the coil. This phenomenon is **electromagnetic induction.**

Methods to increase the induced emf produced in a solenoid due to electromagnetic induction

- ➔ Increase the strength of the magnet.
- ➔ Increase the number of turns in the solenoid.
- ➔ Increase the speed of motion.

Characteristics of electricity received from an AC generator, DC generator and a Battery.

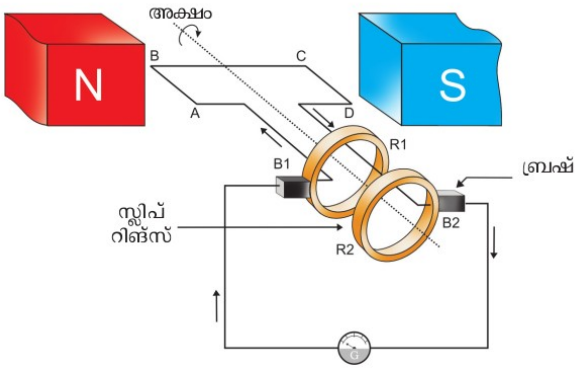
	• Direction changes continuously • emf increases and decreases.

	• Direction doesn't change. • emf doesn't change.
	• Direction doesn't change. • emf increases and decreases.

AC Generator

Parts

- ➔ **NS** – Magnetic Poles
- ➔ **ABCD** - Armature
- ➔ **B_1, B_2** – Graphite Brushes
- ➔ **R_1, R_2** – Slip Rings



- ➔ **Field magnet**- The magnet that creates magnetic flux in the generator.
- ➔ **Armature -**An arrangement of insulated conducting wire wound on a soft iron core. This can be made to rotate about an axis.
- ➔ **Slip Rings**- Metal rings which are welded together with the armature coil. They rotate along with the armature on the same axis of rotation as the armature
- ➔ **Graphite Brushes** -They are arrangements which always make contact with the slip rings. Current flows through them to the external circuits.

Working

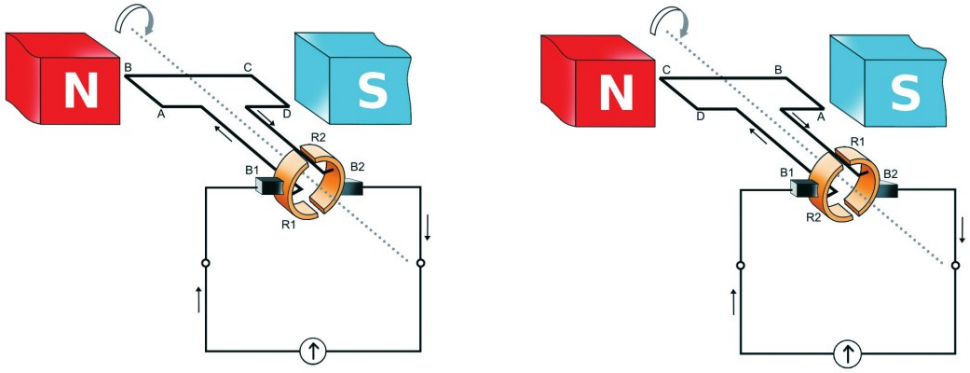
Rotates the armature or field magnet by using mechanical energy. Magnetic flux change is taking place, and an emf is induced on the armature coil due to electromagnetic induction. The electricity produced on the armature coil, reaches the external circuit through the slip rings and brushes.

- ➔ After every half rotation, direction of current in the armature coil and the external circuit is reversed.

- ➔ Working principle – **Electromagnetic Induction**
- ➔ Energy change – **Mechanical energy is converted to electrical energy.**
- ➔ Instances at which maximum emf is induced on the armature - **When the plane of the armature coil becomes parallel to the magnetic field (90^0, 270^0)**

➔ Emf in the armature becomes zero- **When the plane of the armature coil becomes perpendicular to the magnetic field (0^0, 180^0, 360^0)**

DC Generator



Parts

- ➔ **NS** -Magnetic Poles
- ➔ **ABCD** - Armature
- ➔ **B_1, B_2** – Graphite Brushes
- ➔ **R_1, R_2** – Split Rings.

Working

Rotates the armature, by using mechanical energy. Magnetic flux change is taking place, and an emf is induced on the armature coil due to electromagnetic induction. The electricity produced on the armature coil, reaches the external circuit through the slip rings and brushes.

- ➔ After every half rotation, direction of current in the armature coil is reversed.
- ➔ Contact between the **split rings and brushes are interchanged** after every half rotation. Hence, in the external circuit electricity is always flows in the same direction.

Similarities and differences in the structure of an AC generator and DC generator

Similarities

- ➔ Armature and field magnet are used in both.
- ➔ Both works based on the principle of electro magnetic induction.
- ➔ AC is induced in the armature in both cases.

Differences

AC Generator	DC Generator
Slip rings are used.	Split rings are used.
AC in the external circuit.	DC in the external circuit
AC is induced in the armature irrespective of the motion of armature or magnet.	It is designed in such a way that DC will be obtained only if armature is made to rotate.

Mutual induction

Consider two coils of wire kept side by side. When the strength or direction of the current in one coil changes, the magnetic flux around it changes. As a result, an emf is induced in the secondary coil. This phenomenon is the **mutual induction.**

➔ The coil into which we give current for the production of magnetic field – **Primary coil (input coil)**
➔ The coil in which induced emf is generated - **Secondary coil (output coil)**

Transformer

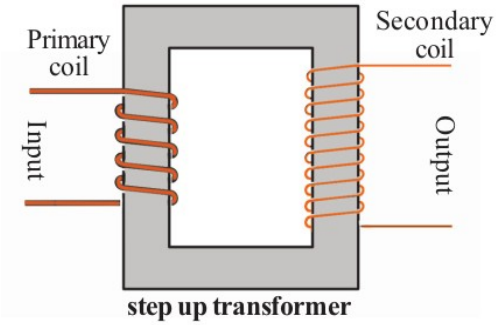
Transformer is a device for increasing or decreasing the voltage of an AC without any change in the electric power.

➔ Transformer which increases AC voltage - **step up transformer.**
➔ Transformer which decreases AC voltage -**step down transformer.**

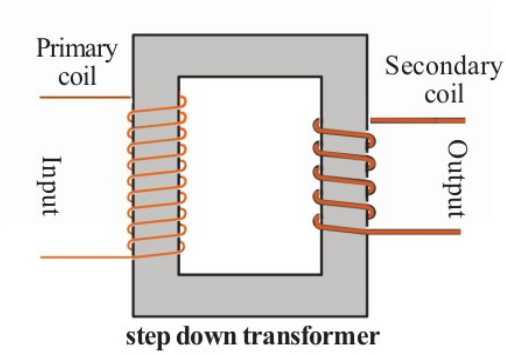
Working

When AC is given to the primary coil of a transformer, a varying magnetic field is produced around it. As a result an emf is induced on the secondary coil, which is situated on the same magnetic field. The emf induced on the secondary coil is proportional to the number of turns on it.

➔ Working principle – **Mutual Induction (Electromagnetic induction)**



step up transformer



step down transformer

Step up transformer	Step down transformer
Number of turns in the primary coil is lesser than Secondary coil	Number of turns in the primary coil is greater than Secondary coil.
Output voltage is greater than input voltage.	Input voltage is greater than output voltage.
Thickness of primary coil is greater than secondary coil.	Thickness of secondary coil is greater than primary coil,
Input current is greater than output current.	Output current is greater than input current.

Self Induction

The change in magnetic flux due to the flow of an AC in a solenoid will generate a **back emf** in the same solenoid in a direction opposite to that applied to it. This phenomenon is known as the **self induction.**

➔ Due to self induction, the effective voltage in the circuit is decreases. Hence the intensity of bulb in the circuit is also decreases.

For self induction,
➔ Supply current must be AC.
➔ A solenoid must be included in the circuit.

Methods to increase self induction (back emf)

- ➔ Use solenoids, having more turns in it.
- ➔ A soft iron core is placed inside the solenoid.
- ➔ Increase the area of cross section (Thickness) of the soft iron core.

Moving coil microphone.

Working

The voice coil is situated in a magnetic field. The diaphragm connected to the voice coil vibrates in accordance with the sound waves falling on it. As a result, electrical signals corresponding to the sound waves are generated in the voice coil

- ➔ Energy change - **Sound energy is converted to electrical energy.**
- ➔ Working principle – **Electromagnetic induction.**

Power transmission

- ➔ When electricity is transmitted to distant places, there is loss of energy in the conductors in the form of heat. This is known as **transmission loss.**
- ➔ **Voltage drop and transmission loss** are the problems we encountered, when power is transmitted to distant places.
- ➔ Electricity is generated at the power station at **11 KV** voltage.
- ➔ The voltage is increased up to **220 kV** at the power station itself. As a result **the current and loss of energy in the form of heat decreases.**
- ➔ The voltage is lowered at different stages of power transmission and electricity is made available to the **distribution transformer** at **11 kV.**
- ➔ **230 V** required for house hold purposes is made available by distribution transformers. **400 V** needed for industrial purposes are also obtained from distribution transformers.

Precautions for avoiding electric shock

- ➔ Never handle electric equipments or operate switches when the hands are wet.
- ➔ Insert plug pins into socket and withdraw them only after switching off.
- ➔ Wear rubber footwear while operating electric devices.
- ➔ Do not fly kites near electric lines.
- ➔ Do not use table fan to dry hair.

First aid to the person, who gets electric shock.

- ➔ Raise the temperature of the body by massaging.
- ➔ Give artificial respiration.
- ➔ Massage the muscles and bring them to the original condition.
- ➔ Start first aid for the functioning of the heart. (Apply pressure on the chest regularly)
- ➔ Take the person to the nearest hospital immediately.

Unit- 4 Reflection of Light

Reflection of light

Light falling on the surface of an object comes back to the same medium.

Laws of Reflection

- ➔ When light is reflected from a smooth surface, the angle of incidence and angle of reflection are equal
- ➔ The incident ray, reflected ray and normal to the surface are in the same plane.

Characteristics of the images formed by a concave mirror and convex mirror

Convex mirror	Concave mirror	
	Position of object	**Position of image and features.**
Image is formed in between the pole of the mirror and the principal focus. The image is diminished, virtual and erect.	At infinity	At F. Real, inverted and diminished.
	Beyond C	Between F and C. Real, inverted and diminished.
	At C	At C. Real, inverted and same size.
	Between C and F	Beyond C. Real inverted and magnified.
	At F	At infinity.
	Between F and P	Behind the mirror. Virtual, erect and magnified.

Concave mirror	Convex mirror
Real images and virtual image are formed	Only virtual images are formed.
Magnified image, diminished image and same size images are formed.	Only diminished images are formed.
Real images are formed in front of the mirror and virtual image is formed behind the mirror.	Images are always formed behind the mirror.
Position and nature of the images are changed, with the change of position of the object.	Whatever be the position of the object, the image is always formed behind the mirror between P and F.

Mirror equation

If **'f**' is the focal length of the mirror, **'u**' is the distance from the object to the mirror and **'v**' is the distance from the image to the mirror, then,

$$\mathbf{1/f = 1/u + 1/v}$$

Equations for solving mathematical problems

- ➔ $f = uv / (u+v)$
- ➔ $v = uf / (u-f)$
- ➔ $u = vf / (v-f)$

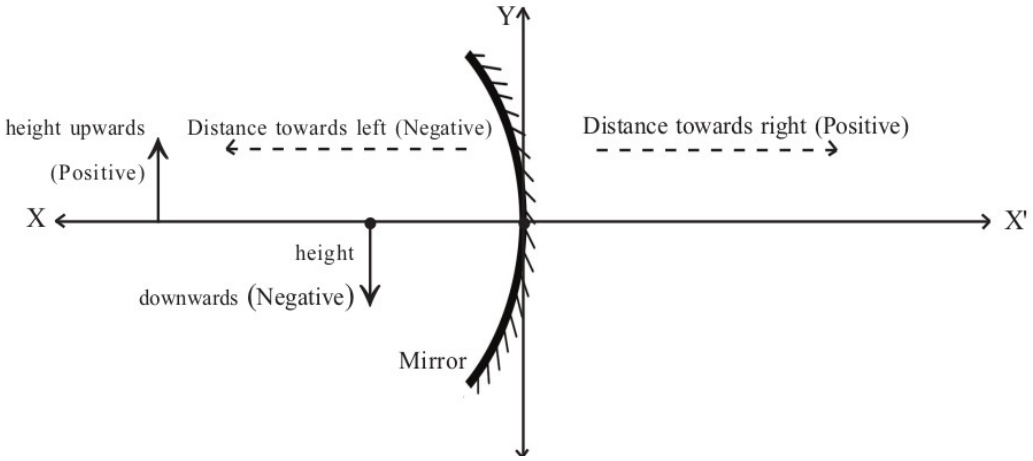
Magnification

- ➔ **Magnification** is the ratio of height of the image to the height of the object
- ➔ Magnification (m) **= Height of the image / Height of the object = hi / ho = -v/u**
- ➔ When the magnification is positive, image is virtual and erect.
- ➔ When the magnification is negative, image is real and inverted
- ➔ When magnification is 1, the size of the image and the size of the object are equal.
- ➔ When magnification is more than 1, the size of the image is greater than the size of the object.
- ➔ When magnification is less than 1, the size of the image is smaller than the size of the object.

New Cartesian Sign Convention

In all experiments related to lenses and mirrors the distances are measured in the same way as in graphs.

- Distances are measured considering the Pole of the mirror as the origin (O).
- Those measured to the right from O are positive and those in the opposite direction are negative.
- Distances measured upwards from X axis are positive and those downwards are negative. The incident ray is to be considered as travelling from left to right.



According to New Cartesian Sign Convention,

- ➔ Distance to the object from the mirror (u) = **Negative**
- ➔ Distance to the image from the mirror (v) = **Negative** (If image is real)
- ➔ Height of object (OB) = **Positive**
- ➔ Height of image (IM) = **Negative (If image is real)**

If Virtual image is formed, then image is behind the mirror. So,

- ➔ Distance to the image from the mirror (v) = **Positive**
- ➔ Height of the image (IM) = **Positive.**

Unit- 5 Refraction of Light

Refraction of light

When a ray of light enters obliquely from one transparent medium to another, its path undergoes a deviation at the surface of separation. This is **refraction.**

- ➔ It is the **difference in the optical densities** that causes the refraction.

Refraction through the glass slab

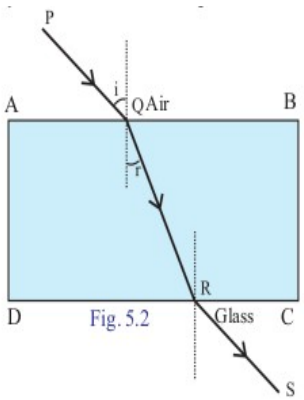


Fig. 5.2

- ➔ When light travels from air to glass (travel from a medium of lower optical density to a medium of higher optical density) - **Refracted ray deviates towards the normal.**
- ➔ When light travels from glass to air (travel from a medium of higher optical density to a medium of lower optical density) - **Refracted ray deviates away from the normal.**

Optical density

Optical density is a measure that shows how a medium influences the speed of light passing through it.

Relation between optical density and speed of light.

- ➔ As the optical density of a medium **increases**, the speed of light through it **decreases.**
- ➔ As the optical density of a medium **decreases**, the speed of light through it **increases**.

Critical angle.

When a ray of light passes from a medium of greater optical density to that of lower optical density, the angle of incidence at which the angle of refraction becomes 90^0 is the **critical angle**. The critical angle in water is 48.6^0.

Total internal reflection.

When a ray of light passes from a medium of higher optical density to a medium of lower optical density at an angle of incidence greater than the critical angle, the ray is reflected back to the same medium without undergoing refraction. This phenomenon is known as **total internal reflection.**

Conditions for total internal reflection

- ➔ Light ray should travel from a medium of **higher optical density** to a medium of **lower optical density**.
- ➔ Angle of incidence should be greater than **critical angle.**

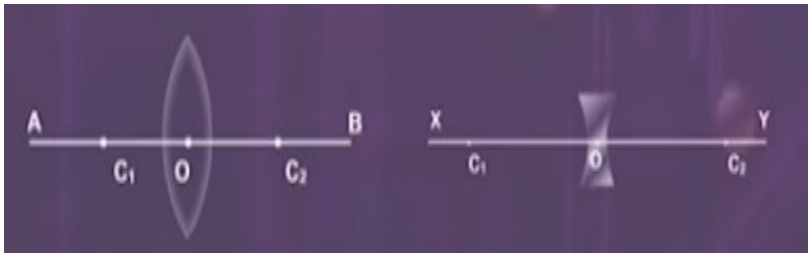
Practical applications of total internal reflection in our day to day life

- ➔ Medical field → **Endoscope.**
- ➔ In the field of telecommunications → **Optical fibre cables.**

Lenses

- ➔ A **lens** is a transparent medium having spherical surfaces.
- ➔ **Convex and concave** lenses are the lenses that we mainly use.

Terms associated with lenses



C_1, C_2 – Centre of curvatures
O – Optic centre.
AB, XY – Principal axis.

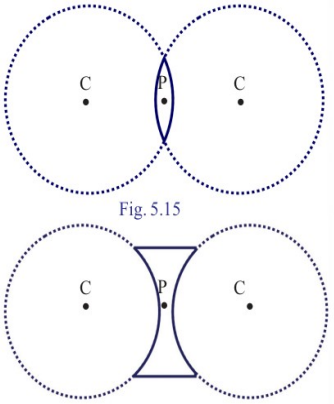


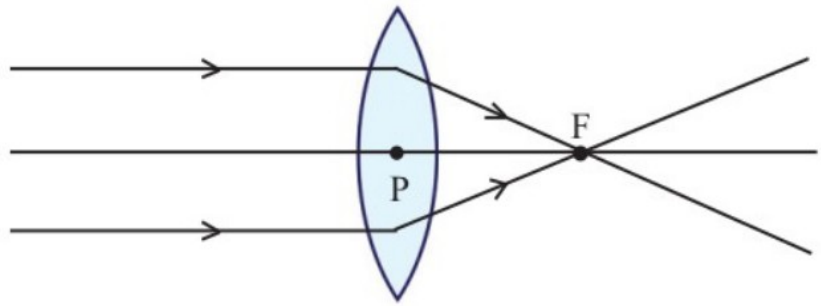
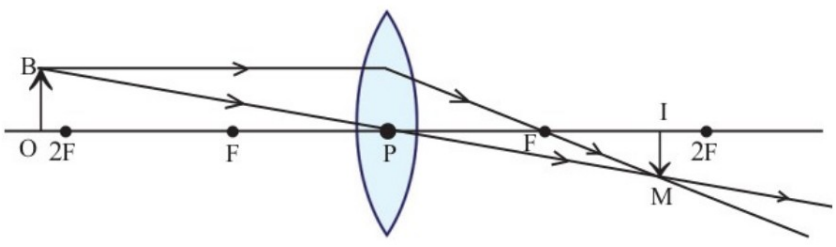
Fig. 5.15

- ➔ **Optic centre** is the midpoint of a lens (P).
- ➔ **Centre of curvature** (C) is the centre of the imaginary spheres of which the sides of the lens are parts.
- ➔ **Principal axis** is the imaginary line that passes through the optic centre joining the two centres of curvature.
- ➔ Light rays incident parallel and close to the principal axis after refraction converges to a point on the principal axis of a convex lens. This point is the **principal focus of a convex lens.**
- ➔ Light rays incident parallel and close to the principal axis diverge from one another after refraction. These rays appear to originate from a point on the same side. This point is the **principal focus of a concave lens.**

Images formed by Convex lens

Position of object	**Position of image**	**Nature of image/ size**		
		Real/ virtual	**Inverted/ erect**	**Magnified/ diminished/ same size**
At infinity	At F	Real	Inverted	Diminished
Beyond 2F	Between 2F and F on other side.	*Real*	*Inverted*	*Diminished*
At 2F	At 2F on other side.	*Real*	*Inverted*	*Same size*
Between 2F and F	Beyond 2F on other side.	*Real*	*Inverted*	*Magnified.*
At F	At infinity.	*Real*	*Inverted*	*Magnified.*
Between F and lens.	Same side of the object	*Virtual*	*Erect*	*Magnified.*

Ray diagrams of image formation by a convex lens

Object is at infinity	
Object is beyond 2F	

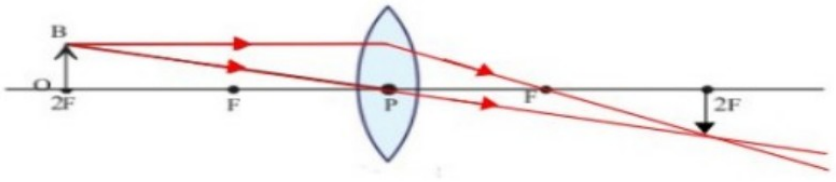
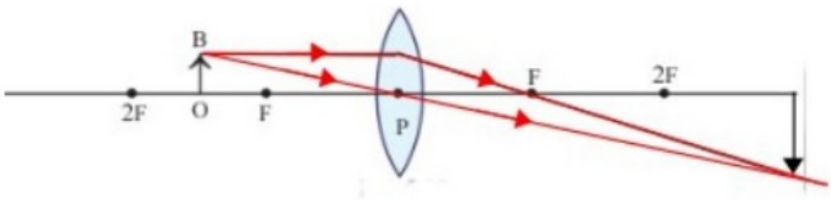
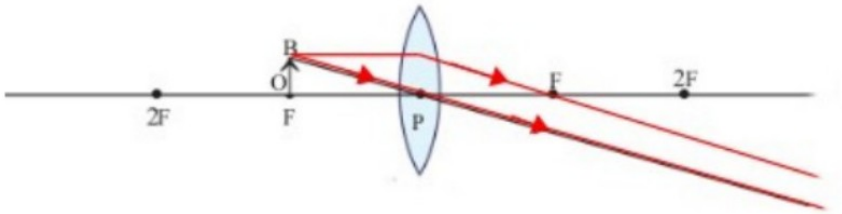
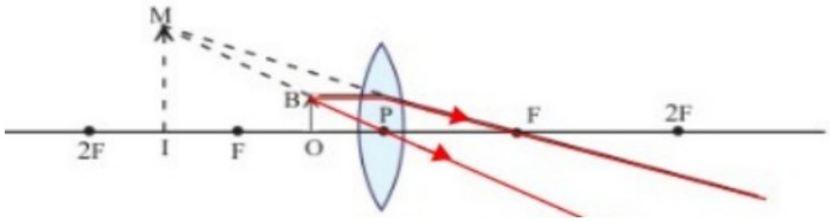
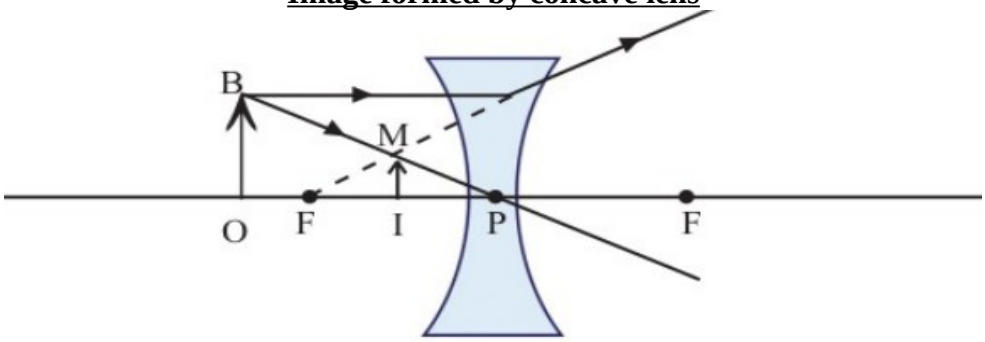
Object is at 2F	
Object is between 2F and F	
Object is at F	
Object is between F and lens.	

Image formed by concave lens



➔ In a concave lens whatever may be the position of the object, the image is always formed at the same side of the object, in b**etween the optic centre (P) and focus(F).** The image is **virtual, erect and diminished.**

Comparison of images formed by a convex lens and a concave lens

Convex lens	Concave lens
Real images and virtual image are formed	Only virtual images are formed.
Magnified image, diminished image and same size images are formed.	Only diminished images are formed.
Real images are formed on the other side of the lens and virtual image is formed at the same side of the object.	Images are always formed at the same side of the object.
Position and nature of the images are changed, with the change of position of the object.	Whatever may be the position of the object, the image is always formed at the same side of the object, in between the optic centre (P) and focus(F)

Unit - 6 Vision And The World of Colours

Dispersion of light

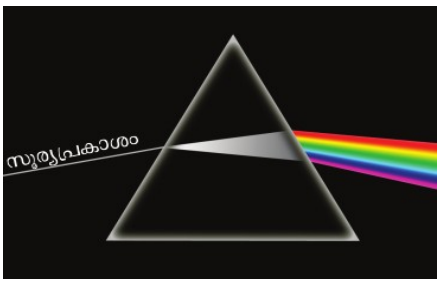
- **Dispersion** is the phenomenon of splitting up of a composite light into its constituent colours
- Any light that is composed of more than one colour is a **composite light.**
- The regular array of colours formed by dispersion is the **visible spectrum.**
- Light rays of shortest wavelength- **Deviates more.**
- Light rays of longest wavelength - **Deviates less.**

Reason for dispersion

Light undergoes **refraction** when it enters the prism obliquely and when it comes out of the prism. **The extent of deviation** depends on the **wavelength**. Therefore waves **undergo deviation** at **different angles** and get separated. This is the reason for dispersion.

Dispersion through glass prism

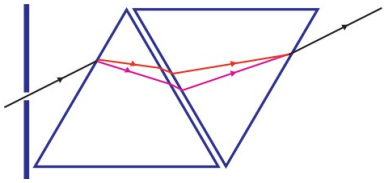
- Colour seen nearer to the base of the prism **-Violet.**
- Colour seen far away from the base – **Red.**
- Order of colours from the base **-Violet, Indigo, Blue, Green, Yellow, Orange, Red. (VIBGYOR)**



Rainbow

- **Dispersion** of light caused by the water droplets in the atmosphere causes rainbow.
- In the morning rainbow is seen- **West.**
- In the evening rainbow is seen – **East.**
- Sunlight passes through the water droplets in the atmosphere **refracted twice,** and has **one internal reflection** also.
- Colour seen at the upper edge of the rainbow –**Red.**
- Colour seen at the lower edge of the rainbow- **Violet.**
- The light ray emerging from the water droplets which make the same angle with the line of vision have the same colour. These droplets appear in the form of an arc of a particular colour.
- When seen from an aeroplane, the rainbow is seen as a **circle.**

Recombination of colours



➔ When the dispersed light coming out from a prism, passes through another prism, it becomes white light again.

Persistence of vision

➔ When an object is viewed by a person, its image remains in the retina of the eye for a time interval of 0.0625s (1/16 s) after seeing it. This phenomenon is called **persistence of vision.**

➔ If more than one scene is viewed within 0.0625s, the effect of all these scenes will be felt by the eye simultaneously.

➔ Examples of persistence of vision -

- ➔ Newton's colour disc appears **white**, when it rotated fast.
- ➔ A torch rotated rapidly appears as an **illuminated circle.**
- ➔ Raindrops appears like a **glass rod.**
- ➔ A fan appears like a **disc**, when it rotates fast.

Scattering of light

➔ **Scattering** is the change in direction brought out by the irregular and partial reflection of light when it hits the particles of the medium**.**

➔ Light rays of shortest wavelength – **Scattered more.**

➔ Light rays of longest wavelength- **Scattered less.**

➔ **Sky appears blue**- Colours like violet, indigo and blue have the smallest wavelengths in sunlight. They undergo maximum scattering while interacting with atmosphere particles.

➔ **Sun and horizon appears red during sunset and sunrise**. - During sunrise and sunset, light reaching us from the horizon has to travel long distances through the atmosphere. During this long journey, colours of shorter wavelength would be almost fully lost due to scattering. Then, the red light which undergoes only less amount of scattering decides the colour of the horizon.

➔ As the **size of the particle increases**, the rate of scattering also **increases.**

➔ If the size of the particles is greater than the wavelength of light, then the scattering is same for all colours**. (**Sky in the cites appears grey**)**

➔ Red colour has been given to the tail lamps of vehicles and signal lights – **Because of its higher wavelength, red can travel long distances without scattering.**

Unit 7 – Energy management

Fossil fuels

➔ **Fossil fuels** are formed by the transformation of plants and animals that went under the earth's crust millions of years ago. The transformation took place in **the absence of air under high pressure and high temperature.**

➔ **Coal, petroleum and natural gases** are fossil fuels.

➔ They are not replenished or renewed in proportion to their consumption. Hence they are **non renewable energy sources.**

Coal

- ➔ **Coal** is the most abundant fossil fuel on the earth.
- ➔ The main component of coal is **carbon.**
- ➔ Based on the carbon content, coal is classified into four groups as **peat, lignite, anthracite and bituminous coal.**
- ➔ When coal is distilled in the absence of air, the substances obtained are **ammonia, coal gas, coal**

C. N. G (Compressed Natural Gas), L. N. G (Liquefied Natural Gas)

- ➔ Obtained from the **natural gas.**
- ➔ Main component is **methane.**
- ➔ used as fuels in vehicles, industries and thermal power stations
- ➔ Importance of L. N. G -**natural gas can be liquefied and transported to distant places conveniently**

L. P. G (Liquefied Petroleum Gas)

- ➔ obtained through the fractional distillation of petroleum
- ➔ Main component is **butane.**
- ➔ colourless, odourless gas
- ➔ **Ethyl mercaptan** is added as an indicator to detect gas leakage

L P G and Safety

- ➔ Never switch on or switch off electricity when there is a leakage of LPG – **Sparking causes fire.**
- ➔ If there is leakage of LPG it is mandatory to open the doors and windows -**LPG is denser than air, so they seen at the bottom of the atmosphere.**
- ➔ Examine the rubber tube at regular intervals and ensure that it does not have a leakage.
- ➔ Turn on the knob of stove only after the regulator is turned on.
- ➔ Ensure that the expiry date of the cylinder is not over.
- ➔ The expiry date of a cylinder is **2024 march 31**, if it is marked as **A24** on the top of the cylinder.

If a gas leak is suspected

- ➔ Disconnect electricity from outside.
- ➔ Switch off the regulator and shift the cylinder to an empty space.
- ➔ Keep the windows and doors open.
- ➔ Well trained rescue operators can put out the fire by covering the top end of the cylinder with wet sack to prevent the contact with oxygen

Green Energy

- ➔ **Green energy** is the energy produced from natural sources that does not cause environmental pollution
- ➔ All the energy produced from **renewable sources** belong to this category

Brown Energy

- ➔ Energy produced from non renewable sources such as petroleum and coal, and the nuclear energy are named **brown energy.**
- ➔ Brown Energy cause **environmental problems including global warming.**

Green Energy	Brown Energy
Solar cell	Atomic reactors
Tidal Energy	Diesel engines
Hydro electric power	Thermal power station.
Wind mills	Coal

Energy Crisis

- ➔ **Energy crisis** is the consequence of increasing demand but decreasing availability

Reasons for energy crisis

- ➔ Energy is wasting.
- ➔ Excess usage of non renewable sources of energy.
- ➔ Industrialisation
- ➔ Population growth.

Solutions for energy crisis

- ➔ Judicious utilisation of energy.
- ➔ Maximum utilisation of solar energy.
- ➔ Making use of public transportation as far as possible.
- ➔ Timely maintenance of machines.

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