SAMAGRA SHIKSHA KERALA

समग्र शिक्षा केरल
Samagra Shiksha Kerala

CLASS 10

PHYSICS

WORKSHEETS

2023 - 24

CONTENT

Introduction

This is a simple learning aid made with an intention of making the study of physics simple. The main concepts and the questions and answers related to them are included in this work book.

With regards

State Project Director
Samagra Shiksha Kerala

UNIT 1
EFFECTS OF ELECTRICITY

Concept

Energy changes in electric devices

To Remember

Electric energy is a form of energy that can easily be converted into many other forms.

Activity 1

Complete the table.

Device	Energy Change	Effect
Electric Stove	. . . . .	Heating effect
Discharge lamps	. . . . .	Lighting effect
. . . . .	Electrical energy changes into mechanical energy	. . . . .
Battery (charging)	Electrical energy changes into chemical energy	. . . . .
Induction cooker	. . . . .	Heating effect
Electric oven	. . . . .	Lighting effect

Concept

Heating effect of electricity

Joule's Law

To Remember

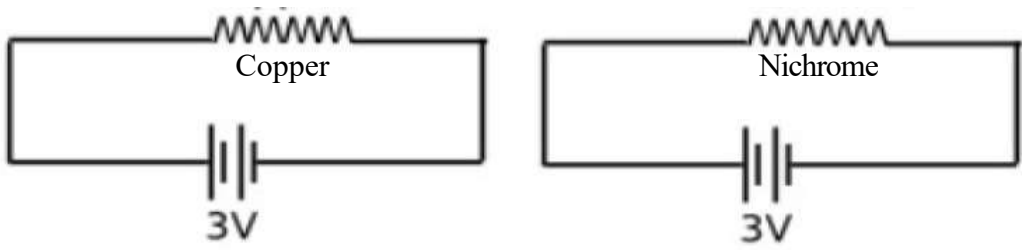
Joule's Law: The heat generated in a current carrying conductor is directly proportional to the square of the current in the conductor, the resistance of the conductor and the time of flow of current

$H = I^2Rt$ joule $H = VIt$ joule $H = \frac{V^2t}{R}$ joule

- When the intensity of current is doubled the heat generated becomes 4 times.
- When intensity of current is halved, the heat generated decreases to one fourth.
- Electric heating devices, safety fuse etc. are devices that make use of heating effect of electricity.
- In heating devices, heat is generated in heating coils.
- Nichrome is used to make heating coil.
- Nichrome has high melting point and high resistivity.

Activity 2

A copper wire and a nichrome wire having the same length and same area of cross section are included in two separate circuits as shown in the figure.



Circuit 1 Circuit 2

a. Which circuit has more current ?

b. The wire in which circuit gets heated more?

Activity 3

1500 Ω is the resistance of a 230 V electric kettle working in AC.

a) Write down the energy change in the kettle.

b) Calculate the electric energy utilised by the kettle when it works for one hour.

Activity 4

0.1 A current flows for 3 minute through a device of resistance 500 Ω

a. Calculate the heat developed.

b. What will be the heat developed if the resistance is changed to 1000 Ω without changing the time and current?

c. What is the change in the heat developed if current is doubled without changing the time and resistance?

Concept

Arrangement of resistors in series and parallel and mathematical problems based on this.

To Remember

- When resistors are connected in series, the effective resistance,

  $R = R_1 + R_2$

- When resistors are connected in parallel and if R is the effective resistance then

  $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ Or $R = \frac{R_1 R_2}{R_1 + R_2}$

- If 'n' resistors of resistance 'r' each are connected in parallel, the effective resistance $R = \frac{r}{n}$. It is R = r x n, if they are in series.

Activity 5

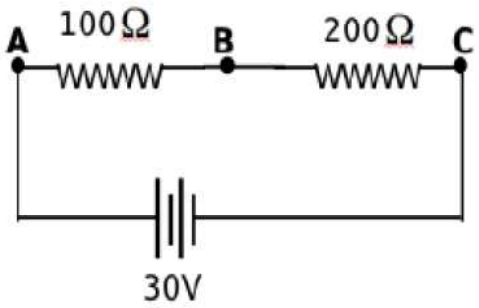
Tabulate the following statements.

- When the number of resistors increases, the current increases.
- When the number of resistors increases, the effective resistance decreases.
- The same current flows through all resistors.
- The potential difference is the same across all resistors.
- Resistor of higher resistance gets heated more.
- The potential difference gets divided across the resistors.

Resistors in series	Resistors in Parallel

Activity 6

Observe the circuit.



a. In this circuit how are the resistors connected?
(series/parallel)

b. What is the effective resistance of the circuit?

c. Which resistor has more voltage?
(100 Ω / 200 Ω)

d. More heat is generated in ….. resistor.
(100 Ω / 200 Ω)

e. Will the current through these differ?

f. Calculate the work done in moving 1 C of charge from A to B if the 100 Ω resistor fets 10 V potential difference.

Concept

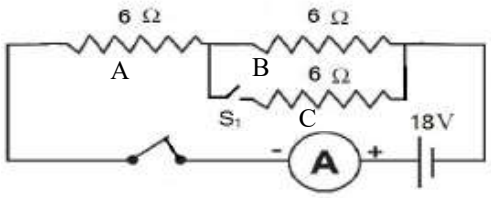
Combination of resistors

To Remember

On connecting resistors in series the effective resistance increases. The current decreases.
On connecting resistors in parallel the effective resistance decreases. The current increases.

Activity 7

Observe the circuit.

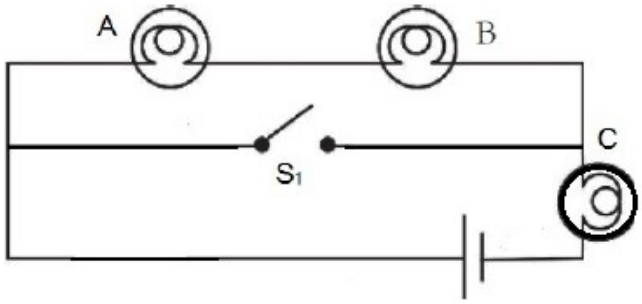


What will be the ammeter reading.

a. if the S_1 is switched off ?
b. if the S_1 is switched on ?

Activity 8

Observe the circuit.



A, B and C are bulbs of the same power. Which bulbs will glow when S_1 is switched on?

Activity 9

10 resistors of 2 Ω each are connected in parallel.

a. Calculate the effective resistance of the circuit.
b. What will be the effective resistance if they are connected in series?

Activity 10

You are given resistors of 2 Ω, 3 Ω, and 6 Ω each.

a. What is the highest resistance you can get using all of these ?
b. What is the lowest resistance you can get using all of these ?
c. Can you make 4.5 Ω resistance using all of these. If so, draw the diagram.

Activity 11

Electric heating devices are those which utilise the heating effect of electricity.

a. Write down two examples for electric heating devices.
b. Which is the alloy used to make the heating coil in electric heating devices?
c. What are the reasons for using this alloy to make the heating coil?

Concept

Safety fuse

To Remember

- Safety fuses work on the basis of heating effect of electricity.
- The fuse wire has a low melting point.
- Whenever there is overloading or short circuit, the fuse wire melts and breaks the circuit.

Activity 12

Safety fuse is a device used to protect electric circuits and devices from damage due to excess current flow.

a. Which effect of electricity is used in the working of safety fuse?
b. In which mode is fuse connected in a circuit?
(in series/ in parallel)
c. What is the main property needed for a fuse wire?
d. How does a safety fuse ensure better safety? Answer in two or three sentences,
e. What is your opinion about using a thick wire as fuse wire?
f. What are the precautions to be taken while handling fuse?

Activity 13

The word amperage is associated with the current carrying capacity of an electric device/ conductor.

a. What do you mean by amperage?
b. What is the relation between the thickness of a wire and amperage?

Concept

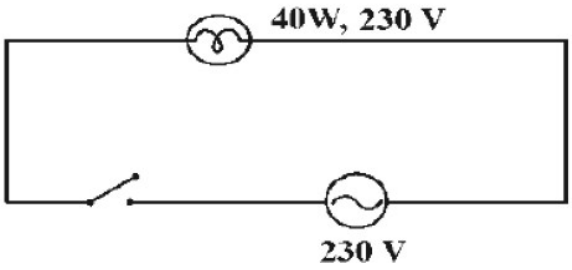
Electric Power - (numericals)

To Remember

- Electric Power is the quantity of energy consumed by an electric appliance in unit time.
- The unit of electric Power is watt (W)

Activity 14

Observe the circuit.



a. What is the power of the bulb in the circuit?
b. What is the resistance of the bulb?
c. Which bulb will glow brighter if a 60 W bulb is also connected in series in the same circuit? Justify your answer.

Activity 15

Calculate the power of a device of resistance 1000 Ω working in 230 V.

Activity 16

On an electric device it is marked as 800 W, 200 V.

a. What is its power when it works at 100 V?
b. What is its power when it works at 50 V?

Activity 17

A current of 1A flows through a device of resistance 200 Ω. Calculate its power.

Concepts

Lighting effect of electricity - filament lamps

To Remember

- In incandescent lamps, the filaments are made of tungsten.
- The metal tungsten has very high melting point and very high resistivity.
- The bulbs are evacuated to prevent the oxidation of filament.
- The bulbs are filled with nitrogen or inert gas at low pressure to reduce the evaporation of the filament.

Activity 18

Filament lamps are also called incandescent lamps

a. What is the meaning of the word incandescent?
b. With which material is a filament in this lamps made up of?
c. What are the special characteristics of this substance for it to be used for making the filament?
d. The bulbs are evacuated and then nitrogen is filled in them at low pressure. What is the advantage of doing so?

e. What is the main demerit of a filament lamp?

Activity 19

A bulb will glow when its broken filament is rejoined.

a. Will the length of the filament increase or decrease on rejoining?
b. If so, will its resistance increase or decrease?
c. What will happen to the brightness of the lamp? Justify your answer.

Concept

Lighting effect of electricity

To Remember

A major quantity of electrical energy used by incandescent lamps is lost as heat only a small quantity is converted into electrical energy. But a major quantity of electrical energy is converted into light in the following lamps.

- Discharge Lamp
- Arc lamp
- Fluorescent lamp
- CF lamps
- LED lamps

Activity 20

Describe the working of discharge Iamps

To Remember

- LED lamps are lamps of low energy loss . They are not harmful to nature because there is no mercury

Activity 21

What are the advantage of LED lamps?

Activity 22

Match the following.

A	B	C
Fuse wire	watt	$R = R_1 + R_2 + R_3$
Incandescent Lamp	Effective resistance decreases	I^2R
Heating devices	Tungsten	$1/R = 1/R_1 + 1/R_2 + 1/R_3$
Resistors in series	Low resistance	Electrical energy is converted into heat energy
Power	High effective resistance	Tin and Lead
Resistors in parallel	Nichrome	Nitrogen

UNIT 1

EFFECTS OF ELECTRICITY

Answer Key

Activity 1

Device	Energy Change	Effect
Electric Stove	Electrical energy changes into heat energy	Heating effect
Discharge lamps	Electrical energy changes into light energy	Lighting effect
Electric fan	Electrical energy changes into mechanical energy	Mechanical effect
Battery (charging)	Electrical energy changes into chemical energy	Chemical effect
Induction cooker	Electrical energy changes into heat energy	Heating effect
Electric oven	Electrical energy changes into heat energy	Lighting effect

Activity 2

a. Current will be higher in circuit 1. This is because copper has low resistance.

b. When voltage is constant, the heat developed in a circuit is inversely proportional to the resistance. Hence more heat is generated in copper due to its low resistance (When voltage is constant, the current decreases. When the resistance increases. Hence heat decreases.)

Activity 3

a. Electrical energy into heat energy.

b. $H = V^2t/R$

$V = 230\ V$

$R = 1500\ \Omega$

$t = 1 \times 60 \times 60 = 3600\ s$

$$H = \frac{(230)^2 \times 3600}{1500}$$

$H = 126960\ J$

Activity 4

a. $H = I^2Rt = 0.1 \times 0.1 \times 500 \times 3 \times 60 = 900\ J$

b. $H = 0.1 \times 0.1 \times 1000 \times 3 \times 60 = 1800\ J$

c. $H = 0.2 \times 0.2 \times 500 \times 3 \times 60 = 3600\ J$

When current is doubled, the heat generated becomes four times.

Activity 5

Resistors in Series	Resistors in Parallel
• The same current flows through all resistors	• When the number of resistors increases, the current increases
• Resistor of higher resistance gets heated more	• When the number of resistors increases, the effective resistance decreases.
• The potential difference gets divided across the resistors	• The potential difference is the same across all resistors

Activity 6

a. Series

b. 300 Ω $(R = R_1 + R_2)$

c. 200 Ω. When resistors are connected in series, the resistor of higher resistance gets more voltage.

d. 200 Ω. When resistors are connected in series more heat is developed in the resistor of higher resistance.

e. The current is same on both resistors (When resistors are connected in series, the same current flows through all resistors.)

f. 10 J (When potential difference between two points is V, the work to be done to move one coulomb charge from one point to the other is V joule)

Activity 7

a. $V = 18\ V$

$R = R_1 + R_2$

$= 6 + 6 = 12\ \Omega$

$$I = \frac{V}{R} = \frac{18\ V}{12\ \Omega} = 1.5A$$

b. When S_1 is switched on the resistors B and C are in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

$$R = \frac{6}{2}\ \Omega = 3\ \Omega$$

Total resistance = 6 + 3 = 9 Ω

$$I = \frac{V}{R}$$

$$= \frac{18\ V}{9\ \Omega} = 2A$$

Activity 8

- C alone
- When switched on, current will not pass through the bulbs A and B which are having high resistance. The current passes through C only.

Activity 9

a. $R = \frac{r}{n}$

$= \frac{2}{10} = 0.2$ ohm

b. $R = r \times n$

$= 2 \times 10 = 20$ ohm

Activity 10

a. Highest resistance

$R = R_1 + R_2 + R_3$

$= 2 + 3 + 6 = 11\ \Omega$

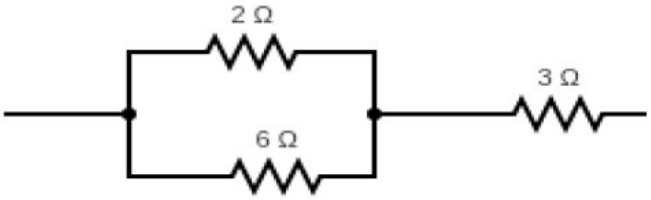
b. Lowest resistance

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$= \frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{6}{6} = 1$

$\therefore R = 1\Omega$

c. Yes



Activity 11

a. Iron box, Electric heater

b. Nichrome

c. High melting point, high resistivity, ability to remain in red hot condition for a long time without getting oxidised even if it is in contact with air.

Activity 12

a. Heating effect

b. In series

c. Low melting point.

d. Replace if there excess of current as if there is excess of current. The heat generated in each second will be more than the heat given out by the wire in each second.The fuse wire which is of low melting point melts and breaks the circuit.

e. If thick wire is used there is no chance of the wire to melt. Hence thin wires are advisable.
f. The ends of the fuse wire must be connected firmly at appropriate points. The fuse wire should not project out of the carrier base. Fuse wire of appropriate amperage should be used.

Activity 13

a. Amperage is the ratio of the power of a device to the voltage.
b. The amperage increases with increase in the thickness of the wire.

Activity 14

a. 40W
b. $R = \frac{V^2}{P} = 230X\frac{230}{40} = 1322.5\ \Omega$
c. 40W The resistance of this bulb is high. When connected in series, same current flows through both, the device with high resistance will produce more heat energy.

Activity 15

Power $P = \frac{V^2}{R} = 230x\frac{230}{1000} = 52.9\ W$

Activity 16

a. Resistance of the device

$$R = \frac{V^2}{P} = 200x\frac{200}{800} = 50\ \Omega$$

Power when it works at 100 V.

$$P = \frac{V^2}{R} = 100x\frac{100}{50} = 200\ W$$

b. 5 Power when it works at 50 V.

$$P = \frac{V^2}{R} = 50x\frac{50}{50} = 50\ W$$

Activity 17

$P = I^2R = 1 \times 1 \times 200 = 200\ W$

Activity 18

a. Glowing with heat
b. Tungsten
c. The filament produces white light when it gets heated. It has high melting point, high resistivity and high ductility (can be made into thin wire).
d. The longevity of the filament can be increased by preventing the oxidation of the filament.
e. Major quantity of the electrical energy we supply is lost in the form of heat.

Activity 19

a. Decreases
b. Decreases
c. Increases. When the resistance decreases the current increases. Hence the power of the bulb increases $H \alpha I^2$

Activity 20

Discharge lamps are glass tubes fitted with two electrodes. They emit light as a result of discharge of electricity through the gases filled in the tubes. When high potential difference is applied the gas molecules gets excited. Excited atoms come back to their original states for attaining stability. During this process the energy stored in them will be radiated as light. Depending on the difference in the energy levels lights of different colours and other radiations are emitted.

Activity 21

- There is no loss of energy in the form of heat.
- Not harmful to the environment because there is no mercury.
- Low power consumption.
- High efficiency.
- High longevity

Activity 22

A	B	C
Fuse wire	Low resistance	Tin and Lead
Incandescent Lamp	Tungsten	Nitrogen
Heating devices	Nichrome	Electrical energy is converted into heat energy
Resistors in series	High effective resistance	$R = R_1 + R_2 + R_3$
Power	watt	I^2R
Resistors in parallel	Effective resistance decreases	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

UNIT 2
MAGNETIC EFFECT OF ELECTRIC CURRENT

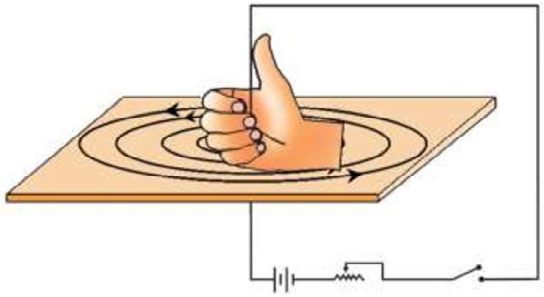
Concept

The magnetic field around a current carrying conductor

To Remember

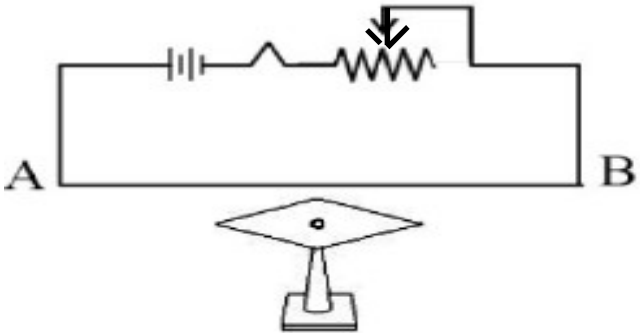
Right Hand Thumb Rule

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



Activity 1

A straight conductor is held above a pivoted magnetic needle and is switched on.



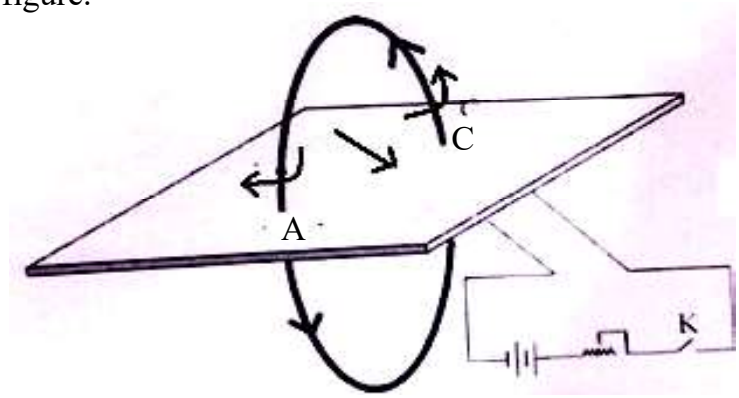
a. Why does the magnetic needle deflect when switched on?
b. Which is the law that helps to find the direction of deflection of the magnetic needle?
c. Suggest a method to make the needle deflect in the opposite direction.

Concept

The magnetic field around a current carrying coil.

Activity 2

Observe the figure.



a. Draw the magnetic field lines around A and C.

b. Which law helped you to find the answer? State the law.

c. What are the methods to strengthen the magnetic field around a coil?

Concept

Solenoid

To Remember

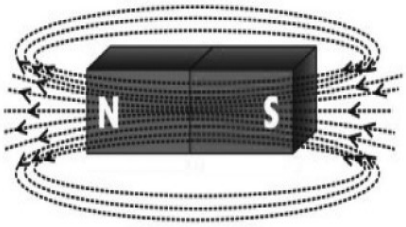
A solenoid is a wire wound in the shape of a helix.

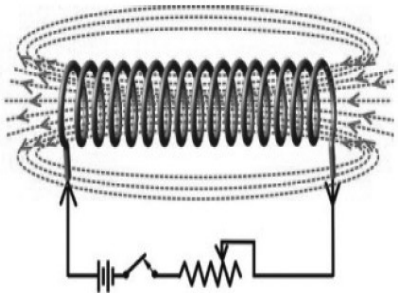
Concept

The magnetic field around a current carrying solenoid.

To Remember

The magnetic field around a bar magnet and a current carrying solenoid are identical.





Activity 3

Complete the table

Bar magnet	Solenoid
The magnetic field is permanent	The magnetic field is temporary
.....	.....
.....	.....

Concept

Factors affecting the magnetic field around an electromagnet.

To Remember

The number of turns of coil, the current, soft iron as core and its area of cross section are the factors affecting the strength of an electromagnet.

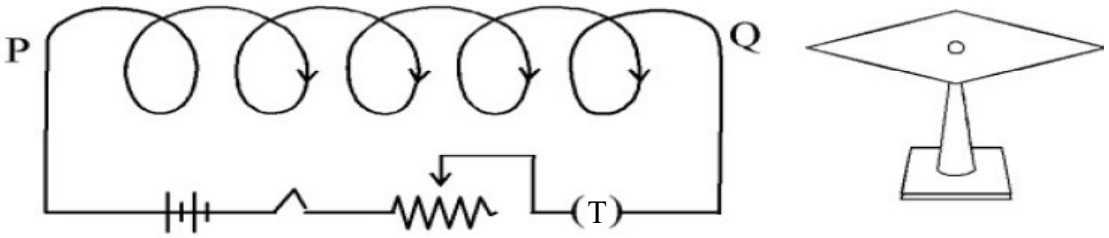
Activity 4

Tabulate the factors affecting the magnetic strength of a current carrying solenoid.

1. Intensity of current
2. . . . . .
3. . . . . .
4. . . . . .

Activity 5

A pivoted magnetic needle is arranged near Q of a solenoid PQ.



a. Which end of the magnetic needle gets attracted Q of the solenoid PQ, when switched on?

b. Which fact helped you to arrive at this inference?

c. Suggest two methods to increase the magnetic strength of a current carrying solenoid.

Concept

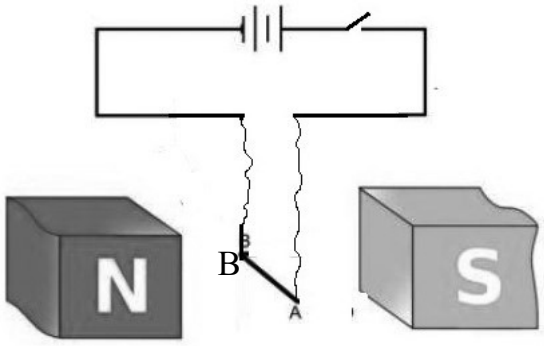
Fleming's Left Hand Rule

To Remember

Hold the forefinger, the middle finger and the thumb of the left hand in mutually perpendiular directions as shown in the figure. If the forefinger indicates the direction of the magnetic field and the middle finger, the direction of the current, then the thumb will indicate the direction of motion of the conductor.

Activity 6

Observe the circuit.



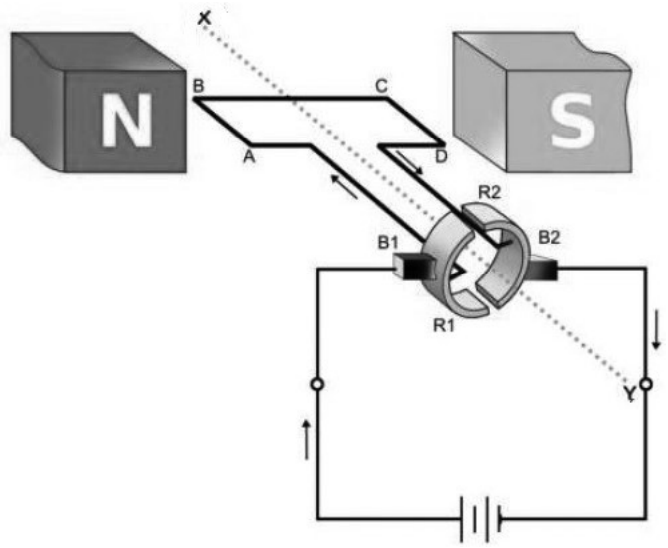
A conductor AB is placed in a magnetic field such a way that it can move freely.

a. In which direction will the conductor AB move, when switched on?
(upwards, downwards, to the North, to the South)

b. State the rule that helped you to arrive at the answer.

Activity 7

Observe the figure.



a. In which direction will the part AB move?
(upwards, downwards)

b. What change should you make in the circuit to make the part AB move in the opposite direction?

c. Which device is depicted in the figure ?

Concept

Motor Principle

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

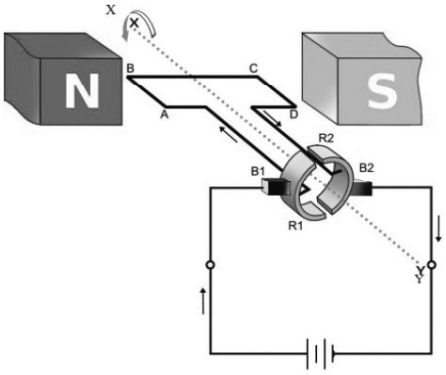
Activity 8

Electric motors work on the basis of motor principle.

a. What is the energy change in an electric motor?
b. Write down the name of another device that works based on motor principle.

Concept

The working of DC motor



Activity 9

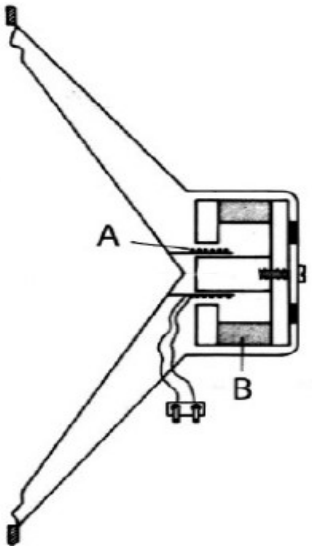
List out the parts of a DC motor.

Concept

Moving coil loud speaker

Activity 10

A moving coil loud speaker is depicted.



a. What does A and B indicate?
b. Write down the energy change in this device.
c. What is the working principle of a moving coil loudspeaker?
d. Write down how this device works.

UNIT 2
MAGNETIC EFFECT OF ELECTRIC CURRENT

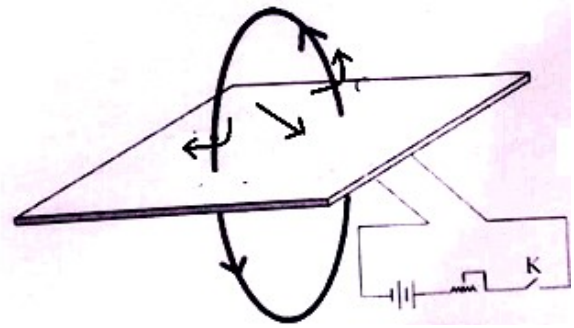
Answer Key

Activity 1

a. This is because a magnetic field is developed around the conductor AB.
b. Right Hand Thumb Rule.
c. Reverse the direction of current or hold the conductor below the magnetic needle.

Activity 2

a.



b. The Right Hand Thumb Rule of Maxwell or the Right Hand Screw Rule

What we have understood is the **Right Hand Thumb Rule** of James Clark Maxwell. Imagine you are holding a current carrying conductor with the right hand in such a way, that the thumb points in the direction of the current. The direction in which the other fingers encircle the conductor gives the direction of the magnetic field.

The same rule is also known as Right Hand Screw Rule. If a right hand screw is rotated in such a way that its tip advances along the direction of the current in the conductor, then the direction of rotation of the screw gives the direction of the magnetic field around the conductor.

c. 1. Increase the number of turns of coiled conductor
2. Increase the current
3. Use soft iron as core. Increase its area of cross section.

Activity 3

Bar magnet	Solenoid
• The magnetic field is permanent	• The magnetic field is temporary
• The polarity of magnet can be changed	• The polarity cannot be changed
• The strength of magnetic field cannot be changed as we like	• We can change the strength of magnetic field as we like

Activity 4

1. Intensity of current
2. Number of turns of the coiled conductor
3. Soft iron core
4. Area of cross section of the soft iron core

Activity 5

a. South Pole
b. The current at the end Q is in the anticlockwise direction. So it becomes the North Pole. Hence it attracts the South Pole of the magnetic needle..
c. Increase the current and the number of turns per unit length. Use soft iron as core and increase its area of cross section.

Activity 6

a. Downwards
b. **Fleming's Left Hand Rule:** Hold the forefinger, the middle finger and the thumb of the left hand in mutually perpendicular directions as shown in the figure. If the forefinger indicates the direction of the magnetic field and the middle finger, the direction of the current, then the thumb will indicate the direction of motion of the conductor.

Activity 7

a. Downwards
b. Reverse the direction of current.
c. DC motor

Activity 8

a. Electrical energy changes into mechanical energy
b. Moving coil loud speaker

Activity 9

- Field magnet
- Armature
- Brushes
- Split ring commutator

Activity 10

a. A - voice coil, B - magnetic field
b. Motor principle
c. Electrical energy changes into sound energy.
d. The electricl pulses from a microphone are strengthened using an amplifier and sent through the voice end of a loudspeaker. The voice coil, which is placed in the magnetic field, moves to and fro rapidly, in accordance with the electrical pulses. Theses movements make the diaphragm vibrate, thereby reproducing sound.

UNIT 3
ELECTROMAGNETIC INDUCTION

Concepts

Electromagnetic induction

To Remember

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

Activity 1

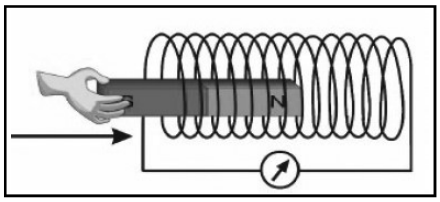
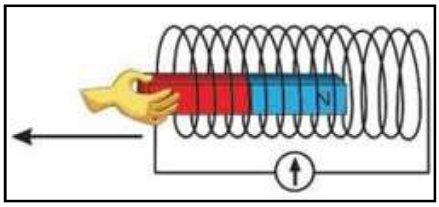
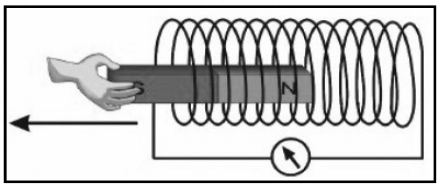
a. Draw the circuit diagram of the experiment you have done to produce electricity using the following devices

1. Magnet 2. Solenoid 3. Galvanometer

b. Which is the phenomenon behind the current flow in the completed circuit?

c. Define the phenomenon.

d. Complete the observation table.

Diagram	Activity	Observation
	Magnet is moved in to the solenoid	.....
	Magnet is stationary inside the solenoid	.....
	Magnet is moved out of the solenoid	.....

Concept

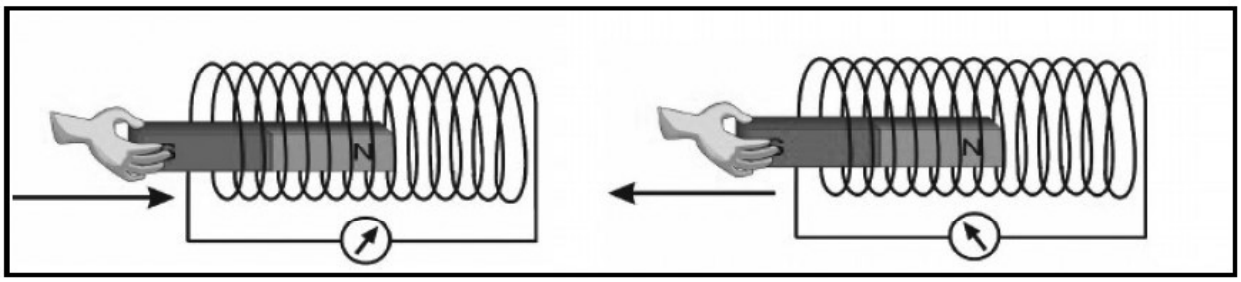
Factors affecting electromagnetic induction

To Remember

Increase the number of turns of the coiled conductor, the strength of the magnet and speed of motion to increase the emf.

Activity 2

Observe the figure.



Electric current is produced in the circuit when an experiment is setup as shown in figure.

a. Name the phenomenon behind the flow of current.
b. Write the name of the current produced in the coil.
c. Write the definition for this phenomenon.
d. What are the factors influencing the induced current ?

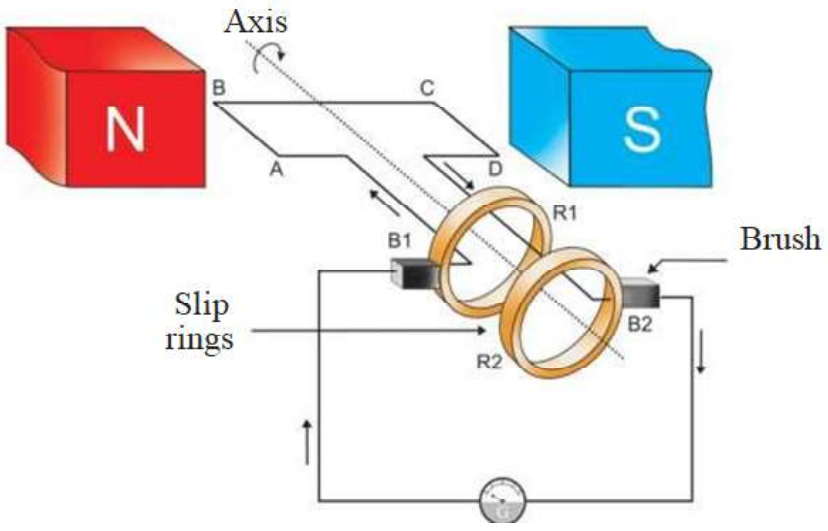
Concept

Flemings Right Hand Rule

To Remember

Flemings Right Hand Rule : - Imagine a conductor moving perpendicular to a magnetic field. Stretch the forefinger, middle finger and the thumb of the right hand in mutually perpendicular directions. If the fore finger represents the direction of the magnetic field, and the thumb represents the direction of motion of the conductor, then, the middle finger represents the direction of the induced current.

Activity 3



a. What will be the direction of current in the part AB when it moves upwards?
(From A to B, From B to A)
b. Which law helped you to find the answer? State the law.
c. Which instrument is depicted in the figure?

Concept

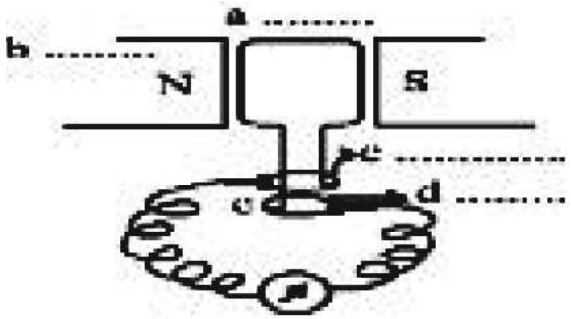
AC Generator

To Remember

- Generator- A device to convert mechanical energy into electrical energy based on electromagnetic induction.
- Principle of working : electromagnetic induction.
- Main parts: Field magnet, Armature, Slip rings, Brushes.
- In an AC generator, the induced emf generated in the first half rotation in one direction and that generated in the second half rotation in the opposite direction together form the cycle of AC.
- The number of cycles per second is the frequency of AC.
- The frequency of AC generated for distribution in our country is 50 cycles per second or 50 Hz.

Activity 4

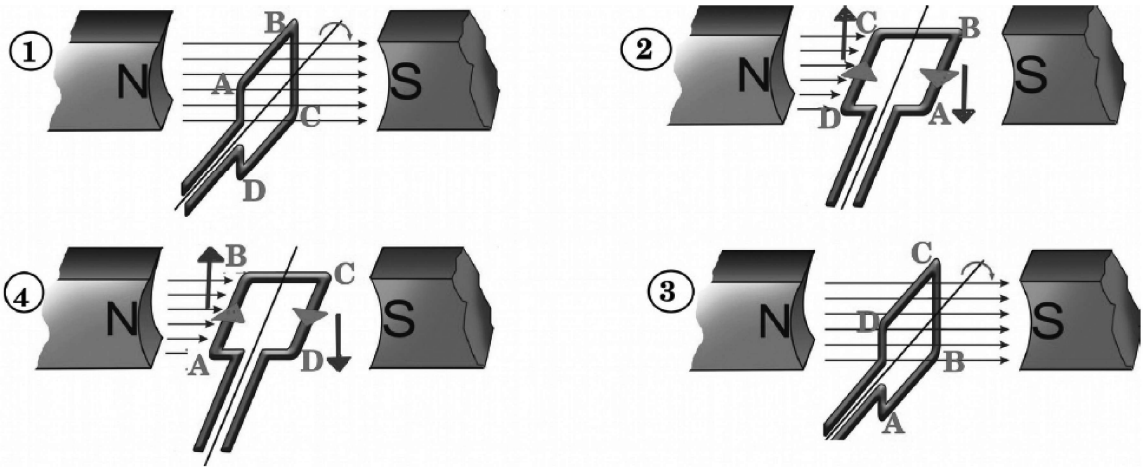
Observe the given figure and answer the following questions



a. Identify the device shown in the figure.
b. What is the working principle of this device?
c. Name the parts a, b, c, & d.
d. What is the energy change in this device?
e. Name the part used in this device to create magnetic flux.
f. Name the part that is moved to change the magnetic flux.
g. Name the type of electricity produced in this device.

Activity 5

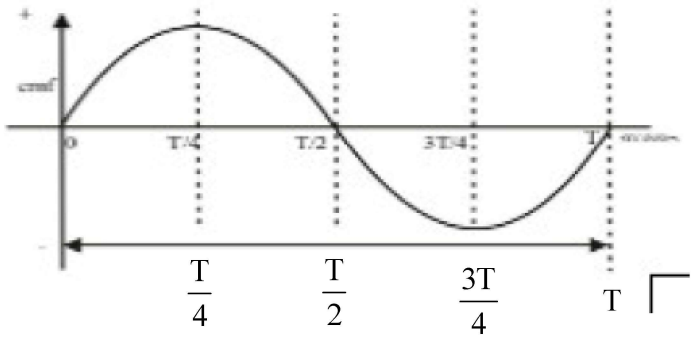
Observe the figures.



a. Find out the positions of the armature in the figure which have zero induced current when it rotates in a magnetic field.

b. What is the frequency of AC generated in our country for distribution?

c. Analyse the given graph and find out the instances at which the emf is maximum and minimum.



Concept

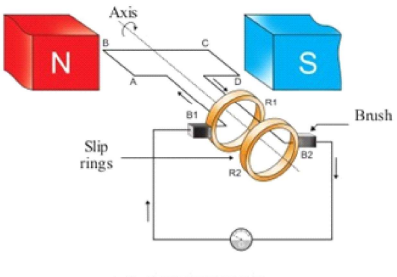
DC Generator

To Remember

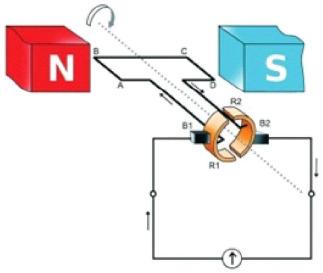
- In a DC generator split ring commutator is used instead of slip rings.
- The AC induced in the armature is converted into DC with the help of split ring commmutator.

Activity 6

Observe the figure and write the difference in structure between the AC generator and a DC generator?



AC GENERTOR



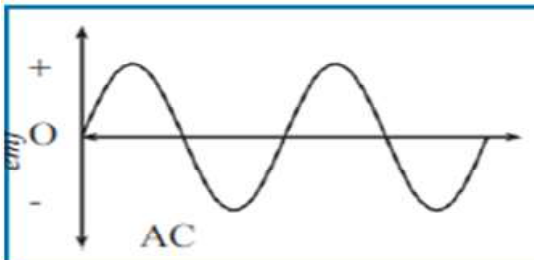
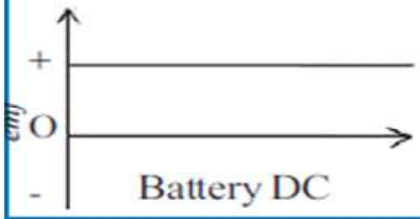
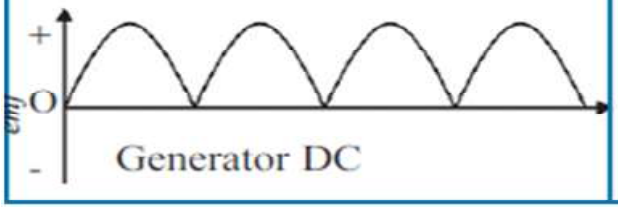
DC GENERATOR

Concept

Characteristics of electricity from AC generator, DC generator and a cell. Graphic representation.

Activity 7

Graphic representation of the emf from AC generator , DC generator , Cell are given in the table below . Observe the figure and complete the table.

	• Direction changes continuously •
	• •
	• • emf increases and decreases.

Concept

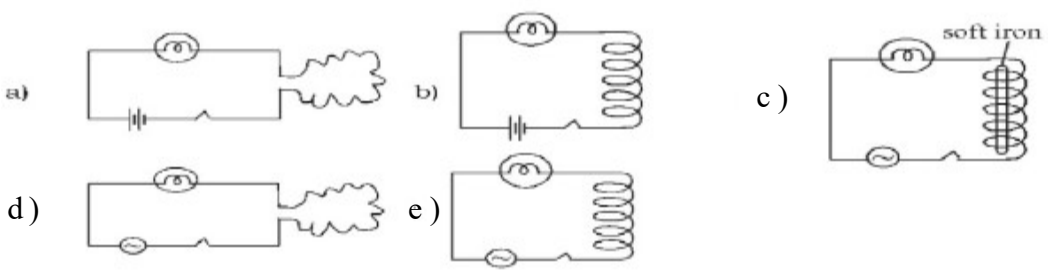
Self induction

To Remember

Inductor is a device which works on the principle of Self Induction.

Activity 8

Copper wires of same length and thickness are connected as coiled or not coiled to form the below five circuits. Observe the circuits and answer the following questions.



a. Compare the intensity of the bulbs.
b. Which is the phenomenon behind for the decrease in the intensity of light from bulbs in some of these circuits?
c. Define the phenomenon
d. Name a device that works based on this principle.
e. Write down the limitation of this device.
f. Describe how the soft iron core in the circuit influences the intensity of current?

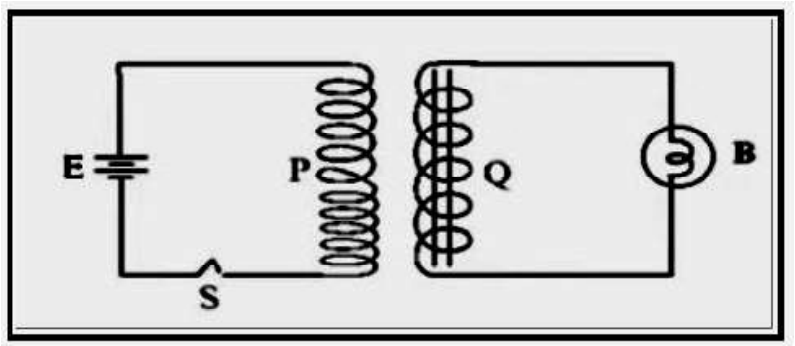
Concept

Mutual Induction

To Remember

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

Activity 9



When S is turned on, the bulb suddenly glows and turns off

a. Name and explain the phenomenon by which electricity passes through the second coil.
b. Suggest a method for the continuous glowing of bulb.
c. Name the coil P and Q in the circuit.

Concept

- Transformer is a device used to increase or decrease the AC voltage without any change in power.
- Transformer – structure and working.

To Remember

Principle: Mutual induction

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

Transformers are of two types. Step up transformer, Step down transformer

Activity 10

Transformer is a device used to change the voltage of AC without changing the power. Differentiate the statements given below suitably as step up and step down transformers.

a. Number of turns in primary coil is less than that of secondary coil.
b. Number of turns in primary coil is greater than that of secondary coil.
c. Input voltage is greater than output voltage.
d. The thickness of primary coil is greater than that of the secondary.
e. The thickness of coil secondary is greater than that of the primary.
f. Input current is greater than that of the output.

Activity 11

Examine the table and answer the following questions.

	Primary			Secondary		
Transformer	Total voltage Vp	No. of turns Np	Voltage in one turn (ε) Vp/Np	Total voltage Vs	No. of turns Ns	Voltage in one turn (ε) Vs/Ns
T1	500 V	100	5 V	50 V	10	5 V
T2	20 V	10	2 V	200 V	100	2 V
T	Np x ε	Np	ε	Ns x ε	Ns	ε

a. Find the value of x and y.
b. What is the voltage in one turn when 500 V is given as input in T_1 primary?
c. Is there a change in one turn voltage of the same transformer when the output voltage decreases to 50 V?
d. Is there a voltage change in each turn of the primary and secondary in the step up transformer T_2?
e. How the ratio of voltages to the number of turns in each of the transformers, primary and secondary is related? Write this ratio in mathematical form.
f. What could be the reason for using thicker wire windings in the primary of a step up transformer and the secondary of a step down transformer?

Activity 12

In a transformer without any loss in power, there are 5000 turns in the primary and 250 turns in the secondary. The primary voltage is 120V and the primary current is 0.1A. Find the voltage and current in the secondary.

Concept

Moving coil microphone

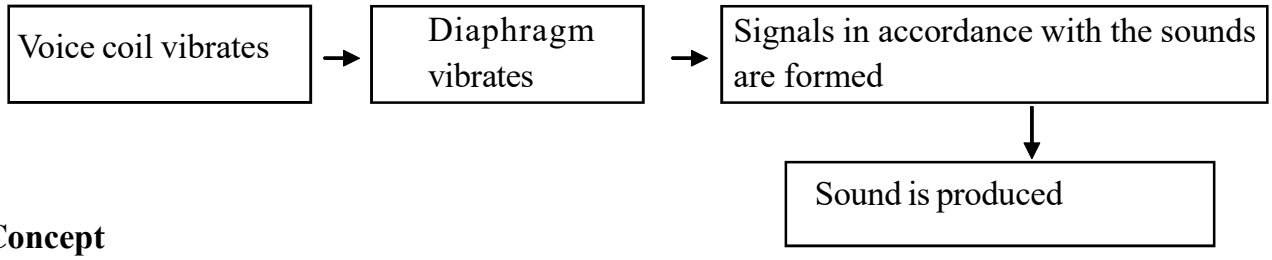
To Remember

- Principle: Electromagnetic induction.
- The energy transformation that takes place in a moving coil microphone is Mechanical energy ⟶ Electrical energy.
- The main parts of a moving coil microphone are Diaphragm, Permanent magnet and voice coil.

  Moving coil microphone: A device that converts sound energy into electrical energy based on the principle of electromagnetic induction.

Activity 13

Write down the following statements given in the boxes regarding the working of a moving coil microphone in the correct order.



Concept

Power transmission in high voltage.

To Remember

- When electricity is transmitted to distant places there is loss of energy in the conductors in the form of heat. This is known as transmission loss.
- In India electricity is produced at 11 kV (11000 V) in power stations.
- The methods to reduce the heat generated are:

  1. Reduce current 2. Reduce resistance, 3. Reduce the time (not practicable)
- Reduce the current without change in power by increasing the voltage.
- The methods to minimise the transmission loss is to increase the voltage to 220 kV in the power station itself. (depending on the distance to be transmitted 110 kV, 400 kV etc., are also used) As a result the current and the the loss of energy in the form of heat decreases.

Activity 14

a. What is the method to reduce the transmission loss?
b. Which type of transformer is there in a power station?
c. Which type of transformer is there in a substation?
d. Which type of transformer is a distribution transformer?
e. How many lines reach a distribution transformer?
f. How many lines go out of a distribution transformer?
g. What is the potential difference between 2 phase lines?
h. What is the potential difference between any one phase line and the neutral line?

i. What is the potential difference between the earth and the neutral line?
j. If a person standing on the earth touches a phase line, will he get an electric shock? Why?
k. Which are the lines essential for household electrification?

Concept

House hold electrification

To Remember

- The electric line entering our home is first connected to the watt hour meter.
- Watt hour meter is the device used to measure the electric energy consumed
- The fuse is to be connected in the phase line.
- The function of main switch is to connect or to disconnect the phase line and neutral line as per need.
- The main switch is in between the main fuse and ELCB.
- Household devices are connected in parallel.
- The switch is connected in the phase line.
- The fuse and switch are connected in series.

Activity 15

a. What is the position of main fuse in house hold circuits?
b. To which device the electric line entering our home is first connected to?
c. What is the difference between main switch and an ordinary switch?
d. What are the safety precautions taken in house hold electric circuits?
e. Which are the devices in house hold electric circuits connected in series ?
f. What is the colour used for a neutral line?

Concept

Watt hour meter

To Remember

- Watt hour meter is a device to measure the electric energy consumed.
- Electric energy is measured in kilowatt hour (kWh). This is also known as **unit**.
- One kilowatt hour electric energy is used when a device of power 1000 W (1 kw) works for one hour
- Energy in kilowatt hour $= \frac{\text{Power in watt} \times \text{time in hour}}{100}$

Activity 16

Watt hour meter is the device to measure the electric energy consumed.

a. Where is the watt hour meter in house hold circuits placed ?
b. Which is the commercial unit of electrical energy?
c. What is the energy consumed by a device of power 2000 W in two hour?

Concept

Methods to ensure safety in house hold electrification

To Remember

- **Safety fuse:** Safety fuse is a device to protect an electric circuit from danger caused by the excess current due to short circuit, over load etc.
- **MCB - Miniature Circuit Breaker**

  Whenever there is excess current due to short circuit or over load, the MCB works automatically and disconnects the circuit.
- **ELCB - Earth Leakage Circuit Breaker.**

  ELCB helps to break a circuit automatically whenever there is a current leak due to insulation failure or any other reason.
- **RCCB (Residual Current Circuit Breaker)**

  Executes the same function as that of ELCB with more safety.
- **Three pin plug and earthing:** If the phase line comes in contact with the metallic cover, excess current flows into the earth through the earth pin in the three pin plug. The safety fuse, MCB etc works and disconnects the circuit.

Activity 17

a. What are the methods adopted to ensure safety in house hold circuits?
b. Write down the full form of MCB and ELCB.
c. What is the advantage of MCB over fuse?
d. Explain how the three pin plug and earthing ensures better safety.

Activity 18

In a house 10 CFL of 10 W each are used 5 hour a day, 5 fans of 60 W each are used 1 hour a day and an electric iron box of power 500 W is used ½ an hour a day. Find the cost of energy consumed at Rs 5 per unit for 30 days.

Concept

Electric shock – precautions and first aid

To Remember

- First aid should be given only after disconnecting the person from the electric line.
- Saving electricity is equivalent to production of electricity.

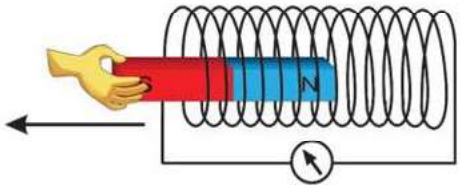
Activity 19

a. What should be done prior to the first aid?
b. What happens to the viscosity when the body temperature decreases?
c. What are the first aids to be given for a person who got electric shock?
d. Electricity is the most useful form of energy. What are the safety methods to be adopted to handle electricity without any danger?

UNIT 2
ELECTROMAGNETIC INDUCTION
Answer Key

Activity 1

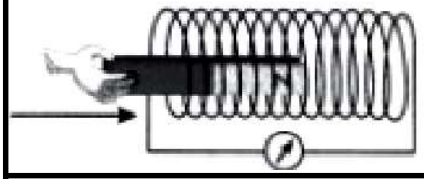
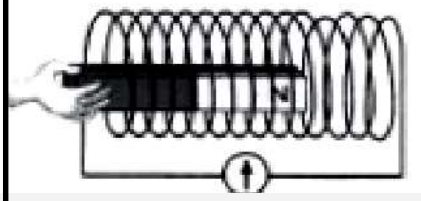
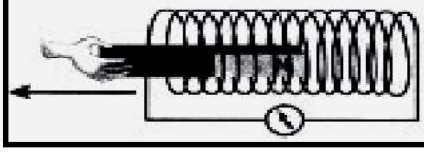
a.



b. Electromagnetic induction principle.

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

d.

Figure	Activity	Observation
	Magnet is moved in to the solenoid	Galvanometer needle get deflected
	Magnet is stationary inside the solenoid	Galvanometer needle does not deflect
	Magnet is withdrawn	The galvanometer needle deflects in the opposite direction

Activity 2

a. Electromagnetic induction principle.

b. Induced current

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

d. Increase the

(i) Number of turns of the coiled conductor

(ii) Strength of the magnet

(iii) Speed of motion

Activity 3

a. From A to B

b. **Fleming's right hand rule :-** Imagine a conductor moving perpendicular to a magnetic field. Stretch the forefinger, middle finger and the thumb of the right hand in mutually perpendicular directions. If the fore finger represents the direction of the magnetic field, and the thumb represents the direction of motion of the conductor, then the middle finger represents the direction of the induced current.

c. AC generator

Activity 4

a. AC generator
b. Electromagnetic induction
c. a – armature b – field magnet c – slip rings d – brush
d. A mechanical energy into electrical energy
e. Field magnet
f. Armature
g. AC

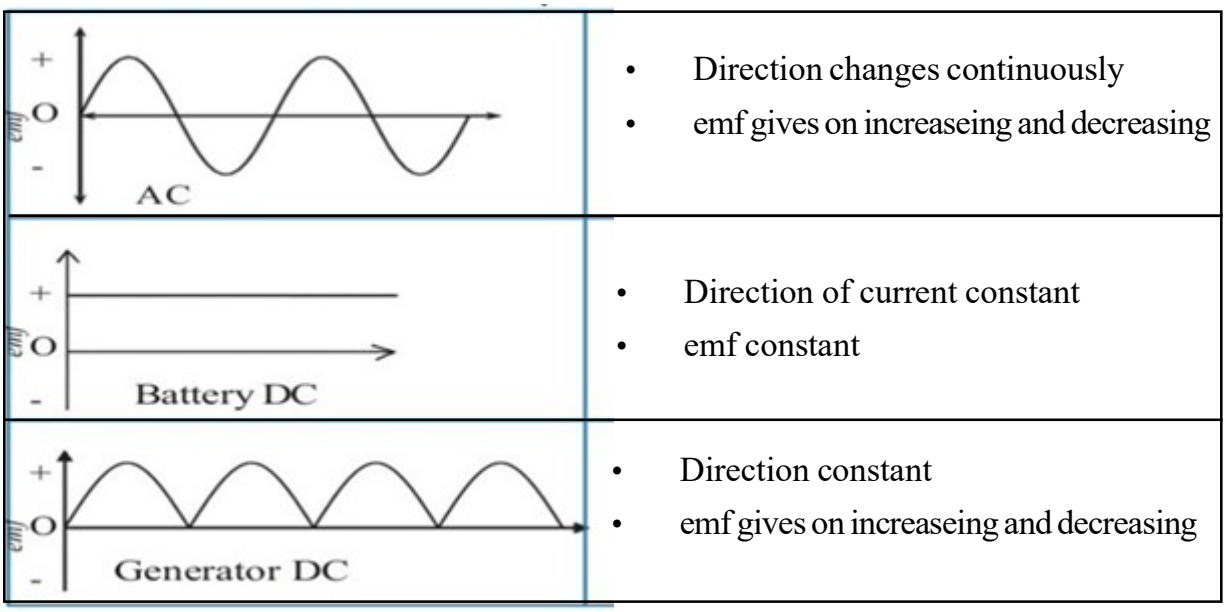
Activity 5

a. 1 & 3
b. 50 HZ
c. emf maximum T/4 and 3T/4
emf minimum T/2 and T

Activity 6

AC generator – slip rings
DC generator – split rings

Activity 7



- Direction changes continuously
- emf gives on increaseing and decreasing

- Direction of current constant
- emf constant

- Direction constant
- emf gives on increaseing and decreasing

Activity 8

a. The bulbs in the circuits a, b and d gives same light. The brightness of bulb is less and that of C is least.
b. Self induction
c. The change in magnetic flux due to the flow ofan AC in a solenoid will generate a back emf in the same solenoid in a direction opposite to that applied to it. This phenomenon is known as the self induction.
d. INDUCTOR
e. Cannot be used in DC circuits
f. The presence of soft iron core increases the flux density. The rate of change of flux increases. The back emf increases. The effective voltage decreases.

Activity 9

a. Mutual induction. The direction or magnitude of DC does not change. Hence mutual induction will not take place continuously.
b. Give AC instead of DC
c. P – Primary coil Q – Secondary coil

Activity 10

Step up	a, d, f
Step down	b, e, c

Activity 11

a. x) 2 V y) Vp
b. 5 V
c. No
d. No
e. $\frac{Ns}{Np} = \frac{Vs}{Vp}$
f. The current in the primary of a step up transformer and secondary of a step down transformer is higher. Hence more electrical energy will be converted into heat energy. If the thickness of such coils are increased the resistance decreases and the energy loss decreases.

Activity 12

Np = 5000
Ns = 250
Vp = 120 V

$$Ip = 0.1\ A$$

$$\frac{Ns}{Np} = \frac{Vs}{Vp}$$

$$\frac{250}{5000} = \frac{Vs}{120}$$

$$20\ Vs = 120$$

$$Vs = 6\ V$$

$$Vp\,Ip = Vs\,Is$$

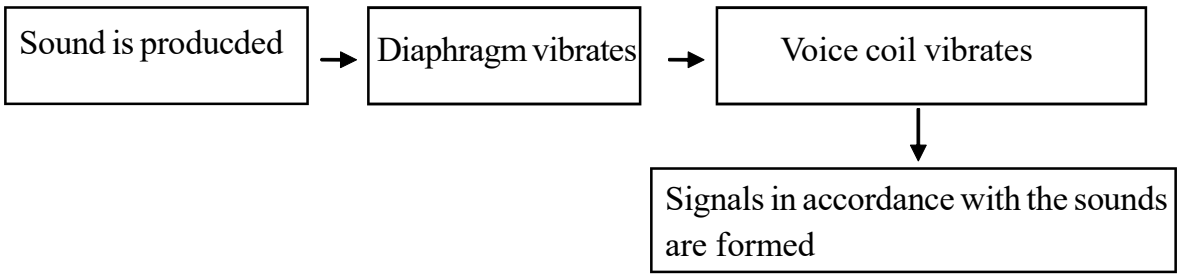
$$120 \times 0.1 = 6\ Is$$

$$Is = \frac{120 \times 0.1}{6}$$

$$= 2\ A$$

Vs = Secondary Voltage
Vp = Primary Voltage
Ns = Number of coils in secondary
Np = Number of coils in primary

Activity 13



Activity 14

a. high voltage transmission
b. Step up transformer
c. Step down transformer
d. Step down transformer
e. 3 lines (11kV)
f. 4 lines (3 phase lines and one neutral line)
g. 400 V
h. 230 V
i. 0 V
j. Phase line, neutral line , earth line
k. Get an electric shock. There is as potential difference of 230 V between phase line and earth.

Activity 15

a. Between watt hour meter and main switch.

b. Watt hour meter

c. Normal switch disconnects the phase line alone. But the main switch disconnects both phase line and neutral line

d. Safety fuse, MCB, ELCB, three pin plug and earthing

e. Safety fuse, MCB, switches

f. Black wire is used as neutral line

Activity 16

a. At the beginning of the house hold circuit.

b. kilowatt hour (kWh).

c. 4 kWh or 4 units

Activity 17

a. Safety fuse , MCB, ELCB, RCCB, earthing and three pin plug

b. MCB – miniature circuit breaker ELCB – Earth Leakage Circuit Breaker

c. If fuse wire melts and breaks the circuit we have to fix a new fuse at each time.

In the MCB we don't have to replace anything as in safety fuse. We can switch on after rectifying the defects.

d. Three pin plug and earthing

If at all the body of electric device comes into contact with an electric connection, electricity flows to the earth through the earth wire. The flow of current to the earth through a circuit of low resistance increases the current. As a result heat generated in the fuse wire increases and the circuit get broken. This ensures the safety of instrument and the person handling it.

Activity 18

a. Energy in kilowatt hour $= \frac{Power\ in\ watt\ x\ time\ in\ hour}{1000}$

b.

Energy consumed by CFL in one hour	$= \frac{10 \times 10 \times 5}{1000} = \frac{500}{1000} = 0.5$ unit
Energy consumed by the fans in one day	$= \frac{60 \times 5 \times 1}{1000} = \frac{300}{1000} = 0.3$ unit
Energy consumed by the electric iron box in one day	$= \frac{500 \times 0.5}{1000} = \frac{250}{1000} = 0.25$ unit

Total energy consumed in one day = 0.5 + 0.3 + 0.25 = 1.05 unit

Total energy consumed in one month = 1.05 x 30 = 31. 50 unit

Total cost of energy at Rs 5 per unit = 31.05 x 5 = Rs 157.50

Activity 19

a. Give first aid only after disconnecting the electric line from the body of person who got an electric shock.

b. As a result of electric shock, the body temperature of the victim decreases, viscosity of blood increases and clotting of blood occurs.

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

d.
- Never handle electric equipments or operate switches when the hands are wet.
- Insert plug pins into socket and withdraw them only after switching off.
- Do not operate devices of high power using ordinary sockets.
- Wear rubber footwear while operating electric devices.
- Do not touch the interior parts of the cable TV adapters.
- Ensure that there is a insulated cover over it.

UNIT 4
REFLECTION OF LIGHT

Concept

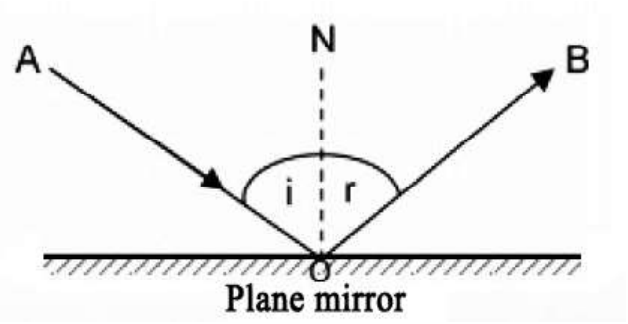
Reflection of light – Laws of Reflection.

To Remember

- Incident ray, reflected ray and normal to the surface are in the same plane.
- Angle of incidence (i) and angle of reflection (r) are equal (i=r)

Activity 1

The figure shows a ray of light (AO) falling on a mirror.



a. Find the following from the mirror.
   (i) Incident ray (ii) Reflected ray (iii) Normal (iv) Angle of incidence
   (v) Angle of reflection
b. Describe the phenomenon reflection of light.
c. State the Laws of Reflection.

Concept

Regular reflection and diffused reflection.

To Remember

Light falling on a smooth surface undergoes reflection. If the surface is rough a clear image will not be formed because the reflected rays will travel in different directions.

Activity 2

A person was looking at his reflection on water. When a leaf fell on water the image became blur. Why?

Concept

Image formation in plane mirror

To Remember

- The image is always virtual.
- The size of the object = size of the image.
- The distance of the object from the mirror = The distance of the image from the mirror.

Activity 3

Draw a diagram to show the image formation in a plane mirror.

Concept

To calculate how many images will be formed if two mirrors are placed at a particular angle.

To Remember

Number of images

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

n = Number of images.

θ = The angle between mirrors.

Activity 4

Calculate the number of images formed when two mirrors are kept at an angle as given below.

a. 30^0 b. 45^0 c. 60^0 d. 90^0 e. 0^0

Activity 5

The details regarding the image formation by a concave mirror are tabulated. Complete the table properly.

Position of the object	Size of the image	Position of the object
Between C and F	a	Beyond C
At C	the same size as that of the object	b . . . . .
Beyond C	c	Between C and F
Between mirror and F	enlarged	d . . . . .

Concept

The method of finding the focal length, distance to the object and distance to the image using New Cartesian sign convention.

To Remember

Use the equation $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ in the following manner as per need.

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

Activity 6

A concave mirror of focal length 20 cm gave an image 30 cm away from the mirror.

a. What is the position of the image?

b. Is the image magnified or diminished?

Activity 7

An object kept 40 cm away from a mirror gave a virtual image 15 cm away. Calculate the focal length of the mirror. Which type of mirror is it?

Activity 8

An object kept 30 cm away from a convex mirror gave an image 15 cm away from the mirror. Where will be the image if the object is placed 40 cm away from the mirror?

Concept

Mirror equation

To Remember

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad \text{or} \quad f = \frac{uv}{u+v}$$

Activity 9

The image of a vehicle coming from behind was seen inside the rear view mirror of a car at a distance 12 m. The distance between the car and the vehicle is 20 m.

a. Which type of mirror is it?

b. Why do we use such mirrors as rear view mirrors?

c. What is the focal length of the mirror?

Concept

Magnification

To Remember

Magnification m $\quad m = \frac{h_i}{h_0}$

Activity 10

When an object of height 6 cm was placed 8 cm away from a concave mirror, a real image was formed 16 cm away from the mirror.

a. What is the height of the image?

b. Calculate the magnification of the image.

Activity 11

An object of height 6 cm placed 30 cm away from a spherical mirror gave a real image 20 cm away from the mirror.

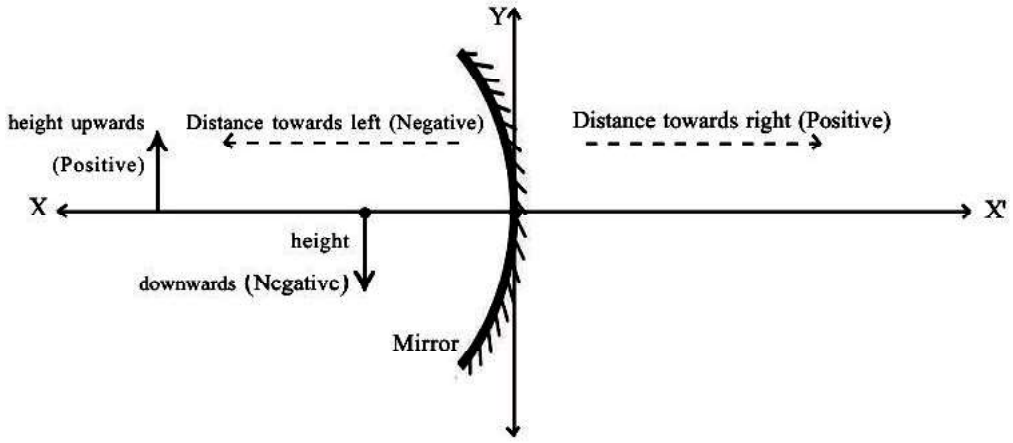
a. What is the height of the image?

b. What is the focal length of the mirror?

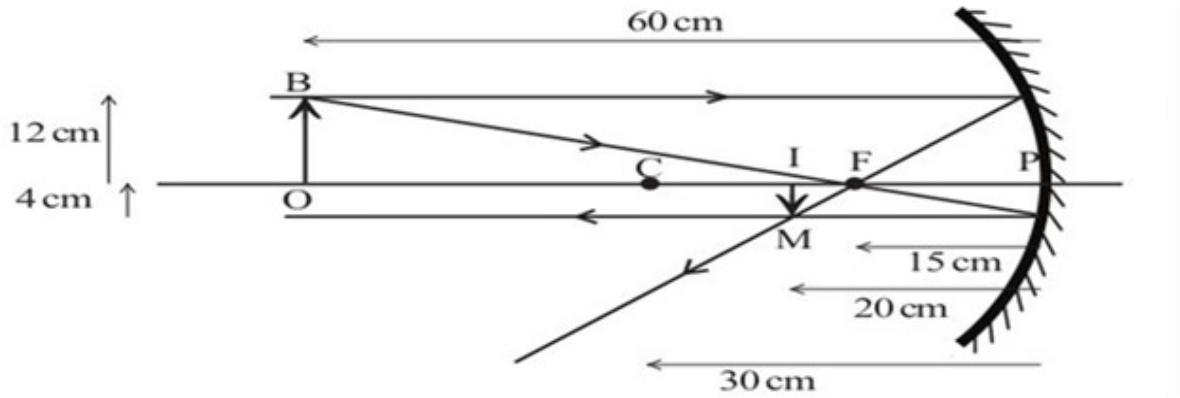
Concept

New Cartesian sign convention

To Remember



Activity 12



Distance of object from the mirror, (u)	-60 cm
Distance of image from the mirror, (v)	
Focal length (f)	
Radius of curvature (r)	-30 cm
Height of object (OB)	+12 cm
Height of image (IM)	

UNIT 4
REFLECTION OF LIGHT
ANSWER KEY

Activity 1

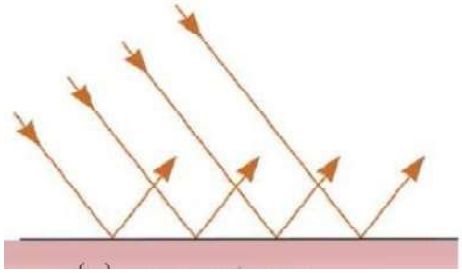
a) i) AO ii) OB iii) ON iv) <AON v) <NOB

b. Light falling on the surface of an object and coming back to the same medium is the reflection of light.

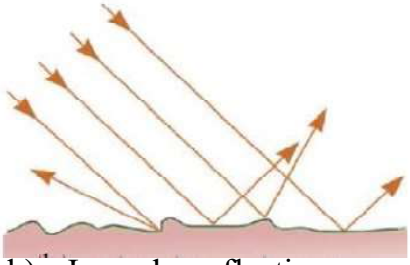
c. The incident ray reflected ray and the normal to the surface are always in the same plane.
Angle of incidence(i) = angle of reflection (r) ie i = r

Activity 2

The non disturbed water acts like a plane mirror. The light incident on it undergoes regular reflection. When water is disturbed, light undergoes scattered reflection. A clear image will not be obtained.

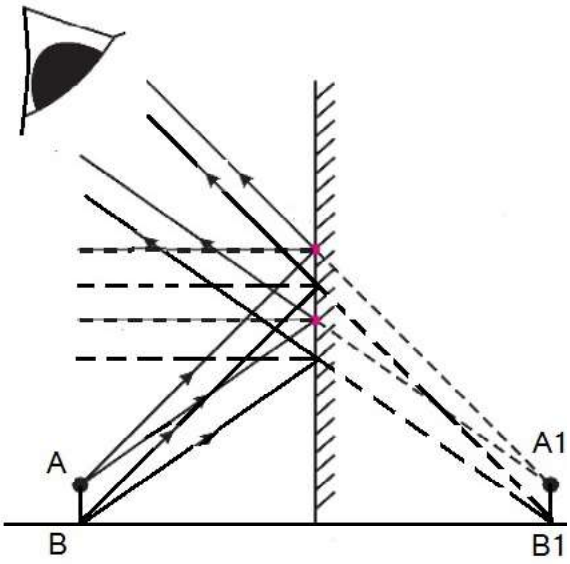


a) Regular reflection



b) Irregular reflection (scattered reflection)

Activity 3



Draw two rays of light from a point to the mirror. Draw their reflected rays backwards. The point at which the reflected rays meet gives the image.

Activity 4

a. 11 b. 7 c. 5 d. 3

e. If the mirrors are placed parallel, infinite number of images is are formed.

Activity 5

a. The image is magnified.

b. Image is at C

c. The image is diminished

d. Virtual image, behind the mirror.

Activity 6

a. $u = \frac{vf}{v-f} = \frac{-30x-20}{-30--20} = +\frac{+600}{-10} = -60cm$

b. The image is diminished. The object is beyond 2 F

Activity 7

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

u = - 40 cm

v = + 15 cm

$$f = \frac{uv}{u+v} = \frac{-40x(+15)}{-40+(+15)} = \frac{-40x15}{-25} = +24cm$$

The mirror is convex because the focal length is positive.

Activity 8

u = -30

v = +15

$$f = \frac{uv}{u+v} = \frac{-30x(+15)}{-30+(+15)} = \frac{-450}{-15} = +30cm$$

u = -40

v = ?

$$v = \frac{uf}{u-f} = \frac{-40x+30}{-40-+30} = \frac{-1200}{-70} = +17.1\,cm$$

Activity 9

a. Convex mirror

b. The image given by a convex mirror is always diminished, virtual and erect. A convex mirror has a wide field of view. Hence a convex mirror is used in vehicles as rear view mirror.

c. u = -20 m, v = +12 m

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

$$= \frac{-20\,x + 12}{-20 + 12}$$

$$= \frac{-240}{-8}$$

$$= +30 \text{ m}$$

Activity 10

a. $h_0 = +6$ cm u = -8 cm v = -16 cm

$$\frac{h_i}{h_o} = \frac{-v}{u} \qquad \frac{h_i}{+6} = \frac{-(-16)}{-8}$$

h_i = -6 x 2 = -12 cm

b. $$m = \frac{h_i}{h_o}$$

$$= \frac{-12}{6} = -2$$

Activity 11

u = - 30 cm

v = -20 cm, h_0 = +6 cm

a) $$m = \frac{-v}{u} = \frac{-(-20)}{-30} = -\frac{2}{3}$$

$$m = \frac{hi}{h_0} = -\frac{2}{3}$$

$$h_1 = \text{mho} = -\frac{2}{3}x + 6 = \text{- 4 cm}$$

b) $$f = \frac{uv}{u+v} = \frac{-30x - 20}{-30 + -20} = \frac{+600}{-50} = \text{- 12 cm}$$

Activity 12

u = -60 cm

v = -20 cm

f = - 15 cm

r = - 30 cm

h_0 = +12 cm

h_1 = - 4 cm

UNIT 5
REFRACTION OF LIGHT

Concept

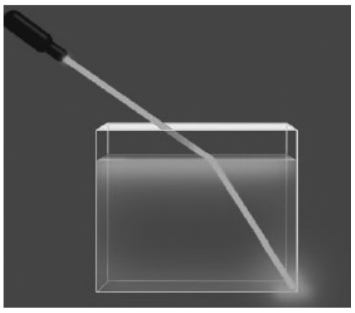
Relation between speed of light and the optical density.

To Remember

- The speed of light is different in different medium.
- The characteristics of a medium influences the speed of light in the medium.
- Optical density is a measure that shows how a medium influences the speed of light passing through it.
- The speed of light decreases with increase in the optical density of the medium.
- The optical density is not at all related to the material density.

Activity 1

Examine the figure given and answer the questions. The light from a laser torch is passed through water in a beaker.



a. What happens to the path of light?
b. Through which mediums does light travel?
c. Which is the phenomenon behind the deviation of light?
d. Explain the phenomenon.

Activity 2

Analyse the given table and answer the following questions.

Medium	Speed of light (m/s)
Vacuum	3×10^8 m/s
Water	2.25×10^8 m/s
Glass	2×10^8 m/s (*approximately*)
Diamond	1.25×10^8 m/s

a. Which are the medium with the highest and lowest speed of light?

b. What is the speed of light in water?
c. Write down the given media in the descending order of the speed of light.
d. What do you mean by optical density?
e. What is the relation between speed of light and the optical density?

Activity 3

Examine the figure given and answer the questions.

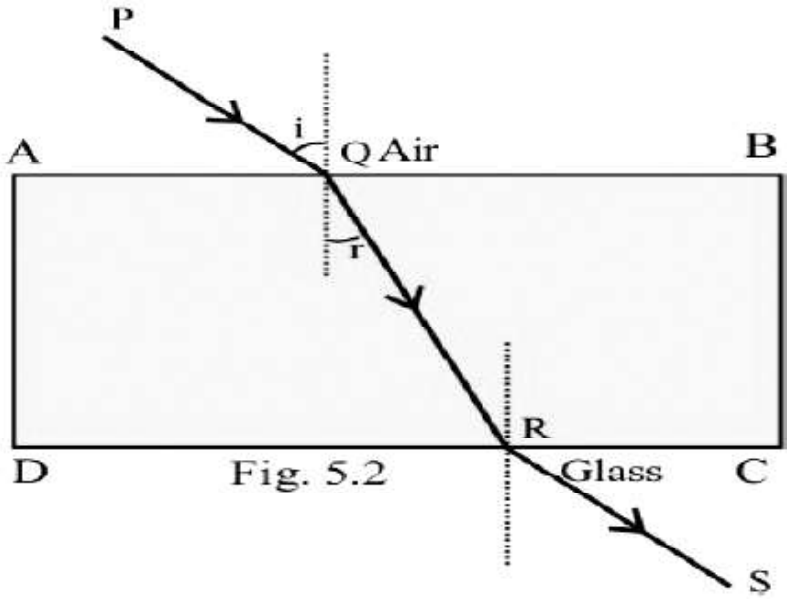


Fig. 5.2

a. Which is the incident ray at CD?
b. Which are the refracted rays?
c. What do "i" and "r" indicate?
d. If the angle between the incident ray and the normal is the angle of incidence, then what is angle of refraction?

Activity 4

Observe the figure.

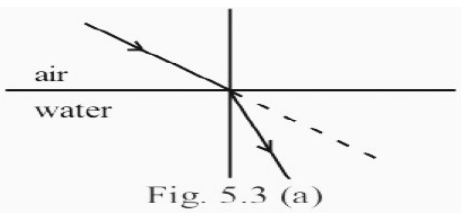


Fig. 5.3 (a)

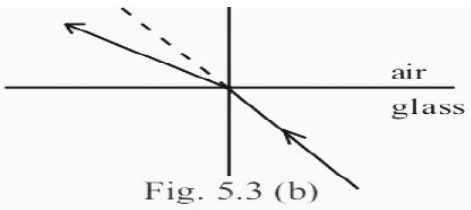


Fig. 5.3 (b)

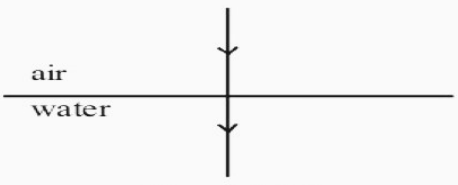


Fig. 5.3 (c)

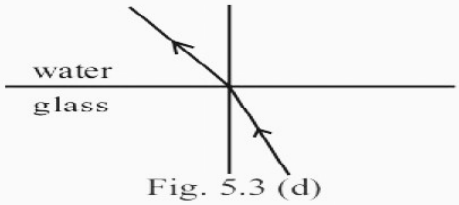
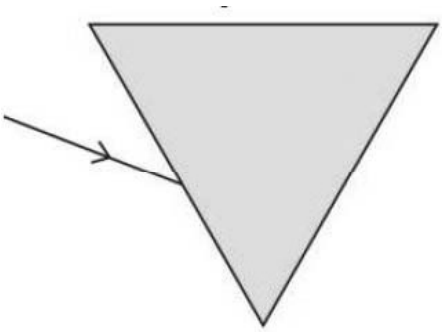


Fig. 5.3 (d)

a. Which figure indicates the path of a ray of light from air to water?
b. Which figure indicates the path of a ray of light from glass to water?
c. In which figure do the refracted ray of light deviate away from the normal?
d. In which figure do the refracted ray of light deviate towards the normal?

Activity 5

The figure shows the path of light from a laser torch passing through a prism. Complete the figure by drawing it.



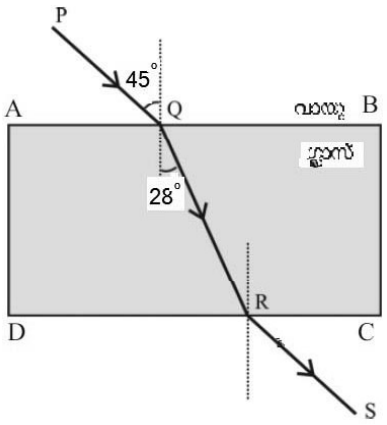
Concept

Refractive index

To Remember

- Laws of refraction
  - ✶ The angle of incidence, the angle of refraction and the normalat the point of incidence on the surface of separation of the two media will always be in the same plane.
  - ✶ The ratio of the sine of the angle of incidence to the sine of the angle of refraction $\frac{\sin i}{\sin r}$ will always be a constant. The constant from Snell's Law is known as refractive index. $n = \frac{\sin i}{\sin r}$
  - ✶ The refractive index of one medium with respect to another is called relative refractive index.
  - ✶ The refractive index of a medium with respect to vacuum is called absolute refractive index.

Activity 6



a. What is the angle of incidence at AB?
b. What is the angle of refraction here?
c. Calculate the refractive index of glass if sin 45 = 0.7 and sin 28 = 0.47
d. What is the difference between the relative refractive index and absolute refractive index?

Activity 7

Match the following.

Refraction	The refracted ray passes along the surface of the surface of separation	dioptre
Total internal reflection	Speed of light	Optical density
Power	Virtual image	Endoscope
Critical angle	$\frac{I}{f}$	Image is not formed on the screen
Concave lens	Optical fibre	The angle of incidence at the instant of giving 90^o as the angle of refraction.

Concept

Lenses, technical terms, image formation, ray diagram, characteristics of a ray diagram.

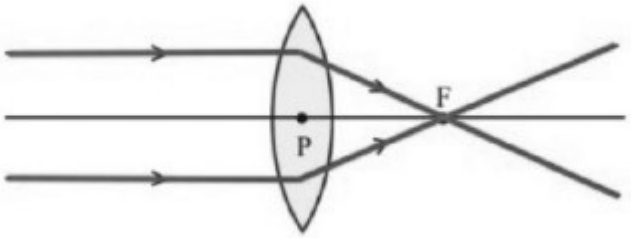
To Remember

- Optice Centre: Optic Centre is the mid point of a lens (P).
- Cenre of Curvature: A lens has two spherical surfaces as parts of the lens. Centre of curvature (C) is the centre of the imaginary spheres of which the sides of the lens are parts.
- Principal Axix : Principal axis is the imaginary line that passes through the optic centre joining the two centres of curvature.
- Principal Focus: Light rays incident parallel and close to the principal axis after refraction converges to a point on the principal axis of a convex lens. This point is the principal focus of a convex lens.

Position of object	Position of image	Characteristics and size of the image		
		Real/ virtual	erect/ inverted	Enlarged/diminished/ same as that of the object
1. At infinity	At F	Real	inverted	diminished
2. Beyond 2 F	between F and 2 F	Real	inverted	diminished
3. At 2 F	At 2 F	Real	inverted	same as that of the object
4. Between F and 2 F	Beyond 2 F	Real	inverted	Enlarged
5. At F	At infinity	Real	inverted	Highly enlarged
6. Between the lens and F	On the same side of the object	Virtual	erect	enlarged

Ray diagrams of the image formation by a convex lens.

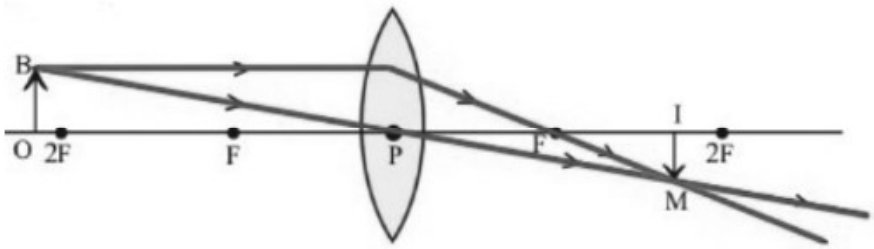
1. Object at infinity



Characteristics of the image

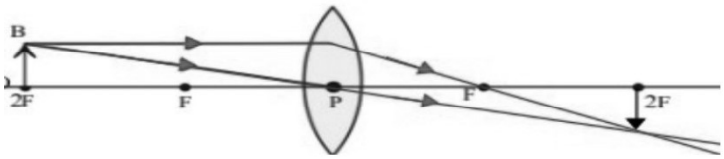
Position of the object : at infinity
Position of the image : at F
Nature of the image : Real, inverted
Size of the image : Pointed (diminished)

2. Object beyond 2F



Characteristic of image position of object beyond 2F position of image between find nature of image: Red, 2 F inrested size of image: diminished.

3. Object 2F

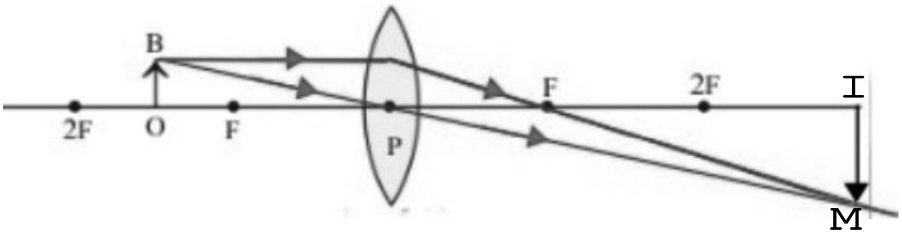


Characteristic of image position of object: at 2 F positive of image: at 2 F ..... of image: red, inrested size of the image.

Characteristics of the image

Position of the image : at 2F
Nature of the image : Real, inverted
Size of the image: Equal Size

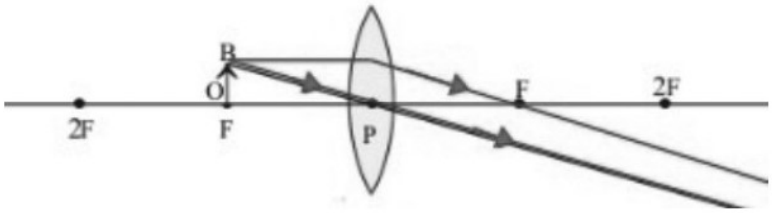
4. Object between F and 2F



Characteristics of the image

Position of the object: Beyond 2 F
Nature of the image : Real, inverted
Size of the image: Magnified

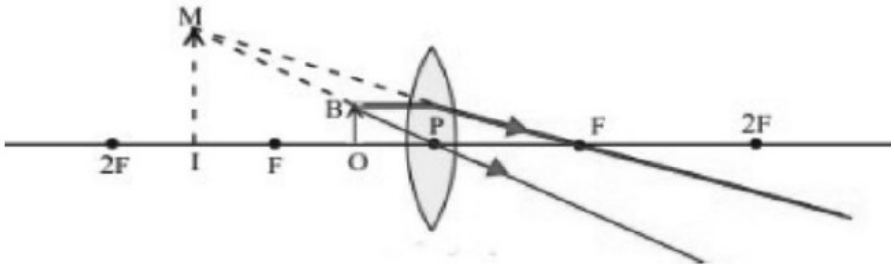
4. Object F



Characteristics of the image

Position of the object: At F
Position of the image: At infinity
Nature of the image: Real, inverted
Size of the image: Highly magnified

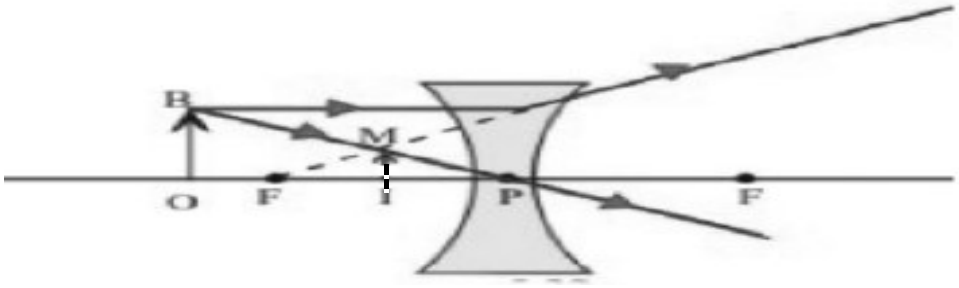
6. Object between F and the lens



Characteristics of the image

Position of the object: Between F and the lens
Position of the image: Behind the object
Nature of the image: Virtual, erect
Size of the image: Magnified

Ray diagram of the image formation by a concave lens



Characteristics of the image

Position of the image : between F and P
Nature of the image : Virtual, erect
Size of the image : Diminished

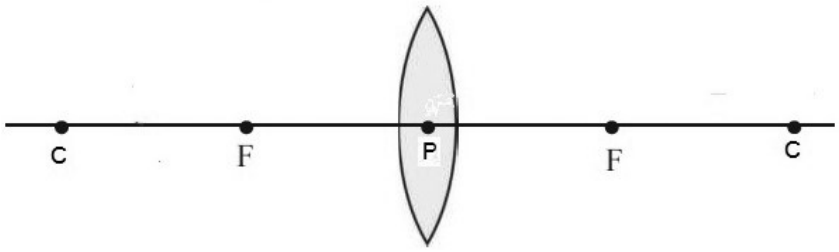
Activity 8

On placing an object of height 2 cm at a distance 20 cm away from a lens a real image was formed at a distance 40 cm.

a. What is the height of the image?
b. Which type of lens is this?
c. What are the other characteristics of the image?

Activity 9

Observe the figure.



a. What does each of the following letters stand for?

C : .....
F : .....
P : .....

b. What do you mean by principal axis?
c. What do you mean by principal focus of a convex lens?
d. Is the principal focus of a concave lens virtual or real?

Concept

New Cartesian Sign Convention

To Remember

- All distances are to be measured by considering the optical centre as the origin.
- All distances are to be measured from the origin (Optic centre).
- Light ray is conceived as travelling form left to right. Those measured in the direction of light is considered positive and those in the opposite direction is considered negative.
- Distances upward form the x – ray is positive and down wards are negative.

Inferences

1. u – Always negative
2. v – Positive if image is real and negative if image is virtual.

3. f - Positive in the case of a convex lens and negative in the case of a concave lens

4. h_o – Always positive

5. hi - Negative if image is real and positive if image is virtual.

1. The lens equation is $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

From this we get

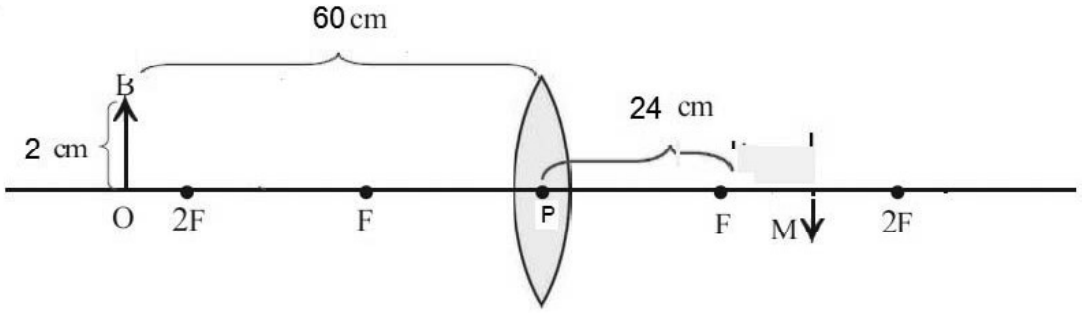
$$f = \frac{uv}{u - v}$$

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

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

Activity 10

a. Observe the figure and write down the values of u, f and h_o in accordance with the New Cartesian Sign Convention



u : .....

f : .....

h_0 : .....

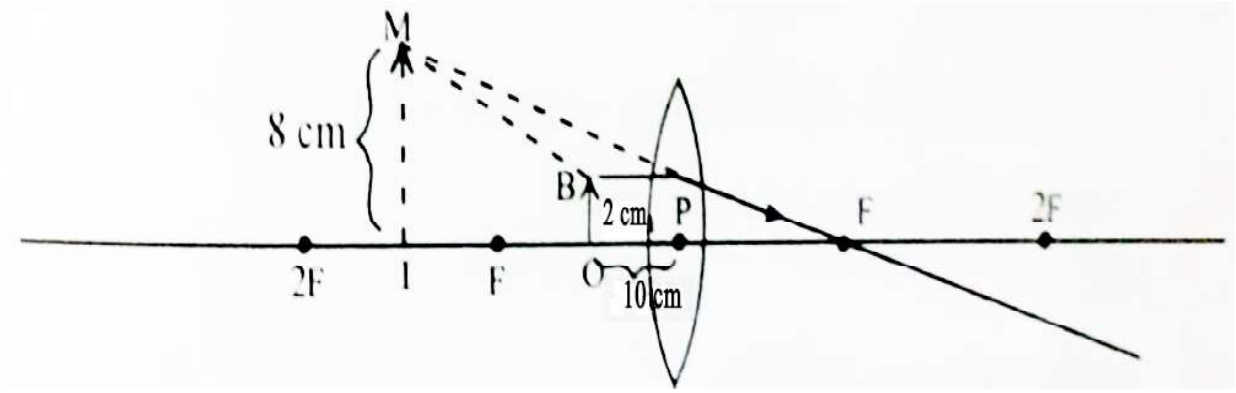
b. Calculate the distance to the image based on the figure.

c. Calculate the height of the image.

Activity 11

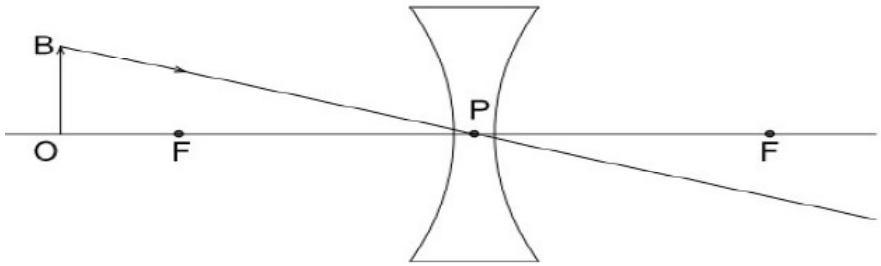
A real image is formed at distance 20 cm away from a convex lens of focal length 12 cm. Calculate the distance to the object.

Activity 12



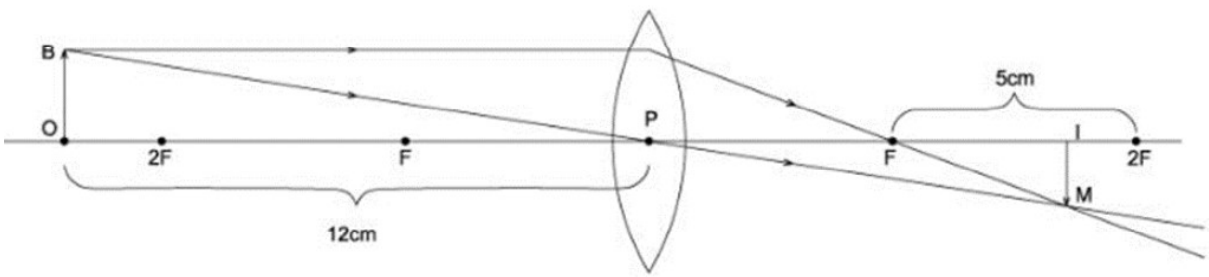
a. Calculate the magnification of the image in the figure.
b. Is the magnification positive or negative here?
c. What is the distance to the image?
d. What are the other characteristics of the image?

Activity 13



a. The ray diagram showing the image formation is given. Complete the figure.
b. Which type of lens is it?
c. What is the position of the image in the figure?
d. What are characteristics of the image in the figure?
e. Which type of lens gives a real image?
f. What should be the position of the object to get an image of the same size as that of the object?
g. At what position of the object will this lens give a virtual image?

Activity 14



a. What is the focal length of the lens?
b. Write down the value of u including the sign
c. Is the value of v positive or negative? Why?
d. (Find the distance to the image.

UNIT 5
REFRACTION OF LIGHT
Answer Key

Activity 1

a. The ray undergoes a deviation at the surface of separation.
b. Air, water
c. Refraction
d. Refraction of Light : When a ray of light entering obliquely from one transparent medium to another, its path undergoes a deviation at the surface of separation. This is refraction. It is the difference in the optical densities that causes the deviation

Activity 2

a. The medium of higher speed : Air/vacuum.
   The medium of lower speed : Diamond
b. 2.25×10^8 m / s
c. Diamond, glass, water, air
d. Optical density is a measure that shows how a medium influences the speed of light passing through it.
e. The speed of light decreases with increase in the optical density (Inversely proportional)

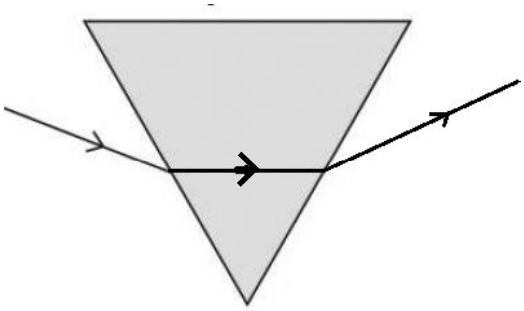
Activity 3

a. QR
b. QR, RS
c. i- angle of incidence
   r - angle of refraction
d. The angle between refracted ray and the normal

Activity 4

a. Figure 5.3 (a) Figure 5.3 (c)
b. Figure 5.3(d)
c. Figure 5.3(b) Figure 5.3(d)
d. Figure 5.3(a)

Activity 5



Activity 6

a. 45^0

b. 28^0

c. $n = \frac{\sin i}{\sin r}$

$= \frac{\sin 45}{\sin 28}$

$= \frac{0.7}{0.47} = 1.5$

d. The refractive index of one medium with respect to another is called relative refractive index.
The refractive index of a medium with respect to vaccum is called absolute refractive index.

Activity 7

Refraction	Speed of light	Optical density
Total internal reflection	Optical fibre	Endoscope
Power	$\frac{I}{f}$	dioptre
Critical angle	The refracted ray passes along the surface of the surface of separation.	The angle of incidence at the instant of giving 90^o as the angle of refraction.
Concave lens	Virtual image	Image is not formed on the screen

Activity 8

a.

u= -20 cm
v=+40 cm
h_o=2 cm
magnification m=v/u=40/-20= -2
$h_i = m \times h_o$
$= - 2 \times 2$
$= - 4$ cm

b. The magnification is negative. Hence the image is real. The lens is convex.

c. Enlarged image. Real, inverted

Activity 9

a.

C : Centre of curvature.

F : Principal focus

P : Optic centre

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

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

d. The principal focus of a concave lens is virtual.

Activity 10

a.

u : - 60 cm

f : + 24 cm

h_0 : + 2 cm

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

$$v = \frac{uf}{u+f} = \frac{-60x24}{-60+24} = \frac{-1440}{-36} = +40cm$$

c. h_o : 2cm

u : -60 cm

v : +40 cm

$$\frac{v}{u} = \frac{hi}{h0}$$

$$\frac{+40}{-60} = \frac{hi}{2}$$

$$h_i = \frac{+40x2}{-60} = -1.33cm$$

Activity 11

f : +12cm

v : +20 cm

u : ?

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

$$= \frac{+12x+20}{(+12-+20)} = \frac{240}{-8} = \text{- 30 cm}$$

Activity 12

a. h_o=+2cm

h_i=+8cm

$$m = \frac{hi}{ho} = \frac{+8}{+2} = +4$$

b. Magnification is positive

c. m =+4cm

u = - 10 cm

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

$$+4 = \frac{v}{-10}$$

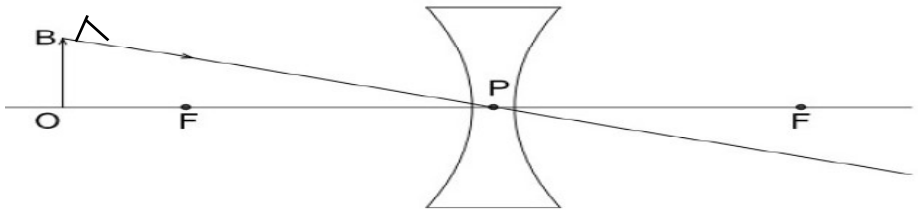
v = +4 x -10 = -40 cm

The image is 40 cm away from the lens on the same side as that of the object.

d. The image is enlarged, virtual and erect.

Activity 13

a.



b. Concave

c. Between F and P

d. Diminished, virtual and erect

e. Convex

f. At 2 F

g. Between F and P Or between lens and F

Activity 14

a. +5 cm

b. u = -12 cm

c. distance measured in the same direction as that of the incident ray is positive.

d. $$V = \frac{uf}{u+E} = \frac{-12 \times 5}{-12+5} = \frac{-60}{-7} = 8.57cm$$

UNIT 6
VISION AND THE WORLD OF COLOURS

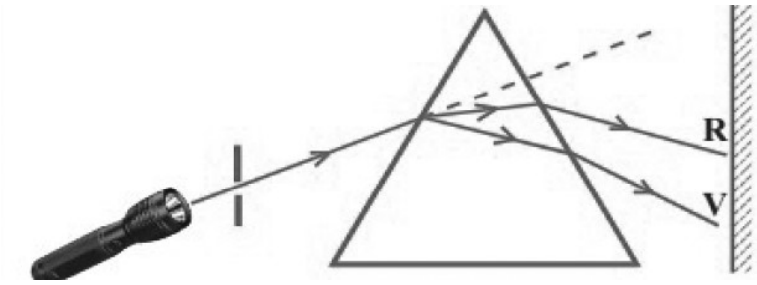
Concept

Dispersion of light.

To Remember

- Any light that is composed of more than one colour is a composite light.
- Dispersion is the phenomenon of splitting up of a composite light into its constituent colours.
- The regular array of colours formed by dispersion is the visible spectrum.

Activity 1



a. Which are the colours formed on the screen?
b. Aren't these colours the same as the component colours obtained from the sunlight?
c. Name the phenomenon.
d. Which colour deviates the most due to dispersion?
e. Which colour deviates least?
f. What is the relation between deviation and wavelength of colours?

Concept

How do we see things? Which are the main parts of the eye?

To Remember

The main parts of the eye are iris, pupil, lens and retina

Activity 2

How do we see things? Describe with the help of a figure.

Concept

Terms related to the vision of the eye.

To Remember

Near point, far point

Activity 3

Describe the terms near point and far point are.

Activity 4

What do you mean by power of accommodation?

Activity 5

What do you mean by hypermetropia (long-sightedness) ? What are the reasons for this defect? Suggest remedy for it.

Activity 6

What do you mean by myopia (near-sightedness) ? What are the reasons for this defect? Suggest remedy for it.

Activity 7

What is the unit of power? How will you differentiate lenses based on the power?

Activity 8

What do you mean by presbyopia?

Activity 9

How can you make the dispersed light from a prism to recombine?

Concept

Recombination of colours

To Remember

Any light which is composed of more than one colour is a composite light.

Activity 10

Teacher demanded you to design an experiment for the recombination of colours.

a. Write down the experiment in brief.
b. What will be your observation?

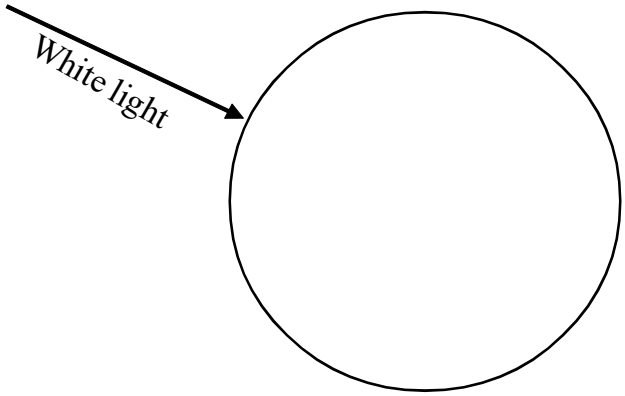
Concept

Formation of rainbow

To Remember

Sunlight, when it passes through water droplets, undergoes refraction and internal reflection. The light ray emerging from the water droplets which make the same angle with the line of vision have the same colour. These droplets appear in the form of an arc of a particular colour. Thus there is red colour at the upper edge and violet colour at the lower edge. All the other colours are seen in between, depending on their wavelengths.

Activity 11



a. Complete the diagram.
b. What change happens to the incident ray?
c. What is the colour seen on the outer edge of a rainbow?
d. What is the shape of a rainbow when it is viewed from an aeroplane flying at a height?
e. Where will be the Sun when a rainbow is seen in the east?
f. What is the colour seen on the inner edge of a rainbow?

Concept

Persistence of vision

To Remember

When a object is viewed by a person, its image remains in the retina of the eye for a time interval of 0.0625s (1/16s) after seeing it. This phenomenon is called persistence of vision. If more than one scene is viewed within 0.0625s, the effect of all these scenes will be felt by the eye simultaneously.

Activity 12

When a burning incense stick is whirled rapidly we see a ring of fire.

a. Which peculiarity of the eye is behind this vision?
b. Explain the phenomenon.

Concept

If the seven colours of light is suitably mixed we will get white light.

To Remember

Newton's colour disc will appear white if it made to rotate fast after painting all the colours of white light in it.

Activity 13

Why does the Newton's colour disc appear white when rotated fast?

Concept

Scattering of light

To Remember

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

Activity 14

Light travels in straight line. Still we get sunlight in the interior of our house. What may be the reason?

Activity 15

A teacher asked you to design an experiment to prove the scattering of light.

a. List out the materials needed.
b. Write down the experiment in brief.

Concept

If the seven colours of light is suitably mixed we will get white light.

To Remember

The blue part with shorter wavelengths has more scattering. The sky appears blue because the blue part is spread out by scattering.

Activity 16

The sky appears blue. The rising and setting sun appears red. Give reasons.

Activity 17

What do you mean by tyndall effect?

Concept

The relation between scattering and wavelength of colours.

To Remember

Rate of scattering and the size of the particles are interrelated. As the size of the particle increases, the rate of scattering also increases. If the size of the particles is greater than the wavelength of light, then the scattering

Activity 18

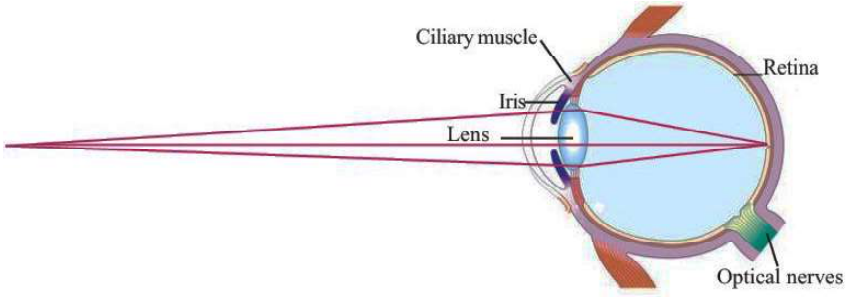
Write down the name of component colours of white light in the ascending order of scattering.

UNIT 6
VISION AND THE WORLD OF COLOURS
Answer Key

Activity 1

a. Violet, Indigo, Blue, Green, Yellow Orange. Red
b. Yes
c. Dispersion
d. Violet
e. Red
f. The deviation decreases as the wavelength increases

Activity 2



Light from a point source reaches the lens through the pupil in the center of the iris, and the lens focuses them on the retina. Photoreceptor cells in the retina receive them and send them to the brain via nerves. At this time we feel that we have seen things.

Activity 3

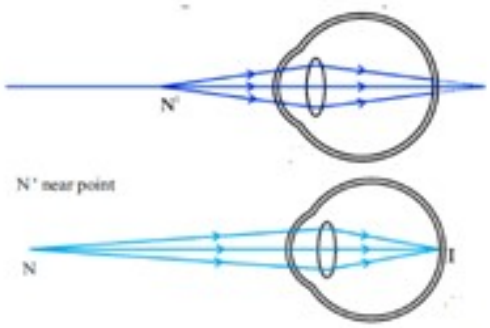
Near point is the nearest point at which the objects can be seen distinctly. The near point of an eye with healthy vision is 25 cm.

Far point is the farthest point at which the objects can be seen distinctly. The far point of an eye with healthy vision is at infinity.

Activity 4

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

Activity 5



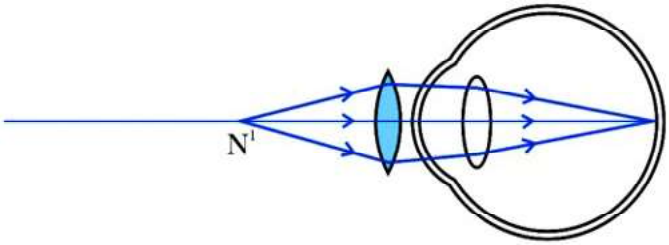
Distant objects can be seen clearly. But the image of near object will not be formed on the retina. Hence the image will not be clear.

Reasons:

1. The size of the eye ball is less for the power of the lens
2. The power of lens is less for the size of the eye ball.

Remedy:

Use a convex lens of suitable power.



Activity 6

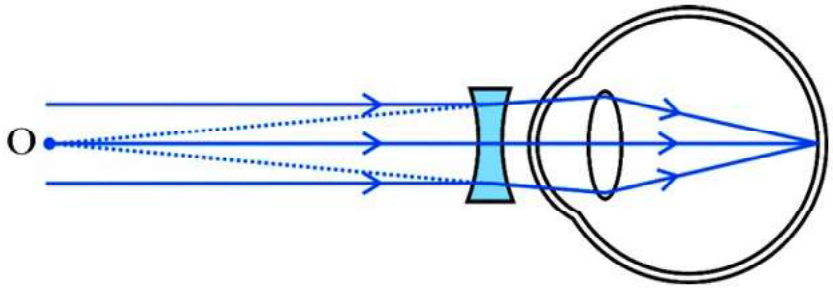
For some persons, even though nearby objects can be seen clearly, they may not be able to see distant objects clearly. This defect is the nearsightedness. The near point of such persons will not be at infinity. It will be at a definite distance from the eye.

Reasons:

1. The size of the eye ball is more for the power of the lens
2. The power of the lens is more for the size of the eye ball.

Remedy

Use a concave lens of suitable power.



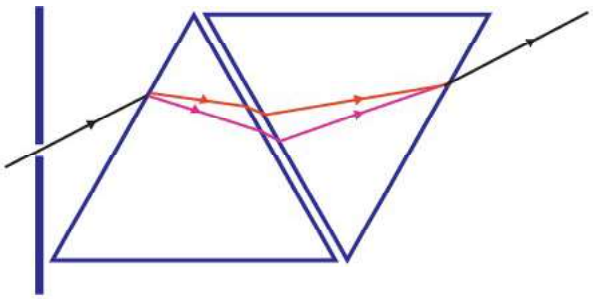
Activity 7

The unit of power is dioptre.
If power is positive then the lens is convex.
If power is negative then the lens is concave.

Activity 8

The distance to the near point increases with increase in age. This is due to the reason that the muscles get relaxed with increase in age.

Activity 9



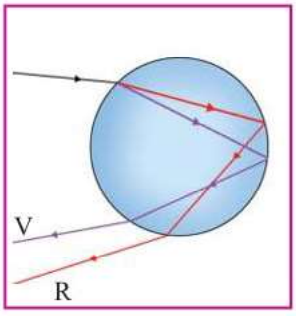
Place another inverted prism close to the first prism in the path of the dispersed light from a prism. The second prism must be similar to the first one. In the second prism those with higher wavelength reach near the base and those with lower wavelengths near them. In the first prism the colours get separated according to their wavelengths. In the second prism they get recombined.

Activity 10

a. Pass white light through a prism. Allow the component colours to fall on a screen. Bring another prism in an inverted way in the path of the dispersed light. The base must be upright.
b. The white light splits up into its component colours. When the second prism is placed close to the first one the light emerging from it is white light.

Activity 11

a.



b. The sunlight undergoes refraction and internal reflection on passing through the water drop.
c. Red
d. In circular shape
e. West
f. Violet

Activity 12

a. Persistence of vision
b. When an object is viewed by a person, its image remains in the retina of the eye for a time interval of 0.0625s (1/16 s) after seeing it. This phenomenon is the persistence of vision. If more than one scene is viewed within 0.0625s, the effect of all these scenes will be felt by the eye simultaneously.

Activity 13

Newton's colour disc is made by painting the constitutent colours of white light in the same order and proportion as in sunlight. The disc appears white since all the rays of light from the seven colours reach the retina of the eye within 0.0625 second (1/16 s). The disc appears white due to persistence of vision.

Activity 14

This is due to scattering of light.

Activity 15

a. Beaker, torch, sodium thio sulphate, hydrochloric acid, screen
b. Water is taken in a beaker. Allow light from a torch to fall on the water from one side of the beaker. The light emerging from the beaker is focussed on a white screen. Sodium thiosulphate is dissolved in water in the beaker at the rate of 2g per litre. Add one or two drops of hydrochloric acid to the water in the beaker. Observe the gradual change in the colour of light in the solution and on the screen.

Activity 16

When sunlight travels through the atmospheric particles like air molecules, dust etc., it undergoes scattering. Colours of shorter wavelengths scatter more. Blue is predominant among these. They appear as if spread in the entire atmosphere.

During sunrise and sunset, light reaching us from the horizon has to travel long distances through the atmosphere. During this long journey, colours of shorter wavelength would bealmost fully lost due to scattering. The, the red light which undergoes only less scattering decides the colour of the horizon. That is why the sun appears red during sunset and sunrise.

Activity 17

When rays of light pass through a colloidal fluid or suspension, the tiny particles get illuminated due to scattering. Because of this, the path of light is made visible. This phenomenon is Tyndal effect.

As the size of the particles increase, the rate of scattering also increases. During fogy times we can see a clear path of sunlight rays coming through gaps of the braches can be seen clearly.

Activity 18

Red, Orange, Yellow, Green, Blue, Indigo, Violet.

UNIT 7
ENERGY MANAGEMENT

Concept

To Remember

1. **Complete Combustion :** Fuels burn with the help of oxygen. Generally, complete combustion is a reaction in which fuels react intensively with oxygen, producing carbon dioxide, steam, heat and light.

2. **Complete Combustion :** If sufficient oxygen is not available, the rate of combustion decreases. If oxygen is not sufficient, large quantities of carbon monoxide, soot and a little of carbon dioxide will be formed. This type of burning is partial combustion.

Activity 1

When wet dry leaves were heaped and burned, excess of smoke was formed.

a. Which type of burning is this?
(complete combustion, partial combustion)
b. What characteristics should a fuel possess to undergo complete combustion?
c. What are the characteristics of complete combustion?
d. What are problems in partial combustion?

Concept

Fossil fuels - coal, petroleum, CNG, LNG, LPG

To Remember

Fossil fuel:-

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

Coal:-

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

Petroleum:-

The products obtained from fractional distillation of petroleum are petrol, diesel, kerosene, naphtha, paraffin wax, grease.

Natural gases (CNG, LNG):-

- Liquefied natural gas (LNG) and compressed natural gas (CNG) from the natural gas are also obtained along with petroleum.
- The main component of all these is methane.
- These are used as fuels in vehicles, industries and thermal power stations.
- The importance of LNG is that natural gas can be liquefied and transported to distant places conveniently. It can again be converted into gaseous form at atmospheric temperature and distributed through pipe lines.

LPG : -

- The expanded form of LPG is liquefied petroleum gas.
- This is a colourless, odourless gas obtained through the fractional distillation of petroleum.
- Domestic LPG produces an odour since ethyl mercaptan is added as an indicator to detect gas leakage.
- The main constituent of LPG is butane

Activity 2

a. Which are the products obtained from fractional distillation of petroleum?

b. Classify the following fuels into solid, liquid and gas?

(Firewood, Petrol, naphtha, Ammonia, Kerosene, Coke, LNG, Nuclear fuel, Biogas)

c. Match the following.

LPG	Methane
CNG	Coke
COAL	Ethyl mercaptan

Concept

Calorific value, hydrogen, fuel cell

To Remember

1. The amount of heat liberated by the complete combustion of 1 kg of fuel is its calorific value. Its unit is kilojoule/kilogram.
2. Hydrogen fuel cell is a cell formed using hydrogen and oxygen.

Activity 3

The calorific value of fuel is 55,000 kJ/kg

a. What do you mean by calorific value?

b. Which is the fuel with the highest calorific value?

c. What is the energy given out when 2 kg fuel burns completely?

d. Hydrogen is not used as a domestic fuel. Why?

e. Which are the gases used in a hydrogen fuel cell?
f. What are characteristics of a good fuel?

Concept

Different types of power stations

To Remember

1. **Hydro Electric Power Station:** Water stored at a height is allowed to flow down through a penstock pipe. The energy of the flowing water is used to rotate the turbine and electricity is generated. In this potential energy changes into electrical energy.

2. **Thermal Power Station:** Fuel like coal, naphtha, lignite etc., are ignited. The heat energy thus liberated is used to convert water into steam at high temperature and pressure. The pressure of steam is used to rotate the turbines to generate electricity.

Activity 4

Power stations are the centres where electricity is generated on a large scale.

a. Which are the different types of power stations?
b. How do we get the energy needed for the working of hydro electric power station?
c. Which are the hydroelectric power stations in Kerala?
d. Which are the fuels commonly used in thermal power stations?
e. Write down the energy change in a thermal power station.

Concept

Making use of solar energy

To Remember

1. We use solar cells to convert solar energy into electrical energy. A solar panel is made by using a large number of solar cells. The power plants in which electricity is generated on a large scale using solar panels is known as Solar Voltaic Power Plants (SPV).
2. Solar cooker, solar water heater etc are devices that make use of solar energy directly.
3. By using solar energy we can convert water into steam. Using this steam we can drive a turbine which in turn can make a generator work and produce electricity. Such power plants are the solar thermal power plants.

Activity 5

Solar cell is a device that can convert solar energy into electrical energy.

a. What is name of the process of producing electricity by a solar cell?
b. Which is the electronic component used for it?
c. What is the relation between a solar cell and a solar panel?
d. Which are the situations in which solar panels are made used?

Activity 6

a. Which are the adaptations that we can use to make use of the heat energy in the solar energy?
b. Explain the structure of a solar cooker.
c. Why is the interior of a solar cooker painted black?
d. What are the limitations of a solar cooker?
e. By what name is the power plants producing electricity by using the heat energy in solar cell energy?

Concept

L P G and Safety

To Remember

LPG is a gas that easily catches fire. Even a very small spark produced while switching on or off an electric switch can lead to a big explosion. LPG is denser than air. Hence it goes down.

- Examine the rubber tube at regular intervals and ensure that it does not have a leakage.
- Turn on the knob of stove only after the regulator is turned on.
- Always store the LPG cylinder in an upright position and away from other combustible and flammable material.
- Check for gas leaks regularly by applying soap solution on cylinder joints and suraksha pipes.
- If you are convinced that there is a gas leakage, disconnect electricity from outside the home (switch off the main switches).
- Switch off the regulator and shift the cylinder to an empty space.
- Keep the windows and doors open.
- Request help from the Fire Force by calling the toll free number 101.
- Well trained rescue operators can put out the fire by covering the top end of the cylinder with wet sack to prevent the contact with oxygen.
- If the fire is in flat or the top storey, then one should not try to escape using lifts. Only staircase should be used.
- Cover the nose and the mouth with soft cloth to avoid the intake of smoke or gases.

Activity 7

a. We should never switch on or switch off electrical switches if there is a leakge in LPG. Why?
b. Will LPG go up or go down when there is leakage of LPG? Why?
c. What are the precautions to be taken to avoid accidents due to leakage of LPG?
d. What should be done if gas leakage is detected or if fire is spread on a cylinder?

Concept

Green energy, Brown energy

To Remember

Green Energy/Clean Energy

- Green energy is the energy produced from natural sources that does not cause environmental pollution.
- All the energy produced from renewable sources belong to this category.
- The renewable sources like solar energy, wind energy, energy from waves and energy from biomass are considered as green energy.
- This is also referred to as clean energy.
- The energy produced from non renewable sources such as petroleum and coal, and the nuclear energy are named brown energy.
- These are sources which cause environmental problems including global warming.

Activity 8

a. Classify the following into "green energy" and "brown energy".

(Tidal energy, Thermal power plant, Windmill, Hydro-power station Nuclear powerstation, Solar power, Diesel engines, Geothermal energy)

Concept

Energy crisis – reasons and remedy

To Remember

There is an increase in the demand for the energy and a decrease in the availability. This is energy crisis.

- Judicious utilisation of energy.
- Maximum utilisation of solar energy.
- Minimising the wastage of water.
- Making use of public transportation as far as possible.
- Construction and beautifying of houses and roads in a scientific manner ensuring energy management
- Controlling of the street lamps with LDR (Light Dependent Resistor).
- Timely maintenance of machines.
- Limiting the size of newly constructed buildings.

Activity 9

a. What all can be done to reduce the energy crisis to a greatest possible level?

Concept

Geo thermal power station, hot spot

To Remember

Though the surface of the earth has cooled down making it habitable, the interior is still in the molten form magma

Activity 10

What do you mean by hotspot? How can we make use of it?

Concept

Nuclear fission and nuclear fusion are the two methods of harnessing nuclear energy.

To Remember

During nuclear fission and nuclear fusion, some matter seems to be lost. This matter which seems to be lost is converted into energy according to Einstien's mass – energy relation $E = mc^2$.

Nuclear fission takes in atom bombs and nuclear fusion in the Sun

Activity 11

How is energy produced in nuclear fission?

Activity 12

What do you mean by nuclear reactor? Which is the fuel used for this? Where all are it established?

Activity 13

What are the methods to reduce nuclear pollution?

UNIT 7
ENERGY MANAGEMENT
Answer Key

Activity 1

a. Partial combustion

b.
- The solid fuels must be dry.
- Liquid fuels must evaporate easily.
- The ignition temperature should be attained.
- Sufficient oxygen must be available for burning.

c.
- Carbon monoxide is not formed. Instead CO_2 is formed.
- More heat is generated.
- Atmospheric pollution is less. Soot is not formed

d.
- Loss of fuel
- Carbon monoxide is formed
- Soot is formed
- Smoke is formed
- Atmospheric pollution takes place

Activity 2

a. Petrol – Diesel- Kerosene - Naphtha – Fuel oil - Grease – Wax

b.

Solid	Liquid	Gas
Firewood	Naphtha	LNG
Nuclear fuel	petrol	Biogas
Coke	Kerosene	hydrogen

c.

LPG	Ethyl Mercaptan
CNG	Methane
COAL	Coke

Activity 3

a. The amount of heat librated by the complete combustion of 1 kg of fuel is its calorific value. Its unit is kilojule/kilogram.

b. Hydrogen

c. 2 x 55,000 kJ/ kg = 110000 kJ

d. Hydrogen is highly inflammable and explosive in nature. So it is difficult to store and transport it.

e. Hydrogen and oxygen

f.
- Should be easily avilable.
- Should be of low cost.
- Should have a high calorific value.
- Should cause minimum atmospheric pollution on combusion.
- Should be easily storable.
- A liquid fuel must not evaporate quickly at ordinary temperatures.

Activity 4

a.
- Hydro electric power station
- Thermal power station
- Nuclear power station etc

b. Water stored at a height is allowed to flow down through a penstock pipe. The energy of the flowing water is used to rotate the turbine and eletricity is generated. In such power station we make use of the potential energy of water stored in dams.

c.
- Moolamattom
- Kuttiadi
- Pallivasal

d. Coal, naphtha , lignite

e. Chemical energy →Heat energy →mechanical energy →electrical energy

Activity 5

a. Photo voltaic effect

b. PN junction diode

c. Solar panel is made by suitably arranging so many solar cells.

d.
- We can lit the street lamps.
- Can be used in artificial satellites to supply electricity for it
- Can be used supply electricity in isolated islands

Activity 6

a. Solar cooker, solar water heater, solar thermal power plant

b. A box painted black in the interior. There is a glass lid. There is a mirror to reflect heat rays into the interior of the box

c. This is because a black body can absorb maximum amount of heat energy.

d.
- Cannot be used at night
- Cannot be used when it is raining
- Fast cooking is impossible. The process is slow

e. Solar thermal power plant.

Activity 7

a. LPG will easily catch fire. Even a small spark produced at the instant of switching on or switching off electric switch can lead to a major explosion.

b. The LPG goes downwards only in the atmosphere. This is because LPG is denser than air.

c.

- Check the rubber tube periodically and ensure that it has no leakage.
- Turn on the knob of the stove only after the regulator is turned on
- Always keep the LPG cylinder on a horizontal surface. Keep it away from any object that is likely to catch fire.
- Examine the joints and safety pipes in the cylinder using soap solution to check the leakage of the gas if any.
- Ensure that the knob is turned off when the cylinder is not in use

d. If you are convinced that there is a gas leak, disconnect electricity from outside the home (switch off the main switches). Switch off the regulator and shift the cyclinder to an empty space. Keep the windows and doors open. Request help from the Fire Force by calling in the toll free number 108. Well trained rescue operators can put out the fire by covrering the top end of the cyclinder with wet sack to prevent the contact with oxygen. If the fire is in flat or the top storey, then one should not try to escape using lifts only staircase should be used. Cover the nose and the mouth with soft cloth to avoid the intake of smoke or gases.

Activity 8

a. Green energy

- Energy from the sea waves
- Energy from the wind
- Hydro electric power station
- Solar panels
- Geo thermal energy

Brown energy

- Thermal power stations
- Nuclear power stations
- Diesel engines

Activity 9

- Judicious utilisation of energy.
- Maximum utilisation of solar energy.
- Minimising the wastage of water.
- Making use of public transportation as far as possible.
- Construction and beautifying of houses and roads in a scientific manner.
- Controlling of the street lamps with LDR (Light Dependent Resistor).
- Timely maintenance of machines.
- Limiting the size of newly constructed building.

Activity 10

Though the surface of the earth has cooled down making it habitable, the interior is still in the molten from. Magma, which is at a higher temperature , comes out of the core through its softer regions. Such places are known as hot spots. Underground water at this place receive energy from the hotspot and is converted into steam. This steam, which is confined to the region between rocks, is brought out by drilling pipes through the rocks. Using the steam, turbine is rotated to produce electricity. Such power plants are referred to as geo thermal power plants.

Activity 11

Nuclear fission is the process by which the nuclei of greater mass are split into lighter nuclei, using neutrons. The mass of small nuclei formed is less than that of parent nucleus. It means that there is loss of matter during such a splitting. The matter that is lost is converted into energy. According to Einstein's equation $E = mc^{2,}$

If 1 kg matter is completely converted into energy then

$E = mc^2$

$= 1kg \times (3 \times 10^8 m/s)^2$

$= 1 \times 9 \times 10^{16} J$

$= 9 \times 10^{16} J$

Activity 12

Nuclear reactor is a system that converts nuclear energy into electrical energy

Enriched uranium is an example for the fuel used it it.

Activity 13

Put the radioactive materials deep into the Earth. Wear protective shields while visitng places likely to have nuclear radiations. Observe the symbols showing the nuclear radiations and behave accordingly. People working in such areas should consume food rich in iodine.