PRISM WORLD

Std.: 10 (English) **Science - I**

Chapter: 7

Q.1 **Textbook activity question** 8

1 Why do we have to bring a small object near the eyes in order to see it clearly?

Ans If we bring small objects near the eyes, the angle subtended by the object at the eye becomes large which makes the eye to see the object clearly.

2 How are concave and convex mirrors constructed?

Ans **Convex Mirror :** Made by grinding a thick plane mirror into a bulging shape, using appropriate tools.
Concave Mirror : made up of Acryl Plastic and is grounded into shape with the help of machines.

3 If we bring an object closer than 25 cm from the eyes, why can we not see it clearly even though it subtends a bigger angle at the eye?

Ans Minimum distance of distinct vision : Though the focal length of the eye lens is adjustable, it cannot be decreased below a certain limit. Hence, if an object is very close to the eye, the minimum distance from the eye at which an object is clearly visible without stress on the eye, is called the minimum distance of distinct vision. For the normal human eye, it is 25 cm.

4 What are real and virtual images? How will you find out whether an image is real or virtual? Can a virtual image be obtained on a screen?

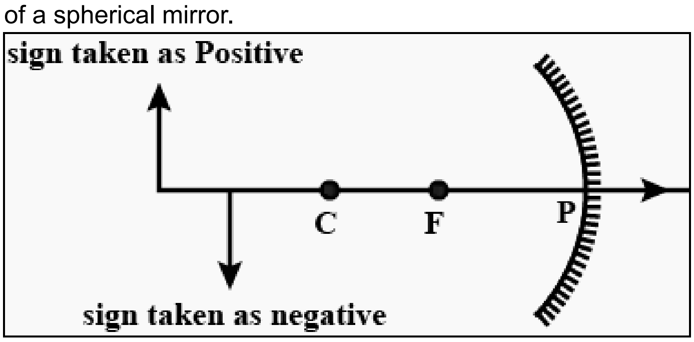
Ans i. The image in front of the mirror which can be obtained on a screen is called a real image.
ii. The image which is behind the mirror and thus cannot be obtained on a screen is called a virtual image.
iii. A virtual image cannot be obtained on a screen , whereas, a real image can be observed on screen. In this way, one can find out whether the image formed is real or virtual by observing the screen.

5 How do we perceive different colours?

Ans Light travels into the eye to the retina located on the back of the eye. The retina is covered with millions of light sensitive cells called rods and cones. When these cells detect light, they send signals to the brain. Cone cells help detect colors.

6 What is the Cartesian sign convention used for spherical mirrors?

Ans This sign convention is known as New cartesian sign convention. Sign is taken as−(negative) from pole of a spherical mirror towards object along the principle axis. This means sign is always taken as−(negative) in front of a spherical mirror.



7 An object is placed vertically at a distance of 20 cm from a convex lens. If the height of the object is 5 cm and the focal length of the lens is 10 cm, what will be the position, size and nature of the image? How much bigger will the image be as compared to the object?

Ans **Given :**
Height of the object (h_1) = 5 cm,

focal length (f) = 10 cm,
distance of the object (u) = - 20 cm
Image distance (v) = ?,
Height of the image (h_2) = ?,
Magnification (M) = ?

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

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

$\frac{1}{v}=\frac{1}{-20}+\frac{1}{10}$

$\frac{1}{v}=\frac{-1+2}{20}$

$\frac{1}{v}=\frac{1}{20}$,

v = 20 cm

The positive sign of the image distance shows that image is formed at 20 cm on the other side of the lens.

Magnification (M) = $\frac{h_2}{h_1}=\frac{v}{u}$

$h_2 = \frac{v}{u} \times h_1$

$h_2 = \frac{20}{-20} \times 5$

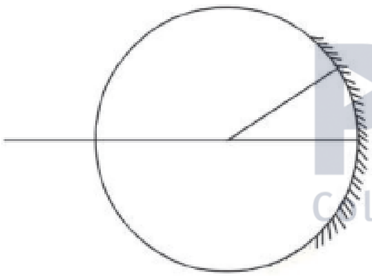
$h_2 = (-1) \times 5$

$h_2 = -5$ cm

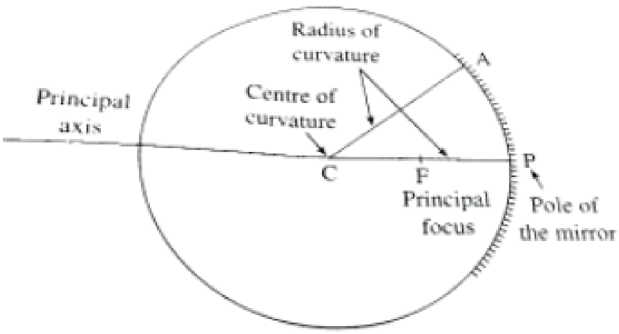
$M = \frac{v}{u} = \frac{20}{-20} = -1$

The negative sign of the height of the image and the magnification shows that the image is inverted and real. It is below the principal axis and is of the same size as the object.

8 Indicate the following terms related to sperical mirrors poles, centre of curvature, radius of curvature, principal focus.



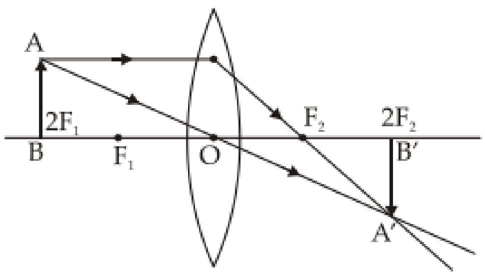
Ans



Q.2 **Draw neat labelled diagrams.** **2**

1 At which position will you keep an object in front of a convex lens so as to get a real image of the same size as the object ? Draw a figure.

Ans In this case, the object is kept at 2f 1 . The image is real inverted and of the same size as that of the object.



AB-object A′B′ = image

Q.3 **Give scientific reasons** **6**

1 Simple microscope is used for watch repairs.

Ans
i. When an object is placed within the focal length of convex lens, one gets a magnified and erect image of the object.
ii. Thus, the watch repairer can see the minute parts of the watch more clearly with the help of simple microscope than the naked eye, without any strain on the eye.
iii. A magnification of about 20 times is obtained by simple microscope.
Hence, simple microscope is used for watch repairs.

2 One can sense colours only in bright light.

Ans i. The retina is made up of many light sensitive cells.
ii. The rod shaped cells respond to the intensity of light.
iii. The cone shaped cells respond to various colours.
iv. These cone shaped cells do not respond to faint or dim light.
v. Hence one can sense colours only in bright light.

3 We can not clearly see an object kept at a distance less than 25 cm from the eye.

Ans i. The eye lens become more rounded when we try to see a nearby object.
ii. Due to this its focal length decreases and a clear image of the object is formed on the retina of the eye.
iii. But the focal length of the eye lens cannot be decreased beyond some limit.
iv. There fore we cannot clearly see an object kept at a distance less than 25 cm from the eye.

Q.4 **Solve Numerical problems.** **8**

1 Doctor has prescribed a lens having power + 1.5D. What will be the focal length of the lens. What is the type of lens and what must be the defect of vision.

Ans Given
P = + 1.5 D
f = ?
f = $\frac{1}{P} = \frac{1}{1.5}$
$= \frac{10}{15} = \frac{2}{3}$ = 0.6667
= 0.67 m
Power is positive, hence the lens is **Convex**. Convex lens is used hence the defect is **farsighted ness** (hyper metropia)

2 Three lenses having power 2, 2.5 and 1.7 D are kept touching in a row.
What is the total power of the lens

Ans Given P_1 = 2D, P_2 = 2.5D, P_3 = 1.7D
$P = P_1 + P_2 + P_3$
P = 2 + 2.5 + 1.7
= 6.2 D

3 An object is kept 60 cm from a lens gives a Virtual image 20 cm in front of lens. What is the focal length of the lens ? Is it converging lens or diverging lens.

Ans Given :
u = -60 cm
V = -20 cm
f = ?
$\frac{1}{f} = \frac{1}{V} - \frac{1}{u}$
$\frac{1}{-20\ \text{cm}} - \frac{1}{-60\ \text{cm}}$
$-\left(\frac{1}{20} - \frac{1}{-60}\right)$
$= -\left(\frac{3-1}{60}\right)$
$= -\frac{2}{60} = \frac{-1}{30\ \text{cm}}$
$\frac{1}{f} = \frac{-1}{30}$
$\therefore$ f = -30

The focal length is -30 cm and it is diverging lens.

4 The focal length of a convex lens is 20 cm. What is its power?

Ans **Given:**

Focal length = f = 20 cm = 0.2 m Power of the lens = P = ?

P = $\frac{1}{\mathrm{f(m)}}$ = $\frac{1}{0.2}$ = 5D

The power of the lens is 5 D.

Q.5 Write Distinguish between 4

1 Concave lens and Convex lens

Ans

	Convex lens	**Concave lens**
i.	It is thicker at the centre than its edges.	It is thinner at the centre than at the edge.
ii.	Convex lens is called converging lens at it converges the rays of light falling on it.	Concave lens is called a diverging lens as it diverges the rays of light falling on it.
iii.	Convex lens can form real as well as virtual image.	It can form only virtual image.
iv.	Convex lens is curved outward.	Concave lens is curved inward.

2 Farsightedness (Hypermetropia) and Near sightedness (Myopia)

Ans

	Farsightedness	**Nearsightedness**
i.	In this defect human eye can see distant objects distinctly but is unable to see nearby objects clearly.	In this defect human eye can see near by objects distinctly but is unable to see distant objects clearly.
ii.	Image of the near by object is formed behind the retina.	Image of the distant object is formed in front of retina.
iii.	Can be corrected using Convex lens.	Can be corrected using Concave lens.

Q.6 Solve Numerical problems 3

1 5 cm high object is placed at a distance of 25 cm from the converging lens of focal length of 10 cm. Determine the position, size and type of image.

Ans Given

f = 10 cm

u = -25 cm

h_1 = 5 cm

V = ?

h_2 = ?

i. $\frac{1}{f} = \frac{1}{V} - \frac{1}{u}$

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

$\frac{1}{V} = \frac{1}{10} + \frac{1}{-25}$

= $\frac{5+(-2)}{50}$

= $\frac{3}{50}$

V = $\frac{50}{3}$

=16.67

= 16.7

ii. $\frac{h_2}{h_1}$ = $\frac{V}{u}$

h_2 = $\frac{V \times h_1}{2}$

= $\frac{50}{3} \times \frac{5}{-25}$

$= \frac{-10}{3}$

= -3.33 cm

Therefore the image is inverted (minus sign) of height **3.3 cm.**

iii. The image is real, inverted and smaller then object.

Q.7 Answer the following 3

1 Match the table and explain in short its defect and correction:

Column 1	Column 2	Column 3
Farsightdness	Nearby object can be seen clearly	Bifocal lens
Presbyopia	Far away object can be seen clearly	Concave lens
Nearsightness	Problem of old age	Convex lens

Ans i. Farsightedness → Far away object can be seen clearly → Convex lens

Explanation: In farsightedness, the human eye can see far away object clearly but cannot see nearby objects distinctly. To correct this defect, a convex lens with proper focal length is used.

ii. Presbyopia → Problem of old age → Bifocal lens.

Explanation: The ability of the muscles near the eye lens to change the focal length of the lens decreases with age. This defect is known as presbyopia. In this defect, sometimes people suffer from both nearsightedness and farsightedness. Therefore, bifocal lenses are required to correct this defect.

iii. Nearsightedness → Nearby object can be seen clearly → concave lens

Explanation: In nearsightedness, the human eye can see nearby objects clearly but cannot see far away objects distinctly. To correct this defect, a concave lens with proper focal length is used.

Q.8 Answer the following in detail 15

1 Explain the working of astronomical telescope using refraction of light.

Ans
i. It consists of two Convex lenses called objective lens (directed towards object) and eyepiece (directed towards eye)
ii. The focal length and diameter of objective lens is greater then the focal length and diameter of the eye piece.
iii. The principal axes of the objective lens and eye piece are along the same line.
iv. When the objective lens is pointed towards the distant object to be observed.
v. The rays of light from the distant object, which are almost parallel to each other pass through the objective lens.
vi. The objective lens being larger in size collect maximum amount of light
vii. It forms a real, inverted and diminished image in the focal plane of the objective lens.
viii. Now the position of the eye piece is adjusted such that image falls just with in the focal length of the eye piece and serves as the object for the eye piece which works as a simple microscope
ix. The final image is highly magnified, Virtual on the same side as that of the object and inverted with respect to original object.
x. The final image can be observed by keeping the eye close to the eye piece.
xi. If the image formed by the objective lens lies in the focal plane of the eye piece, the final image is formed at infinity.

2 What is the function of iris and muscles connected to the lens in human eye ?

Ans **Function of Iris:** The iris is a muscular diaphragm that controls the size of the pupil, which, in turn, controls the amount of light entering the eye. It also gives colour to the eye.

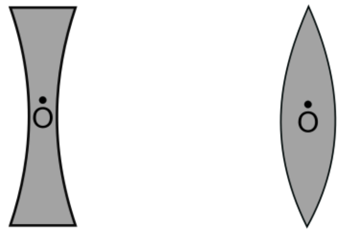
Function of ciliary muscles: The eye lens is held in position by the ciliary muscles. The focal length of the eye lens is adjusted by the expansion and contraction of the ciliary muscles.

3 Draw a figure explaining various terms related to a lens.

Ans **Terms Associated with Lenses:**

Optical centre

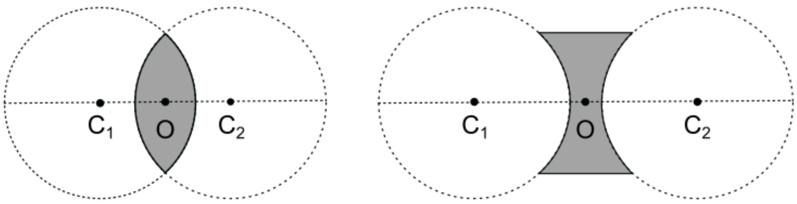
Optical centre is a point at the centre of the lens. It always lies inside the lens and not on the surface. It is denoted by **'O'**.



Optical centre of a concave lens   Optical centre of a convex lens

Centre of curvature:

It is the centre point of arcs of the two spheres from which the given spherical lens (concave or convex) is made. Since a lens constitutes two spherical surfaces, it has two centers of curvature.



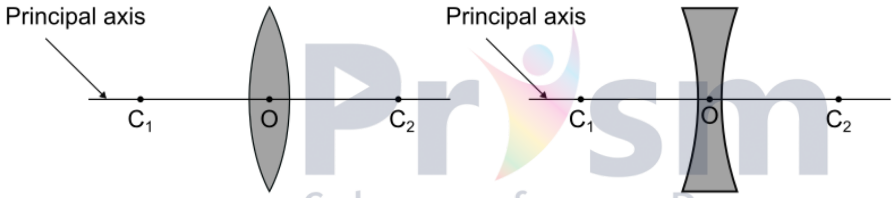
Centre of curvatures of a convex lens   Centre of curvatures of a concave lens

Radius of curvature:

The distance of the optical centre from either of the centre of curvatures is termed as the **radius of curvature**.

Principal axis:

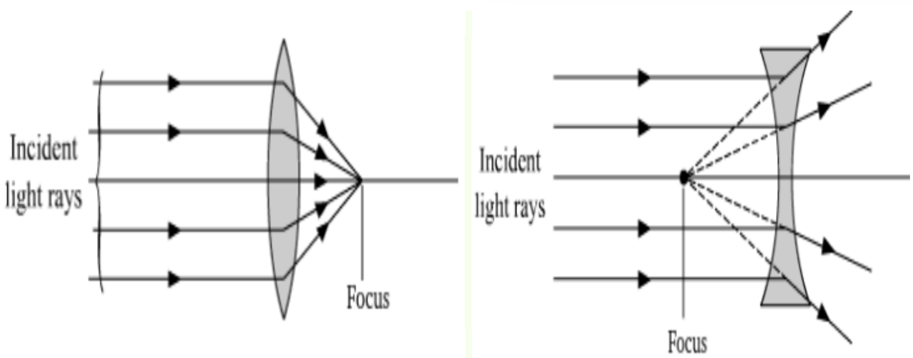
The imaginary straight line joining the two centers of curvature and the optical centre **(O)** is called the **principal axis** of the lens.



Convex lens   Concave lens

Focus:

The focus **(F)** is the point on the principal axis of a lens where all incident parallel rays,
after refraction from the lens meet or appear to diverge from. For lenses there are two foci (**F_1** and **F_2**) depending on the direction of



Focal length:

The distance between the focus (**F_1** or **F_2**) and the optical centre (**O**) is known as the **focal length** of the lens.