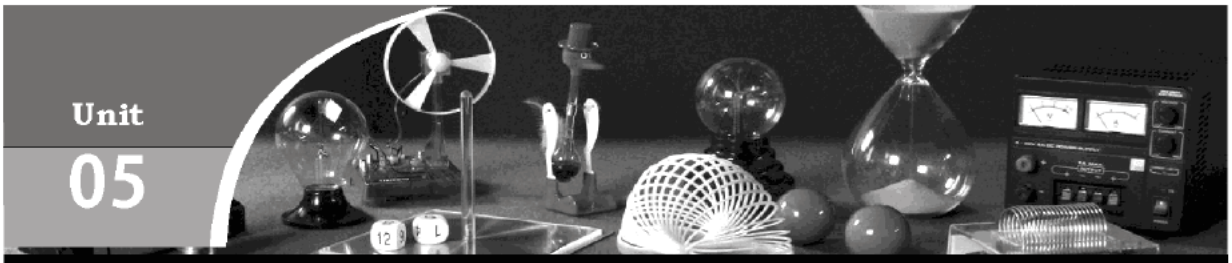


Unit
05

REFRACTION OF LIGHT

Points to Remember

- The characteristics of each medium influence the speed of light that passes through the respective medium.
- Optical density is a measure that show how a medium influence the speed of light passing through it.
- As the optical density of the medium increases, the speed of light through it decreases.
- When a ray of light entering obliquely from one transparent medium to another, its path undergo deviation at the surface of separation. This is refraction.
- The angle of incidence, the angle of refraction and the normal to the point of incidence on the surface of separation of the two media will always be the same plane.
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction $\left(\frac{\sin i}{\sin r}\right)$ will always be a constant. This in known as Snell's law.
- The constant from Snell's law is known as refractive index. This is indicated by the letter 'n'.
- Refractive index (n) = $\frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in medium (v)}}$
- The refractive index of one medium with respect to another is called relative refractive index.
- The refractive index of a medium with respect to vacuum is called absolute refractive index.
- When a ray of light passes from a medium of greater optical density to that of lower optical density, the angle of incidence at which the angle of refraction becomes 90^{o} is the critical angle.
- When a ray of light passes from a medium of higher optical density to a medium of lower optical density at an angle of incidence greater than the critical angle, the ray is reflected back to the same medium

without undergoing refraction. This phenomenon is known as total internal reflection.

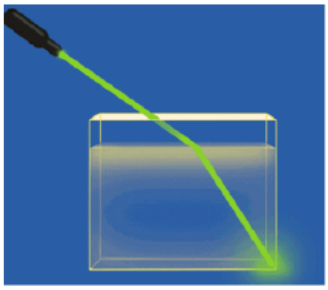
- The phenomenon of total internal reflection is applicable in medical field (Endoscope) and also in the field of telecommunication (Optical Fibre Cables)
- A lens is a transparent medium having spherical surface.
- Optic centre (P) is the midpoint of a lens.
- Centre of curvature (C) is the centre of the imaginary spheres of which the sides of the lens are parts.
- Principal axis is the imaginary line that passes through the optic centre joining the two centres of curvature.
- Light rays incident parallel and close to the principal axis after refraction converges to a point on the principal axis of a convex lens. This point is the principal focus of a convex lens.
- The principal focus of a convex lens is real.
- In concave lens light rays incident parallel and close to the principal axis diverge from one another after refraction. These rays appear to originate from a point on the same side. This point is the principal focus of a concave lens.
- The principal focus of a concave lens is virtual.
- Focal length (f) is the distance from the optic centre to the principal focus.
- Lens equation $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\qquad f = \frac{uv}{u-v}, \quad v = \frac{uf}{u+f}, \quad u = \frac{fv}{f-v}$

Convex lens	Concave lens
u $\rightarrow$ negative	u $\rightarrow$ negative
v $\rightarrow$ positive (real image) nagative (virtual image)	v $\rightarrow$ negative
f $\rightarrow$ positive	f $\rightarrow$ negative

- Power of a lens is the reciprocal of focal length expressed in metre

  p = $1/f$
- Unit of power is dioptre (D).
- Power of convex lens is positive and concave lens is negative.
- Magnification is the ratio of the height of the image to the height of the object. It shows how many times the image is larger than the object.
- Magnification m = hi/ho or m = v/u

1. Light from a laser torch passes through water in a beaker, is shown in the figure.



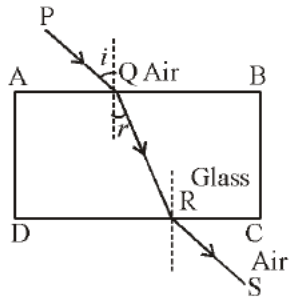
   a. What happens to the path of light?
   b. Which are the media involved here?
   c. Name the phenomenon responsible for the deviation of the path of light.
   d. Define this phenomenon.

2. Analyse the table and answer the following questions.

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

   a. Find the speed of light in water from the table?
   b. Which are the medium having highest and lowest velocity of light?
   c. What is meant by optical density?
   d. Arrange the media in the descending order of their optical density.
   e. What is the relation between optical density and velocity of light?

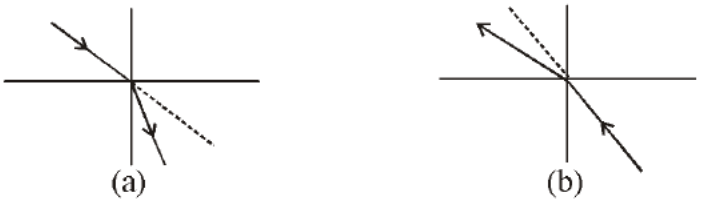
3. Observe the given figure.



   a. Find the incident ray on the surface of separation CD
   b. Which are the refracted rays?
   c. What are 'i' and 'r' here?

d. The angle between the incident ray and the normal is called the angle of incidence, if so what is meant by angle of refraction?

4. Observe the given figure.



a. Which figure indicates the path of light from air to water?

b. Which figure indicates the path of light from glass to water?

c. Which figure represents the refracted ray move away from the normal?

d. Which figure represent the refracted ray deviates towards the normal?

5. a. Consider a ray of light passing from air to glass. Sine value of the angle of incidence is 0.5, sine value of the angle of refracion is 0.33. Calculate refractive index of the medium.

b. Name the Law related to this?

c. State the Law.

d. What are the Laws of refraction?

6. Fill in the blanks.

a) Mirror : pole

Lens : .....

b) Convex lens : Real focus

Concave lens :.....

7. When light travels from glass to water obliquely at the plane of separation of medium. What happened to the refracted ray. Choose from the given.

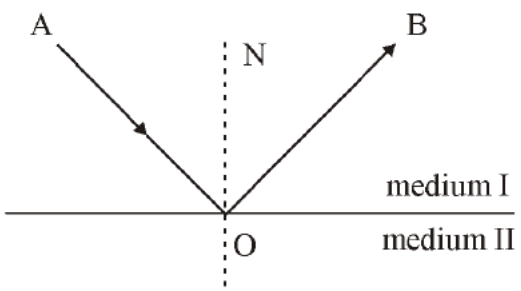
(a) proceeds undeviated.

(b) deviates towards the normal.

(c) deviates away from the normal.

(d) is reflected back.

8. The diagram shows total internal reflection.Classify the following statements into true or false.



a) angle AON is the angle of incidence

b) angle AON = angle NOB

c) angle AON must be the critical angle

d) the speed of light in medium II is greater than that in medium I

e) if the angle AON were increased,there would still be total internal reflection

9. Match the columns A, B and C together.

A	B	C
Refraction	Refracted ray grazes through the surface of the medium	Dioptre
Total internal reflection	Velocity of light	Optical density
Power	Virtual image	Endoscope
Critical angle	1/f	Image is not formed on the screen
Concave lens	Optical Fibre	Angle of incidence in the denser medium corresponding to the angle of refraction 90^0

10. The refractive index of glass and water is given.

Medium	Refractive index
Glass	3/2
Water	4/3

a) What do you mean by relative refractive index and absolute refractive index?

b) Choose the medium of highest optical density from the table.

c) Find the refractive index of glass with respect to water?

d) If the speed of light in glass is $2x10^8$ m/s,calculate the speed of light in vacuum?

11. Analyse the following table and write answer to the questions.

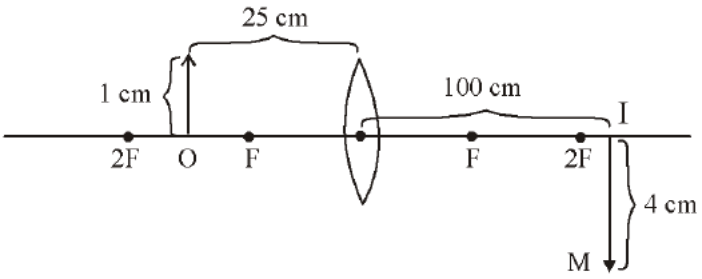
Medium	Speed of light(m/s)
Vacuum/Air	3×10^8
Water	2.25×10^8
Glass	2×10^8 (approximately)

a) Find out the medium which has highest optical density from the table?

b) Calculate the refractive index of glass with water?

c) What is absolute refractive index of a medium?

12. Write the measures given in the figures by New Cartesian Sign Convention.



a) Object distance(u)

b) Image distance(v)

c) Height of the object(OB)

d) Height of the image (IM)

e) Find magnification of image.

13. When an object of height 2 cm is placed at a distance 20 cm away from a lens, a real image is formed 40 cm away from the lens.

a) Find the height of the image?

b) Which type of lens is this?

c) What are the other characteristics of the image?

14. When an object of height 6 cm is placed in front of a lens of focal length 15 cm, a virtual image of height 2 cm is formed.

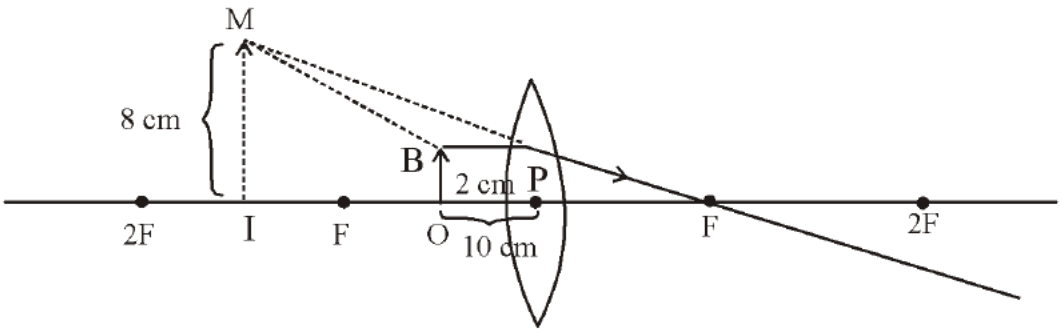
a) Find the magnification of the image?

b) Which type of lens is this?

c) Write any one use of such lens.

d) Find the other characteristics of the image?

15.



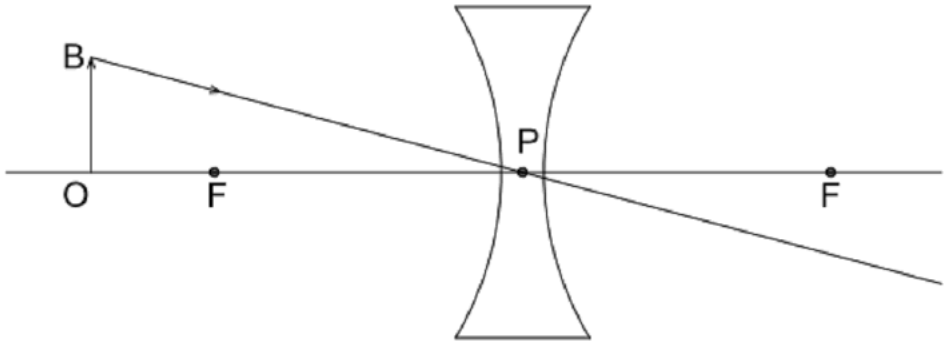
a) Observe the figure and find the magnification of the image.

b) Whether magnification is positive or negative?

c) Find the position of the image.

d) What are the other properties of the image?

16. a. Complete the ray diagram related to the image formation.



b. Which lens is shown in the figure ?

c. Where is the position of the image in this figure ?

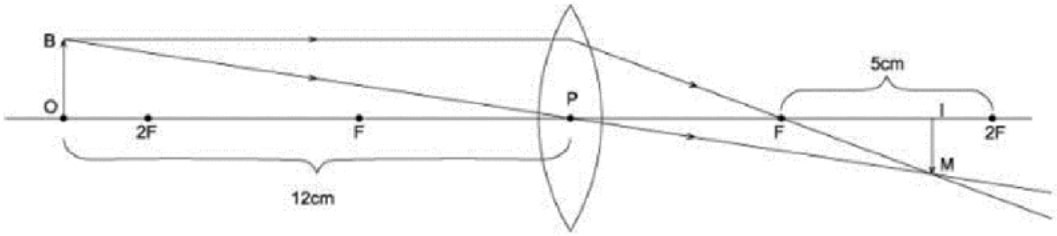
d. Write the characteristics of the image in this figure ?

e. Which lens form real image ?

f. Where should the position of the object be placed in front of a convex lens so as to obtain an image of the same size as that of the object ?

g. To get a virtual image in front of a convex lens, where should the object be placed ?

17. Analyse the following figure and answer the questions given below.



a. What is the focal length of the lens ?

b. Write the value of ' u' in the figure, including sign ?

c. Is the value of ' v' positive or negative. Why ?

d. Calculate the distance to the image ?

18. When an object is placed at a distance of 30 cm from a convex lens, a real image is formed at a distance of 60 cm.

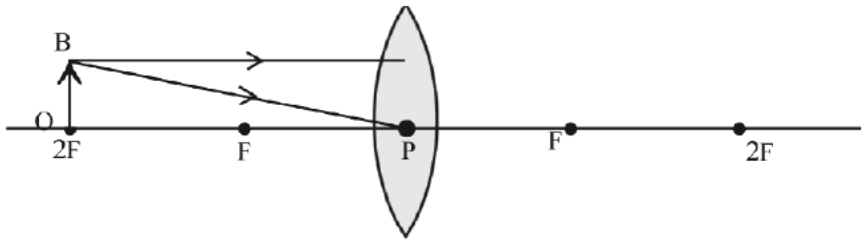
a. What is the focal length of the lens?

b. Find out the magnification of the image formed?

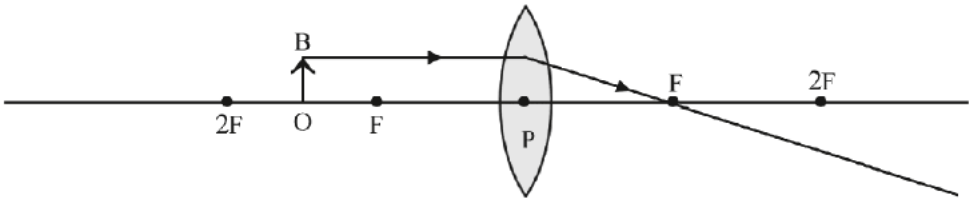
c. Calculate the power of the lens.

19. Complete the ray diagrams given below.

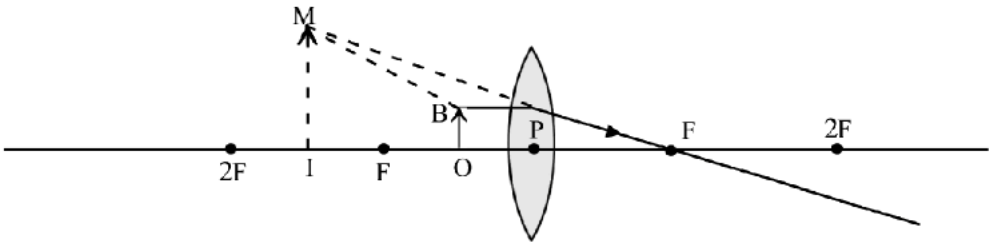
a.

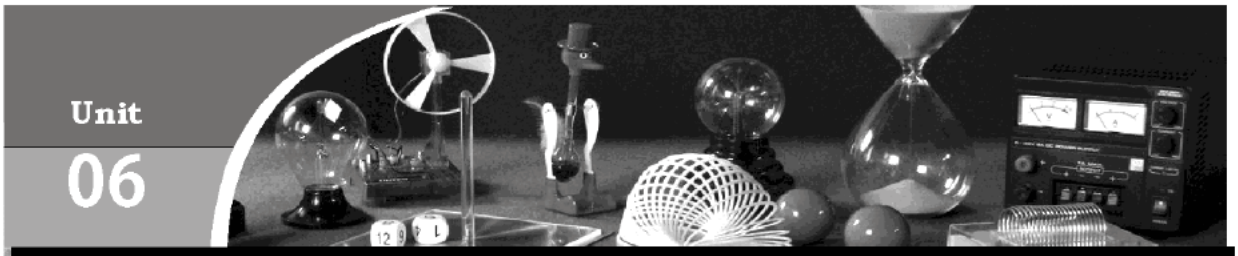


b.



c.





Unit
06

VISION AND THE WORLD OF COLOURS

Points to Remember

- **Near Point :** The nearest point at which the objects can be seen distinctly.
- **Far point :** The farthest point at which the object can be seen distinctly.
- **Power of accommodation :** The ability of the eye to form an image on the retina by adjusting the focal length of the lens in the eye, by varying the curvature of the lens, irrespective of the position of the object, is the power of accommodation.
- **Long-sightedness (Hypermetropia) :** Nearer objects cannot be seen clearly eventhough distant objects are clearly seen.
- **Near-sightedness :** Nearer object can be seen clearly but distant objects cannot seen clearly.
- **Presbyopia :** The condition of reducing power of accommodation due to the diminishing ability of the ciliary muscles.
- **Dispersion of light :** Splitting up of composite light into its constituent colours.
- **Rainbow :** Dispersion of light caused by the water droplets in the atmosphere.
- **Persistence of vision :** Image remains in the retina of the eye for a time interval of $\frac{1}{16}$ s after seeing it.
- **Scattering of light :** Change in direction brought out by the irregular and partial reflection of light.
- **Rate of scattering :** As wavelength increases rate of scattering decreases.
- **Tyndal effect :** When rays of light pass through a colloidal fluid or suspension, the tiny particles get illuminated due to scattering.
- **Light pollution :** The use of light in excess in a non-judicious manner.

Visible spectrum in the ascending order of wavelength - VIBGYOR

Characteristics	High	Low
Wavelength	Red	Violet
Rate of scattering	Violet	Red

Defect of eye	Reason for the Defect	Remedy
Long sightedness	• Smaller size of the eye ball • Low power of eye lens	Convex lens of suitable power
Near sightedness	• Larger size of the eye ball • High power of eye lens	Concave lens of suitable power
Presbyopia	• Diminishing ability of ciliary muscles	Convex lens of suitable power.

ACTIVITIES

1. Check whether the following statements are true or false. If false correct it.

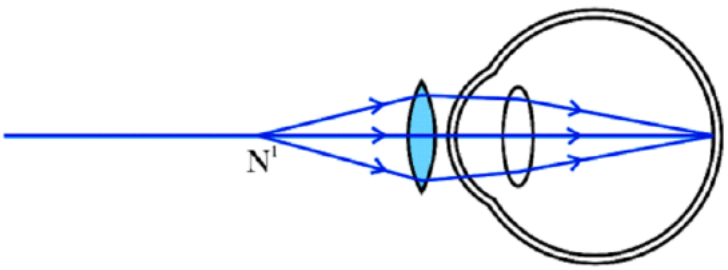
   (a) The near point of an eye with healthy vision is 35 cm.

   (b) Far point is the farthest point at which the objects can be seen distinctly.

   (c) When we look at nearer objects, the ciliary muscles are relaxed, the curvature of the lens decreases and the focal length of the lens increases.

   (d) When we look at far objects, the ciliary muscles are relaxed, the curvature of the lens decreases and the focal length of the lens increases.

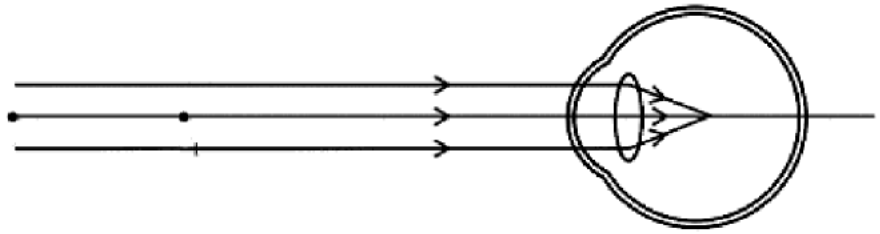
2. Observe the diagram.



   (a) Which defect of eye is rectified by using a convex lens of suitable power?

   (b) What may be the reasons behind this defect?

3. The following figure shows the image formed by a defective eye.



(a) Which defect of eye is represented by the above figure?

(b) What is the reason for this defect?

(c) Which type of lens is used to rectify the above defect of eye?

(d) Draw how does that lens correct near sightedness?

4. The doctor has written '+2 D' in his prescription,

(a) What does the letter 'D' stands for?

(b) Which type of lens is referred as +2 D?

(c) Which type of lens is used, if '-2 D' is mentioned?

(d) What peculiarity of the lens has been mentioned here? Define the term?

5. What is the distance to the near point of the human eye with normal vision?

6. For elderly people the distance to the near point is greater than 25 cm.

(a). Name the condition.

(b). Write down the reason for this condition?

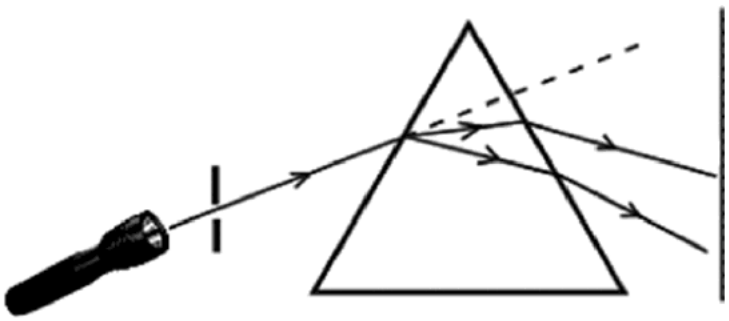
7. How can presbyopia be corrected?

8. Eye donation is one of the noblest donation. Through eye donation those who have closed their eyes forever can light up others lives.

(a) How many hours after death can eyes be donated?

(b) Which part of eye of the donor can be donated?

9. A beam of light is made to incident on a prism as shown in figure.



(a) What are the colours formed on the screen?

(b) Are they same as that from sunlight?

(c) What is this phenomenon known as?

(d) Which colour deviates more?

(e) Which colour deviates less?

(f) What is the relation between the deviation of colours through the prism and wavelength of colours?

10. The regular array of the component colours of white light is given. Write the colours a, b and c?

Violet, Indigo, (a)___, Green, (b)__, Orange, (c)____

11. When white light is passed through a prism visible spectrum is obtained.

(a) Which phenomenon of light causes this?

(b) Which colour has the highest wavelength?

(c). The following are some of the colours in the spectrum. Which of the following is correct.

(i) Blue – violet – red - green

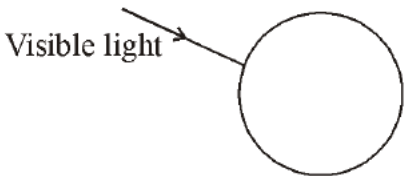
(ii) Violet – blue – yellow - red

(iii) Violet - Indigo - Green - Yellow

(iv) Green – yellow – orange - violet

(d). Explain the deviation of colours at the time of spectral formation based on their wavelength?

12. Dispersion occur when sunlight passes through the droplets of water.



(a) Complete the diagram.

(b) What happens to the sun light, when it passes through water droplets?

(c) Which colour is seen at the outer edge of rainbow?

(d) Watching from an aeroplane the rainbow will seen in which shape?

(e) When the rainbow is seen in the east, the Sun will be at which position?

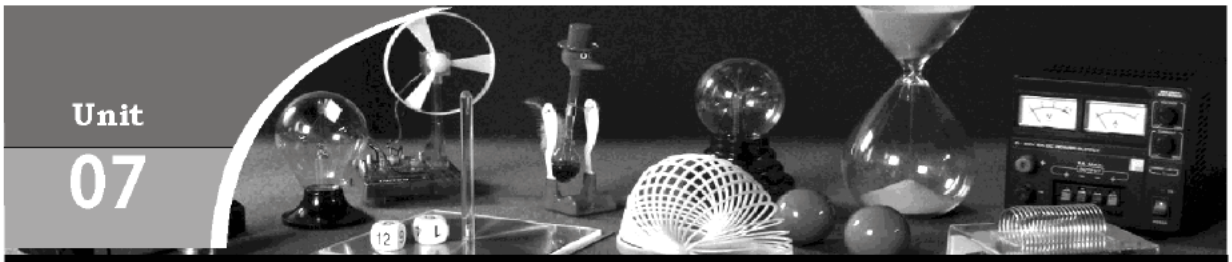
(f) Which colour is seen in the inner edge of rainbow?

13. The teacher asked to plan an experiment to prove the recombination of colours.

(a) Summarise the experimental steps.

(b) What will be your observations?

14. A glowing agarbathi when rotated fast we feel that there is a continuous glowing circle.
    (a) Name the phenomenon behind this?
    (b) Explain it?
15. The teacher asked to plan an experiment to prove the scattering of light.
    (a) List the materials needed to perform the test?
    (b) Summarise the test procedure.
16. Write the component colours in white light in ascending order of scattering rate?
17. Even though light travels in straight line, we get light in our rooms during day time. What is the reason?
18. Scattering of light causes the blue colour of sky.
    (a) Which are the occasions where sunlight has to travel greater distance through the atmosphere before reaching our eyes?
    (b) Explain why the colour of rising and the setting sun is red?
19. Put two or three drops of dettol in a beaker containing water. A beam of light is allowed to pass through the solution.
    (a) The path of the light become visible, what is the reason behind it?
    (b) How scattering is related to the size of the particle?
20. Write four methods to prevent light pollution?



Unit
07

ENERGY MANAGEMENT

Points to Remember

- When energy is transformed from one form to another, some part of it gets lost in other forms. Such a loss is the main cause of energy crisis.
- Fuels are substances that release plenty of heat energy on burning.
- Complete combustion causes less atmospheric pollution. Incomplete combustion causes atmospheric pollution.
- Nonrenewable energy sources.
  - Fossil fuels – Coal, Natural gas, Petroleum.
  - Nuclear fuel – Uranium
- Renewable energy sources – Wind, Solar Energy, Ocean energy, Geo thermal energy.
- Calorific value is the amount of energy released by the complete combustion of 1 kg of fuel.
- Green energy is produced from natural sources that does not cause environmental pollution.
- Brown energy is produced from nonrenewable energy sources which cause environmental pollution.
- Energy crisis is the consequence of increasing demand but decreasing availability.

ACTIVITIES

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

   Firewood, Petrol, Naphtha, Ammonia, Kerosene, Coke, LNG, Nuclear fuel, Biogas

   b. What are the major problems arises due to partial combustion of fuels?

2. Match the following.

LPG	Methane
CNG	Coke
Coal	Ethyl Mercaptan

3. Have you ever noticed the numbers and letters such as C 26 marked on a cooking gas cylinder.
   a. What does it mean?
   b. If it is marked as B 22, what will it indicates?
4. Bio waste generally named as biomass.
   a. Find the odd one in the list below and write the reason for it?
      (Fire wood, Petrol, Dried cow dung)
   b. What are the advantages of biogas over biomass?
   c. What are the major components of biogas?
5. Fuel efficiency is described in calorific value.
   a. What is meant by calorific value of the fuel?
   b. Which is the unit of calorific value?
   c. Which is the most efficient fuel based on its calorific value?
6. Which of the following is not a fossil fuel?
   (Coal, LPG, Hydrogen, Petroleum)
7. Hydrogen has very high calorific value.
   a. Where hydrogen is utilised to generate electricity?
   b. Hydrogen is a fuel with high calorific value, but it is not used as a domestic fuel. Why?
   c. Which are the instances where hydrogen is used as a fuel?
8. Write any 4 properties of a good fuel.
9. Which of the following is the correct operation of a thermal power station?
   A heat energy → mechanical energy → chemical energy → electrical energy.
   B chemical energy → heat energy → mechanical energy → electrical energy.
   C mechanical energy →heat energy → chemical energy → electrical energy.
   D heat energy → chemical energy → mechanical energy → electrical energy.
10. The source of all energy forms in earth is Sun.
    a. What are the energy forms obtained from the Sun?
    b. Write the names of instruments which make use of solar energy?
    c. What is the energy conversion in a solar panel?
    d. Write the situations when the energy conversion does not take place in a solar panel?
    e. Write the situations where only solar panels can be used?
    f. Name the phenomenon that is used in solar cells to convert solar energy into electrical energy.

11. The two specialities of solar cooker is given below. Write the functions of each?
    a) A box with blackened interior.
    b) A mirror outside the box.
12. Solar thermal power plant generates electricity using solar energy. Describe its working.
13. Write the merits and demerits of wind energy?
14. Tidal energy is not exploited in Kerala. Give reason?
15. What is meant by Ocean Thermal Energy Conversion Plants (OTEC Plants) ?
16. What is meant by hotspot ?
17. Why is it said that geothermal power plants are not possible in Kerala ?
18. Energy obtained from nucleus is called nuclear energy.
    a. What are the different methods by which the energy is produced from the nucleus?
    b. What are the process that takes place in nuclear power stations?
    c. Name the pollutions caused by the presence of radioactive substances and radiations in water, air and environment.
19. Write the precautions to face nuclear hazards.
20. Classify the following into "green energy" and "brown energy".

    Tidal energy

    Thermal power plant

    Windmill

    Hydroelectric power plant

    Nuclear power station

    Solar panel

    Diesel engines
21. Energy crisis is the consequence of increasing demand but decreasing availability. Write any four solutions to reduce energy crisis.
22. Write 3 devices that can be used at home to reduce energy consumption.
23. Match the following.

A	B	C
Hydro electric power station	Nuclear energy → electrical energy	Tarapur, Koodamkulam
Thermal power station	Potential energy → electrical energy	Moolamattam, Pallivasal
Nuclear power station	Chemical Energy → electrical energy	Neyveli, Kayamkulam

5 REFRACTION OF LIGHT

1. a. Path of light deviates
   b. Air, water
   c. Refraction
   d. When a ray of light entering obliquely from one transparent medium to another, its path undergoes deviation at the surface of separation. This is Refraction.
2. a. 2.25×10^8 m/s
   b. Highest velocity of light – air/vaccum
   Lowest-diamond
   c. Ability of a medium to influence the velocity of light
   d. Diamond, glass, water, air
   e. When optical density increases velocity of light decreases(inversely proportional)
3. a. QR
   b. QR, RS
   c. i - angle of incidence
   r-angle of refraction
   d. The angle between the refracted ray and the normal
4. a. fig. (a)
   b. fig. (b)
   c. fig. (b)
   d. fig. (a)
5. a. Refractive index = sin i/sin r
   = 0.5/0.33 =1.5
   b. Snell's Law

c. The ratio of sine of the angle of incidence to the sine of the angle of refraction (sin i/sin r)will always be a constant. This is known as Snell's Law

d. (i) The angle of incidence, the angle of refraction and the normal at the point of incidence on the surface of separation of the two media will always be in the same plane.

(ii) The ratio of sine of the angle of incidence to the sine of angle of refraction (sin i/sin r)will always be a constant.

6. a) Optic centre

b) Virtual focus

7. c) Deviates away from the normal

8. a) True

b) True

c) False

d) True

e) True

9.

Refraction	**Velocity of light**	**Optical density**
Total internal reflection	Optical fibre	Endoscope
Power	1/f	Dioptre
Critical angle	Refracted ray grazes through the surface of the medium	Angle of incidence in the denser medium corrosponding to the angle of refraction 90^0
Concave lens	Virtual image	Image is not formed on the screen

10. a) The refractive index of one medium with respect to another is called relative refractive index.

The refractive index of a medium with respect to vacuum is called absolute refractive index.

b) Glass

c) Refractive index of water =4/3

Refractive index of glass =3/2

Refractive index of glass with respect to water

$$= \frac{\text{Refractive index of glass}}{\text{Refractive index of water}}$$

$$= (3/2) \,/\, (4/3)$$

$$= (3 \times 3) \,/\, (2 \times 4)$$

$$= 9/8$$

d) Speed of light in glass , $v = 2 \times 10^8$ m/s

Absolute refractive index of glass, n=3/2

$$\text{Absolut refractive index of glass} = \frac{\text{Speed of light in vacuum}}{\text{speed of light in glass}}$$

$$n = c/v$$

$$c = n \times v$$

$$c = (3/2) \times (2 \times 10^8)$$

$$= 3 \times 10^8 \text{ m/s}$$

11. a) Glass

b) Refractive index of glass with respect to water

$$= \frac{\text{Velocity of light in water}}{\text{Velocity of light in glass}}$$

$$= (2.25 \times 10^8) / (2 \times 10^8)$$

$$= 1.125$$

c) The refractive index of a medium with respect to vacuum is called absolute refractive index

12. a) u = –25 cm

b) v = +100 cm

c) OB = +1 cm

d) IM = – 4 cm

e) m = v/u = 100/–25 = –4

13. a) u = –20 cm

v = +40 cm

h_o = 2 cm

Magnification, m=v/u=40/-20= -2

M = hi/ho

–2 = hi/2

h_i = 2 × – 2 = – 4 cm

b) Here the magnification is negative and the image is real. So it is a convex lens.

c) (i) Larger than the object (magnified)

(ii) Inverted

(iii) real

14. a) h_o = +6 cm

h_i = +2 cm

$m = h_i/h_o = +2/+6 = +1/3$

b) Since the value of magnification is +ve and less than 1, it is a concave lens.

c) This lens is used to rectify myopia or near -sightedness

d) • Image is smaller than the object (diminished)

• Erect

15. a) $h_o = +2$ cm

$h_i = +8$ cm

$m = h_i/h_o = +8/+2 = +4$

b) Magnification is positive

c) $m = +4$

$u = -10$

$m = v/u$

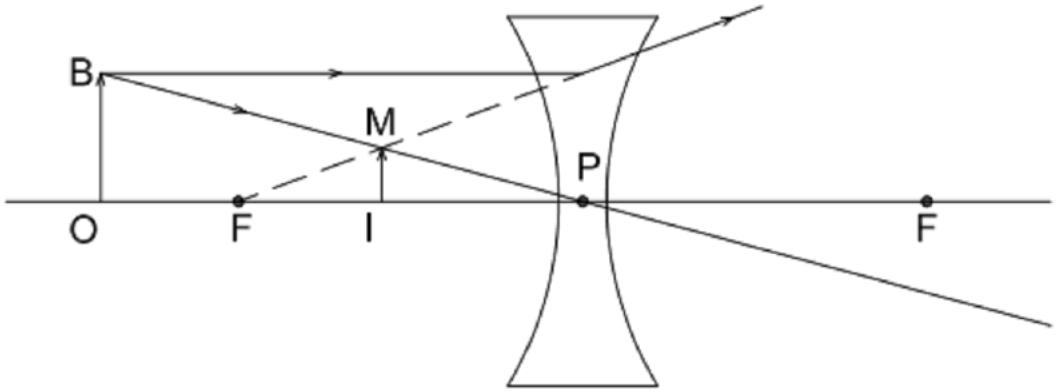
$+4 = v/-10$

$v = +4 \times -10 = -40$ cm

The image is 40 cm away from the lens

d) Larger than the object, erect, virtual

16. a.



b. Concave

c. Between F and P

d. Diminished, erect,virtual

e. Convex

f. At 2F

g. Between F and P

OR

Between F and lens

17. a. +5 cm

b. u = –12 cm

c. Value of 'v' is positive. Because the distance measured along the direction of incident light is taken as positive.

d. u = –12 cm

f = +5 cm

v = ?

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

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

$$\frac{1}{v}=\frac{1}{+5}+\frac{1}{-12}$$

$$\frac{1}{v}=\frac{1}{5}-\frac{1}{12}$$

$$\frac{1}{v}=\frac{12-5}{12\times5}$$

$$\frac{1}{v}=\frac{7}{60}$$

$$v=\frac{60}{7}$$

ie, v = 8.57 cm

18. a. u = –30 cm

v = 60 cm

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

$$f=\frac{uv}{u-v}=\frac{-30\times60}{-30-60}$$

$$=\frac{-30\times60}{-90}$$

= + 20 cm

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

$$= \frac{60}{-30}$$

m = –2

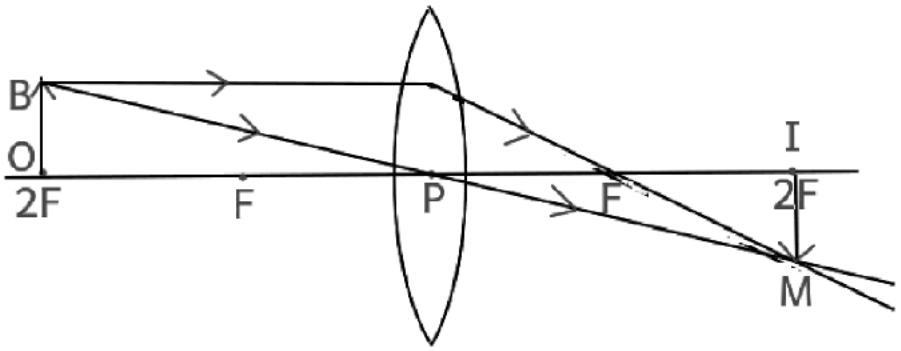
c. $p = \frac{1}{f}$

$$= \frac{1}{+20 \times 10^{-2}}$$

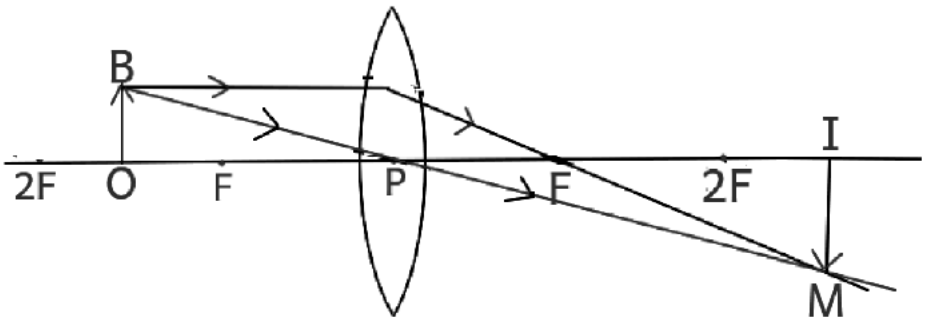
$$= \frac{100}{+20}$$

p = 5 D

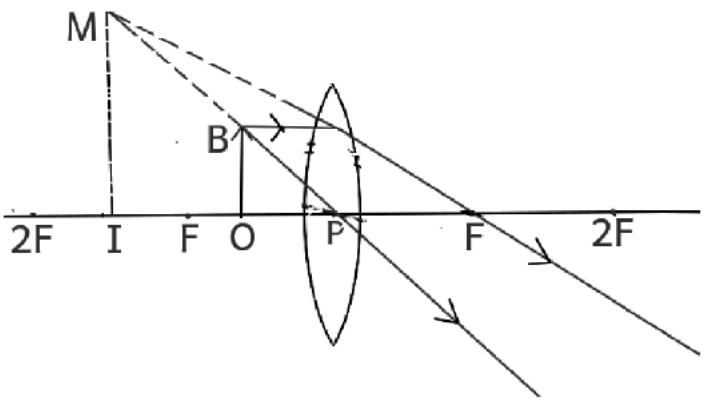
19. a.



b.



c.



6 VISION AND THE WORLD OF COLOURS

1. (a) False.

   The near point of an eye with healthy vision is 25 cm.

   (b) True

   (c) False

   When we look at nearer objects, the ciliary muscles are contracted, the curvature of the lens increases and the focal length of the lens decreases.

   (d) True

2. (a) Long - sightedness or Hypermetropia.

   (b) 1. Smaller size of the eye ball.

   2. Low power of lens / high focal length of eye lens.

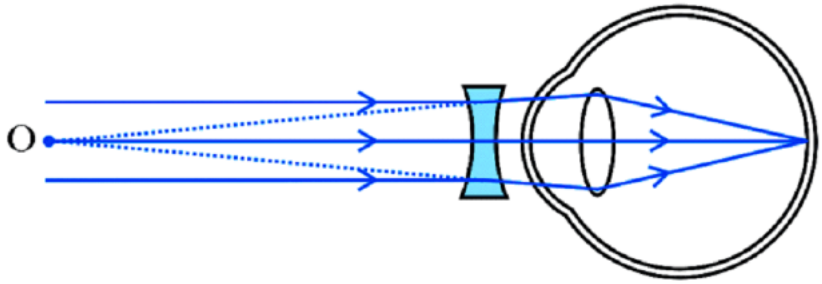
3. (a) Near - sightedness (Myopia)

   (b) 1. The power of the eye lens is more.

   2. The length of the eye ball is more.

   (c) Concave lens.

   (d)



4. (a) Dioptre (D)

   (b) Convex lens

   (c) Concave lens

   (d) Power

   Power is the reciprocal of focal length expressed in metre.

5. 25 cm

6. (a) Presbyopia.

   (b) This is due to the diminishing ability of the ciliary muscles. For such people the power of accommodation will be less.

7. By using a convex lens of suitable power.

8. (a) The cornea of the donor should be harvested within six hours of death.

   (b) Cornea of the donor can be donated.

9. (a) Violet, Indigo, Blue, Green, Yellow, Orange, Red

   (b) Yes

   (c) Dispersion of light

   (d) Violet

   (e) Red

   (f) When wavelength increases deviation of colours decreases.

10. (a) Blue

    (b) Yellow

    (c) Red

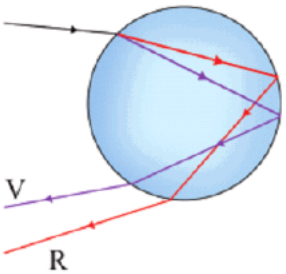
11. (a) Dispersion

    (b) Red

    (c) Violet - Indigo - Green - Yellow

    (d) For colours with higher wavelengths, the deviation is less.

12. (a)



    (b) Sunlight undergoes refraction twice and internal reflection once.

    (c) Red

    (d) Circle

    (e) West

    (f) Violet

13. (a) Allow white light to pass through a prism and obtain the constituent colours on a screen. A prism similar to the first is placed in inverted position, adjacent to the first.

    (b) When the white light is passed through the first prism, it is dispersed into seven colours. But when the second prism is placed near the first prism the colour of light coming out from the second prism is white.

14. (a) Persistence of vision

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

15. (a) Beaker, Water, Torch, Sodium thiosulphate, Hydrochloric acid, Screen.

    (b) Dissolve sodium thiosulphate in water taken in a beaker. Add two drops of hydrochloric acid to it. Observe the change in light in the solution and on the screen. From this we can understand the scattering of light.

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

17. Due to the scattering of light.

18. (a) During sunrise and sunset.

    (b) During sunrise and sunset light reaching us from the horizon has to travel long distance through the atmosphere. During this long journey colours of shorter wavelength would be almost fully lost due to scattering. Then the red light having more wavelength less amount of scattering only reaches our eyes.

19. (a) Tyndal effect

    (b) As the size of the particle increases the rate of scattering also increases.

20. 1. Use shades in light sources.

    2. Restrict usage of light beyond a specific period during night.

    3. Dim the headlights.

    4. Make people aware of light Pollution.

7 ENERGY MANAGEMENT

1. a)

Solid	Liquid	Gas
Firewood	Naphtha	LNG
Nuclear fuel	Petrol	Biogas
Coke	Kerosene	Ammonia

b) Fuel wastage.

Creates atmospheric pollution due to the release of smoke, soot and carbon monoxide.

2.

LPG	Ethyl Mercaptan
CNG	Methane
Coal	Coke

3. a) It denotes the expiry date.

b) B indicates the expiring month is from April to June and 22 indicates the expiring year of the cylinder is 2022.

4. a) Petrol, All others are biomass

b) 1. Biogas has high calorific value.

2. Low atmospheric pollution

3. The slurry from the plant is a good manure.

c) Methane, Carbon dioxide

5. a) The amount of heat liberated by the complete combustion of 1kg of fuel is its calorific value.

b) kilojoule/kilogram (kJ/Kg)

c) Hydrogen

6. Hydrogen

7. a) Hydrogen fuel cell

b) Hydrogen is highly inflammable and explosive. It is also difficult to store and transport.

c) In rockets and space vehicles

8. 1. Easily available

2. Low cost

3. Have a high calorific value

4. Cause minimum atmospheric pollution.

9. B chemical energy → heat energy → mechanical energy → electrical energy

10. a) Heat energy, Light energy,

    b) Solar panel, solar water heater, solar cooker, solar power plant, solar cell etc.

    c) Light energy (Solar) → Electrical energy

    d) In cloudy seasons and at night.

    e) In artificial satellites, space and in isolated islands where electricity is not accessible.

    f) Photo voltaic effect

11. a) The black colour of the vessel lets it to absorb more heat.

    b) The plane mirror will reflect maximum sun rays in to the cooker.

12. Concave reflectors are used to focus the sun rays on the blackened pipes filled with water. As a result water boils and vapourises. The steam rotates the steam turbine, so that the generator attached to the turbine produces electrical energy.

13. **Merits**

    - Renewable
    - Environment friendly
    - Production of electricity doesn't incur any recurring expenditure

    Demerits

    - This can be established only at those places where wind is available for most time of the year.
    - We may require storage systems to use electricity when there is no wind.
    - The expense to establish a windmill is very high.
    - For repairing it in the event of damages caused by natural calamities is very high.

14. The rise in water due to high tide is less than a metre in Kerala.

15. The surface of Ocean is relatively hot due to solar radiations. But the temperature will be very low at the deep levels. OTEC plants produce energy, making use of this difference in temperature.

16. The interior part of the earth is still in the molten form. Magma, which is at a higher temperature, comes out of the core through its softer regions. Such places are known as hotspot.

17. There is no hotspots in Kerala

18. a) Nuclear fission, Nuclear fusion.

    b) In a nuclear reactor, nuclear energy is used to heat water to make steam at high temperature and pressure. The force of steam is used to turn the turbine to generate electricity.

c) Nuclear pollution.

19.
- Shift out to safe place.
- Strictly follow the directions from the concerned authorities.
- Observe the symbols showing nuclear radiations and behave accordingly.
- Reduce the density of population in place likely to experience nuclear pollution.
- Consume potassium iodide tablet or take food rich in iodine, if necessary.

20. **Green energy**

Tidal energy

Windmill

Hydro electirc power plant

Solar panel

Brown energy

Thermal power station

Nuclear energy

Diesel engine

21. A (1) Judicious utilisation of energy.

(2) Maximum utilisation of solar energy.

(3) Minimising the wastage of water.

(4) Making use of public transportation as far as possible.

(5) Construction and beautifying of houses and roads in a scientific manner.

(6) Controlling of the street lamps with LDR.

(7) Timely maintenance of machines.

(8) Limiting the size of newly constructed buildings.

(9) Ensuring of maximum efficiency of the machines used.

(10) Reduce the use of fossil fuels and increase the use of renewable sources of energy.

Write any four from the above list.

22. (1) Hot box

(2) Pressure cooker

(3) Energy efficient oven

23.

Hydro electric power station	Potential energy → electrical energy	Moolamattom, Pallivasal
Thermal power station	Chemical energy → electrical energy	Neyveli, Kayamkulam
Nuclear power station	Nuclear energy → electrical energy	Tarapur, Koodamkulam