# SMILE 2024

## SSLC-PHYSICS

## (ENGLISH)

# SMILE 2023- SSLC-PHYSICS
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# ആമുഖം

കണ്ണൂർ ജില്ലയുടെ SSLC, +2 പൊതു പരീക്ഷാ ഫലം ഉയർത്താൻ, ജില്ലാ പഞ്ചായത്തും വിദ്യാഭ്യാസ വകുപ്പും സംയുക്തമായി നടപ്പാക്കി വരുന്ന സ്മൈൽ സമഗ്ര വിദ്യാഭ്യാസ പരിപാടിയെ കുറിച്ച് നമുക്കറിയാമല്ലോ. അതിന്റെ ലക്ഷ്യപ്രാപ്തിക്കായി ജില്ലയിലെ മികച്ച അധ്യാപകരുടെ സഹകരണത്തോടെ ഇത്തവണയും കൈപുസ്തകം തയ്യാറാക്കുകയാണ് .എല്ലാ പാഠഭാഗങ്ങളിലൂടെയും ഒരവലോകനം നടത്താനും ചോദ്യമാതൃകകൾ കുട്ടികളെ പരിചയപ്പെടുത്താനും ഉതകും വിധമാണ് ഈകൈപുസ്തകം തയ്യാക്കിയിട്ടുള്ളത് . എല്ലാതരം ചോദ്യമാതൃകകളും ഈ കൈപുസ്തകത്തിൽ ഉൾപ്പെടുത്താൻ ശ്രമിച്ചിട്ടുണ്ട് . പത്താംതരം ഭൗതികശാസ്ത്രത്തിൽ മെച്ചപ്പെട്ട ഗ്രേഡ് കരസ്ഥമാക്കാൻ കുട്ടികൾക്ക് സാധിക്കത്തക്കവിധം ഈ കൈപുസ്തകം ഉപയോഗിക്കാൻ കഴിയും എന്ന് വിശ്വസിക്കുന്നു. അതുവഴി വിദ്യാഭ്യാസരംഗത്ത് വീണ്ടും ജില്ലയെ ഒന്നാമതെത്തിക്കാനുള്ള സദുദ്യമത്തിന് ദീപശിഖകളാവാനും സാധിക്കുമെന്ന പ്രത്യാശിക്കുന്നു.

# Unit 1 - Effects of electric current

## Important concepts

* Transformation of electrical energy
* Heating effect of electricity
"Joules law
*Electric power
*Devices that works in heating effect

The electric effect of a device is decided by, into which energy form it to transforms electrical energy

Electric bulb: lighting effect
Electric iron : Heating effect
Electric motor: mechanical effect
Charging a battery: chemical effect

## Heating effect of electricity

Heating effect is the utilization of heat generated while electric current is passing through a conductor
Major devices
1. Electric iron
2. Electric heater
3. Soldering iron
4. Immersion heater

**Joule heating ( ohmic heating)**
Joule heating is the process by which heat energy generated in a conductor while current passing through that

**Joules law**
The heat generated in a conductor due to flow flow of current is directlr prportional to the product of square of inencity of current (I), resistance of the conductor (R) and the time of flow(t)

**Factors influencing heat generated in a conductor while current is passing through that**

1. Intensity of electric current ( I )
When current increases by two times, heat increase is by 4 times
Then current decreases by 1/2, heat decreases by 1/4 times
2. Resistance of the conductor ( R)
When resistance is doubled without change in current, heat also doubled
3. Time of flow of current (t)
When time of flow is doubled heat also is doubled

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

H=heat (unit J), I= current( unit A), V- potential difference ( unit V), t= time (unit s)
R =resistance (unit Ω)

**Electric power**

Electric power of a device is the electric energy consumed by it in one second

It's unit is Watt(J/s)

Power offer and electric device is the product of voltage applied and the current passing through it

**P = V x I**

other equations

**$P= I^2R$**

**$P= V^2/R$**

**Factors affecting the power of of an electric device**

1. **Resistance** (R) when resistance increases power decreases (when resistance increases by two times power decreases by half)
2. **Voltage (V)** as the voltage increases power increases (when voltage increases by 2 times power increases by four times , when voltage decreases by half, power decreases by 1/4 times)

**Heating coil**

Heating coil is the part of an electrical devices where electrical energy is converted to heat energy

**Nichrome** is used as heating coil. Nichrome is an alloy of nickel, chromium and iron

Features of nichrome

- # high resistivity
- # high melting point
- # can stand for long time in Red hot condition

Safety fuse is an arrangement that protects electrical circuits and devices from the hazards of excess electric flow

The major part of safety fuse is the fuse wire, which is made of an alloy of tin and led.

It's melting point is **low**

**Some sample questions**

1. Identify relation and fill the other

a) intensity of electric current : ampere

Electric charge : .....

b) electric bulb : lighting effect

Soldering iron : .....

2. The process by which heat energy is generated in a conductor while electric current is flowing through that is known as .....

What change occurs in the heat energy generated in a conductor when the electric current is decreased by 1/2 times?

( 1/ 2 times, 1/4 times, 2 times, 4 times)

4. Which part of an electrical heating device converts electrical energy heat energy ? Which material is used to make that part?
5. Which peculiarities of nichrome are the reasons behind using it as heating coil ?
6. If the current is " I " ampere , then the charge flowing in "t" second is .....

( $Q = I^2t$,. Q= It,. Q= I/ t)

7. In which way safety fuse is connected in a circuit?
8. Safety fuse works in the ..... of electricity

( mechanical effect, lighting effect, heating effect, magnetic effect. )

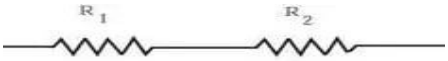
9. An electric device is marked as 240V, 100 W. If the working voltage is 100 V, what will be it's power?
10. Calculate the power of a heater , if it works in 200 V, and the current is 0.5 A

## Connection of resistors

Major concepts
* Resistors in series
* Resistors  in parallel
* Effective resistance
* Circuit analysis

**Series**

Resistors are connected one after the other to complete circuit through **single path**




* Effective resistance increases
* Voltage at each resistor is different ( more voltage at high resistance )
* Current is same through each resistor

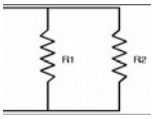
In series connection effective resistance is the sum of individual resistance

$\mathbf{R = R_1 + R_2 + R_3}$

If equal resistors are connected in series then **R = n x r** , where **n** is the number of resistors and **r** the value of single resistance

**Parallel**

The ends of resistors are connected to common point and arranged as **branches**



* Effective resistance decreases
* Voltage is same at each resistor
* Current is different through each resistor ( less current through high resistance )

In parallel connection effective resistance is calculated as ,

$\mathbf{1/R = 1/R_1 + 1/R_2 + 1/R_3}$

If two equal resistors are connected in parallel , effective resistance will be half of individual resistance

If “n” resistors of “r” ohm are connected as parallel, then effective resistance is **R= r/n**

**Sample questions**

1. In which way resistors are connected to get the effective resistance to be increased ?

2. In which method, resistors are connected to a common point ?

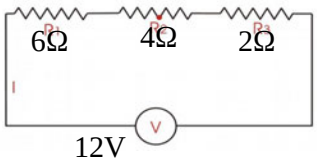
3. Classify the below given statements as **series** and **parallel**

a. Voltage is same across each resistor
b. current is same through each resistor
c. Effective resistance increases
d. Effective resistance decreases

4. If **two r**esistors of 10 Ω are connected as parallel, then the effective resistance will be .....

5. If **ten** resistors of 20 Ω are connected as parallel, then the effective resistance is.....

6. Observe the circuit diagram




1. In which way resistors are connected ?
   ( Series/ parallel )
2. What is the effective resistance ?
3. Calculate the current through circuit
4. How much is the current through 4Ω resistor ?

## Lighting effect of electricity

Major concepts
* filament lamps
* discharge lamps
* LED

**1. Filament lamps/ incandescent**

Filament lamps are called as incandescent lamps as they emit light by glowing the filament on heat.
The filament is made of **tungsten**

**Features of tungsten**

***** high resistivity
* high melting point
* can be made as thin wires
* gives white light on white hot condition

The bulb is evacuated to avoid oxidation of filament
To reduce the vaporisation of filament, inert or nitrogen gas is filled in the bulb.

**Disadvantage**

The efficiency of filament lamps are very less as most of the electric energy is lost in the form of heat.

**2. Discharge lamps**

* A glass tube having two electrodes at the ends
* Certain gases are filled inside the tube
* Light is emitted due to electric discharge through the gas.

**3. LED**

*Light emitting diode
* Eco-friendly , lighting devices
* Low power consumption , High efficiency, longevity are the advantages

**Sample questions**

1. Identify relation and fill the blank
heating coil : nichrome
filament : .....

2. Nichrome is not used as filaments in electric bulbs . Why ?
3. What is the importance of nitrogen gas in filaments lamps ?

4. In filament lamps, how the oxidation of tungsten filament is avoided ?

5. Write down the advantages of LED lamps

6. The use of filament lamps must be controlled . Why ?

7. Which part of LED helps to absorb the heat developed ?

8. What is the reason behind the low efficiency of filament lamps ?

9. What is the structure of discharge lamp ?

10. Light is emitted due to the ..... through gas filled in a discharge lamp.

11. Among the given statements identify the statement which is not suitable for tungsten
a. high resistivity
b. high melting point
c. low resistivity
d. made as thin wires

12. Nitrogen is filled in the filament lamps to reduce .....of the filament.
( melting, oxidation, vaporisation )

# Unit 2 - Magnetic effect of electricity

**Important concepts**

►Magnetic field around a straight current carrying conductor
►Solenoid
►Motor principle
►Devices working in magnetic effect

A magnetic field is developed around a straight current carrying conductor due to the current flow

Right hand thumb rule helps to find the direction of magnetic field developed around a straight current carrying conductor

Right hand thumb rule was introduced by James Clerk Maxwell

**Right hand thumb rule**
Hold the conductor pointing the thump in the direction of current
The direction of magnetic field is indicated by the other fingers that hold the conductor

**Solenoid**
The solenoid is **a coil of wire that acts** like an electromagnet when a flow of electricity passes through it

At the end where the electricity is in **clockwise** direction is **South pole**
At the end where the electricity is in **anticlockwise** direction is **north pole**

## Methods to increase the magnetic strength of a a current carrying solenoid

*Increase the intensity of current
*increase the number of turns
* increase the thickness of the soft iron core
*decrease the closeness of of windings

## Comparison of current carrying solenoid and a bar magnet in thier magnetic property

### solenoid

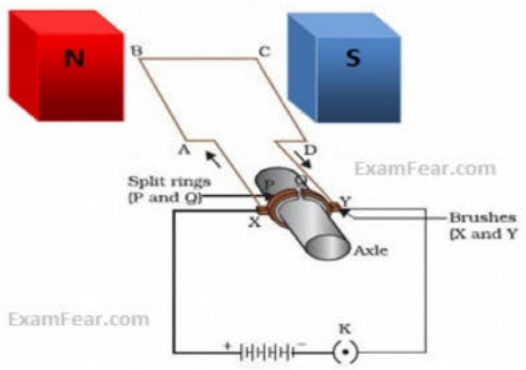
Magnetic strength can be changed
Poles can be reversed by changing the direction of current

**Bar magnet**
Magnetic strength is fixed
Poles are permanent

**Flemings left hand rule**
It is to find the **direction of motion** of current carrying conductor in magnetic field

**Motor principle**
A current carrying conductor in magnetic field experience a force and moves in the direction of force

**Dc motor**




**N ,S –** magnetic poles

**ABCD** - Armature

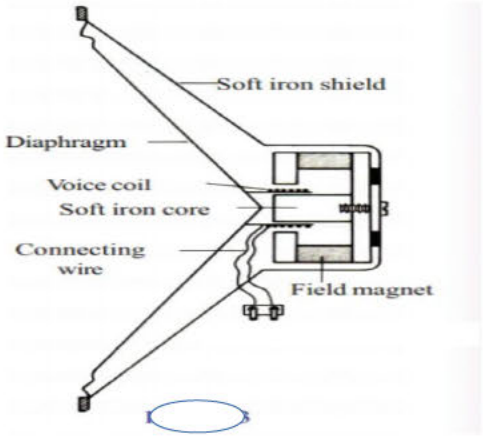
**P& Q** -split rings

X, Y- brushes

When current is passing through the armature according to motor principle a force is developed in the armature and it moves in the direction of force

The s**plit ring commutator** changes the direction of electric current through the armature after each half rotation to maintain the rotation in one direction
Energy transformation → electrical energy to mechanical energy
Working principle → motor principle

**Moving coil loudspeaker**



## Working of a loudspeaker

The electrical signals from microphone reaches and amplifier
Amplifier increases the strength of the signals
The signals are reached in the voice coil
The voice coil is situated in a magnetic field
It experiences a force and vibrates
The diaphragm along with the voice coil also starts vibrate and sound is reproduced

**Sample questions**

1. What is the reason when a magnetic needle near a current carrying conductor deflects ?

2.Which rule helps us to find the direction of magnetic field around a straight current carrying conductor ?

3. In the right hand thumb rule, the thumb indicates .....

4. The insulated copper wire coil that utilise the magnetic effect of electric current is known as.....

5.When current through a solenoid is increased its magnetic strength .....

6. What are the factors that affect the direction of motion of the conductor when it is kept in a magnetic field ?

7.In Flemings left hand rule which finger indicates the direction of magnetic field?

8. Identify the relation and fill in the blanks
   magnetic field around a straight conductor : right hand thumb rule
   the motion of conductor in a magnetic field: .....
9. Which effect of electricity is utilised in an electric motor ?

10. Which part of the DC motor helps to rotate armature continuously in one direction ?

11. What are the moving parts in a DC motor ?

12. What is the working principle of a moving coil loudspeaker ?

13. Which device converts electrical energy to sound energy on the basis of motor principle ?

14. If you supply AC electricity in the input of a DC motor, will it works ? Why ?

15. Compare the magnetic property of solenoid and bar magnet

# 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 electro-magnetic induction.

**Factors influencing induced e.m.f. (induced current)**

- Number of turns of the coiled conductor
- The strength of the magnet
- The speed of motion of a magnet or coil

The direction of induced current in electromagnetic induction depends on the direction of the magnetic field and the direction of motion.

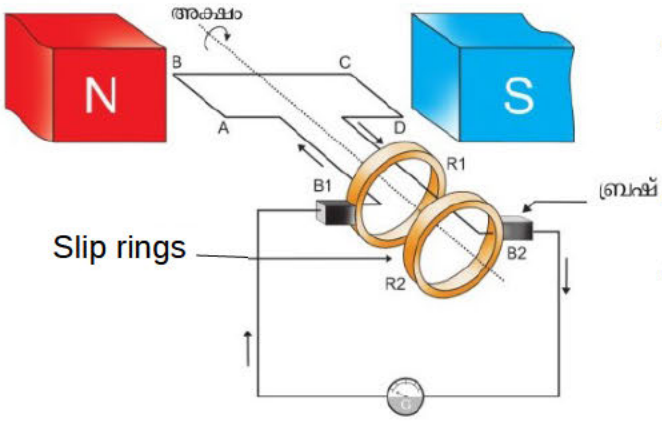
**Direct current (DC)** - A current that flows only in one direction continuously
**Alternating current (A C)** - Current that changes direction at regular intervals of time,

## Generator

Generator is a device that converts mechanical energy into electrical energy by making use of electromagnetic induction.

## Ac Generator

**Parts of AC generator**




➔ NS -Field magnet

➔ ABCD -Armature

➔ B 1 , B 2 – Brushes

➔ R 1 , R 2 - Slip rings

**Field magnet**- generates 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.

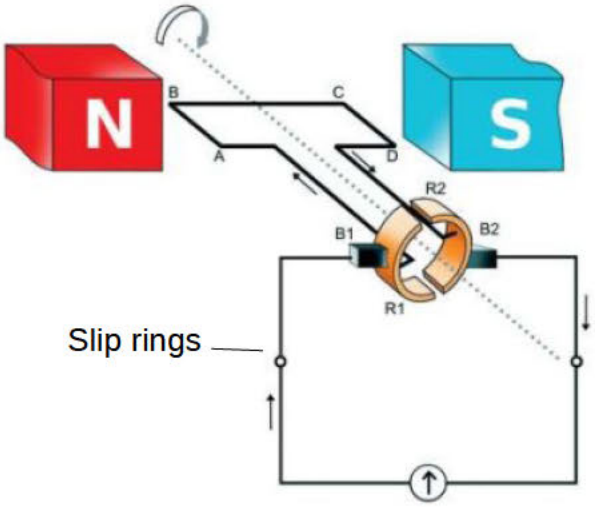
**Slip rings-** Metal rings which are welded together with the armature coil.

**Brushes-**They are arrangements which always make contact with the slip rings.

Current flows through them to the external circuits.

**Working principle** - Electromagnetic induction
**Energy transfer** – mechanical energy to electrical energy

## DC generator

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**Parts of DC generator**

➔ NS -Field magnet

➔ ABCD -Armature

➔ B 1 , B 2 – Brushes

➔ R 1 , R 2 - Split rings

**Structural differences and similarities between AC generator and DC generator**

**Similarities**

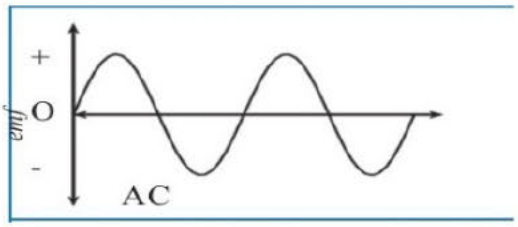
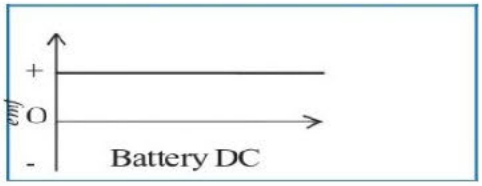
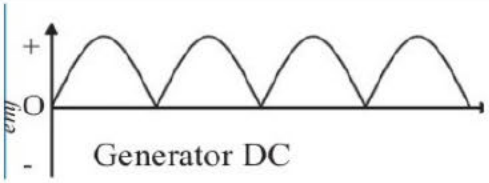
1 Armature and field magnet are used in both.
2 Both works based on the principle of electro magnetic induction.
3 AC is induced in the armature in both cases.

**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. |

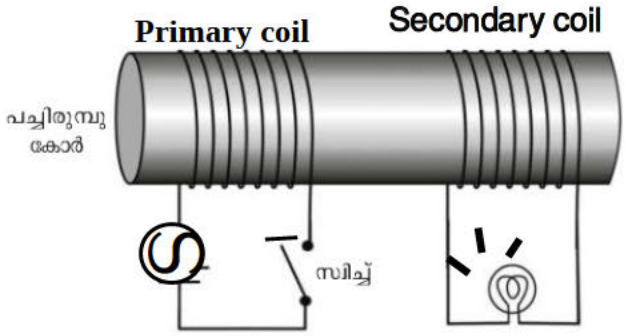
► The frequency of AC generated for distribution in our country is 50 cycles per second or 50 Hz.

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

| | |
|---|---|
|  | • Direction changes continuously<br>• Emf increase or decrease |
|  | • Direction does not changes<br>• Emf does not change |
|  | • Direction does not changes<br>• Emf increase or decrease |

## mutual induction

*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*

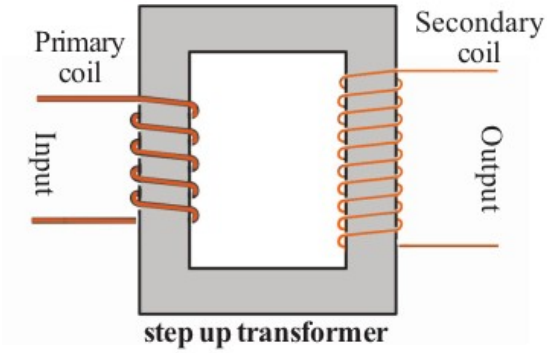



➔ The coil into which we give current for the production of magnetic field is the **primary coil**
➔ The coil in which induced emf is generated is the **secondary coil.**

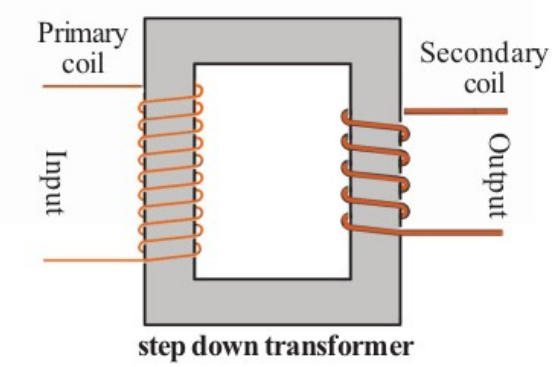
## Transformer

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

- The one which increases AC voltage is **step up transformer.**
- The one which decreases AC voltage is a **step down transformer.**
- A transformer is a device that works on the principle of **mutual 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. |

◙ If **$V_S$** is the secondary voltage, **Vp** is the primary voltage, **$N_S$** is the number of turns in the secondary and **$N_P$** the number of turns in the primary in

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

◙ In a transformer,

Power in the primary = Power in the secondary

That is,

$$V_P \times I_P = V_S \times I_S$$

*In a step up transformer the voltage in the secondary coil is more and the current is less. But in a step down transformer the secondary voltage is less and the current is more.*

## 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, 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.

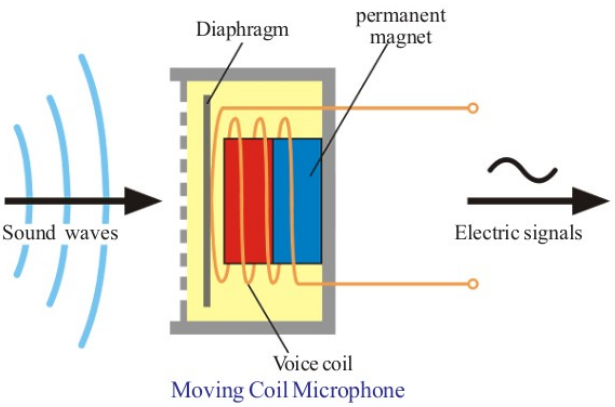
## Methods to increase self induction (back emf)

► 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



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 and Distribution

►Power stations are places where electricity is generated on a large scale for distribution

►In India electricity is produced at 11 kV (11000 V) In each in power stations.

►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.**

►Transmission loss can be reduced by **increasing voltage and decreasing current** .

►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.

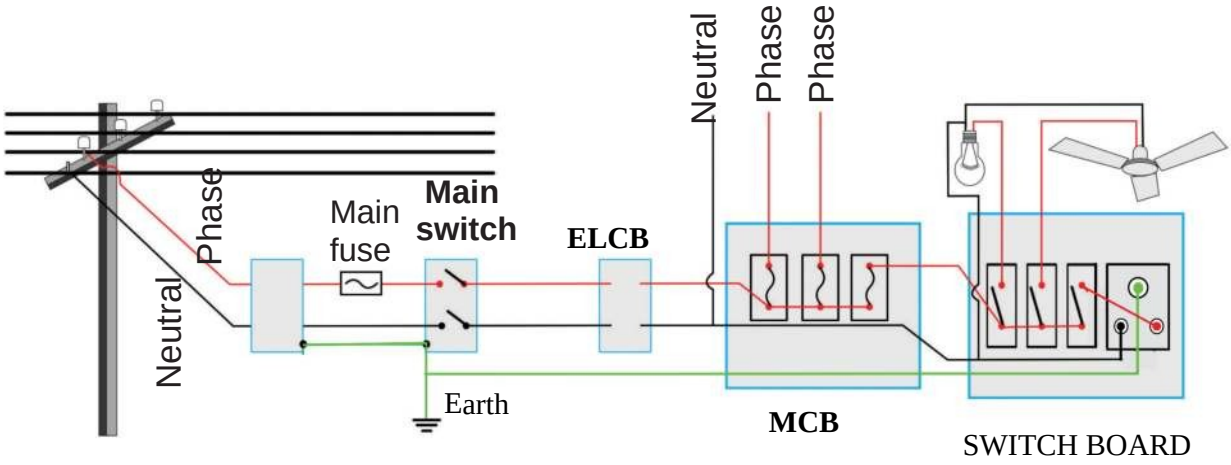
►Electricity is made available to the distribution transformer at 11 kV.

►4 wires are coming out from a distribution transformer. Of these one is neutral and the other three are phases.

►The potential difference between a phase and neutral is 230 V and that between any two phases is 400 V.

►Transformer in a power station is step up and distribution transformer is step down

## Household Electrification




♦ The household devices are connected in parallel
♦ Fuse and switches are connected to phase

**The advantages of connecting devices in parallel**

♦ Devices work according to the marked power
♦ Devices can be controlled using switches as per need.
♦ If one equipment damage other works

►**Watt - hour meter** is a device that is used to measure electrical energy. Electrical energy is measured using the unit **kilowatt hour**. This is also known as **a unit.**

*If "n" equipments of "p" power ( in watt) works for " t" hours*

$$\text{Energy in kilowatt hour} = \frac{npt}{1000}$$

►MCB is a device that is used in the place of a fuse wire branch circuits
►MCB works making use of heating and magnetic effects of electricity..
►ELCB helps to break the circuit automatically whenever there is a current leak due to insulation failure or any other reason

►In order to ensure safety, three pin plugs are used .
►The length and thickness of the earth pin is more than that of the other.
►Earth line connected to body of the appliance

## Electric Shock

Electric shock occurs when we touch bare wires or cable with damaged insulation or when lightning strikes

**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.
►Take the person to the nearest hospital immediately

## Sample questions

1) Understand the word relation and fill in the blanks.
   a) AC Generator: Slip Rings; DC Generator: .....
   b) Transformer: Mutual induction; Inductor: .....

2)Electricity is induced in a solenoid whenever there is a change in the magnetic flux linked with it.

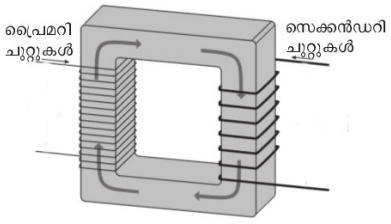
a) This phenomenon is known as.....?

b) write an instrument makes use of this ?

3) Below are some relations about transformers. From these, select suitable for step-up transformer

(a) Vs > Vp (b) I s < I p (c) I s > I p

4) Below is a picture of a transformer

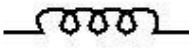



a) What type of transformer is this?

b) What is the reason for using thicker wire used in secondary?

5) a) Write the names of the electronic components below.

(i) 

(ii) 

b) If each of these is connected to an AC circuit, in which circuit will the power loss occur? Why?

6) Find out odd one out . Validate the answer.

(Microphone, Loudspeaker, Transformer, Generator)

7) What are the factors influencing the strength of induced emf in electro-magnetic induction

8) What is the function of the following devices in household electrification?

a) MCB b) ELCB c) Earth wire

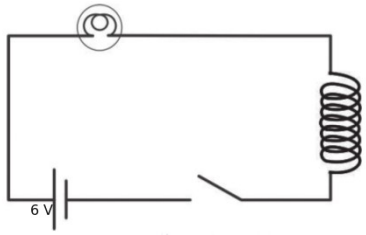
9) The current in the secondary of a transformer is 2A and the current in the primary is 1 A.

(a) What type of transformer is this?

(b) If 200V is obtained in the secondary of this transformer, what is the voltage in the primary?

10) What is meant by transmission loss? How can this be fixed?

12) Observe the picture and find the answers to the following questions.




a) In this circuit, 6V dc replaced by 6Vac , what change you will observe in the intensity of the bulb

b) Explain what is the phenomenon that causes this? Why?

13) Find false statements from the following and correct it

♦ The potential difference between a phase and neutral is 400 V

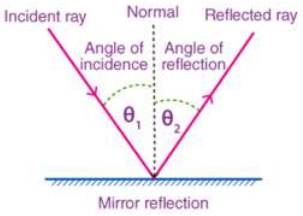
♦ The neutral potential is zero.

♦ Electricity is made available to the distribution transformer at 11 Kv.

♦ 110 V required for house hold purposes is made available by distribution transformers.

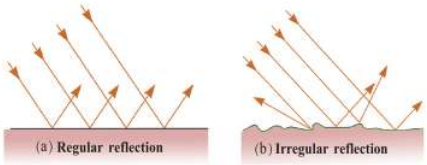
# 4 Reflection of light

## Laws of reflection



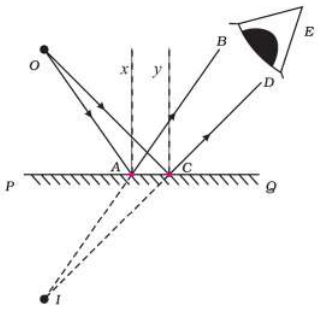

- When light is reflected from a smooth surface, **the angle of incidence and angle of reflection** are equal.
- The incident ray, reflected ray and normal to the surface are in the same plane

## Regular reflection and Irregular reflection




**Regular reflection:** When light falls on a smooth surface, it undergoes regular reflection. The ray of light travelling parallel after reflection.
**Irregular reflection:**When light falls on a rough surface, it undergoes an irregular reflection. This is scattered reflection.

## Image Formation by a Plane Mirror

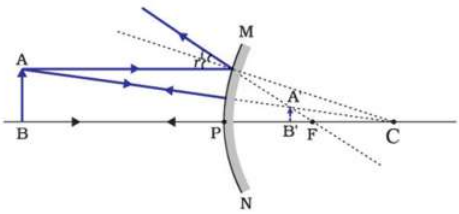



**Characteristics of the image :**

- The distance from the mirror to the object and the image from the mirror is **Equal.**
- Size of object and the image are **same size**
- Image is **virtual & Erect** image

***Use: For observing face***

## Image Formation by a Convex mirror




**Characteristics of the image :**

- Image is formed in between the pole of the
- mirror and the principal focus.
- The image is **diminished,virtual and erect.**

***Use: Used as rear view mirror***

## Image Formation by a Concave mirror

| Position of object | Position of image & features | Uses |
|---|---|---|
| At Infinity | At F,real &inverted,small | Used as Solar cocentrators |
| Beyond C | Between C&F,real &inverted, small | |
| At C | At C,real &inverted,same size | |
| Between C&F | Beyond C,real&inverted,Big | |
| At F | At Infinity,real&inverted,Big | Used as head light of car ( As reflector) |
| Between F & P | Behind the morror, virtual & erect,Big | Used by dentist,shaving morror, makeup mirror |

## Multiple Image Formation

If **N** is the number of images and **θ** is the angle between mirrors then,

$$N = \frac{360}{\theta} - 1$$

## Mirror formula

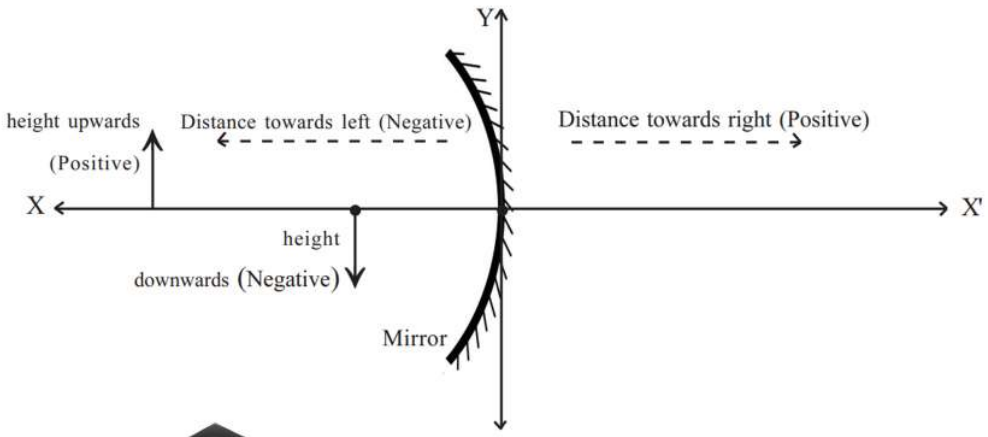
$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

u = Object distance
v = Image distance
f = focal length

$$f = \frac{uv}{u+v} \qquad u = \frac{vf}{v-f} \qquad v = \frac{uf}{u-f}$$

## 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.




## Points to remember

| Concave mirror | Convex mirror |
|---|---|
| f - Negative<br>u -Negative<br>v -Negative(real) or Positive(Virtual) | f - Positive<br>u -Negative<br>v -Positive(Virtual) |

## Magnification

Magnification is the ratio of height of the image ($h_i$) to the height of object ($h_o$)

$$m = \frac{h_i}{h_o} = \frac{-v}{u}$$

## Points to remember

| | |
|---|---|
| If magnification is negative | Image is real and inverted. |
| If magnification is positive | Image is virtual and erect. |
| If magnification is 1 | Height of image and height of object are equal. |
| If magnification is less than 1 | Height of image is less than height of object. |
| If magnification is greater than 1 | Height of image is greater than height of object. |

## Sample Questions

1. Observe the relation in the first pair and complete the second pair.

Shaving mirror : Concave Mirror

Rearview mirror :.....

2. The radius of curvature of a convex mirror is 24 cm. Find its focal length ?

3. Which mirror that forms an image that is always upright and smaller than the object ?

4.Which of the following statements is correct?

a) When magnification is more than 1, the size of the image is greater than the size of the object.

b) When magnification is less than 1, the size of the image is greater than the size of the object.

c) When the magnification is positive, image is real and inverted

d) When the magnification is negative, image is real and inverted

5.Two plane mirrors are arranged at an angle of 60º between the mirrors

What is the number of images formed ?

(4, 5, 6, 7)

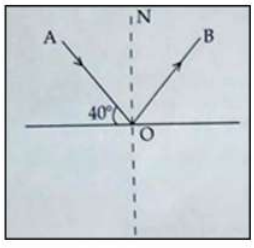
6. A concave mirror forms an image of the same size as that of object .What will be the position of object ?F

(beyond C, At C, between C and F, between F and P)

7. Observe the picture

a) What is the angle of incidence?

b) What is the angle of incidence?



8.From the following, list the statements related to concave mirror and convex mirror .

(a) As makeup mirror

(b) As rearview mirror in vehicles

(c)In solar concentrators

(d) Shaving mirror

(e)Reflector in head lamp of vehicles

(f) Doctors head mirror

9. Which type of mirror is used to produce images with the following characteristics?

(a) Real, greater than object

(b)Virtual, greater than object

(c) Virtual , smaller than object

(d) Real, smaller than the object

10.(a)Which spherical mirror always forms an upright and virtual image?

(b) Is the size of this image larger or smaller than the object?

11.Complete the table.

| **Position of image and features** | **Mirror** | **Uses** |
|---|---|---|
| For the object placed between principal focus and pole, the images formed are enlarged and erect. | Concave mirror | Shaving mirror |
| Converges distant rays to the principal focus. | a) …… | b) …… |
| Image is always formed in between the pole of the mirror and the principal focus The image is diminished, virtual and erect. | c)…… | d)…… |

12.An object of height 1 cm is placed 10 cm away from a concave mirror.The height of the image formed in front of the mirror is 2.5 cm.

(a) Calculate the magnification.

(b) Calculate the distance from the mirror to the image.

13. An object is located at a distance of 24 cm away from a concave mirror. A real image is formed at a distance of 12 cm from the mirror. Find the focal length?

14. An object is placed 20 cm away from a concave mirror of focal length 15 cm. How far from the mirror is the image formed?

15.When an object of 2 cm high is placed 15 cm away in front of a concave mirror .A real image is formed at a distance of 30 cm.

a) Find the focal length of the mirror.

b) Calculate the magnification.

c) Calculate the height of the image.

# 5 Refraction of light

## Refraction

When a ray of light entering 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 deviation.*

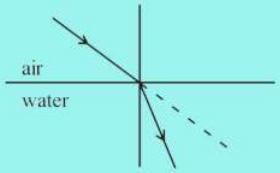
## Points to remember

decreases ⟵ Optical density ⟶ increases

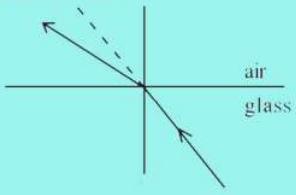
**Air < Water < Glass < Diamond**

increases ⟵ Speed of light ⟶ decreases

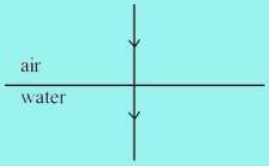
From a medium of lower optical density to that of a greater one the refracted ray **deviates towards the normal.**




From a medium of greater optical density to that of a lower one the refracted ray **deviates away from the normal.**




**No deviation** takes place in the case of a light ray falling normally on a medium

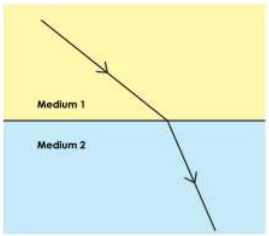



## Laws of Refraction

- The angle of incidence, the angle of refraction and the normal at the point of incidence on the surface of separation of the two media will always be in the same plane.
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction $\frac{\sin i}{\sin r}$ will always be a constant.
  This is known as **Snell's Law.**
  The constant from Snell's Law is known as **refractive index**. This is indicated by the letter **n**.

## Speed of light in media and refractive index

The refractive index of one medium with respect to another is called **relative refractive index.**
Imagine that the speed of light in medium 1 is $V_1$ and that in medium 2 is $V_2$.The refractive index of medium 1 with respect to medium 2 is represented as $n_{12}$ and of medium 2 with respect to medium 1 is represented as $n_{21}$.




| | |
|---|---|
| Refractive index $n_{12} = \frac{\text{Speed of light in Medium 2, } V_2}{\text{Speed of light in Medium 1, } V_1}$ | Refractive index $n_{21} = \frac{\text{Speed of light in Medium 1, } V_1}{\text{Speed of light in Medium 2, } V_2}$ |

The refractive index of a medium with respect to vacuum is called **absolute refractive index.** If the speed of light in air (in vacuum) is considered as 'c' and that in a medium is considered as ' v ', then

$$\text{absolute refractive index of the medi} = \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

## TOTAL INTERNAL REFELCTION

**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 $48.6^0$
* The critical angle in glass is $42^0$

**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.**

**Practical applications of total internal reflection**

Medical field - **Endoscope.**

Telecommunications - **Optical fibre cables.**

## LENS

**Optic centre**

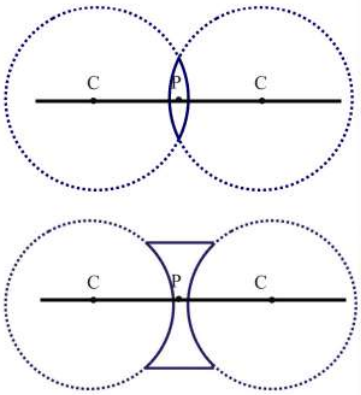
Optic centre is the midpoint of a lens (P).

**Centre of curvature**

Centre of curvature (C) is the centre of the imaginary spheres of which the sides of the lens are parts.

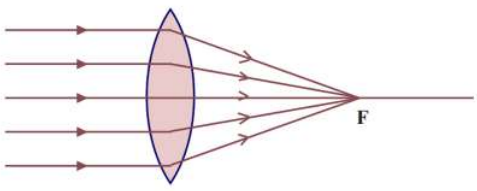
**Principal axis**

Principal axis is the imaginary line that passes through the optic centre joining the two centres of curvature.



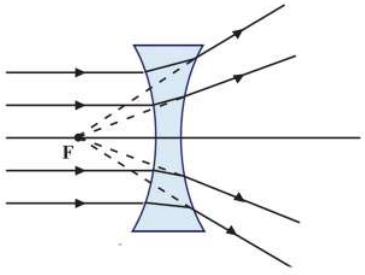

**Principal focus of convex lens**

Light rays incident parallel and close to the principal axis after refraction converges to a point on the principal axis ofa convex lens. This point is the principal focus ofa convex lens.

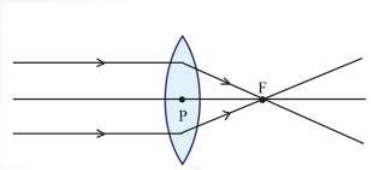
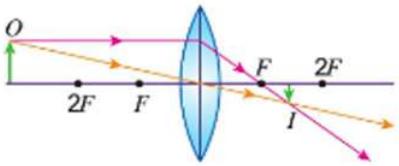
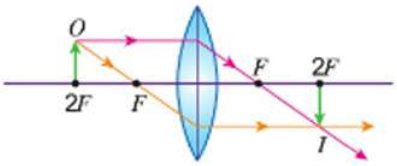
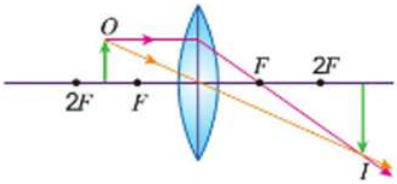
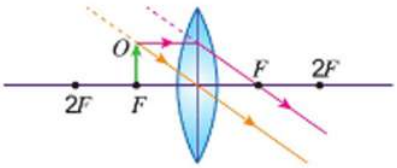
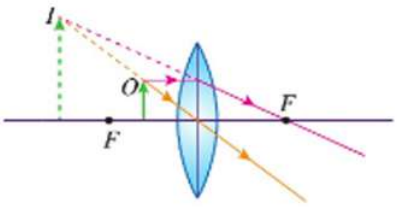



**Principal focus of concave lens**

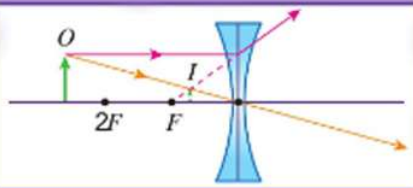
Light rays incident parallel and close to the principal axisdiverge from one another after refraction. These rays appear to originate from a point on the same side. This point is the principal focus ofa concave lens.



## Formation of image by Convex lens & its characteristics

| Position of object | Ray diagram | Position of image | characteristics |
|---|---|---|---|
| 1. At infinity |   | At F | Real, inverted, diminished |
| 2.Beyond 2F |   | Between 2F and F | Real, inverted, diminished |
| 3.At 2F |   | At 2 F | Real, inverted, same size as that of the object. |
| 4. Between 2F and F |   | Beyond 2F | Real, inverted, magnified |
| 5. At F |   | At Infinity | Real, inverted, magnified |
| 6. Between F and Lens |   | At the same side of the object. | Virtual, erect, magnified. |

## Formation of image by Concave lens & its characteristics

| Position of object | Ray diagram | Position of image | characteristics |
|---|---|---|---|
| Anywhere on the left side |   | Between F and P | Virtual, erect, dimnished |

### Lens Equation

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

u = Object distance
v = Image distance
f = focal length

$$f = \frac{uv}{u - v} \qquad u = \frac{fv}{f - v} \qquad v = \frac{uf}{u + f}$$

### Points to remember

| Convex Lens | Concave Lens |
|---|---|
| f - Positive<br>u -Negative<br>v-Positive(Real) or Negative(Virtual) | f - Negative<br>u -Negative<br>v -Negative (Virtual) |

### Magnification

Magnification is the ratio of the **height of the image**(hi) to the **height of the object** (ho).
It shows how many times the image is larger than the object.
Magnification (m) = Height of image / Height of object

$$m = \frac{v}{u} = \frac{h_i}{h_o}$$

### Points to remember

| | |
|---|---|
| If magnification is negative | Image is real and inverted. |
| If magnification is positive | Image is virtual and erect. |
| If magnification is 1 | Height of image and height of object are equal. |
| If magnification is less than 1 | Height of image is less than height of object. |
| If magnification is greater than 1 | Height of image is greater than height of object. |

### Power of a lens

Power of a lens is the reciprocal of focal length expressed in metres.
Unit of power is dioptre. It is represented by **D**
Power of a Convex lens – **Positive.**
Power of a Concave lens – **Negative**

$$P = \frac{1}{f}$$

## Sample Questions

1. Which of the following statements is correct?

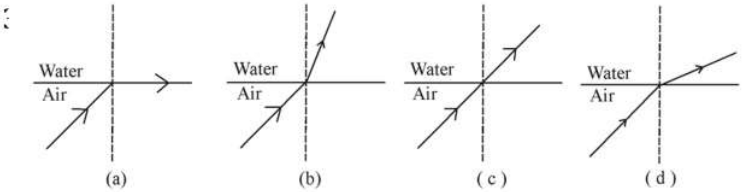
• When a ray of light falls obliquely from air to glass, the refracted ray deviates away from the normal

• When a ray of light falls obliquely from air to glass, the refracted ray deviates towards normal

• No refraction occurs when a ray of light falls obliquely from air to glass

2.If the image formed by a convex lens is real and enlarged,Where will be the position of object?

(Beyond 2F, At 2F, Between F and 2F, Between F and P)



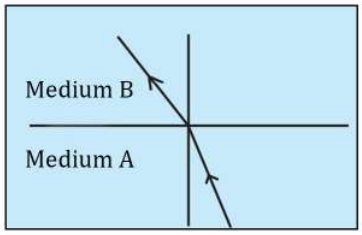

4.What is the power of a convex lens of focal length 100 cm?

((+1/100D , +100 D , +1 D , +2 D )

5. A ray of light enters from medium A to medium B as shown in the diagram.

a)Which medium has the highest optical density?

b) Speed of light is greater in which medium?

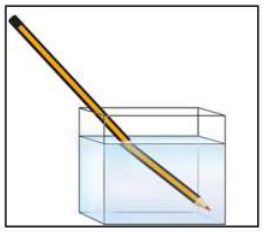



6. Observe the picture. A pencil tilted in water in a vessel appears to bend under the water.

a)Which is the phenomenon behind this ?

b) Define this phenomenon.

c) What causes this phenomenon?



7. When an object is placed 20 cm in front of a convex lens,an image is formed 30 cm from the lens. Calculate the focal length of the lens.

8. The focal length of a concave lens is 15 cm. An object is placed 30 cm away from this lens Calculate the distance to the image .

9.Choose the appropriate statement from the box and write it down.

| Optic centre, focal length, center of curvature, principal axis |
|---|

a) The centre of the imaginary spheres of which the sides of the lens are parts.

b) The midpoint of a lens

c) It is the imaginary line that passes through the optic centre joining the two centres of curvature.

d) Distance between optic centre and focus

10. (a) Which of the following are the conditions for total internal reflection to occur?

i) The light ray must enter obliquely from the medium of higher to less density

ii) The light ray must enter obliquely from the medium of lower optical density to higher

iii)The angle of incidence should be equal to the critical angle

iv) Incidence angle should be greater than critical angle

b) Write two uses of total internal reflection.

11. The critical angle of light entering air from glass is 42°.

a) What is the angle of refraction when the angle of incidence is 42°?

b)Which phenomenon occurs when the angle of incidence is 40°?

c)Which phenomenon occurs when the angle of incidence is 45°?

Justify the answer.

12. The speed of light in some media is given in the table.

| Medium | Speed of light (m/s) |
|---|---|
| Vacuum | $3\times10^8$ m/s |
| Water | $2.25\times10^8$ m/s |
| Glass | $2\times10^8$ m/s (*approximately*) |
| Diamond | $1.25\times10^8$ m/s |

a)Write the given media in ascending order of optical density.

b) In which medium light refracted more when light is incident from air ?

c)Calculate the Refractive index of diamond using speed of light given in table.

d) Calculate the refractive index of glass compared to water.

13.Rays of light fall from the glass to the air at different angles illustrated below

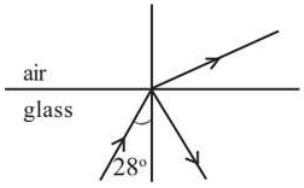



fig 1

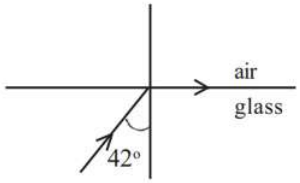



fig 2

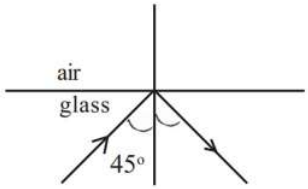



fig 3

a)Which figure represents the critical angle of glass?

b) What is critical angle?

c) What is the critical angle of the glass?

d)Which figure represents total internal reflection?

e)Explain the phenomenon of total internal reflection.

14.Given some statements related to the image formed by a lens. Select and write the ones related to virtual image.

i) Upside down

ii) Upright

iii)Cannot be obtained on a screen

iv) Can be obtained on a screen

v)The position of the object and the position of the image are on the same side of the lens

15.The refractive index of some media is given in the table .

| Medium | Refractive index |
|---|---|
| Water | $\frac{4}{3}$ |
| Glass | $\frac{3}{2}$ |
| Diamond | $\frac{12}{5}$ |

a) What is the relationship between the refractive index of a medium and the speed of light in it?

b)What is the difference between relative refractive index and absolute refractive index?

c)Calculate the speed of light in diamond using the information in the table?
(Speed of light in air = 3 x$10^8$ m/s)

16. The power of the lens of the glasses one uses is -2D.

a)What type is this lens?

b)What is meant by power of lens?

c)Find the focal length of this lens.

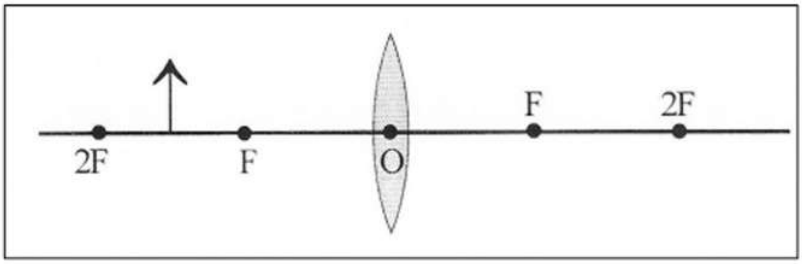
17.An object of height 3 cm is placed at a distance of 30 cm in front of a convex lens. The focal length of the lens is 20 cm.

a) What is the distance to the image?

b)What is the nature of image?

c) What is the height of the image?

18.Observe the diagram given below.




a) Complete the figure and find the position of the image.

b)Write two characteristics of image

# Unit-6. **Vision And The World of Colours**

## Vision and eye

‣The nearest point where an object can be clearly seen is called the **"near point".** Minimum distance for clear vision for healthy eyes is **25 cm**

‣When we look at nearer objects, the ciliary muscles related to convex lenses in our eyes are contracted and the curvature of the lens increases. The focal length decreases.

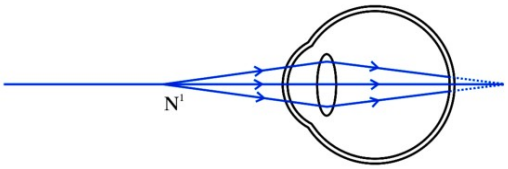
‣While looking at far objects the ciliary muscles are relaxed and the curvature of the lens decreases. The focal length of the lens increases.

‣The ability of the eye to form an image on the retina by adjusting the focal length of the lens in the eye, by varying the curvature of the lens, irrespective of the position of the object, is the power of accommodation

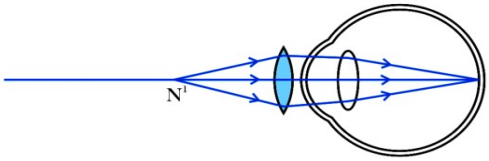
### Long-sightedness ( Hypermetropia)

‣Some people can see distant objects clearly but not near nearby objects clearly. This defect of the eye is the long sightedness

‣In this case the image is not formed at the retina(**behind the retina** ), instead of being formed at the retina.




‣Cause of this defect → size of the eyeball is smaller and power of the eye lens is low (Focal length is high)

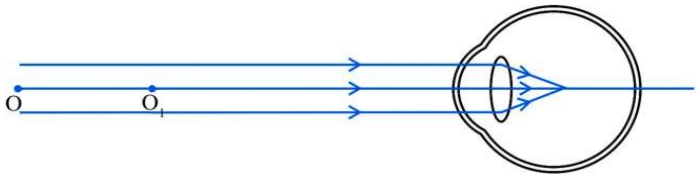



‣ This defect can be remedied with a convex lens of suitable power .

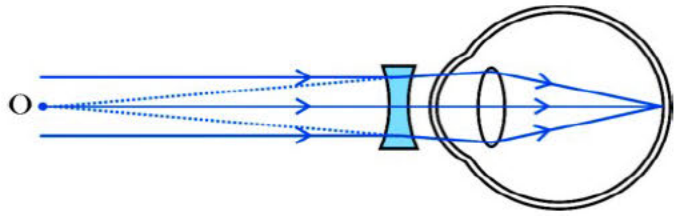
## **Myopia or Near-sightedness**

‣ For some persons, even though nearby objects can be seen clearly, they may not be able to see distant objects clearly. This defect is the near sightedness.

‣ The image of distant object is formed in front of the retina.



- This defect is due to the larger size of the eyeball and the power of the lens More (less focus distance).



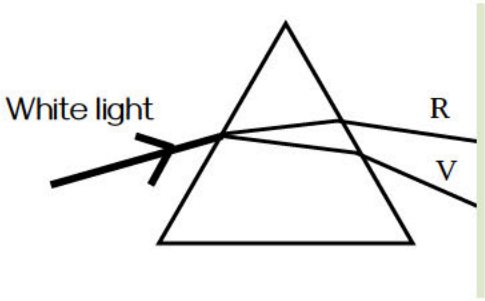

- This defect can be remedied with a using concave lens of suitable power.

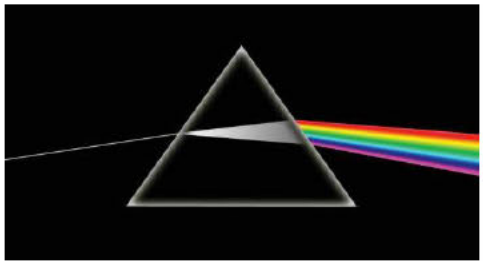
## Presbyopia

For elderly people the distance to the near point is greater than 25 cm. This is due to the diminishing ability of the ciliary muscles. For such people the power of accommodation will be less this is presbyopia.

## Dispersion

- The phenomenon of splitting up of a composite light into its constituent colours .
- When sun light allowed to pass through prism ,it split in to seven colours.
- Light rays of shortest wavelength- Deviates more.
- Light rays of longest wavelength - Deviates less.
- Dispersion occurs due to difference in wavelength of colours.

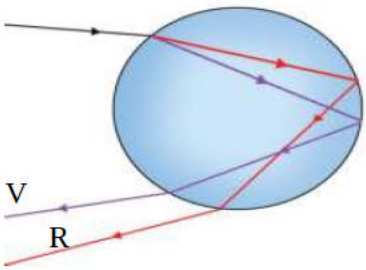


- Any light that is composed of more than one colour is a **composite light.**
- The regular array of colours formed by dispersion is the visible spectrum.

## 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.

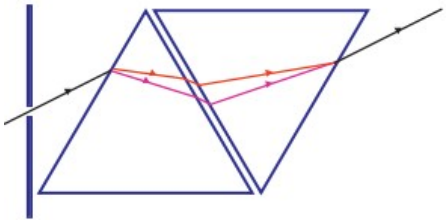
‣Colour seen at the lower edge of the rainbow- Violet.

‣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.

‣ When the position of the sun is near the horizon, the rainbow appears to be bigger.

## 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.

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

‣Scattering increases as the wavelength of the colours decreases,

‣Scattering decreases with increasing wavelength

‣Violet undergoes more scattering and red undergoes less scattering.

‣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.(urban skies appears gray)

‣Sky appears blue , sun and horizon appears red during sunset and sunrises are due to scattering of light

‣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.

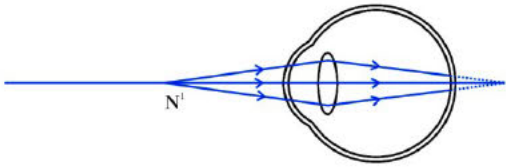
▸There is no scattering of sunlight in space, so the sky appears dark to the astronaut.

**Tyndal effect.**

When light rays pass through a colloidal fluid or suspension, very small particles are emitted due to the scattering that occurs to them. Hence the trajectory of light is visible. This phenomenon is called the **Tyndal**l effect.

**Sample questions**

**1)** a) Which eye defect is indicated by the image below?



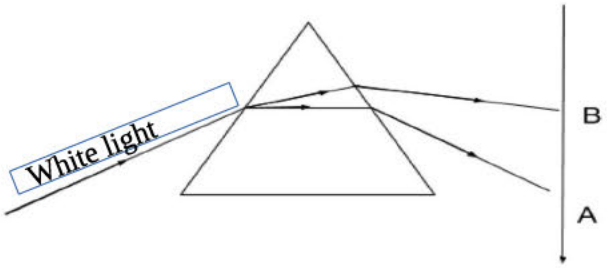

b) Write down the causes of this disability?
c) How can this defect be remedied?

2) A child sitting in the back bench cannot see what is being written on the teacher's board

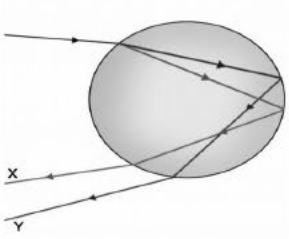
a) What is the eye defect of the child?
b) Where is the image formation in this case?
c) How can this defect be remedied?

3) The phenomenon of splitting up of a composite light into its constituent colour is dispersion.

a) What is the reason for dispersion?
b)The colours indicated by A and B in the below figure is

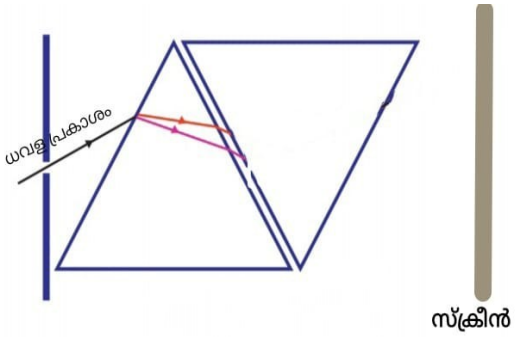



**4.** It has been depicted that the light is depicted as passing through a water particle.




a) Identify the colours X and Y from the picture

b)How many times is the refraction occur when light passing through the water particle?
c) How many times is the refraction occur
d) What colour is the outer surface of the rainbow?
e) What is the colour of the inner edge of the rainbow?
f) What is the shape of the rainbow when viewed from an aeroplane?
**5)** Finish the image below and write the colour appears on the screen
..




6)Newton's colour disc turns white as it rotates faster.
a) What is the cause of this phenomenon?
b) Define this phenomenon?
c) Write another example of this phenomenon.?
7). Find the reason for the following.
a) To an astronaut: the sky appears as black.
b) At sunrise / sunset: the horizon sun appears red.
c) Red colour of vehicle's tail lamps and signal lamps

8) When does scattering occur equally for all colours?
9) How far away from the eye can you read clearly?
10) Where does the image form in the eye of a healthy person?

11) Check the following statements and correct the incorrect ones
a) The focal length of the lens decreases when looking at distant objects
b) The curvature of the lens increases when looking at close objects
12) The near point of a far-sighted person is 25 cm (more / less)?
13) a) .....is a common eye defect in the elderly people
b) What is the reason for this?
14) It illuminates the path of light when the torch is lit on a snowy night
What is the reason?
15) Make a poster to convey the glory of eye donation to the people.
**********

# Unit 7- Energy management

**Important concepts**

♦Fuels
♦Fossil fuels
♦Combustion
♦Biogas
♦Fuel efficiency
♦Solar energy
♦Nuclear energy
♦Green energy and brown energy
♦Energy crisis

**Complete combustion**

Complete combustion is a reaction in which fuels react intensively with oxygen producing carbon dioxide steam heat and light

**Conditions favourable for complete combustion**

Solid fuel must be dry
Sufficient oxygen must be available
The ignition temperature must be attained

**Features of complete combustion**

Carbon monoxide is not formed
More heat is generated
Less smoke

**Partial combustion**

If oxygen is not sufficient the rate of combustion decreases. Such one is partial combustion

carbon monoxide is formed
less heat generated
smoke and soot produced

**Fossil fuels**

Fossil fuels are formed by the transformation of plants and animals that went under the earth's crust millions of years ago

●Coal, petroleum and natural gases are fossil fuels
●Fossil fuels are not replenished or renewed in proportion to their consumption hence they are called non renewable energy

**Coal**

►The most abundant fossil fuel on earths crust

►The main component of coal is carbon

Coal can be classified into four groups as **peat, lignite, anthracite and bituminous coal**

When coal is distilled in the absence of air, the substance obtained are ammonia coal gas ,coal tar and coke

**CNG**

Compresed natural gas

Obtained from natural gas

Main component is methane

Used in vehicles and industries

**LNG**

Liquefied natural gas

Importance is it can be liquefied and transported to distant places conveniently

**LPG**

Obtained as a product of fractional distillation of petroleum

Main component is butane

It has no order and colour

Ethyl mercaptan is added to identify the leakage

## Precautions

The expiry date of gas cylinder must be noted

Examine the rubber tube at regular interval

Turn on knob only after the regulator

Open the windows

**Biogas**

Bio mass deposited in biogas plant in the absence of oxygen biogas is formed by the action of bacteria

Main component is methane

Slurry is good manure

Fuel of greater calorific value is obtained

Atmospheric pollution is minimised

**Calorific value**

The amount of heat energy liberated by complete combustion of 1 kg of fuel

Unit is kilojoule kilogram ( kJ/kg )

Hydrogen is the fuel with highest calorific value

But not used as domestic fuel

- Difficult to store
- Highly explosive

Hydrogen fuel cell is used to produce electricity by combining hydrogen and oxygen

**Power stations**

Hydroelectric power station==Flowing water ( mechanical energy )
Nuclear power station==Nuclear fusion (nuclear energy)
Thermal power station==Coal /Fossil fuels ( thermal energy )

**Solar energy**

Devices utilising solar energy
- Solar panel
- Solar water heater
- Solar cooker

In a solar panel light energy is converted into electrical energy.

In space stations, satellite, and in remote islands where there is no electricity, solar panels are used.

**Nuclear fusion, nuclear fission**

Two methods by which energy is produced from the nucleus

Nuclear fission is the process in which the nuclei of greater atomic mass are split into lighter
Nuclear fusion is the process by lighter nuclei are combined to form heavier nuclei

**Green Energy**

Produced from natural resources that does not cause environment pollution
Solar energy, energy from wind,ocean energy, geo-thermal energy are green energy sources. They are renewable energy as well.

**Brown energy**

Energy sources that cause environmental problems and is produced from non renewable sources.
Fossil fuels, thermal power, nuclear energy

**Energy crisis**

Increasing demand of energy but decreasing availability

Measures to reduce energy crisis

Judicious utilisation of energy
Maximum use solar energy
Minimise wastage of water
Making use of public transportation

## Sample questions

1. Which gas is formed during partial combustion?

2. Compare complete combustion and partial combustion

3. Explain how fossil fuels are formed

4. It is said that the usage of fossil fuels must be controlled, why ?

5. Why fossil fuels are classified as non renewable energy sources ?

6. What are the four forms of coal ? On which basis it is classified ?

7. Find the odd one out with reason
( coke , coal tar, ammonia, coal gas )

8. When natural gas is liquefied it is known as LNG
a. What is the full form of LNG ?
b. What is the main component of this ?
c. What is the importance of making natural Gas in the form of liquid

9. What is used as domestic cooking gas ? What is the main component of this?

10. An LPG cylinder is marked as d24 what does it mean why ethyl mercaptan is mixed with LPG

11. What precautions are to be taken to avoid accidents due to leakage of LPG ?

12. What are the advantages of converting biomass into biogas ?

13. Name the process by which the components of coal are separated?

14. How does the biomass change into biogas in a biogas plant?

15.Classify the following into green energy and brown energy
Solar cell, nuclear reactor, tidal energy, hydroelectric, diesel engine, windmill, thermal power station

16. What is the fuel used in a nuclear reactor?

17. Which nuclear reaction is carried out in stars?

18.Identify the relation and fill in the blanks.
a. Hydrogen bomb: Nuclear fusion
Atom bomb: ……