ACADEMIC WINDOW

GRADE 10-PHYSICS

2023-24

INDEX

SYLLABUS

Grade: X

Subject: Science – Physics **Study: 60 periods**

LIGHT- REFLECTION AND REFRACTION
HUMAN EYE

- Reflection of light at curved surfaces, Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, and focal length
- Mirror Formula (Derivation not required), Magnification
- Refraction: Laws of refraction, refractive index
- Refraction of light by spherical lens, Image formed by spherical lenses, Lens formula (Derivation not required), Magnification
- Power of a lens: Functioning of a lens in human eye, problems of vision and remedies, applications of spherical mirrors and lenses
- Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life

ELECTRICITY

- Effect of Current: Potential difference and electric current
- Ohm's law: Resistance, Resistivity, Factors on which the resistance of a conductor depends
- Series combination of resistors, parallel combination of resistors and its applications in daily life.
- Heating effect of Electric current and its application in daily life, Electric power,Inter relation between P,V,I and R

MAGNETIC EFFECT OF ELECTRIC CURRENT

- Magnetic field, field lines, field due to a current carrying wire, field due to current carrying coil or solenoid
- Force on current carrying conductor, Fleming's left-hand rule
- Electromagnetic induction, induced potential difference, Induced current
- Fleming's Right-Hand Rule, Direct current,
- Alternating current: Frequency of AC. Advantage of AC over DC.
- Domestic electric circuits

SOURCES OF ENERGY

- Different forms of energy,
  Conventional and non-conventional sources of energy: fossil fuels, solar energy; biogas; wind, water and tidal energy; nuclear energy.
- Renewable versus non-renewable source

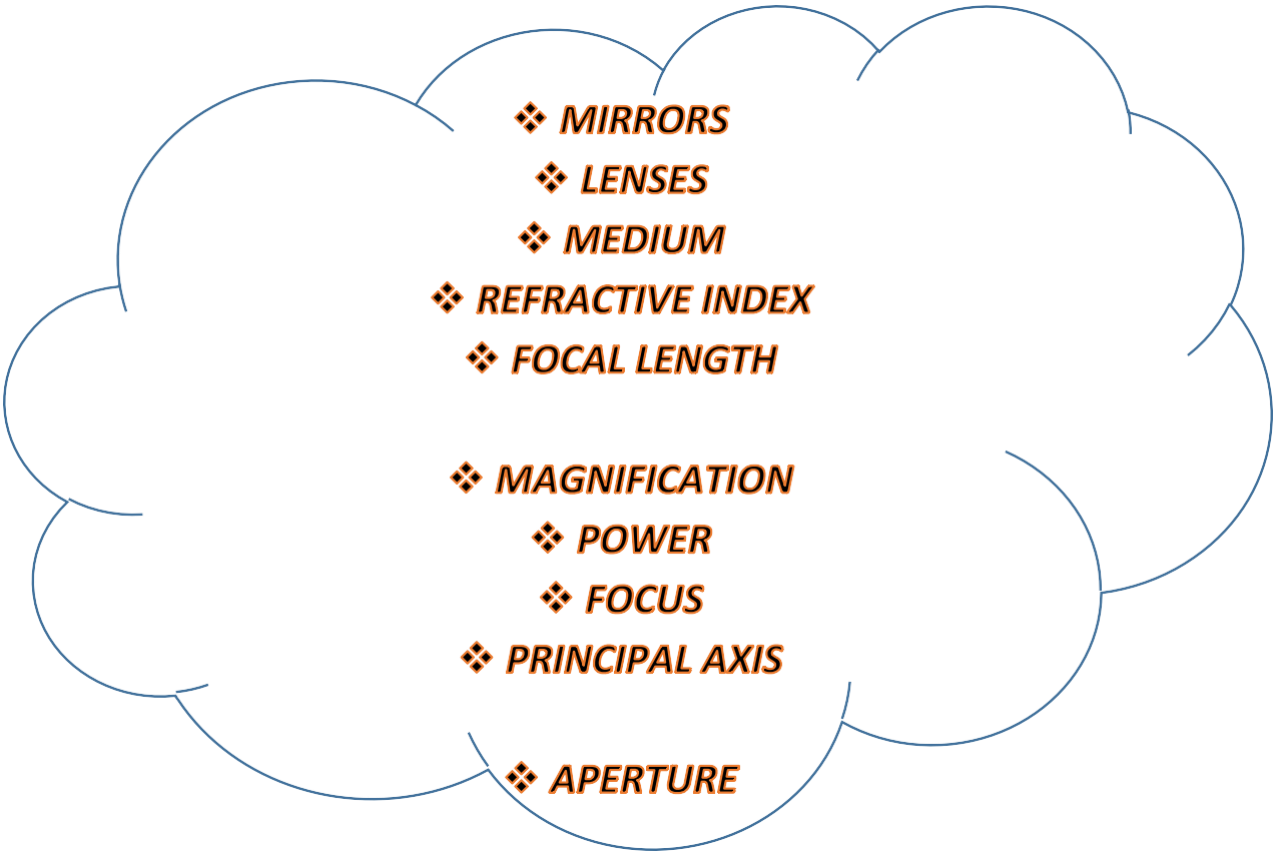
CURRICULUM PLANNER

Sr. No	Term	Months	Chapters
1	First term	April	Light- Reflection and Refraction
		May	Human Eye
		June	
2	Second Term	September	Electricity
		October	M.E.O.E.C
		November	Sources of Energy

LIGHT: REFLECTION AND REFRACTION

GLOSSARY

Important terms



THINGS TO REMEMBER

MIRROR FORMULA

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

MAGNIFICATION FOR MIRRORS

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

IMAGE FORMATION BY CONCAVE MIRROR

Object position	Image position	Size of image	Nature of image
At infinity	Focus (**F**)	Point sized	Real
Beyond **C**	Between **F** and **C**	Small	Real and inverted
At **C**	At **C**	Same as that of the object	Real and inverted
Between **C** and **F**	Behind **C**	Enlarged	Real and inverted
At **F**	At infinity	Highly enlarged	Real and inverted
Between **F** and **P**	Behind mirror	Enlarged	Virtual and erect

IMAGE FORMATION BY CONVEX MIRROR

Position of the object	Position of the image	Size of the image	Nature of the image
Anywhere between P and infinity	Behind the mirror between P and F	Diminished	Virtual and erect
At infinity	Behind the mirror at focus	Highly Diminished	Virtual and erect

SIGN CONVENTION FOR MIRRORS

Type of Mirror	u	v		f	R	Height of the Object	Height of the Image	
		Real	Virtual				Real	Virtual
Concave mirror	-	-	+	-	-	+	-	+
Convex mirror	-	No real image	+	+	+	+	No real image	+

RULES OF REFRACTION OF LIGHT

Rule 1

When a ray of light goes from an optically rarer medium to an optically denser medium, it bends towards the normal.

Rule 2

When a ray of light goes from an optically denser medium to an optically rarer medium, it bends away from the normal.

Snell's law. ***The ratio of sine of the angle of incidence to the sine of angle of refraction is constant for a given pair of media.***

$$\frac{\sin i}{\sin r} = \text{Constant}$$

Summary of Image Formed by a Convex Lens

S No.	Position of Object	Position of Image	Size of Image	Nature of Image
1.	At infinity	At the focus	Highly diminished, Point sized	Real and inverted
2.	Beyond 2F	Between the focus and centre of curvature	Diminished	Real and inverted
3.	At 2F	At the centre of curvature	Same size	Real and inverted

4.	Between F and 2F	Beyond the centre of curvature	Enlarged	Real and inverted
5.	At the focus F	At infinity	Highly enlarged	Real and inverted
6.	Between the focus F and optical centre C	Behind the object	Enlarged	Virtual and erect

Summary of Image Formed by a Concave Lens

SNo.	Position of Object	Position of Image	Size of Image	Nature of Image
1.	At infinity	At the focus	Highly diminished, Point sized	Virtual and erect
2.	Between the infinity and optical centre	Between focus and optical centre	Diminished	Virtual and erect

LENS FORMULA

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

Where, v = Distance of image from optical centre of lens

u = Distance of object from optical centre of lens and f = Focal length of lens

The lens formula is applicable both in convex lenses and concave lenses

MAGNIFICATION OF A LENS

$$\frac{\text{height of image (image size)}}{\text{height of object (object size)}} = v/u$$

height of image (image size)
height of object (object size)
=v/u
=v/u

POWER OF A LENS

Power=1/f

where, p = power of the lens

f = focal length of the lens in meter

SIGN CONVENTION

Sign conventions for thin lenses

Focal Length

f is positive for converging (convex) lenses.

f is negative for diverging (concave) lenses.

Magnification

m is positive for upright images (same orientation as object).

m is negative for inverted images (opposite orientation of object).

Image Distance

d_i is positive for real images (images on the opposite side of the lens from the object).

d_i is negative for virtual images (images on the same side of the lens as the object).

Object Distance

d_o is positive for real objects (from which light diverges).

d_o is negative for virtual objects (toward which light converges).

TYPES OF QUESTIONS

FACTUAL / SIMPLE

ABOVE AVERAGE

INTERESTING!

HOT

MULTIDISCIPLINARY

LIGHT: REFLECTION AND REFRACTION

- **Light**: It is a form of electromagnetic radiation which is considered as waves. These waves are electromagnetic and non-mechanical that do notrequire any material medium for propagation
- **Speed of light**: The speed of light depends upon the nature of the medium it is traveling. In space or vacuum its speed is $3x10^8$m/s.
- **Real image**: The image is said to be real if the rays actually meet. A real image can be obtained on the screen.
- **Virtual image**. The image is said to be virtual when rays do not actually meet, but appear to meet when produced backward.
- **Reflection of light**: When light traveling from one medium falls on the surface of another medium, a portion of the incident light is turned back into the first medium. This is called reflection of light.
- **Laws of reflection of light**:
  - The angle of incidence is equal to the angle of reflection.
  - The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.
- **Terms related to Spherical Mirrors**
  - Spherical mirror: It is a mirror whose reflecting surface forms a part of a hollow sphere
  - Concave mirror: It is the spherical mirror in which the reflection of light takes place from the inner hollow surface
  - Convex mirror. It is the spherical mirror in which the reflection of light takes place from the outer bulged surface
  - Pole (P). It is the middle point of the spherical mirror.
  - Centre of curvature(C). It is the centre of the sphere of which the mirror forms a part.
  - Radius of curvature(R). It is the radius of the sphere of which the mirror forms a part.

- Principal axis. The line passing through the pole and the centre of curvature of the mirror is called its radius of curvature
- Principal focus (F). It is the point on the principal axis where a beam parallel to the principal axis either actually converges to or appears to diverge from, after reflection from the mirror
- Focal length (f). It is the distance between the focus and the pole of the mirror.
- Plane mirrors form images which are virtual, erect, same sized and laterally inverted
- Convex mirrors form images which are virtual diminished and erect.
- Concave mirrors form images which can be real / virtual, inverted / erect, and diminished / same sized / enlarged depending upon the position the object

➢ **Reflection by spherical Mirrors**

The position of the image formed by spherical mirrors can be studied by considering any two of the following rays of light coming from a point on the object

- The ray parallel to the principal axis passes through the focus F of a concave mirror after reflection .Whereas it appears to pass through the principal focus of a convex mirror
- A ray passing through the principal focus in a concave mirror or a ray which is directed towards it (in a convex mirror) is reflected parallel to the principal axis.
- A ray passing through the centre of curvature falls on the concave or convex is reflected back along its own path.

➢ **Image formed by Concave mirror**

- The nature, size and the position of the image formed by a concave mirror changes with the distance of the object from the mirror.
- If the object is beyond C, the image is always diminished and for object within C the image is always enlarged.
- If the object is at C, the image of the same size is obtained. In this case **u = v = R = 2f**
- Virtual and erect image is obtained only when the object b/w F and P.
- Convex mirrors are used as shaving mirrors, used in search lights, torch lights and car head lights. Used to concentrate heat radiations from sun in solar furnaces

➢ **Image formed by Convex mirror**

- Only virtual, erect and diminished images can be formed by the convex mirror.

- Concave mirrors are used as rear view mirrors in vehicles.

➢ ***Lens*.** It is the portion of a transparent medium bounded by two surfaces, at least one of which is a curved surface

- ***Concave lens***. It is thicker at the centre than at the edges. It converges a parallel beam of light on refraction through it. It has a real focus
- ***Concave lens***. It is thinner at the centre than at the edges. It diverges a parallel beam of light on refraction through it. It has a virtual focus
- ***Centre of curvature (C***. It is the centre of the sphere of which it forms a part. Because a lens has two surfaces, so it has two centre of curvature
- ***Radius of curvature(R)*** The radius of curvature of the surface of a lens is the radius of the sphere of which the surface forms a part.
- ***Optical centre(O)*** It is a point situated within the lens through which a ray of light passes undeviated
- ***Focal length(f)*** I t is the distance between the principal focus and the optical centre of the lens
- ***Aperture***. I t is the diameter of the circular boundary of the lens.

➢ **Image formed by a convex lens**

- The nature, size and the position of the image formed by a convex lens changes with the distance of the object from the lens
- If the object is beyond 2F, the image is always diminished and for object within 2F the image is always enlarged.
- If the object is at 2F, the image of the same size is obtained. In this case

  u = v = R = 2f
- Virtual and erect image is obtained only when the object b/w F and O.

➢ **Image formed by Concave lens**

- Only virtual, erect and diminished images can be formed by the convex mirror.

Note: The focal length of a concave lens is positive and that of a convex lens negative.

➢ **Dioptre**: The S.I unit of power of a lens is Dioptre denoted by the symbol D. One dioptre is the power of a lens whose focal length is 1 meter.

➢ **Refraction of light**: When light passes from one transparent medium to another, the ray of light changes its path. This phenomenon is called refraction of light .It is due to the change in speed of light in going from one medium to another. Some phenomena observed in day today life due refraction are

- When a thick glass slab is placed over some printed matter the letters appear raised when viewed through the glass slab.

- A pencil partly immersed in water appears to be bent at the interface of water and air.
- Lateral shift or displacement depends on the refractive index of the glass, the angle of incidence and the thickness of the glass slab.

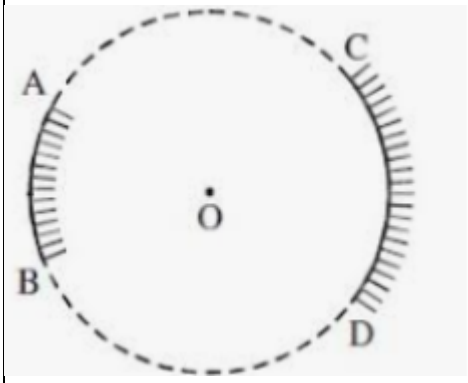
➢ **Refractive index**: The refractive index of the second medium is equal to speed of light in the first medium divided by speed of light in thesecond medium

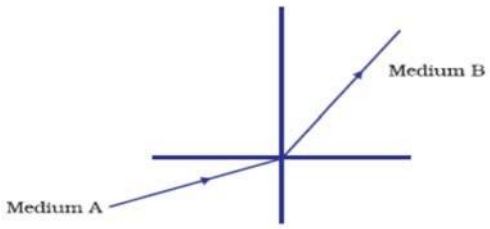
$$n_{21} = \frac{speed\ of\ light\ in\ the\ first\ medium}{speed\ of\ light\ in\ the\ second\ medium} = \frac{v_2}{v_1}$$

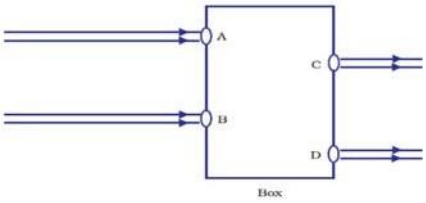
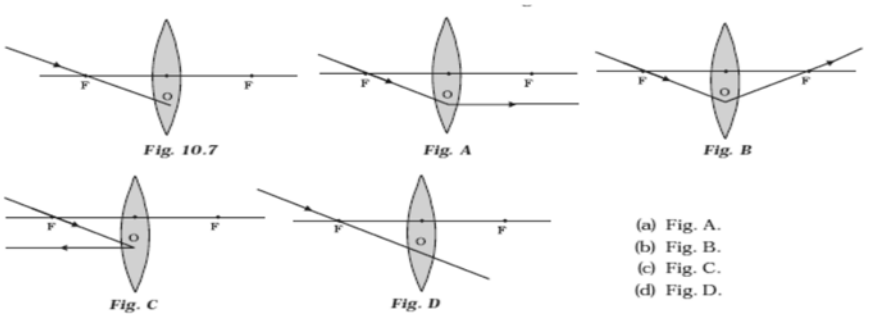
➢ **Absolute refractive index**: When the first medium is vacuum, then the refractive index of the second medium with respect to vacuum(known as absolute refractive index of the medium) is n

$$\text{Refractive index} = \frac{speed\ of\ light\ in\ vacuum}{speed\ of\ light\ in\ the\ medium} = \frac{c}{v}$$

QUESTIONS

A		MCQ 'S	Mks	Lvel
1		AB and CD, two spherical mirrors, form parts of a hollow spherical ball with its centre at O as shown in the diagram. If arc AB = 1/2 arc CD, what is the ratio of their focal lengths  A) 1:1.5 B) 1:1 C) 2:3 D) 0.5:1	1	C

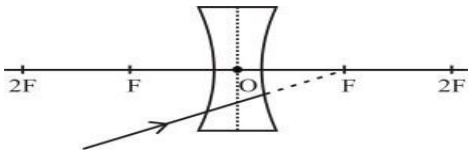
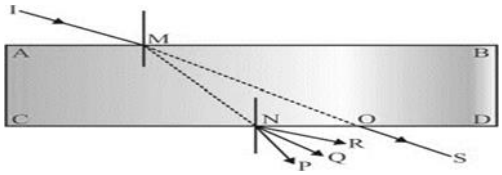
2		In torches, search lights and head lights of vehicles the bulb is placed : a. between the pole and the focus of the reflector b. very near to the focus of the reflector c. between the focus and centre of curvature of the reflector d. at the centre of curvature of the reflector	1	U
3		A black paper on a sunny day can be burnt either by using a spherical mirror or a lens. For doing so, the black paper must be placed at the focus of a. either a concave lens or a concave mirror b. plane mirror c. either a concave mirror or a convex lens d. convex mirror	1	A
4		A light ray enters from medium A to medium B as shown in Figure. The refractive index of medium B relative to A will be  a. greater than unity b. b. less than unity c. equal to unity d. Zero	1	MD

5		Which of the following statements is true? a. A convex lens has 4 dioptre power having a focal length 0.25 m b. A convex lens has –4 dioptre power having a focal length 0.25 m c. A concave lens has 4 dioptre power having a focal length 0.25 m d. A concave lens has –4 dioptre power having a focal length 0.25 m	1	A
6		Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in the Figure. Which of the following could be inside the box (a) A rectangular glass slab (b) A convex lens (c) A concave lens (d) A prism 	1	A
7		Which of the following ray diagrams is correct for the ray of light incident on a lens shown in Fig. 10.7?  Fig. 10.7 Fig. A Fig. B Fig. C Fig. D (a) Fig. A. (b) Fig. B. (c) Fig. C. (d) Fig. D.	1	A
8		Two mirrors A and B are fitted on a wall. A boy approaching the wall finds that the image of his face is increasing in size when he looks at the mirror A but image of his face remains the same when he looks at the mirror B a. Mirror A is concave and mirror B is convex	1	U

		b. Mirror A is plane and mirror B is concave c. Mirror A is concave and mirror B is plane d. Mirror A is convex and mirror B is concave		
9		The focal length of a plane mirror : a. 0 b. 10 cm c. 20 cm d. infinity	1	C
10		A ray of light passing through the center of curvature falls on the concave mirror, what is the value of angle of incidence A) 90 degree B) 0 degree C) 45 degree D) 60 degree		
11 **A**		Linear magnification (m) produced by a rear view mirror fitted in vehicles a.is less than one. b.is more than one. c.is equal to one d.can be more or less than one depending on the position of object.	**Mks**	**Level**

.		**Very Short Answer Questions (VSA)**		
1		A ray of light is incident normally on a plane mirror. What will be the angle of reflection?	1	C
2		For which position of an object a concave mirror forms an enlarged virtual image?	1	U

3		The outer surface of a hollow sphere of aluminium of radius 50 cm is to be used as a mirror. What will be the focal length of this mirror? Which type of spherical mirror will it provide?	1	HOT

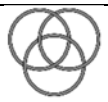
4		"A concave mirror of focal length 'f ' can form a magnified, erect as well as an inverted image of an object placed in front of it." Justify this statement stating the position of the object with respect to the mirror in each case for obtaining these images.	1	HOT
5		"The refractive index of diamond is 2.42". What is the meaning of this statement in relation to speed of light?	1	U
6		Redraw the diagram given below in your answer book and show the direction of the light ray after refraction from the lens 	1	A
7		A ray of light, incident obliquely on a face of a rectangular glass slab placed in air, emerges from the opposite face parallel to the incident ray. State two factors on which the lateral displacement of the emergent ray depends.	1	U
8		If a light ray IM is incident on the surface AB as shown, identify the correct emergent ray. 	1	A
B.		Short Answer Questions (SA)	2	Level
1		A girl was playing with a thin beam of light from her laser torch by directing it from different directions on a convex lens held vertically. She was surprised to see that in a particular direction the beam of light continues to move along the same direction after passing through the lens. State the reason for this observation.	2	HOT
2		A concave mirror produces three times enlarged image of an object placed at 10cm in front of it. Calculate the focal length of the mirror.	2	A

3		Identify the device used as a spherical mirror or lens in following cases, when the image formed is virtual and erect in each case. (a) Object is placed between device and its focus, image formed is enlarged and behind it. (b) Object is placed between the focus and device, image formed is enlarged and on the same side as that of the object. (c) Object is placed between infinity and device, image formed is diminished and between focus and optical centre on the same side as that of the object. (d) Object is placed between infinity and device, image formed is diminished and between pole and focus, behind it.	2	A
4		Why does a light ray incident on a rectangular glass slab immersed in any medium emerges parallel to itself? Explain using a diagram.	2	A
5		A pencil when dipped in water in a glass tumbler appears to be bent at the interface of air and water. Will the pencil appear to be bent to the same extent, if instead of water we use kerosene or turpentine? Support your answer with reason. 	2	A
6		The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium?	2	U
7		At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 24 cm	2	A

<table>
<tr><td></td><td></td><td>from it on the other side. What will be the magnification produced in this case?</td><td></td><td></td></tr>
<tr><td>8</td><td></td><td>(a) If the image formed by a lens is diminished in size and erect, for all positions of the object, what type of lens is it?
(b) Name the point on the lens through which a ray of light passes undeviated.</td><td>2</td><td>U</td></tr>
<tr><td>C</td><td></td><td>Short Answer Questions (SA)</td><td>3</td><td></td></tr>
<tr><td>1</td><td></td><td>i. The following table gives the values of refractive indices of a few media.

<table><tr><th>S.No.</th><th>Medium</th><th>Refractive Index</th></tr><tr><td>1</td><td>Water</td><td>1.33</td></tr><tr><td>2</td><td>Crown glass</td><td>1.52</td></tr><tr><td>3</td><td>Rock salt</td><td>1.54</td></tr><tr><td>4</td><td>Ruby</td><td>1.71</td></tr><tr><td>5</td><td>Diamond</td><td>2.42</td></tr></table>
Use this table to give an example of a medium pair so that light speeds up when it goes from one of these media to another.

ii. A ray of light enters a rectangular glass slab of refractive index 1.5. It is found that the ray emerges from the opposite face of the slab without being displaced. If its speed in air is $3\times10^{8}ms^{-1}$ then what is its speed in glass?</td><td>3</td><td>A</td></tr>
<tr><td>2</td><td></td><td>In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 55º with the normal on one face of the slab, after refraction strikes</td><td>3</td><td>A</td></tr>
</table>

		the opposite face of the slab before emerging out into air making an angle of 40° with the normal. Draw a labelled diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence?		
3		Define power of a lens. What is its unit? One student uses a lens of focal length 50 cm and another of -50 cm. What is the nature of the lens and its power used by each of them?	3	U
4		The power of combination of two lenses X and Y is 5D. If the focal length of lens X be 15 cm, calculate the focal length and power of the lens Y.	3	U
D		**Long Answer Questions**	**5**	
1		**(a)** Under what condition will a glass lens placed in a transparent liquid become invisible? **(b)** Describe and illustrate with a diagram, how we should arrange two converging lenses so that a parallel beam of light entering one lens emerges as a parallel beam after passing through the second lens. **(c)** An object is placed at a distance of 3 cm from a concave lens of focal length 12 cm. Find the (i) position and (ii) nature of the image formed.	5	MD
2		An object placed on a meter scale at 8 cm mark was focused on a white screen placed at 92 cm mark, using a converging lens placed on the scale at 50 cm mark. i. Find the focal length of converging lens. ii. Find the position of image formed if the object is shifted towards the lens at a position of 29.0 cm. iii. State the nature of image formed if the object is further shifted towards the lens.	5	U
3		a)Draw ray diagrams to show the formation of a three times magnified (i) real image	5	MD

		(ii) Virtual image of an object kept in front of a converging lens. Mark the positions of object, F, 2 F, O and position of image clearly in the diagram. b) An object of size 5 cm is kept at a distance of 25 cm from the Optical centre of a converging lens of focal length 10 cm. Calculate the distance of the image from the lens and size of the image.		
4		State the law of refraction of light that defines the refractive index of a medium with respect to the other. Express it mathematically. How is refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light in two media A and B? State the name of this constant when one medium is vacuum or air. The refractive indices of glass and water with respect to vacuum are 3/2 and 4/3 respectively. If the speed of light in glass is 2×10^8m/s , find the speed of light in (i) Vacuum, (ii) water.	5	U

ASSERTION- REASONING TYPE QUESTIONS

Sr. No.	Instructions: For question numbers, two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below i) Both A and R are true, and R is correct explanation of the assertion. ii) Both A and R are true, but R is not the correct explanation of the assertion. iii) A is true but R is false. iv) A is false but R is true.	Marks	Question type U/C/A/Hots
1	Assertion: Keeping a point object fixed, if a plane mirror is moved, the image will also move. Reason: In case of a plane mirror, distance of object and Its image is equal from any point on the mirror.	1	C
Ans	(iv) Assertion (A) is false but reason (R) is true.		

2	Assertion: Large concave mirrors are used to concentrate sunlight to produce heat in solar cookers. Reason: Concave mirror converges the light rays falling on it to a point.	1	U
Ans	(i) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).		
3	Assertion: When a concave mirror is held under water, its focal length will increase. Reason: The focal length of a concave mirror is independent of the medium in which it is placed.	1	H
Ans	(iv) Assertion (A) is false but reason (R) is true. Explanation: Focal length is the property of mirror and is independent of the medium in which it is placed.		
4	Assertion: Refractive index of glass with respect to air is different for red light and violet light. Reason: Refractive index of a pair of media depends on the wavelength of light used.	1	H
Ans	(i) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). Refractive index of any pair of media is inversely proportional to wavelength of light. Gu<Gr Mr <Mu where, Gu and Gr are wavelengths of violet and red light, Mu and Mr are refractive index of violet and red light		
5	Assertion: An object is placed at a distance of f from a convex mirror of focal length f, its image will form at infinity. Reason: The distance of image in convex mirror can never be infinity.	1	C
Ans	(iv) Assertion (A) is false but reason (R) is true The distance of image in convex mirror is always finite.		

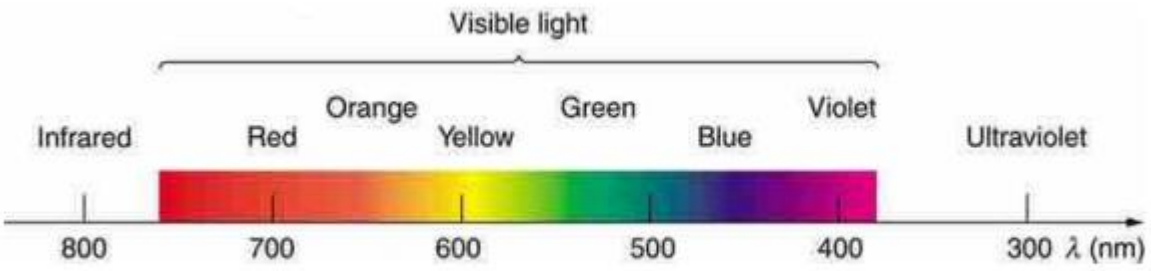
6	Assertion : Plane mirror may form real image. Reason : Plane mirror forms virtual image, if objects is real. Ans : (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A). Plane mirror may form real image, if object is virtual.		
7	Assertion : Blue colour of sky appears due to scattering of blue colour. Reason : Blue colour has shortest wave length in visible spectrum Ans Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).		
	Read the following and answer the following questions.		
	The spherical mirror forms different types of images when the object is placed at different locations. When the image is formed on screen, the image is real and when the image does not form on screen, the image is virtual. When the two reflected rays meet actually, the image is real and when they appear to meet, the image is virtual. A concave mirror always forms a real and inverted image for different positions of the object. But if the object is placed between the focus and pole. the image formed is virtual and erect. A convex mirror always forms a virtual, erect and diminished image. A concave mirror is used as doctor's head mirror to focus light on body parts like eyes, ears, nose etc., to be examined because it can form erect and magnified image of the object. The convex mirror is used as a rear-view mirrors in automobiles because it can form an small and erect image of an object.		
	a) When an object is placed at the centre of curvature of a concave mirror, comment on the image formed ?	1	
	b)The linear magnification produced by a spherical mirror is + 1/3. Analyzing this value, state the (i) type of mirror and (ii) position of the image with respect to the pole of the mirror	1	
	c) A child is standing in front of a magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. What is the order of combinations for the magic mirror from the top. OR c) Identify the nature of spherical mirror in the following cases, and draw ray diagrams for it.. When object is placed between mirror and its focus, image formed is erect, enlarged and behind it.	2	
	Read the following and answer any four questions from (i) to 19 (iv) Rajesh wanted to participate in school science fair. After registering his name for science fair he planned to build a box type solar cooker. A box type solar cooker consists of box covered by a thick transparent sheet 1×4 of glass. When the box with glass cover is placed in the sunlight, the glass cover allows the infra-red rays present in sunlight to pass into the box. Most of these infra-red rays are then absorbed by black surface of the box and the box becomes hot. A spherical surface reflector attached increases the efficiency of solar cooker by reflecting more and more sunlight towards the cooker.		

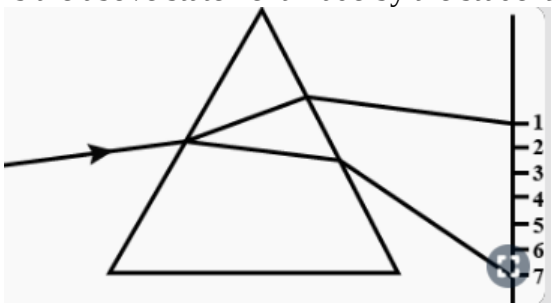
a) What type of reflecting surface is used in the figure shown above?	1	
b)What is the formula for magnification obtained by a spherical mirror?	1	
(c) While using the above device Rajesh obtained the best result when the cooker was placed at 50 cm from the centre of mirror. What is the focal length of the mirror or. © Rajesh after doing this activity, he found that the above mirror can also be used as shaving mirror .comment and explain with the diagram	2	

Read the following and answer any four questions from (i) to (v)

Rainbows are produced by a combination of refraction and reflection. You may have noticed that you see a rainbow only when you look away from the sun. Light enters a drop of water and is reflected from the back of the drop . The light is refracted both as it enters and as it leaves the drop. Since the index of refraction of water varies with wavelength, the light is dispersed, and a rainbow is observed. (There is no dispersion caused by reflection at the back surface, since the law of reflection does not depend on wavelength.) The actual rainbow of colors seen by an observer depends on the myriad of rays being refracted and reflected toward the observer's eyes from numerous drops of water. The arc of a rainbow comes from the need to be looking at a specific angle relative to the direction of the sun.

We see about six colors in a rainbow—red, orange, yellow, green, blue, and violet; sometimes indigo is listed, too. These colors are associated with different wavelengths of light. White light, in particular, is a fairly uniform mixture of all visible wavelengths. Sunlight, considered to be white, actually appears to be a bit yellow because of its mixture of wavelengths, but it does contain all visible wavelengths. The sequence of colors in rainbows is the same sequence as the colors plotted versus wavelength . What this implies is that white light is spread out according to wavelength in a rainbow. Dispersion is defined as the spreading of white light into its full spectrum of wavelengths. More technically, dispersion occurs whenever there is a process that changes the direction of light in a manner that depends on wavelength. Dispersion, as a general phenomenon, can occur for any type of wave and always involves wavelength-dependent processes.



	a)Name the optical phenomenon does the splitting of white light into seven constituent colours occur?	1	
	b) Which colour of light deviates minimum in the dispersion of white light by prism?	1	
	c) A beam of white light falling on a glass prism gets split up into seven colours marked 1 to 7 as shown in the diagram. A student makes the following statements about the spectrum observed on the screen. The colours at positions marked 3 and 5 are similar to the colour of the sky and the colour of gold metal respectively. Is the above statement made by the student correct or incorrect? Justify.  OR Why red is used as danger signal?	2	

Human Eye and the colourful world

CHAPTER-5

SYNOPSIS

From seeing a tiny object nearby to a distant object, we need and use many instruments. The study of the objects has revealed a lot about the universe. The optical instruments include the human eye, microscope, and telescope.

In his endeavor to know even about minute organism, man is developing instruments having high resolving power. The defective eye and other instruments are even being corrected to perform well. These instruments are based on the refraction and reflection of light in various surfaces.

Human eye is the most important and sensitive sense organ. The essential parts of human eye are sclerotic, cornea, choroid, iris, pupil, crystalline lens, ciliary muscles, aqueous humour, vitreous humour and retina.

Common defects of vision: There are mainly four common defects of vision which can be corrected using suitable eye glasses. These are

i) Myopia or near sightedness

ii) Hypermetropia or far sightedness

iii) Presbyopia

Prism: A prism is a portion of a transparent medium, bounded by two plane faces inclined to each other a certain angle. A ray of light, after suffering refraction through a prism, bends towards the base of the prism.

For any ray of light,

Angle of incidence + angle of emergence = Angle of prism + Angle of deviation

$$i + e = A + D$$

Dispersion of white light: The splitting of white light into its constituent colors when it passes through a glass prism is called dispersion. The dispersion of light occurs because refractive index ofprism material is different for light of different colors.

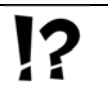
Advance sunrise and delayed sunset: Due to atmospheric refraction, the sun is visible to us about two minutes before the actual sunrise and two minutes after the actual sunset.

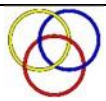
Scattering of light: The scattering of light by the atmospheric molecules causes the blue colour of the sky and reddening of the sun at sunrise and sunset.

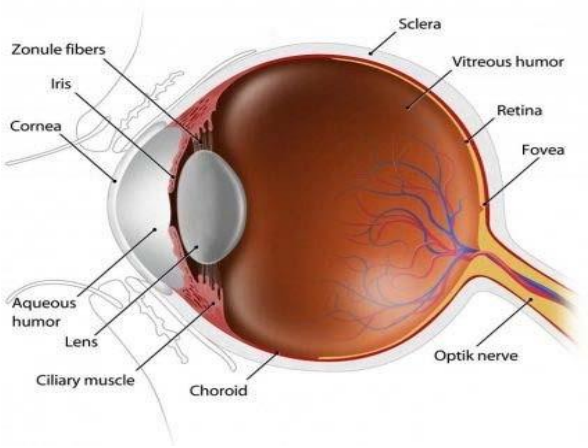
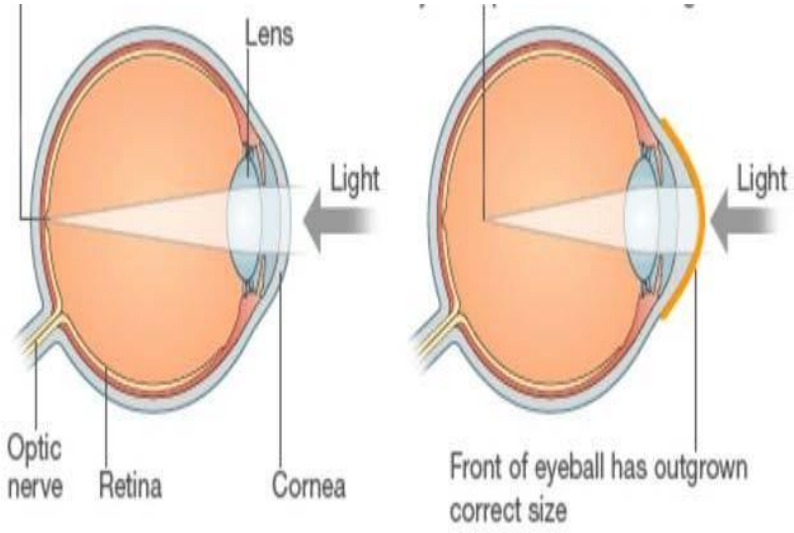
Blue colour of the sky: The atmospheric molecules scatter blue light of shorter wavelength more strongly than the red light of longer wavelength. When this scattered light reaches our eyes, it contains blue light in larger proportion. That is why the sky appears blue.

QUESTIONS

A.		MCQ'S	Mks	Level
1		A man cannot see objects distinctly at a distance greater than 3 meter. He is suffering from a. astigmatism b. myopia c. hypermetropia d. distortion	1	C
2		Color– blindness is due to the absence of a. Rod– shaped cells b. Cone– shaped cells c. Both rod and cone– shaped cells d. None of these	1	C
3		The impact of an image on the retina persists for. a. 1/ 10 s b. 1/20 s c. 10 s d. 20 s	1	U
4		The person suffering from both myopia and hypermetropia requires the use of a. Bifocal lenses b. Concave lens c. Convex lens d. Cylindrical lenses	1	U
5		In a myopic eye, the rays from infinity are brought to focus at a point a. In front of retina b. Behind the retina c. On the retina d. On the eye lens	1	A

6		The beams of light, one red and the other blue fall on the same spot on a white screen. The color on the screen will appear to be a. Magenta b. cyan c. yellow d. green	1	A
7		Cinematography makes use of a. accommodation b. Persistence of vision c. Least distance of distinct vision d. Bi-focal lens system	1	U
8		The color of the eyes of any person is determined by a. Pupil b. Retina c. Iris d. Cornea	1	C
9		Colloidal solutions exhibit_____phenomenon of light a. dispersion b. scattering c. twinkling d. refraction	1	U
B.		**Short Answer Questions (SA)**	**2**	**Level**
1		Ciliary muscles of human eye can be stretched or relaxed. How does it help in functioning of the eyes?	2	U
2		How does the color of the scattered light depend on the size of the colloidal particles?	2	A
3		How can we determine the focal length and power of the concave lens required to correct a myopic eye?	2	A

4		A glass prism is able to produce a spectrum when white light passes through it but glass slab does not produce ay spectrum. Explain why it is so.	2	HOT
C.		**Short Answer Questions (SA)**	**3**	**Level**
1		What causes Tyndall effect in Light? Name two phenomena observed in daily life which are based on Tyndall effect.	3	C
2		Why do we have two eyes for vision and not just one?	3	A
D		**Long Answer Questions**	**5**	**Level**
1		Why do we observe the apparent random wavering or flickering of objects when seen through a turbulent stream of hot air rising above fire, a stove or radiator?	5	HOT
2		Why is the colour of the clear sky blue? What will be the colour of sky in the absence of atmosphere?	5	U
3		Give some points of similarity and dissimilarity between a camera and the human eye.	5	MD
		COMPREHENSION TYPE QUESTIONS		
		Answer question numbers (a) - (d) on the basis of your understanding of the following paragraph and the related studied concepts. Light rays reflected from an object pass through the conjunctiva, cornea, and pupil before falling on the biconvex lens. The size of the pupil determines the amount of light that will enter into the eye ball. The size of the pupil enlarges when the intensity of the light is low and the size diminishes when the intensity is high. The light rays are then focused on the retina by the biconvex lens, so that a sharp inverted image is formed on the retina. The impression of the inverted retinal image is carried by the optic nerve to the brain where it is being		

		interpreted. The eye can see objects both far and nearby adjusting the focal length of lens i.e., by changing the curvature of the lens. This is called as the power of accommodation of the eye.  Figure A  Figure B		
	a	What could you interpret from the Figure B? Support your answer with reason	1	U
	b	What is the defect of eye in which the power of accommodation decreases due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens?	1	C
	c	Least distance of distinct vision of a long-sighted man is 40 cm. He wishes to reduce it to 25 cm by using a lens. What is the focal length of the lens?	1	A
	D	A 52 year old nearsighted person wears a glass with the power of minus 5.5 diopters for his distance viewing. His doctor	1	HOTS

		prescribes a correction of + 1.5 diopters in the near vision for his bifocals. This is measured relative to the main part of the lens. i. What is the focal length of his distance viewing part of the lens? ii. What is the focal length of the near vision section of the lens ?		
		ANSWERS		
	a	First image is normal vision Second is myopia since the image lies before retina	½ ½	
	b	Presbyopia	1	
	c	Here, v=−40cm,u=−25cm,f=? From 1/f=1/v−1/u=1/−40−1/−25=−5+8/200=3/200,f=200/3cm	1	
	d	Since we know that power of a lens = 1/focal length(in metres) (a) -5.5 = 1/f f = -1/5.5 f = -0.1819 m f = -18.19 cm (b) for near vision +1.5 = 1/f 1.5 = 1/f f = 1/1.5	½ ½	

		f = 0.6667 m f = 66.67cm		

NOTES

Lesson-Human Eye and the colorful world

Learning Objective	Achieved 	Working towards 	Needs reinforcement 
I will be able to describe the structure of a human eye, define the power of accommodation, analyse defects of vision and suggest corrections.			
I can understand the phenomenon of refraction of light through a prism and explain dispersion of white light by a prism			
I can describe atmospheric refraction, discuss scattering of light, compare color of the sun at sunrise and sunset			

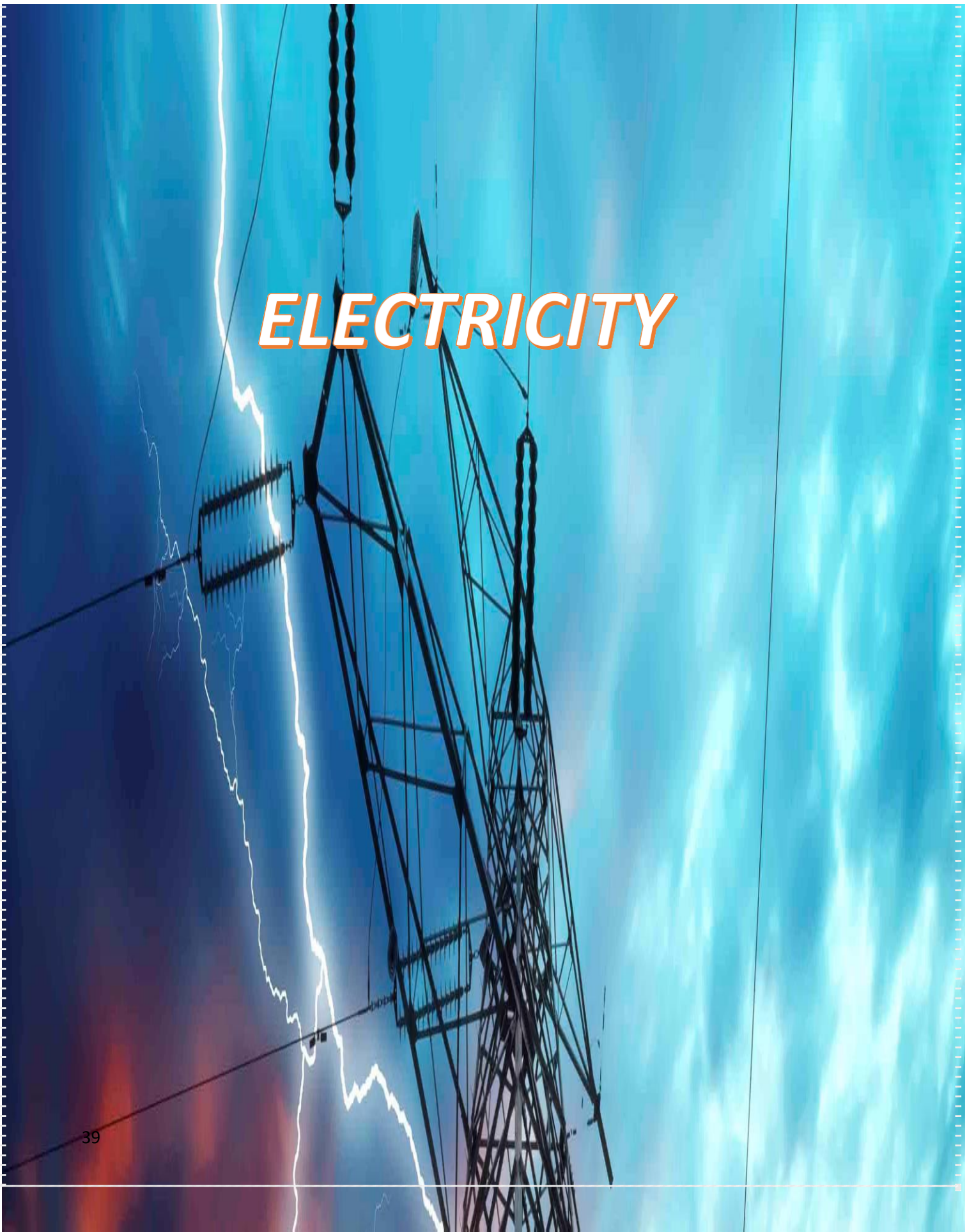
Teacher's feedback: _____

_____

Student's feedback: _____

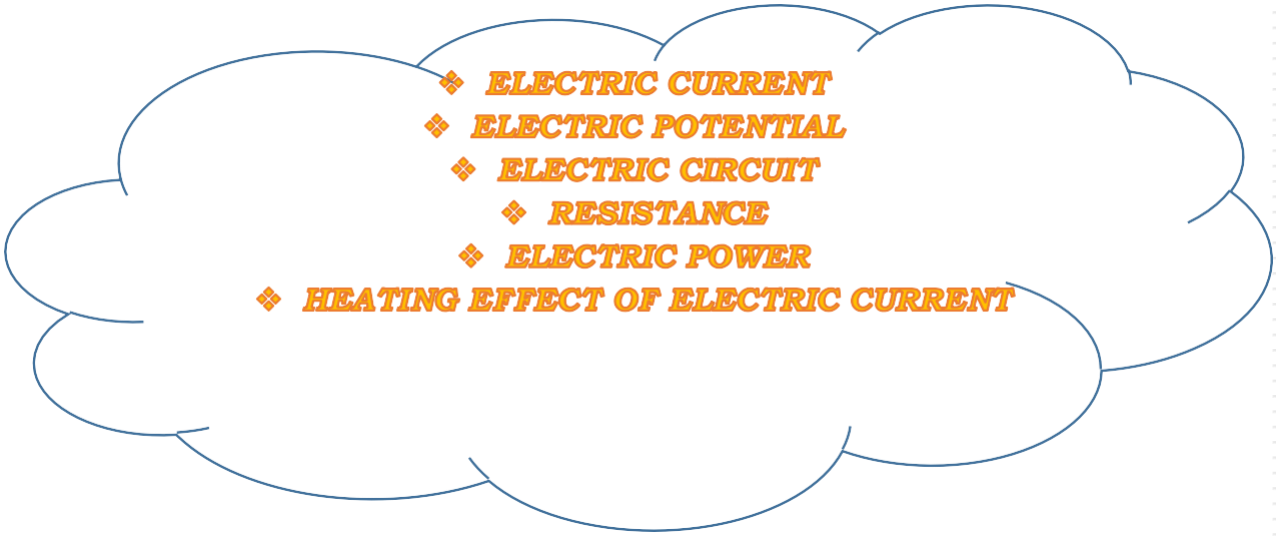
_____

Next step in
Learning:_____


ELECTRICITY

GLOSSARY

Important words



PHYSICAL QUANTITY	UNIT
ELECTRIC CHARGE	COULOMB
ELECTRIC CURRENT	AMPERE
ELECTRIC POTENTIAL	VOLT
RESISTANCE	OHM
RESISTIVITTY	OHM METRE
HEAT ENERGY	JOULE/KILOWATT HOUR
ELECTRIC POWER	WATT (JOULE/SECOND)

TYPES OF QUESTIONS

FACTUAL / SIMPLE

ABOVE AVERAGE

INTERESTING!

HOT

MULTIDISCIPLINARY

ELECTRICITY

- **Electric Current**: The rate of flow of charge through a conductor is termed the ***electric current*** and is measured in ***Ampere.***

- **The potential difference** between two points in an electric field is defined as the amount of work done in moving a unit positive charge from one point to another point. So,

$$potential\ difference = \frac{work\ done}{quantity\ of\ charge\ transfered} = \frac{W}{Q}$$

- The SI unit of electric potential difference is ***volt (V)***

The potential difference between two points is said to be one Volt if 1 Joule of work is done in moving 1 Coulomb of electric charge from one point to another.

$$1\ Volt = \frac{1\ joule}{1\ Coulomb}$$

- The potential difference is measured by means of an instrument called the ***voltmeter.***

- The voltmeter is always connected in ***parallel*** across the points between which the potential difference is to be measured.

- **Electric current** is expressed by the amount of charge flowing through a particular area in unit time.
  In other words, it is the rate of flow of electric charges (electrons) in a conductor (for example copper or metallic wire).

- If a net charge Q, flows across any cross-section of a conductor in time t, then the current I, through the cross-section is

  I = Q/t

- The S.I. unit of electric current is ***Ampere (A)***

"When 1 Coulomb of charge flows through a cross section of conductor in 1 second then current flowing through the conductor is said to be 1 Ampere."

- Current is measured by an instrument called ***ammeter.*** It is always connected in series in a circuit through which the current is to be measured.
- A continuous and closed path of an electric current is called an ***electric circuit.***
- For example figure given below shows a typical electric circuit comprising a cell, an electric bulb, an ammeter A and a plug key K.

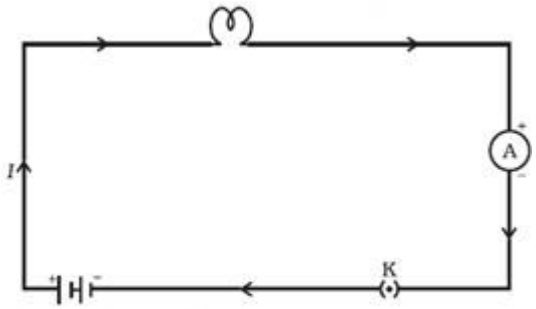


Figure 1

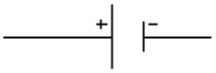
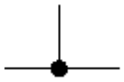
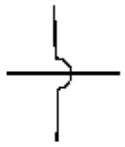
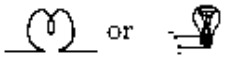
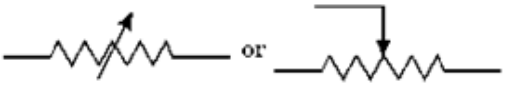
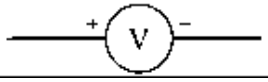
Note that the electric current flows in the circuit from the positive terminal of the cell to the negative terminal of the cell through the bulb and ammeter

- The conventional direction of electric current is from positive terminal of the cell to the negative terminal through the outer circuit.
- Or we can say that conventional direction of electric current is in the direction of the flow of positive charged carriers.

➢ Circuit Diagrams

A diagram which indicates how different components in a circuit have to be connected by using symbols for different electric components is called a circuit diagram.

- Fig2

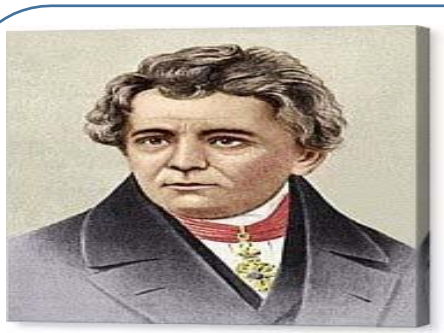
S. No.	Component	Symbol
1	An electric cell	
2	A battery or a combination of cells	
3	Plug key or switch (open)	
4	Plug key or switch (closed)	
5	A wire joint	
6	Wires crossing without joining	
7	Electric bulb	
8	A resistor of resistance *R*	
9	Variable resistance or rheostat	
10	Ammeter	
11	Voltmeter	

Ohm's Law

➢ Ohm's law is the relation between the potential difference applied to the ends of the conductor and current flowing through the conductor. This law was expressed by **George Simon Ohm in 1826.**

- **Statement of Ohm's Law**
  If the physical state of the conductor (Temperature and mechanical strain etc.) remains unchanged, then current flowing through a conductor is always directly proportional to the potential difference across the two ends of the conductor

$V \propto I$
or
V=IR
where constant of proportionality **R** is called the electric resistance or simply resistance of the conductor.



George Simon Ohm (1787-1854), German physicist. Ohm published his most important work in 1827, after many years researching the relationship between electrical current and potential difference. The unit of electrical resistance is named the ohm in his honour

- Value of resistance depends upon the nature, length and area of the conductor.

- **The resistance of a conductor depends on**
  1. Its length
  2. Its area of cross section
  3. Its nature

Resistance of a uniform metallic conductor is directly proportional to its length (l) and inversely proportional to the area of cross-section (A). That is,

$$R = \rho \, l/A$$

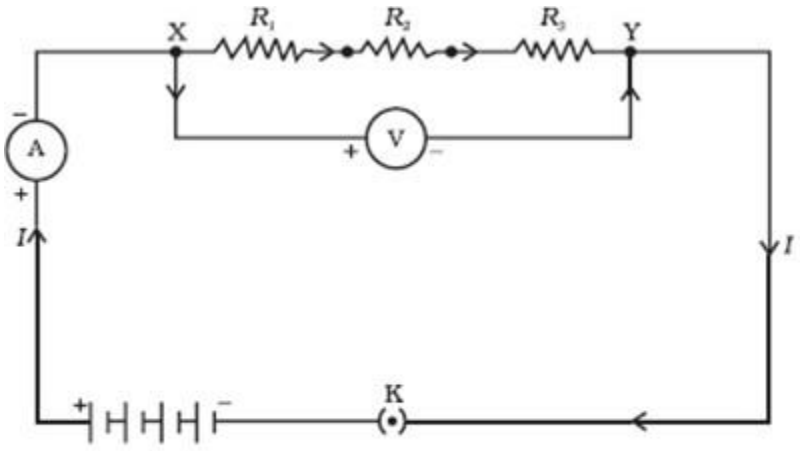
- Where ρ is the constant of proportionality and is called the electrical resistivity of the material of the conductor.
- The SI unit of resistivity is Ω m. It is a characteristic property of the material.
- The metals and alloys have very low resistivity in the range of 10^{-8} Ω m to 10^{-6} Ω m. They are good conductors of electricity.
- Insulators like rubber and glass have resistivity of the order of 10^{12} to 10^{17} Ω m.
- Both the resistance and resistivity of a material vary with temperature.

- The resistances can be combined in two ways
  1. *In series*
  2. *In parallel*

To increase the resistance individual resistances are connected in series combination and to decrease the resistance individual resistances are connected in parallel combination.

Resistors in Series

- When two or more resistances are connected end to end then they are said to be connected in series combination.
- Figure below shows a circuit diagram where two resistors are connected in series combination.



Resistors in series

Figure 3

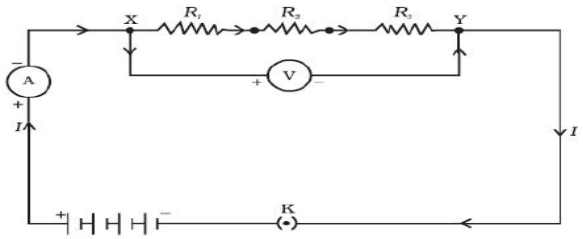
- Now value of current in the ammeter is the same irrespective of its position in the circuit. So we conclude that

"For a series combination of resistors the current is same in every part of the circuit or same current flows through each resistor"

The total potential difference across a combination of resistors in series is equal to the sum of potential differences across the individual resistors.

$V = V1 + V2 + V3$
$= IR1 + IR2 + IR3$
$IR = I(R1+R2+R3)$
$R = R1 + R2\ R3$

- **Resistors in parallel**
  Fig4



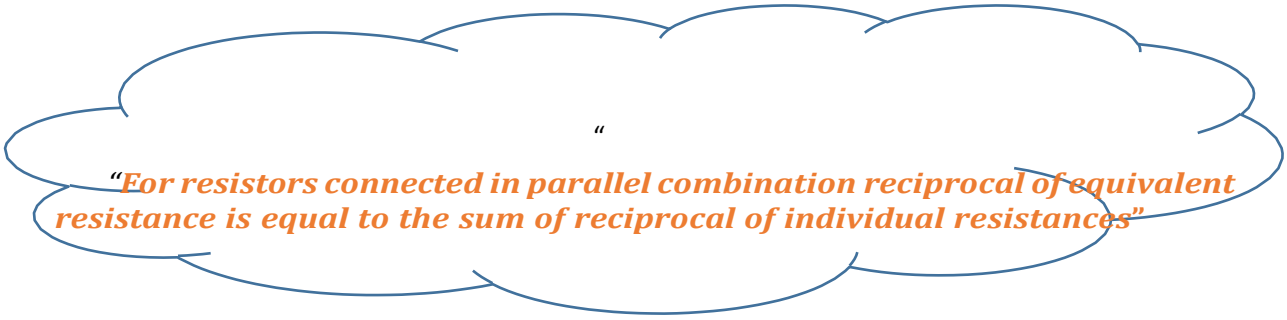
$I = I_1 + I_2 + I_3$
$V/Re = V/R_1 + V/R_2 + V/R_3$
$V/Re = V(1/R_1 + 1/R_2 + 1/R_3)$
$1/Re = (1/R_1 + 1/R_2 + 1/R_3)$

- When two or more resistances are connected between the same two points they are said to be connected in parallel combination.

- When a number of resistors are connected in parallel, then the potential difference across each resistance is equal to the voltage of the battery applied.

- When a number of resistances are connected in parallel, then the sum of the currents flowing through all the resistances is equal to total current flowing in the circuit.

- When numbers of resistances are connected in parallel then their combined resistance is less than the smallest individual resistance. This happens because the same current gets additional paths to flow resulting decrease in overall resistance of the circuit



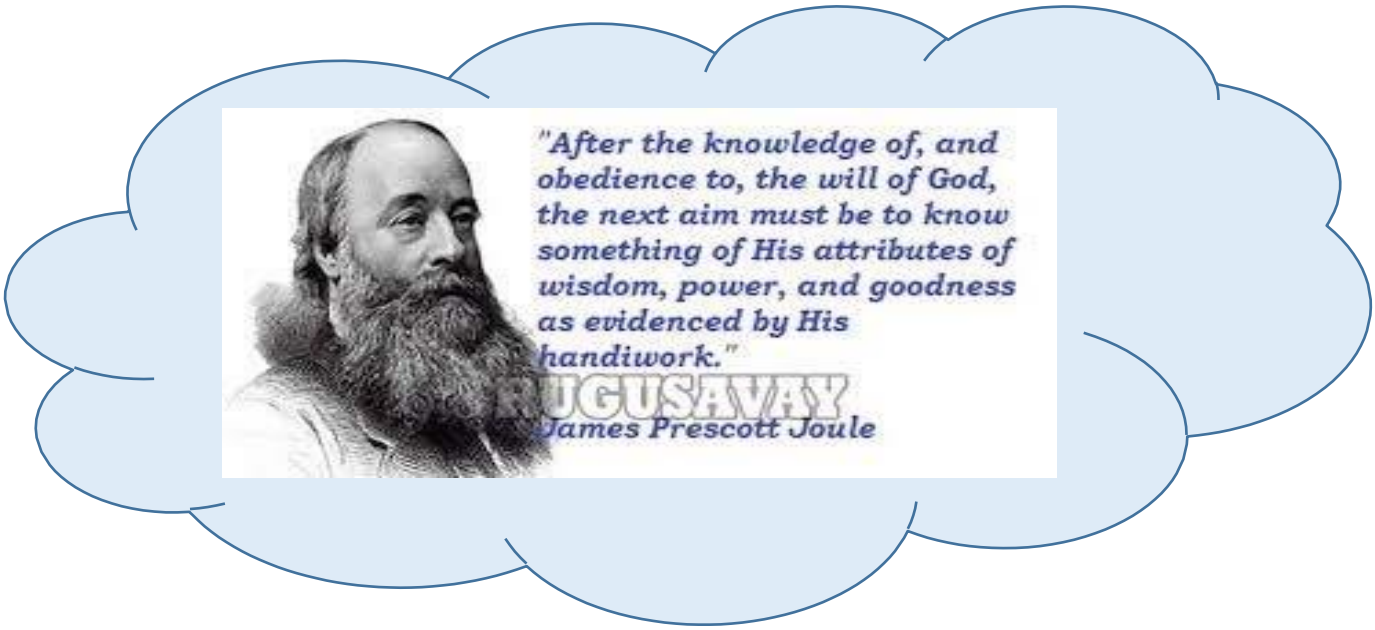
- ***Joule's law of heating***
- According to Joule's Law of heating, Heat produced in a resistor is
  (a) Directly proportional to the square of current for a given resistor.
  (b) Directly proportional to resistance of a given resistor.
  (c) Directly proportional to time for which current flows through the resistor.

- It is given by the expression $H = I^2Rt$ and is well known as ***Joule's Law***.

Applications of the heating effect of electric current

- Appliances like electric immersion water heater, electric iron box, etc. All of these have a heating element in it. Heating elements are generally made of specific alloys like, *nichrome, manganin, constantan etc.*

- The heating effect of electric current is utilized in *electric bulbs or electric lamps* for producing light.
- An ***electric fuse*** is an important application of the heating effect of current. The working principle of a fuse wire is based on the heating effect of current. When high current flow through the fuse (current higher than the rated value) then the heat developed in the wire melts it and breaks the circuit.

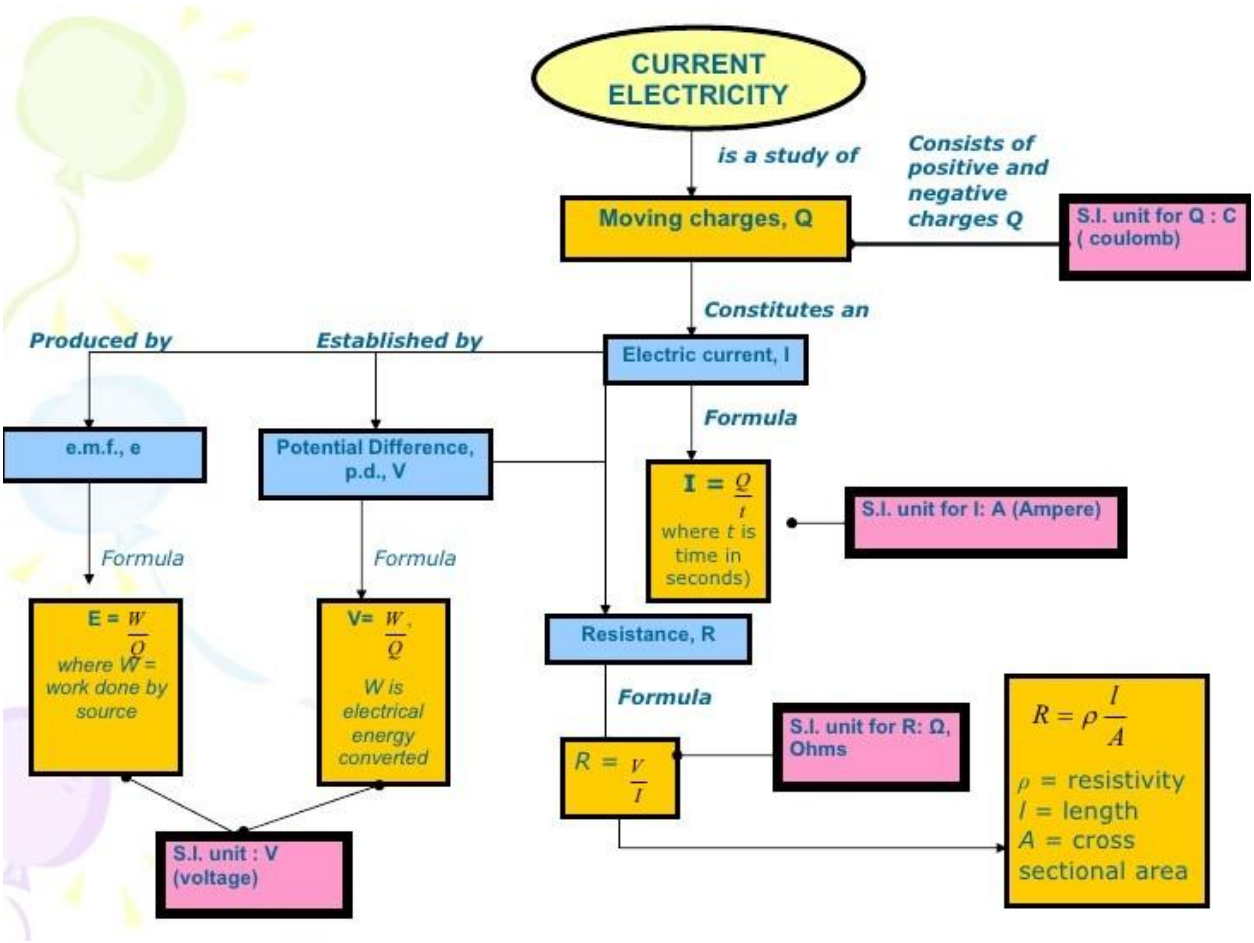


➢ Electric Power

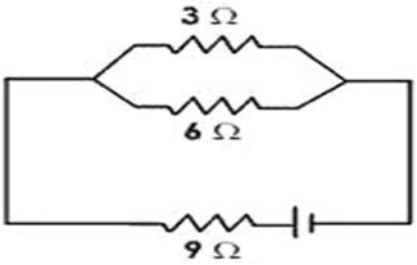
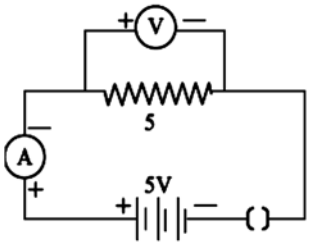
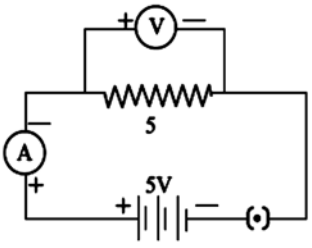
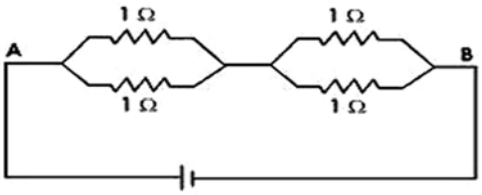
" The rate at which electric work is done or the rate at which electric energy is consumed is called electric power "

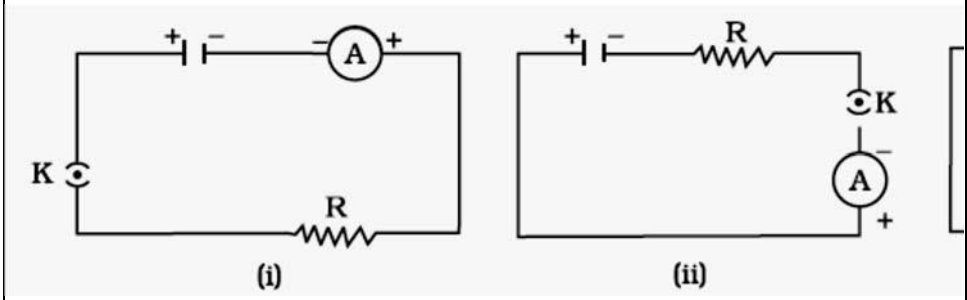
- Mathematically, P = W/t
- SI unit of power is **Watt** which is denoted by letter **W.**
- *The power of 1 Watt is a rate of working of 1 Joule per second.*

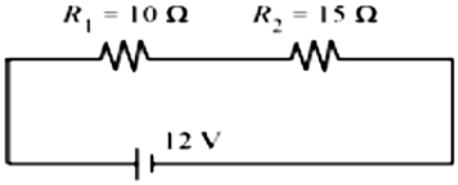
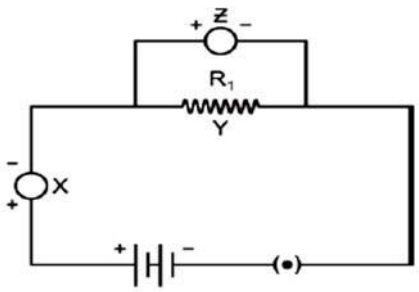
Electric Power = voltage x current

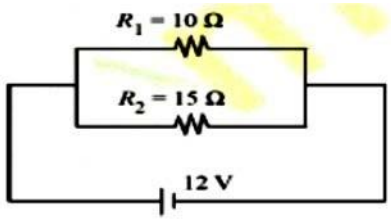
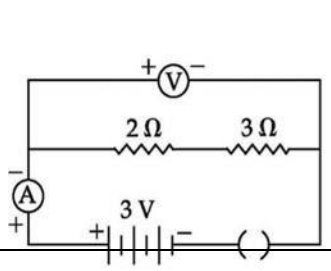
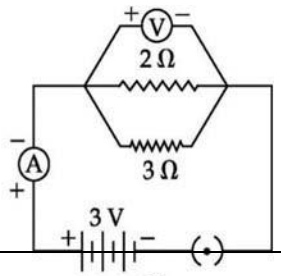

CURRENT ELECTRICITY
is a study of
Consists of positive and negative charges Q
Moving charges, Q
S.I. unit for Q : C (coulomb)
Constitutes an
Produced by
Established by
Electric current, I
Formula
e.m.f., e
Potential Difference, p.d., V
I = Q/t
where t is time in seconds)
S.I. unit for I: A (Ampere)
Formula
Formula
E = W/Q
where W = work done by source
V= W/Q
W is electrical energy converted
Resistance, R
Formula
S.I. unit for R: Ω, Ohms
R = V/I
R = ρ l/A
ρ = resistivity
l = length
A = cross sectional area
S.I. unit : V (voltage)

MCQ QUESTIONS

A		Very Short Answer Questions (VSA)	Mks	Level
1		3 ohm, 6 Ohm and 9 Ohm resistor are connected as shown in the given circuit. The resultant resistance is a) 18 Ohms b) 11 Ohms c) 9 ohms d) 6 ohms 	1	
2		Which of the following statements does not represent ohm's law? a) current / potential difference = constant b) potential difference / current = constant c) potential difference = current x resistance d)current = resistance x potential difference	1	
3		For the circuits I and II, the ammeter readings would be, a)0 A & 5 A b) 0 A & 0A c) 0 A & 1 A d) 1 A & 1 A  I  II	1	
4		The resistance across AB is a) 4 Ohms b) 2 Ohms c) 0.5 ohms d) 1 ohms 	1	

6		Two electric bulbs have their resistance in the ratio 1: 2. If they are joined in series and connected to a voltage, the energy consumed by them will be in the ratio a) 1: 2 b) 2: 1 c) 4: 1 d) 1: 1	1	
7		A cell, a resistor, a key and an ammeter are arranges as shown in the circuit diagrams. The current recorded in the ammeter will be  a) Maximum in (i) b) Maximum in (ii) c) Maximum in (iii) d) Same in all the cases.	1	
8		The unit of resistivity is : a)ohm b)ohm/m c)ohm-m d)mho	1	
9		The potential difference required to pass a current 0.2 A in a wir eof resistance 20W is : a) 100 V b) 4 V c) 0.01 V	1	

		d) 40 V		
10		Work done to move unit charge from one point to another in an electrical circuit is: a) Current b) Potential difference c) Resistance d) None of the above	1	
11		In the given circuit, the current in the circuit would be a) 0.48 A b) 2.08 A c) 1.2 A d) 2 A 		
12		A student draws the following circuit diagram to measure the dependence of current with voltage, The parts labelled inthe circuit diagram as X, Y and Z respectively are :  a) Ammeter, Voltmeter and resistance b) Ammeter, resistance and Voltmeter. c) Voltmeter, resistance and Ammeter d) Resistance, Voltmeter and ammeter.		
13		When three equal resistors are connected in series, their resultant resistance is 15 ohms. When they are connected in parallel, their equivalent resistance will be, a) 5/3 Ohms b) 5 Ohms c) 15 Ohms d) 3/5 Ohms		

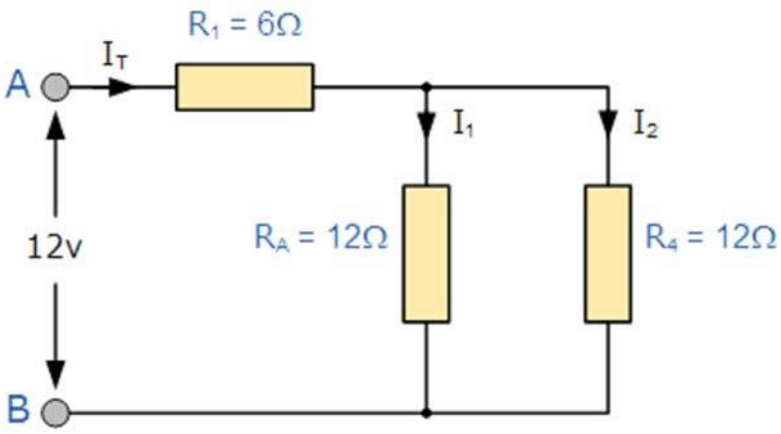
14		Heat produced in a current carryingwire in 5s is 60 **J**. The same current is passed through another wire of half the resistance. The heat produced in5 s will be : a)60 **J** b) 30 **J** c) 15 **J** d) 120 **J**		
15		The current in the given circuit is : a) 2 A b) 0.48 A c) 1.2 A d) 1.5 A 		
16		Three equal resistances when combined in series are equivalent to 90W. Their equivalent resistance when combined in parallel will be : a) 270 W b) 30 W c) 810 W d) 10 W		
17		The resistivity of a wire depends on : a) length b) material c) area of cross- section d) length, material and area of cross- section		
18		For the circuits A and B shown below the voltmeter readings would be :  (A)  (B)		

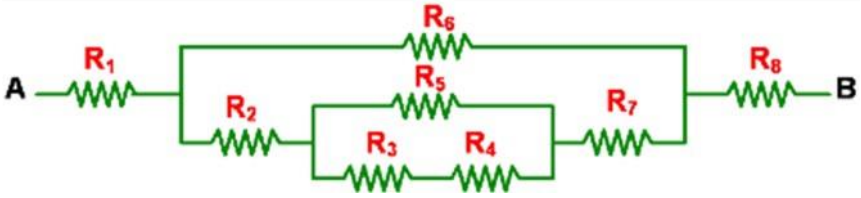
		a) 0 V in circuit (A) and 2.5 V in circuit (B) b) 0 .6V in circuit (A) and 3 V in circuit (B) c) 3 V in both circuits d) None of these		
19		Four cells each of e.m.f 'E' are joined in parallel to form a battery. The equivalent e.m.f ofthe battery will be : a) 4 E b) E c) E / 4 d) E =0		
20		A boy records that 4000 joule of work is required to transfer 10 coulomb of charge between two points of a resistor of 50 Ω. The current passing through it is (a) 2 A (b) 4 A (c) 8 A (d) 16 A		
		ANSWER KEY		

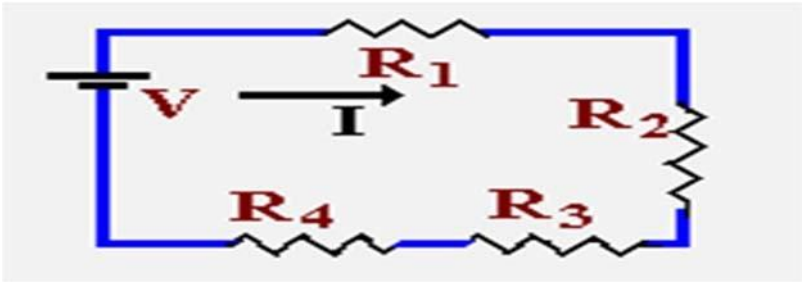
1	2	3	4	5	6	7	8	9	10
11	**12**	**13**	**14**	**15**					

QUESTIONS

B.		Very Short Answer Questions (VSA)	Mks	Level
1		Why copper wires are used as connecting wires?	1	C
2		Which physical quantity is represented by Joule/coulomb?	1	U
3		A wire of resistivity ρ is stretched to double its length. What is its new resistivity?	1	HOT
4		A wire of resistance R is bent in form of a closed circle, what is the resistance across a diameter of the circle?	1	HOT
5		What happens to the resistance of a circuit if the current passing through it is doubled?	1	U
6		10 C of charge passes a point in a circuit in 2 minutes. Give the amount of the current in the circuit?	1	A
7		How does the resistance of a wire depends on its radius?	1	U
8		How much power is dissipated when 0.2 ampere of current flows through a 100-ohm resistor?	1	A

C.		**Short Answer Questions (SA)**	**2**	**Level**
1		Two wires of equal cross sectional area, one of copper and other of manganin have same resistance. Which one will be longer?	2	HOT
2		Two cubes A and B are of the same material. The side of B is thrice as that of A. Find the ratio R_A/R_B.	2	A
3		Three equal resistances are connected in series then in parallel. What will be the ratio of their Resistances?	2	A
4		How many bulbs of 8Ω should be joined in parallel to draw a current of 2A from a battery of 4 V?	2	A
5		3 X 10 ^{11}electrons are flowing through the filament of bulb for two minutes. Find the current flowing through the circuit. Charge on one electron=1.6X10^{-19} C.	2	A
6		a) Name a metal which is the best conductor electricity? b) Give three factor on which the resistance of a conductor depends. Explain with mathematical expression.	2	U
7		 a) Calculate the effective resistance of the following circuit? b) The value of current passing through the circuit?	2	A

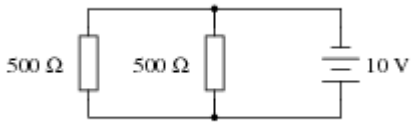
D		**Short Answer Questions (SA)**	**3**	**LEVEL**
1		 Find the total resistance of eight resistors above: R_1 = 10 Ω R_2 = 2 Ω R_3 = 3 Ω R_4 = 17 Ω R_5 = 20 Ω R_6 = 20 Ω R_7 = 8 Ω R_8 = 10 Ω	3	A
2		When a potential difference of 2 V is applied across the ends of a wire of 5 m length, a current of 1 A is found to flow through it. Calculate: (i) the resistance per unit length of the wire (ii) the resistance of 2 m length of this wire (iii) the resistance across the ends of the wire if it is doubled on itself.	3	A
3		Define electric power? Give its unit? How much energy is converted by a device that draws 1.5 amperes from a 12-volt battery for 2 hours?	3	U
4		What should be the resistance of an ideal ammeter? Ammeter burns out when connected in parallel. Give reasons.	3	U
5		a)Draw the following symbols (i)Battery (ii) Switch closed (iii) Resistor of resistance R (iv) Voltmeter	3	U

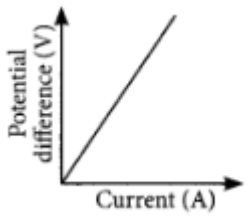
		b) Write one important advantage of using alternative current. How alternating current differ from direct current?		
E		**Long Answer Questions**	**5**	**LEVEL**
1		a) State Joule's law of heating effect? b) Should the heating element of an electric iron be made of iron, silver or nichrome wire? c) If the current I through a resistor is increased by 100% (assume that temperature remains unchanged), find the increase in power dissipated.	5	MD
2		a)With the help of neat circuit, derive the expression for the equivalent resistance of 3 resistances connected in series and parallel b)  The current flowing in a circuit containing four resistors connected in series is I = 1.0 A. The potential drops across the first, second and third resistors are, respectively: V = 5 V, V = 8 V and V = 7 V. The equivalent resistance of the circuit is R = 30 $^{\Omega}$. Find the total voltage supplied by the battery, and also current, voltage drop, and resistance of each resistor in the circuit.	5	U

3		An electric bulb draws a current of 0 .8 A and works on 250 V on the average 8 hours a day. a) Find the power consumed by the bulb b) If the electric distribution company changes Rs 5 for 6 KWH, what is the monthly bill for 60 days?	5	A
4		a) State Ohm's Law. b) Draw a circuit diagram for the verification of Ohm's Law. Also plot graphically the variation of current with potential difference. c) You are measuring the current in a circuit that is operated on an 18 V battery. The ammeter reads 40 mA. Later you notice the current has dropped to 20 mA. How much has the voltage changed?	5	U

Sr. No.	Question	Marks	Question type U/C/A/Hots
	For question numbers , two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (i), (ii),(iii) and (iv) as given below i) Both A and R are true and R is correct explanation of the assertion. ii) Both A and R are true but R is not the correct explanation of the assertion. iii) A is true but R is false. iv) A is false but R is true.		
1	Assertion: A conductor has 3.2 x 10^{-19}C charge. Reason: Conductor has gained 2 electrons.	1	U
Ans	(iii) A is true but R is false		

2	Assertion: The resistivity of conductor increases with the increaseof temperature. Reason: the resistivity is the reciprocal of conductivity	1	C
Ans:	(ii) Both A and R are true but R is not the correct explanation of theassertion		
3	Assertion: Bending of a wire does not affect electrical resistance. Reason: Resistance of wire is proportional to resistivity of material.	1	A
Ans	(i)Both A and R are true and R is correct explanation of the assertion		
4	Assertion: Two resistance having value R each. Their equivalentresistance is R/2. Reason: Given resistor is connected in parallel.	1	A
Ans	(i) Both A and R are true and R is correct explanation of the assertion		
5	Assertion: In a simple battery circuit the point of lowest potential ispositive terminal of the battery. Reason: The current flows towards the pint of the lower potential as it flows in such a circuit from the negative to the positive terminal.	1	U
Ans	(iv) A is false but R is true		
6.	Assertion: The 200w bulbs glow with more brightness than 100w bulbs. Reason: A 100w bulb has more resistance than a 200w bulb.		A
Ans	i) Both A and R are true and R is correct explanation of the assertion		
7.	Assertion: Voltmeter is always connected in parallel in a circuit. Reason: Voltmeter measures electric current in circuit.		U
Ans	iii) A is true but R is false.		
	Read the passage and answer the following questions.		
8.	The heating effect of current is obtained by transformation of electrical energy in heat energy. Just as mechanical energy used to overcome friction is covered into heat, in the same way, electrical energy is converted into heat energy when an electric current flows through a resistance wire. The heat produced in a conductor, when a current flows through it is found to depend directly on (a) strength of current (b) resistance of the conductor (c) time for which the current flows.		

	The mathematical expression is given by H = I2Rt. The electrical fuse, electrical heater, electric iron, electric geyser etc. all are based on the heating effect of current.		
a)	If the current passing through a conductor is doubled , what will be the change in heat produced ?	1	
b)	Why does the cord of an electric heater not glow while the heating element does ?	1	
c)	A current of 0.5 A passes through a conductor for 5 min and the resistance of conductor is 10 Ω. Calculate the amount of heat produced. Or Should the heating element of an electric iron be made of iron, silver or nichrome wire? why?	2	
9.	Several resistors may be combined to form a network. The combination should have two end points to connect it with a battery or other circuit elements. When the resistances are connected in series, the current in each resistance is same but the potential difference is different in each resistor. When the resistances are connected in parallel, the voltage drop across each resistance is same, but the current is different in each resistor. When we have two or more resistances joined in parallel to one another, then the same current gets additional paths to flow and the overall resistance decreases. The equivalent resistance is given by 1/Rp=1/R1+1/R2+1/R3		
a)	A series circuit has two identical resistors. A current of 4 A flows from the battery. What is the value of the current through each resistor?	1	
b)	State one difference between a series and parallel circuit.	1	
c)	Three resistors of equal resistance R are connected in series and then connected in parallel. What will be the ratio of equivalent resistance in series and parallel? Or Calculate the total amount of current that the battery must supply to this parallel circuit.  	2	
10.	The potential difference across the terminals of the wire is directly proportional to the electric current passing through it at a given temperature. Thus, V= IR Where R is the proportionality constant called as resistance of the wire. Thus, we can say that the resistance of the wire is inversely proportional to the electric current. As the resistance increases current through the wire decreases. The resistance of the conductor is directly proportional to length of the conductor, inversely proportional to the area of cross section of the conductor and also depends on the nature of the material from which conductor is made. Thus R=pL/A., where p is the resistivity of the material of conductor.		
a)	A 12 V battery of a car is connected across a 4 resistor. Calculate the current passing through the resistor.		
b)	V-I graph for a conductor is as shown in the figure.		

	 (i) What do you infer from this graph? (ii) State the law expressed here.		
c)	The area of cross section of wire becomes half when its length is stretched to double. How is the resistance of wire affected in new condition? Justify your ans. Or The resistivity of a metal wire is 10 x 10−8 Ω m at 20°C. Find the resistance of the same wire of 2 meter length and 0.3 mm thickness.		

NOTE

Lesson-Electricity

Learning Objective	Achieved 	Working towards 	Needs reinforcement 
I can interpret electric current and circuit, understand electric potential and potential difference, analyse circuit diagram, illustrate ohm's law and list factors on which the resistance of a conductor depends.			
I can discuss the resistance of a system of resistors.			
I can demonstrate heating effect of electric current and explain electric power.			

Teacher's feedback: _____

_____

Student's feedback: _____

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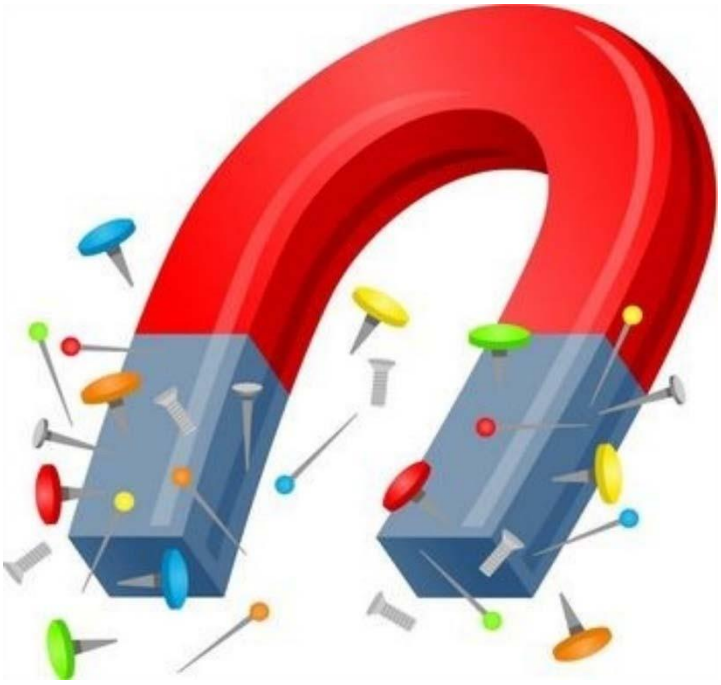
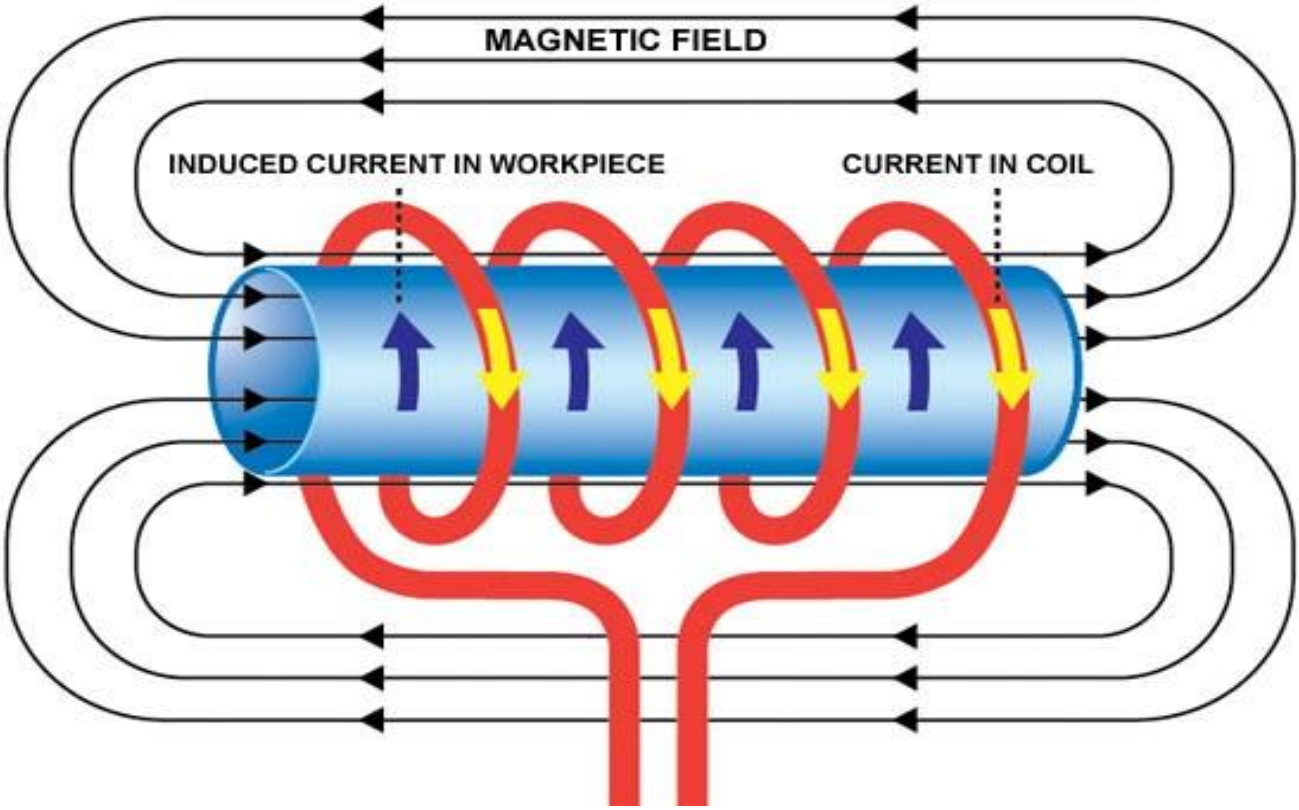
Next step in
Learning:_____

MAGNETIC EFFECT OF ELECTRIC CURRENT





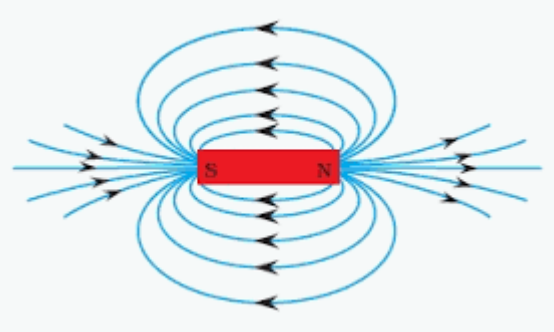
- **Magnet:**

is an object that attracts objects made of iron, cobalt & nickel.
Comes to rest in North-South direction, when suspended freely.

- **Magnets are used:** (i) In radio & stereo speakers, (ii) In refrigerator doors, (iii) on audio & video cassettes players, (iv) On hard discs & floppies of computers & (v) in children's toys.

- **Magnetic field:** The area around a magnet where a magnetic force is experienced is called a magnetic field. It is a quantity that has both direction & magnitude.

- **Magnetic field lines:** Magnetic field is represented by field lines. They are lines drawn in a Magnetic field along which a North magnetic pole moves. Magnetic field lines are called as Magnetic lines of force.



- **Properties of Magnetic field lines:**

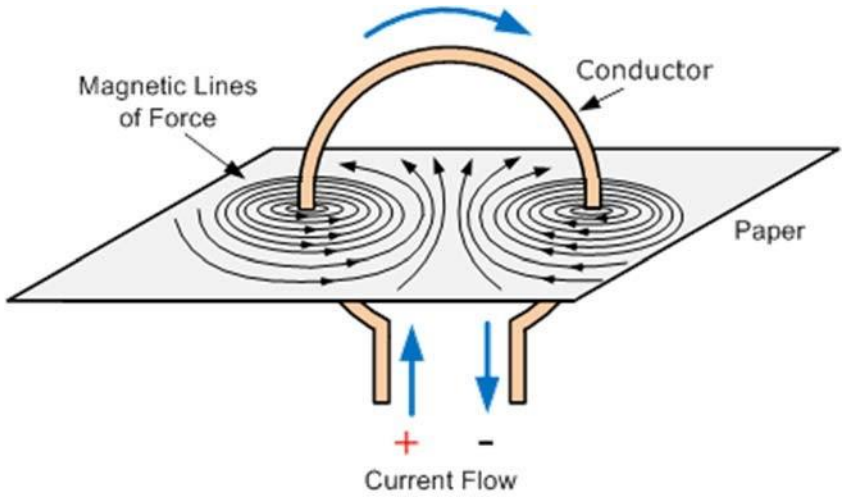
They do not intersect each other.

It is taken by convention that magnetic field lines emerge from North pole and merge at the South pole. Inside the magnet, their direction is from South pole to North pole. Therefore magnetic field lines are closed curves.

- **Magnetic field lines due to a current through a straight conductor (wire)-** consist of series of concentric circles whose direction is given by the Right hand thumb rule.

- **Right hand thumb rule:** If a current carrying straight conductor is held in your right hand such that the thumb points towards the direction of current, then the wrapped fingers show the direction of magnetic field lines.

- **Magnetic field lines due to a current through a circular loop**



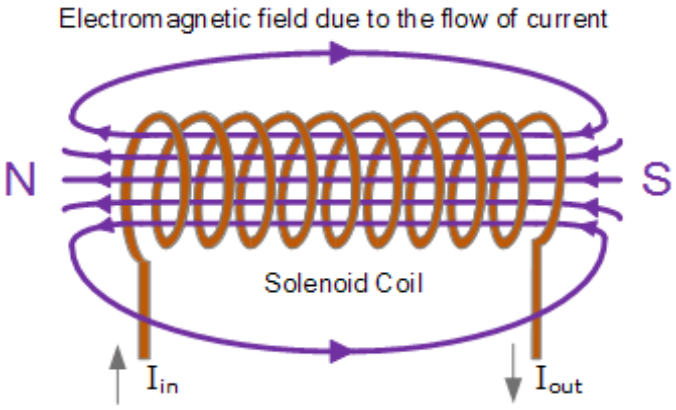
- **The strength of the magnetic field at he centre of the loop(coil)depends on:**

The radius of the coil- The strength of the magnetic field is inversely proportional to the radius of the coil. If the radius increases, the magnetic strength at the centre decreases.

The number of turns in the coil: As the number of turns in the coil increase, the magnetic strength at the centre increases, because the current in each circular turn is having the same direction, thus the field due to each turn adds up.

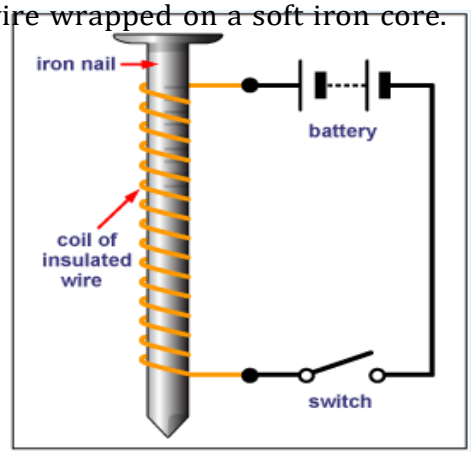
The strength of the current flowing in the coil: as the strength of the current increases, the strength of thee magnetic fields also increases.

Solenoid:

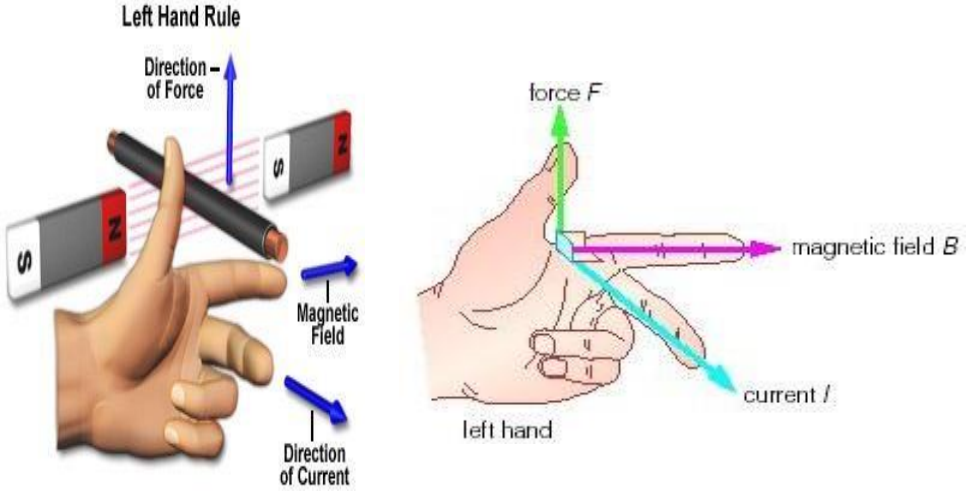


- A coil of many turns of insulated copper wire wrapped in the shape of a cylinder is called a Solenoid.

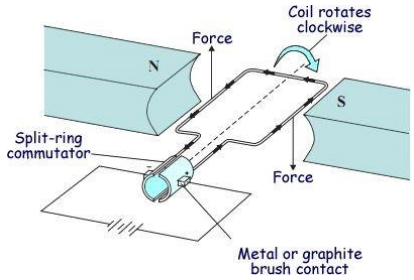
- Magnetic field produced by a Solenoid is similar to a bar magnet.
- The strength of magnetic field is proportional to the number of turns & magnitude of current.
- **Electromagnet:** An electromagnet consists of a long coil of insulated copper wire wrapped on a soft iron core.



Fleming's Left hand rule: Stretch the thumb, forefinger and middle finger of left hand such that they are mutually perpendicular. Forefinger points in the direction of magnetic field and centre finger in the direction of current, then the thumb gives the direction of force acting on the conductor.

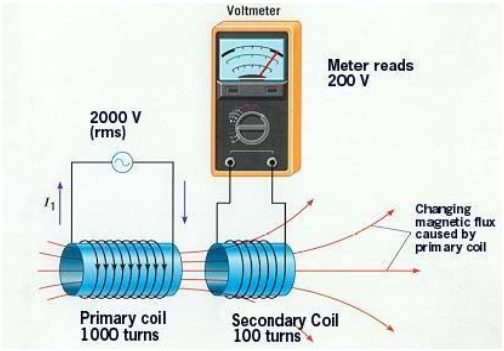


Electric motor: A device that converts electric energy to mechanical energy.

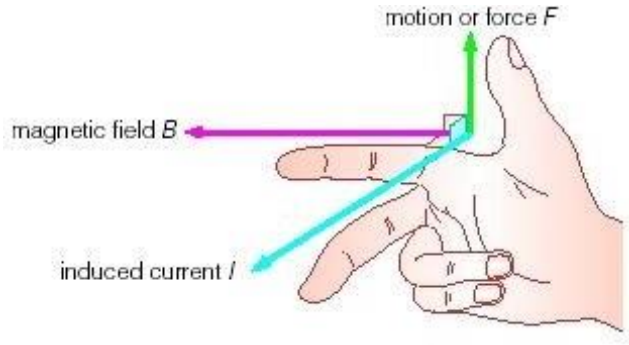


Principle of Electric motor: When a rectangular coil is placed in a magnetic field and a current is passed through it, force acts on the coil, which rotates it continuously. With the rotation of the coil, the shaft attached to it also rotates.

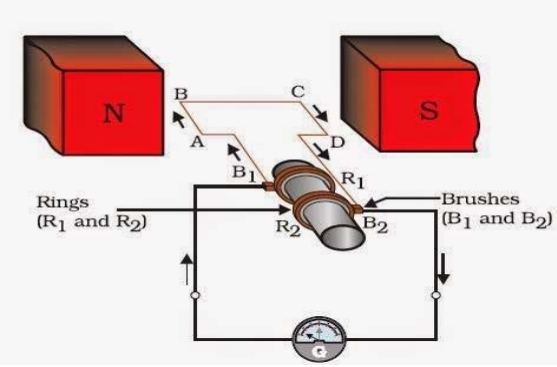
Electromagnetic induction: Electricity production as a result of magnetism (induced current) is called Electromagnetic induction.



Fleming's Right hand rule: gives the direction of induced current. Stretch the thumb, forefinger and middle finger of right hand such that they are mutually perpendicular. Forefinger points in the direction of magnetic field and centre finger in the direction of induced current, then the thumb gives the direction of motion of the conductor.



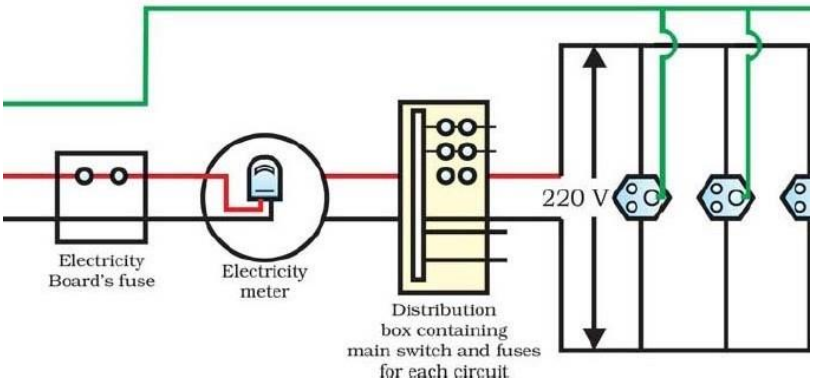
Electric generator: A devise that converts mechanical energy to electric energy.
Electric generator is of two types- (i) A.C generator (ii) D. C generator



Principle of Electric generator: Electromagnetic induction

Domestic electric circuits:

We receive electric supply through mains supported through the poles or cables. In our houses we receive AC electric power of 220V with a frequency of 50HZ



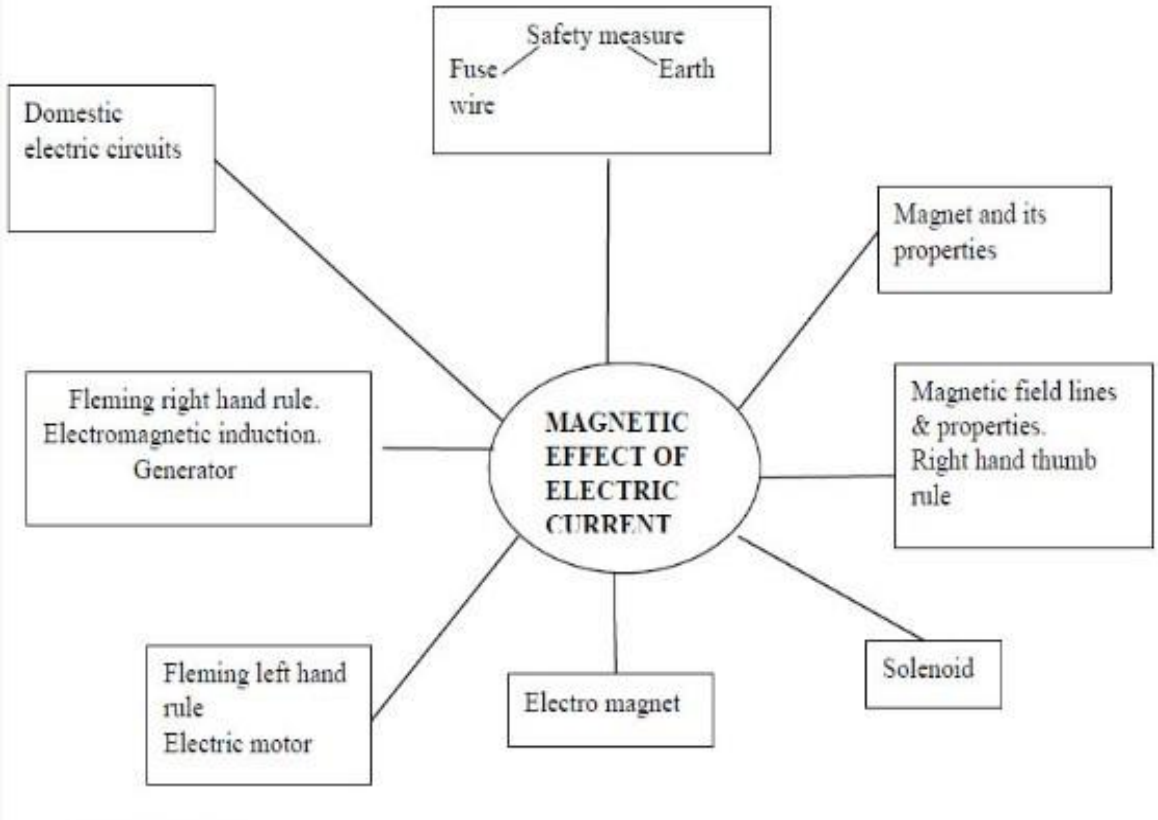
The 3 wires are as follows- **(i) Live wire**- (Red insulated, Positive)
Neutral wire- (Black insulated, Negative)

Earth wire- (Green insulated) for safety measure to ensure that any leakage of current to a metallic body does not give any serious shock to a user.

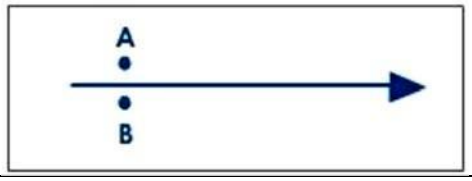
Short circuit: is caused by touching of live wires and neutral wire

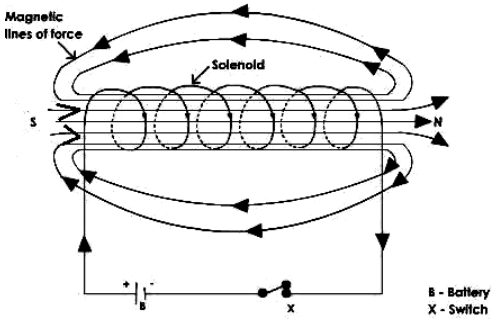
Fuse: is a protective device used for protecting the circuits from short circuiting and over loading.

MIND MAP

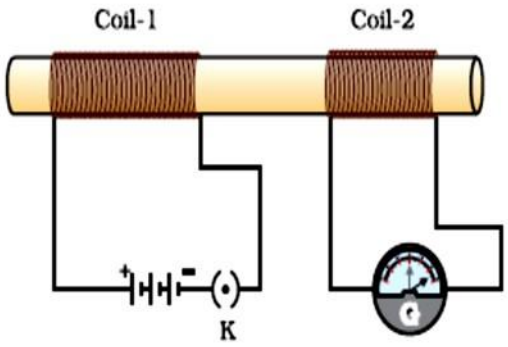

Safety measure
Fuse wire
Earth
Domestic electric circuits
Magnet and its properties
Fleming right hand rule.
Electromagnetic induction.
Generator
MAGNETIC EFFECT OF ELECTRIC CURRENT
Magnetic field lines & properties.
Right hand thumb rule
Fleming left hand rule
Electric motor
Electro magnet
Solenoid

MCQ QUESTIONS

1		The direction of the force on a current-carrying wire placed in a magnetic field depends : a) Only on the direction of current b) Only on the direction of magnetic field c) On both the directions of current and magnetic field d) On neither the direction of current nor the direction of magnetic field	1	
2		An electric current passes through a straight wire in the direction of south to north. Magnetic compasses are placed at points A and B as shown in the figure. What is your observation? a) The needle will not deflect b) Only one of the needles will deflect c) Both the needles will deflect in the same direction d) Both the needles will deflect in opposite directions 	1	
3		The magnetic lines of force inside a current carrying solenoid are: a) Along the axis and parallel to each other b) Perpendicular to the axis and parallel to each other c) Circular and do not intersect with each other. d) Circular and intersect each other.	1	

				
4		A fuse in an electric circuit acts as a: a) Energy multiplier b) Voltage multiplication c) Current multiplication d) Safety device	1	
5		Which of the following describes the common domestic power supplied in India? a) 220 V, 50 Hz b) 220 V, 100 Hz c) 110 V, 100 Hz d) 100 V, 50 Hz	1	
6		Electromagnetic induction is the: a) charging of a body with a positive charge b) production of current by relative motion between a magnet and a coil c) rotation of the coil of an electric motor d) generation of magnetic field due to a current carrying solenoid	1	
7		A fuse wire is rated 8A. It means: a) It will not work if the current is less than 8 A. b) It will work only if the current is 10 A. c) It has a resistance of 8 Ohms d) It will melt if the current exceeds 8 A.	1	
8		An electric generator actually acts as: a) source of electric charge b) a converter of energy c) an electromagnet d) source of heat energy	1	

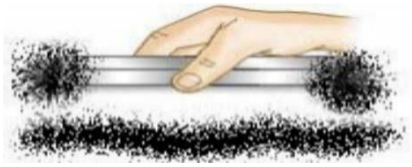
9		Which of the following devices works on the principle of electromagnetic induction? a) Electric motor b) Electric generator c) Ammeter d) Voltmeter	1	
10		The magnetic field lines due to a straight wire carrying a current are: a) Straight b) Circular c) Parabolic d) Elliptical	1	
11		A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid: a) Will remain zero b) Will decrease c) Will increase d) Will remain unaffected		
12		In an electric motor, the energy transformation is from: a) Electrical to mechanical energy b) Mechanical to electrical energy c) Chemical energy to Light energy d) Electrical energy to chemical energy		
13		The direction of induced current is obtained by : a) Fleming's left-hand rule b) Right hand thumb rule c) Fleming's right-hand rule d) Ampere's rule		
14		Magnetic field produced at the centre of a current carrying circular wire : a) Increases with increase in radius of the circular coil b) Decreases with increase in strength of the current c) increases with decrease in radius of the coil d) increases with decrease in strength of the current		

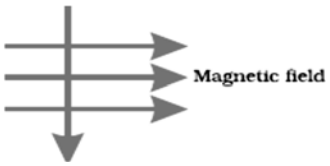
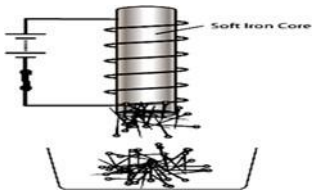
	15	When the main switch of the house is put off, it disconnects: a) Live and neutral wire b) Live wire c) Neutral wire. d) Earth wire.		
	16	You have a coil and a bar magnet. You can induce an electric current on the coil : a) Only by moving the coil but not the magnet. b) Only by moving the magnet and not the coil. c) By moving the coil or the magnet. d) None of the above		
	17	Choose the incorrect statement from the following regarding magnetic lines of field: a) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points b) Magnetic field lines are closed curves c) Relative strength of the magnetic field is determined by the degree of closeness of magnetic lines of forces. d) If magnetic lines are parallel and equidistant, they represent zero field strength		
	18	Commercial electric motors do not use a) an electromagnet to rotate the armature b) Effectively a large number of turns of conducting wire in the current carrying coil c) a permanent magnet to rotate the armature d) a soft iron core on which the coil is wound		
	19	In the arrangement shown in figure, there are two coils wound on a non-conducting cylindrical rod. Initially, the key is not inserted. Then the key is inserted and later removed. Then, a) the deflection in the galvanometer remains zero throughout b) there is a momentary deflection in the galvanometer but it dies out shortly and there is no effect when the key is removed 		

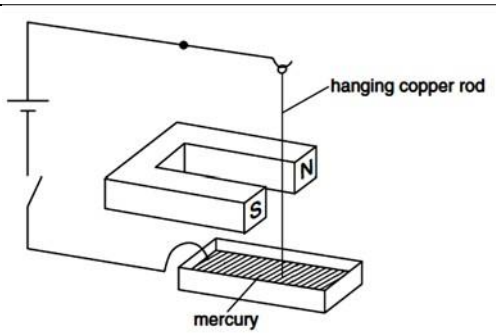
		c) There are momentary galvanometer deflections, which die out shortly, and the deflections are in the same direction. d) There are momentary deflections, which die out shortly and the deflections are in the opposite directions.		
	20	A student arrived at the following conclusions about connecting all the appliances in parallel to each other in domestic circuits A. Each appliance can be switched on or off as desired B. Each appliance will get the same current C. Each appliance will get different voltage D. each appliance will get same voltage. The correct statements are: a) A & D b) B & C c) A & B d) D & B		

QUESTIONS

B		Very Short Answer Questions (VSA)	MKS	LEVEL
1		Two magnetic field lines cannot intersect each other. Explain why.	1	C
2		Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise, apply the right hand rule to find the direction of magnetic field inside and outside the loop.	1	(A)
3		A horizontal power line carries current in the east to west direction. What is the direction of magnetic field due to the current in the power line at a point above and at a point below the power line?	1	HOT

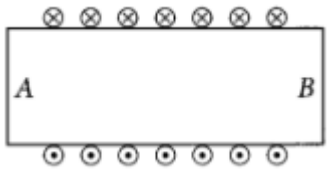
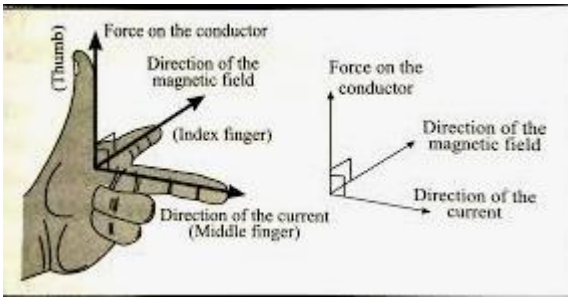
4		Two circular coils A and B are placed close to each other. If the current in coil A is changed, will some current be induced in coil B? Identify and state the phenomenon?	1	U
5		A magnetic compass is placed near a current carrying wire. What will you observe (i) When current in the wire is increased? (ii) When the magnetic compass is displaced away from the wire?	1	A
6		Complete the diagram given below after drawing the field lines around the current carrying conductor. 	1	U
7		Why is an alternating current considered to be advantageous over direct current for long range transmission of electric energy?	1	(U)
C		**Short Answer Questions (SA)**	**Mks**	**Level**
1		Which of the property of a proton can change when it moves freely in a magnetic field? Give reason for your answer. a)mass b)speed c)velocity d)momentum)	2	HOT
2		When iron filings or iron nails are brought close to a magnet, the filings or nails are attracted to the magnetic poles. Why do the iron filings form dense clusters near the ends of the magnet? 	2	(U)

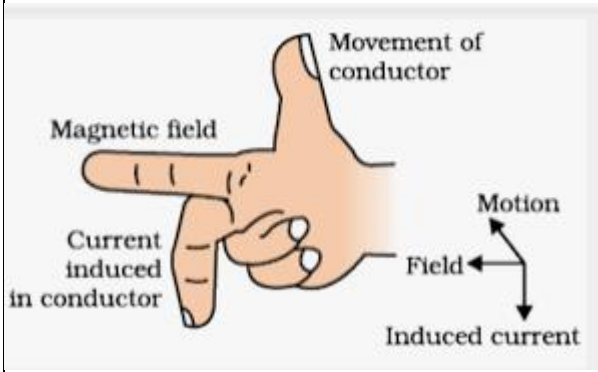
3	!?	A particle enters the magnetic field at right angles to the magnetic field as shown. What will be the direction of force acting on the particle if the particle is a) A proton b) A neutron  Give reason for your answer.	2	A
4	!?	It is established that an electric current through a metallic conductor, produces magnetic field around it. Is there a similar magnetic field produced if a thin beam of (i) Alpha particles (ii) Neutrons? Justify your answer.	2	A
5		The diagram shows the apparatus set up to investigate the factors that affect the strength of an electro magnet. When the switch is closed, the pins are attracted to the soft iron core.  ? State the two factors which are responsible for increasing the number of pins attracted to the soft iron rod.	2	U
D.		Short Answer Questions (SA)	3	

1		Study the following diagram and answer the questions.  a) Suggest what is seen to happen to the hanging copper rod when the switch is closed. b) Explain your answer? c) The cell is reversed and the key is closed. How does what is seen now differ from what you described before explain the difference?	3	A
2		Why is electromagnetic induction so called? A coil connected to a sensitive galvanometer is held stationary. A bar magnet with its North Pole facing coil is moving towards the coil at a certain speed. The galvanometer needle shows deflection of 10 divisions to towards right of the centre of the scale. How will the reading on the galvanometer scale be affected if the south pole of the bar magnet facing the coil is moved away at the same speed?	3	U
E.		**Long Answer Questions (SA)**	5	
1		Draw an appropriate schematic diagram showing common domestic circuits and discuss the importance of fuse. Why is it that a burnt out fuse should be replaced by another fuse of identical rating?	5	MD
2		Explain with the help of a labelled diagram the distribution of magnetic field due to a current through a solenoid. Why is it that if a current carrying coil has *n* turns the field produced at any point is *n* times as large as that produced by a single turn? How can you increase the strength of the magnetic field produced by a solenoid? The magnetic field produced by a current carrying solenoid is similar to that of which magnet?	5	U

Sr. No.	Question For question numbers, two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below: i) Both A and R are true, and R is correct explanation of the assertion. ii) Both A and R are true, but R is not the correct explanation of the assertion. iii) A is true but R is false. iv) A is false but R is true.	Marks	Question type U/C/A/Hots
1.	Assertion: As we move away from the current carrying conductor the magnetic field decreases. Reason: The magnetic field strength is directly proportional to the distance from the current carrying conductor.	1	U
Ans:	iii) A is true but R is false.		
2.	Assertion: Magnetic field lines start from the north pole and end at the south pole. Reason: magnetic field lines are closed and continuous loops.	1	C
Ans:	iv) Assertion is false, but reason is true		
3.	Assertion: Relative strength of magnetic field is shown by the degree of closeness of the field lines. Reason: Magnetic strength is uniform at its poles.	1	U
Ans:	iii) Assertion is true, but reason is false		
4.	Assertion: The field lines inside the solenoid are in the form of straight lines, which indicates that the magnetic field is the same at all points inside the solenoid. Reason: The field lines inside the solenoid are similar to that of bar magnet.	1	U

Ans:	i) Both A and R are true, and R is correct explanation of the assertion.		
5.	Assertion: AC generator has slip rings while the DC generator has a split ring. Reason: Commutator is device used to reverse the direction of current and split rings act as commutators.	1	U
Ans:	i) Both A and R are true, and R is correct explanation of the assertion.		
6.	Assertion: The magnetic field produced by a current carrying solenoid Is independent of its length and cross-sectional area. Reason: The magnetic field inside the solenoid is uniform	1	U
Ans:	ii)Both assertion and reason are correct statements, but reason is not correct explanation of assertion.		
7.	Assertion: Force experienced by moving charge will be maximum if direction of velocity of charge is perpendicular to applied magnetic field. Reason: Force on moving charge is independent of direction of applied magnetic field.	1	A
	iii) Assertion is true, but reason is false	1	
8.	Assertion(A) : Alternating Current is used in household supply. Reason (R) : AC electric power can be transmitted over long distances without much loss of energy		U
	i) Both A and R are true, and R is correct explanation of the assertion.		
	Read the passage and answer the following questions.		
1.	An insulated copper wire wound on a cylindrical cardboard tube such that its length is greater than its diameter is called a solenoid. When an electric current is passed through the solenoid, it produces a magnetic field around it. The magnetic field produced by a current-carrying solenoid is similar to the magnetic field produced by a bar magnet. The field lines inside the solenoid are in the form of parallel straight lines. The strong magnetic field produced inside a current-carrying solenoid can be used to magnetize a piece of magnetic material like soft iron, when placed inside the solenoid. The strength of magnetic field produced by a current carrying solenoid is directly proportional to the number of turns and strength of current in the solenoid.		

a.	The current carrying solenoid when suspended freely rests along a particular direction. Why?	1	
b.	List two distinguishing features between a bar magnet and a solenoid.	1	
c.	State three factors on which the strength of magnetic field produced by a current carrying solenoid depends. Or Following diagram shows the lengthwise section of a current carrying solenoid. ⊗ indicates current entering into the page, ⊙ indicates current emerging out of the page. Decide which end of the solenoid A or B, will behave as north pole. Give reason for your answer. 	2	
2.	Andre Marie Ampere suggested that a magnet must exert an equal and opposite force on a current carrying conductor, which was experimentally found to be true. But we know that current is due to charges in motion. Thus, it is clear that a charge moving in a magnetic field experience a force, except when it is moving in a direction parallel to it. If the direction of motion is perpendicular to the direction of magnetic field, the magnitude of force experienced depends on the charge, velocity (v), strength of magnetic field (B), and sine of the angle between v and B. Direction of magnetic force is given by Fleming's left-hand rule. 		
a.	On what factors does the force experienced by a current–carrying conductor placed in a uniform magnetic field depend?	1	
b.	Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of the magnetic field?	1	
c.	State whether an alpha particle will experience any force in a magnetic field if (alpha particles are positively charged particles) (i) it is placed in the field at rest.	2	

	(ii) it moves in the magnetic field parallel to field lines. (iii) it moves in the magnetic field perpendicular to field lines. Justify your answer in each case. Or State Flemings's left-hand rule.		
3.	The phenomena in which an electromotive force and current (if the conductor is in the form of a closed circuit) is induced by changing magnetic field (or by passing magnetic field lines) through it is called electromagnetic induction. The emf so developed is called induced emf and current made to flow is called induced current. The cause of induced emf carried out by Faraday and Henry. It can be concluded that the induced current flows in a conductor as long as the magnetic lines of force change within the conductor. In case of relative motion i.e., motion of coil w.r.t to magnet or vice versa, the direction of the current flowing in the conductor is determined by the direction of the relative motion of the conductor with respect to the magnetic field. The induced emf or current is directly proportional to the rate of change in magnetic field. Fleming's right hand rule is used to find the direction of induced current.  		
a.	Define the term induced electric current	1	
b.	Give one application of electromagnetic induction.	1	
c.	State Fleming's right hand rule. Or Two circular coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in the galvanometer connected across the coil Q (a) if current in the coil P is changed? (b) if both the coils are moved in the same direction with the same	2	

	speed? Give reason to justify your answer in each		

NOTES

Lesson-Magnetic effect of Electric Current.

Learning Objective	Achieved 	Working towards 	Needs reinforcement 
I can describe magnetic field and field lines, explain magnetic field due to a current-carrying conductor			
I can explain magnetic field due to a current through a straight conductor, state right hand thumb rule, demonstrate magnetic field due to a current through a circular loop, analyze the magnetic field pattern around a solenoid carrying current, express force on a current – carrying conductor in a magnetic field.			
I can describe the working of an electric motor, define electromagnetic induction discuss electric generator.			

Teacher's feedback: _____

_____

Student's feedback: _____

_____

Next step in
Learning:_____

HANDS ON EXPERIMENTS

FOCAL LENGTH OF A CONCAVE MIRROR

Experiment no 4 **Date:**

AIM

To determine the focal length of a concave mirror by obtaining image of a distant object.

THEORY

A concave mirror, like a plane mirror, obeys the laws of reflection of light. The rays of light coming from a distant object such as the sun or a distant tree or a distant building can be considered to be parallel to each other.

When parallel rays of light fall on a concave mirror along its axis, the rays meet at a point in front of the mirror after reflection from it. This point is the focus of the mirror.

For a parallel beam of light coming from a distant object, a real, inverted and very small image size is formed at the focus of the mirror .Since the image formed by the mirror is real, it can be obtained on a screen.

The distance between the pole O of the concave mirror and the focus F is the focal length of the concave mirror. Thus, the focal length of a concave mirror can be estimated by obtaining a real image of a distant object at its focus.

MATERIALS REQUIRED

A concave mirror, a mirror holder, a small screen fixed on a stand, and a measuring scale.

PROCEDURE

- Fix a concave mirror in the mirror holder and place it on the table near an open window. Turn the face of mirror towards a distant object (a tree or a distant building).
- Place the screen fitted to a stand in front of the concave mirror.
- Move the screen back and forth until a sharp, clear and inverted image of the distant object is formed on it.
- Mark the position of the centre of the stand holding the mirror and the screen when a sharp image of the distant object has been obtained on the screen.
- Measure the horizontal distance between the centre of the concave mirror and the screen with the help of a measuring scale.
- Record your observations in the observation table

.

PRECAUTIONS

- Concave mirror should be placed near an open window through which sufficient sunlight enters, with its polished surface facing the distant object.
- There should be no obstacle in the path of rays of light from the distant object, incident on the concave mirror.

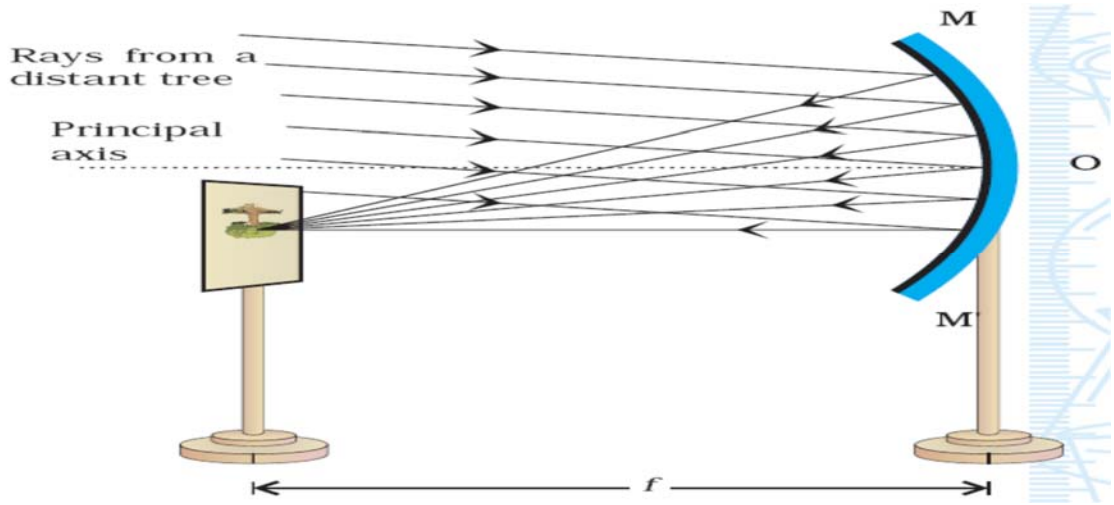
- The base of the stands of the concave mirror and screen should be parallel to the measuring scale.
- The mirror holder along with the mirror should be kept perpendicular to the measuring scale for precise measurements.

RESULT

The approximate value of focal length of the given concave mirror = cm.

NOTE to the Student:
The following content should be on the unruled side of the Journal

DETERMINATION OF FOCAL LENGTH OF A CONCAVE MIRROR

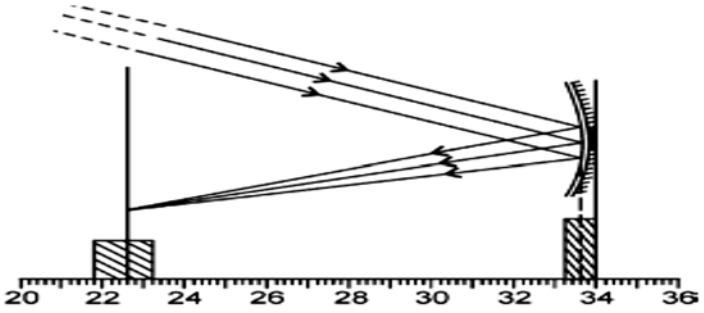


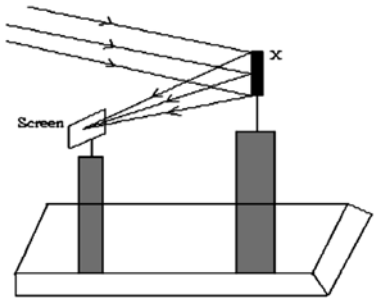
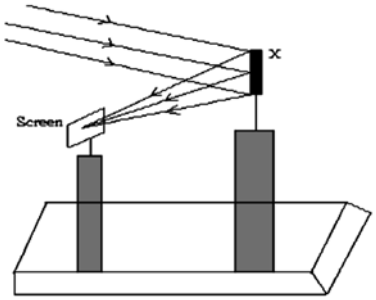
OBSERVATIONS

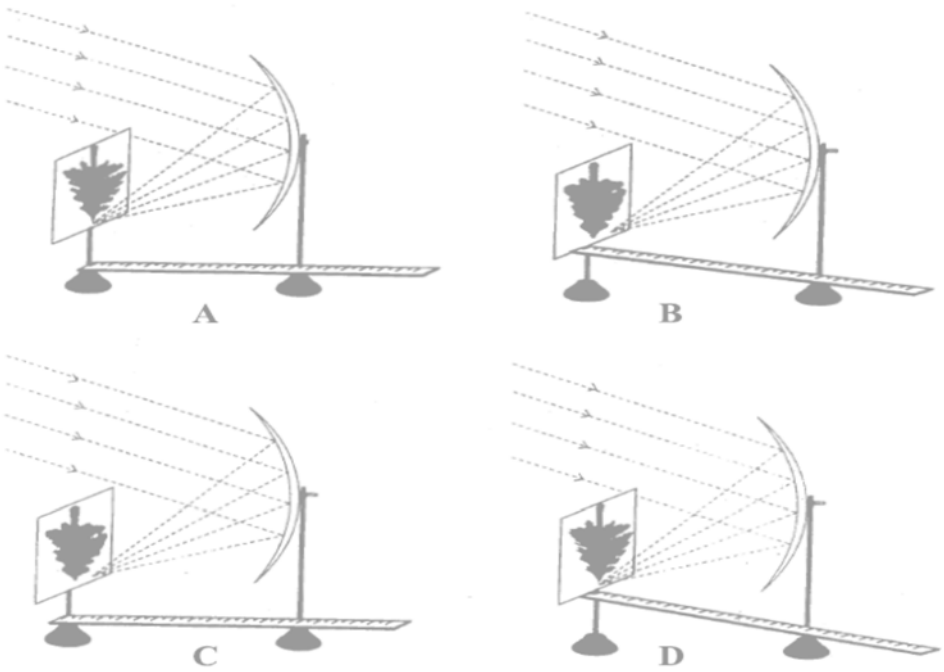
No	Name of the distant object	Distance between the concave mirror and the screen (f cm)	Mean focal length (f cm)
1			
2			

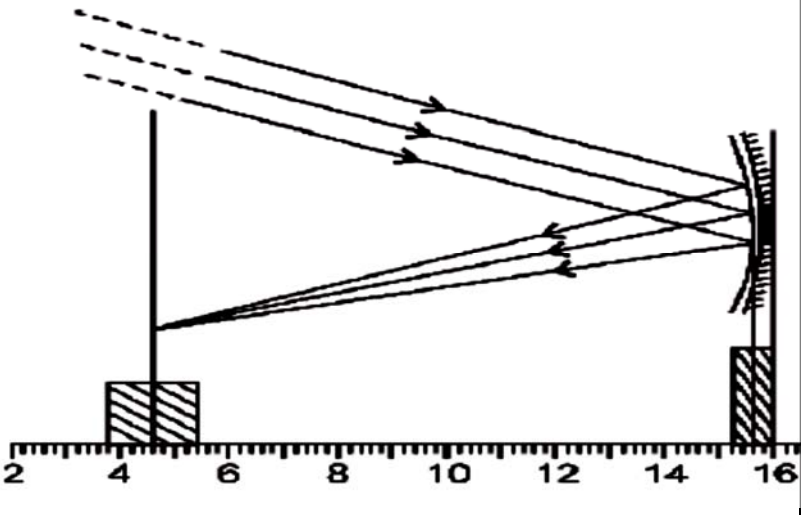
Mean focal length of the concave mirror = cm

MCQ QUESTIONS

A		MCQ BASED ON PRACTICAL SKILL	Mks	Level
1		The image of a distant object is obtained on a screen by using a concave mirror. The focal length of the mirror can be determined by measuring the distance between a. the object and the mirror b. the object and the screen c. the mirror and the screen d. the mirror and the screen as well as that between the object and the screen	1	C
2		The focal length of the concave mirror in the experimental set up is  a.10.2 cm b.11.4 cm c.12.2 cm d.11.0 cm	1	U
3		Your school laboratory has a large window. To determine the focal length of a concave mirror by focusing on a very distant object, using a screen, the screen should be placed	1	HOT

		a. In front of the mirror b. Behind the mirror c. Image formed only on the table top d. No image is formed		
4		An object is placed at a distance of 20cm in front of concave mirror of focal length 10cm. The image produced is a. real, inverted & diminished b. real, inverted & enlarged c. real inverted & same size d. virtual, erect and enlarged	1	HOT
5		To determine the focal length of a concave mirror, a student focuses on a distant object to obtain the image on the screen. The image will be a. Inverted and diminished b. Erect and diminished c. Inverted and magnified d. Erect and magnified 	1	U
6		A student determines the focal length of X by focusing a far off object to obtain the image of it on the screen positioned as shown in the figure below. X is a a. Concave mirror b. Convex mirror c. Plane mirror d. Convex lens 	1	HOT
7		A parallel beam of light coming from the distant object incident on a concave mirror parallel to its principal axis. After reflection from the mirror, the beam a. passes through its principal focus	1	C

		b. appears to pass through its principal focus c. appears to reflect from the point of incidence d. appears to pass through its center of curvature		
8		 Identify the correct experimental set up a. A b. B c. C d. D	1	U
9		The image of a distant object is obtained on a screen by using a concave mirror. The focal length of the mirror can be determined by measuring the distance between a. the object and the mirror b. the object and the screen c. the mirror and the screen d. the mirror and the screen as well as that between the object and the screen	1	A

10		The focal length of the concave mirror in the experimental set up shown below is  a. 10.3 cm b. 11.0 cm c. 11.7 cm d. 12.2 cm	1	A

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
c	d	a	c	a	a	a	a	c	b

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		To determine the focal length of a concave mirror, a student focusses a classroom window, a distant tree and the sun on the screen with the help of a concave mirror. In which case will the student get more accurate value of focal length? What is focal length of a concave mirror?	2	C
2.		A student takes a mirror which is depressed at the centre and mounts it on a mirror stand. An erect and enlarged image of his face is formed. He places the mirror on a stand along a metre scale at 10 cm mark. In front of this mirror, he mounts a white screen and moves it back and forth along the metre scale till a highly sharp, well-defined image of a distant building is formed on the screen at 25.5 cm mark. a. Name the mirror and find its focal length. b. Why does the student get sharp image of the distant building at 25.5 cm mark?	2	U
3.		a. A ray of light passing through the center of curvature of a concave mirror is incident on its reflecting surface. What is the angle of incidence and angle of reflection of this ray? b. The radius of curvature of concave mirror is 42 cm. What is its focal length?	2	U
4.		The following is part of a student's report on an experiment to measure the focal length of a concave mirror. "I started with the object 6 cm from the mirror but couldn't get an image to form on the screen. I moved the object back a few cm and tried again, but I couldn't get an image to form on the screen until the object was 24 cm from the mirror. From then on I moved the object back 8 cm each time and measured the corresponding image distances. I wrote my results in the table." *u*/cm: 24.0, 32.0, 40.0, 48.0 *v*/cm: 72.5, 40.3, 33.0, 27.9	2	A

		a. Give two precautions that should be taken when measuring the image distance. b. Explain why the student was unable to form an image on the screen when the object was close to the mirror.		
5.		Is the image formed by a concave mirror at focus real or virtual? Write two differences between real and virtual image.	2	C

FOCAL LENGTH OF A CONVEX LENS

Experiment no 6 **Date:**

AIM

To determine the focal length of a convex lens by obtaining the image of a distant object.

THEORY

The rays of light coming from a distant object such as a distant tree or a distant building can be considered to be parallel to each other.

When a parallel beam of light falls on a convex lens, the rays, after refraction, converge at a point on its other side. This point is one of the two foci of the lens.

If the parallel beam of light comes from a distant object, a real, inverted image of very small size is formed at the focus of the lens. Since the image formed by the lens is real, it can be obtained on a screen.

The distance between the optical centre O of the convex lens and the focus point F1 or F2 is its focal length. Thus, the focal length of a convex lens can be estimated by obtaining a real image of a distant object at its focus.

MATERIALS REQUIRED

A thin convex lens, a lens holder, a small screen fixed to a stand, and a measuring scale.

PROCEDURE

- Fix a thin convex lens on a lens holder and place it on the table or platform near an open window through which sufficient sunlight enters. Turn the face of lens towards a distant object (a tree or a distant building).
- Place the screen fixed to a stand on the other side of the lens. Adjust the position of screen (by moving it back and forth in front of the convex lens) to get a sharp, clear and inverted image of the distant object on it .
- Mark the position of the centre of the stands holding the lens and that of the screen when a sharp image of the distant object has been obtained on the screen.
- Measure the horizontal distance between the centre of the convex lens and the screen with the help of a measuring scale. Record your observations in the observation table. This will give the focal length of the convex lens.

.

PRECAUTIONS

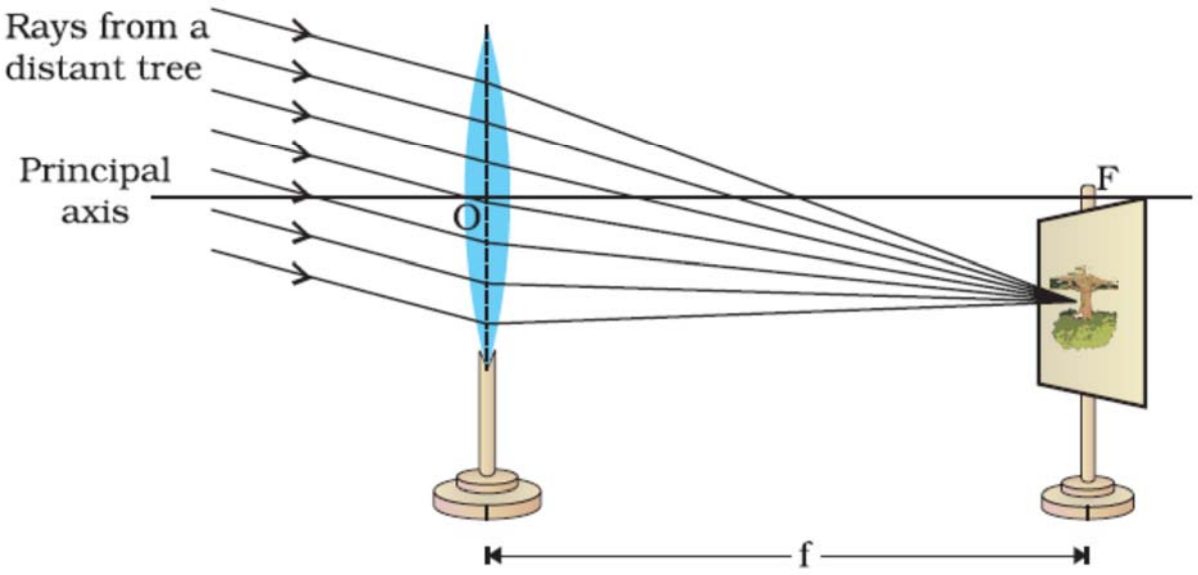
- The principal axis of the convex lens should be horizontal, that is, the lens should be placed vertically.
- There should be no obstacle in the path of rays of light from the distant object incident on the convex lens. Adjust the position of convex lens such that the light rays coming from the distant object fall on the lens without any obstruction.

- The base of the stands of the convex lens and screen should be parallel to the measuring scale. To determine the focal length, the distance between the convex lens and the screen should be measured horizontally (placed at the focus point on the other side of the lens).

RESULT

The approximate value of focal length of the given convex lens = cm.

DETERMINATION OF FOCAL LENGTH OF A CONVEX LENS

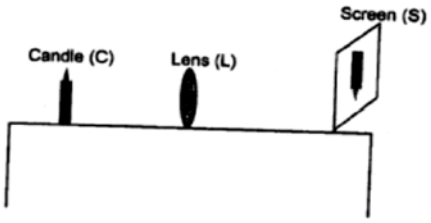


OBSERVATIONS

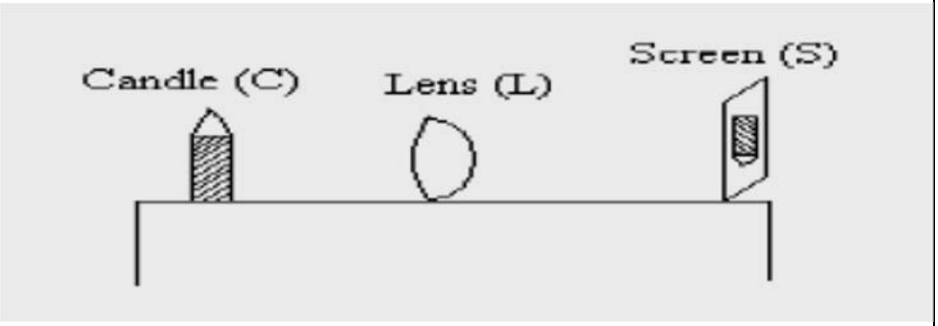
No	Name of the distant object	Distance between the convex lens and the screen (f cm)	Mean focal length (f cm)
1			
2			

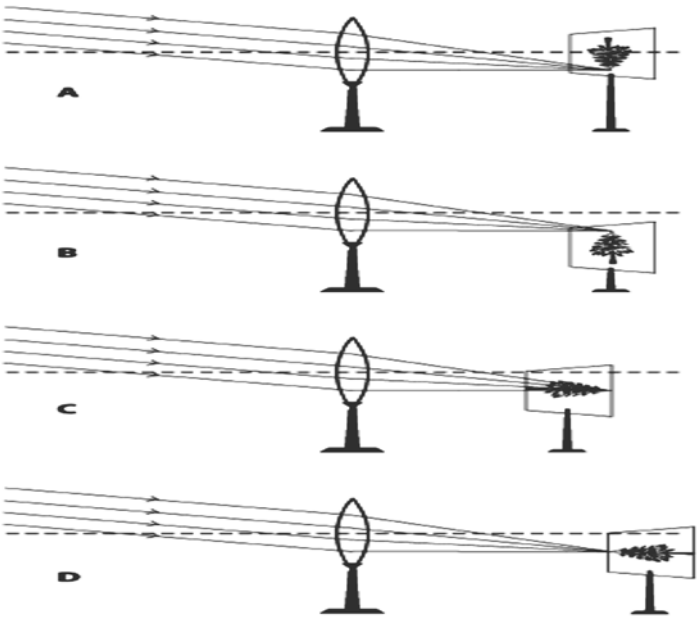
Mean focal length of the convex lens = cm

MCQ QUESTIONS

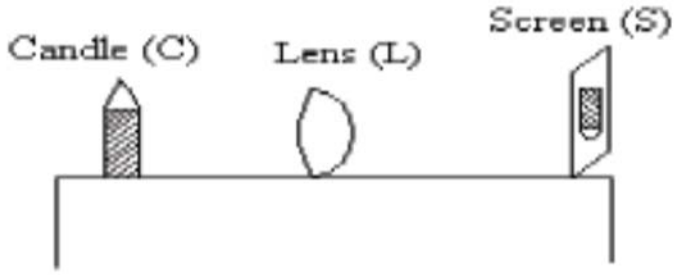
A		MCQ BASED ON PRACTICAL SKILL	Mks	Level
1		A glowing electric lamp kept at the focus of a convex lens produces a. Parallel beam b. Convergent beam c. Divergent beam d. No beam	1	C
2		A student obtains a sharp image of the candle flame on a screen using a convex lens by placing a lighted candle at one end of the table, a screen on the other end and the lens in between the candle and the screen as shown in the figure.  If now the candle flame were to be replaced by a distant lamp on a far away electric pole, the student would be able to get the sharp image of the lamp on the screen by moving a. The screen closer to the lens b. The lens away from the screen c. Moving the lens and the screen away from each other d. Neither the screen nor the lens	1	U
3		Parallel rays of light entering a convex lens always converge at a. centre of curvature b. principal focus c. optical centre	1	C

		d. the focal plane		
4		In order to determine the focal length of a convex lens, a student obtained a sharp image of a distant object on a screen. For getting better results, the student should focus at? a. grill b. distant tree c. distant building d. distant illuminated building	1	HOT
5		For determining the image of a distant object by a convex lens, you use a screen. The screen should be placed at: a. at the focal plane of the lens b. always from the focal plane of the lens c. before the focal plane of the lens d. at any position before the lens	1	U
6		In an experiment to determine the focal length, a student obtained a sharp inverted and diminished image of the distant tree on a screen. When she removed the lens and looked through the lens in the direction of the tree, she will see a. No image as the screen has been removed. b. An erect image of the tree c. An inverted image of the tree d. A blurred image of the tree	1	HOT

7		A student performs an experiment by placing the screen on one side of a table, a lighted candle on the other end of the table and a convex lens in between them as shown in the figure given below. The image of the candle flame would be,  a. Inverted and diminished b. Erect and magnified c. Erect and diminished d. Erect and same size	1	C
8		In order to determine the focal length of a convex lens, a student obtained a sharp image of the window grill on a screen. For getting better results, the teacher suggested of focusing a distant tree instead of the grill. In which direction should the lens be moved a. Away from the screen b. Towards the screen c. Very far away from the screen d. Behind the screen	1	U
9		Identify the correct experimental set up	1	A

		 a. A b. B c. C d. D		
10		A student performs an experiment on finding the focal length of a convex lens by keeping a lighted candle on one end of laboratory table, a screen on its other end and the lens between them as shown in the figure. The positions of the three are adjusted to get a sharp image of the candle flame on the screen a. the screen in the direction of the lens or the lens in the direction of the screen b. the screen in the direction of the lens or the lens away from the screen c. the screen away from the lens or the lens in the direction of the screen	1	A

d. neither the screen nor the lens



ANSWER KEY

1	2	3	4	5	6	7	8	9	10
a	a	b	d	a	c	a	b	a	a

<table>
<tr><th>B</th><th></th><th>PRATICAL BASED QUESTIONS</th><th>MARK</th><th>LEVEL</th></tr>
<tr><td>1.</td><td>  </td><td>What is the nature of an image formed by a thin convex lens for a distant object? What change do you expect if the lens were rather thick?</td><td>2</td><td>C</td></tr>
<tr><td>2.</td><td>  </td><td>A teacher sets up a stand carrying a convex lens of focal length 15 cm at 20.5 cm on the optical bench. She asks the students to suggest the position of the screen on the optical bench so that a distinct image of a distant tree is obtained on it. What should be the correct position of screen as suggested by the students and why?</td><td>2</td><td>U</td></tr>
<tr><td>3.</td><td>  </td><td>A student focused the image of a candle flame on a white screen by placing the flame at various distances from a convex lens. He noted his observations as given below:
<table>
<tr><th>S. No</th><th>Distance of flame from the lens (cm)</th><th>Distance of the screen from the lens (cm)</th></tr>
<tr><td>1.</td><td>60</td><td>20</td></tr>
<tr><td>2.</td><td>40</td><td>24</td></tr>
<tr><td>3.</td><td>30</td><td>30</td></tr>
<tr><td>4.</td><td>24</td><td>40</td></tr>
<tr><td>5.</td><td>12</td><td>70</td></tr>
</table>
(a) What is the focal length of a given convex lens?
(b) Which set of observations is incorrect and why?</td><td>2</td><td>A</td></tr>
<tr><td>4.</td><td>  </td><td>Suppose you move the candle from the focus of a convex lens towards infinity. In which direction should the screen be moved to get the real and sharp image? Why?</td><td>2</td><td>U</td></tr>
<tr><td>5.</td><td>  </td><td>The image of a candle formed by a convex lens is obtained on a screen. Will the full size of image be obtained if the lower half of the lens is covered with black paper and made completely opaque?</td><td>2</td><td>U</td></tr>
</table>

REFRACTION OF LIGHT THROUGH A GLASS SLAB

AIM : To trace the path of a ray of light passing obliquely through a rectangular glass slab and to measure the angle of incidence, angle of refraction, the angle of emergence and interpret the results.

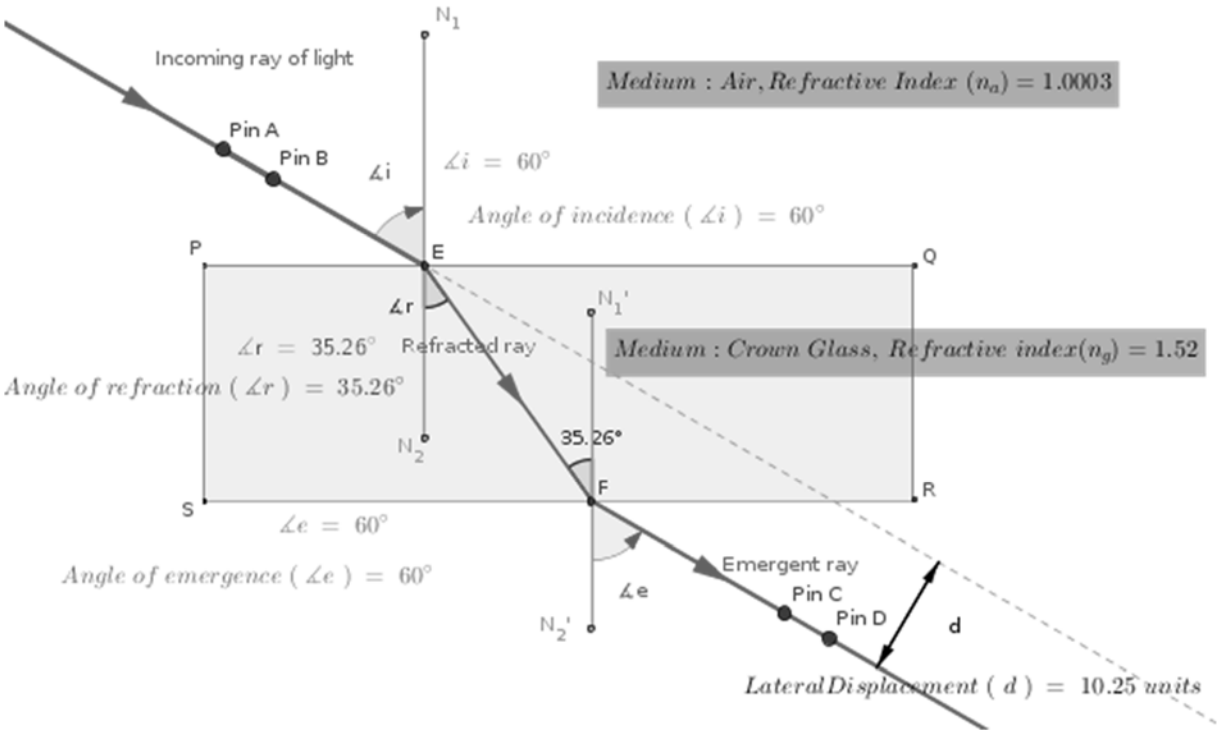
APPARATUS:

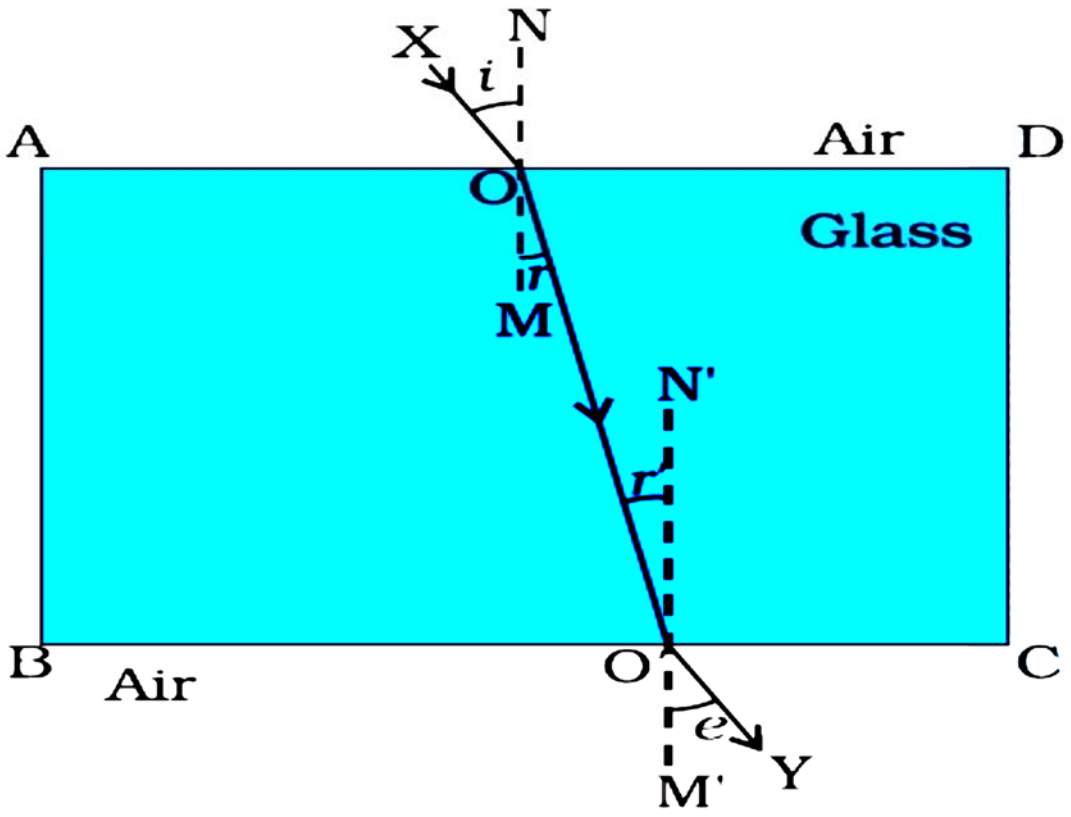
Drawing board, sheets of white paper, drawing pins, pencil, glass slab, protractor

PROCEDURE :

1. Fix a sheet of white paper on a drawing board with drawing pins. Place the given glass slab nearly in the middle of the sheet.
2. Mark the boundary of the glass slab with a sharp pencil and label it as PQRS after removing the slab from its position.
3. On the line PQ mark a point E and draw a normal N1EN2 at it. Draw a line AE making angle AEN1 with the normal. The angle should neither too small nor too large (say about 40 degree).
4. Now place the glass slab again on its boundary PQRS and fix two pins A and B vertically about 10 cm apart on the line AE (say points A and B).
5. Look through the glass slab along the plane of the paper from the side SR and move your head until the images of the two pins A and B are seen clearly. Closing your one eye, adjust the position of your head in such a way that the images of the pins A and B lie in the same straight line.
6. Fix two other pins C and D vertically in such a way that the images of the pins A and B and pins C and D, all these four, lie in the same straight line. Ensure that the feet of the pins (not their heads) lie in the same straight line.
7. Remove the slab and also the pins from the board and encircle the pin-pricks on the paper, with a sharp pencil.
8. Join the points D and C and produce the line DC towards the slab so that it meets the boundary line RS at the point F. Join the points e and F. Thus for the incident ray represented by line AE, the refracted ray and the emergent ray are represented by EF and FD respectively.
9. On the line RS draw a normal N1'FN2' at point F. Now, with a protractor, measure angle AEN1, angle FEN2 and angle DFN2' labelled as angle i, angle r and angle e respectively.

10. Now place the glass slab at some other position on the sheet of paper fixed on the board and repeat all the above steps again taking another angle of incidence.
11. Measure the angle of incidence i.e angle of refraction, angle of emergence, again.
12. Make a record of your observations in the observation table as shown below.





OBSERVATIONS

No	Angle of incidence	Angle of refraction	Angle of emergence

PRECAUTIONS:

1. The glass slab should be perfectly rectangular with all its faces smooth.
2. The angle of incidence should preferably be between 30˚ and 60˚.
3. Thin lines should be drawn, using a sharp pencil

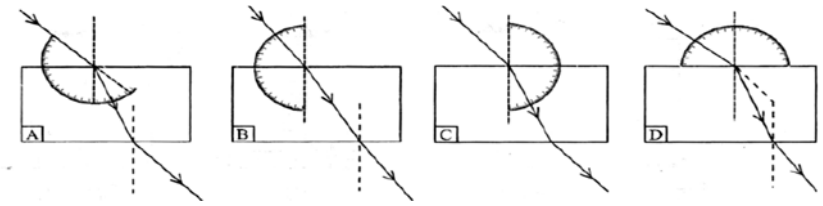
4. The angles should be measured accurately, using a good quality protractor having clear marking by keeping the eye above the marking.

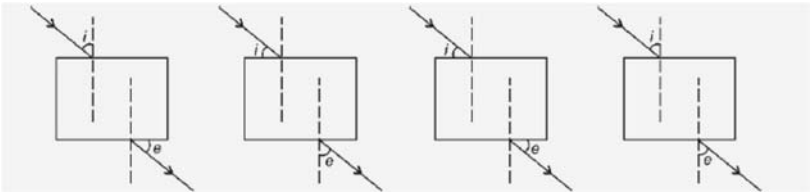
RESULT :

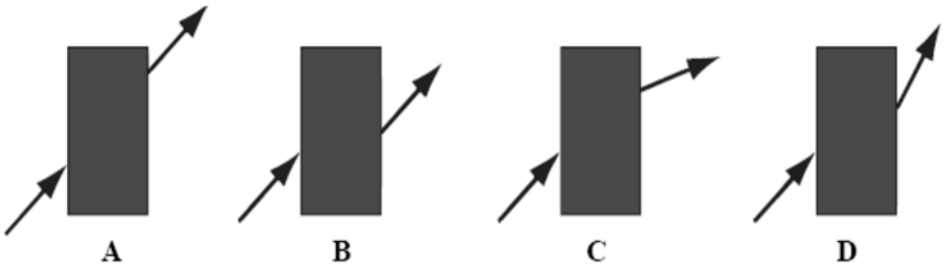
1. The path of the ray of light through a glass slab is shown.
2. As angle of refraction is less than angle of incidence, the ray entering from air to glass (denser medium) bends towards normal
3. As angle of incidence and angle of emergence are equal, the emergent ray emerging out of the rectangular glass slab, is parallel to, but laterally displaced with respect to the incident ray.

QUESTIONS

A.		MCQ BASED ON PRACTICAL SKILL	Mks	Level
1		A student performs the experiment on tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. He measures the angle of incidence i, angle of refraction r and angle of emergence e for all his observations. He would find that in all cases a)Angle i is more than angle r but (nearly) equal to angle e b)Angle i is less than angle r but (nearly) equal to angle e c)Angle i is more than angle e but (nearly) equal to angle r d)Angle i is less than angle e but (nearly) equal to angle r	1	U
2		A student suggested the following 'guidelines' to his friend for doing the experiment on tracing the path of a ray of light passing through a rectangular glass slab for three different angles of incidence: A. Draw the 'outline' of the glass slab at three positions on the drawing sheet. B. Draw 'normal' on the top side of these 'outline' near their left end. C. Draw the incident rays on the three 'outline' in directions making angles of 30^o, 35^o and 40^o with the normal drawn.	1	U

		D. Fix two pins vertically on each of these incident rays. E. Look for the images of the 'heads' of these pins while fixing two pins from the other side, to get the refracted rays. The incorrect statement is a) B b) C c) D d) E		
3		Four students to measure the angle of incidence of a light ray which passes through a rectangular glass slab, positions the protractor in a manner as shown in the figure. The correct way of positioning the protractor to measure the angle of incidence is that of the student A B C D  a) A b) B c) C d) D	1	U
4		4. Four students A, B, C and D performed an experiment to trace the path of the emergent ray through a rectangular glass slab for three different angles of incidence. They tabulated their observations of < i, < r and < e as per the tables given below.	1	U

		<table><tr><td>∠i</td><td>∠r</td><td>∠e</td></tr><tr><td>30°</td><td>32°</td><td>30°</td></tr><tr><td>40°</td><td>42°</td><td>40°</td></tr><tr><td>50°</td><td>55°</td><td>50°</td></tr></table> (A) <table><tr><td>∠i</td><td>∠r</td><td>∠e</td></tr><tr><td>30°</td><td>20°</td><td>30°</td></tr><tr><td>40°</td><td>25°</td><td>39°</td></tr><tr><td>50°</td><td>31°</td><td>49°</td></tr></table> (B) <table><tr><td>∠i</td><td>∠r</td><td>∠e</td></tr><tr><td>30°</td><td>25°</td><td>29°</td></tr><tr><td>40°</td><td>35°</td><td>39°</td></tr><tr><td>50°</td><td>45°</td><td>49°</td></tr></table> (C) <table><tr><td>∠i</td><td>∠r</td><td>∠e</td></tr><tr><td>30°</td><td>20°</td><td>32°</td></tr><tr><td>40°</td><td>30°</td><td>43°</td></tr><tr><td>50°</td><td>40°</td><td>52°</td></tr></table> (D) The student, who has done the experiment best of all, is a) A b) B c) C d) D		
5		Four students in an experiment to plot the path of the emergent ray through a rectangular glass slab labelled the angle of incidence ***i*** and the angle of emergence ***e*** as shown below.  **A** **B** **C** **D** The correct labelling of the angle of incidence ***i*** and the angle of emergence ***e*** is that of the student a) A b) B c) C d) D	1	U
6		While performing the experiment on tracing the path of a ray of light passing through a glass slab as shown in the	1	U

		given diagram, four students interpreted the results as given below. Which one of the four interpretations in correct? a) r > e b) r = e c) i = r d) i > r		
7		On the basis of their experiment 'to trace the path of a ray of light passing through a rectangular glass slab' four students arrived at the following interpretations: (1) Angle of incidence is greater than the angle of emergence. (2) Angle of emergence is less than the angle of refraction. (3) Emergent ray is parallel to the incident ray. (4) Emergent ray is parallel to the refracted ray. The correct interpretation is that of the student a) I b) II c) III d) IV	1	U
8		Four students A, B, C and D performed an experiment to trace the path of the emergent ray through a rectangular glass slab. The trace most likely to be correct is that of the student  A B C D	1	U

a) A
b) B
c) C
d) D

9 To trace the path of the emergent ray through a rectangular glass slab, four students measured the angle of incidence< I, angle of refraction<r and the angle of emergence <e as given

/i	/r	/e
30°	40°	30°
40°	50°	40°
50°	60°	50°

I

/i	/r	/e
30°	20°	30°
40°	30°	40°
50°	40°	50°

II

/i	/r	/e
30°	20°	40°
40°	30°	50°
50°	40°	60°

III

/i	/r	/e
30°	20°	20°
40°	30°	30°
50°	40°	40°

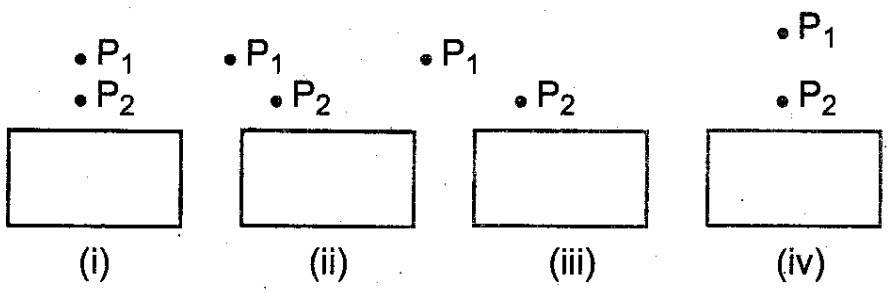
IV

The correct observation would be of the student

a) I
b) II
c) III
d) IV

10 Two dots P_1 and P_2 shown in each of the following diagrams denote the position of two pins in respect of the distance and direction for performing an experiment on tracing the path of a ray of light passing through a rectangular glass slab.

In which one of the 'four cases, one is likely to get the best result?



a) ii
b) iii
c) iv
d) i

SI.NO	1	2	3	4	5	6	7
	a	d	b	b	c	d	c

SI.NO	8	9	10
	b	b	a

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		In a experiment to trace the path of a ray of light through a glass slab, a) if the angle of incidence is increased, how does the angle of refraction change? b) What relationship students work out when they measure the angle of incidence and angle of emergence	2	C
2.		In a experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 55˚ with the normal on one face of the slab, after refraction, strikes the opposite face of the slab before emerging out into air making an angle of 40˚ with the normal. What value would you assign to the angle of refraction and angle of emergence?	2	U
3.		A ray of light, incident obliquely on a face of a rectangular glass slab placed in air, emerges out from the opposite face. a) Draw a ray diagram to show the path of the ray of light and identify two points where refraction takes place. b) If this experiment is repeated with the different angles of incidence, what relation would you observe among the angle of incidence, the angle refraction and angle of emergence?	2	U
4.		Why the glass slab must not be displaced from tis boundary during the experiment to trace the path of a ray of light through a glass slab?	2	A
5.		What would be the observations of a student who performed the experiment to trace the path of a ray of light through a glass slab, whose two opposite faces are not parallel to each other?	2	C

REFRACTIVE INDEX OF PRISM

AIM :

To trace the path of rays through a rectangular glass prism

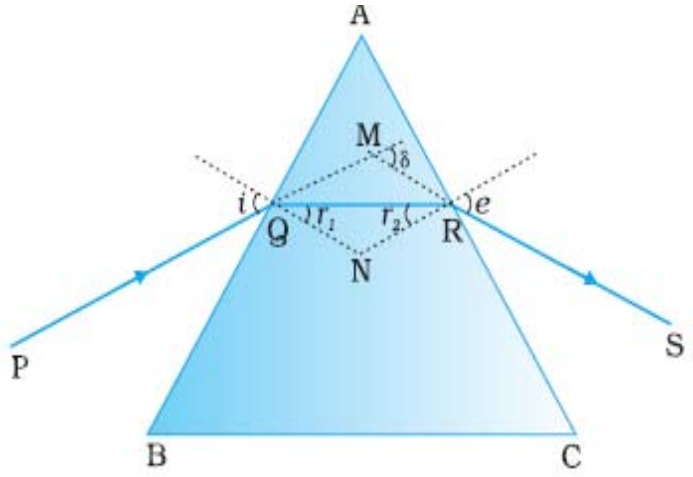
APPARATUS:

Drawing board, sheets of white paper, drawing pins, pencil, protractor.

THEORY:

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

The angle between the incident ray produced forward and emergent ray produced backward is called angle of deviation.



i = angle of incidence

e= angle of emergence

δ = angle of deviation

r_1 & r_2 = angle of refraction

- As the angle of incidence increases, the angle of deviation first decreases and then increases.
- For an equilateral prism

Angle of incidence + angle of emergence = Angle of prism + angle of deviation.

$$\angle i + \angle e = \angle A + \angle \delta$$

PROCEDURE

1 Fix the white sheet of paper in the drawing board. Place the prism and draw its boundary with the help of a sharp pencil.

2 Draw a normal N on the face AB and draw an incident ray PQ making an angle of incidence I say 35^0.

3 Fix two pins P_1 and P_2 on the incident line PQ.

4 Now see the images P_1 and P_2 through the face Ac. Fix other pins P_3 andP_4 in such a way that these two pins and images of pins P1 and P_2 all appear in the same line.

5 Remove the pins P_3 andP_4 and join their positions getting the emergent ray RS.

6 Measure the angle of incidence, angle of refraction on the first face, angle of refraction on the second face, angle of emergence and angle of deviation δ corresponding to this angle of incidence.

SOURCES OF ERROR

1 The pins are not fixed vertically.

2 Prism is disturbed while taking observations.

PRECAUTIONS

1 The angle of incidence should be between 30^0 and 60^0.

2 The distance between pins should be at least 6 cm.

3 The pins must be vertical

4 The position of the prism should disturb on the white sheet

OBSERVATIONS

Angle of prism A = ----------

Sl no	Angle of incidence	Angle of refraction on face AB r_1(degrees)	Angle of refraction on face AC r_2(degrees)	Angle of emergence (degrees)	Angle of deviation δ(degrees)	$r_1 + r_2$	i + e	A + δ
1								
2								
3								

RESULT

1. As angle of incidence is increased, angle of deviation decreases then increases.
2. Angle of incidence + angle of emergence = Angle of prism + angle of deviation.
3. Angle of prism A = Angle of refraction on face AB (r_1) + Angle of refraction on face AC (r_2)

VIVA QUESTIONS WITH ANSWERS

1 Define angle of deviation.
Ans. The angle through which a ray of lights turns its original path on passing through a prism is called angle of deviation.

2 On what factors does the angle of deviation depend?

Ans. The angle of deviation depends upon the following factors:

(i) The angle of incidence

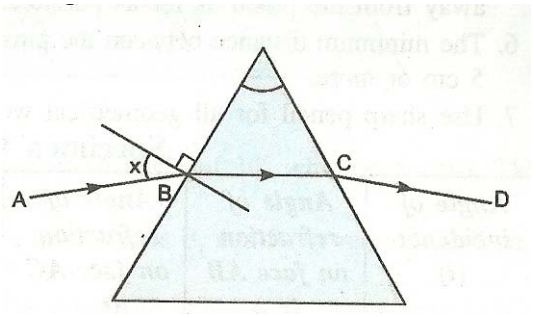
(ii) The refracting angle of the prism

(iii) The material of the prism

3 Define angle of minimum deviation?

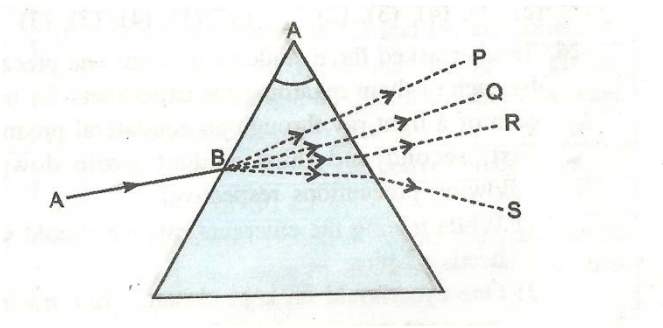
Ans. The least value of the angle of deviation is known as the angle of minimum deviation.

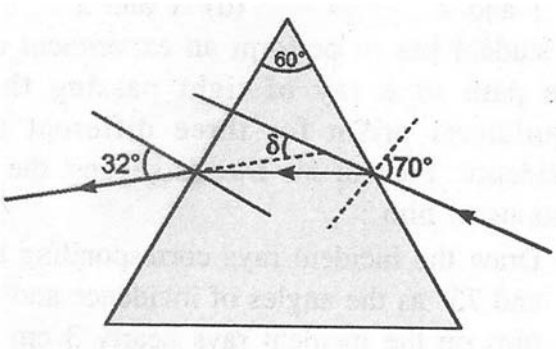
QUESTIONS

A.		Very Short Answer Questions (VSA)	Mks	Level
1		1. The angle between the given two refracting surfaces of a prism is called a. angle of refraction b. angle of a prism c. refracting angle d. any of the (b) or (c)	1	C
2		2. In the diagram AB and x are  a. incident ray and the angle of incidence b. incident ray and angle of emergence	1	U

		c. incident ray and the angle of refraction d. refracted ray angle of incidence		
3		In the case of glass prism when refraction takes place at its first refracting surface the angle of incidence is a. more than the angle of refraction b. equal to the angle of refraction c. less than the angle of refraction d. depends upon the angle of prism	1	U
4		In the case of prism when the refraction takes place at second refracting surfaces the angle r_2 inside the glass is always a. more than the angle of emergence b. equal to the angle of emergence c. less than the angle of emergence d. none of the above	1	U
5		The angle between the incident ray (produced forward) and the emergent ray (produced backward) is called a. angle of prism b. angle of emergence c. angle of refraction d. angle of deviation	1	U
6		The correct relation for <i, <A, <δ and <e for a prism is a. <i + <δ = <A + <e b. <i +<A = <δ +<e c. <i + <e = <A + <δ d. <i + <e + <δ = <A	1	U

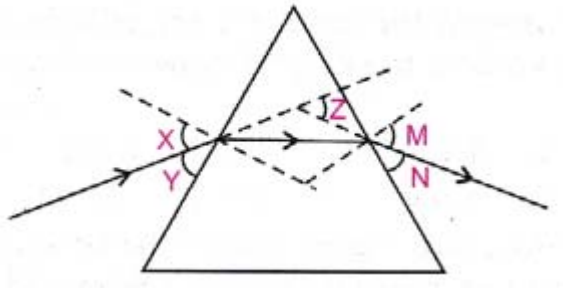
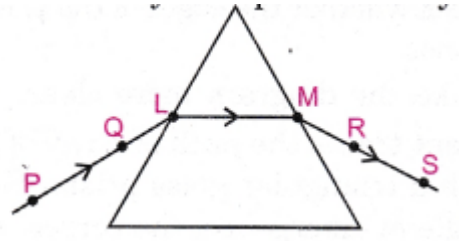
7		The correct relation for $<A$, $<r_1$ and $<r_2$ for a prism is a. $<r_1 = <A + <r_2$ b. $r_2 = <A + <r_1$ c. $<A + <r_1 + <r_2 = 90^0$ d. $<A = <r_1 + <r_2$	1	U
8		When a prism is in the minimum deviation position then a. $<i$ greater than $<e$ b. $<i$ less than $<e$ c. $<i = <e$ d .none of the above	1	U
9		When a prism is in minimum deviation position then a. $<r_1 = <r_2$ b. $<i$ greater than $<r_2$ c. $<r_1$ less than $<r_2$ d..None of the above	1	U
10		In an equilateral prism, $<e = 39^0$, $<\delta = 39^0$. The angle of incidence is a.45^0 b.50^0 c.70^0 d.60^0	1	A
11		In an equilateral prism, if the angle of incidence and the angle of emergence are 30^0 and 77^0 respectively, then the angle of deviation is a.47^0 b.44^0 c.39^0	2	A

		d.49^0		
12		In an equilateral prism, if the angle of incidence and the angle of deviation are 40^0 and 39^0 respectively, then the angle of emergence is a .47^0 b.49^0 c.55^0 d.59^0	2	A
13		In an equilateral prism if $<r_1 = 31^0$, then $<r_2$ on the second refracting surface is a.39^0 b.31^0 c.29^0 d.27^0	2	A
14		In the diagram, an incident ray AB strikes the refracting surface of an equilateral glass prism. The correct path of emergence is shown by  a. P b .Q c. R d .S		U

15		15. In the diagram the angle of deviation is  a.32^0 b.**36^0** c.42^0 d.44^0		U

SI.NO	1	2	3	4	5	6	7
	b	a	a	c	d	c	d

SI.NO	8	9	10	11	12	13	14	15
	c	a	d	a	d	c	d	c

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		1.For the refraction of a ray of light through a glass prism, the path of a ray of light is shown below.  Represent the angle of incidence, the angle of emergence ,and the angle of deviation respectively .Is angle of incidence equal to angle of emergence?	2	C
2.		Identify PL,LM AND RS. Why does the ray of light bend through the prism?  	2	U
3.		In the experiment to trace the path of a ray of light through a triangular glass prism, 1. a student is asked to draw the boundary of prism on the paper, why? 2. if the angle of incidence is 30°, what can be the measure of angle of emergence at the minimum deviation condition of the prism?	2	U
4.		In the experiment to trace the path of a ray of light through a triangular glass prism, 1. if the emergent ray makes an angle of 35° with the second face of prism, then what is the angle of emergence?	2	A

		2. can the angle of deviation be zero and why?		
5.		A very thin narrow beam of white light is made incident on one face of rectangular glass slab and one face of the combination of two prisms, one up and one down in contact. Comment on the nature of the behaviour of the emergent beam in the above two cases.	2	C

PRACTICAL SKILLS

LIST OF EXPERIMNTS

- To study the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plot a graph between V and I.

- To determine the equivalent resistance of two resistors when connected in series.

- To determine the equivalent resistance of two resistors when connected in parallel.

OHM'S LAW

Experiment No: 1 Date:

AIM

To study the dependence of the potential difference across a resistor on the current through it and to determine its resistance and to verify the Ohm's law

APPARATUS

A resistor, an ammeter, a voltmeter, a rheostat, a battery eliminator, a plug key, connecting wires, and a piece of sand paper.

THEORY

According to the Ohm's law, the potential difference (*V*) across the ends of a resistor is directly proportional to the current (*I*) through it provided its temperature remains the same.

That is
$V \propto I$
$V = IR$
constant = R

Here *R* is a constant for the given resistor at a given temperature and is called its resistance.

The SI unit of resistance is ohm (Ω).

A graph between the potential difference across the two ends of a resistor and the current through it is a straight line passing through the origin. The slope of this graph gives the resistance *R* of the resistor.

To verify the Ohm's law, we measure the potential difference across the two ends of a resistor at different currents through it in an electric circuit. The current through the resistor is measured by connecting an ammeter in series with it. The potential difference across the two ends of the resistor is measured by connecting the voltmeter in parallel with it.
A straight line graph obtained between *V* and *I* verify the ohm's law.

PROCEDURE

- Note the range and least count of the given ammeter and the voltmeter.
- Fresh connecting wires have an insulating layer on it. Similarly the connecting wires lying unused for some time may also develop an insulating layer. It is therefore important to clean the ends of connecting wires using a sand paper.
- Draw a circuit diagram for studying the Ohm's law .Observe how different components like the ammeter, voltmeter, resistor, and the plug key are connected with the cells (or battery eliminator).

- Set up the circuit by connecting different components with the help of connecting wires. Make sure that the positive and negative terminals of the ammeter and voltmeter are correctly connected in the circuit.
- Insert the key in the plug to let the current establish in the circuit.
- Note the readings of the ammeter and voltmeter and record them. The voltmeter measures the potential difference (*V*) across the two ends X and Y of the resistor, and the ammeter measures the current *I* through it. Remove the key from the plug to avoid unnecessary heating of wire
- Repeat the experiment by moving the sliding contact of the rheostat

GRAPH

- Find the range of variation in the values of *I* and *V*. Choose appropriate scales for *I* and *V* along the *x*- and *y*-axes respectively on the graph paper.
- Mark the points on the graph paper for each value of current *I* and corresponding value of potential difference *V*.
- Join all the points as a smooth line as possible such that most of the points lie on it.
- Find the slope of this straight line graph by choosing two points P and Q on it. This slope is the resistance of the resistor used in the circuit.

PRECAUTIONS

- The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
- Connections should be tight otherwise some external resistance may introduce in the circuit.
- The ammeter should be connected in series with the resistor such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
- Voltmeter should always be connected in parallel to resistor.
- The pointers of the ammeter and voltmeter should be at zero mark when no current through the circuit.
- Current should be passed through the circuit for a short time while taking observations; otherwise current would cause unnecessary heating in the circuit. Heating may change the resistance of resistors

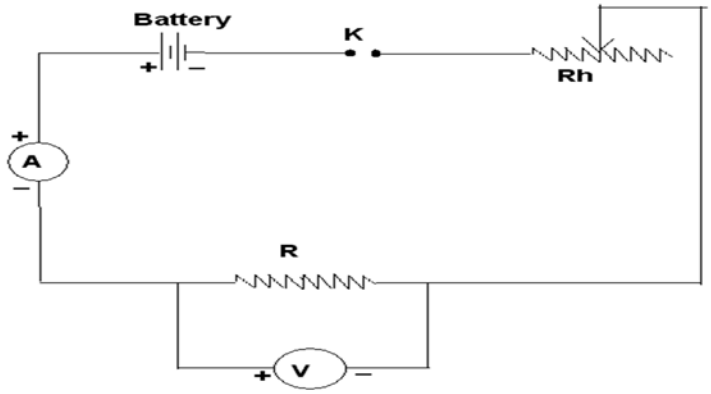
RESULTS

- The ratio of voltmeter to the ammeter reading is found to be a constant.
- Resistance of the material of the wire = Ohms
- The graph between *V* and *I* is a straight line and passes through the origin. This verifies the Ohm's law.

NOTE to the Student:
The following content should be on the unruled side of the Journal

VERIFICATION OF OHM'S LAW

CIRCUIT DIAGRAM



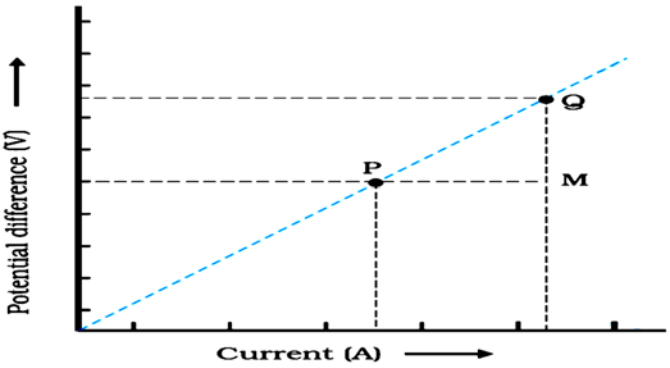
OBSERVATIONS AND CALCULATIONS

Range of the ammeter = 0 to A.
Least count of the ammeter = Amperes.
Range of the voltmeter = 0 to Volts.
Least count of the voltmeter = Volts.

No	VOLTMETER READING (V Volts)	AMMETER READING (I Amperes)	RESISTANCE = V/I (R Ohms)
1	0	0	
2			
3			
4			

Mean resistance of the wire = Ohms

V- I Graph



Resistance from V- I graph = $\frac{QM}{PM}$ = ohms.

MCQ QUESTIONS

		MCQ'S (PRACTICAL BASED)	Mks	Level
1		In the experiment to study the dependence of current with voltage, three students tabulated their readings as shown below.	1	

I

L.C. of milliammeter = 2 mA

L.C. of voltmeter = 0.1 V

S. No.	Reading of the	
	Voltmeter	milliammeter
1.	1	20
2.	2	38
3.	3	60
4.	4	80

II

L.C. of milliammeter = 2mA

L.C. of voltmeter = 0.1 V

S. No	Reading of the	
	Voltmeter	milliammeter
1.	1	20
2.	2	39
3.	3	61
4.	4	80

III

L.C. of millammeter = 2mA

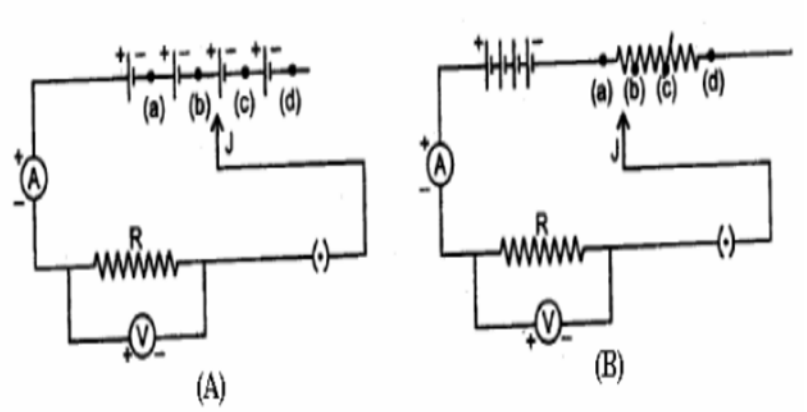
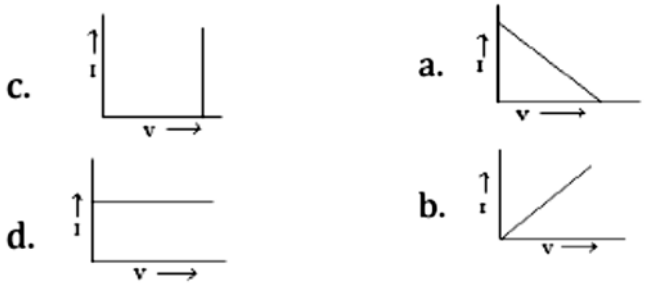
L.C. of voltmeter = 0.1V

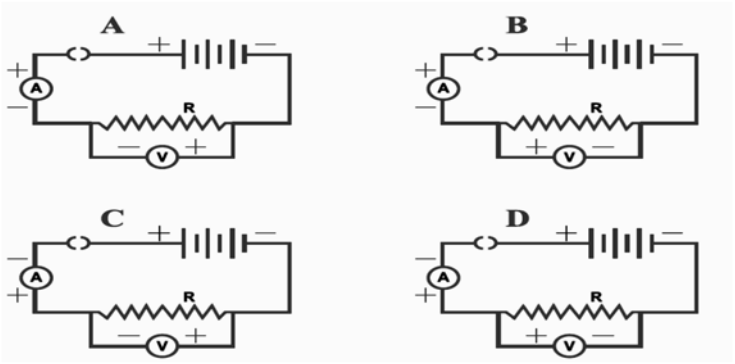
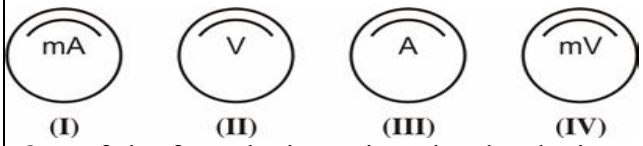
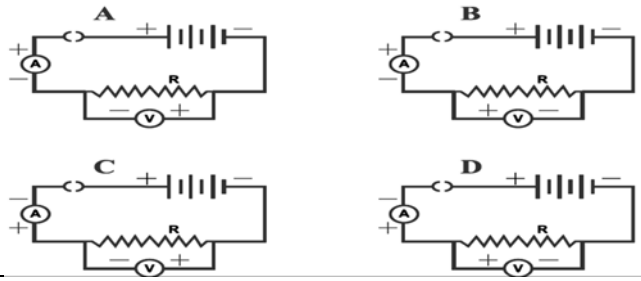
S. No	Reading of the	
	Voltmeter	milliammeter
1.	1.0	20
2.	2.0	40
3.	3.0	62
4.	4.0	80

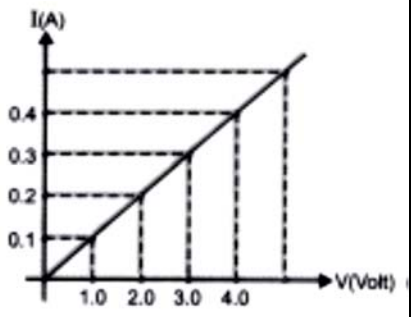
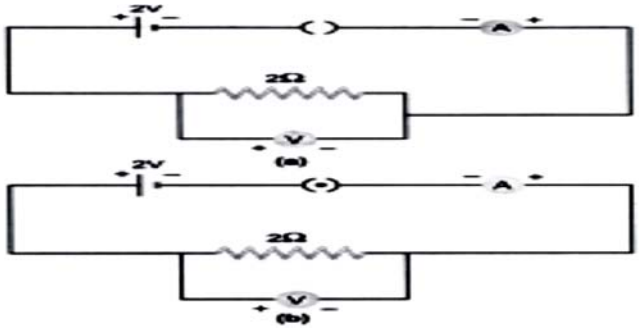
The reading is likely to be correct is that of the student:

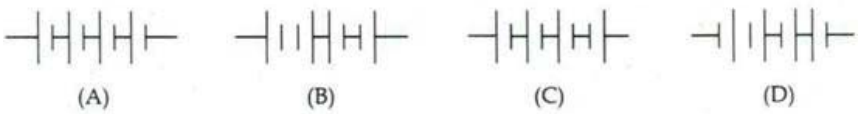
a) Student I
b) Student II
c) Student III
d) Student I and III

2		To study the dependence of current (I) with potential difference (V) across the resistor (R), two students used the set up s as shown the figure A and B. For the students, ammeter and voltmeter readings will be minimum when the contact J is in positions,	1	

		 a) **a** and **d** b) **b** and **c** c) **c** and **b** d) **d** and **a**		
3		Identify the correct voltage- current graph from the following a) a b) b c) c d) d 	1	
4		The correct circuit diagram to determine the value of unknown resistance is : a) A	1	

		b) B c) C d) D 		
5		Four different measuring devices are given below.  Out of the four devices given be the devices which can be used to measure current are: a) I and II b) I and III c) I and IV d) I and II	1	
6		Of the four experimental set ups, the voltmeter and ammeter are correctly connected in a) A b) B c) C d) D 	1	
7			1	

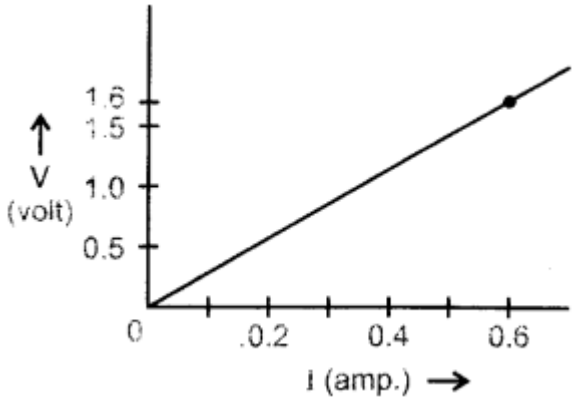
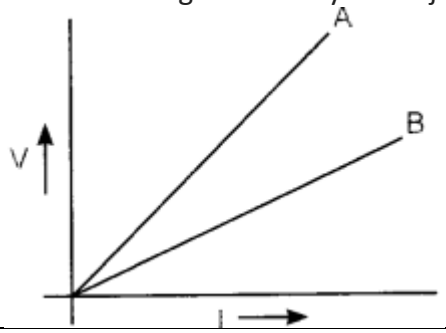
		In an experiment to study the dependence of current on potential difference across a resistor, a student obtained the graph as shown in Fig. The value of resistance of the resistor is : a) 4 Ω b) 20 Ω c) 10 Ω d) 2 Ω 		
8		For the circuits shown in Fig. (a) and (b), the voltmeter reading would be :  a) 2 V in circuit (*a*) and 0 V in circuit (*b*) b) 0 V in both circuits c) 2 V in both circuit d) 0 V in circuit (*a*) and 2 V in circuit (*b*)	1	
9		The following 'precautions' were listed by a student in the experiment on study of 'Dependence of current on potential difference.' (A) Ammeter should be connected in parallel and voltmeter in series to the resistor. (B) All the connections should be kept tight. (C) The positive terminal of the battery should be connected to the positive terminals of voltmeter and the ammeter. (D) The 'zero error' in the ammeter and the voltmeter should be noted and taken into consideration while recording the measurements.	1	

		(E) The 'key' in the circuit, once plugged in, should not be taken out till all the observations have been completed. The 'precautions' that need to be corrected and revised are: a) (A), (C) and (E) b) (C) and (E) c) (B) and (E) d) (A) and (E)		
10		A student has to connect 4 cells of 1.5 V each to get a voltage of 6V. The correct way of connecting the cells is shown in the figure: a) A b) B c) C d) D  (A) (B) (C) (D)	1	

ANSWER KEY

1. d 2. a 3.b 4.b 5.b 6.b 7.c

8. d 9.d 10.a

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		a)A bulb can not be used in place of a resistor to verify Ohm's law. Justify this statement with reason? (hint: The condition of Ohm's law is constant temperature) b) what is likely to happen if the positions of the ammeter and voltmeter interchanged in Ohm's law verification experiment?	2	C
2.		Draw a closed-circuit diagram consisting of a 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each and a plug key. (ii)Following graph was plotted between V and I values:  What would be the values of V /I when the potential difference is 1.6 V? Define the unit of the physical quantity obtained from the ratio V/I? (ans:2.67Ω)	2	U
3.		V-I graph for two wires A and B are shown in the figure. If both wires are of same length and same thickness, which of the two is made of a material of high resistivity? Give justification for your answer.  	2	U
4.		When a high resistance voltmeter is connected directly across a resister its reading is 2 V. An electric cell is sending the current of 0.4 A, (measured by an ammeter) in the electric circuit in which a rheostat is	2	A

		also connected to vary the current. (a) Draw an equivalent labelled circuit for the given data. (b) Find the resistance of the resister. (c) Name and state the law applicable in the given case. A graph is drawn between a set of values of potential difference (V) across the resister and current (I) flowing through it. Show the nature of graph thus obtained.?		
5.		When a high resistance voltmeter is connected directly across a resister its reading is 2 V. An electric cell is sending the current of 0.4 A, (measured by an ammeter) in the electric circuit in which a rheostat is also connected to vary the current. (a) Draw an equivalent labelled circuit for the given data. (b) Find the resistance of the resister. (c) Name and state the law applicable in the given case. A graph is drawn between a set of values of potential difference (V) across the resister and current (I) flowing through it. Show the nature of graph thus obtained.?	2	C

RESISTORS IN SERIES

Experiment No: 2 Date:

AIM

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

THEORY

When two resistors of resistance *R1* and *R2* respectively are connected in a series combination, then their equivalent resistance R_s is given by

$$R_s = R_1 + R_2$$

In order to determine the resistance of a combination of resistors in series, the current *I* flowing through the circuit is measured with an ammeter connected in series with the combination. The potential difference *V* across the combination of resistors is measured with a voltmeter connected in parallel

MATERIALS REQUIRED

Two resistors, an ammeter, a voltmeter, a battery eliminator, a plug key, connecting wires and a piece of sand paper.

PROCEDURE

- Note the range and least count of the given ammeter and the voltmeter.
- Draw a circuit diagram for the series combination of resistors. Observe how different components like the ammeter, voltmeter, combination of resistors in series (of known resistances *R1* and *R2*) and the plug key are connected with the battery eliminator.
- Place the given resistors one after the other and join the ends in series. Set up the circuit by connecting different components with the help of connecting wires as shown in the circuit diagram.
- Make sure that the positive and negative terminals of the ammeter and voltmeter are correctly connected in the circuit.
- Insert the key in the plug to let the current establish in the circuit.
- Note the readings of the ammeter and voltmeter and record them.
- The voltmeter measures the potential difference (*V*) across the two ends of the series combination of two resistors, and the ammeter measures the current *I* through the series combination.
- Remove the key from the plug to avoid unnecessary heating of wires

- Repeat the activity for three different values of current through the circuit and record the readings of the ammeter and voltmeter in each case.

PRECAUTIONS

- The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
- Connections should be tight otherwise some external resistance may introduce in the circuit.
- The ammeter should be connected in series with the combination of resistors such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
- Voltmeter should always be connected in parallel to the combination of resistors.
- The pointers of the ammeter and voltmeter should be at zero mark when no current flows through the circuit.

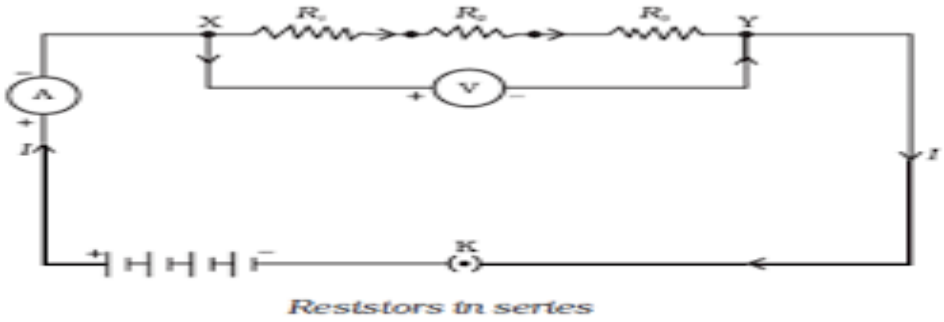
RESULT

Observed value of the equivalent resistance of the series combination =

Calculated value of equivalent resistance =

NOTE to the Student:
The following content should be on the unruled side of the Journal

VERIFICATION OF THE LAW OF COMBINATION OF RESISTORS IN SERIES



Reststors tn serles

Figure 3

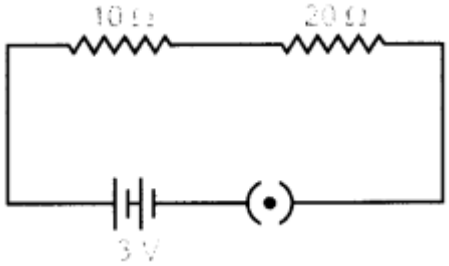
OBSERVATIONS AND CALCULATIONS

Range of the ammeter = to A
Least count of the ammeter = A
Range of the voltmeter = to V
Least count of the voltmeter = V
Resistance of first resistor *R1* = Ω
Resistance of second resistor, *R2* = Ω

Equivalent resistance $R_S = R1 + R2$ = Ω

No	VOLTMETER READING (V Volts)	AMMETER READING (I Amperes)	RESISTANCE = V/I (Rs Ohms)
1			
2			
3			
4			

Mean equivalent resistance by series combination = Ohms

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		There are three resistors joined in series in a system having resistance equal to 10 Ω, 20 Ω and 30 Ω respectively. If the potential difference of the circuit is 240 V, find the total resistance and current through the circuit.	2	C
2.		There are two electric lamps M and N which are joined in a series having resistance equal to 15 Ω and 20 Ω respectively. If the potential difference between two terminals of electric circuit is 220V, find the total resistance and electric current through the circuit. Also find the potential difference across the two lamps separately.	2	U
3.		Name the physical quantity which is (i) same and (ii) different in all the bulbs when three bulbs of: a. Same wattage is connected in series b. Different wattage is connected in series. or a. Same current and same potential difference b. Same current and different pd.	2	U
4.		Study the following electric circuit and find (i) the current flowing in the circuit and (ii) the potential difference across 10 Ω resistor. 	2	A
5.		Two resistors of 10 Ω and 15 Ω are connected in series to a battery of 6 V. How can the values of current passing through them be compared?	2	C

RESISTORS IN PARALLEL

Experiment No: 3 Date:

AIM

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

THEORY

When two resistors of resistance *R1* and *R2* respectively are connected in a parallel combination, then their equivalent resistance *Rp* is given by

$$1/R_p = 1/R_1 + 1/R_2$$

In order to determine the resistance of a combination, of resistors connected in parallel, the current *I* flowing through the circuit is measured with an ammeter connected in series with the combination.

The potential difference *V* across the combination of resistors is measured with a voltmeter connected in parallel

MATERIALS REQUIRED

Two resistors, an ammeter, a voltmeter, a battery eliminator, a plug key, connecting wires, and a piece of sand paper.

PROCEDURE

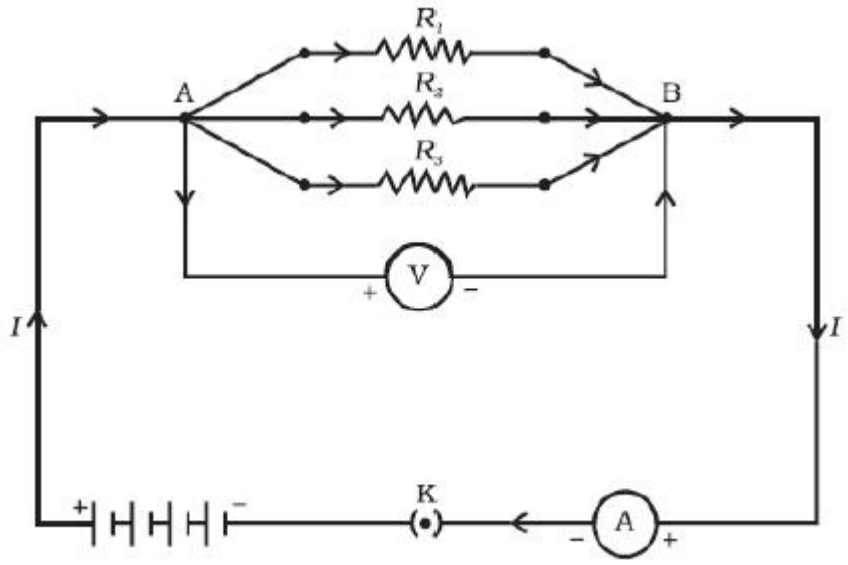
- Note the range and least count of the given ammeter and the voltmeter.
- Draw a circuit diagram for the parallel combination of resistors. Observe how different components like the ammeter, voltmeter, combination of resistors in parallel (of resistances *R1* and *R2*) and the plug key are connected with the battery eliminator.
- Place the given resistors side by side and join them in parallel. Set up the circuit by connecting different components with the help of connecting wires.
- Make sure that the positive and negative terminals of the ammeter and voltmeter are correctly connected in the circuit.
- Insert the key in the plug to let the current establish in the circuit.
- Note the readings of the ammeter and voltmeter and record them.
- Repeat the activity for three different values of current through the circuit and record the readings of the ammeter and voltmeter in each case.

PRECAUTIONS AND SOURCES OF ERROR

- The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
- Connections should be tight otherwise some contact resistance may introduce in the circuit.
- The ammeter should be connected in series with the combinations of resistors such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.

NOTE to the Student:
The following content should be on the unruled side of the Journal

VERIFICATION OF THE LAW OF COMBINATION OF RESISTORS IN PARALLEL



OBSERVATIONS AND CALCULATIONS

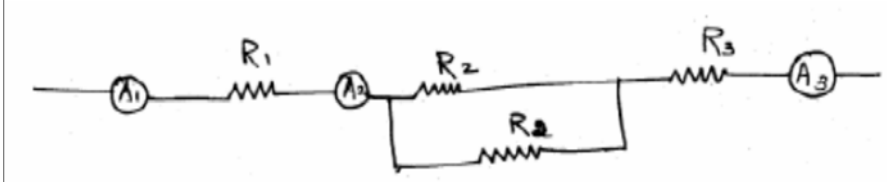
Range of the ammeter = to A.
Least count of the ammeter = A.
Range of the voltmeter = to V.
Least count of the voltmeter = V.
Resistance of first resistor *R1* = Ω.
Resistance of second resistor, *R2* = Ω.
Equivalent resistance
$R_p = R_1R_2/R_1 + R_2$ = Ω

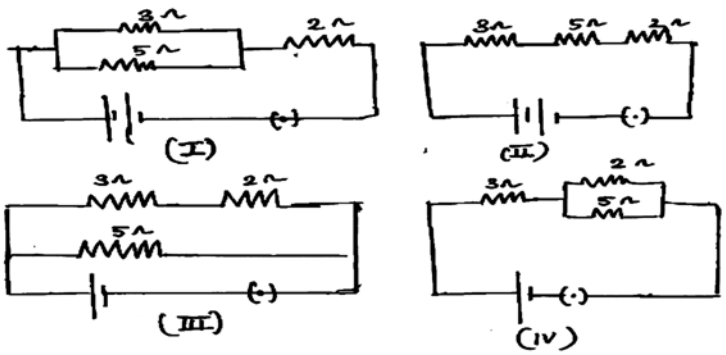
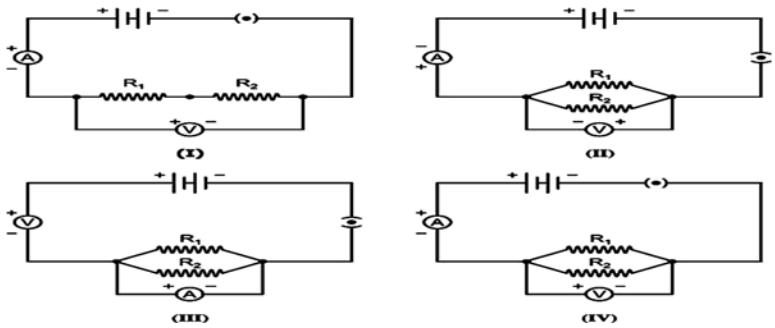
		AMMETER READING	RESISTANCE = V/I

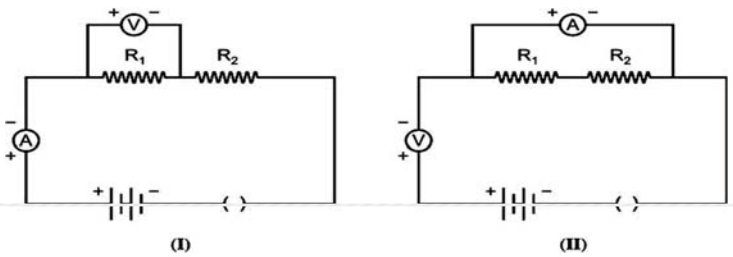
No	VOLTMETER READING (V Volts)	(I Amperes)	(R_p Ohms)
1			
2			
3			
4			

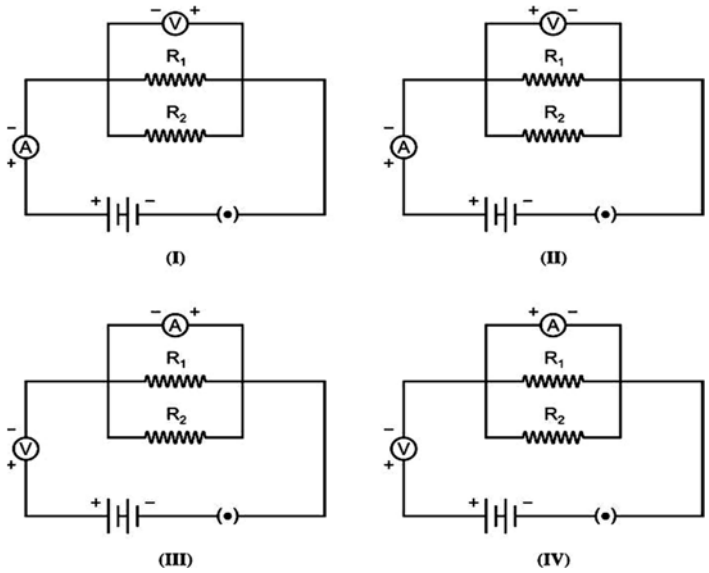
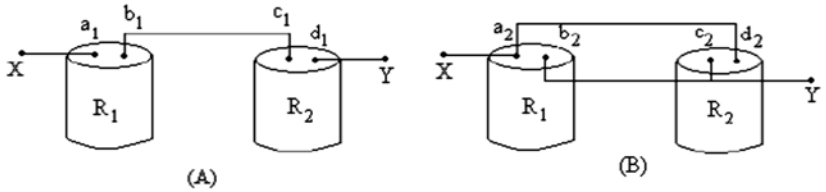
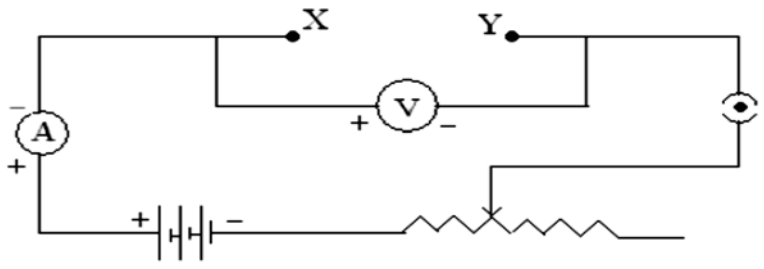
Mean equivalent resistance by parallel combination = Ohms

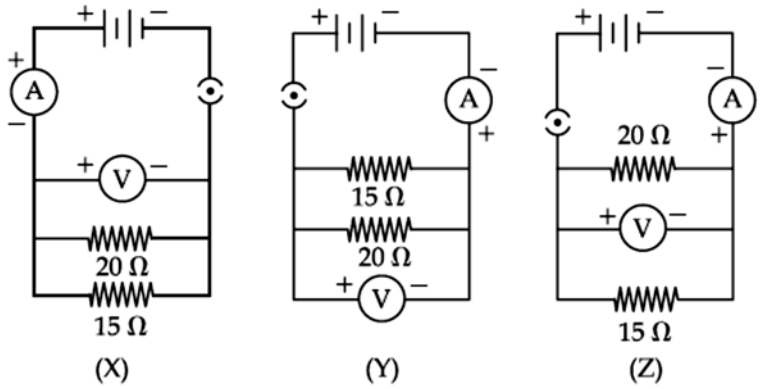
MCQ QUESTIONS

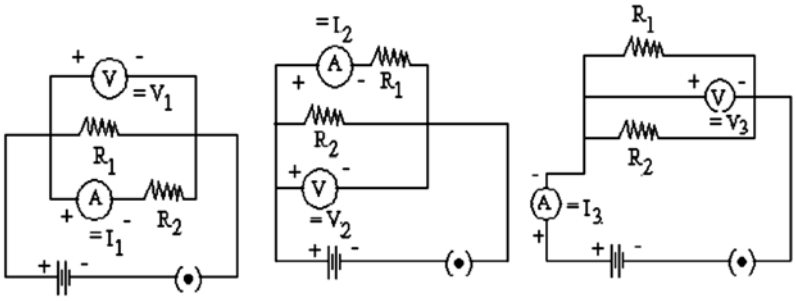
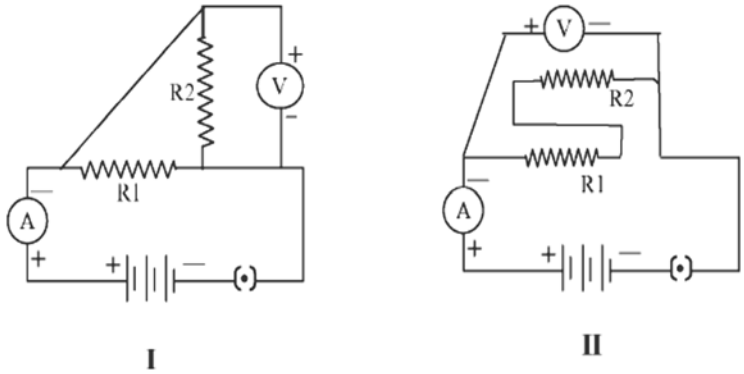
A		Very Short Answer Questions (VSA)	Mks	Level
1		The ammeter which shows maximum current is :  a) A1 b) A2 c) A3 d) All the ammeters show the same current.	1	
2		The three resistors 2 ohms, 3 ohms, and 5 ohms are connected in order to get a resultant of 2.5ohms. Of the four Circuit diagrams given below, the correct circuit diagram is :	1	

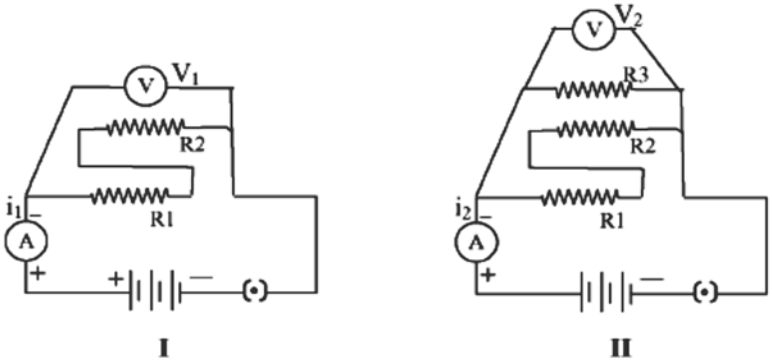
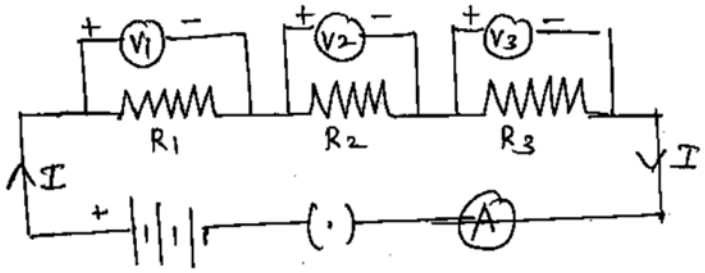
		 a) I b) II c) III d) IV		
3		Of the four circuit diagrams given below, the correct circuit diagram to determine the resultant resistance in series is :  a) I b) II c) III d) IV	1	
4		Of the four experimental set ups, the voltmeter and ammeter are correctly connected in : a) I b) II c) III d) IV	1	

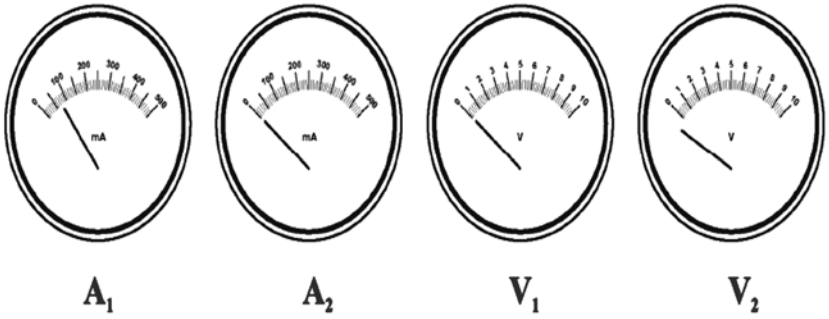
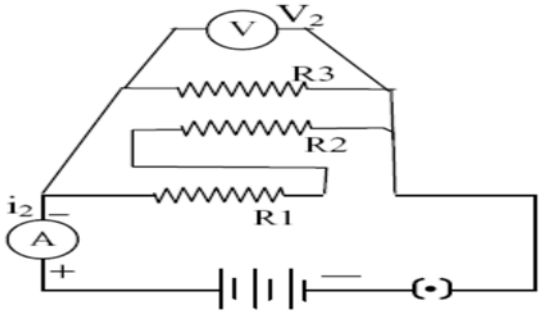


5		Following Circuits were drawn by four students, to determine the equivalent resistance of two resistors when connected in parallel. The correct circuit is drawn by the student:  a) I b) II c) III d) IV	1	
6		Students A and B connected the two resistors R 1and R2 given to them in the manners shown below.  And then they inserted between the terminals X and Y into the measuring circuit given below  We can say that,	1	

		a) Both the students A and B will determine the resultant resistance of R_1 and R_2 in series. b) Both the students A and B determine the resultant resistance in parallel. c) Student A determines the resultant of R_1 and R_2 in series and the student B determines the resultant of R_1 and R_2 in parallel. d) Student A determines the resultant of R_1 and R_2 in parallel and the student B determines the resultant of R1 and R2 in series.		
7		To determine the resultant of two resistors of 20 ohms and 15 ohms in parallel, three students connected the circuit as shown in the figure.  The current circuit diagram to determine the resultant resistance is that of : a) Student X b) Student Y c) Student Z d) All the 3 students X , Y and Z	1	

8		The same resistors R_1 and R_2 have been connected in parallel and the ammeter and the voltmeter have been connected in three different ways. The relation between the three voltmeter and ammeter readings will be,  a) $V_1 = V_2 = V_3$; $I_1 = I_2 = I_3$ b) $V_1 \neq V_2 \neq V_3$; $I_1 \neq I_2 \neq I_3$ c) $V_1 \neq V_2 \neq V_3$; $I_1 = I_2 = I_3$ d) $V_1 = V_2 = V_3$; $I_1 \neq I_2 \neq I_3$	1	
9		The resistors R_1 and R_2 are connected in  I II a) Series in both the circuits b) Parallel in both the circuits c) Series in circuit I and parallel in circuit II d) Series in circuit II and parallel in circuit I	1	
10		Circuit I: Ammeter reads i_1 and Voltmeter reads V_1	1	

		Circuit II: Ammeter reads i_2 and Voltmeter reads V_2  Relation between the readings is a) $i_1 > i_2$; $v_1 = v_2$ b) $i_1 > i_2$; $v_1 > v_2$ c) $i_1 < i_2$; $v_1 < v_2$ d) $i_1 < i_2$; $v_1 = v_2$		
11		Three resistors R1, R2 and R3 are connected in series as sown in the figure. Also $R_1 = R_2$. The potential differences across R1, R2 and R3 are : a) $V_1 = V_2 = V_3$ b) $V_1 = V_2 \neq V_3$ c) $V_1 \neq V_2$; $V_1 = V_3$ d) $V_1 \neq V_2 \neq V_3$  	1	
12		The initial positions of the pointers of ammeters and the voltmeters available in the lab are shown below. In the circuit to verify the law of combination of resistors, a student should use,	1	

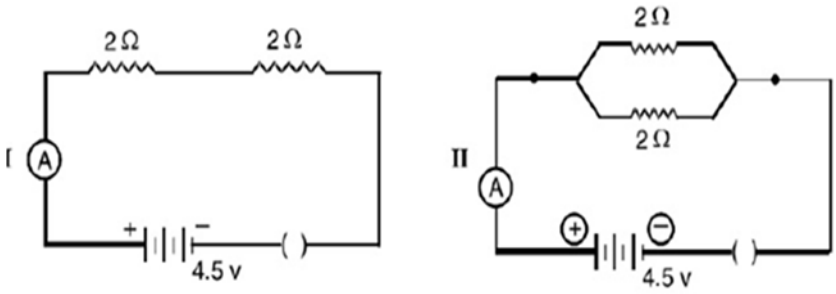
		 A_1 A_2 V_1 V_2 a) Ammeter A_1 & Voltmeter V_1 b) Ammeter A2 & Voltmeter V1 c) Ammeter A1 & Voltmeter V2 d) Ammeter A2 & Voltmeter V2		
13		The following apparatus is available in the laboratory **Cell Adjustable from 0 to 1.5 V** **Resistor 4 Ohms and 12 Ohms** **Ammeter A_1 of range 0 to 3A. Least count 1 A** **A2 of range 0 to 1A. Least count 0.05 A** **Voltmeter V1 of range 0 to 10V Least count 0.5V** **V2 of range 0 to 5V. Least count 0.1 V** The best combination of ammeter and voltmeter to determine the equivalent resistance of the resistors in **parallel** will be a) Ammeter A1 & Voltmeter V1 b) Ammeter A2 & Voltmeter V1 c) Ammeter A1 & Voltmeter V2 d) Ammeter A2 & Voltmeter V2	1	
	14	In the following circuit, which of the following statement is true?  a) R1, R2, R3 are connected in series to each other b) R1, R2 and R3 are connected in parallel to each other.	1	

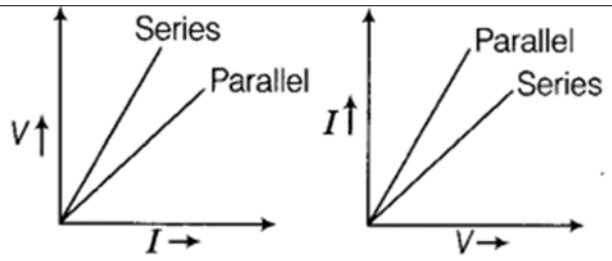
c) R1 and R2 are connected in series and R3 parallel to them

d) R3 and R2 are in series and R1 parallel to them.

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
11	**12**	**13**	**14**	**15**					

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		In the circuit I two resistors, each of 2 Ω are connected in series and in circuit II two resistors each of 2 Ω are connected in parallel. The potential difference across the two terminals of the battery in both the circuit are 4.5V. What will be the ammeter reading in circuit I and circuit II ? 	2	C
2.		Two students perform the experiments on series and parallel combination of two given resistors R1 and R2 and plotted the following V-I graphs. Identify the correctly labelled graph. Justify your answer.	2	U

				
3.		The following apparatus is available in a laboratory Cell : Adjustable from 0-1.5V Resistor : 4 Ω and 12 Ω Ammeters A1 of range 0 to 3 A ; least count 0.1A A2 of range 0 to 1A ;least count 0.05A Voltmeters : V1 of range 0 to 10 V;least count 0.5V V2 of range 0 to 5V ;least count 0.1V Find the best combination of ammeter and voltmeter for finding the equivalent resistance of resistors connected in parallel	2	U
4.		How the ammeter and voltmeter should be connected in a circuit.What is the resistance of an ideal ammeter and voltmeter?	2	A
5.		An ammeter can measure current up to 500 mA. There are 20 equal divisions between 0 and 100mA marks on the scale .During an experiment to determine the equivalent resistance of the two resistors joined in parallel a student observes ammeter point in 3rd graduation mark after 0 when the key is off and the pointer at 17th graduation mark after 200 mA when the key is closed. Find the value of current in the circuit?	2	C

CONVEX LENS

AIM

To find the image distance for various object distances in the case of convex lens and to draw ray diagrams to show the nature of the image.

APPARATUS

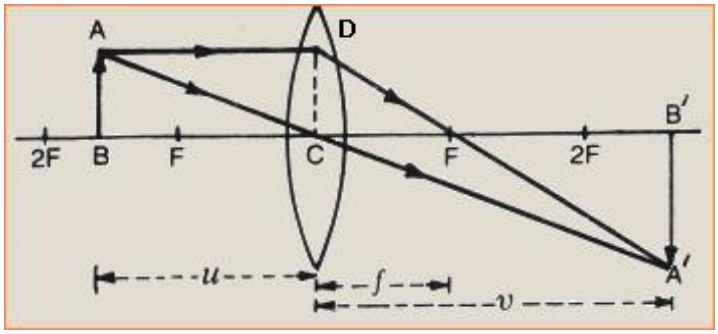
Convex lens, optical bench, two needles and meter scale.

THEORY

The position of the image formed by a convex lens depends upon the position of object with respect to lens. The relation between u, v and f for convex lens is

1/f = 1/v - 1/u

DIAGRAM



PROCEDURE

1. Find the rough focal length of the convex lens is found by taking the image of a distant object on the screen.
2. Place lens and the two needles are mounted on a vertical upright. The tips of the needles and the centre of the lens should be kept at the same height from the end of the bench. The object needle is placed between F and 2F of the convex lens and the image needle on the other side of the lens. The image needle is moved forward and backward till the real and inverted image of the object needle is seen through the lens just over the image needle.
3. Then the distance between the object needle and lens u and the image needle and lens v is measured.
4. Repeat the above steps for different positions of object needle and image needle.
5. A graph is plotted between u and v between 1/u and 1/v.

SOURCES OF ERROR

1. The convex lens is very thick.
2. The principal axis of the lens may not be parallel to the optical bench scale.
3. The parallax is not removed from tip to tip

PRECAUTIONS

1. Always place the convex lens in the middle of the optical bench.

2. Always choose a lens of small focal length.

3. The parallax should be removed from tip to tip

4. The uprights should be vertical &stable.

5. Eyes should be placed at a distance of about 100 cm from the needle while removing

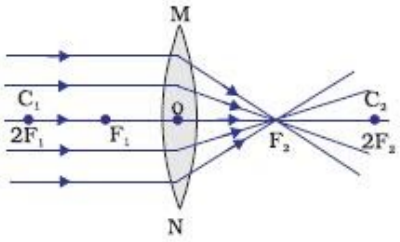
OBSERVATIONS

Rough focal length of convex lens = ----------cm

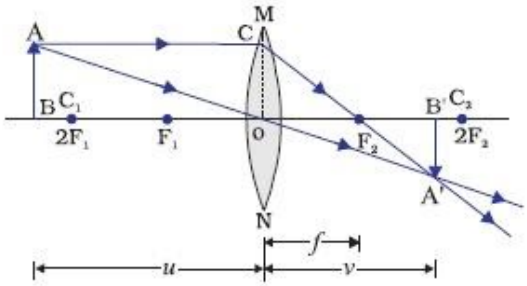
S.No	Position of			Distance b/w object needle & lens(u) [a-b]	Distance b/w image needle & lens(v) [c-a]
	Convex lens(a)cm	Object needle(b)cm	Image needle c (cm)		
1					
2					
3					
4					
5					

RESULT:

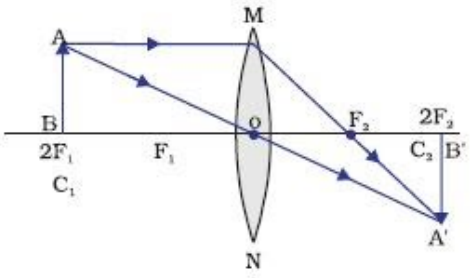
The following ray diagrams are verified for various object distances.



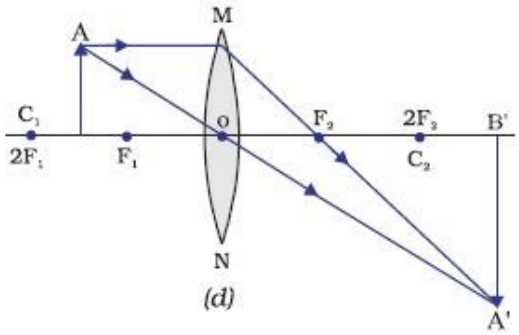
(a)



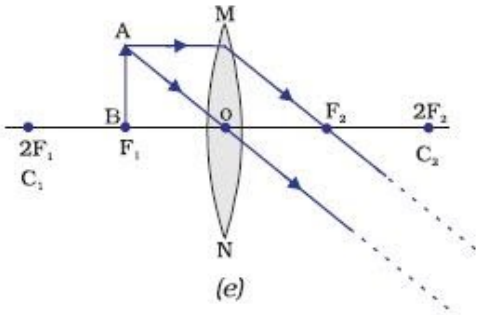
(b)



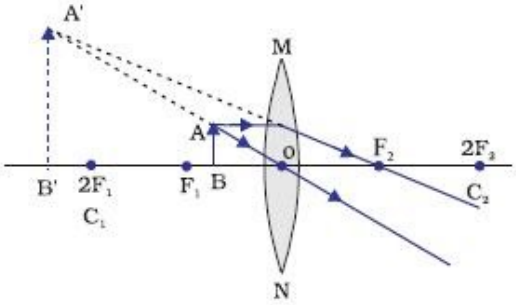
(c)



(d)



(e)



(f)

ORAL QUESTIONS WITH ANSWERS

1. Define focal length of a lens.
   Ans: The distance of optical centre from the principal focus of a lens, is called its focal length .

2. Define power of a lens.
   Ans : The reciprocal of focal length of a lens is called power of that lens.

3. What is the unit of power of a lens?
   Ans Dioptre.

4. Define dioptre.
   Ans: Power of lens in dioptre = 1/ focal length in metres

5. What is the property of the optical centre?
   Ans: A ray

6. What is the least distance between the object and its real image formed by a convex lens?
   Ans : It is equal to 4 times the focal length of that convex lens.

7. Are the positions of object and image interchangeable?
   Ans: Yes

8. Can convex mirror ever form a real image?
   Ans: No

9. Does the focal length of a lens change when immersed in water?
   Ans: Yes the focal increases when immersed in water.

10. Does focal length of a lens depend upon u and v?
    Ans: No

B		PRATICAL BASED QUESTIONS	MARK	LEVEL
1.		A student places a candle flame at a distance of about 60 cm from a convex lens of focal length 10 cm and focuses the image of the flame on a screen. After that he gradually moves the flame towards the lens and each time focuses the image on the screen. (a) In which direction-toward or away from the lens, does he move the screen to focus the image? (b) How does the size of the image change? (c) How does the intensity of the image change as the flame moves towards the lens? (d) Approximately for what distance between the flame and the lens, the image formed on the screen is inverted and of the same size?	2	C
2.		A student focuses the image of a well illuminated distant object on a screen using a convex lens. After that he gradually moves the object	2	U

		towards the lens and each time focuses its image on the screen by adjusting the lens. (a) In which direction—towards the screen or away from the screen, does he move the lens? (b) What happens to the size of the image—does it decrease or increase? (c) What happens to the image on the screen when he moves the object very close to the lens?		
3.		An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O', principal focus F and height of the image on the diagram.	2	U
4.		A 4 cm tall object is placed on the principal axis of a convex lens. The distance of the object from the optical centre of the lens is 12 cm and its sharp image is formed at a distance of 24 cm from it on a screen on the other side of the lens. If the object is now moved a little away from the lens, in which way (towards the lens or away from the lens) will he have to move the screen to get a sharp image of the object on it again? How will the magnification of the image be affected?	2	A
5.		To find the image-distance for varying object-distances in case of a convex lens, a student obtains on a screen a sharp image of a bright object placed very far from the lens. After that he gradually moves the object towards the lens and each time focuses (a) In which direction-towards or away from the lens, does he move the screen to focus the object? (b) What happens to the size of image—does it increase or decrease? (c) What happen when he moves the object very close to the lens?	2	C

SAMPLE PAPERS.

مـــدرسـة دلهـــي الخـاصـة ذ.م.م.

DELHI PRIVATE SCHOOL L.L.C.

Affiliated to C.B.S.E., DELHI

(Approved & Recognized By Ministry of Education - United Arab Emirates)

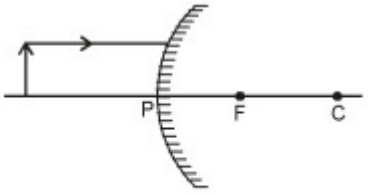
DPS SHARJAH

PT2 -(2022-23) Sample paper

Subject: PHYSICS	**Max. Marks: 11**
Grade: 10	**Time: 30 Minutes**

General Instructions:

-

1.	The focal length of a plane mirror is a) Zero b) +1 c) – 1 d) infinity	1
2.	The magnification produced by a concave mirror a) is always more than one b) is always less than one c) is always equal to one d) maybe less than or greater than one.	1
3.	The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object? a) Between the principal focus and centre of curvature b) At the centre of curvature c) Between the pole and principal focus d) Beyond centre of curvature	1
4.	i) Name the spherical mirror that can form real as well as virtual image. ii) A ray of light moving along centre of curvature is falling on above spherical mirror. Draw the path of incident and reflected ray in this case and state the value of angle of incidence and angle of reflection.	2
5.	i) Complete the following ray diagram for the spherical mirror M shown in fig.  M	3

	ii)Is the image real or virtual in above case? iii)Write one use of the mirror M.	
6.	A spherical mirror produces an image of magnification -1 on a screen placed at a distance of 40 cm from the mirror. (a) Write the type of mirror. (b) Find the distance of the image from the object and focal length of the mirror. (c) Draw the ray diagram to show the image formation in this case.	3

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مـــدرسـة دلهـــي الخـاصـة ذ.م.م.

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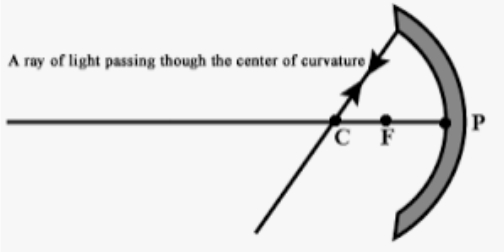
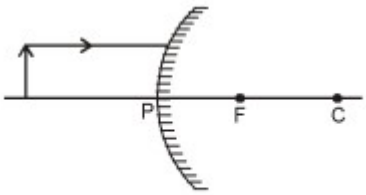
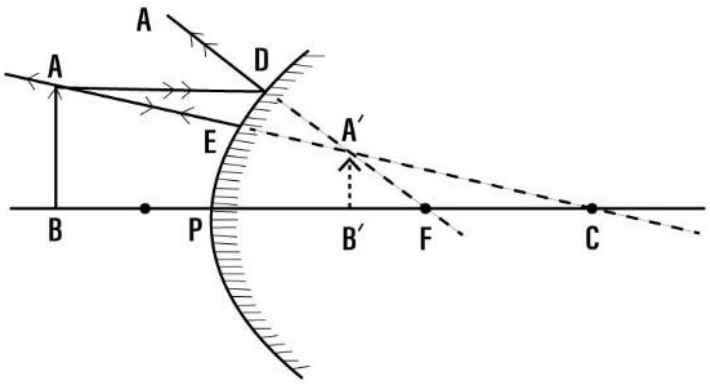
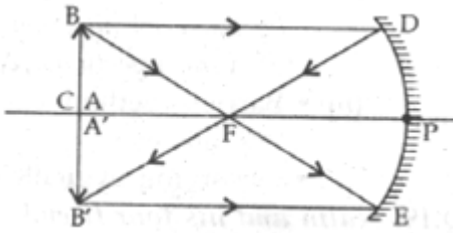
3.	The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object? a) Between the principal focus and centre of curvature b) At the centre of curvature c) Between the pole and principal focus d) Beyond centre of curvature	1
4.	i) Name the spherical mirror that can form real as well as virtual image. ii) A ray of light moving along centre of curvature is falling on above spherical mirror. Draw the path of incident and reflected ray in this case and state the value of angle of incidence and angle of reflection. ANS **i) Concave mirror** **ii)**	2

	 **the ray passing through the centre of curvature is incident normally to the mirror. the angle of incidence is 0 degree and the angle of reflection should also be 0 degree**	
5.	i) Complete the following ray diagram for the spherical mirror M shown in fig.  M ii)Is the image real or virtual in above case? iii)Write one use of the mirror M. ANS i)  **ii) Virtual** **iii) Convex mirrors are used in the rear-view mirrors of all the vehicles.security purposes in building hallways, in shops.**	3
6.	A spherical mirror produces an image of magnification -1 on a screen placed at a distance of 40 cm from the mirror. (a) Write the type of mirror. (b) Find the distance of the image from the object and focal length of the mirror. (c) Draw the ray diagram to show the image formation in this case.	3

ANS

a) **Concave mirror**
b) **Image distance = object distance = 40 cm**
c)



AB -OBJECT A'B'-IMAGE

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DPS SHARJAH

PT2 -(2022-23) Sample paper

Subject: PHYSICS	**Max. Marks: 11**
Grade: 10	**Time: 30 Minutes**

General Instructions:

-

1.	Which among the following is used in torch to form parallel beam of light? a) Concave lens b) Concave mirror c) Convex mirror d) Plane mirror	1
2.	i)The linear magnification produced by a spherical mirror is -1. State the type of mirror and position of the object with respect to the pole of the mirror. ii) An object is placed at a distance 2f from the pole of a convex mirror of focal length f. Calculate its linear magnification.	2
3.	"A convex lens can form a magnified erect as well as magnified inverted image of an object placed in from of it." Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.	2
4.	i) State the law of refraction of light that defines the refractive index of a medium with respect to the other. ii)The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium?	3
5.	i) Define optical centre of a spherical lens. ii)The focal length of a concave mirror is 30cm.Find the position of the object in front of the mirror, so that the image is three times the size of the object.	3

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DPS SHARJAH

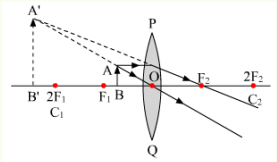
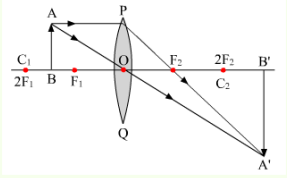
PT1 -(2022-23) Sample paper

Subject: PHYSICS	**Max. Marks: 11**
Grade: 10	**Time: 30 Minutes**

General Instructions:

-

1.	Which among the following is used in torch to form parallel beam of light? a) Concave lens b) Concave mirror c) Convex mirror d) Plane mirror	1
2.	i)The linear magnification produced by a spherical mirror is -1. State the type of mirror and position of the object with respect to the pole of the mirror. ii) An object is placed at a distance 2f from the pole of a convex mirror of focal length f. Calculate its linear magnification. Ans i)Type of mirror - concave mirror Position of object: at centre of curvature ii) Here, $u = -2f$ $v = ?$ $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ $\frac{1}{v} + \frac{1}{-2f} = \frac{1}{f}$ $\frac{1}{v} = \frac{3}{2f}$ $v = \frac{2f}{3}$ Now, $M = \frac{-v}{u}$ $= -\frac{\frac{2f}{3}}{(-2f)}$ $= \frac{1}{3}$ (M is positive for convex mirror)	2
3.	"A convex lens can form a magnified erect as well as magnified inverted image of an object placed in from of it." Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.	2

	Ans (a) Magnified erect image (When the object is placed between O and F_1)  (b) Magnified inverted image (When the object is placed between F_1 and $2F_1$)  	
4.	i) State the law of refraction of light that defines the refractive index of a medium with respect to the other. ii)The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium? Ans i)Snell's law is defined as "The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant, for the light of a given colour and for the given pair of media". Snell's law formula is expressed as: $\frac{\sin i}{\sin r} = constant = \mu$ Where i is the angle of incidence and r is the angle of refraction. This constant value is called the refractive index of the second medium with respect to the first. ii) Refractive index of medium = speed of light in vacuum / speed of light in medium n=c/v n= c/0.6c=1/0,6 -5/3=1.67	3
5.	i) Define optical centre of a spherical lens. ii)The focal length of a concave mirror is 30cm.Find the position of the object in front of the mirror, so that the image is three times the size of the object. Ans i) The Optical centre of the lens is defined as the point which lies on the principal axis through the rays of light passes without any deflection ii)	3

$f = -30$ cm, $m = -3$

$u = ?$

a. For real image

$$m = -\frac{v}{u} = -3$$

$$v = 3u$$

Mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$$\frac{1}{(-30)} = \frac{1}{3u} + \frac{1}{u}$$

$$-\frac{1}{30} = \frac{4}{3u} \text{ or } u = -40 \text{ cm}$$

object must be 40 cm in front of mirror to get a real inverted image by the concave mirror.

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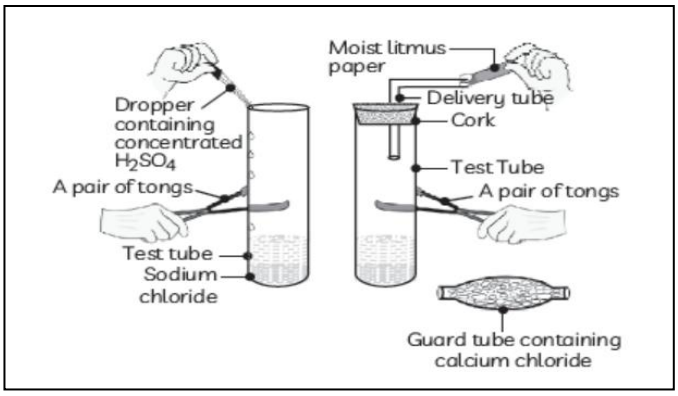
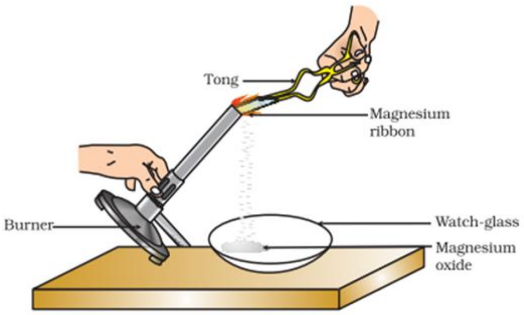
Science (086)
Class X
Sample Question Paper 2022-23

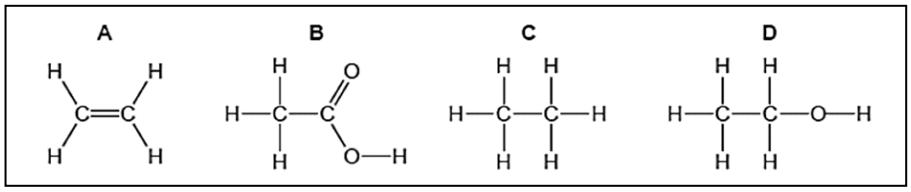
Max. Marks: 80 **Time Allowed: 3 hours**

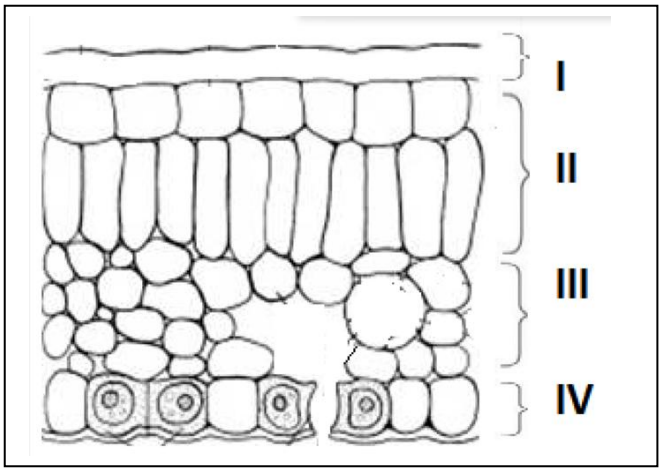
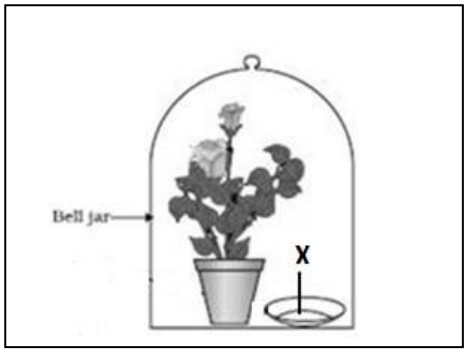
General Instructions:

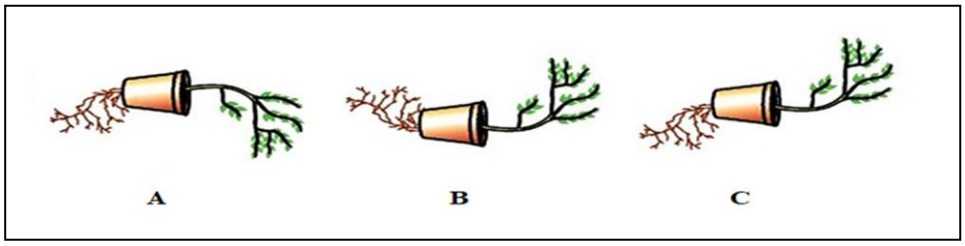
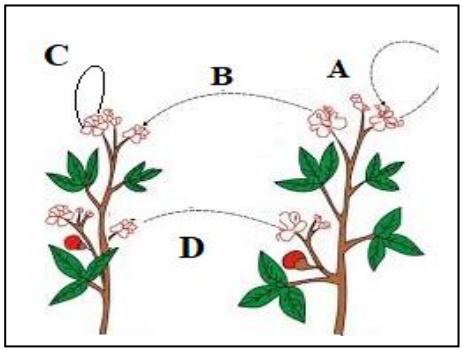
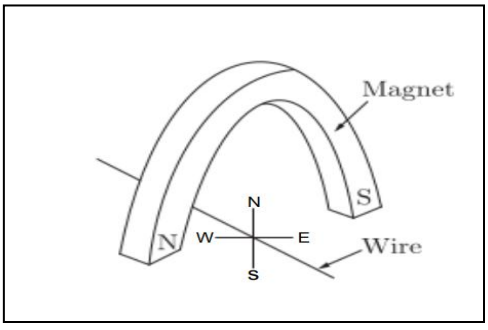
i. *This question paper consists of 39 questions in 5 sections.*
ii. *All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.*
iii. ***Section A** consists of 20 objective type questions carrying 1 mark each.*
iv. ***Section B** consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.*
v. ***Section C** consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words*
vi. ***Section D** consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.*
vii. ***Section E** consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.*

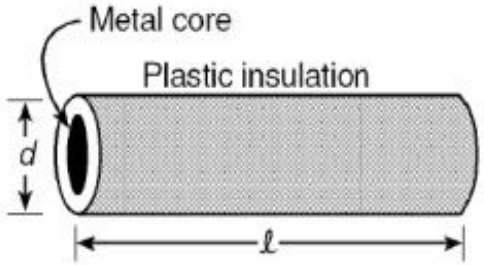
SECTION - A Select and write one most appropriate option out of the four options given for each of the questions 1 – 20		
Q. No	**Questions**	**Marks**
1	The change in colour of the moist litmus paper in the given set up is due to  i. presence of acid ii. presence of base iii. presence of H^+(aq) in the solution iv. presence of Litmus which acts as an indicator (a) i and ii (b) Only ii (c) Only iii (d) Only iv.	1
2	In the redox reaction $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$ (a) MnO_2 is reduced to $MnCl_2$& HCl is oxidized to H_2O (b) MnO_2 is reduced to $MnCl_2$& HCl is oxidized to Cl_2	1

<table>
<tr><td></td><td>(c) MnO_2 is oxidized to $MnCl_2$ & HCl is reduced to Cl_2
(d) MnO_2 is oxidized to $MnCl_2$ & HCl is reduced to H_2O</td><td></td></tr>
<tr><td>3</td><td> 

Which of the following is the correct observation of the reaction shown in the above set up?
(a) Brown powder of Magnesium oxide is formed.
(b) Colourless gas which turns lime water milky is evolved.
(c) Magnesium ribbon burns with brilliant white light.
(d) Reddish brown gas with a smell of burning Sulphur has evolved.</td><td>1</td></tr>
<tr><td>4</td><td>With the reference to four gases CO_2,CO, Cl_2 and O_2, which one of the options in the table is correct?
<table>
<tr><th>Option</th><th>Acidic oxide</th><th>Used in treatment of water</th><th>Product of respiration</th><th>Product of incomplete combustion</th></tr>
<tr><td>(a)</td><td>CO</td><td>Cl_2</td><td>O_2</td><td>CO</td></tr>
<tr><td>(b)</td><td>CO_2</td><td>Cl_2</td><td>CO_2</td><td>CO</td></tr>
<tr><td>(c)</td><td>CO_2</td><td>O_2</td><td>O_2</td><td>CO_2</td></tr>
<tr><td>(d)</td><td>CO</td><td>O_2</td><td>CO_2</td><td>CO_2</td></tr>
</table></td><td>1</td></tr>
<tr><td>5</td><td>On placing a copper coin in a test tube containing green ferrous sulphate solution, it will be observed that the ferrous sulphate solution
(a) turns blue, and a grey substance is deposited on the copper coin.
(b) turns colourless and a grey substance is deposited on the copper coin.
(c) turns colourless and a reddish–brown substance is deposited on the copper coin.
(d) remains green with no change in the copper coin.</td><td>1</td></tr>
<tr><td>6</td><td>Anita added a drop each of diluted acetic acid and diluted hydrochloric acid on pH paper and compared the colors. Which of the following is the correct conclusion?
(a) pH of acetic acid is more than that of hydrochloric acid.
(b) pH of acetic acid is less than that of hydrochloric acid.
(c) Acetic acid dissociates completely in aqueous solution.
(d) Acetic acid is a strong acid</td><td>1</td></tr>
<tr><td>7</td><td>The formulae of four organic compounds are shown below. Choose the correct option

</td><td>1</td></tr>
</table>

	(a) A and B are unsaturated hydrocarbons (b) C and D are saturated hydrocarbons (c) Addition of hydrogen in presence of catalyst changes A to C (d) Addition of potassium permanganate changes B to D	
8	In the given transverse section of the leaf identify the layer of cells where maximum photosynthesis occurs.  (a) I, II (b) II, III (c) III, IV (d) I, IV	1
9	Observe the experimental setup shown below. Name the chemical indicated as 'X' that can absorb the gas which is evolved as a byproduct of respiration.  (a) NaOH (b) KOH (c) Ca $(OH)_2$ (d) K_2CO_3	1
10	If a tall pea plant is crossed with a pure dwarf pea plant then, what percentage of F1 and F2 generation respectively will be tall? (a) 25%, 25% (b) 50%, 50% (c) 75%,100% (d) 100%, 75%	1
11	Observe the three figures given below. Which of the following depicts tropic movements appropriately?	1

	 (a) B and C (b) A and C (c) B only (d) C only	
12	The diagram shown below depicts pollination. Choose the options that will show a maximum variation in the offspring.  (a) A, B and C (b) B and D (c) B, C and D (d) A and C	1
13	A complete circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire (a) decreases. (b) remains the same. (c) increases. (d) increases for some time and then decreases .	1
14	A copper wire is held between the poles of a magnet. 	1

	The current in the wire can be reversed. The pole of the magnet can also be changed over. In how many of the four directions shown can the force act on the wire? (a) 1 (b) 2 (c) 3 (d) 4	
15	 Plastic insulation surrounds a wire having diameter ***d*** and length ***l*** as shown above. A decrease in the resistance of the wire would be produced by an increase in the (a) length l of the wire (b) diameter d of the wire (c) temperature of the wire (d) thickness of the plastic insulation	1
16	Which of the following pattern correctly describes the magnetic field around a long straight wire carrying current? (a) straight lines perpendicular to the wire. (b) straight lines parallel to the wire. (c) radial lines originating from the wire. (d) concentric circles centred around the wire.	1

Q. no 17 to 20 are Assertion - Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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

(b) Both A and R are true and R is not the correct explanation of A

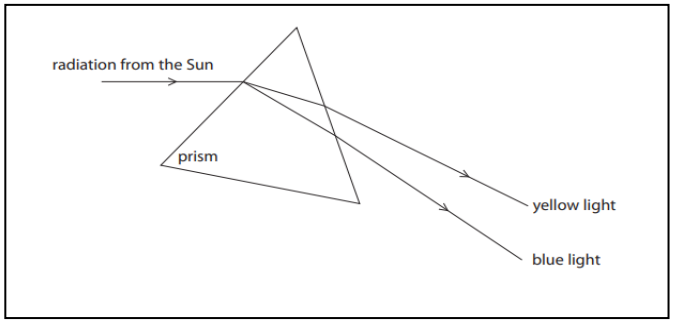
(c) A is true but R is false

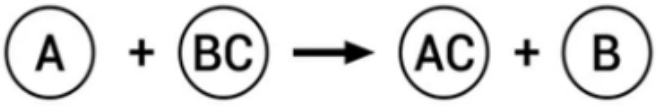
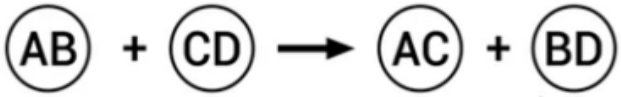
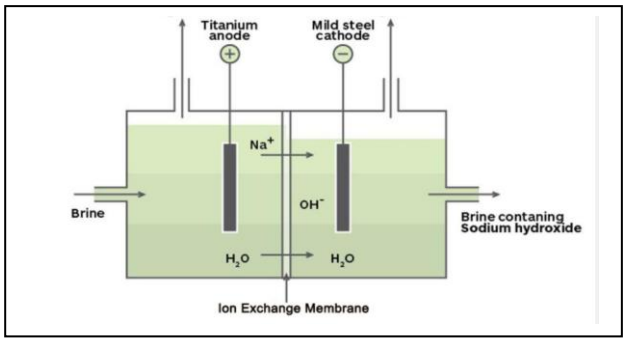
(d) A is False but R is true

17	Assertion: Silver bromide decomposition is used in black and white photography. Reason: Light provides energy for this exothermic reaction.	1
18	Assertion: Height in pea plants is controlled by efficiency of enzymes and is thus genetically controlled. Reason: Cellular DNA is the information source for making proteins in the cell.	1
19	Assertion: Amphibians can tolerate mixing of oxygenated and deoxygenated blood. Reason: Amphibians are animals with two chambered heart	1
20	Assertion: On freely suspending a current – carrying solenoid, it comes to rest in Geographical N-S direction. Reason : One end of current carrying straight solenoid behaves as a North pole and the other end as a South pole, just like a bar magnet.	1

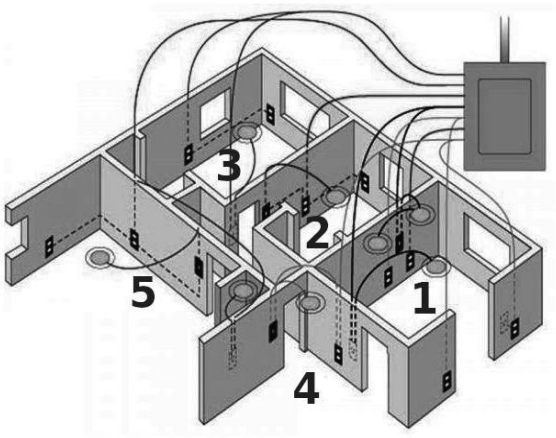
SECTION – B

Q. no. 21 to 26 are very short answer questions.

21	A clear solution of slaked lime is made by dissolving $Ca(OH)_2$ in an excess of water. This solution is left exposed to air. The solution slowly goes milky as a faint white precipitate forms. Explain why a faint white precipitate forms, support your response with the help of a chemical equation. **OR** Keerti added dilute Hydrochloric acid to four metals and recorded her observations as shown in the table given below: **Metal** / **Gas Evolved** Copper – Yes Iron – Yes Magnesium – No Zinc – Yes Select the correct observation(s) and give chemical equation(s) of the reaction involved.	2
22	How is the mode of action in beating of the heart different from reflex actions? Give four examples.	2
23	Patients whose gallbladder are removed are recommended to eat less oily food. Why?	2
24	Name the substances other than water, that are reabsorbed during urine formation. What are the two parameters that decide the amount of water that is reabsorbed in the kidney?	2
25	 State the phenomena observed in the above diagram. Explain with reference to the diagram, which of the two lights mentioned above will have the higher wavelength? **OR** How will you use two identical prisms so that a narrow beam of white lightincident on one prism emerges out of the second prism as white light? Draw the diagram.	2

26	A lot of waste is generated in neighborhood. However, almost all of it is biodegradable. What impact will it have on the environment or human health?	2
	SECTION - C Q.no. 27 to 33 are short answer questions.	
27	i)  ii)  Identify the types of reaction mentioned above in (i) and (ii). Give one example for each type in the form of a balanced chemical equation.	3
28	 (a) Identify the gasses evolved at the anode and cathode in the above experimental set up. (b) Name the process that occurs. Why is it called so? (c) Illustrate the reaction of the process with the help of a chemical equation.	3
29	The leaves of a plant were covered with aluminium foil, how would it affect the physiology of the plant? **OR** How is lymph an important fluid involved in transportation? If lymphatic vessels get blocked, how would it affect the human body? Elaborate.	3
30	Rohit wants to have an erect image of an object using a converging mirror of focal length 40 cm. (a) Specify the range of distance where the object can be placed in front of the mirror. Justify. (b) Draw a ray diagram to show image formation in this case. (c) State one use of the mirror based on the above kind of image formation.	3
31	(a) A lens of focal length 5 cm is being used by Debashree in the laboratory as a magnifying glass. Her least distance of distinct vision is 25 cm. (i) What is the magnification obtained by using the glass? (ii) She keeps a book at a distance 10 cm from her eyes and tries to read. She is unable to read. What is the reason for this?	3

	(b) Ravi kept a book at a distance of 10 cm from the eyes of his friend Hari. Hari is not able to read anything written in the book. Give reasons for this?	
32	A student fixes a white sheet of paper on a drawing board. He places a bar magnet in the centre and sprinkles some iron filings uniformly around the bar magnet. Then he taps gently and observes that iron filings arrange themselves in a certain pattern. (a) Why do iron filings arrange themselves in a particular pattern? (b) Which physical quantity is indicated by the pattern of field lines around the bar magnet? (c) State any two properties of magnetic field lines. **OR** A compass needle is placed near a current carrying wire. State your observations for the following cases and give reasons for the same in each case- (a) Magnitude of electric current in wire is increased. (b) The compass needle is displaced away from the wire.	3
33	Why is damage to the ozone layer a cause for concern? What are its causes and what steps are being taken to limit this damage?	3
	SECTION - D Q.no. 34 to 36 are Long answer questions.	
34	Shristi heated Ethanol with a compound A in presence of a few drops of concentrated sulphuric acid and observed a sweet smelling compound B is formed. When B is treated with sodium hydroxide it gives back Ethanol and a compound C. (a) Identify A and C (b) Give one use each of compounds A and B. (c) Write the chemical reactions involved and name the reactions. **OR** (a) What is the role of concentrated Sulphuric acid when it is heated with Ethanol at 443 K. Give the reaction involved. (b) Reshu by mistake forgot to label the two test tubes containing Ethanol and Ethanoic acid. Suggest an experiment to identify the substances correctly? Illustrate the reactions with the help of chemical equations	5
35	(a) Why is it not possible to reconstruct the whole organism from a fragment in complex multicellular organisms? (b) Sexual maturation of reproductive tissues and organs are necessary link for reproduction. Elucidate. **OR** (a) How are variations useful for species if there is drastic alteration in the niches? (b) Explain how the uterus and placenta provide necessary conditions for proper growth and development of the embryo after implantation?	5

36	 The diagram above is a schematic diagram of a household circuit. The house shown in the above diagram has 5 usable spaces where electrical connections are made. For this house, the mains have a voltage of 220 V and the net current coming from the mains is 22A. (a) What is the mode of connection to all the spaces in the house from the mains? (b) The spaces 5 and 4 have the same resistance and spaces 3 and 2 have respective resistances of 20Ω and 30Ω. Space 1 has a resistance double that of space 5. What is the net resistance for space 5. (c) What is the current in space 3? (d) What should be placed between the main connection and the rest of the house's electrical appliances to save them from accidental high electric current?	5

SECTION - E

Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internal choice is provided in one of these sub-parts.

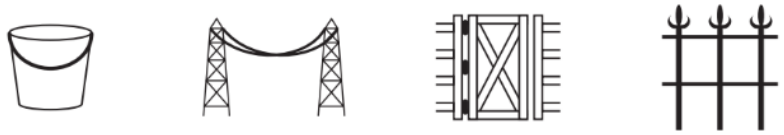
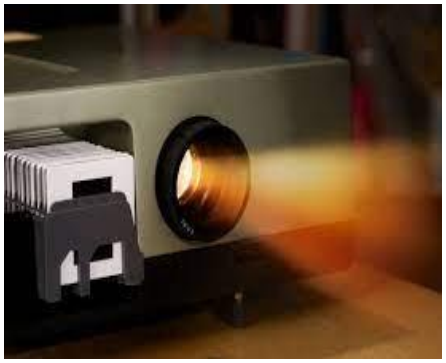
37 (4)

Two students decided to investigate the effect of water and air on iron object under identical experimental conditions. They measured the mass of each object before placing it partially immersed in 10 ml of water. After a few days, the object were removed, dried and their masses were measured. The table shows their results.

Student	Object	Mass of Object before Rusting in g	Mass of the coated object in g
A	Nail	3.0	3.15
B	Thin plate	6.0	6.33

(a) What might be the reason for the varied observations of the two students?

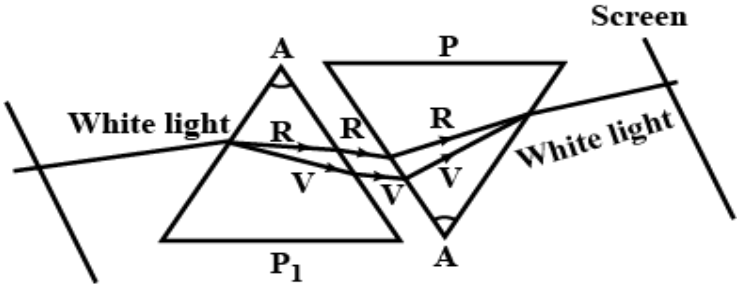
(b) In another set up the students coated iron nails with zinc metal and noted that, iron nails coated with zinc prevents rusting. They also observed that zinc initially acts as a physical barrier, but an extra advantage of using zinc is that it continues to prevent rusting even if the layer of zinc is damaged. Name this process of rust prevention and give any two other methods to prevent rusting.

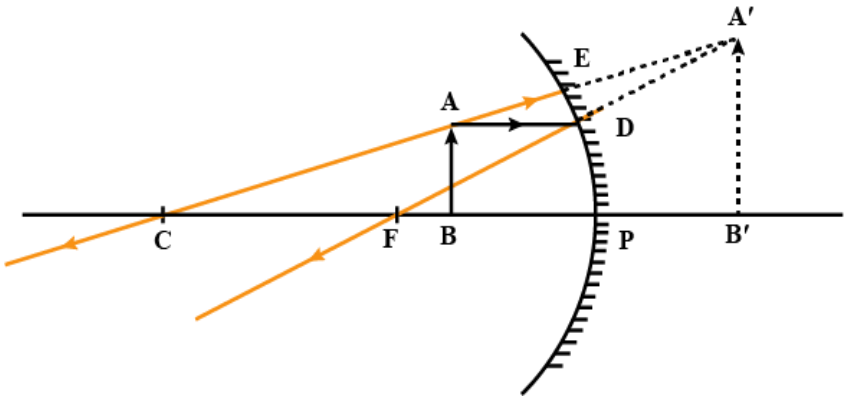
	OR (b) In which of the following applications of Iron, rusting will occur most? Support your answer with valid reason. A B C D  A - Iron Bucket electroplated with Zinc B - Electricity cables having iron wires covered with aluminium C - Iron hinges on a gate D - Painted iron fence	
38	Pooja has green eyes while her parents and brother have black eyes. Pooja's husband Ravi has black eyes while his mother has green eyes and father has black eyes. (a) On the basis of the above given information, is the green eye colour a dominant or recessive trait? Justify your answer. (b) What is the possible genetic makeup of Pooja's brother's eye colour? (c) What is the probability that the offspring of Pooja and Ravi will have green eyes? Also, show the inheritance of eye colour in the offspring with the help of a suitable cross. **OR** (d) 50% of the offspring of Pooja's brother are green eyed. With help of cross show how this is possible.	4
39	  The above images are that of a specialized slide projector. Slides are small transparencies mounted in sturdy frames ideally suited to magnification and projection, since they have a very high resolution and a high image quality. There is a tray where the slides are to be put into a particular orientation so that the viewers can see the enlarged erect images of the transparent slides. This means that the slides will have to be inserted upside down in the projector tray. To show her students the images of insects that she investigated in the lab, Mrs. Iyer brought a slide projector. Her slide projector produced a 500 times enlarged and inverted image of a slide on a screen 10 m away.	4

	(a) Based on the text and data given in the above paragraph, what kind of lens must the slide projector have? (b) If v is the symbol used for image distance and u for object distance then with one reason state what will be the sign for $\frac{v}{u}$ in the given case? (c) A slide projector has a convex lens with a focal length of 20 cm. The slide is placed upside down 21 cm from the lens. How far away should the screen be placed from the slide projector's lens so that the slide is in focus? **OR** (c)When a slide is placed 15 cm behind the lens in the projector, an image is formed 3 m in front of the lens. If the focal length of the lens is 14 cm, draw a ray diagram to show image formation. (not to scale)	

SCIENCE (086)
CLASS X
MARKING SCHEME (2022-23)

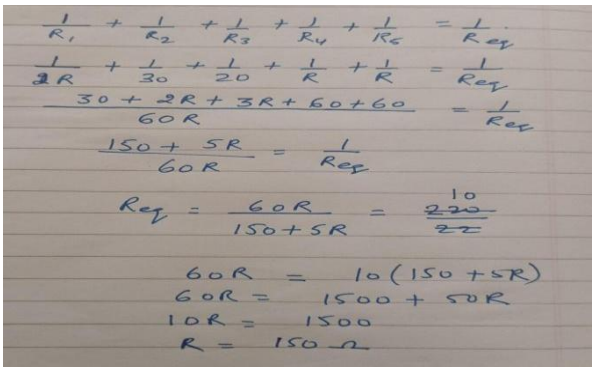
Q. No	**Questions**	Marks
	SECTION – A	
1.	(c) Only iii	1
2.	(b) MnO_2 is reduced to $MnCl_2$ & HCl is oxidized to Cl_2	1
3.	(c) Magnesium ribbon burns with brilliant white light	1
4.	(b) CO_2, Cl_2, CO_2, CO	1
5.	(d) Ferrous sulphate solution remains green with no change in the copper coin.	1
6.	(a) Only i	1
7.	(c) Addition of hydrogen in presence of catalyst changes A to C	1
8.	(b) II,III	1
9.	(b)	1
10.	(d)	1
11.	(d) C only	1
12.	(b) B and D	1
13.	(c) increases	1
14.	(b) 2 (Either North or South)	1
15.	(b) diameter d of the wire	1
16.	(d) The field consists of concentric circles centred around the wire.	1
17.	(c) A is true but R is false	1
18.	(a) Both A and R are true and R is the correct explanation of A	1
19.	(c) A is true but R is false	1
20.	(a) Both A and R are true and R is the correct explanation of A	1
	SECTION – B	
21.	Calcium hydroxide reacts with Carbon dioxide present in the atmosphere to form Calcium carbonate which results in milkiness/white ppt / Formation of Calcium carbonate (1mark) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ (1mark) **OR** $Fe + HCl \rightarrow FeCl_2 / FeCl_3 + H_2$ (1mark) (No deduction for balancing/ states) $Zn + HCl \rightarrow ZnCl_2 + H_2$ - 1M	2

22.	<table><tr><th>Beating of heart</th><th>Reflex actions</th></tr><tr><td>Involuntary actions are the actions which are not controlled by our will.</td><td>Reflex actions are the sudden action in response to something.</td></tr><tr><td>They do not need any kind of stimulus to work.</td><td>They required stimulus for its action.</td></tr><tr><td>These actions are regulated by the brain.</td><td>These actions are regulated by the spinal cord.</td></tr><tr><td>They do not involve skeletal muscle.</td><td>They do involve skeletal muscle.</td></tr><tr><td>These actions are performed throughout one's life.</td><td>These actions are produced in response to an event of an emergency.</td></tr><tr><td>This action may be quick or slow.</td><td>Reflex actions are always quick.</td></tr></table> **Any four points** (½ x4=2 marks)	2
23.	Gallbladder stores bile which helps in emulsification of lipids (1mark). In the absence of stored bile, emulsification of fats will be negligible/ affected/ less (1mark) and thus fat digestion will be slow. Hence there are such diet restrictions.	2
24.	Glucose, amino acids, salts (any 2, 1 mark each) and a major amount of water are selectively re-absorbed as the urine flows along the tube. The amount of water reabsorbed depends on how much excess water there is in the body (0.5 marks), and on how much of dissolved waste there is to be excreted (0.5marks)	2
25.	Dispersion- The splitting of white light into seven colours on passing through a prism. (1 mark) Velocity is directly proportional to wavelength given constant frequency. So yellow will have greater wavelength than blue as the velocity of yellow light is greater than blue. (0.5 + 0.5 mark) **OR** Angle of deflections of the two prisms need to be equal and opposite. While the first prism splits the light in the seven colours due to different angles of deflection, the second prism combines the spectrum along a single ray and the colours again combine to give white light as the emergent light. (1mark)  (1mark)	2
26.	Excess generation of biodegradable wastes can be harmful as - Its decomposition is a slow process leading to production of foul smell and gases. (1mark) It can be the breeding ground for germs that create unhygienic conditions.(1 mark)	2

SECTION - C Q.no. 27 to 33 are short answer questions.		
27.	i) Displacement - ½ M • $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$ (1 mark) • $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ • $Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$ *(Any one of the reaction or other displacement reaction.)* ii) Double displacement (½ mark) $Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$ (1 mark) *(Any one of the reaction or other double displacement reaction.)*	3
28.	(a) Anode: Chlorine; Cathode: Hydrogen (b) Chlor alkali process as the products obtained are alkali, chlorine gas and hydrogen gas (c) $2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{Electric current}} 2NaOH(aq) + Cl_2(g) + H_2(g)$	3
29.	No photosynthesis will occur so no glucose will be made. Also no respiration will take place as no Oxygen will be taken in. (1) No transpiration will occur so there would be no upward movement of water or minerals from the soil as there will be no transpirational pull.(1) Temperature regulation of leaf surface will be affected. (1) **OR** Lymph carries digested and absorbed fat from the intestine (1) and drains excess fluid from extracellular space back into the blood (1). Blockage of lymphatic system will lead to water retention and poor fat absorption in the body (1- any one)	3
30.	(a) The object has to be placed at a distance between 0 - 40 cm. This is because image is virtual, erect and magnified when the object is placed between F and P. (1mark) (b)  (1mark) (c) Used as shaving mirror or used by dentists to get enlarged image of teeth (any one use) (1mark)	3

31.	(a) Given, image distance = v = -25 cm, focal length = f = 5 cm, magnification = m = ? From lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$ $\frac{1}{u} = \frac{1}{-25} - \frac{1}{5} = \frac{-1-5}{25} = \frac{-6}{25}$ Object distance $= u = \frac{-25}{6} cm.$ We know that, $m = \frac{v}{u} = \frac{-25 \times 6}{-25} = 6.$ (2 marks) (b) This is because the least distance of distinct vision is 25 cm. (1 mark)	3
32.	(a) When iron filings are placed in a magnetic field around a bar magnet, they behave like tiny magnets. The magnetic force experienced by these tiny magnets make them rotate and align themselves along the direction of field lines. (1 mark) (b)The physical property indicated by this arrangement is the magnetic field produced by the bar magnet. (1 mark) (c) Magnetic field lines never intersect, magnetic field lines are closed curves. (1mark) **OR** (a) The deflection in the compass needle increases as Magnetic field of the current carrying conductor is directly proportional to current flowing through it. (1.5marks) (b) The deflection in the needle decreases as the magnetic field is inversely proportional to the perpendicular distance from the wire. (1.5marks)	3
33.	Damage to the ozone layer is a cause for concern because the ozone layer shields the surface of earth from harmful UV radiations from the sun which cause skin cancer in human beings. Synthetic chemicals like chlorofluorocarbons (CFCs) which are used as refrigerants and in the fire - extinguishers are the main reason for the depletion of the ozone layer. Steps taken to limit this damage - Many developing and developed countries have signed and are obeying the directions of UNEP (United Nations Environment Programme) to freeze or limit the production and usage of CFCs at 1986 levels. (1 x 3 = 3 marks)	3
	SECTION - D	
34.	(a) A – Ethanoic acid/ Or any other carboxylic acid , C- Sodium salt of ethanoic acid/ any other carboxylic acid/ sodium ethanoate (½ + ½ mark) (b) Use of A- dil solution used as vinegar in cooking/ preservative in pickles (1mark) Use of B – making perfumes, flavoring agent (1 mark) (c) $CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc } H_2SO_4} CH_3COOC_2H_5 + H_2O$ (1mark) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$ (1mark) **OR**	5

	(a) Sulphuric acid acts as dehydrating agent (1mark) Conc H_2SO_4, 443K C_2H_5OH —----------> $C_2H_4 + H_2O$ (1mark) (b) By reaction with sodium carbonate/ bi carbonate 1M with the samples, ethanol will not react whereas ethanoic acid gives brisk effervescence (1mark) $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$ **OR** $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$ (1 mark)	
35.	(a) The reason is that many multi-cellular organisms are not simply a random collection of cells. Specialised cells are organised as tissues, and tissues are organised into organs, which then have to be placed at definite positions in the body. Therefore, cell-by-cell division would be impractical. (2 marks) (b) Sexual maturation of reproductive tissues is a necessary link for reproduction because of the need for specialised cell called germ-cells to participate in sexual reproduction. The body of the individual organism has to grow to its adult size, the rate of general body growth begins to slow down, reproductive tissues begin to mature. (1½ marks) A whole new set of changes in the appearance of the body takes place like change in body proportions, new features appear. This period during adolescence is called puberty. There are also changes taking place that are different between boys and girls. In girls, breast size begins to increase, with darkening of the skin of the nipples at the tips of the breasts. Also, girls begin to menstruate at around this time. Boys begin to have new thick hair growth on the face and their voices begin to crack. (1½ marks) **OR** (a) If the niche were drastically altered, the population could be wiped out. However, if some variations were to be present in a few individuals in these populations, there would be some chance for them to survive. Variation is thus useful for the survival of species over time. (2 marks) (b) ● The lining of the uterus thickens and is richly supplied with blood to nourish the growing embryo. (½ mark) ● The embryo gets nutrition from the mother's blood with the help of placenta. It is embedded in the uterine wall. (½ mark) ● It contains villi on the embryo's side of the tissue. On the mother's side are blood spaces, which surround the villi. (½ mark) ● This provides a large surface area for glucose and oxygen to pass from the mother to the embryo. The developing embryo will also generate waste substances which can be removed by transferring them into the mother's blood through the placenta. (1 mark) ● The child is born as a result of rhythmic contractions of the muscles in the uterus. (½ mark)	5

36.	(a) All spaces are connected in parallel. (1mark) (b) Let Resistance of Space 5 and 4 be R ohms respectively (2marks) Resistance of Space 1 = 2 R ohms Resistance of Space 2 = 30 ohms Resistance of Space 3 = 20 ohms Current = 22 A V= 220 V Total Resistance= V/I  $\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}+\frac{1}{R_5}=\frac{1}{R_{eq}}$ $\frac{1}{2R}+\frac{1}{30}+\frac{1}{20}+\frac{1}{R}+\frac{1}{R}=\frac{1}{R_{eq}}$ $\frac{30+2R+3R+60+60}{60R}=\frac{1}{R_{eq}}$ $\frac{150+5R}{60R}=\frac{1}{R_{eq}}$ $R_{eq}=\frac{60R}{150+5R}=\frac{10}{\frac{220}{22}}$ $60R=10(150+5R)$ $60R=1500+50R$ $10R=1500$ $R=150\ \Omega$	5
	SECTION - E	
37.	a) Rusting occurs in both A and B so there is an increase in mass. (1 mark) As the surface area of B is more, extent of rusting is more (1 mark) b) Galvanization -(1 mark) Oiling/ greasing/ painting/ alloying/ chromium plating or any other (any two ½ mark each) – (1 mark) **OR** b) C - Iron hinges on a gate - Iron is in contact with both atmospheric oxygen and moisture/ water vapour. (2 marks)	4
38.	a. Yes, green eye colour is recessive (½ mark) as it will express only in homozygous condition (½ mark) b. BB, Bb (1 mark) c. bb*Bb (0.5mark) Genetic cross - (1 mark) 50% of the offsprings can have green eye colour (0.5)	4

	B	b
b	Bb	bb
b	Bb	bb

OR

c. Brother is heterozygous(Bb) and wife is green(bb) - (1)
Wife bb*Bb brother

	B	b
b	Bb	bb
b	Bb	bb

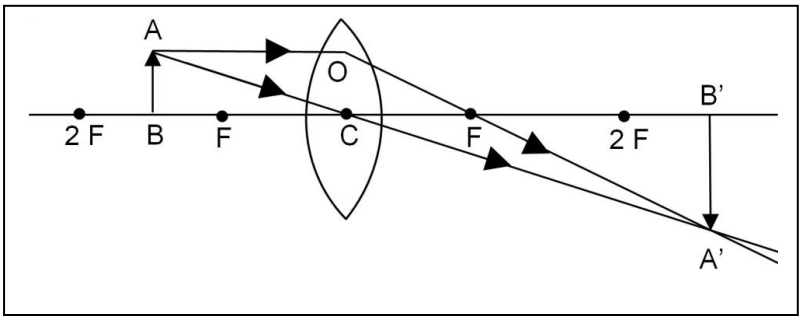
50% of the offsprings can have green eye colour as per the cross shown.(1 mark)

39. 4

(a) Convex Lens (1mark)
(b) Negative as the image is real and inverted. (1mark)
(c) 1/f= 1/v- 1/u
1/20 = 1/v- 1/-20
1/v = 1/20 - 1/21
= (21 - 20)/420
= 1/420
v= 420 cm (2 marks)

OR

(c)



(2 marks)