SMART SKILLS

2020-2021

PHYSICS

INDEX

Light – Reflection and refraction

CLASS X

PHYSICS SYLLABUS [2019-20)

MARCH- MAY

Potential difference and electric current.Ohm's law; Resistance, Factors on which the resistance of a conductor depends.

Series combination of resistors, parallel combination of resistors; Heating effect of Electric current; Electric Power, Interrelation between P, V, I and R.

PRACTICALS

1. To study the dependence of current (I) on the potential difference (V) across a resistor and determine its resistance. Also plot a graph between V and I.
2.To determine the equivalent resistance of two resistors when connected in series.
3. To determine the equivalent resistance of two resistors when connected in parallel

JULY

Chapter 13: Magnetic effects of current

Magnetic field, field lines, field due to a current carrying wire, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's left hand rule Electric Motor. Electro magnetic induction, Induced potential difference, Induced current. Fleming's Right Hand Rule, A.C. Generator, Direct current.Alternating current; frequency of AC. Advantage of AC over DC.Domestic electric circuits.

AUGUST-

Chapter 14: Sources of energy

Non-conventional sources of energy, solar energy, tidal energy, wave energy, thermal energy, Geothermal energy, Nuclear energy.

SEPTEMBER- OCTOBER

Chapter 10 Light – Reflection and Refraction

Reflection of light at curved surfaces, Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, Mirror Formula (Derivation not required), Magnification.

Refraction; laws of refraction, refractive index.

Refraction of light by spherical lens, Image formed by spherical lenses, Lens Formula (Derivation not required), Magnification, Power of a lens.

PRACTICALS

1. To determine the focal length of a
   (a) Concave mirror
   (b) Convex lens

by obtaining the image of a distant object

2. To trace the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.

3. To trace the path of a ray through a triangular prism

4. Image formation by a convex lens

NOVEMBER

Chapter 11: Human Eye and colourful World

Functioning of a lens in human eye-, problems of vision and remedies, applications of Spherical mirrors and lenses.

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

Chapter - 12
ELECTRICITY

Electric current:
The rate of flow of electric charges through any cross section f the conductor is called electric current.

Define one ampere, the S.I. unit of current
When one coulomb of charge flows through a conductor in one second the current is said to be one ampere.

Like charges_____ and unlike charges_____

The smallest amount of charge is the charge on one electron, which is equal to_____

The S.I. unit of charge is _____
The other units are milli coulomb and micro coulomb.

Question:
Calculate the number of electrons constituting one coulomb of charge.

Formulae.
I=Q/t
Q=ne
Q=It

NUMERICALS

1. A current of 5A is drawn by a filament of an electric bulb for 5 min. Find the amount of charge that flows through the circuit.

2. If $6x\ 10^{17}$ electrons cross through an area per min, calculate the electric current If 10 A of current flows through a conductor, also find the number of electrons passing per second.

3. Calculate the amount of charge that will flow in 2 hours through the filament of an electric bulb drawing a current of 0.2 A.

Electric potential and potential difference
Let w_{ab} be the work done in moving a charge +q from a to b. Work done in moving unit positive charge from a to b is equal to potential difference.
$Wab/q=V_b-V_a$

The potential difference between the two points in an electric circuit is defined as amount of work done to move a unit positive charge from one point to another.
V=W/Q
The S.I. unit for potential difference is _____

Define one volt:
The potential difference between two points is said to be one volt when the work done in moving 1 coulomb of charge from one point to another is one joule.

Potential difference is measured using an instrument called_____

A voltmeter is always connected in _____ in a circuit.

A voltmeter has very high resistance.
The electrons flow from lower potential to higher potential where as current flows from higher potential to lower potential.

CIRCUIT DIAGRAM AND SYMBOLS

COMONENTS	SYMBOLS
Cell	
A battery	
Plug key or switch (open)	
Plug key or switch (closed)	
A wire joint	
Wires crossing without joining	
Electric bulb	
A resistor	
Variable resistance or rheostat	
Ammeter Voltmeter	
Galvanometer	

QUESTION:
Draw a circuit diagram using the appropriate symbols when a bulb, battery, ammeter, voltmeter and a key are connected . Also mark the direction of flow of current.

Statement of Ohm's law:

The current flowing through a conductor is directly proportional to the potential difference applied across its ends, provided the temperature and other physical conditions remain unchanged.

Resistance:

It is the property of a conductor by virtue of which it opposes the flow of charges through it.

The S.I. unit of resistance is _____

Define one ohm:
The resistance of a conductor is said to be 1 ohm if current of one ampere flows through it on applying a potential difference of one volt across it's end.

NUMERICALS
Q1. How much work is done in moving a charge of 4C across two points having a potential difference of 12 volts?

Q2. How much energy is given to each coulomb of charge passing through a 9 volt battery?

Q3. How much current will an electric bulb draw from a 220 volt source if the resistance of the filament is 600 ohm?

Q4. How much current will a heater coil draw from a 220 volt source if the resistance of the heater coil is 100 ohm?

Q5. The potential difference between the terminals of a electric heater is 60 volt when it draws a current of 2 ampere from the source. What current will the heater draw if the potential difference is increased to 120 volts?

Cause of resistance:
Collisions are the basic cause of resistance. When a potential difference is applied across a conductor, the free electrons get accelerated. On their way they frequently collide with the positive metal ions.

Factors affecting resistance:
1. Length:
The resistance is directly proportional to length
2. Area of cross section:
It is inversely proportional to the area of cross-section
3. nature of the material

Resistivity;
It is defined as the resistance of a conductor having unit length and unit area of cross-section.

The S.I unit of resistivity:
It is ohm-meter.

Resistivity of a material depends upon:
- Nature of the material
- Temperature

QUESTION
Differentiate between resistance and resistivity:

NUMERICALS

Q1) A piece of wire is stretched by pulling it out to double the length. Compare the new resistance with the original.

Q2) The resistance of a metal wire of length 1m is 26 Ω at 20 degree Celsius. If the diameter of the wire is 0.3mm, calculate the resistivity of this metal at that temperature.

Q3) A 16 Ω resistance wire is compressed to half of its length. Calculate the new resistance of the wire.

Q4) A wire of length 4m is stretched so that it's length becomes 8m. Will its resistance and resistivity change, and by how much?

Q5) Calculate the resistivity of a conductor of length 1m and area $1mm^2$ if it's resistance is 8Ω.

Q6) An aluminum wire is stretched so that it's length is increased 4 times. Find its new resistance.

Series combination of resistances:
Diagram

When two or more resistors are connected in such a way that the current passing through any one is also passing through the remaining resistors then they are connected in series.

Derivation:

Laws of equivalent resistance in series

1. Current through each resistance is same.
2. Total potential drop = sum of potential drops across the individual resistances
3. Individual potential drops are directly proportional to individual resistances.
4. Effective resistance = Sum of individual resistance
5. Effective resistance is larger than largest individual resistance.

Parallel combination of resistors:
When two or more resistors are connected in such a way that the potential difference across each remains same, they are said to be connected in parallel.
Diagram

Derivation:

Laws of equivalent resistance in parallel:

1. _____ is same across all resistors.
2. The total current is equal to _____ of the currents through individual resistances.
3. Individual currents are_____proportional to the individual resistances.
4. Reciprocal of equivalent resistance = _____ of reciprocal of the individual resistances
5. Effective resistance of the combination is _____ than each individual resistance.

Question:

Why do we have household wiring in parallel not in series??

Heating Effect Of Electric current

Let,

I=current passing through a resistor of resistance R

V= potential difference across the resistor

t= time for which a charge Q flows

W= work done in moving charge Q through potential difference V in time t

Then, power input to the circuit by the source is

$P=w/t = VQ/t$_____ (1) (as I=Q/t)

Also, energy,E supplied to the circuit by the source in time t,

$E= Pt = VIt$ (from 1 P=VI)

This energy gets dissipated in the resistor as heat

Therefore, for steady current I, amount of heat produced, H in time t is

E=H

H= VIt

H= IR.It

$H= IR^2t$

This is known as Joules law of heating

POWER – It is defined as the rate at which electrical energy is consumed.

P=E/t

The S. I. unit of power = S.I. unit of 'E" / S.I. unit of't'

= Joule/second

= Watt

Definition of 1 watt

One watt is defined as the power of an electric circuit when one ampere of current flows through the circuit having potential difference of one volt.

Power of an appliance is 1 watt if one joule of energy is consumed in one second.

Bigger units of power are

$1KW = 10^3$ W

$1MW = 10^6$W

1Horse power= 746 W

Electrical energy

Work done by a source of electricity to maintain a current in the circuit is a measure of the electrical energy consumed.

W=VQ P=VQ/t

$W=VIt$ $P=VI$
$W=I^2Rt$ $P= I^2R$
$W=V^2t/R$ $P=V^2/R$
$W=Pt$ $P=E/t$

Relationship between S.I. unit of energy and commercial unit of energy
S.I. Unit of energy= joule
Commercial unit of energy= kilowatt-hour

1kWh= 1000W x1h
=1000Wx3600s
= $3.6x10^6$ J

Question:

1. A current of 4A passes through a resistance 100 ohm for 15 min. Calculate the heat produced.

2. Calculate the power of an electric heater which draws 5A current when connected to a 220V power supply.

3. Two bulbs are rated 60W, 220V and 100V, 220V. Which of them has higher resistance?

Chapter – 12
ELECTRICITY
ASSIGNMENT-12.1

FILL IN THE BLANKS:

Q1 If there is no current, a voltmeter connected across a resistor will register____voltage.

Q2. Rate at which electric work is done is called .....

Q3. Copper is a preferred material for making wire because of its low .....

Q4. The potential difference across the ends of a resistor is ..... to the current through it, provided its .....remains the same.

Q5. A fuse is a short piece of wire of high.....……and low…….

TRUE OR FALSE

Q6. The equivalent resistance of several resistors in series is equal to the sum of their individual resistances.

Q7. The series arrangement is used for domestic circuits.

Q8. The commercial unit of electrical energy is kilowatt- hour.

Q9. Pure tungsten has high resistivity and a high melting point (nearly 3000^0C).

Q10. Two wires of resistances 2 Ω and 4 Ω are connected in parallel. The combination is connected to a 220 V supply. The power dissipated in 2 Ω resistor is more.

MATCHING QUESTION:

(Q.No. 1-3) : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

1 Match the Following

Column I		Column II	
(A)	1 Ohm	(p)	$\frac{rL}{A}$
(B)	Resistance	(q)	$\frac{1\ V}{1A}$
(C)	Resistivity	(r)	zero resistance
(D)	Super conductor	(s)	ohm-meter

ASSIGNMENT-12.2

ASSERTION AND REASON

DIRECTION : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1. **Assertion :** The connecting wires are made of copper.
Reason : The electrical conductivity of copper is high.

Q2. **Assertion :** When the length of a wire is doubled, then its resistance also gets doubled.

Reason : The resistance of a wire is directly proportional to its length.

Q3. **Assertion :** The 200 W bulbs glow with more brightness than 100 W bulbs when connected in parallel.
Reason : A 100 W bulb has more resistance than 200 W bulb.

Q4. **Assertion :** Wire A is thin in comparison to wire B of same material same length then resistance of wire A is greater than resistance of wire B.
Reason : Resistivity of wire A is greater than resistance of wire B.

Q5. **Assertion :** Longer wires have greater resistance and the smaller wires have lesser resistance.
Reason : Resistance is inversely proportional to the length of the wire

ASSIGNMENT-12.3

Q1. State and define the S.I. unit of current?

Q2. How will you join 3 resistors each of 2 ohm so that the effective resistance is 3 ohm?

Q3. If three resistors are combined in series, derive the expression for equivalent resistance.

Q4. N resistors are given each having resistance R ohm. How will you combine them to have 1) maximum resistance 2) minimum resistance? What is the ratio of maximum to minimum resistance?

Q5. An ammeter burns out when connected in parallel. Give reason.

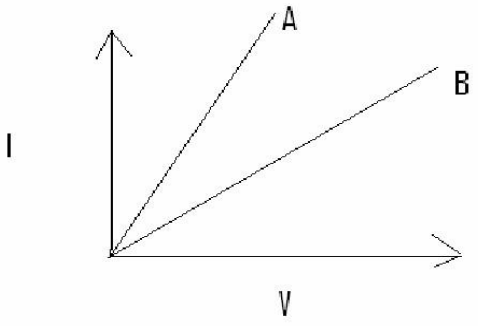
Q6. Which has more resistance a 100 W bulb or a 40 W bulb? Give reason.

Q7. An electric geyser has rating 2000W, 220V. What should be the minimum rating in whole number of a fuse wire that may be required for safe use of this geyser?

Q8. A wire of resistance R is bend in the form of a closed circle. Find its resistance across diameter.

Q9. How many bulbs of 8 ohm should be joined in parallel to draw a current of 4A from a 2V battery?

Q10. In the following diagram which has more resistance? Why?



ASSIGNMENT-12.4

1. Will the current flow more easily through a thick wire or a thin wire when connected across the same source? Give reason.

2. Define watt-hour.

3. Explain why tungsten is used for making filaments

4. Explain the role of fuse in a circuit

5. Explain short-circuiting why it catches fire in case of short-circuiting

6. Silver is better conductor of electricity than copper they why copper is used in wires to carry current?

7. In household wiring, appliances are connected in parallel, why?

8. A resistance of 40 ohms and one of 60 ohms are arranged in series across 220-volt supply. Find the heat in joules produced by this combination in half a minute.

9. Ten bulbs are connected in a series circuit to a power supply line. Ten identical bulbs are connected in a parallel circuit to an identical power supply line.

1. Which circuit would have the highest voltage across each bulb
2. In which circuit, if one bulb blows out, all others will stop glowing?
3. Which circuit would have less current in it?

10. If the current I through a resistor is increased by 100 %, Find the percentage increase in power dissipation assuming temperature to remain constant.

11. In a house two 60 W electric bulbs are lighted for 4 hours, and three 100 W bulbs for 5 hours every day. Calculate the electric energy consumed in 30 days.

12. An electric bulb is rated as 10 W, 220 V. How many of these bulbs can be connected in parallel across the two wires of 220 V supply line if the maximum current which can be drawn is 5 A.

Chapter - 12

ELECTRICITY

QUESTION _BANK

1. Give the unit of (a) Charge (b) Current
2. Define current
3. Name the unit of (a) electrical resistance (b) resistivity
4. Define One Ohm
5. Define Resistivity
6. What is the resistance of a torch bulb rated at 2.5 V and 500 mA?
7. Two resistances of each 2 ohm are connected in parallel. Find their equivalent resistance.
8. On what factors does the resistivity of a material depend?
9. Plot a graph between the Potential difference V and current I through a conductor
10. What happens to the resistance of the circuit if the current through it is doubled?
11. Two wires of same material are having length L and 2L. Compare their resistance and resistivity.
12. Why are coils of electric toaster and electric iron made of an alloy rather than a pure metal?
13. Two wires are of same length and radius but one of them is copper and the other is of iron. Which will have more resistance? (Given the resistivity of copper = 1.62 x 10 -8 ohm meter and resistivity of iron = 10 x 10-8 ohm meter.
14. Define 1KWh. Give the relation between 1kwh and Joule.
15. State which has a higher resistance. A 50W or 25W lamp. Also find the ratio of their resistances.
16. A wire of resistance 5 Ohm is spent in the form of closed circle. What is the resistance between 2 points at the ends of any diameter of the circle?
17. Calculate the amount of charge that would flow in one hour through the element of an electric iron drawing a current of 0.4 amps.
18. A electric toaster of resistance 20 Ohm takes a current of 5A. Calculate the heat developed in 30 s.
19. A bulb is rated at 5V, 100mA. Calculate its (1) Power (2) Resistance
20. Name two special characteristics of a heater coil.
21. Define resistance and resistivity. Give the relation between them. Explain the dependence of resistance on temperature.
22. With the help of neat circuit, derive the expression for the equivalent resistance of 3 resistances connected in series.
23. With the help of neat circuit, derive the expression for the equivalent resistance of 3 resistances connected in parallel
24. (a) Draw the circuit consisting of a battery of five 2V cells, 5ohm resistor, 10 ohm resistor, 15 ohm resistor and a plug key. All connected in series (b) calculate the current

passing through the above circuit when key is closed.
25. Two identical resistors each of resistance 2 Ohm are connected in turn (1) in series (2) in parallel to a battery of 12 V. Calculate the ratio of power consumed in two cases.

26. A piece of wire is redrawn by pulling it until its length is tripled. Compare the new resistance with the original value.
27. An electric kettle is rated 500W, 200V. IT is used to heat 400 gm of water for 30 secs. Assuming the voltage 220V calculate the rise in temperature of water. Specific heat capacity of water is 4200 J/Kg ^{o}C.
28. In an experiment the current flowing through a resistor and potential difference across it are measured. The values are given below. Show that these values confirm Ohm's Law and also find the resistance of the resistor.
I (ampere) I(ampere) 1.0 1.0 2 1.5 2.0 2.0 2.5 2.5 3.0 3.0
V (volt) V(volt) 4.0 4.0 6.0 6.0 8.0 8.0 10.0 10.0 12.0 12.0

29. A heater draws 1100 W at 220V. (a) Find the resistance of the heater (b) Calculate the energy in KWh consumed in a week if the heater is used daily for 4 hours.
30. State Ohms law with a neat circuit. Explain how this law can be verified and also plot the expected v-I graph.
31. (a) Differentiate resistance and resistivity
(b) the ratio of resistivity's of two materials a and b is 1:2, ratio of their length is 3:4 and if the ratio of radii is 2:3 find the ratio of resistance of a and b.

Chapter - 12
ELECTRICITY
H.O.T.S.

1. Alloys are usually used in electrical heating devices because
(A) Resistively of an alloy is generally higher than that of consistent elements.
(B) Alloys do not oxidize readily at high temperature
(C) Both (A) & (B)
(D) Neither (A) & (B)

2. What happens to the heating effect when the direction of current is reversed?
(A) Cooling effect is observed
(B) Amount of heat remains unchanged
(C) There will be a short circuit
(D) All of the above

3. And electric bulb of rating 40W, 220V is connected to a source of 220V the current drawn by the bulb will be
(A) 0.18A (B) 18A
(C) 1.8A (D) 180A

4. A man has five resistors each of value 0.2 ohms. The maximum resistance he can obtain by connecting them will be
(A) 0.1 ohm (B) 1.0 ohm
(C) 0.04 ohm (D) 0.4 ohm

6. What is the power of an electric lamp, if it draws 20 A current when connected to 220 V line?
(A) 4400 W (B) 2200 W
(C) 1100 W (D) 440 W

7. How much current will an electric heater coil draw from a 220 volt line, if the resistance of the heater coil is 40 ohm?
(A) 5.5 A (B) 5 A
(C) 4.5 A (D) 5 A

8. Why is tungsten metal used for making the filaments of electric bulbs?
(A) High melting point (B) low melting point
(C) High conductivity (D) None of these

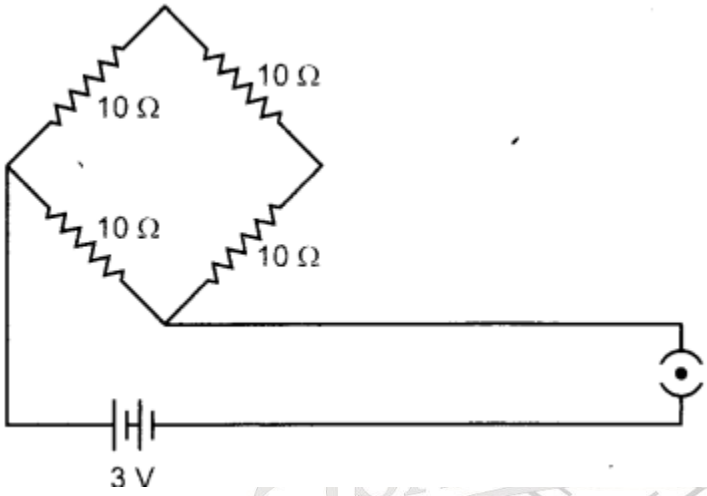
9. Calculate the number of electrons constituting one coulomb of charge.
   (A) 1.6 x 10-19 (B) 1
   (C) 6 x 1020 (D) 6.25 x 1018

10. The current passing through an appliance is doubled. The heat produced will become
   (A) Half (B) Double
   (C) Four times (D) One fourth

11. How many joules of electrical energy transferred per second across a 6V, 0.5 Amp lamp
   (A) 30 (B) 12
   (C) 0.83 (D) 3

12. The resistance of a wire of length 300m & cross-section 1 mm^2 & resistivity 1 x 10^{-7} ohm is
   (A) 2 ohm (B) 3 ohm
   (C) 20 ohm (D) 30 ohm

13. Find the equivalent resistance and the current in the circuit.



DID YOU KNOW

Resistance of human body is 5, 00, 00 ohm, when skin is dry. However it becomes very small when the skin is

Silver is the best conductor of Electricity.

EXPERIMENT NO-1

AIM : To study the dependence of potential difference (V) across a resistor on the current (I) and determine the resistance. Also, plot a graph between V and I.

APPRATUS USED:

Theory: According to the Ohm's law, the potential difference (V) across the ends of a resistor is directly proportional to the current (I) through it provided its temperature remains the same. That is V ∝ I or = I V constant = R or V = RI.
Here R is a constant for the given resistor at a given temperature and is called its resistance. The SI unit of resistance is ohm (Ω). A graph between the potential difference across the two ends of a resistor and the current through it is a straight line passing through the origin.
The slope of this graph gives the resistance R of the resistor. To verify the Ohm's law, we measure the potential difference across the two ends of a resistor at different currents through it in an electric circuit.
The current through the resistor is measured by connecting an ammeter in series with it. The potential difference across the two ends of the resistor is measured by connecting the voltmeter in parallel with it. A straight line graph obtained between V and I verifies the ohm's law.

OBSERVATION

1. **Least count of ammeter :**
2. **Range of ammeter:**
3. **Least count of voltmeter:**
4. **Range of voltmeter:**

S.No.	VOLTMETER READING			AMMETER READING			RESISTANCE
	Number of division	Least count	Voltage (V)	Number of division	Least count	Current (I)	R=V/I

1. The Average value of resistance (With calculations) =

2. The value of resistance from graph =

Result: The average value of resistance is _____ (with calculations) and _____(from graph).

PRECAUTIONS AND SOURCES OF ERROR:

• The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
• Connections should be tight otherwise some external resistance may introduce in the circuit.
• The ammeter should be connected in series with the resistor such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
• Voltmeter should always be connected in parallel to resistor.
• The pointers of the ammeter and voltmeter should be at zero mark when no current through the circuit. If not, then ask your teacher to correct it.
• Current should be passed through the circuit for a short time while taking observations; otherwise current would cause unnecessary heating in the circuit. Heating may change the resistance of resistors.

DIAGRAM:

EXPERIMENT NO-2

AIM : To determine the equivalent resistance of two resistors connected in series.

APPRATUS USED:

THEORY: When two resistors of resistance R1 and R2 respectively are connected in a series combination, then their equivalent resistance
Rs is given by $Rs = R_1 + R_2$.

OBSERVATION

1. **Least count of ammeter :**
2. **Range of ammeter:**
3. **Least count of voltmeter:**
4. **Range of voltmeter:**
5. **R_1=**
6. **R_2=**

S.No.	VOLTMETER READING			AMMETER READING			RESISTANCE
	Number of division	Least count	Voltage (V)	Number of division	Least count	Current (I)	R=V/I

CALCULATION;

1. R_1+R_2 (Experimentally) =
2. R_1+R_2 (With the given values)=

RESULT: The equivalent resistance of two resistors connected in series is _____(Experimentally) and _____ (With the given values).

PRECAUTIONS: The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.

• Connections should be tight otherwise some external resistance may introduce in the circuit.

• The ammeter should be connected in series with the combination of resistors such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.

• Voltmeter should always be connected in parallel to the combination of resistors.

• The pointers of the ammeter and voltmeter should be at zero mark when no current flows.

DIAGRAM:

EXPERIMENT NO-3

AIM: To determine the equivalent resistance of two resistors connected in parallel.

APPRATUS USED:

THEORY: When two resistors of resistance R1 and R2 respectively are connected in a parallel combination, then their equivalent resistance
Rp is given by $1/Rp=1/R_1+1/R_2$
In order to determine the resistance of a combination of resistors connected in parallel, the current I flowing through the circuit is measured with an ammeter connected in series with the combination. The potential difference V across the combination of resistors is measured with a voltmeter connected in parallel.

OBSERVATION

1. **Least count of ammeter :**
2. **Range of ammeter:**
3. **Least count of voltmeter:**
4. **Range of voltmeter:**
5. **R_1=**
6. **R_2=**

S.No.	VOLTMETER READING			AMMETER READING			RESISTANCE
	Number of division	Least count	Voltage (V)	Number of division	Least count	Current (I)	R=V/I

CALCULATION
Equivalent resistance

1. **Experimentally=**

2. **With given values=**

RESULT: The equivalent resistance of two resistors when connected in parallel is _____(experimentally) and _____ (with given values).

Precautions: The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.

- Connections should be tight otherwise some contact resistance may introduce in the circuit.
- The ammeter should be connected in series with the combinations of resistors such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
- Voltmeter should always be connected in parallel to the combinations of resistors.
- The pointers of the ammeter and voltmeter should be at zero mark when no current through the circuit. If not, then ask your teacher to correct it.
- Current should be passed through the circuit for a short time while taking observations; otherwise current would cause unnecessary heating in the circuit. Heating may change the resistance of resistors.

DIAGRAM:

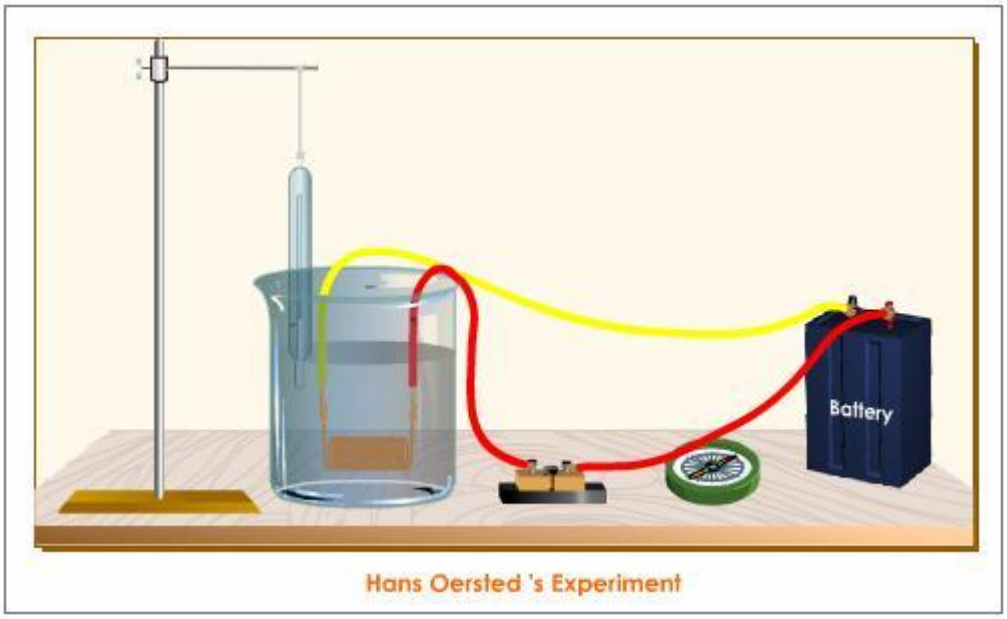
NOTES

NOTES

CHATER -13
MAGNETIC EFFECT OF CURRENT
(NOTES)

Major progress in understanding magnetism came after **Hans Christian Oersted** established the relationship between electricity and magnetism in 1820.

While performing a classroom demonstration of the heating effect of electric current he discovered that a magnetic compass needle got deflected when it was placed near an electric current carrying conductor.



Magnetic Field and Field Lines

Magnetic field is a region near a magnetised body where magnetic forces can be detected.

In a magnetic field, the magnetic dipole (Two equal and oppositely magnetised poles separated by a distance is referred to as magnetic dipole) experiences a turning force, which tends to align it parallel to the direction of the field.

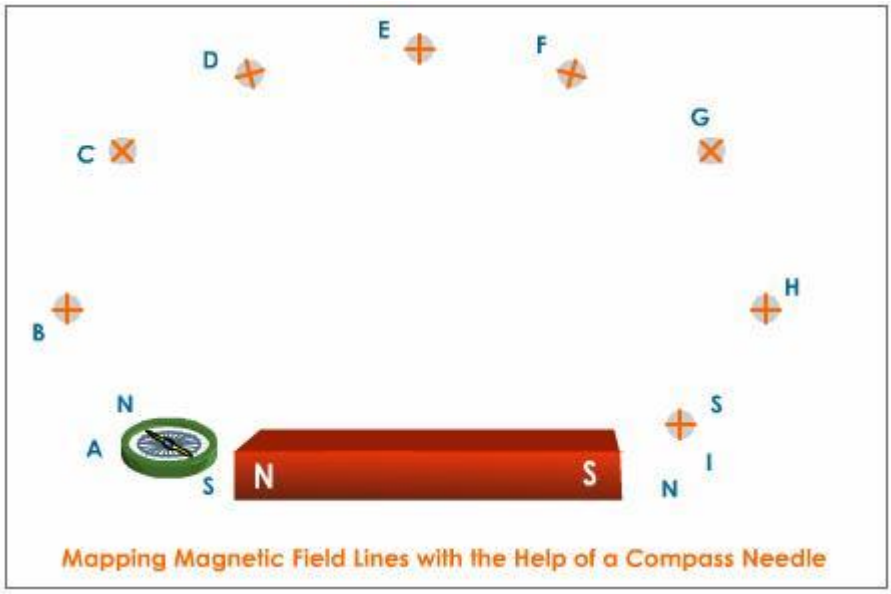
Let us understand the concept of magnetic field with the help of an experiment.

Iron Filings Near the Bar Magnet Align Themselves Along the Field Lines

Procedure	Observation	Inference
Fix a sheet of paper on a drawing board. Place a bar magnet at the centre of the sheet. Sprinkle some iron filings uniformly around the magnet. Tap the cardboard gently.	The iron filings experience a force due to the magnet and thus align themselves in a particular pattern. These patterns indicate the magnetic field of the magnet. A magnetic field is represented graphically by lines of force.	The iron filings align themselves in a particular pattern which represents the magnetic field lines.

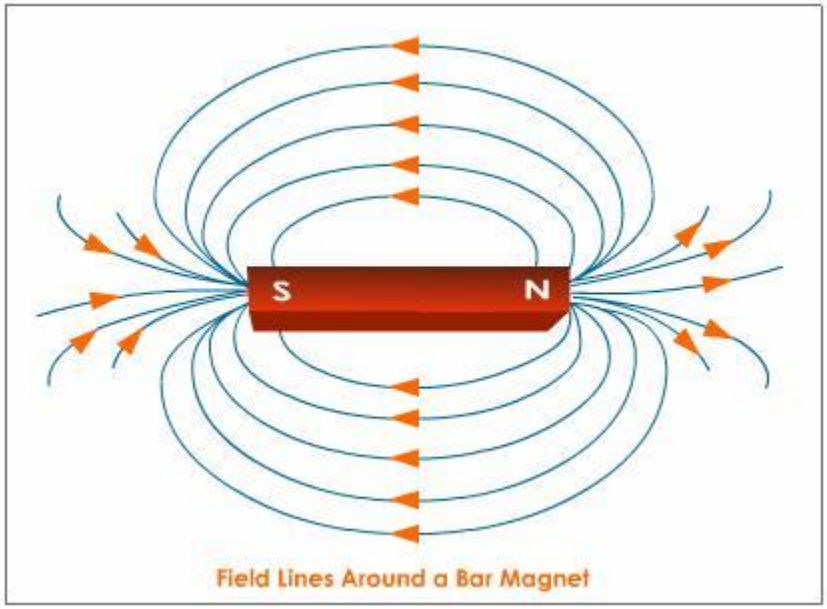
Mapping of Magnetic Lines of Force

- A pictorial representation that gives the direction of the magnetic field at various points in a magnetic field is called a map of the magnetic field
- Let us now map the magnetic field by using a compass
- Fix a sheet of paper on a drawing board
- Place a bar magnet on the sheet of paper
- Trace the boundary NS of the bar magnet
- Place a compass at the North Pole
- The magnetic needle comes to rest in a particular direction
- Mark the ends of the needle. The tail end of the needle is the south pole and the tip of the needle is the north pole
- Now move the magnetic needle in such a way that its tail (south pole) always points towards the north pole of the bar magnet
- Mark the new position of its north pole
- Repeat this until you reach the other end of the magnet



Mapping Magnetic Field Lines with the Help of a Compass Needle

- Join the points
- These points form a curve
- The curved line represents a magnetic field line or magnetic line of force
- Repeat the above procedure and draw as many lines as you can



Field Lines Around a Bar Magnet

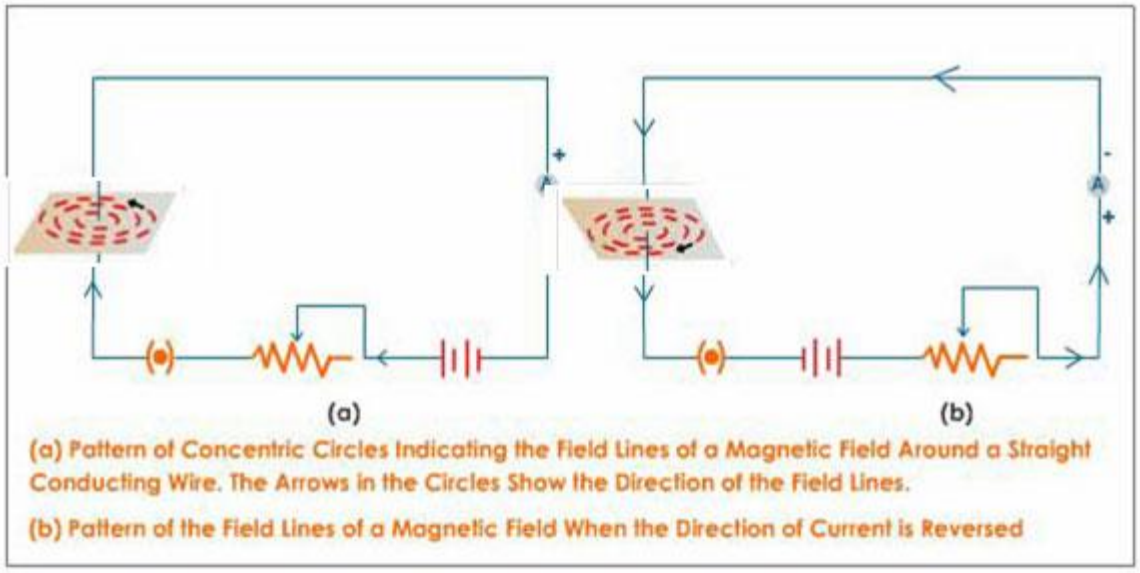
Types of magnetic field

Uniform magnetic field: It is said to be uniform if its magnitude is equal and direction is same at every point in space. It is represented by equidistant parallel lines.

Non-uniform magnetic field: It is said to be non-uniform if its magnitude if not equal and direction is not same at every point in space. It is represented by non-parallel non equidistant lines.

Magnetic Field Due to a Current in a Conductor

We need to understand the pattern of field lines around a straight conductor carrying current and also the direction of these field lines. Here is an experiment to map the magnetic field lines.



(a) Pattern of Concentric Circles Indicating the Field Lines of a Magnetic Field Around a Straight Conducting Wire. The Arrows in the Circles Show the Direction of the Field Lines.

(b) Pattern of the Field Lines of a Magnetic Field When the Direction of Current is Reversed

Procedure	Observation	Inference
Arrange a copper wire, key, battery and a thick sheet of cardboard with a hole at its centre as shown here	The iron filings arrange themselves in concentric circles around the conductor	This is because the electric current produces a magnetic field around the conductor and the iron filings being magnetic in nature align themselves in concentric circles

Sprinkle some iron filings on the cardboard

The direction of magnetic field lines can be found out using a compass needle

Gently tap the cardboard

The iron filings do not show any change in their arrangement because no current is flowing through the conductor

Switch on the current and observe the magnetic field lines

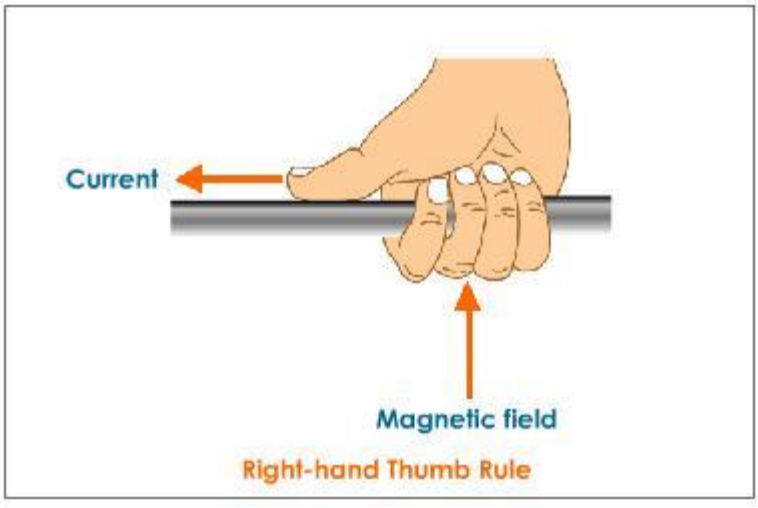
Repeat the experiment by reversing the direction of flow of current

The iron filings arrange themselves in concentric circles around the conductor but in the opposite direction

This is because the direction of magnetic field changes when the direction of flow of current is reversed

Rules for the Direction of Magnetic Field

The direction of magnetic field around a current carrying conductor can be determined by using one of the laws given here.

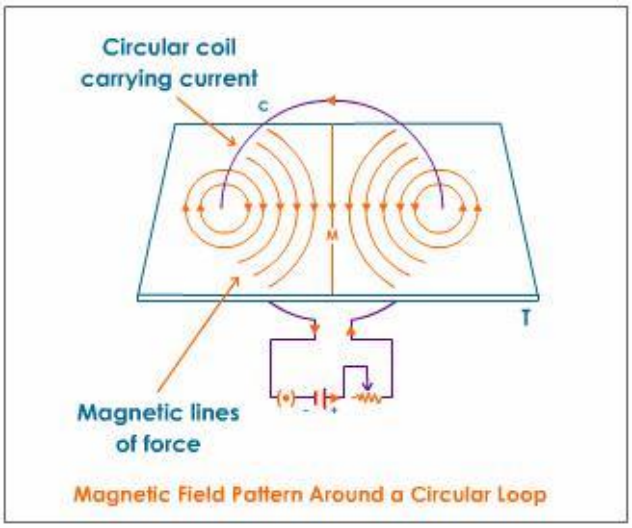
Rule	**Pictorial Representation**
Right Hand Thumb Rule Imagine that you are holding the conductor in your right hand with the fingers curled around it. If the thumb points in the direction of the current, then the curled fingers show the direction of the magnetic field.	

Factors on which the strength of the magnetic field due to a current carrying conductor depends

1. The amount of current flowing through the conductor
2. Distance from the conductor.

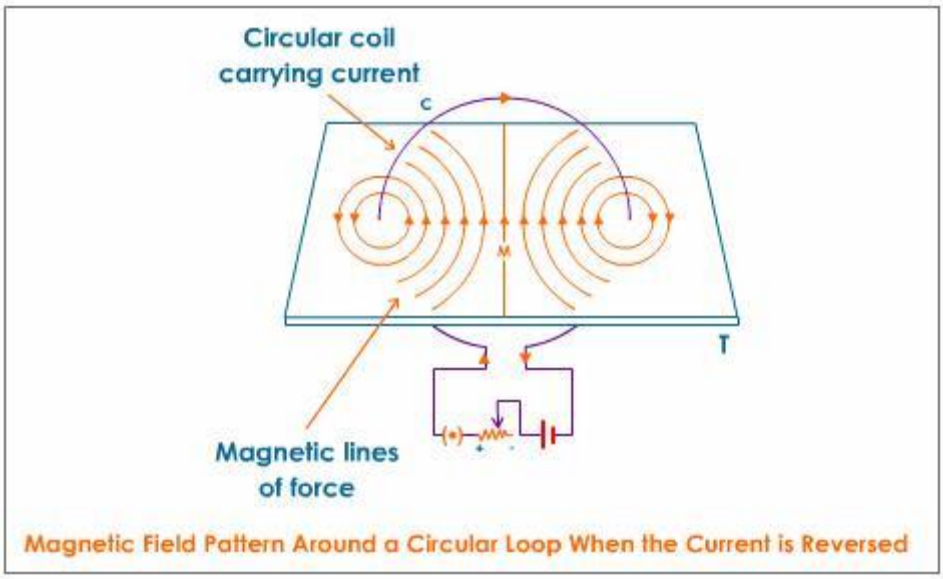
Magnetic Field due to a Current Carrying Circular Loop

The demonstration given below explains the nature of magnetic field due to a current carrying circular loop.



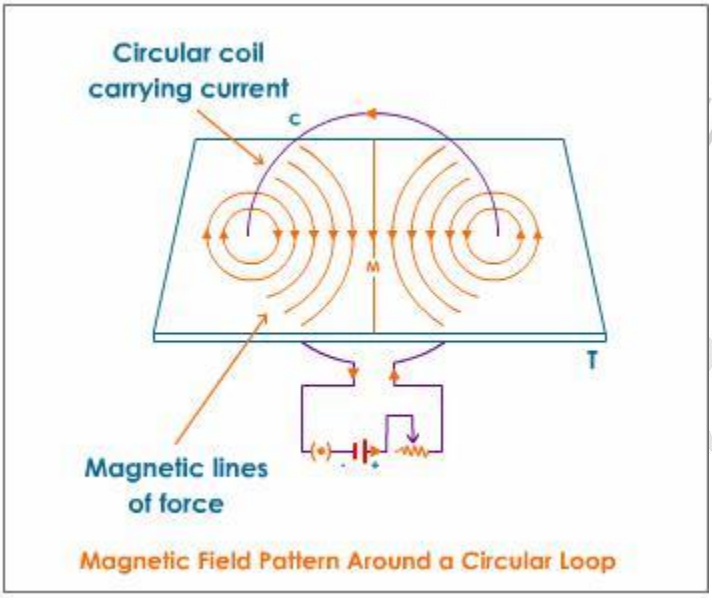
Magnetic Field Pattern Around a Circular Loop

Procedure	Observation
Take a long wire and bend it to form a circle	Concentric circles are formed, which are centred at the point where the wire passes through the cardboard
Pass the wire through the cardboard such that half the wire is above it and the remaining part of the wire is below the cardboard	The lines near the centre of the loop are almost straight. The magnetic field at the centre of the loop is perpendicular to the plane of the loop
Join the free ends of the wire to a battery through a plug key	The concentric circles become larger as we move away from the wire
Insert the key and pass the current. Sprinkle iron filings on the cardboard and tap gently	
Note the pattern of the iron filings that emerge on the cardboard	



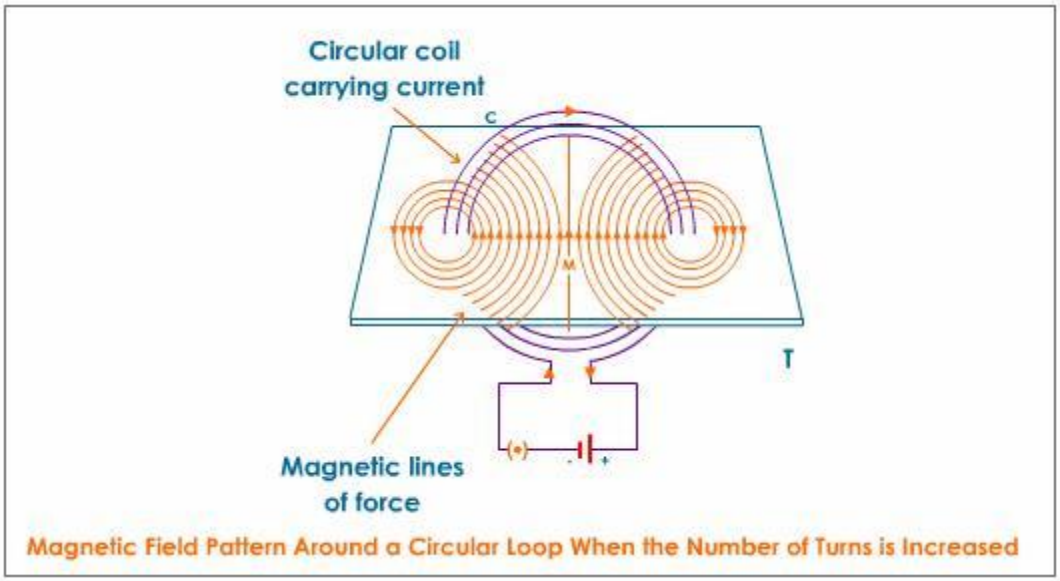
Magnetic Field Pattern Around a Circular Loop When the Current is Reversed

Procedure	Observation
Repeat the experiment by reversing the direction of flow of current	The needle of the compass deflects in the opposite direction



Magnetic Field Pattern Around a Circular Loop

Procedure	Observation
Repeat the experiment by increasing the strength of the current	On increasing the strength of current in the conducting wire, the number of lines of force around it increases



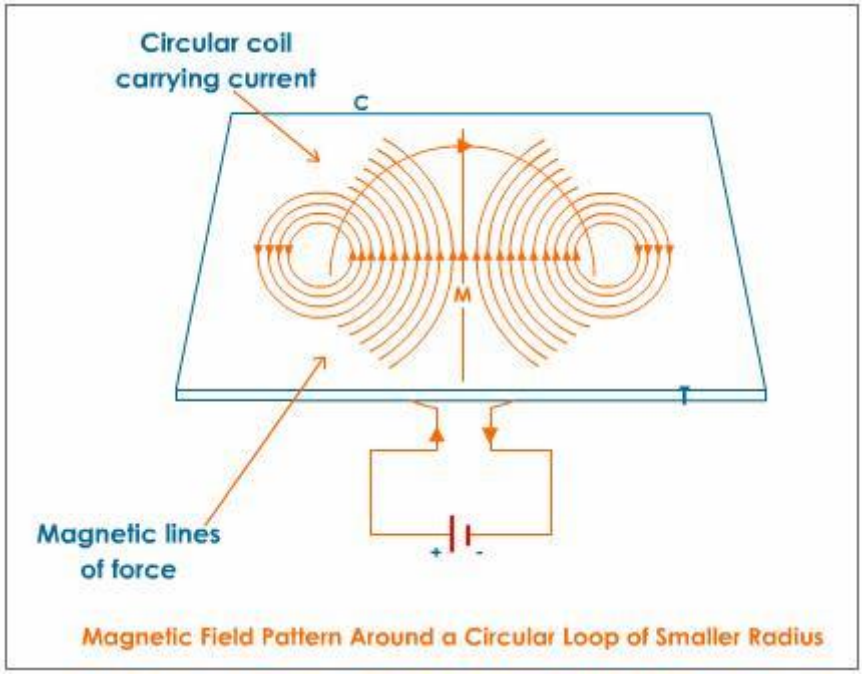
Magnetic Field Pattern Around a Circular Loop When the Number of Turns is Increased

Procedure

Repeat the experiment by increasing the number of turns of the coil

Observation

The number of lines of force around the coil increases



Magnetic Field Pattern Around a Circular Loop of Smaller Radius

Procedure

Repeat the experiment by reducing the radius of the coil

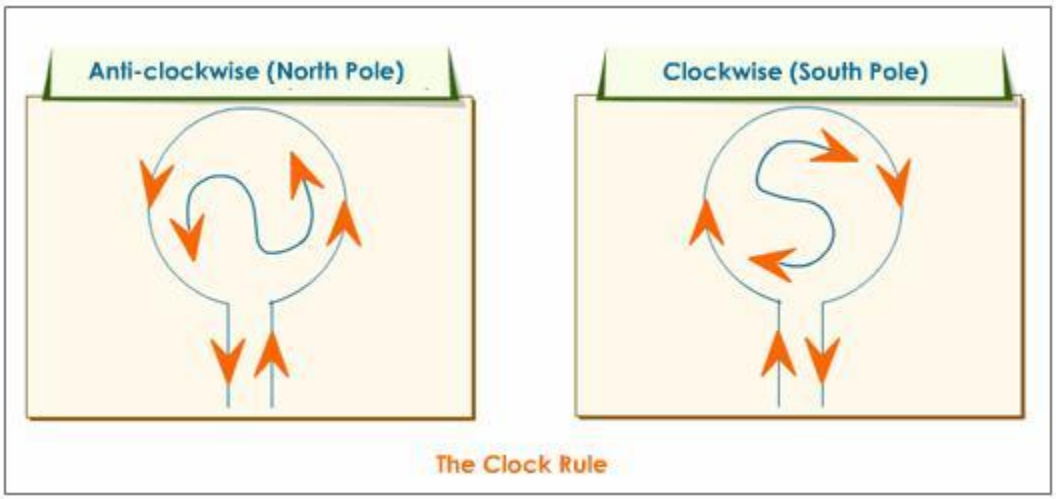
Observation

The number of lines of force around the coil increases

Magnetic Field in a Coil Carrying Current

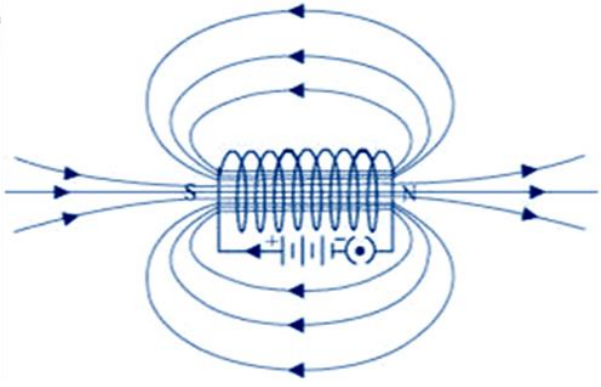
If a coil carrying current is suspended by thin elastic long conductors, it will align itself as the compass needle, i.e., one end of the coil will point in the north direction and the other end will point towards the south.

The polarity of the faces of the coil depends on the direction of current and is obtained by a rule known as "The Clock Rule"According to this rule "When an observer, looking at the face of the coil, finds the current to be flowing in the anti-clockwise direction, then the face of the coil will behave like the north pole. While if the current is in the clockwise direction, the face of the coil will behave like South Pole.



Magnetic Field Due to a Solenoid

A solenoid is a long coil (shaped like a cylinder) containing a large number of close turns of insulated copper wire.



The figure above shows a solenoid SN whose ends are connected to a battery B through a switch X. When a current is passed through a solenoid, it produces a magnetic field around it. The magnetic field is shown in the fig. It is along the axis of the solenoid and is almost constant in magnitude and direction. The magnetic lines of force inside the solenoid are nearly parallel to each other and parallel to the axis of the solenoid.

A solenoid when suspended freely, aligns itself in the north-south direction, thus behaving like a bar magnet. One end of the solenoid acts like a north pole and the other end the south pole.

The polarity of the solenoid can be changed by reversing the direction of the current.

The strength of the magnetic field produced by a current carrying solenoid depends on:

- The number of turns - larger the number of turns, greater is the magnetism produced
- The strength of the current - when current increases, magnetism also increases
- Nature of 'core-material' used in making the solenoid - if we use soft-iron as a core for the solenoid, then it produces the strongest magnetism

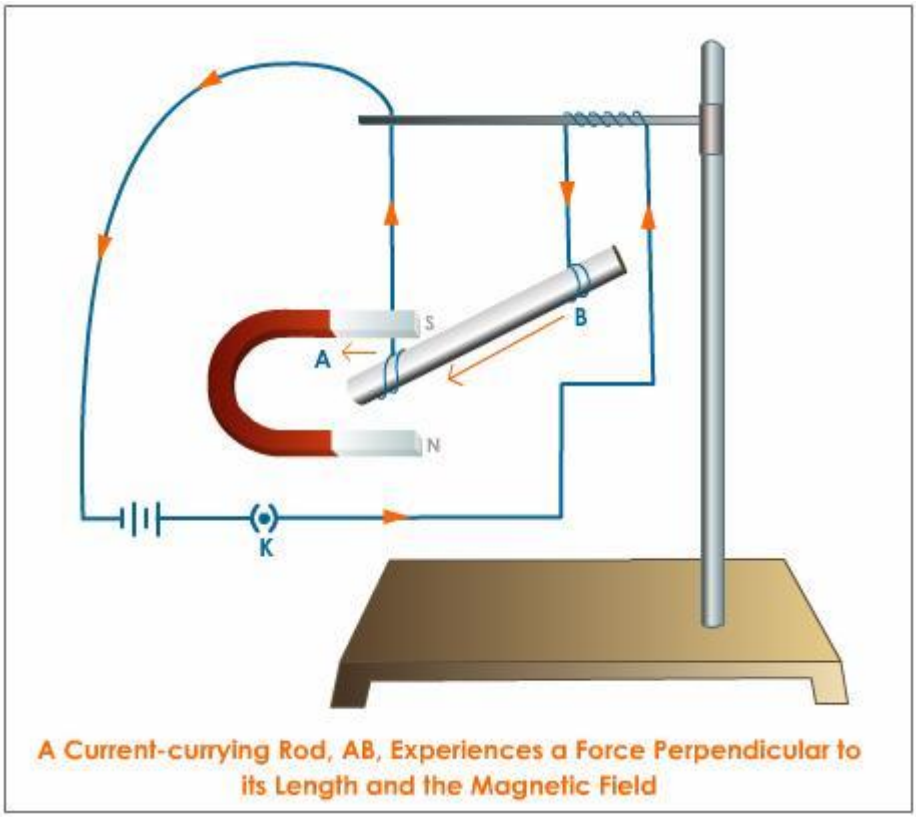
Electromagnet

An electromagnet can be defined as a soft-iron core that is magnetised temporarily by passing a current through a coil of wire wound on the core.

Principle: It is based on the magnetic effect of electric current.

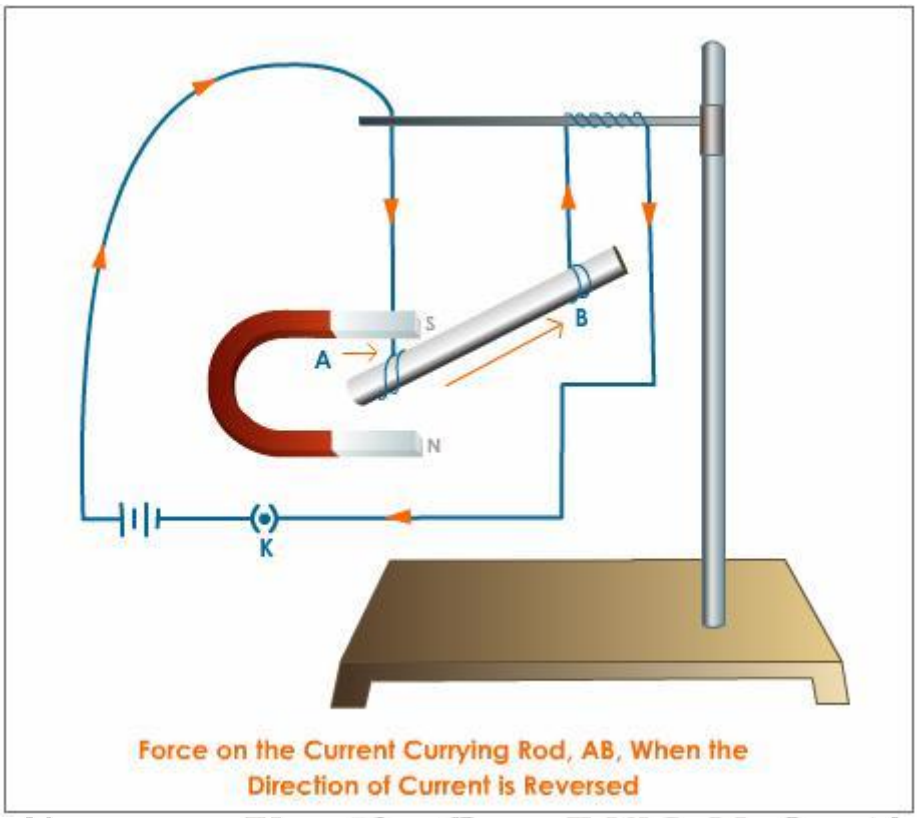
Force on a Conductor in a Magnetic Field

Oersted's experiment shows that a current carrying wire exerts a force on a magnetic needle and deflects it from its usual north-south position. The reverse must also be true, which was proved by the French scientist Andre Marie Ampere, who suggested that a magnet must also exert an equal and opposite force on the current carrying conductor. The above mentioned concept can be best understood by way of a demonstration as explained below.



A Current-currying Rod, AB, Experiences a Force Perpendicular to its Length and the Magnetic Field

Procedure	**Observation**
A small aluminium rod AB (5 cm in length) is connected to the wires and suspended horizontally as shown in the fig	
A strong horse-shoe magnet is placed in such a way that the magnetic field is directly upwards and is placed vertically	The rod AB gets displaced.
The rod AB is connected in series to a battery, a key and a rheostat	
Switch on the current	



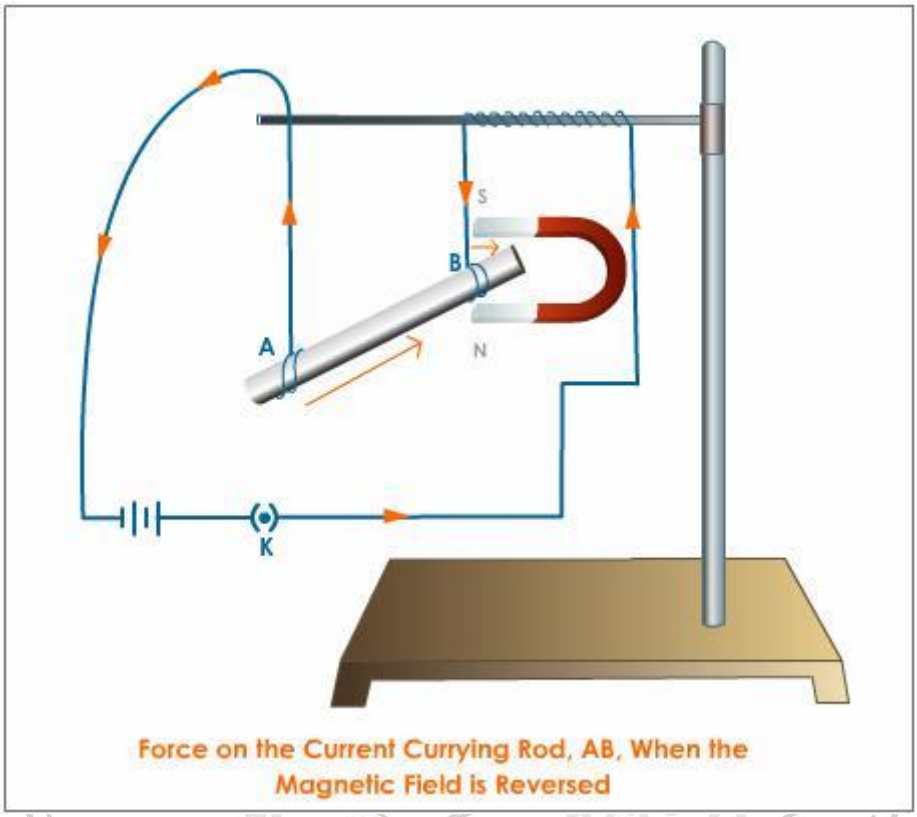
Force on the Current Currying Rod, AB, When the Direction of Current is Reversed

Procedure

Repeat the experiment by changing the direction of flow of current.

Observation

The rod AB gets displaced in the reverse direction.



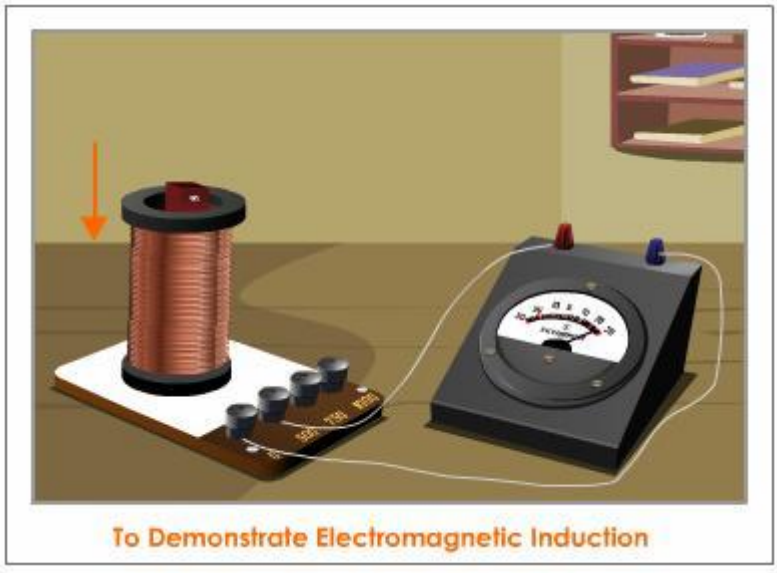
Force on the Current Currying Rod, AB, When the Magnetic Field is Reversed

Procedure
Repeat the experiment by reversing the direction of magnetic field.

Observation
The rod AB gets displaced in the reverse direction.

Electromagnetic Induction

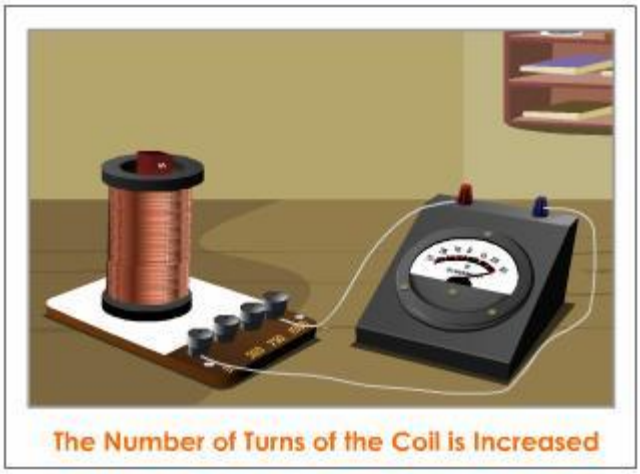
- Michael Faraday the English scientist was the first person to prove that a magnet can create a current
- To test this he moved a magnet towards and away from the coil of wire connected to a galvanometer
- He observed that there was a deflection in the galvanometer indicating that a current is induced in it



- The current obtained due to the relative motion between the coil and the magnet is called induced current
- The phenomenon by which an emf or current is induced in a conductor due to change in the magnetic field near the conductor is known as electromagnetic induction
- Faraday arrived at a few conclusions by moving a bar magnet in and out of the coil of wire
- Some of the experiments performed by Faraday and his observations are tabulated here. Go through them

Experiment	Observation
 The North pole of the magnet is moved into the coil of wire	Deflection in the galvanometer indicates that the current is induced in the coil due to the relative motion between the magnet and the coil.
 The North Pole of the Magnet is Moved out of the Coil of Wire	The deflection in the galvanometer is reversed when the same pole of the magnet is moved in the opposite direction.
 TThe Magnet is Held Stationary Inside the Coil of Wire	The galvanometer pointer comes back to the zero position indicating that the deflection in the galvanometer lasts as long as there is relative motion between the magnet and the coil.

The deflection in the galvanometer is reversed when the opposite pole is moved in the same direction.



The deflection in the galvanometer changes with the change in number of turns of the coil - more the number of turns in the coil greater the deflection. The magnetic field goes around each loop of wire in the coil, so if we increase the number of coils the change in magnetic field is more.

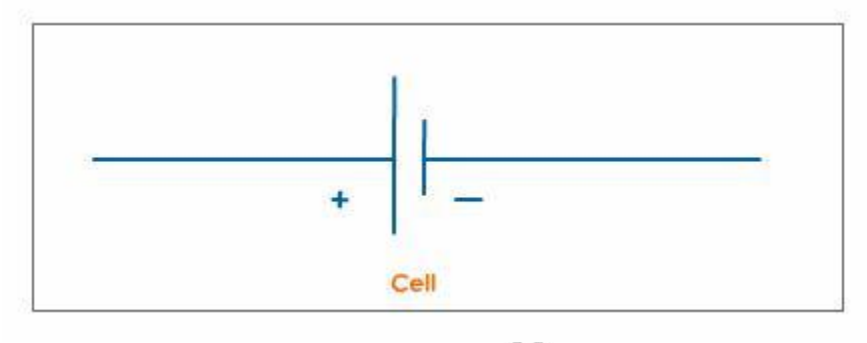
The magnet is moved faster in and out of the coil

The deflection is more if the magnet is moved faster. That is, the rate at which the current is induced is more when the magnet is moved faster.

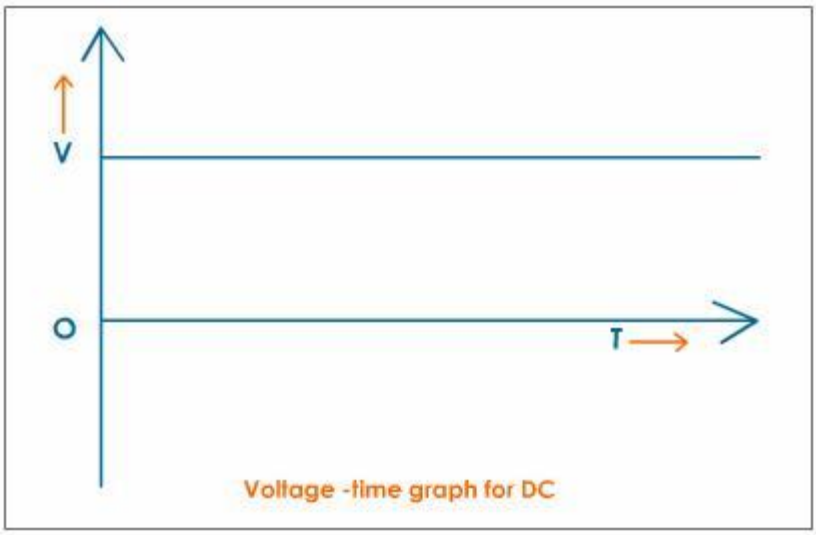
Direct and Alternating Current

When the current flows in the same direction it is called 'direct current' or DC

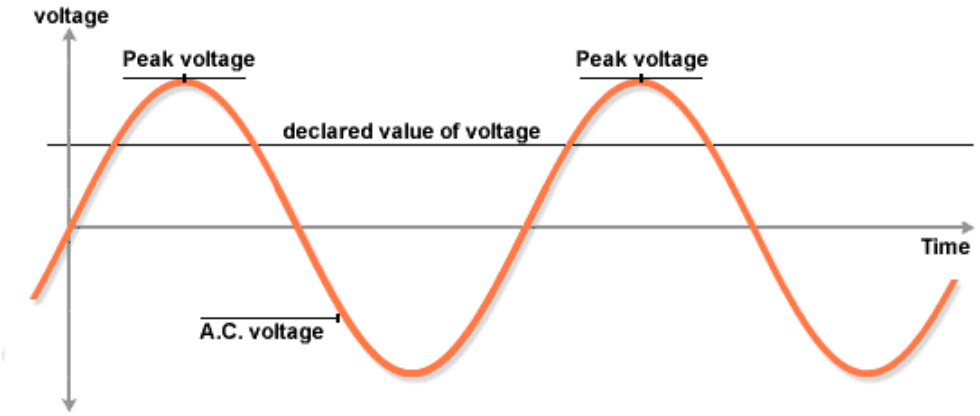
- The current derived from a cell or battery is unidirectional. So it is a DC source
- It is represented in an electrical circuit as



- The voltage V/s time graph for a DC source is represented as follows:



Voltage –Time graph for AC



Advantages of A.C. over D.C.

1. The cost of generating A.C. is less than the cost of generation of D.C.
2. A.C. can be easily converted into D.C.
3. A.C. can be transmitted to distant places without much loss of electric power than D.C.

Disadvantages of A.C. over D.C.

1. A.C. is more dangerous than D.C.
2. A.C. can not be used in the process of electrolysis.

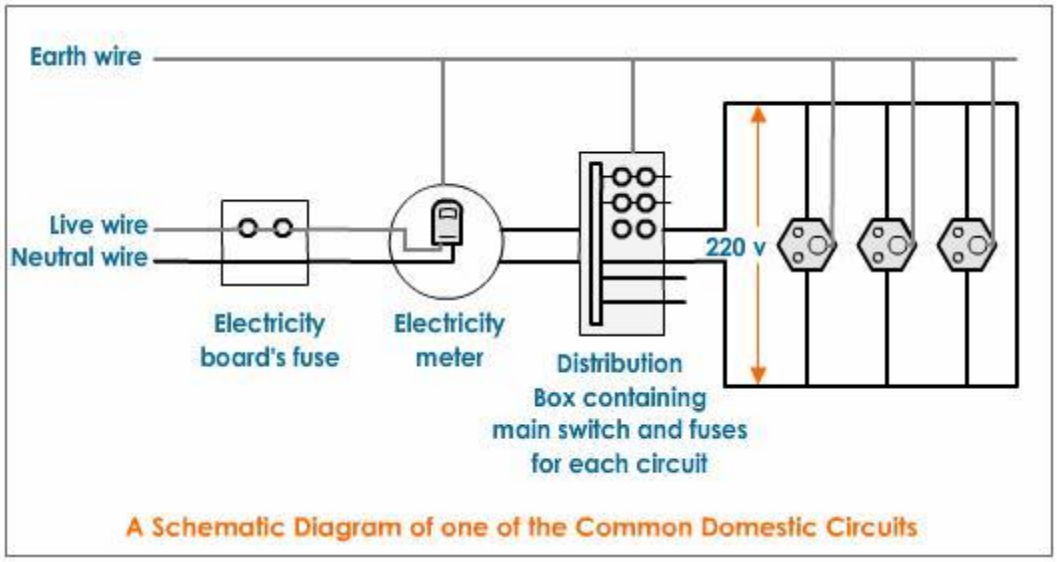
Domestic Electric Circuits

Electric power is usually generated at places which are far away from the places where it is consumed. At the generating station, the electric power is generated at 11,000 volts. This voltage alternates at a frequency of 50 Hz.

The power is transmitted over long distances at high voltage to minimise the loss of energy in the transmission.

Domestic Wiring

- The electric power line enters our house through three wires- namely the live wire, the neutral wire and the earth wire. To avoid confusion we follow a colour code for insulating these wires. The red wire is the live wire, and the black wire is neutral. The earth wire is given green plastic insulation.
- The live wire has a high potential of 220 volts whereas the neutral wire has zero potential. Thus the potential difference between the live wire and the neutral wire is 220-0 = 220 volts.

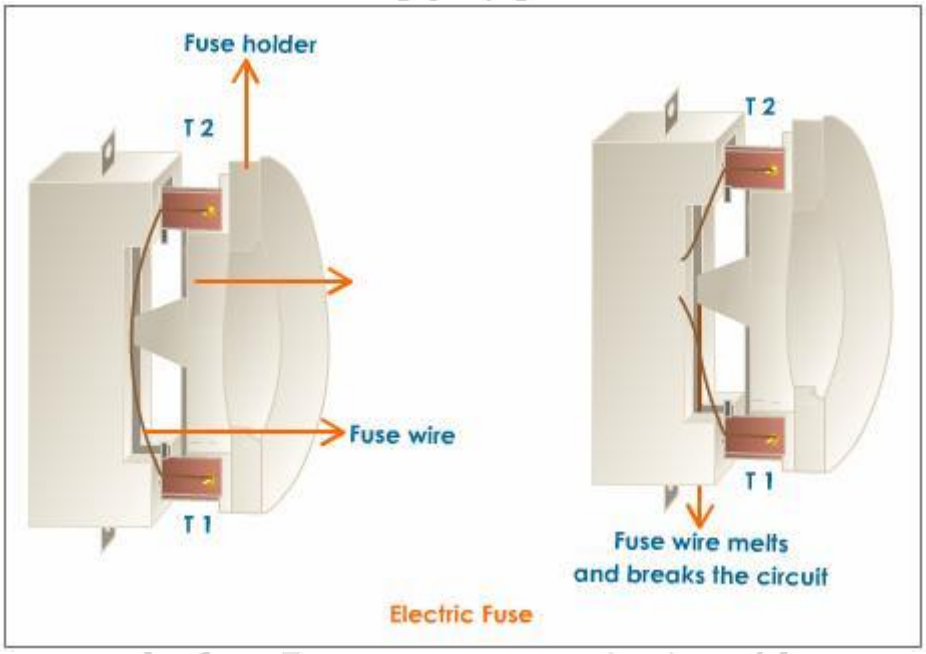


A Schematic Diagram of one of the Common Domestic Circuits

- The earth wire is much thicker in size and is made of copper. One end of it is connected to a copper plate buried deep under the earth. The earth connection is made to the electric meter and then to the main switch.
- In our homes, we receive supply of electric power through a main supply (mains), either supported through overhead electric poles or by underground cables.
- The live wire and neutral wire, coming from the electric pole, enter a box fitted just outside our house which has a main fuse F_1. The fuse is connected in series with the live wire. This is done so because it is only the live wire which has a high potential of 220 volts unlike the neutral wire which carries zero potential. The fuse F_1 has a high rating of about 50 amperes. Thus it prevents any damage such as fire to the entire electrical wiring entering the house due to short-circuit or overloading.
- The two wires then enter the electricity meter which records the electrical power consumed by us in kilowatt-hour (kWh). This meter is installed by the electric supply Department of our city.
- These two wires coming out of the meter are then connected to a main switch which is placed in a distribution box. Another fuse F_2 is placed in series with the live wire in this box for the sake of consumer safety.
- There are two separate circuits in a house namely lighting circuit and power circuit. The lighting circuit with a 5 A fuse is used for running electric bulbs, fan, radio, TV, tube lights etc. and the power circuit with a 15 A fuse is used for running electric heater, electric iron, geyser, refrigerator etc as it draws more current.
- The ditribution circuits are always connected in parallel combination. In a parallel circuit even if there is a fault or short-circuiting in any one line, the corresponding fuse blows off leaving the other circuits and appliances intact and prevents damage to the entire house.

- In case short-circuit occurs in the power circuit, then the power-fuse will blow off but our lights will continue to burn as the lighting circuit remains unaffected.
- A constant voltage of the main line is available for all other electrical appliances.
- Along with the two wires, a third wire called the earth wire also enters our house as shown in the fig. The earth connection is first made to the electric meter and then to the main switch. This wire then goes into the rooms along with the live and neutral

Electric Fuse



- An electric fuse is a device which is used to limit the current in an electric circuit. The fuse safeguards the circuit and the electrical appliances from being damaged.
- The fuse wire is generally an alloy of lead and tin. It has a low melting point and breaks the circuit if the current exceeds a safe value. The thickness and length of the fuse wire depends on the maximum current allowed through the circuit.
- It is connected in series in the beginning of the electric circuits.

Electric fuses are always connected in series in an electric circuit. Why?

When the circuit current exceeds a specified value due to voltage fluctuations or short-circuiting, the fuse wire gets heated and melts. Thus it breaks the connection as shown in the figure and no current flows. This prevents damage to the appliance.

CHAPTER-13
MAGNETIC EFFECT OF CURRENT
Assignment13.1
MCQ

Q1.Which of the following correctly describes the magnetic field near a long straight wire?

(a) The field consists of straight lines perpendicular to the wire.
(b) The field consists of straight lines parallel to the wire.
(c) The field consists of radial lines originating from the wire.
(d) The field consists of concentric circles centered on the wire.

Q2. Magnetic field due to a current through a straight conductor depends on

(e) current
(f) distance from the wire
(g) Both (a) and (b)
(h) cross-sectional area of wire

Q3. The magnetic field inside a long straight solenoid- carrying current

(a) is zero
(b) decreases as we move towards its end.
(c) increases as we move towards its end.
(d) is the same at all points.

Q4. To avoid risk of electrical shock, which phenomena is used?

(a) Overloading
(b) Short circuiting
(c) Earthing
(d) None of these

Q5. Magnetic lines do not intersect on one-another because

(a) they are at a distance
(b) they are in the same direction
(c) they are parallel to another
(d) at the point intersection there will be two direction of the magnetic force which is impossible.

TRUE-FALSE:

Q1. It is standard practice to connect fuse wire in the neutral wire of the household wiring.

Q2. A magnetic field exists in the region surrounding a magnet, in which the force of the magnet can be detected.

Q3. Fleming's left hand rule helps us to find the direction of the induced current.

Q4. The direction of force on a current carrying conductor placed in a magnetic field can be reversed by reversing the direction of current flowing in the conductor.

Q5. We can use either a two pin (plug and socked) or a three pin (plug and socket) while working with an electric iron.

FILL IN THE BLANK:

Q1. Field lines are shown closer together where the magnetic field is .....

Q2. Magnetic field lines emerge from the ..... pole of a solenoid or a permanent magnet.

Q3. Red colour insulation is used for .....wire.

Q4. A generator converts mechanical energy into .....energy. It works on the basis of .....

Q5. In our houses we receive AC electric power of .....with a frequency of .....

MATCHING QUESTIONS

DIRECTION : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

1.

Column I		**Column II**	
(A)	An electric motor works on	(p)	to a battery
(B)	An electric motor is also	(q)	direct current
(C)	A commuta- tor is used to	(r)	reverse the direction of flow of current.
(D)	Commuta- tor rings are connected	(s)	known as DC MOTOR

ASSERTION AND REASON

DIRECTION : In the following questions, a statement of assertion (A) is followed by

a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q1.
Assertion : Safety fuses are made up of materials having a low melting point.
Reason : Safety fuses should not allow electric current to flow.

Q2.
Assertion : The magnetic field produced by a current carrying solenoid is independent of its length and cross-section area.
Reason : The magnetic field inside the solenoid is uniform.

Q3.
Assertion : Copper is used to make electric wires.
Reason : Copper has very low electrical resistance.

Q4.

Assertion : The magnetic field is stronger at a point which is nearer to the conductor and goes on decreasing on moving away from the conductor.

Reason : The magnetic field *B* produced by a straight current carrying wire is inversely proportional to the distance from the wire.

Q5.
Assertion : Two bar magnets attract when they are brought near to each other with the same pole.
Reason : Unlike poles will attract each other.

CHAPTER-13
MAGNETIC EFFECT OF CURRENT
Assignment13.2

Q1. Describe an activity to draw magnetic field lines around a bar magnet.

Q2. Describe an activity to show the pattern of magnetic field lines around straight current carrying conductor. Name and state the rule to find direction in this case.

Q3. Draw the pattern of magnetic field lines produced by current carrying circular loop.

Q4. With the help of an activity draw magnetic field lines around a solenoid.

Q5. (a) With the help of an experiment show that force is exerted on a current carrying conductor when placed in a magnetic field.

(b) How will this force change when the current in the conductor is increased?

Q6. What is the pattern of field lines inside the solenoid? What do they indicate?

Q7. Differentiate between permanent magnet and electromagnet.

Q8. Differentiate between short-circuiting and overloading.

Q9. Explain two ways to induce current in a coil. Name and state the rule to find direction of induced current.

Q10. With the help of an experiment explain the electromagnetic induction.

Q11. Differentiate between direct and alternating current.

Q12. A switch is always connected to

a) Live wire
b) Neural wire
c) Earth wire

CHAPTER-13
MAGNETIC EFFECT OF CURRENT
Assignment13.3

Q1. Name the scientist who provided the first evidence of connection between electricity and magnetism.

Q2. List the properties of magnetic lines of force?

Q3. Why two magnetic field lines are are never found to cross each other?

Q4. What are the factors on which the magnetic field produced by straight current carrying conductor depends?

Q5. State right hand thumb rule.

Q6. Draw magnetic field lines due to a circular loop.

Q7. State flaming's left hand rule.

Q8. What is an electromagnet? Explain electromagnetic induction with the help of an activity.

Q9. State Fleming's right hand rule.

Q10. What is a fuse wire? Name 2 special characteristics that a fuse wire must have

Q11. What is the frequency of A.C. in India? Find the time in which A.C. changes its direction?

Q12. Name a device that converts electrical energy to mechanical energy. Explain the underlying principle and working of the device with the help of a neat diagram.

Q13. An electrician assembling a household circuit uses a long thick copper wire with green insulation and a short wire made of copper tin alloy. What are the two wires called? Mention the importance of each wire in an electric circuit. How are these wires connected in the circuit?

Q14. A coil connected to galvanometer is held stationary. A bar magnet with its North Pole facing the coil is moved towards the coil at a certain speed. The galvanometer shows deflection of 10 divisions towards right. How will deflection in the galvanometer scale be affected if the bar magnet is moved away from the coil at the same speed?

MAGNETIC EFFECT OF ELECTRIC CURRENT
QUESTION-BANK

Q.1 A straight wire carrying electric current is moving out of plane of paper and is perpendicular to it. What is the direction and type of induced magnetic field?

Q.2 How can it be shown that magnetic field exist around a wire carrying current?

Q.3 How can a solenoid be used to magnetise a steel bar.

Q.4 Why can't two magnetic field lines ever intersect?

Q.5 Can a 5 A fuse be used in wire carrying 15 A current? Why?

Q.6 Give the factors that affect strength of magnetic field at a point due to a straight conductor carrying current.

Q.7 Where do we connect a fuse: with live wire or with neutral wire?

Q.8 Give two uses of electromagnets.

Q.9 Name any two devices which use permanent magnets.

Q.10 Draw the magnetic field lines representing uniform magnetic field.

Q.11 A current-carrying straight conductor is placed in the east-west direction. What will be the direction of the force experienced by this conductor due to earth's magnetic field? How will this force get affected on? (a) reversing the direction of flow of current (b) doubling the magnitude of current.

Q.14 A coil of insulated copper wire is connected to a galvanometer. What would happen if a bar magnet is

(i) Pushed into the coil?

(ii) Withdrawn from inside the coil?

(iii) Held stationary inside the coil?

Q. 16. An electron beam is moving vertically upwards. If it passes through a magnetic field which is directed from south to north in a horizontal plane, then in which direction will the beam be deflected?

Q. 17. The magnetic force acts on a moving proton is towards north in a horizontal plane. If the proton is moving vertically up, then what will be the direction of magnetic field?

Q. 18. A charged particle moves in a clockwise direction in a magnetic field which is perpendicular to plane of paper directed downward. What is the nature of charge particle.

Q. 19. A constant current is flowing through a primary coil, What will be the direction of induced current in the secondary coil placed along coaxially? Justify.

Q. 20. The magnetic field all points well inside a long straight solenoid carrying current is ----------

Q.21 Draw magnetic field lines around a bar magnet

Q. 22. Give the characteristics of magnetic field lines

Q. 23. What is a compass needle?

Q. 24. What is the current rating of a) bulbs b) geysers?

CHAPTER-13
MAGNETIC EFFECT OF ELECTRIC CURRENT
H.O.T.S.

1. An electron is moving
   a) From west to east in the plane of the paper in s region where there is uniform magnetic field , directed inwards and perpendicular to the plane of the paper
   b) From south to north , in the planer of the paper in a region where there is a uniform magnetic field directed from west to east , in the plane of the paper itself .
   c) From south to north , in the planer of the paper in a region where there is a uniform magnetic field directed from ,north to south in the plane of the paper itself .

   State the direction of force , experienced by the electron , in each case.
2. A proton is moving in a region where there is uniform magnetic field directly outwards and perpendicular to the plane of the page itself. It experiences a force directed from west to east in the plane of the page itself. What is the direction of motion of this proton?

3. Anelectron, moving from south to north in plane of the page in a region where there is uniform magnetic field , experiences a force that is directed from west to east in the plane of the page itself. What is the direction of this uniform magnetic field?

CHAPTER-13
MAGNETIC EFFECT OF ELECTRIC CURRENT
FUN-FACTS

Hammering or heating a magnet in a hot flame will cause it to loose its magnetic properties. In both scenarios the molecules lose their north-south alignment and get arranged in random directions.

- All magnets have a north and south pole, including all of our custom promotional magnets. Opposite poles attract while the same poles repel each other.
- Many scientists believe the Earth's magnetic field helps to guide migrating birds.
- Over 80% off all households in the US have promotional magnets on their refrigerator.
- The worlds largest magnet is planet Earth. Earths hot liquid core contains iron which, as it moves, creates an electric current that generates a magnetic field around the planet.
- Neodymium magnets (a type of very strong rare-earth magnets) are known to repel sharks. While we don't currently sell neodymium magnets we do have a large collection of super strong magnets.
- Today's high speed trains use magnets to float each car, reducing friction and allowing the train to run very efficiently.
- Magnets can be found in many common household items such as telephones, computers, stereos, refrigerators, TVs, and VCRs.
- A coil of wire with an electric current flowing through it becomes magnetized.
- The pull of a magnet is strongest at the north and south pole.
- Rare-earth magnets are the strongest type of permanent magnets made.
- Legend has it that magnets were first discovered around 4,000 years ago when a shepherd named Magnes got the nails in the sole of his shoe stuck to a magnetic rock, later called magnetite.
- Magnets are usually made of steel or iron. Special alloys of iron, nickel, copper, cobalt, and aluminum can also be made into magnets.

DO SOME RESARCH ON MAGNTIC HILL IN INDIA.

NOTES

NOTES

CHAPTER-10
LIGHT – REFLECTION AND REFRACTION

Light is a form of _____ which enables us to see.
PROPERTIES OF LIGHT

- It is non-mechanical wave as it does not require any medium to travel
- Speed of light in vacuum is 3x108 m/s
- It is transverse electromagnetic wave

Reflection of light:
Bouncing back of the light rays in the same medium when these rays strike on a surface or on a boundary separating two media.

LAWS OF REFLECTION

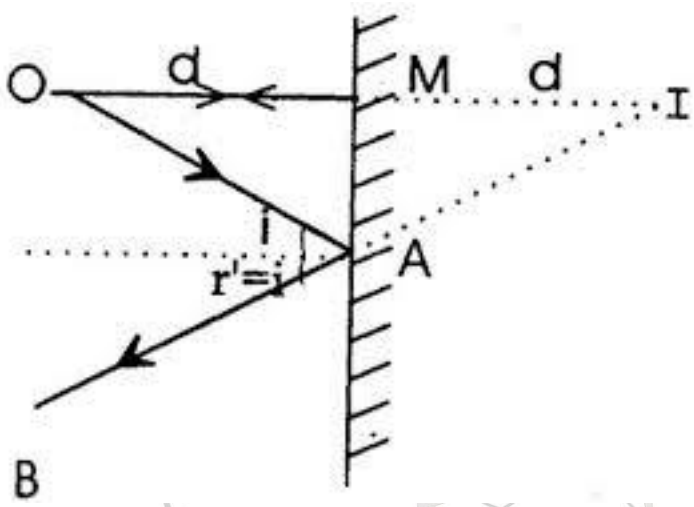
1. The incident ray the reflected ray and the normal at the point of incidence , they all lie in the same plane
2. The angle of incidence is equal to the angle of reflection.

DIAGRAM:

QUESTION
DIFFERENCES BETWEEN REAL AND VIRTUAL IMAGES:

REAL IMAGE	VIRTUAL IMAGE

Image formation by a plane mirror(Diagram)



QUESTION
What are the Characteristics of an image formed by a plane mirror?

Spherical Mirror

Mirrors having curved reflecting surface are called spherical mirrors. A spherical mirror is a part of a sphere.

Types of Spherical Mirror:

Concave Mirror: Spherical mirror with reflecting surface curved inwards is called concave mirror.

Convex Mirror: Spherical mirror with reflecting surface curved outwards is called convex mirror.

Important terms in the case of spherical mirror:

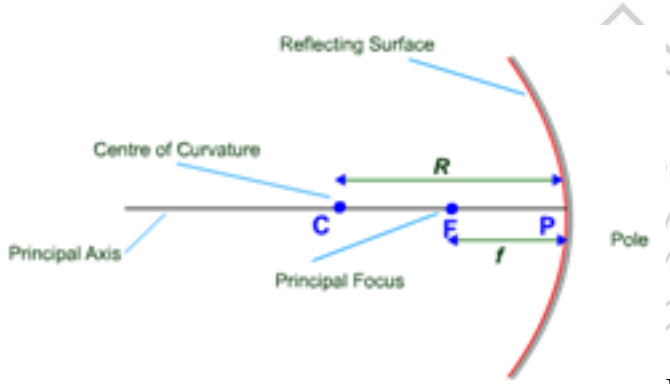


Fig: Concave Mirror

Pole: The centre of reflecting surface of a spherical mirror is known as Pole. Pole lies on the surface of spherical mirror. Pole is generally represented by 'P'.

Centre of Curvature: The centre of sphere; of which the reflecting surface of a spherical mirror is a part; is called the centre of curvature of the spherical mirror. Centre of curvature is not a part of spherical mirror rather it lies outside the mirror. Centre of curvature is denoted by letter 'C'.

In the case of concave mirror centre of curvature lies in front of the reflecting surface. On the other hand, centre of curvature lies behind the reflecting surface in the case of convex mirror.

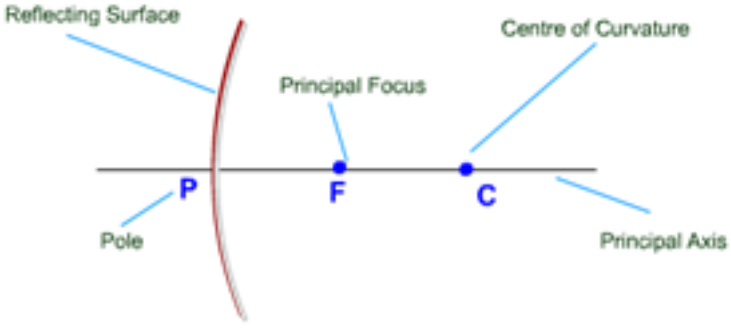


Fig: Convex Mirror

Radius of Curvature: The radius of sphere; of which the reflecting surface of a spherical mirror is a part; is called the Radius of Curvature of the spherical mirror. The radius of curvature of a spherical mirror is denoted by letter 'R'.

Similar to centre of curvature, radius of curvature lies in front of concave mirror and lies behind the convex mirror and is not a part of the mirror as it lies outside the mirror.

Aperture: The diameter of reflecting surface of a spherical mirror is called aperture.

Principal Axis: Imaginary line passing through the centre of curvature and pole of a spherical mirror is called the Principal Axis.

Focus or Principal Focus: Point on principal axis at which parallel rays; coming from infinity; converge after reflection is called the Focus or Principal Focus of the spherical mirror. Focus is represented by letter 'F'.

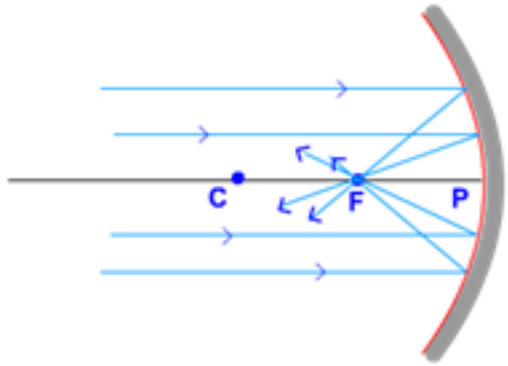


Fig: Converging Mirror

In the case of a concave mirror, parallel rays; coming from infinity; converge after reflection in front of the mirror. Thus, the focus lies in front of a concave mirror.

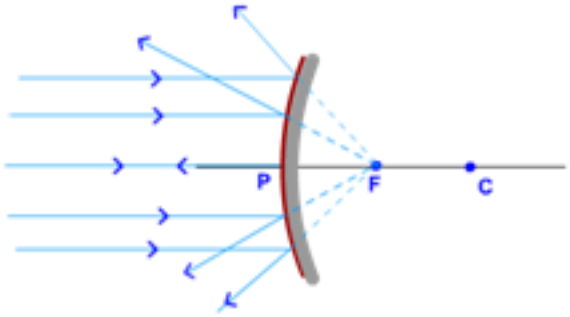


Fig: Diverging Mirror

In the case of a convex mirror, parallel rays; coming from infinity; appear to be diverging from behind the mirror. Thus, the focus lies behind the convex mirror.

Focal length: The distance from pole to focus is called focal length. Focal length is denoted by letter 'f'. Focal length is equal to half of the radius of curvature.

$$Or, f = \frac{R}{2} \qquad Or, R = 2f$$

Rules for drawing ray diagrams

In the case of concave mirror: A Ray parallel to principal axis passes through the principal focus after reflection from a concave mirror.

DIAGRAM

Similarly, all parallel rays to the principal axis pass through the principal focus after reflection from a concave mirror. Since, a concave mirror converge the parallel rays after reflection, thus a concave mirror is also known as **converging mirror.**

In the case of convex mirror: A ray parallel to principal axis appears to diverge from the principal focus after reflecting from the surface of a convex mirror.

DIAGRAM

Similarly, all rays parallel to the principal axis of a convex mirror appear to diverge or coming from principal focus after reflection from a convex mirror. Since, a convex mirror diverges the parallel rays after reflection, thus it is also known as **diverging mirror.**

Reflection of ray passing through the Principal Focus:

In the case of concave mirror: Ray passing through the principal focus goes parallel to principal axis after reflection in the case of concave mirror.

DIAGRAM

In the case of convex mirror: A ray directed towards principal focus goes parallel to principal axis after reflecting from the surface of a convex mirror.

DIAGRAM:

Ray passing through the Centre of curvature:

In the case of concave mirror: Ray passing through the centre of curvature returns at the same path after reflecting from the surface of a concave mirror.

DIAGRAM

In the case of convex mirror: Ray appears to passing through or directed towards the centre of curvature goes parallel to the principal axis after reflecting from the surface of a convex mirror.

DIAGRAM

Ray incident obliquely to the principal axis: Ray obliquely to the principal axis goes obliquely after reflecting from the pole of the both concave and convex mirror and at the same angle.

DIAGRAM

Image formation by a concave mirror:
Case1: when the object is at infinity
Case2: When the object is beyond C
Case3: When the object is at C
Case4: When the object is between C and F
Case 5: When the object is at F
Case 6 when the object is between F and P

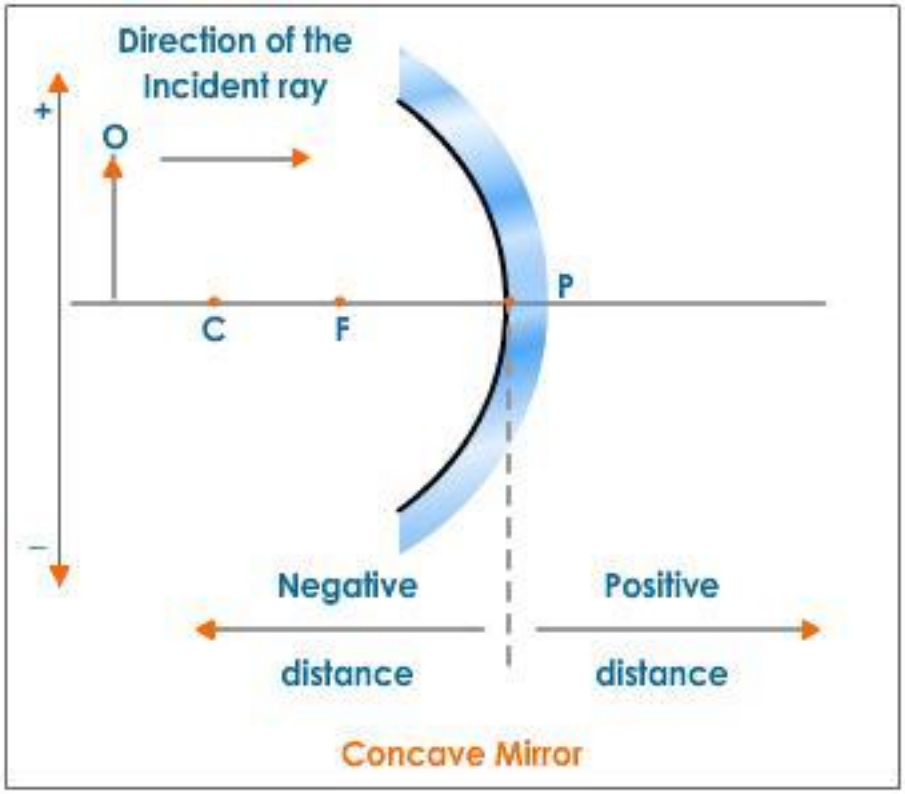
Position of the object	Position of the image	Nature of the image	Size of the image
Infinity			
Beyond C			
At C			
Between C and F			
At F			
Between F and P			

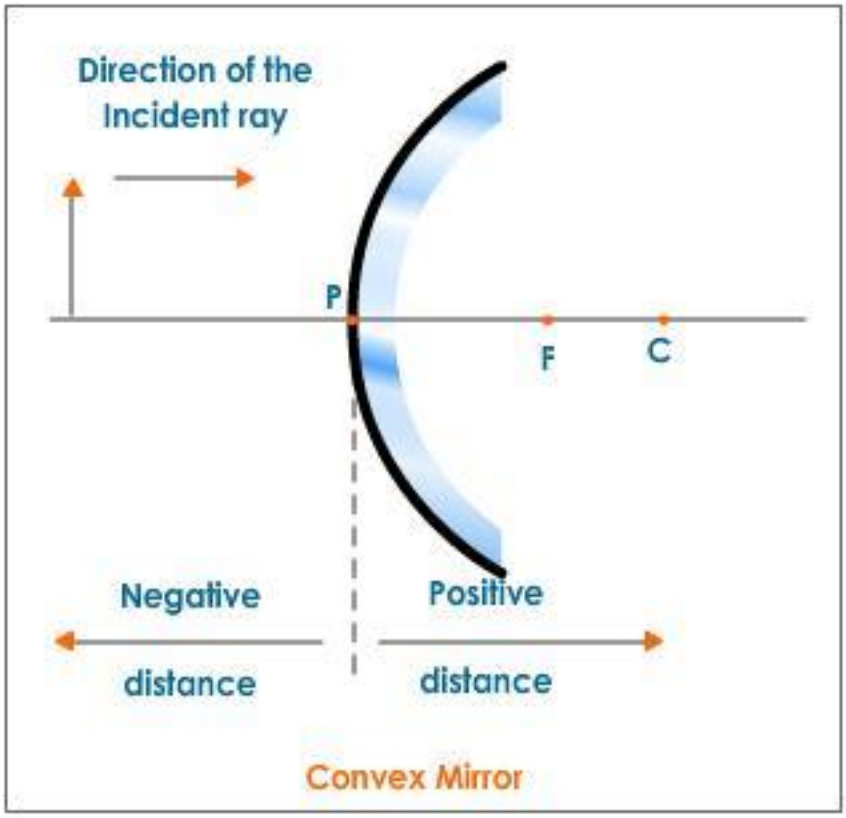
Image formation by a convex mirror
Case1: When the object is at infinity
Case2: When the object is between infinity and pole;

Sign Convention for Spherical Mirrors

The following sign convention is used for measuring various distances in the ray diagrams of spherical mirrors:

- Object is always placed to the left of mirror
- All distances are measured from the pole of the mirror.
- Distances measured in the direction of the incident ray are positive and thedistances measured in the direction opposite to that of the incident rays are negative.
- Distances measured along y-axis above the principal axis are positive and that measured along y-axis below the principal axis are negative.


Direction of the
Incident ray
+
O
P
C
F
–
Negative
distance
Positive
distance
Concave Mirror


Direction of the
Incident ray
P
F
C
Negative
distance
Positive
distance
Convex Mirror

Mirror formula:

Magnification: It is defined as the ratio of height of image to the height of the object. It has no unit. The negative sign indicates _____ while the positive sign indicates _____.
If the magnitude is greater than 1 the image is _____ and if it is less than 1 the image is _____.

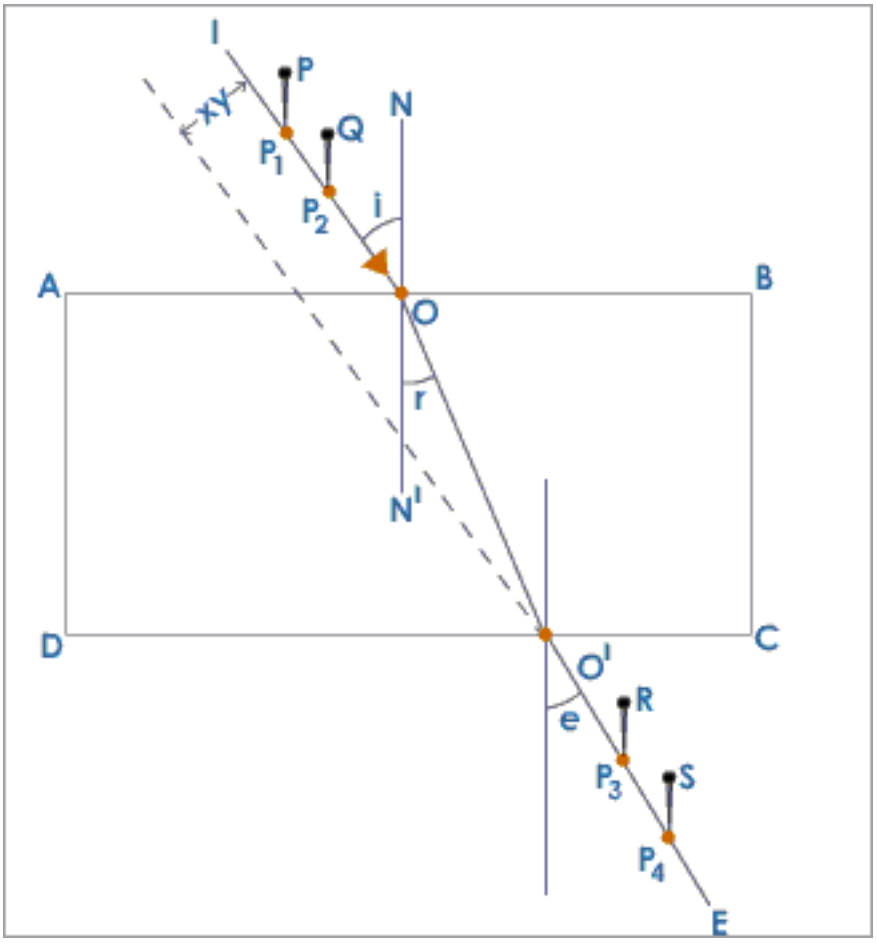
Question:
A 1.2 cm pin is placed 8 cm away from a diverging mirror of focal length 12 cm. Find the position of the image its height and interpret its nature.

Refraction of Light through a Glass Slab

Let us now perform an experiment and find out how light gets refracted when it is incident on a rectangular glass slab.

- Place a rectangular glass slab on a white sheet of paper fixed on a drawing board.
- Trace the boundary ABCD of the glass slab.
- Remove the glass slab. Draw an incident ray IO on AB.
- Draw the normal at point of incidence (NN^1 through O)
- Fix two pins P and Q on the incident ray IO.
- Place the glass slab within its boundary ABCD.
- Looking from the other side of the glass slab fix two pins R and S such that your eye and the feet of all the pins are in one straight line.
- Remove the glass slab and the pins. Mark the pin points P_1, P_2, P_3 and P_4.

- Join OO^1.It is the refracted ray.
- Measure $\angle i$, $\angle r$ and $\angle e$. $\angle i$, $\angle r$ and $\angle e$ are the angle of incidence, angle of refraction and angle of emergence respectively.
- $\angle i > \angle r$ and $\angle i = \angle e$
- Extend O^1E backwards. The emergent ray is parallel to the incident ray.



Refraction through a Glass Slab

The above experiment shows that

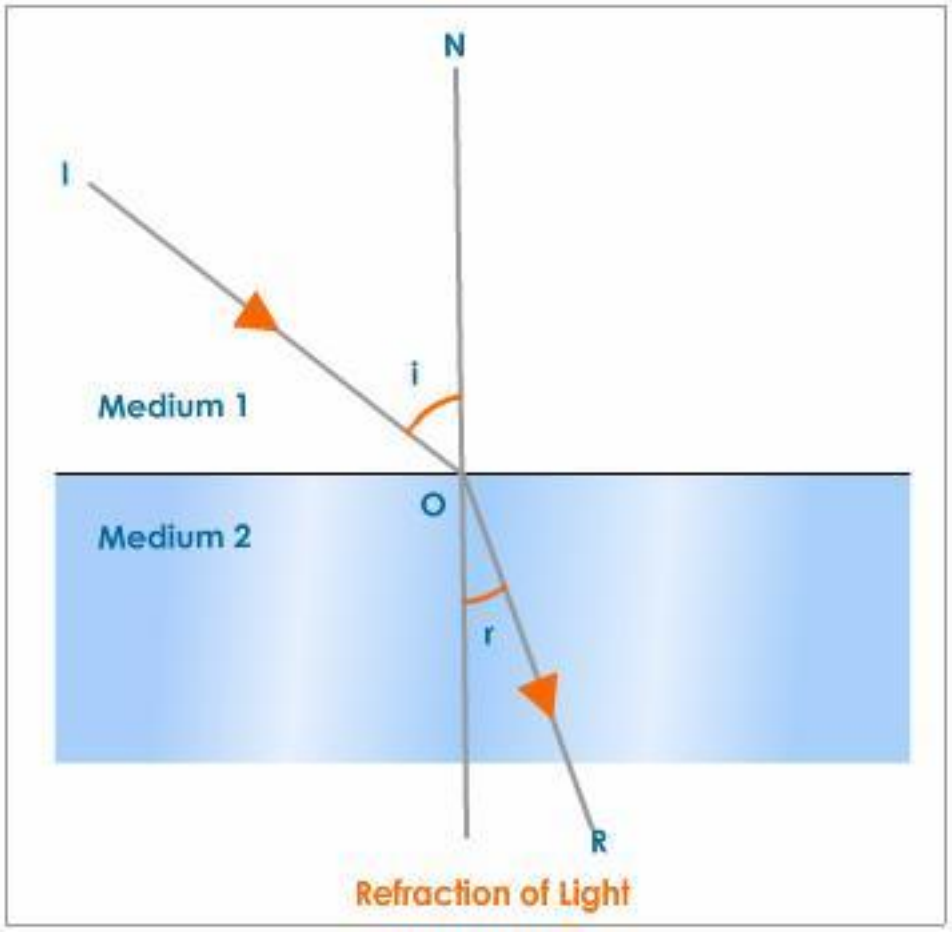
- When a ray light is passing from air to glass, that is, from a rarer medium to a denser medium, the refracted ray bends towards the normal drawn at the point of incidence. In this case $\angle i > \angle r$. But when the ray of light is passing from glass to air, that is, from a denser medium to a rarer medium the refracted ray bends away from the normal. In this case $\angle r > \angle i$.

- The emergent ray, O^1E which is nothing but the refracted ray emerging out of the glass slab is parallel to the incident ray. This means that the refracted ray (emergent ray) has been displaced from its original path by a distance XY. This displacement is referred to as lateral displacement.

The **refractive index** or **index** of **refraction** of a substance is a measure of the speed of light in that substance. It is expressed as a ratio of the speed of light in vacuum relative to that in the considered medium.

Laws of Refraction

- The incident ray, the refracted ray and the normal to the surface at the point of incidence all lie in one plane.
- For any two given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant.
- The above law is called Snell's law after the scientist Willebrod Snellius who first formulated it



The refractive index of a medium depends on the following factors:

- the nature of the medium
- the colour or wavelength of the incident light

Lateral Displacement

- In the rectangular block the incident ray and refracted ray are parallel to each other. The perpendicular distance between them is called lateral displacement.

Refraction through a lens

Lens:

it is a piece of a transparent material having at least one curved surface.

Types of lenses

The two main types of lenses are the ***CONVEX*** and the***CONCAVE*** lens.

Terms related to lenses:

Principal axis: A line, which passes through the center of the lens, perpendicular to the lens surface. (Lines X-Y in the diagrams on the left illustrate the principal axes of the lenses.)

Optical centre: This is a point on the principal axis of a lens through which light passes without undergoing any deviation. In other words, a ray of light passing through the optical center will not change its direction. For thin lenses whose faces have the same curvature, this point, marked **O** in the diagram, is in the center of the lens.

Principal focus or **focal point**: This is a point, marked **F** in the diagram, to which all rays parallel to the principal axis converge (in the case of a convex lens), or (in the case of a concave lens) from which the rays appear to diverge.

Focal length: This is the distance between the optical centre and the principal focus. In the diagram, it is the distance **OF**.

Principal focal plane: An imaginary plane located at the principal focus, perpendicular to the principal axis.

Rules for drawing Ray Diagrams
Any incident ray traveling parallel to the principal axis of a converging lens will refract through the lens and travel through the focal point on the opposite side of the lens.

Any incident ray traveling parallel to the principal axis of a diverging lens will refract through the lens and travel *in line with* the focal point (i.e., in a direction such that its extension will pass through the focal point).

Diagram

Any incident ray traveling through the focal point on the way to the convex lens will refract through the lens and travel parallel to the principal axis

Any incident ray traveling towards the focal point on the way to the concave lens will refract through the lens and travel parallel to the principal axis.
Diagram

- An incident ray that passes through the center of the lens will in effect continue in the same direction that it had when it entered the lens.

Diagram

Image formation by a convex lens:
Case1: when the object is at infinity
Case2: When the object is beyond 2F
Case3: When the object is at 2F
Case4: When the object is between 2F and F
Case 5: When the object is at F
Case 6 When the object is between F and O

Position of the object	Position of the image	Nature of the image	Size of the image
at infinity			
beyond 2F			
at 2F			
between 2F and F			
at F			
between F and O			

Image formation by a Concave lens
Case1: When the object is at infinity
Case2: When the object is between infinity and O;
Sign Convention for lens

Lens formula:

Magnification: It is defined as the ratio of height of image to the height of the object. It has no unit. The negative sign indicates _____ while the positive sign indicates _____.

If the magnitude is greater than 1 the image is _____ and if it is less than 1 the image is _____.

Power of a lens:

_____
_____
_____
_____

The S.I. unit of power:

Define 1 dioptre:_____
_____
_____
_____

The power is positive for _____ lens and negative for _____.

For lenses in contact the power of combination is given by:

CHAPTER- 10

LIGHT-Reflection and refraction

M.C.Q.

Q1. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object ?

a) 15 cm in front of the mirror

b) 30 cm in front of the mirror

c) Between 15 cm and 30 cm in front of the mirror

d) Between 15 cm and 30 cm in front of the mirror

Q2. Which of the following can make a parallel beam of light when light from a point source is incident on it ?

a) Concave mirror as well as convex lens
b) Convex mirror as well as concave lens
c) Two plane mirrors placed at 90
d) Concave mirror as well as concave lens

Q3. Two plane mirrors are facing each other. An object placed between them has N number of images. The value of N is

a) 1
b) 2
c) 10
d) Infinity

Q4. An object at a distance of 30 cm from a concave mirror gets its image at the same point. The focal length of the mirror is

a) – 30
b) +30
c) – 15
d) +15

Q5. Magnification produced by a rear view mirror fitted in vehicles

a) Is less than one
b) Is more than one

c) Is equal to one
d) can be more than or less than one depending upon the position of the object in front of it.

TRUE-FALSE:

Q1. The speed of light is different in different media.

Q2. The laws of reflection are valid for plane mirrors and not for spherical mirrors.

Q3. The mirror formula is valid only if the aperture of the mirror is small.

Q4. A concave mirror always produces inverted image.

Q5. A ray of light passing through the optical centre of a lens will emerge without any deviation.

FILL IN THE BLANK:

Q1.An object is placed in front of a spherical mirror. The image is found to be virtual for all positions of the object. The spherical mirror is .....

Q2. The SI unit of power of a lens is .....

Q3. The power of a convex lens is ..... and that of a concave lens is .....

Q4. Line passing through the pole and the centre of curvature of a spherical mirror is called the .....

Q5. A concave lens will always give a virtual, erect and diminished image.

MATCH THE FOLLOWING:

	Column I		**Column II**
1.	Reflection	(a)	The radius of that sphere of which the mirror is a part.
2.	Refraction	(b)	The bouncing back of light from a smooth surface.
3.	Incident ray	(c)	A mirror whose reflecting surface is the part of a hollow sphere.

4.	Spherical mirror	(d)	The bending of light, when it passes from one medium to another.
5.	Rarer medium	(e)	A ray of light that strikes the reflecting surface.
6.	Denser medium	(f)	It is the degree of convergence or divergence of light rays achieved by a lens.
7.	Radius of curvature	(g)	A medium in which the speed of light is less.
8.	Focal length	(h)	The centres of spheres which form the part of the surface of the lens.
9.	Optic centre	(i)	The distance of the principal focus from the pole of the mirror.
10.	Power of lens	(j)	A medium in which the speed of light is more.

ASSERTION AND REASON

DIRECTION : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1.

Assertion : Keeping a point object fixed, if a plane mirror is moved, the image will also move.

Reason : In case of a plane mirror, distance of object and Its image is equal from any point on the mirror.

Q2.

Assertion : If the rays are diverging after emerging from a lens; the lens must be concave.

Reason : The convex lens can give diverging rays.

Q3.

Assertion : Light travels faster in glass than in air

Reason : Glass is denser than air.

Q4.

Assertion : Refractive index has no units.
Reason : The refractive index is a ratio of two similar quantities.

Q5.

Assertion : Large concave mirrors are used to concentrate sunlight to produce heat in solar cookers.
Reason : Concave mirror converges the light rays falling on it to a point

CHAPTER- 10

LIGHT-Reflection and refraction

Assignment-10.1

1. A concave mirror forms a real image of the same size as that of the object, where is the object placed?
2. What is the focal length of a plane mirror?
3. Name the types of the mirrors through which you can get the virtual image of an object placed in front of it.
4. What kind of a mirror is used in automobiles and why?
5. Which mirror always produces a virtual, erect and diminished image of an object?
6. What are the values of angle of incidence (i) and that the reflection (r) for a normal incidence?
7. See the equation magnification m= + 1, for a plane mirror. What does this signify for (a) m=1 and (b) positive sign of m?
8. Describe a method to determine the focal length of a concave mirror.
9. An object is placed at a distance of 30cm from a concave mirror of focal length 20cm. where will the image be formed?
10. Sunlight is incident on a concave mirror, parallel to its principal axis. The image is formed at a distance of 12cm from the pole. Find the radius of curvature of the mirror.
11. An object is placed in front of a concave mirror of focal length 20 cm. Real image is twice the size of the object,find the distance of object from the mirror.
12. Object is placed in front of a convex mirror of radius of curvature is 40 cm. The magnification is found to be ¼, find the location of the object?
13. Object is placed in front of a concave mirror of focal length 30 cm. Magnification is found to be 3. Find the locations of the object?

14. A diverging mirror has a radius of curvature of 30 cm. where in front of the mirror should an object be placed so that virtual image of half the size of the object is formed?

15. The image formed by a converging mirror is real and highly enlarged. Where will you place the object? Explain with the help of a neat-labeled ray diagram.

16. The image formed by a converging mirror is virtual and enlarged. Where will you place the object? Explain with the help of a neat-labeled diagram.

17. The shiny bulging surface of a hollow aluminum sphere of radius 40 cm is used as a mirror.
    a) Which type of spherical mirror will it be?
    b) What is the focal length of this mirror?

18. Draw a neat ray diagram to show the formation of a real equal sized image by a concave mirror?
19. If a concave mirror converges the rays of the sun 15 cm away from the mirror, what should be the distance at which an equal sized image will be formed for a 1cm object placed in front of this mirror?
20. A student obtained a sharp image of the grills of a window on a screen using a concave mirror. The teacher remarked that for better results, the sun should be focused on the screen. What should be done for this purpose?
    a) Move the screen slightly away from the mirror.
    b) Move the mirror slightly towards the screen.
    c) Move the screen and mirror away from the object.
    d) Move the screen and mirror towards the object.

CHAPTER- 10

LIGHT-Reflection and refraction

Assignment-10.2

1. When a ray of light passes from medium 1 to medium 2, it bends towards the normal, which of the two is optically denser?
2. The absolute refractive index of diamond is 2.42, what is the speed of light in diamond?
3. List the factors affecting the lateral displacement.
4. How should a ray be incident on a rectangular slab so that it comes out from the opposite side without being displaced?
5. Given the refractive index of water and glass is 4/3 and 3/2 respectively. Write the relation and find the value of refractive index of water with respect to glass and glass with respect to water.
6. A ray of light travelling in air falls on a surface whose refractive index is 1.5. If the angle of incidence is 30^0, find the angle of refraction.
7. a) Define refractive index. State its mathematical formula.
   b) Refractive index of media A, B, C and D are A-1.33, B-1.52, C-1.44, D-1.65. In which of the four media speed of light is (i) maximum (ii) minimum.
8. How is the refractive index of a medium related to the speed of light? Obtain an expression for refractive index of a medium with respect to another in term of speed of light in these two media?
9. Light passes through a rectangular glass slab and through a triangular glass Prism. Using proper ray diagram, explain in what way does the direction of the two emergent beams differs with respect to the incident beam of light.
10. Refractive index of diamond with respect to glass is 1.6 and absolute refractive index of glass is 1.5. Find out the absolute refractive index of diamond.
11. State Snell's law of refraction?
12. If the speed of light in flint glass is 1.86×10^8 m/s and that in vacuum is 3×10^8 m/s, what is the absolute refractive index of flint glass?

13. For the same angle of incidence of 45 degrees, the refraction angle (in degrees) in three transparent media A,B,C are 25, 30 and 35respectively. In which medium is the speed of light-
    a) Minimum
    b) Maximum

14. What do you mean by lateral displacement? List the factors on which lateral displacement depend?
15. A ray of light travelling in water emerges into air. Draw a neat figure to indicate the change in its path with the ray direction?

16. A student performs an experiment to trace the path of a ray of light through a rectangular glass slab. He measures the angles of incidence, refraction and emergence. The correct observation will be –

a. Angle of incidence is larger than angle of refraction but nearly equal to the angle of emergence.
b. Angle of incidence is less than angle of refraction but nearly equal to the angle of emergence.
c. Angle of incidence is greater than angle of emergence but nearly equal to the angle of refraction.
d. Angle of incidence is less than angle of emergence but nearly equal to the angle of refraction.

17. What is meant by the statement" refractive index of diamond is 2.42"

18. A ray of light travelling in glass emerges into air. Draw a neat figure to indicate the change in its path with the ray direction?

CHAPTER- 10

LIGHT-Reflection and refraction

Assignment-10.3

1. Where a pin should be placed before a convex lens so that the image is formed at infinity?

2. The power of a lens used in reading glasses of a person is +1.5. Is the lens concave or convex?

3. A concave lens of focal length 20 cm forms an image 10 cm away from the lens. Use lens formula to find the position of the object with respect to the lens. Also draw ray diagram to illustrate the image formed in this case.

4. A 5 cm tall object is placed on the principal axis of a convex lens of focal length 50 cm at a distance of 40 cm from it. Use lens formula to find the nature and position of the image?

5. A convex lens of focal length 20 cm can produce a magnified as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?

6. Sudha finds out that the sharp image of the windowpane of her science laboratory is formed at a distance of 15 cm from the lens. She now tries to focus the building visible to her outside the window instead of the windowpane without disturbing the lens. In which direction will she move the screen to obtain a sharp image of the building? What is the approximate focal length of this lens?

7. How are power and focal length of the lens related? You are provided with two lenses of local length 20 cm and 40 cm respectively. Which lens will you use to obtain more convergent light?

8. Draw a neat ray diagram to show the formation of a real equal sized image by a convex lens?

9. Define-Refraction, Pole, centre of curvature, focal length, Power of a lens, angle of deviation, lateral displacement, Optical centre, Principal focus of a lens, Magnification.

10. An object placed on a metre scale at the 8cm marking, was focused clearly on a white screen placed at the 92cm marking, using a converging lens that is placed on the 50cm marking. Using this information answer the following –

a) Find the focal length of the lens

b) Find the position of the image, if the object is shifted towards the lens to the 29 cm marking.

c) State the nature of the image formed if the object is shifted further towards the lens?

11. Two lenses A and B have a power of +2.5D and – 1.5D respectively.

a. Identify the nature of the **lens A** and draw a neat figure to show the **lens.**
b. What is the focal length of lens A?
c. What is the power of the combination of the two lenses?

12. State and define the S I unit of the power of a lens.

Calculate the combination of the power of a convex lens of focal length 25 cm and a concave lens of focal length 10cms placed in contact.

CHAPTER- 10
LIGHT-Reflection and refraction

Question bank

1. What are the characteristics of image formed by a plane mirror?
2. Where an object should be placed in front of a concave mirror so as to get unit magnification?
3. Define pole of a spherical mirror.
4. Name the type of spherical mirror used by a dentist to see the teeth of a patient clearly.
5. A beam of light parallel to the principal axis of a concave mirror converges to a point. What is the point called? Draw a diagram to illustrate it.
6. Draw a diagram to show the transmission of light when the angle of incidence at the surface of separation between two transparent media is zero degree.
7. What is lateral displacement?
8. Draw neat labelled diagram to show the formation of image by a concave mirror when an object is placed at a point
   1. Beyond centre of curvature
   2.At centre of curvature
   3.Between F and C
   4.At F
   5.Between F and P. Also write the characteristics of image formed in each case.
9. Draw neat labelled diagram to show the formation of image by a convex lens when an object is placed at a point
   1. Beyond 2F
   2. At 2F
   3.Between F and 2F
   4.At F
10. Write the sign conventions for a spherical lens.
11. Draw a neat labeled diagram to show lateral displacement when light is passed through a rectangular glass slab
12. An object of height 8.0 cm is placed at 50 cm in front of a concave mirror of focal length 30 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image? Also find the nature and size of image.
13. Write any two typical rays chosen to locate the image formed by a concave mirror.
14. Define real image and virtual image.

15. When an object is kept beyond the centre of curvature of a concave mirror, what is the nature of image formed?

16. An object is placed at a distance of 10cm from a convex lens of focal length 15 cm. Find the position size and nature of image formed.

17. What is lateral inversion?

18. Write any 4 uses of a plane mirror.

19. Define centre of curvature, radius of curvature, pole and principal axis of a spherical mirror.

20. Define principal focus of a

a. Concave mirror

b. Convex mirror

c. Convex lens and

d. Concave lens

21. What is the relation between the radius of curvature and focal length of a spherical mirror?

22. Write any 3 uses of a concave mirror.

23. With the help of ray diagram explain the uses of convex mirror.

24. Write mirror formula and explain the terms involved.

25. Define magnification of a mirror.

26. A rear view mirror used in a bus has a radius of curvature 3.5 m. If the driver of the bus locates a car at 10.0m behind the bus, find the position, nature and size of the image of the car.

27. What is the focal length of a plane mirror?

28. An object 4cm high is placed at a distance of 6 cm in front of a concave mirror of focal length 12 cm. Find the position, nature and size of the image formed.

29. How far an object should be placed from the pole of a concave mirror of focal length 20cm to form a real image whose size is 1/5 the size of the object.

30. What is diffused reflection?

31. State the laws of reflection

32. State the laws of refraction.

33. Why a convex mirror is used as the rear view mirror of a vehicle and not a plane mirror?

34. Define power of a lens. What is its unit? Define it.

35. A concave mirror is kept in water. Will there be any change in its focal length as compared to that in air?

36. What kind of a wave is light?

37. Define refractive index of a medium.

38. What is the minimum value of refractive index possible?

39. Light enters from air into glass plate which has a refractive index of 1.5. Calculate the speed of light in glass. (Given, speed of light in vacuum is 3 x 108ms-1

40. A convex lens has a focal length of 40 cm. Calculate its power.

41. List the physical quantities which remain constant when light travels from one medium to another.

CHAPTER- 10

LIGHT-Reflection and refraction

Fun Facts:

Light Waves

Light waves consist of oscillating transverse electric and magnetic fields. An electric field accelerates a charged particle and a magnetic field exerts a force on a moving charged particle when its velocity has a component perpendicular to the magnetic field. The light from the Sun and the light emitted by ordinary lamps is a mixture of waves with different wavelengths oscillating in all possible directions on a plane perpendicular to the direction of propagation (it is then unpolarized light). A real polarizer just lets the components parallel to its axis pass through and eliminates all other components. The polarizer thus produces linearly polarized light.

What makes a rainbow?
When sunlight is intercepted by a drop of water in the atmosphere, some of the light refracts into the drop, reflects from the drop's inner surface, and then refracts out of the drop. The first refraction separates the sunlight into its component colours, and the second refraction increases the separation. The result is a rainbow.

EXPERIMENT NO-4

AIM: To determine the Focal length of a given concave mirror by obtaining the image of a distant object.

APPRATUS:

THEORY: A concave mirror, like a plane mirror, obeys the laws of reflection of light. The rays of light coming from a distant object such as the sun (or a distant tree or a distant building) can be considered to be parallel to each other. When parallel rays of light fall on a concave mirror along its axis, the rays meet at a point in front of the mirror after reflection from it. This point is the focus of the mirror. For a parallel beam of light coming from a distant object, a real, inverted and very small image size is formed at the focus of the mirror. Since the image formed by the mirror is real, it can be obtained on a screen. The distance between the pole O of the concave mirror and the focus F is the focal length of the concave mirror. Thus, the focal length of a concave mirror can be estimated by obtaining a real image of a distant object at its focus.

OBSERVATION

1. **Least count of meter scale :**

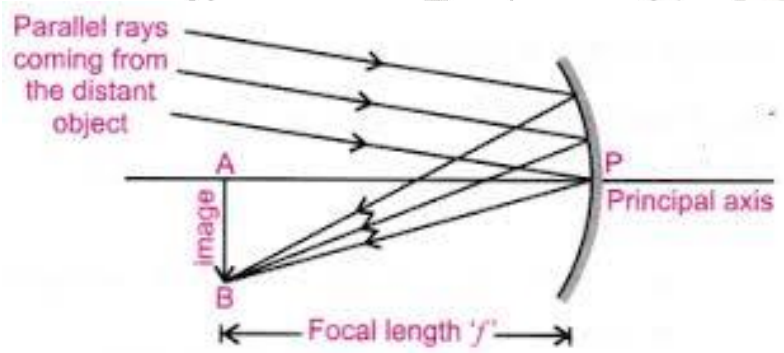
S.NO.	**Position of mirror (in cm)**	**Position of screen (in cm)**	**Distance between mirror and screen or focal length**

RESULT: The focal length of the given concave mirror is _____.

PRECAUTIONS: Concave mirror should be placed near an open window through which sufficient sunlight enters, with its polished surface facing the distant object.

- There should be no obstacle in the path of rays of light from the distant object, incident on the concave mirror.
- The image of the sun should be focussed only on the screen. The image of sun should never be seen directly with the naked eye. Sunlight should never be focussed with a concave mirror on any part of the body, paper or any inflammable materials, as it could be dangerous to do so.
- In order to obtain a sharp and clear image of the distant object on the wall/ground, it must be ensured that the object is well illuminated so that amount of light incident on the concave mirror is suffiecient to produce a well illuminated and distinct image.
- The base of the stands of the concave mirror and screen should be parallel to the measuring scale.
- The mirror holder along with the mirror should be kept perpendicular to the measuring scale for precise measurements.

DIAGRAM:



Determining the focal length of a concave mirror

EXPERIMENT NO-5

AIM: To determine the Focal length of a given convex lens by obtaining the image of a distant object.

APPRATUS:

THEORY: The rays of light coming from a distant object such as the sun (or a distant tree or a distant building) can be considered to be parallel to each other. When a parallel beam of light falls on a convex lens, the rays, after refraction, converge at a point on its other side. This point is one of the two foci of the lens. If the parallel beam of light comes from a distant object, a real, inverted image of very small size is formed at the focus of the lens. Since the image formed by the lens is real, it can be obtained on a screen. The distance between the optical centre O of the convex lens and the focus point F1 or F2 is its focal length. Thus, the focal length of a convex lens can be estimated by obtaining a real image of a distant object at its focus.

OBSERVATION

1. **Least count of meter scale :**

S.NO.	**Position of lens (in cm)**	**Position of screen (in cm)**	**Distance between lens and screen or focal length**

RESULT: The focal length of the given convex lens is _____.

PERCAUTIONS:
The principal axis of the convex lens should be horizontal, that is, the lens should be placed vertically.
• There should be no obstacle in the path of rays of light from the distant object incident on the convex lens.
• The image of the sun formed by the lens should be focussed only on the screen. The image of sun should never be seen directly with the naked eye. Sunlight should never be focussed with a convex lens on any part of the body, paper or any inflammable materials, as it can be dangerous to do so.
• Adjust the position of convex lens such that the light rays coming from the distant object fall on the lens without any obstruction.
• In order to obtain a sharp and clear image of the distant object on the screen (or wall), it must be ensured that the distant object is well illuminated. This would allow an appreciable amount of light to fall on the lens. This is required to produce a well illuminated and distinct image.
• In certain situations, the parallel rays of light originating from a distant object and incident on a convex lens may not be parallel to its principal axis.
• The base of the stands of the convex lens and screen should be parallel to the measuring scale. To determine the focal length, the distance between the convex lens and the screen should be measured horizontally (placed at the focus point on the other side of the lens).

DIAGRAM:

EXPERIMENT NO-6

AIM: To trace the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, and angle of emergence and interpret the result.

APPRATUS

THEORY;
When a ray of light passes from air to glass through a rectangular glass slab, it bends towards the normal at the surface of the air-glass boundary. The phenomenon of change in the direction of a ray of light when it enters from one medium to the other is known as refraction.

OBSERVATION

1. **Least count of protractor :**

S no.	angle of incidence(i)	angle of refraction(r)	angle of emergence(e)

Result: The angle of incidence is found to be _____ to the angle of emergence, within experimental limit.
The angle of refraction is _____ than the angle of incidence.

PRECAUTIONS:
The glass slab should be perfectly rectangular with all its faces smooth.
• The tips of pins P1, P2, P3, and P4 should be sharp. These pins fixed on the sheet of paper may not be exactly perpendicular (or vertical) to the plane of paper. Thus, if their heads appear to be collinear, their feet may not be so. It must, therefore, is important to look at the feet of pins and their images while ascertaining collinearity between them. The mark of the pointed end or the foot of a pin on the paper must be considered while marking its position.

• While viewing the collinearity of pins and images, the eye should be kept at some distance from the pins so that the feet of all of them can be seen simultaneously in the same straight line.
• While fixing the pins P1 and P2 or the pins P3 and P4, care should be taken to maintain a distance of about 5 cm between the two pins. This would help in tracing the direction of incident ray and that of emergent ray with greater accuracy.
• The angle of incidence should preferably be between 30^o and 60^o.
• Thin lines should be drawn, using a sharp pencil.
• The angles should be measured accurately, using a good quality protractor having clear markings, by keeping the eye above the marking.

DIAGRAM:

EXPERIMENT NO-7

AIM: To trace the path of the rays of light through a glass prism.

APPRATUS:

THEORY: When a ray of light (DE) from air strikes on a face AB of a triangular glass prism ABC, it gets refracated and bends towards the normal to the plane of the face AB (Fig. 42.1). The refracted ray EF travels inside the prism until it strikes its other face AC. Here again, the ray from glass gets refracted into air but bends away from the normal towards the face BC. The ray FG is the ray that emerges out of the glass prism at the glass-air boundary face AC. The ray FG that emerges out of the glass prism at the face AC after successive refractions is the emergent ray (Fig, 42.1). Usually the emergent ray is bent towards the base (BC) of the prism as shown. The angle ∠IHG between the incident ray DE (when extended) and the emergent ray FG, when produced backwards to meet at a point H, is known as the angle of deviation (∠δ).

Figure will be drawn in class

OBSERVATION :

1. **Least count of protractor :**

S.NO	Angle of incidence(i)	Angle of emergence(e)	Angle of prism(A)	Angle of deviation(D)	I+e	A+D

RESULT:

1. The path of the ray of light incident on one face of a glass prism is shown by the ray _____.
2. The value of angle of deviation for angle of incidence _____ is _____.

PRECAUTIONS: While viewing the collinearity of pins and images, the eye should be kept at a distance from the pins so that all of them can be seen simultaneously. The collinearity of pins fixed on one side of the glass prism and the images of pins on the other side could also be confirmed by moving the head slightly to either side while viewing them. All the pins and images of pins would appear to move together if they are collinear.

• The pins P1, P2 , P3 and P4 fixed on the paper may not be exactly perpendicular (or vertical) to the plane of paper. It is therefore desirable to look at the feet of the pins or their images while establishing their collinearity. That is why the position of each pin is marked with pointed tip of the pins on the paper.

• In order to locate the direction of incident ray and refracted ray with a greater accuracy, the distance between the pins P1 and P2; and that between P3 and P4 should not be too short or too large. A separation of nearly 6 cm between the pins would be sufficient.

• The angle of incidence should be between 30^o and 60^o.

EXPERIMENT NO-8

AIM: Image formation by a convex lens.

APPRATUS:

THEORY: The light rays when refracted through a convex lens obey the laws of refraction. The formation of images by a convex lens can be studied by drawing ray diagrams, using the New Cartesian Sign Convention.

OBSERVATION

1. **Least count of meter scale :**

S.No.	Position of object	Position of image	Size of image	Nature of image

RESULT: The image for various positions of object is as shown in the figure.

PRECAUTIONS: For obtaining distinct and sharp images of the candle flame, it is advised to perform this experiment in a dark room or at least in shade where no direct light reaches to the working table.

• To avoid the flickering of the candle flame, perform this experiment in calm air. Switch off the fan while performing this experiment.

• While finding out the approximate value of the focal length f of the convex lens by using sunlight, do not look at the image directly with the naked eye, otherwise it might damage the eyes.

• The convex lens should be thin and of good quality transparent glass, without any scratches to obtain a distinct image.

• The aperture of the thin convex lens should be small for obtaining a distinct image.

• The eye should be placed at a distance of at least 25 cm from the image formed by the convex lens on the screen.

• The base of the stands of the convex lens and screen should be parallel to the measuring scale.

DIAGRAM:

DID YOU KNOW

Convex mirror forms a full length image of a tall building or a tall tree.

A small convex mirror fitted on the wall of Agra fort is used to see the full length image of Tajmahal.

Power of a convex lens is positive because its focal length is positive and that of a concave is negative as its focal length is negative.

NOTES

NOTES

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD

The human eye uses light and enables us to see objects around us. Our eye is the most important natural optical instrument. The important parts of the eye are:

1) Cornea: The front part of the eye is covered by a transparent spherical membrane called the Cornea. Light enters the eye through the Cornea. The space behind the Cornea is filled with a liquid called Aqueous Humour.

2) Iris: Just behind the Cornea is a dark coloured muscular diaphragm which has a small circular opening in the middle.

3) Pupil: Pupil is the small circular opening of Iris. The pupil appears black · .· No light is reflected from it. The Iris regulates the amount of light entering the eye by adjusting the size of the Pupil.

How Iris regulates the amount of light entering the eye:

When the intensity of light is more or if it is a bright source of light then Iris makes the Pupil to contract and as a result the amount of light entering the eye decreases. When the intensity is less than the Iris dilates the Pupil so that more light can enter the eye.

4) Eye Lens: It is a convex lens. It is hard at the middle and gradually becomes soft towards the outer edges. The eye lens is held in position by ciliary muscles. The ciliary muscles help in changing the curvature and 'f' of the eye lens.

5) Retina: It is a semi transparent membrane which is light sensitive and is equivalent to the screen of a camera. The space between the Retina and eye lens is filled with another fluid called Vitreous Humour.

Working of an Eye: When we look towards an object, light from the object enters the Pupil of the eye. The eye lens converges these light rays to form a real, inverted and diminished image on the Retina. The Retina of the eye contains cells convert light energy into electrical signals. The signals are sent to the brain by the optic nerves. The brain finally interprets the signal and hence we see an image which is erect and of the same size as the object.

Power of accommodation: The ability of the eye to focus both near and far objects by adjusting its focal length is known as power of accommodation.

For far objects $u = \infty$ $v = 2.5$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{2.5} + \frac{1}{\infty} = \frac{10}{25} = f = \frac{25}{10}$$

$$P = \frac{1}{f} = 100 \times \frac{10}{26} = 40D$$

For near objects $u = -25$ cm $v = 2.5$ cm

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{2.5} + \frac{1}{25} = \frac{11}{25}$$

$$P = \frac{1}{f} = \frac{11}{25} \times 100 = 44D$$

Variation in power = 44 – 40 = 4D

Accommodation of the Eye:

The process by which the ciliary muscles change the focal length of an eye lens to focus distant or near objects clearly on the Retina is called accommodation of the eye.

Near Point: Near point of least distance of distinct vision is the point nearest to the eye at which an object is visible distinctly. For normal eye it is about 25 cm.

Far Point: Far point of the eye is the maximum distance upto which the normal eye can see things clear. It is infinity for a normal eye.

Range of Vision: The distance between the near point and the far point is called the range of vision.

Defects of Vision:

Due to advancing age or many other biological changes in human body, ciliary muscles become inactive. The person can't see near or fat objects clearly. The vision becomes blurred due to refractive defects. Such eye is called defective eye. Some defects of vision are:-

1. Hypermetropia or long sightedness:

It is an eye defect in which distant vision is clear while near vision is blurred.

A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point of the hypermetropic persons is farther away from the normal near point (i.e. 25 cm). This is .due to the light rays entering the eye converge behind the retina

Causes of hypermetropia:

1. The 'f' of the eye lens is too long.

2. The eyeball has become too small.

Correction:

It is due to the decreased converging power of the lens. It can be rectified by using a convex lens of appropriate power.

2. Myopia or near sightedness:

A person with myopia can see nearby objects clearly but cannot see far objects distinctly.

The far point of the myopic person is nearer than o0. This is ·the light rays entering the eye converge in front of the Retina.

Causes of Myopia

1. Excessive curvature of the eye lens.

2. Elongation of the eye ball.

Correction:

It is due to increase in converging power of the eye lens · It can be rectified by using suitable concave lens.

Presbyopia:

When the near point of a person recedes with age the person is unable to see nearby objects clearly. The defect of the eye is called Presbyopia.

Causes:

1. Weakening of the ciliary muscles.

2. Diminishing flexibility of the eye lens.

Correction:

For hypermetropia of old age. The corrective lens is convex lens.

For a persons suffers from both myopia and hypermetropia, corrective lenses are bi focal lenses. Bi focal lenses consist of both concave and convex lenses. The upper portion consists of a concave lens. It facilitates distant vision. The lower part is a convex lens. It facilitates near vision.

Astigmatism: This occurs when the cornea is not spherical in shape e.g. the cornea could have a large curvature in the vertical plane than in the horizontal plane or vice versa. Astimatism results in lines in one direction being well focussed while those in a perpendicular direction may appear distorted. It can be correct by using a cylindrical lens of desired R (radius of curvature). This defect can occur along with myopia or hypermetropia

1. The far point of a myopic person is 80 cm in front of the eye. What is the nature and the power
   of lens required to enable him to see very distant objects clearly?

2. The near point of hypermetropic eye
   is 1m. What is the power of lens required to correct this defect? Assume that the near point of normal eye is 25 cm.

3. A boy uses spectacles of focal length – 60 cm. Name the defect of vision he is suffering from.
   Which lens is used for the correction of this defect? A person with myopic eye cannot see object beyond 1.2 m distinctly. What should be type of
   corrective lens used to restore proper vision?

Refraction of Light Through a Prism:

Prism is a transparent optical element which refracts light. An optical object to be defined as prism must have at least two faces with an angle between them. Triangular prism is the most common type of prism. It has a triangular base and rectangular sides.

When a ray of light enters the prism, it bends towards the normal; because light is entering from a rarer medium to a denser medium. Similarly, when the light emerges from the prism, it follows the laws of refraction of light. Due to the angle of the prism and due to different wavelengths of different components of white light; the emergent ray gets segregated into different colours. Finally, a colourful band of seven colours is obtained. This phenomenon is called dispersion of white light by the prism.

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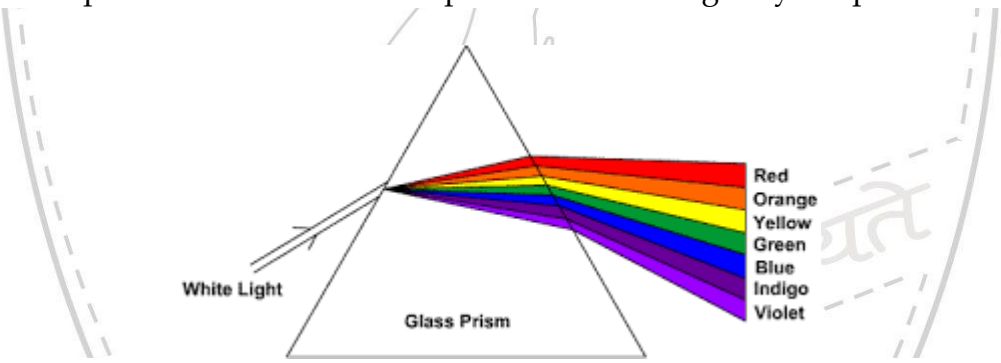


Formation of Rainbow: Raindrops work like a prism. When white light enters a raindrop, it experiences refraction and total internal refraction inside the raindrop. The emergent light experiences dispersion of light. As a result, rainbow is formed against the backdrop of sky.

Atmospheric Refraction

When light enters from one medium to another, there is a deviation in its path. This phenomenon is called refraction of light. Atmosphere is composed of layers of various optical densities. Because of this, light rays passing through various layers of atmosphere; get deviated. Many interesting phenomenon can be observed because of atmospheric refraction. Some of them are given here.

Twinkling of stars

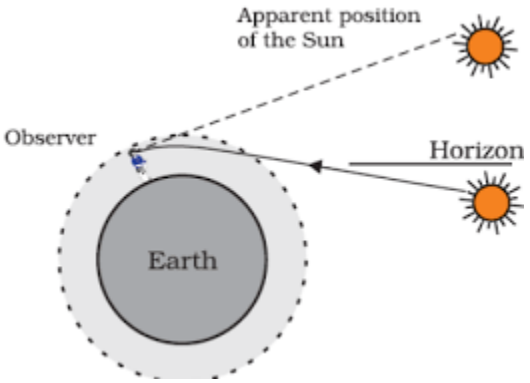
The twinkling of a star is due to atmospheric refraction of starlight. The starlight, on entering the earth's atmosphere, undergoes refraction continuously before it reaches the earth. The atmospheric refraction occurs in a medium of gradually changing refractive index. Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. The star appears slightly higher

(above) than its actual position when viewed near the horizon. Further, this apparent position of the star is not stationary, but keeps on changing slightly, since the physical conditions of the earth's atmosphere are not stationary. Since the stars are very distant, they approximate point-sized sources of light. As the path of rays of light coming from the star goes on varying slightly, the apparent position of the star fluctuates and the amount of starlight entering the eye flickers, i.e. the star sometimes appears brighter, and at some other time, fainter, which gives the twinkling effect.

Advance sunrise and delayed sunset

The Sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction. By actual sunrise, we mean the actual crossing of the horizon by the Sun. The time difference between actual sunset and the apparent sunset is about 2 minutes. The apparent flattening of the Sun's disc at sunrise and sunset is also due to the same phenomenon.

DIAGRAM



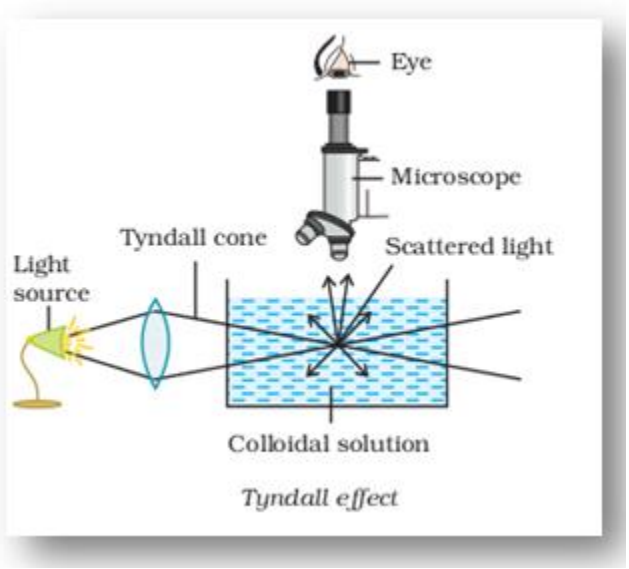
Scattering Of Light

When light hits a particle, it scatters in different directions. Refraction happens because of non-uniformities of particles of a medium. Many interesting phenomenon can be observed because of scattering of light. Some of them are given here.

Tyndall Effect

The optical effect because of scattering of light from the particles of colloid or suspension is called Tyndall Effect. For Tyndall effect to be possible, the size of particles should be less than or equal to the wavelength of the visible spectrum. So, the size of particles should be between 40 and 900 nanometer. Tyndall effect is responsible for many natural

phenomena. The white beam of light which appears to come through the ventilation or through a slit in the door is because of Tyndall Effect and the dust particles in the air cause the scattering of light in this case. The white beam appears because scattering of light makes the dust particles visible in the light.



Why is the colour of the clear Sky Blue?

We know that the wavelength of red colour is more than that of blue colour. The size of particles in air is smaller than the wavelength of visible light. Hence, these particles scatter the light of shorter wavelength more effectively than light of longer wavelength. The blue end of the visible spectrum has shorter wavelength than the red end. Due to this, blue colour is scattered more strongly in the atmosphere; compared to the red colour. This is the reason sky appears blue. Since red colour is scattered the least hence it is used in traffic lights for showing the danger signal.

White colour of clouds Clouds are seen due to scattering of light from lower parts of earth's atmosphere containing large particles of dust, water, etc. So all the colours are scattered equally and the clouds appear white.

What would happen in absence of atmosphere?

If the earth has no atmosphere, the atmospheric refraction would not take place and we would see the actual sunrise and sunset. The day would have been shorter by 4 minutes. Also, there would not have been any scattering and the sky would have looked dark.

Danger signals are red in colour Danger signals are red in colour because the red colour is scattered least by smoke and fog and so can be seen from a longer distance due to its longer wavelength.

Sun appears red at sunrise and at sunset Light from the sun near the horizon has to travel the larger distance through thicker layers of atmosphere. Due to this, most of the blue colour present in the sunlight has been scattered out and most of the red colour reaches our eye.

Stars appear to be twinkle while planets do not. The continuously changing atmosphere causes variations in the light coming from point sized star due to refraction. So the stars appear to be twinkle. The atmospheric refraction cannot cause variations in the light coming from big sized planets and they do not twinkle.

Glass prism forms spectrum while glass slab does not A glass slab can be assumed as the combination of two prisms. The first prism decomposes the white light into seven colours and the second prism (placed inverted) recomposes the seven colours into white light. It takes some time to see the image clearly when enter into dim room.

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD

MCQ

Q1. Rainbow is caused due to

(a) Reflection of sun light air
(b) Dispersion of sun light from water drops
(c) Refraction of sun light from water drops
(d) Diffraction of sun rays from water drops

Q2. The splitting of white light into several colours on passing through a glass prism is due to

(a) refraction (b) reflection
(c) interference (d) diffraction

Q3. The least distance of distinct vision for a young adult with normal vision is

a. 25 m
b. 20 m
c. 25 cm
d. 20 cm

Q4. The amount of light entering the human eye is controlled by

a. Ciliary muscles
b. Pupil
c. Cornea
d. Iris

Q5. The colored light that refracts most while passing through a prism is

a. Yellow
b. Violet
c. Blue
d. Red

TRUE- FALSE:

Q1. Hypermetropia is corrected by using a convex lens of suitable power.
Q2.The part of human eye that determines the colour of a person's eye is known as cornea.
Q3.Clouds look white because water droplets of clouds scatter all colours of light equally.
Q4. A person suffering from myopia cannot see distant objects clearly.
Q5. A dentist uses a convex mirror to view the inner parts of a patient's mouth.

FILL IN THE BLANK:

Q1. The closest distance at which the eye can focus clearly is called the .....

Q2. The eye which suffers from myopia as well as from hypermetropia is said to suffer from .....

Q3. The ability of the eye to focus both near and distant objects, by adjusting its focal length, is called the .....

Q4. Light enters the eye through a thin membrane called as .....

Q5. ..... regulates and controls the amount of light entering the eye.

Match the following:

Column I		Column II	
(A)	Myopia	(p)	Convex lens
(B)	Hyper-metropia	(q)	Concave lens
(C)	Astigmatism	(r)	Cylindrical lens
(D)	Presbyopia	(s)	Bi-focal lens

ASSERTION – REASONING:

DIRECTION : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

(e) Both Assertion and Reason are false.

Q1.

Assertion : The light of violet colour deviates the most and the light of red colour the least, while passing through a prism.

Reason : For a prism material, refractive index is highest for red light and lowest for the violet light.

Q2.
Assertion : A normal human eye can clearly see all the objects beyond certain minimum distance.
Reason : The human eye has capacity of adjusting the focal length of eye lens.

Q3.
Assertion : Light from a distant object arriving at the eye lens may get converged at a point in front of the retina.
Reason : The eye is producing too much divergence in the incident beam.

Q4.
Assertion : A normal human eye can clearly see all the objects beyond certain minimum distance.
Reason : The human eye has capacity of adjusting the focal length of eye lens.

Q5.
Assertion : Rainbow is an example of the dispersion of sunlight by the water droplets.
Reason : Light of shorter wavelength is scattered much more than light of larger wavelength.

Assignment 11.1

1. What do you mean by accommodation of human eye?
2. Draw a neat labelled diagram of human eye and explain the function of each part.
3. What is Myopia? How is it caused? How can it be corrected? Explain with the help of a diagram.
4. What is hypermetropia? How is it caused? How can it be corrected? Explain with the help of a diagram.
5. What is presbiopia? How is it caused? How can it be corrected?
6. What is dispersion?
7. Draw a neat diagram to show the dispersion of light when passed through a glass prism.

18. How is rainbow formed?

9. If you see a rainbow in the morning, in which direction of the sky will you see it?
10. What is scattering?
11. Explain the blue colour of sky?
12. Why clouds are white?
13. Write the constituent colours of white light in order of increasing wavelength.
14. When you enter a dark room from sunlight, you cannot see things for a while and after sometime you start seeing things. Explain this observation.
15. Why do stars twinkle?
16. Define near point and least distance of distinct vision. What is its value for a normal human eye?
17. Define far point. What is its value for a normal human eye?
18. Draw a neat labelled diagram showing the refraction of light through a glass prism.
19. The sun is seen a few minutes before actual sunrise and after actual sun set. Explain why?
20. The sky appears black when viewed from the surface of moon. Explain why?

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD
Assignment 11.2

Complete the following table-

Part of the human eye	**Description and Functions**
Cornea	It is the front transparent membrane of the eye. It permits light into the eye and causes maximum refraction of the light rays.
Iris	
Pupil	
Eye lens	
Ciliary muscles	
Retina	

Define following:
Far point-

Near Point –

Least distance of distinct vision-

Persistence of vision-

Cataract

What is meant by Power of Accommodation? What is its value for a normal eye? Prove the same with calculations?

A person is unable to see objects closer than 1m from the eye clearly? Identify the defect of the eye? What is the nature and the Power of the lens required to correct this defect?

The far point of a Myopic eye is 80cm. What is the nature and Power of the lens needed for correction?

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD
QUESTION -BANK

1. What do you mean by accommodation of human eye?
2. Define power of accommodation of human eye and Calculate its value for a normal human eye.

3. Draw a neat labelled diagram of human eye and explain the function of each part.
4. What is Myopia? How is it caused? How can it be corrected? Explain with the help of adiagram.

5. What is hypermetropia? How is it caused? How can it be corrected? Explain with the help of a diagram.

6. What is presbiopia? How is it caused? How can it be corrected?

7. What is astigmatism? How can it be corrected?

8. What is dispersion?

9. Draw a neat diagram to show the dispersion of light when passed through a glass prism.

10. How is rainbow formed?

11. If you see a rainbow in the morning, in which direction of the sky will you see it?

12. What is scattering?

13. Explain the blue colour of sky?

14. Why clouds are white?

15. A red coloured piece of glass appears white when it is ground. Explain why?

16. What is Tyndal effect?

17. Write the constituent colours of white light in order of increasing wavelength.

18. When you enter a dark room from sunlight, you cannot see things for a while and after sometime you start seeing things. Explain this observation.

19. Why do stars twinkle?

20. Define near point and least distance of distinct vision. What is its value for a normal human eye?

21. Define far point. What is its value for a normal human eye?

22. Draw a neat labelled diagram showing the refraction of light through a glass prism.

23. The sun is seen a few minutes before actual sunrise and after actual sun set. Explain why?

24. The sky appears black when viewed from the surface of moon. Explain why?

25. What is Tyndall effect? Give three examples from day to day observations where the Tyndall effect is seen?

26. What is persistence of vision? How does it help us in seeing motion pictures?

27. What are primary colors?

28. Why planets do not twinkle?

29. What is total internal reflection?

30. What is cataract? How is it corrected?

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD
H.O.T.S.

1. What is the least distance of distinct vision of a normal human eye?

2. Name the muscle responsible for bringing change in the focal length of the eye lens?

3. Name one defect of vision which cannot be corrected by any type of spectacle lenses?

4. State one effect produced by the scattering of light by the atmosphere?

5. What is the nature of image formed on the retina of the eye?

6. What type of lens is used for correcting hypermetropia?

7. Who was the first person to obtain the spectrum of sunlight?

8. What is the function of optic nerve in human eye?

9. What is range of vision?

10. Why do different colours deviate through different angles on passing through a prism?

11. As light rays pass from air into glass prism, are they refracted towards or away from the normal?

12. Which color has largest wavelength?

13. Which defect of vision can be rectified using a concave lens?

14. What phenomenon causes twinkling of star on a clear night?

15. What is meant by scattering of light?

16. Why does the sky appear black instead of blue to an astronaut?

17. What is the basic cause of atmospheric refraction?

18. Why does clear sky look blue?

19. Can visible light be scattered by atoms/molecules in earth's atmosphere?

CHAPTER 11
HUMAN EYE AND THE COLOURFUL WORLD
FUN-FACTS

A COLOURFUL SHINING WORLD

Have you ever thought what it would be like to live in a world without light and colour? Free yourself for a moment from your experience, forget all that you've learned and start using your imagination. Try to visualise your body, the people around you, the seas, the sky, trees, flowers, in short everything in black. Imagine that there is no light and colour around you. Try to think how you would feel if people, cats, dogs, birds, butterflies, and fruits had no colour at all. You would never want to live in such a world, would you?

Most people may never have thought about what a shining and colourful world they are living in or wondered how such a diversity of colour has come to exist on earth. They may never have given a thought to how a world without light and colour would be. This is because everyone who sees was born into a world full of light and colour. However, a model of a black and white, colourless world is not impossible. On the contrary, the really amazing thing is our living in a bright, colourful world.

A colourless world would normally be thought of as having only black, white and shades of grey. However, black, white and shades of grey are also colours. In this respect, it is difficult to imagine colourlessness. To describe colourlessness, one always feels the need to mention a colour. With statements such as "it was colourless, completely dark", "there was no colour in her face; it was completely white" people try to describe colourlessness. In fact, these are not the descriptions of colourlessness, but of a world of black and white.

Try, just for a second, to imagine that all of a sudden, everything loses its colour. In such a situation, everything would mix with everything else and it would become impossible to distinguish one object from another. It would become impossible to see, for example, an orange, red strawberries or colourful flowers on a brown wooden table, for neither would the colour of the orange be orange, nor that of the table brown, nor that of the strawberries red. For a person, it would be quite annoying to live, even for a short time, in such a colourless world, which is even difficult to describe.

Light and colour have a crucial role in man's communication with the outside world, in

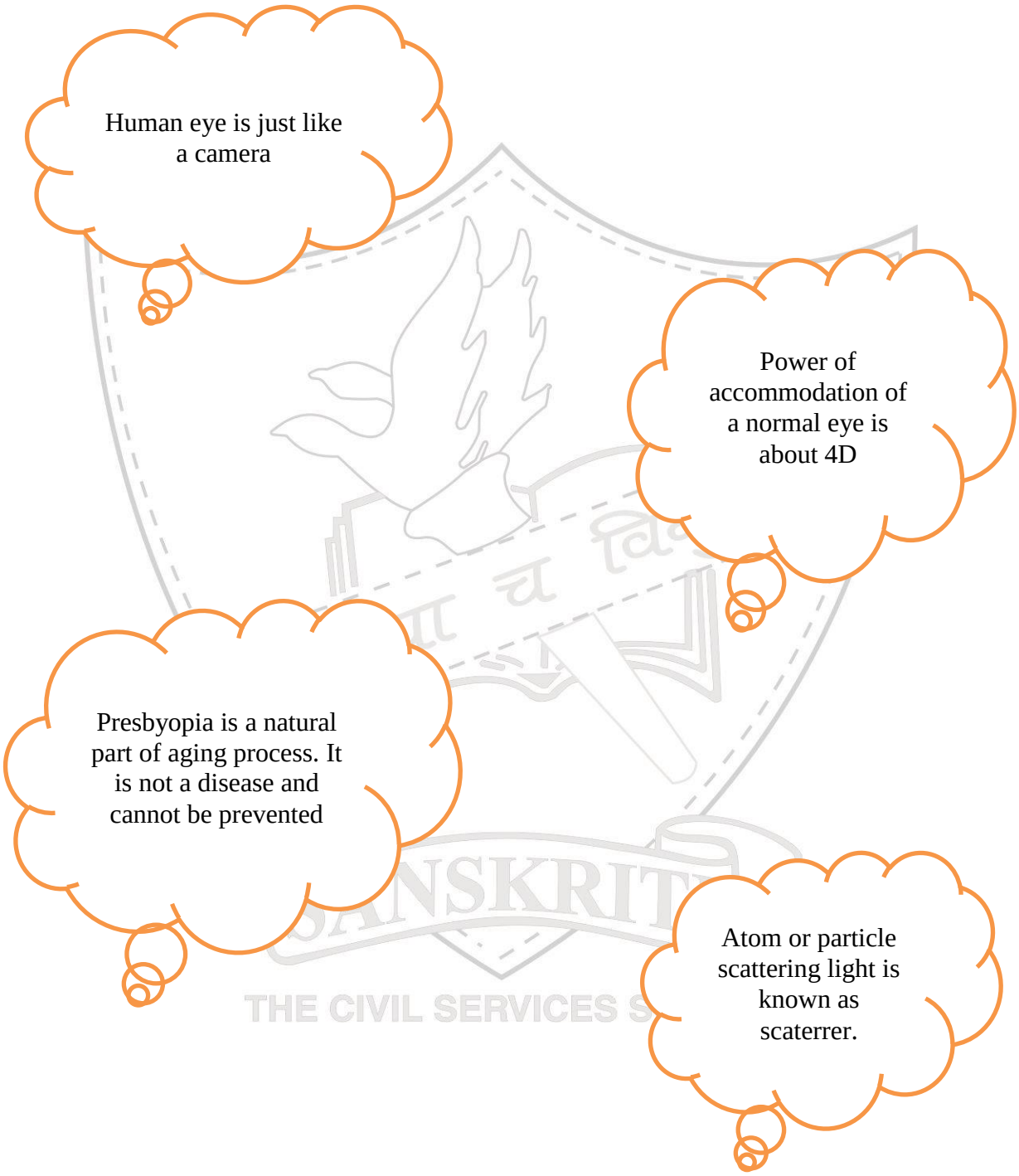
the proper functioning of his memory, and in his brain's fulfilment of its learning functions. This is because humans can develop appropriate connections between events and places, people and objects only through their external appearances and colours. Neither hearing nor touch alone suffice to define objects. For humans, the external world only means something when it is seen as a whole with its colours.

We always see a world full of color

When the pictures above and on the right are compared, it will be better understood how nice it is to see a world full color. Colors are one of the greatest blessings that Allah has bestowed upon people in the world.

With thanks from www.miracleoflightandcolour.com

DID YOU KNOW


Human eye is just like a camera
Power of accommodation of a normal eye is about 4D
Presbyopia is a natural part of aging process. It is not a disease and cannot be prevented
Atom or particle scattering light is known as scaterrer.

NOTES

NOTES

CHAPTER- 14

SOURCES OF ENERGY

MCQ

Q1. Which is the ultimate source of energy
a) Water
b) Sun
c) Fossil Fuel
d) Uranium

Q2. Which part of the solar cooker is responsible for green house effect?
a) Mirror
b) Glass Sheet
c) Outer cover of the cooker
d) Coating of black colour inside the box

Q3. The main constituent of biogas is
a) Carbon dioxide
b) Oxygen
c) Methane
d) Hydrogen

Q4. Which of the following is the odd one out?
a) Petroleum
b) Hydro electricity
c) Coal
d) CNG

Q5. Which method is used to produce electricity in thermal power plant?
a) By heating chargeable cells
b) By boiling water
c) By pushing pistons by heat energy
d) Any of above

TRUE- FALSE:

Q1.Sun is the source of heat contained in geothermal energy.

Q2. Bio-gas is a better fuel than animal dung-cakes.

Q3. Nuclear fission reactions have been used to generate electricity.

Q4. Biomass is the oldest source of heat energy for domestic purposes.

Q5. Deep drilling in the earth to obtain geothermal energy is very difficult.

FILL IN THE BLANKS:

Q1.A device that utilises solar energy for cooking purposes is called a .....
Q2.The flowing water possesses ..... energy.
Q3.The material obtained from the bodies of plants and animals is called .....
Q4.To maintain the required speed of the turbine, wind speed should be higher than .....
Q5.Bio-gas contains ..... % methane.

ASSERTION – REASONING:

DIRECTION : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.
(e) Both Assertion and Reason are false.

Q1.

Assertion : Dam is a barrier that is built across a river or a stream.
Reason : Large dam can ensure the storage of adequate water for irrigation and also for generating electricity.

Q2.

Assertion : Certain gases like carbondioxide, water vapour, methane are called green house gases.
Reason : These gases are responsible for heating up of the atmosphere.

Q3.

Assertion : Solar cooker is painted white from inside.
Reason : The black surface to the solar cooker is a better heat absorber than a white surface.

Q4.

Assertion : Solar heating devices are painted black.
Reason : Black bodies are good absorbers of heat, so temperature rises quickly.

Q5.

Assertion : Nuclear fusion is used to generate electricity.
Reason : Nuclear power is used because it cannot be controlled.

CHAPTER- 14
SOURCES OF ENERGY
Assignment-14

1. In a box type solar cooker a thick glass sheet is used to
    d) Absorb radiation from sun
    e) Produce green house effect
    f) Reflect the radiations from the sun
    g) None of these

2. Name four different forms of energy that can be traced back to the sun?

3. Draw a labeled diagram of a box type solar cooker and explain the need of using
    a) Mirror
    b) Black painted surfaces
    c) Glass cover

4. What are the environmental consequences of the increasing energy demands? Suggest 3 significant measures to reduce energy consumption?

5. What is the basic cause for winds to blow? Name the part of our country where wind energy is commercially harnessed? Write 2 limitations of hydel energy? Which of the two-wind or hydel energy is a more reliable and consistent energy source?

6. Can we replace the glass sheet of a solar cooker with a plane mirror? How will it affect the efficiency of the solar cooker?

7. List advantages and limitations of solar cell.

8. Write two different ways of harnessing energy from ocean.

CHAPTER- 14

SOURCES OF ENERGY

QUESTION-BANK

1) Which component of sunlight facilitates drying of wheat after harvesting?
2) Which part of solar radiation stimulates the formation of vitamin D in our bodies?
3) Name two semiconductor materials or elements used in fabricating solar cells.
4) Name any one element used in making solar cells. On what property of the element is this use based?
5) Name the largest component of biogas.
6) How is slurry left over after generation of biogas in biogas plant used?
7) What is greenhouse effect?
8) What is bagasse? What is its use?
9) Name the gas that is added to LPG to detect its leakage.
10) How is biogas produced?
11) Which hydrocarbon has the highest calorific value?
12) What is wind energy farm?
13) What is geothermal energy?
14) What is visible light? What is its approximate wavelength range?
15) "Electricity generated by the water stored in a dam can be considered to be another form of solar energy." Explain describing the series of energy transformations in sequence taking place during the process.
16) Explain how harmful components of sunlight are prevented from reaching the earth's surface?
17) State two disadvantages of using hydrogen gas as a fuel.
18) Mention any two ways by which water can be used to produce hydroelectricity.
19) Electricity generated with a windmill is another form of solar energy. Explain.
20) People living on hills often get sunburns on their skin. Which component of sunlight is responsible for this effect? Why is this effect generally not observed near sea level?
21) In which form is solar energy stored in oceans? Mention any two forms that could be harnessed to obtain energy in usable form.

22) For producing electricity, the energy from flowing water is preferred to energy obtained by burning coke. State two reasons for it.
23) What do you mean by the destructive distillation of wood? What are the substances obtained during the process?
24) State one important advantage and one important limitation of water energy.
25) Draw the diagram of the floating gas holder type biogas plant and mark on it the gas outlet.
26) Name the three forms in which energy from oceans is made available for use. What are OTEC power plants? How do they operate?
27) Write two advantages of using geothermal technologies for power generation purposes. Name atleast two places where geothermal energy can be used for commercial purposes.
28) Why is biogas considered superior to animal dung as a fuel? Draw a neat labelled diagram of a biogas plant.
29) Name a possible fuel of the future that is being produced by the fermentation of sugars. To what use is a mixture of this fuel and petrol being put in some countries? Why is this fuel not being used as a commercial fuel at present?
30) Name some forms of biomass that are suitable for making biogas. Give two advantages of using biowastes to produce biogas.
31) Draw a labelled diagram of solar cooker. What purposes are served by the blackened surface, glass cover plate and the mirror in a solar cooker? What would happen if the plane glass mirror of a solar cooker is replaced by a concave glass mirror?
32) Describe the construction of a box - type solar cooker and show it with the help of a diagram. How is the rise in temperature obtained in this set up? Mention two advantages and two limitations of a solar cooker..
33) What is the basic cause for winds to blow? Name a part of India where wind energy is commercially harnessed. Compare wind power and power of water flow in respect of generating mechanical and electrical energies. What is the hindrance in developing them?

CHAPTER- 14

SOURCES OF ENERGY

NOTES

1. A good source of energy is one that is able to provide large amount of work per unit volume or mass, be easily accessible at economical rate and can be easily stored and transported.

2. Conventional sources of energy: Fossil fuels, coal, petroleum, natural gas (thermal power plants), energy of flowing water (hydrowater plants), biomass, cow-dung, plants and vegetable wastes (bio-gas plants), wind energy (windmill).

3. Fossil fuels: Any naturally occurring organic fuel formed in the Earth's crust, such as petroleum, coal and natural gas are called fossil fuels.

4. Alternate or non-conventional sources of energy: Solar energy-energy derived from sun, Nuclear energy-fission of radioactive substances, Geo-thermal energy-energy derived from hot spots under the earth, Ocean energy-ocean thermal energy, wave energy.

5. Non-renewal sources of energy: Fossil fuels like coal, petroleum and natural gas non-renewable.

6. Thermal power plants: Thermal power plants should be preferably located near coal or oil fields. It is easier to transport electricity than the fuel.

7. Hydropower plants: Convenient location to build dams. Potential energy of falling water is converted into electricity.

8. Biomass: The plant and animal products, which act as the source of fuel is said to be biomass.

9. Biogas: Cow-dung, various plants materials like the residue after harvesting the crops, vegetable waste and sewage decomposed in the absence of oxygen to give biogas (or Gober gas).

10 Biogas plants: Anaerobic micro-organisms (in the absence of oxygen) decompose complex compounds of cow-dung slurry or biomass-water mix produce biogas (60-80% methane).

11. Tidal energy: The gravitational pull of the moon on the rotating earth causes rise and fall in the level of water in the sea. The sea-level changes during the day. This phenomenon is called high and low tides and difference in sea levels gives us tidal energy. Tidal energy is harnessed by constructing a dam across narrow opening to the sea. A turbine fixed at the opening of the dam converts tidal energy to electricity.

12. Windmill: The power of wind (>15km/h) gives rotatory motion of the windmill which is used to turn the turbine of the electric generator. The output of a single windmill is quite small and so a number of windmills are to be erected over a large area.

13. Nuclear reactor is a device in which a fission reaction is carried out in a controlled manner. The energy so released is used to heat water which then turns turbines and generates electricity. (Note: Fission of heavy radioactive isotopes gives tremendous amount of energy.)

14. Environment consequences: Sources of energy as are available produce lot of pollution in the atmosphere or cause environmental damage in other ways.

15. Quality of fuel is measured by its calorific value (heat regenerated by burning unit mass of a substance

16. Solar energy: 47% of the sun's energy reaching the periphery of the earth's atmosphere reaches the earth's surface. One m2 of earth's surface receives 1.4kJ/m2s. This is called solar constant. This energy is trapped by various means such as solar cookers, solar heaters and solar cells. A typical solar cell (using high quality silicon or silver) develops a voltage of 0.5-1V and can produce 0.7W of electricity. So a panel of solar cells is used.

Central Board of Secondary Education

Class-X
Science-086
SAMPLE QUESTION PAPER 2019-20

TIME: 3 Hrs. **M.M.: 80**

General Instructions:

1. The question paper comprises three sections – A, B and C. Attempt all the sections.
2. All questions are compulsory.
3. Internal choice is given in each section.
4. All questions in Section A are one-mark questions comprising MCQ, VSA type and assertion-reason type questions. They are to be answered in one word or in one sentence.
5. All questions in Section B are three-mark, short-answer type questions. These are to be answered in about 50 - 60 words each.
6. All questions in Section C are five-mark, long-answer type questions. These are to be answered in about 80 – 90 words each.
7. This question paper consists of a total of 30 questions.

SECTION A

1 Define catenation. 1

2 How does valency of an element vary across a period? 1

3 **Answer question numbers 3(a) - 3(d) on the basis of your understanding of the following paragraph and the related studied concepts.**

Renewable energy sources such as wind energy are vital for the Indian economy, not only from the point of view of supply, but also from the perspective of environmental and social benefits. India is the world's fifth largest wind-power producer and the largest windmill facilities in India are installed in Tamil Nadu. Muppandal is a small village of Tamil Nadu and one of the most important sites of wind-farm in the state. It uses wind from the Arabian Sea to produce renewable energy. The suitability of Muppandal as a site for wind farms stems from its geographical location as it has access to the seasonal

PRACTICALS

INSTRUCTIONS FOR WRITING PRACTICAL IN FILE

- The sequence as given here must be followed.
- Diagram has to be drawn with pencil.
- What is given in smart skills has to be copied from here to the file and the rest in the given sequence is to be noted down from the laboratory manual.

1. **AIM**
2. **APPARATUS**
3. **THEORY**
4. **DIAGRAM [Left hand side of the file / Blank page]**
5. **OBSERVATION [Left hand side of the file / Blank page]**
6. **OBSERAVTION TABLE [Left hand side of the file / Blank page]**
7. **CALCULATION [If any]**
8. **RESULT**
9. **PRECAUTION**
10. **SOURCES OF ERROR**

ANSWERS TO NUMERICALS:

ASSIGNMENT – 12.3
7. 10 A
9. 16

ASSIGNMENT – 12.4
8. 14520J
10. 300%
11. 59.4 units
12 110

ASSIGNMENT 10.1
9. V= - 60 cm
10. R= 24 cm
11. u = - 30 cm
12. u = -60 cm
13. u = - 40 cm and – 20 cm
14. u= - 15 cm
19. 30 cm

ASSIGNMENT 10.2
2. $1.2X10^8$ m/s
5. 8/9 and 9/8
6. $\sin^{-1}$ (3)
10. 2.4
12. 1.6

ASIGNMENT 10.3

3. u= - 20 cm
4. v = -200 cm
6. 15 cm
10. a) 21 cm
11. b) 40 cm
c) 1.0 D
12. 6D

Link to some books/ sites:

https://www.physicsclassroom.com (for concept enrichment)
http://www.ncert.nic.in/exemplar/labmanuals.html **(For NCERT lab manual)**
http://cbse.nic.in/newsite/examination.html (For CBSE papers)

Academic Session: 2019 - 20
Preboard Examination
Subject - Science
M/3/1

Time : 3Hrs. **MM-80**

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7. This question paper consists of a total of 30 questions.

SECTION A

Q1 Draw the structure of 2, 2 - dimethyl butane. 1

Q2 Arrange the following elements in decreasing atomic size- Carbon, oxygen, nitrogen 1

Q3 Two students A and B have recorded following observations to verify Ohm's law. 1+1+1+1

Based on the table below, answer the following questions.

Student	S. No.	Voltmeter reading (mV)	Ammeter reading (mA)
Student A	1. 2. 3.	2 4 6	1 2 3
Student B	1. 2. 3.	1 2 3	1 1 1.5

I) Which student's measurement is wrong?
II) What is the mathematical relation between voltage and current?
III) The value of resistance from the measurement of student A is
(a) 1 ohm
(b) 2 Ohm
(c) 3 Ohm
(d) 4 Ohm

IV) Plot a graph between V and I for student A on your answer sheet. (without using graph paper)

Q4 The Fig given below shows extent to which carbohydrates (___), proteins (**……..**) and fats **(- - - - -)** are digested as food passes through alimentary canal of human beings. 1+1+1+1

The letters (**A to F**) represent successive parts of alimentary canal.

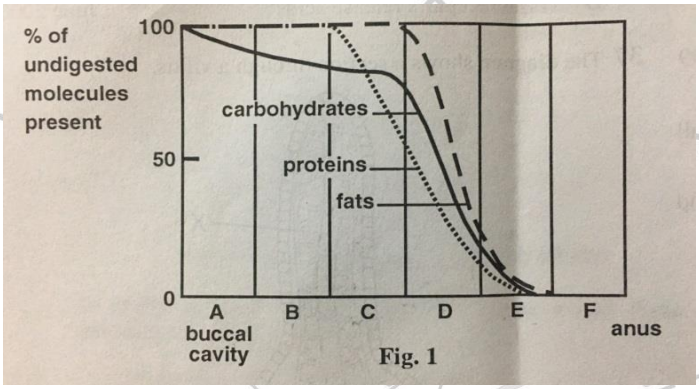


Fig. 1

Examine the Fig and answer the following questions :

4 (a) Name the parts C and D.

4 (b) What brings the start of digestion of carbohydrate molecule in part A of the alimentary canal?

4 (c) In which part of the alimentary canal **(A to F)** would lipase be present and on which part of food would it act?

4 (d) What is the function of part **E** of alimentary canal

Q5 When we enter a dark room coming from outside during a sunny afternoon, immediately the things inside the room do not appear clear to our eyes, this is because 1

a) Pupils do not open at all in the dark
b) Pupils take time to adjust
c) Light travels slower in a dark room
d) Pupils open very quickly in the dark

OR

The Change in the focal length of the eye lens is caused by the action of

a) Pupil
b) Retina
c) Ciliary muscles
d) Iris

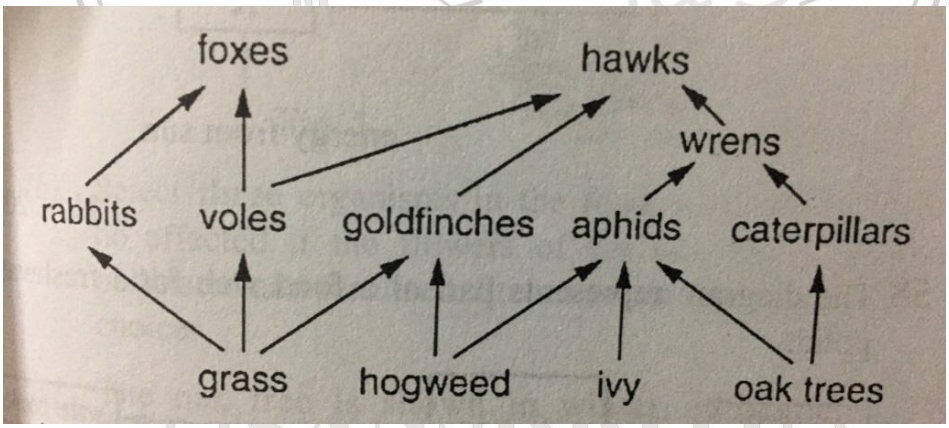
Q6 Which part of solar cooler is responsible for greenhouse effect? 1

a) coating with black colour inside the box
b) mirror
c) glass sheet
d) none of these

Q7 Which of the following is a non-renewable source of energy 1

a) wood
b) sun
c) fossil fuels
d) wind.

Q8 A food web is shown 1



An insecticide is sprayed to kill caterpillars.

In which organism will the highest level of insecticide accumulate after a period of time?

a) Foxes
b) Hawks
c) Voles
d) Wrens

OR

Select the **INCORRECT** statement

a) Sustainable development links economic development to environmental conservation

b) Sustainable development is a long planned and persistent development

c) Sustainable development does not consider readiness of stakeholders to alter their present use of resources

d) Sustainable development encourages usage of resources by current generation and conservation for future generation

Q9 Which of the following compounds will not show addition reaction? 1

a. Ehene
b. Ethane
c. Ethyne
d. Acetylene

Q10 Which of the following displacement reaction will not occur- 1

a. Copper and zinc sulphate
b. Magnesium and iron sulphate
c. Copper and silver chloride
d. Iron and copper sulphate

Q11 Which combination will neutralise to form a neutral salt? 1

a. Sodium hydroxide and carbonic acid
b. Potassium hydroxide and carbonic acid
c. Sodium hydroxide and hydrochloric acid
d. Calcium hydroxide and hydrochloric acid

Q12 An element belongs to the third period and seventeenth group of the Modern periodic table. The element is- 1

a. Fluorine
b. Chlorine
c. Sulphur
d. Aluminium

OR

Elements belong to the same period if -

a. They have the same number of valence electrons
b. Their size decreases from left to right across the period
c. The valency first increases and then decreases from left to right
d. They have the same valency

Q13 For the 13 and 14, given below: 2 statements are given- one labeled Assertion (A) and the other labeled reason (R) . Select the correct answer to the question from the codes 1

a Both A and R are true and R is correct explanation of the assertion.
b Both A and R are true but R is not the correct explanation of the assertion.
c A is true but R is false
d. A is false but R is true.

Assertion- The following compounds belong to the same homologous series.

Ethanone, propanone, butanone

Reason: Compounds of the same homologous series have the same functional group and differ from each other by a $-CH_2$ unit.

Q14 Assertion: Fuses are made up of materials having low melting point. 1
Reason: Fuses should be resistant to electric current.

Q15 a. Write two observations when barium chloride solution is added to sodium sulphate solution 3
b. Name the type of the reaction.
c. Write a balanced chemical equation to represent the above reaction.

SECTION B

Q16 Salt A commonly used to set fractured bones is obtained by heating compound B at 373K. If heated at a higher temperature, it forms compound C. 3

a. Identify A, B and C.
b. Write a balanced chemical equation for the formation of salt A.
c. What precaution must be taken to store compound A and why?

OR

Give reasons for the following statements-

a. While diluting an acid, acid must be added to water and not vice versa.
b. Tartaric acid is added to baking soda.
c. Both acetic acid and hydrochloric acid react with zinc to release hydrogen gas. Both acids react with sodium hydroxide also to form salt and water. However, they are still different to each other.

Q17 Two elements X and Y have atomic numbers 12 and 16 respectively. 3

a. To which period and group of the modern periodic table do these two elements belong?
b. What type of bond will be formed between them and why?
c. Also give the chemical formula of the compound formed.

Q18 How will you create an artificial aquatic ecosystem which is self-sustaining? 3

OR

a) What is water harvesting? List two main advantages associated with water harvesting at community level.

b) Mention two advantages of water which is stored in the underground reservoirs.

Q19 a) Define excretion 3

b) Name the following:

i) The cup shaped structure of the nephron that collects the initial filtrate.
ii) The tube that connects the kidneys to the urinary bladder

c) State two factors on which the amount of water re-absorbed by the nephron depends.

Q20 a) Planaria, insects, octopus and vertebrates all have eyes. Can we group eyes of these animals together to establish a common evolutionary origin? Justify your answer 3

b) In an experiment, tall pea plants with round seeds were crossed with short pea plants with wrinkled seeds and in F1 generation all plants were tall with round seeds.

On selfing F1 progeny some tall plants with wrinkled seeds and some short plants with round seeds were obtained.

What does this tell us about inheritance of characters?

Q21 a) Define tropic movements. 3

b) How does auxin promote the growth of a tendril around a support? Explain

Q22 A spherical mirror forms a real image four times magnified at a distance of 60 cm from the mirror. Calculate the distance of the object from the mirror and the focal length of the mirror. 3

Q23 a) State Fleming's left hand rule. 3

b) Give the function of brushes and split ring in an electric motor.

c) Name the type of current

i) Given by a cell

ii) Used in household supply

Q24 a) Why does the sun appear reddish early in the morning? Justify your answer with a reason. 3

b) Why do stars twinkle but planets do not? Give reason.

OR

a) What is dispersion of light?

b) Why are traffic signals red in colour for stopping?

c) Why do different colours of white light bend at different angles through a prism?

SECTION C

Q25 a. Show the bonding in $MgCl_2$. 5

b. Why does this compound have a high melting point?

c. Write two differences between roasting and calcination.

d. With the help of a labeled diagram, explain electrolytic refining of copper.

OR

a. State the steps used in extracting a metal of middle order reactivity from its sulphide ore.

b. What is thermite reaction? Why is it useful?

c. Why does calcium stick to the surface when treated with dilute hydrochloric acid? Write a balanced chemical equation to show the above reaction.

Q26 a. Write the IUPAC names of the following chemical compounds- 5

1. CH_3-CH_2-CO-CH_3
2. C_2H_6O
3. CH_2=CH-CH_3

b. Complete the following chemical reactions-

1. $C_2H_5OH + CH_3COOH \rightarrow$
2. $CH_4 + CI_2 \xrightarrow{\text{Sunlight}}$ ->

Q27 a) Why is blood circulation in human heart called double circulation? Explain the advantage of double circulation. 5

b) Why do arteries have thick and elastic walls?

c) State the function of capillaries.

Q28 a) Draw a neat diagram of human female reproductive system and label the following parts: 5

i) Site of fertilization
ii) Site of implantation
iii) Site of formation of egg

b) What happens when the egg is not fertilized? Explain

c) Name one intra-uterine contraceptive device used by females.

OR

a) How does the embryo get nourishment from the mother's blood? Explain

b) What are the two functions of the secretion poured by seminal vesicle and prostate gland into the vas deferens?

c) In a bisexual flower in spite of the young stamens being removed artificially, the flower produces fruit. Give reason.

d) Name two organisms that reproduce by regeneration.

Q29 a) List any two factors on which resistance of a conductor depends. 5

b) I) A wire of resistance R is cut into four equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is Rp, then find the ratio R/Rp.
II) What will be the new resistivity of each of these parts? Why?

c) Why are the alloys commonly used in electric heating devices? (Give two points)

Q30 a) A convex lens has a focal length 12 cm. At what distance from the lens should an object be placed so that this lens may act as a magnifying glass? 5

b) A lens produces a magnification of -0.5. Is this a converging or a diverging lens? If the focal length of the lens is 4 cm, draw a ray diagram showing image formation in this case.

c) A convex lens of power 4D is placed at a distance of 40 cm from a wall. At what distance from the lens should a candle be placed so that its image is formed on the wall.

OR

a) What is meant by absolute refractive index?

b) On entering a medium from air, the speed of light becomes half of it's value in air. Find the refractive index of that medium with respect to air.

c) A glass slab made of a material of refractive index n_2 is kept in a medium of refractive index n_1
A light ray is incident obliquely on the slab. Draw the path of the rays of light emerging from the glass slab if i) $n_1 > n_2$ ii) $n_1 = n_2$ iii) $n_1 < n_2$

Academic Session: 2019 - 20
Preboard Examination
Subject - Science
Class – X
Set - 2

Time : 3Hrs. **MM-80**

General Instructions:
1. The question paper comprises three sections – A, B and C. Attempt all the sections.
2. All questions are compulsory.
3. Internal choice is given in each section.
4. All questions in Section A are one-mark questions comprising MCQ, VSA type and assertion-reason type questions. They are to be answered in one word or in one sentence.
5. All questions in Section B are three-mark, short-answer type questions. These are to be answered in about 50 - 60 words each.
6. All questions in Section C are five-mark, long-answer type questions. These are to be answered in about 80 – 90 words each.
7. This question paper consists of a total of 30 questions.

SECTION A **MM 80**

Q1 Draw the structure of 2,3 -dimethyl butane. 1

Q2 Arrange the following elements in increasing atomic size- 1
Carbon, oxygen, nitrogen

Q3 Two students A and B have recoded following observations to verify Ohm's law. 1+1+1+1
Based on the table below, answer the following questions.

Student	S. No.	Voltmeter reading (mV)	Ammeter reading (mA)
Student A	1. 2. 3.	2 4 6	1 2 3
Student B	1. 2. 3.	1 2 3	1 1 1.5

I) Which student's measurement is wrong?
II) What is the mathematical relation between voltage and current?
III) The value of resistance from the measurement of student A is
(a) 1 ohm
(b) 2 Ohm
(c) 3 Ohm
(d) 4 Ohm

IV) Plot a graph between V and I for student A on your answer sheet. (without using graph paper)

Q4 The Fig given below shows extent to which carbohydrates (___), proteins (**.....**) and fats **(- - - -)** are digested as food passes through alimentary canal of human beings. The letters **(A to F)** represent successive parts of alimentary canal. 1+1+1+1

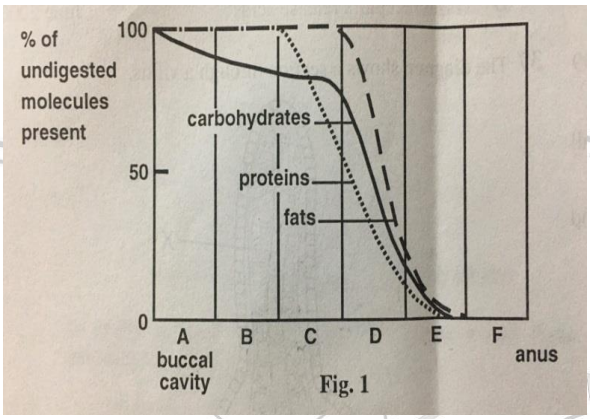


Fig. 1

Examine the Fig and answer the following questions :

4 (a) Name the parts C and D.

4 (b) What brings the start of digestion of carbohydrate molecule in part A of the alimentary canal?

4 (c) In which part of the alimentary canal **(A to F)** would lipase be present and on which part of food would it act?

4 (d) What is the function of part **E** of alimentary canal

Q5 When we enter a dark room coming from outside during a sunny afternoon, immediately the things inside the room do not appear clear to our eyes, this is because 1

a) Pupils do not open at all in the dark
b) Pupils take time to adjust
c) Light travels slower in a dark room
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OR

The Change in the focal length of the eye lens is caused by the action of

e) Pupil
f) Retina
g) Ciliary muscles
h) Iris

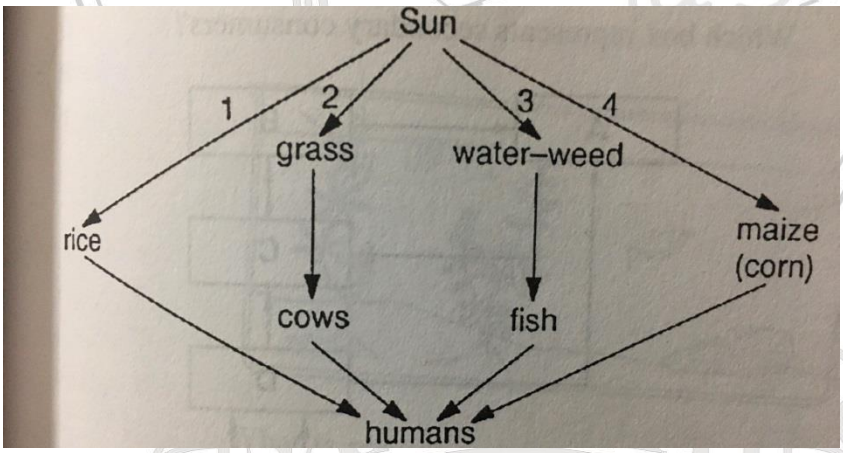
Q6 Which part of solar cooler is responsible for greenhouse effect? 1

a) coating with black colour inside the box
b) mirror
c) glass sheet
d) none of these

Q7 Which of the following is a non-renewable source of energy 1

a) wood
b) sun
c) fossil fuels
d) wind.

Q8 The diagram shows four food chains leading to human 1



Which food chains pass on highest proportion of solar energy to humans?

a. 1 and 2
b. 1 and 4
c. 2 and 3
d. 2 and 4

OR

In our country, vast tracts of forests are cleared and a single species of plant is cultivated. This practice promotes:

a. Biodiversity in the area
b. Monoculture in the area
c. Growth of natural forest
d. Soil fertility

Q9 In which of the following compounds will show substitution reaction? 1

a. Ehene
b. Ethane
c. Propyne
d. Butene

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a. Iron and zinc sulphate
b. Silver and copper sulphate
c. Sodium and magnesium sulphate
d. Mercury and copper sulphate

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a. Sodium hydroxide and carbonic acid
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a. Fluorine
b. Chlorine
c. Sulphur
d. Aluminium

OR

Elements belong to the same group if -

a. They have the same number of valence electrons
b. The element on the top is bigger in size
c. The valency first increases and then decreases from top to bottom
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Q13 For question 13 and 14, 2 statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to the question from the codes given below: 1

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Assertion- The following compounds belong to the same homologous series.

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Reason: Fuses should be resistant to electric current.

Q15 a. Write two observations when lead nitrate solution is added to potassium iodide solution. 3
b. Name the type of the reaction.
c. Write a balanced chemical equation to represent the above reaction.

SECTION B

Q16 Salt A commonly used in bakeries when heated gets converted into another salt B which is used to remove permanent hardness of water and a gas C is evolved. The gas C when passed through lime water turns it milky. 3
a. Identify A, B and C.
b. Write a balanced chemical equation for the formation of salt A.
c. What is the nature of salts A and B?

OR

Give reasons for the following statements-
a. While diluting an acid, acid must be added to water and not vice versa.
b. Ant sting can be treated with calamine solution.
c. Both acetic acid and hydrochloric acid react with zinc to release hydrogen gas. Both acids react with sodium hydroxide also to form salt and water. However, they are still different to each other.

Q17 Two elements X and Y have atomic numbers 12 and 16 respectively. 3
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OR

a) What is water harvesting? List two main advantages associated with water harvesting at community level.

b) Mention two advantages of water which is stored in the underground reservoirs.

Q19 a) Mention the substance that is oxidised in human body during respiration. 3

b) Why are lungs divided into small sac like structures?

c) What is the advantage of cartilaginous rings in the trachea?

Q20 a) Planaria, insects, octopus and vertebrates all have eyes. Can we group eyes of these animals together to establish a common evolutionary origin? Justify your answer 3

b) In an experiment, tall pea plants with round seeds were crossed with short pea plants with wrinkled seeds and in F1 generation all plants were tall with round seeds.
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What does this tell us about inheritance of characters?

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SECTION C

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b. Why does this compound have a high melting point?
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a. State the steps used in extracting a metal of lower order reactivity from its sulphide ore.
b. What is thermite reaction? Why is it useful?
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1. CH_3-CO-CH_3
2. $C_2H_4O_2$
3. CH_2=CH-CH_3

b. Complete the following chemical reactions-
1. CH_3+ CH_3COOH →
2. $C_2H_4 + H_2$ ---- ---> (Ni)

Q27 a) How does circulation of blood in fish differ from that in human beings? Explain 5

b) Name the following:

i) Blood vessel that carries oxygenated blood to the heart
ii) Blood vessel that brings deoxygenated blood back to the heart

c) What is the advantage of valves in the veins?

Q28 a) Draw a neat diagram of human female reproductive system and label the following parts: 5

i) Site of fertilization
ii) Site of implantation
iii) Site of formation of egg

b) What happens when the egg is not fertilized? Explain

c) Name one intra-uterine contraceptive device used by females.

OR

a) How does the embryo get nourishment from the mother's blood? Explain

b) What are the two functions of the secretion poured by seminal vesicle and prostate gland into the vas deferens?

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d) Name two organisms that reproduce by regeneration.

Q29 d) List any two factors on which resistance of a conductor depends. 5

e) Why are the alloys commonly used in electric heating devices? (Give two points)

f) I) A wire of resistance R is cut into four equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is Rp, then find the ratio R/Rp.
II) What will be the new resistivity of each of these parts? Why?

Q30 d) A convex lens has a focal length 10 cm. At what distance from the lens should an object be placed so that this lens may act as a magnifying glass? 5

e) A lens produces a magnification of -0.5. Is this a converging or a diverging lens? If the focal length of the lens is 6 cm, draw a ray diagram showing image formation in this case.

f) A convex lens of power 4D is placed at a distance of 40 cm from a wall. At what distance from the lens should a candle be placed so that its image is formed on the wall.

OR

d) What is meant by absolute refractive index?

e) On entering a medium from air, the speed of light becomes half of its value in air. Find the refractive index of that medium with respect to air.

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A light ray is incident obliquely on the slab. Draw the path of the rays of light emerging from the glass slab if i) $n_1 > n_2$ ii) $n_1 = n_2$ iii) $n_1 < n_2$