Class – X　　　　**Physics**　　**Chapter – 10 Light – Reflection and Refraction**

Q1) When a plane mirror is rotated through a certain angle, the reflected ray turns through twice as much and the size of the image:

(a) is doubled

(b) is halved

(c) becomes infinite

(d) remains same

Correct Answer: Option (d)

Q2) If an object is placed symmetrically between two plane mirrors, inclined at angle of 72

degree, then total no. of images formed:

(a) 5

(b) 4

(c) 2

(d) infinite

Correct Answer: Option (b)

Q3) Which statement is true for the reflection of light?

(a) The angle of incidence and reflection are equal.

(b) The reflected light is less bright than the incident light.

(c) The sum of angle of incidence and reflection is always greater than 90^0.

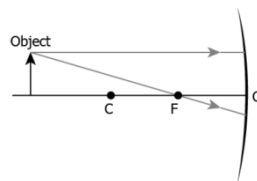(d) The beams of incident light after reflection diverge at unequal angles.

Correct Answer: Option (a)

Q4) Focal length of a plane mirror is

(a) 0

(b) infinite

(c) 25cm

(d) -25

Correct Answer: Option (b)

Q5) The image shows the path of incident rays to a concave mirror.

Where would the reflected rays meet for the image formation to take place?

(a) behind the mirror

(b) between F and O

(c) between C and F

(d) beyond C

Correct Answer: Option (c)

Q6) A beam of light incident on a plane mirror forms a real image on reflection. The incident beam is :

(a) parallel

(b) convergent

(c) divergent

(d) not certain

Correct Answer: Option (b)

Q7) An object is placed at a distance of 40cm in front of a concave mirror of focal length 20cm.

The image produced is:

(a) virtual and inverted

(b) real and erect

(c) real, inverted and of the opposite size as that of the object

(d) real, inverted and of the same size as that of the object

Correct Answer: Option (d)

Q8) A student conducts an experiment using a convex lens. He places the object at a distance of 60 cm in front of the lens and observes that the image is formed at a distance of 30 cm behind the lens. What is the power of the lens?

(a) 0.005 dioptre

(b) 0.05 dioptre

(c) 5 dioptre

(d) 50 dioptre

Correct Answer: Option (c)

Q9) An image of an object produced on a screen which is about 36 cm using a convex lens.

The image produced is about 3 times the size of the object. What is the size of the object?

(a) 12 cm

(b) 33 cm

(c) 39 cm

(d) 108 cm

Correct Answer: Option (a)

Q10) Image formed by a convex spherical mirror is:

(a) virtual

(b) real

(c) enlarged

(d) inverted

Correct Answer: Option (a)

Q11) A student studies that a convex lens always forms a virtual image irrespective of its position. What causes the convex mirror to always form a virtual image?

(a) because the reflected ray never intersects

(b) because the reflected ray converges at a single point

(c) because the incident ray traces its path back along the principal axis

(d) because the incident ray of a convex mirror gets absorbed in the mirror

Correct Answer: Option (a)

Q12) A 10 mm long awl pin is placed vertically in front pin is formed at 30cm in front of the mirror. The focal length of this mirror is:

(a) -30cm

(b) -20cm

(c) -40cm

(d) -60cm

Correct Answer: Option (b)

Q13) Rahul conducts an experiment using an object of height 10 cm and a concave lens with focal length 20 cm. The object is placed at a distance of 25 cm from the lens. Can the image be formed on a screen?

(a) yes, as the image formed will be real

(b) yes, as the image formed will be erect

(c) no, as the image formed will be virtual

(d) no, as the image formed will be inverted

Correct Answer: Option (c)

Q14) Magnification produced by a rear view mirror fitted in vehicles:

(a) is less than one

(b) is more than one

(c) is equal to one

(d) can be more than or less than one depending upon the position of the object in front of it

Correct Answer: Option (a)

Q15) A student conducts an activity using a concave mirror with focal length of 10 cm. He placed the object 15 cm from the mirror. Where is the image likely to form?

(a) at 6 cm behind the mirror

(b) at 30 cm behind the mirror

(c) at 6 cm in front of the mirror

(d) at 30 cm in front of the mirror

Correct Answer: Option (d)

Q16) The image of an object placed in front of a convex mirror is formed at

(a) the object itself

(b) twice the distance of the object in front of the mirror

(c) half the distance of the object in front of the mirror

(d) behind the mirror

Correct Answer: Option (d)

Q17) A full length of image of a distant tall building can definitely be seen using:

(a) a concave mirror

(b) a convex mirror

(c) a plane mirror

(d) both concave as well as plane mirror

Correct Answer: Option (b)

Q18) A student conducts an activity using a flask of height 15 cm and a concave mirror. He finds that the image formed is 45 cm in height. What is the magnification of the image?

(a) -3 times

(b) -1/ 3 times

(c) 1/ 3 times

(d) 3 times

Correct Answer: Option (d)

Q19) Which of the following can make a parallel beam of light from a point source incident on it?

(a) concave mirror as well as convex lens

(b) convex mirror as well as concave lens

(c) two plane mirrors placed at 90degree to each other

(d) concave mirror as well as concave lens

Correct Answer: Option (a)

Q20) A student studies that the speed of light in air is 300000 kms/ sec where that of speed in a glass slab is about 197000 kms/ sec. What causes the difference in speed of light in these two media?

(a) difference in density

(b) difference in temperature

(c) difference in amount of light

(d) difference in direction of wind flow

Correct Answer: Option (a)

Q21)   Focal length of plane mirror is
   a. At infinity
   b. Zero
   c. Negative
   d. None of these
Correct Answer: Option (a)

Q22)   Image formed by plane mirror is
   a. Real and erect
   b. Real and inverted
   c. Virtual and erect
   d. Virtual and inverted
Correct Answer: Option (C)

Q23)   A concave mirror gives real, inverted and same size image if the object is placed
   a. At F
   b. At infinity
   c. At C
   d. Beyond C
Correct Answer: Option (C)

Q24)   Power of the lens is -40, its focal length is

   a. 4m

   b. -40m

   c. -0.25m

   d. -25m

Correct Answer: Option (C)

Q25)   A concave mirror gives virtual, refract and enlarged image of the object but image of smaller size than the size of the object is

   a. At infinity

   b. Between F and C

   c. Between P and F

   d. At E

Correct Answer: Option (C)

Q26)   In optics an object which has higher refractive index is called

   a. Optically rarer

   b. Optically denser

   c. Optical density

   d. Refractive index

Correct Answer: Option (b)

Q27)   The optical phenomena, twinkling of stars, is due to

   a. Atmospheric reflection

   b. Total reflection

   c. Atmospheric refraction

   d. Total refraction

Correct Answer: Option (C)

Q28)   Convex lens focus a real, point sized image at focus, the object is placed

   a. At focus

   b. Between F and 2F

   c. At infinity

   d. At 2F

Correct Answer: Option (C)

Q29)   The unit of power of lens is

   a. Metre

   b. Centimeter

   c. Diopter

   d. M^{-1}

Correct Answer: Option (C)

Q30)   The radius of curvature of a mirror is 20cm the focal length is

   a. 20cm

   b. 10cm

   c. 40cm

   d. 5cm

Correct Answer: Option (b)

INTEXT AND EXERCISE QUESTIONS ANSWERS

Question 1
Define the principal focus of a concave mirror.
Answer:
The principal focus of a concave mirror is a point on its principal axis to which all the light rays which are parallel and close to the axis, converge after reflection from the concave mirror.

Question 2
The radius of curvature of a spherical mirror is 20 cm. What is its focal length?
Answer:
Focal length = $\frac{1}{2}$ x Radius of curvature = $\frac{1}{2}$ x 20 cm = 10 cm

Question 3
Name a mirror that can give an erect and enlarged image of an object.
Answer:
Concave mirror.

Question 4
Why do we prefer a convex mirror as a rear-view mirror in vehicles ?
Answer:
We prefer a convex mirror as a rear-view mirror in vehicles because of two reasons :

1. A convex mirror always produces an erect image of the objects.
2. The image formed in a convex mirror is highly diminished or much smaller than the object, due to which a convex mirror gives a wide field of view of the traffic behind. A convex mirror enables the driver to view such larger area of the traffic behind him

Page Number: 171

Question 1
Find the focal length of a convex mirror whose radius of curvature is 32 cm.
Solution:
R = +32 cm and $f = R/2 = +32/2 = +16$ cm

Question 2
A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located ?
Solution:
Because the image is real, so magnification m must be negative

$$m = \frac{h'}{h} = -\frac{v}{u} = -3 \quad \text{or} \quad v = 3\,u$$

But $\quad u = -10$ cm

Therefore, $\quad m = \frac{-v}{u} \quad \Rightarrow \quad -3 = \frac{-v}{-10}$

$\therefore \quad v = -\textbf{30 cm}.$

Thus the image is located at a distance of 30 cm from the mirror on the object side of the mirror.

Page Number: 176

Question 1
A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal ? Why ?
Answer:
The light-ray bends towards the normal because the ray of light goes from a rarer medium to a denser medium.

Question 2
Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass ? The speed of light in vacuum is 3 x 10^8 ms^{-1}.
Solution:

Refractive index of glass, $n_g = 1.50$

$$\text{Speed of light in vacuum, } c = 3 \times 10^8 \text{ ms}^{-1}.$$

$$\text{Speed of light in glass} = \frac{c}{n_g} = \frac{3 \times 10^8 \text{ m/s}}{1.5} = 2 \times 10^8 \text{ ms}^{-1}$$

Question 3
Find out, from Table 10.3, the medium having highest optical density. Also find the medium with lowest optical density.
Answer:
From table 10.3, diamond has highest refractive index (= 2.42), so it has highest optical density.
Air has lowest refractive index (= 1.0003),
so it has lowest optical density.

Question 4
You are given kerosene, turpentine and water. In which of these does the light travel fastest ? Use the information given in Table 10.3.
Answer:
For kerosene, n = 1.44
For turpentine, n = 1.47
For water, n = 1.33
Because water has the lowest refractive index, therefore light travels fastest in this optically rarer medium than kerosene and turpentine oil.

Question 5
The refractive index of diamond is 2.42. What is the meaning of this statement?
Answer:
By saying that the refractive index of diamond is 2.42, we mean that the speed of light in diamond is lower by a factor of 2.42 relative to that in vacuum.

Page Number: 184

Question 1
Define 1 dioptre of power of a lens.
Answer:
One dioptre is the power of a lens whose focal length is 1 metre.

Question 2
A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object ? Also, find the power of the lens. , Sol. Here, u — +50 cm ..
Solution:
Here v = +50cm
Because the real image is of the same size as the object,

Therefore, $\qquad m = \dfrac{h'}{h} = \dfrac{v}{u} = -1$

or $\qquad u = -v = -50 \text{ cm}$

Now, $\qquad \dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{+50} - \dfrac{1}{-50} = +\dfrac{2}{50} = +\dfrac{1}{25}$

or $\qquad f = 25 \text{ cm} = 0.25 \text{ m}$

$\qquad P = \dfrac{1}{f} = +\dfrac{1}{0.25 \text{ m}} = \textbf{+4 D}$

Question 3
Find the power of a concave lens of focal length 2 m.
Solution:
Because the focal length of a concave lens is negative,

therefore f = -2 m

Therefore, $\qquad m = \dfrac{h'}{h} = \dfrac{v}{u} = -1$

or $\qquad u = -v = -50$ cm

Now, $\qquad \dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{+50} - \dfrac{1}{-50} = +\dfrac{2}{50} = +\dfrac{1}{25}$

or $\qquad f = 25$ cm $= 0.25$ m

$\qquad P = \dfrac{1}{f} = +\dfrac{1}{0.25\ m} = \textbf{+4 D}$

Textbook Chapter End Questions

Question 1
Which one of the following materials cannot be used to make a lens ?
(a) Water
(b) Glass
(c) Plastic
(d) Clay
Answer:
(d) Clay

Question 2
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 the centre of curvature
(b) At the centre of curvature
(c) Beyond the centre of curvature
(d) Between the pole of the mirror and its principal focus.
Answer:
(d) Between the pole of the mirror and its principal focus.

Question 3
Where should an object be placed in front of a convex lens to get a real image of the size of the object ?
(a) At the principal focus of the lens (b) At twice the focal length
(c) At infinity
(d) Between the optical centre of the lens and its principal focus.
Answer:
(b) At twice the focal length

Question 4
A spherical mirror and a thin spherical lens have each a focal length of -15 cm. The mirror and the lens are likely to be :
(a) Both concave.
(b) Both convex.
(c) the mirror is concave and the lens is convex.
(d) the mirror is convex, but the lens is concave.
Answer:
(a) Both concave

Question 5
No matter how far you stand from mirror, your image appears erect. The mirror is likely to be
(a) plane
(b) concave
(c) convex
(d) either plane or convex.
Answer:
(d) Either plane or convex.

Question 6
Which of the following lenses would you prefer to use while reading small letters found in a dictionary ?
(a) A convex lens of focal length 50 cm.
(b) A concave lens of focal length 50 cm.
(c) A convex lens of focal length 5 cm.
(d) A concave lens of focal length 5 cm.
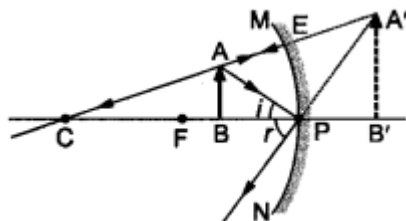Answer:
(c) A convex lens of focal length 5 cm.

Question 7
We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror ? What is the nature of the image ? Is the image larger or smaller than the object ? Draw a ray diagram to show the image formation in this case.
Answer:
A concave mirror gives an erect image when the object is placed between the focus F and the pole P of the concave mirror, i.e., between 0 and 15 cm from the mirror. The image thus formed will be virtual, erect and larger than the object.

Question 8
Name the type of mirror used in the following situations.
(a) Headlights of a car.
(b) Side/rear-view mirror of a vehicle.
(c) Solar furnace.
Support your answer with reason.
Answer:
(a) Concave mirrors are used as reflectors in headlights of cars. When a bulb is located at the focus of the concave mirror, the light rays after reflection from the mirror travel over a large distance as a parallel beam of high intensity.

(b) A convex mirror is used as a side/rear-view mirror of a vehicle because

- A convex mirror always forms an erect, virtual and diminished image of an object placed anywhere in front it.
- A convex mirror has a wider field of view than a plane mirror of the same size.

(c) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces

Question 9
One-half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object ? Verify your answer experimentally. Explain your observations.
Answer:
A convex lens forms complete image of an object, even if its one half is covered with black paper. It can be explained by considering following two cases.
Case I : When the upper half of the lens is covered
In this case, a ray of light coming from the object will be refracted by the lower half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the following figure.
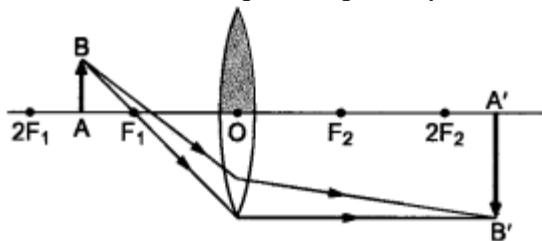
Case II: When the lower half of the lens Is covered
In this case, a ray of light coming from the object is refracted by the upper half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the given figure.
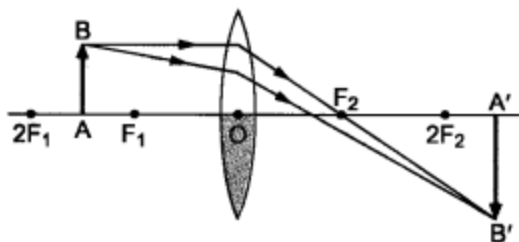
Question 10
An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and the nature of the image formed.
Answer:

Here : Object distance, u= -25 cm,
Object height, h = 5 cm,
Focal length, f = +10 cm

According to the lens formula, $1/f = 1/v - 1/u$, we have
$\Rightarrow 1/v = 1/f - 1/u = 1/10 - 1/25 = 15/250$ or $v = 250/15 = 16.66 cm$
The positive value of v shows that the image is formed at the other side of the lens.

Now, magnification, $m = \dfrac{\text{Image distance}}{\text{Object distance}} = \dfrac{v}{u} = \dfrac{16.66}{-25} = -0.66$.

The negative sign shows that the image is inverted.

But magnification, $m = \dfrac{\text{Image height}}{\text{Object height}} = \dfrac{h'}{5}$

or $h' = -0.66 \times 5$
$= -3.3$ cm

The negative value of image height indicates that the image formed is inverted.
The position, size, and nature of image are shown alongside in the ray diagram.

Question 11
A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens ? Draw the ray diagram.
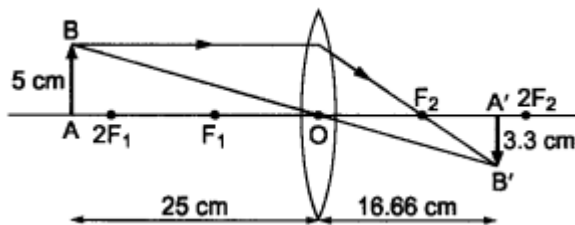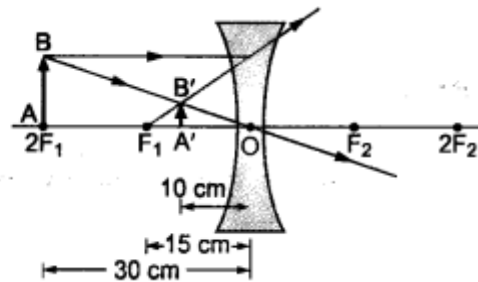Solution:
Focal length, f = -15 cm, Image distance, v = -10 cm (as concave lens forms the image on the same side of the lens)
From the lens formula $1/f = 1/v - 1/u$, we have

$\Rightarrow$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-10} - \frac{1}{-15}$$
$$= \frac{-3+2}{30} = -\frac{1}{30}$$

Object distance, u = -30 cm
The negative value of u indicates that the object is placed in front of the lens.

Question 12
An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.
Solution:
Object distance, u = -10 cm, Focal length, f = +15 cm, Image distance, v = ?

From mirror formula, $\dfrac{1}{u} + \dfrac{1}{v} = \dfrac{1}{f}$, we have

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{+15} - \frac{1}{-10} = \frac{2+3}{30} = \frac{1}{6} \text{ or } v = \textbf{6 cm}$$

Thus, image distance, v = + 6 cm
Because v is +ve, so a virtual image is formed at a distance of 6 cm behind the mirror.

Magnification, $m = -v/u = -6/-30 = 15$ (i.e. < 1)

The positive value of m shows that image erect and its value, which is less than 1, shows that image is smaller than the object. Thus, image is virtual, erect and diminished.

Question 13
The magnification produced by a plane mirror is +1. What does this mean ?
Answer:
Since magnification, $m = h'/h = -v/u$. Given, m = +1, so h' = h and v = -u
(i) m = 1 indicates the size of image is same as that of object.
(ii) positive sign of m indicates that an erect image is formed.

The opposite signs of v and u indicate that image is formed on the other side of the mirror from where the object is placed i.e., image is formed behind the mirror and thus image formed is virtual.

Question 14
An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.
Solution:
Since object size, h = +5 cm,
object distance, u = -20 cm
and radius of curvature, R = +30 cm

$$\therefore \quad \text{Focal length, } f = \frac{R}{2} = +\frac{30}{2} = 15 \text{ cm}$$

$$\text{From mirror formula, } \frac{1}{f} = \frac{1}{v} + \frac{1}{u}, \text{ we have } \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\text{or} \quad \frac{1}{v} = \frac{1}{+15} - \frac{1}{-20} = \frac{4+3}{60} = \frac{7}{60} \quad \text{or} \quad v = \frac{60}{7} = \mathbf{8.6 \text{ cm}}$$

$$\because \quad \text{Magnification, } m = -\frac{v}{u} = \frac{h'}{h}$$

$$\therefore \quad \text{Image size, } h' = -\frac{vh}{u} = -\frac{8.6 \times 5}{-20} = 2.15 \cong \mathbf{2.2 \text{ cm}}$$

A virtual, erect image of height 2.2 cm is formed behind the mirror at a distance of 8.6 cm from the mirror.

Question 15
An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed, so that a sharp focussed image can be obtained ? Find the size and the nature of the image.
Answer:
Here, object size, h = +7.0 cm,
object distance, u = -27 cm
and focal length, f = -18 cm
Image distance, v = ?
and image size, h' = ?
From the mirror formula, $1/f = 1/v - 1/u$, we have

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} \quad \text{or} \quad \frac{1}{v} = \frac{1}{-18} - \frac{1}{-27} = \frac{-3+2}{54} = -\frac{1}{54} \quad \text{or} \quad v = \mathbf{-54 \text{ cm}}$$

The screen should be placed at a distance of 54 cm on the object side of the mirror to obtain a sharp image.

$$\text{Now, magnification, } m = \frac{h'}{h} = -\frac{v}{u}$$

$$\text{or} \quad \text{image size, } h' = -\frac{vh}{u} = \frac{(-54) \times (+7)}{(-27)} = \mathbf{-14 \text{ cm.}}$$

The image is real, inverted and enlarged in size.

Multiple Choice Questions (MCQs) [1 mark each]

Question 1.
Hold a highly polished steel spoon curved inwards close to your face and move it slowly away from your face. What will you observe?
(a) Enlarged and erect image of your face
(b) Smaller and inverted image of your face
(c) Smaller and erect image of your face
(d) Enlarged and inverted image of your face
Answer:
(b) The inner curved surface of a highly polished steel spoon acts as a concave mirror. When the spoon is at a small distance from the face such that, the object lies between pole and focus of concave mirror, so an enlarged and erect image of your face will be observed but as the spoon is slowly moved away from the face, the image becomes smaller and appears inverted.

Question 2.
Which one of the following materials cannot be used to make a lens? **[NCERT]**
(a) Water
(b) Glass
(c) Plastic
(d) Clay
Answer:
(d) Clay can never be transparent, so it cannot be used to make lens.

Question 3.
No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be **[NCERT]**
(a) plane
(b) concave
(c) convex
(d) either plane or convex
Answer:
(d) Plane mirrors and convex mirrors always form the erect images.

Question 4.
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? **[NCERT]**
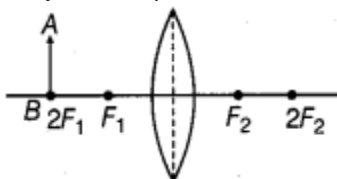(a) Between principal focus and centre of curvature
(b) At centre of curvature
(c) Beyond centre of curvature
(d) Between pole of the mirror and its principal focus
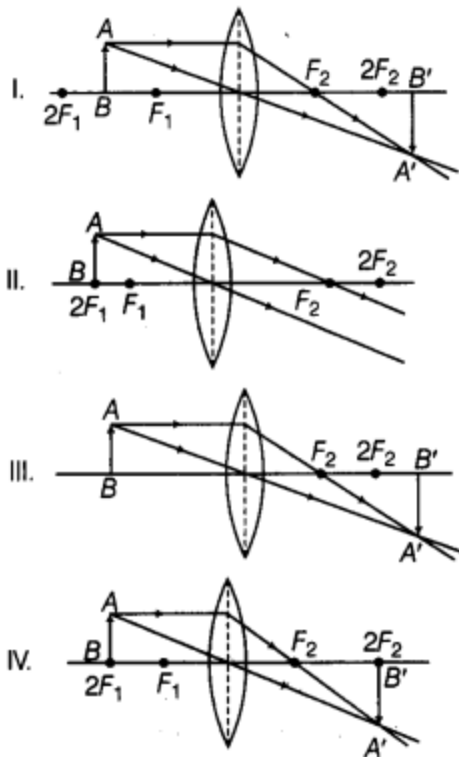Answer:
(d)

Question 5.
An object AB is placed in front of a convex lens at its centre of curvature as shown in figure below.

Four students traced the path of light ray after refraction through the lens. Which one of them is correct?

(a) Only I
(b) Only II
(c) Only III
(d) Only IV
Answer:
(d) When the object is placed at centre of curvature (2Fx) of convex lens, the same sized image is formed at 2F2. The image formed is real and inverted.

Question 6.
A spherical mirror and a thin spherical lens have each of a focal length -15 cm. The mirror and lens are likely to be **[NCERT]**
(a) both concave
(b) both convex
(c) mirror is concave and lens is convex
(d) mirror is convex and lens is concave
Answer:
(a) The focal length is taken as negative for both concave mirror and concave lens.

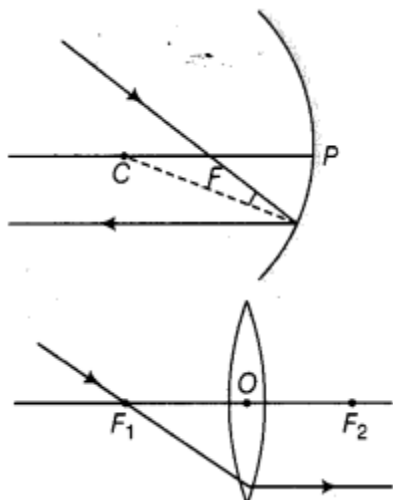Question 7.
Which of the following can make a parallel beam of light when light from a point source is incident on it? **[NCERT Exemplar]**
(a) Concave mirror as well as convex lens
(b) Convex mirror as well as concave lens
(c) Two plane mirrors placed at 90° to each other
(d) Concave mirror as well as concave lens
Answer:
(a) A ray passing through the principal focus of a concave mirror or convex lens, after reflection/refraction, will emerge parallel to the principal axis.

Question 8.
Under which of the following conditions, a concave mirror can form an image larger than the actual object? **[NCERT Exemplar]**
(a) When an object is kept at a distance equal to its radius of curvature
(b) When an object is kept at a distance less than its focal length
(c) When an object is placed between the focus and centre of curvature
(d) When an object is kept at a distance greater than its radius of curvature
Answer:
(c) A concave mirror can form an image enlarged, real and inverted than the actual object, beyond centre of curvature (C) when object is placed between the focus (F) and centre of curvature.

Question 9.
A light ray enters from medium A to medium Bas shown in the figure. The refractive index of medium B relative to A will be [NCERT Exemplar]


NCERT Exemplar
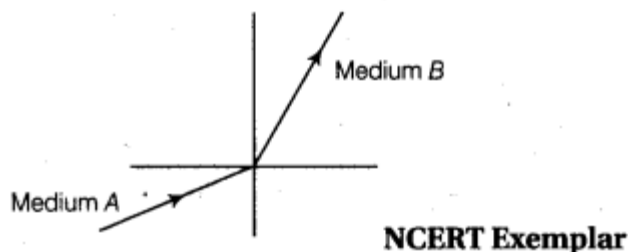
(a) greater than unity
(b) less than unity
(c) equal to unity
(d) zero
Answer:
(a) Since, light rays in the medium B goes towards normal. So, it has greater refractive index and lesser velocity of light w.r.t. medium A. So, refractive index of medium B w.r.t. medium A is greater than unity.

Question 10.
Figure shows a ray of light as it travels from medium A to medium B. Refractive index of the medium B relative to medium A is

NCERT Exemplar
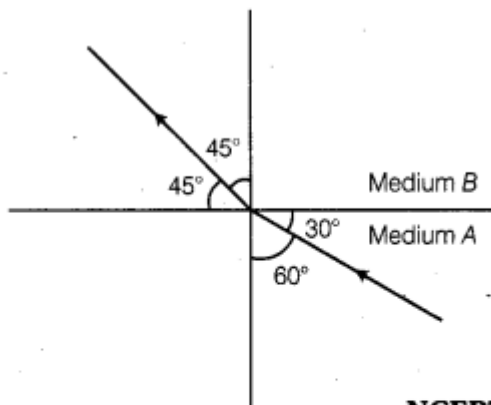
(a) $\dfrac{\sqrt{3}}{\sqrt{2}}$

(b) $\dfrac{\sqrt{2}}{\sqrt{3}}$

(c) $\dfrac{1}{\sqrt{2}}$

(d) $\sqrt{2}$
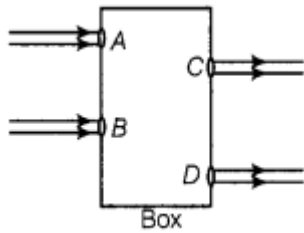
Answer:
(a) Given, angle of incidence, i = 60°, angle of refraction, r = 45°
Refractive index of the medium B relative to medium A,

$$\mu_{BA} = \frac{\sin i}{\sin r} = \frac{\sin 60°}{\sin 45°} = \frac{\left(\dfrac{\sqrt{3}}{2}\right)}{\left(\dfrac{1}{\sqrt{2}}\right)} = \frac{\sqrt{3}}{\sqrt{2}}$$

Question 11.
Beams of light are incident through the holes A and B and emerge out of box through the holes C – and D respectively, as Box shown in the figure.

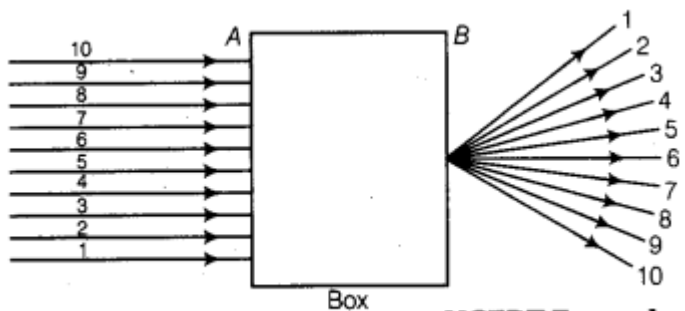Which of the following could be inside the box? **[NCERT Exemplar]**
(a) A rectangular glass slab
(b) A convex lens
(c) A concave lens
(d) A prism
Answer:
(a) Here, the emergent rays are parallel to the direction of the incident ray. Therefore, a rectangular glass slab could be inside the box as the extent of bending of light ray at the opposite parallel faces AB (air-glass interface) and CD (glass-air interface) of the rectangular glass slab are equal and opposite. This is why the ray emerges parallel to the incident ray.

Question 12.
A beam of light is incident through the holes on side A and emerges out of the holes on the other face of the box as shown in the figure. Which of the following could be inside the box? [NCERT Exemplar]
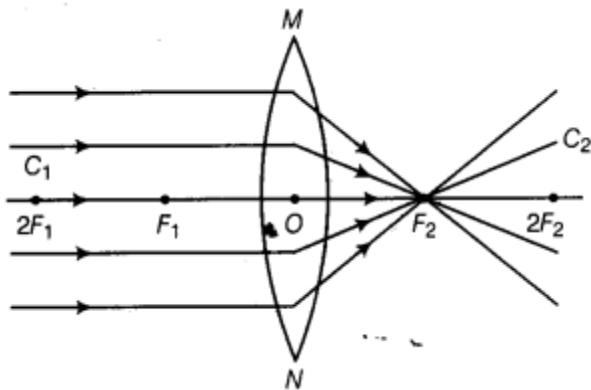

(a) Concave lens
(b) Rectangular glass slab
(c) Prism
(d) Convex lens
Answer:
(d) Since, in the figure all the parallel rays converge at a point. So, inside the box there must be a convex lens.

Question 13.
Which of the following statement is true? **[NCERT Exemplar]**
(a) A convex lens has 4D power having a focal length 0.25 m
(b) A convex lens has 4D power having a focal length -0.25 m
(c) A concave lens has 4D power having a focal length 0.25 m
(d) A concave lens has 4D power having a focal length -0.25 m
Answer:
(a) The power P of a lens of focal length f is given by
$P = 1/f$, where f is the focal length in metre and P is the power in dioptre.
$P= 1/f$ or $f = 1/P = 1/4 = 0.25$ m

Question 14.
Magnification produced by a rear view mirror fitted in vehicles **[NCERT Exemplar]**

(a) is less than one
(b) is more than one
(c) is equal to one
(d) can be more or less than one depending upon the position of the object in front of it.
Answer:
(a) The convex mirror forms virtual, erect and diminished image of the object and rear view mirror also form same type of image. Therefore, magnification (m) produced by a rear view mirror fitted in vehicles is less than one, i.e. m < 1.

Question 15.
Rays from the Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed, so that size of its image is equal to the size of the object? **[NCERT Exemplar]**
(a) 15 cm in front of the mirror
(b) 30 cm in front of the mirror
(c) between 15 cm and 30 cm in front of the mirror
(d) more than 30 cm in front of the mirror
Answer:
(b) The rays from the Sun, i.e. from infinity, are parallel to principal axis after reflection converge at a point is known as focus. Therefore, focal length if) of concave mirror is 15 cm. And we know that, same size, real and inverted image is formed by concave mirror when object is placed at focus 2 A or centre of curvature, so to form same size of image, object will be placed at 15 x 2 =30 cm.

Question 16.
The path of a ray of light coming from air passing through a rectangular glass slab traced by four students shown as I, II, III and IV in the figure. Which one of them is correct? **[NCERT Exemplar]**
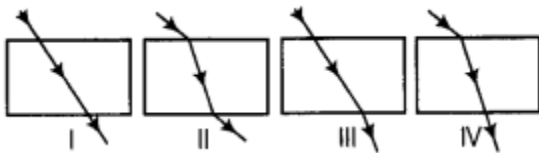
(a) Only I
(b) Only II
(c) Only III
(d) Only IV
Answer:
(b) In a rectangular glass slab, the emergent rays are parallel to the direction of the incident ray, because the lateral deviation of bending of the ray of light at the opposite parallel faces (air-glass interface) and (glass-air interface) of the rectangular glass slab are equal and opposite. This is why the ray emerges are parallel to the incident ray.

Question 17.
You are given water, mustard oil, glycerine and kerosene. In which of these media, a ray of light incident obliquely at same angle would bend the most? **[NCERT Exemplar]**
(a) Kerosene
(b) Water
(c) Mustard oil
(d) Glycerine
Answer:
(d) The given material having their refractive index as kerosene is 1.44, water is 1.33, mustard oil is 1.46 and glycerine is 1.74. Thus, glycerine is most optically denser and hence have the largest refractive index. Therefore, ray of light bend most in glycerine.

Question 18.
A student placed a light bulb in midway between the two plane mirrors inclined at an angle of 60°. How many images will be observed by him?
(a) 4
(b) 6
(c) 5
(d) 8
Answer:
(c) Number of images formed by two plane mirrors inclined at an angle 60° when a light bulb is placed in midway between them is N = 360°/60° − 1 = 6 − 1 = 5

Question 19.
Where should an object be placed in front of a convex lens to get a real image of the size of the object? **[NCERT]**
(a) At the principal focus of the lens
(b) At twice the focal length
(c) At infinity
(d) Between the optical centre of the lens and its principal focus
Answer:
(b) To set the real image of the size of the object, it should be placed at twice the focal length of a convex lens.

Question 20.
Which of the following lenses would you prefer to use while reading small letters found in dictionary? **[NCERT]**
(a) A convex lens of focal length 50 cm
(b) A concave lens of focal length 50 cm
(c) A convex lens of focal length 5 cm
(d) A concave lens of focal length 5 cm
Answer:
(c) Convex lens is used as magnifying glass. For better performance its focal length should be small.