CBSE Test Paper 05

Chapter 10 Reflection and Refraction

1. Match the following with the correct response**: (1)**

(1) Refraction	(A) Bending of light
(2) Reflection	(B) Velocity of light increases
(3) Rarer medium	(C) Bouncing back of light
(4) Denser medium	(D) Velocity of light decreases

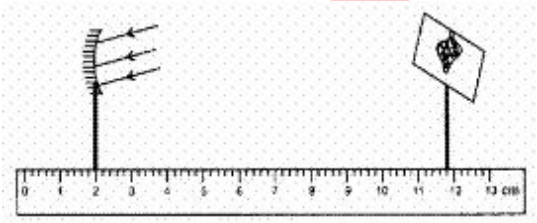
a. 1-D, 2-A, 3-C, 4-B

b. 1-A, 2-C, 3-B, 4-D

c. 1-C, 2-B, 3-D, 4-A

d. 1-B, 2-D, 3-A, 4-C

2. In the set-up shown below, a clear image of a distant object is obtained on the screen. The focal length of the concave mirror is: **(1)**



a. 9.4 cm

b. 9.9 cm

c. 9.8 cm

d. 11.4 cm

3. Which of the following lens would you prefer to use while reading small letters found in a dictionary? **(1)**

a. A convex lens of focal length 50 cm

b. A convex lens of focal length 5 cm

c. A concave lens of focal length 50 cm

d. A concave lens of focal length 5 cm

4. How does the frequency of a beam of ultra-violet light change when it goes from air into glass? **(1)**

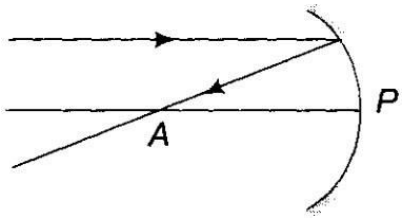
   a. None of these
   b. Frequency decreases
   c. Remains the same
   d. Frequency increases

5. An experiment to trace the path of a ray of light through a glass slab was performed by four students I, II, III and IV. They reported the following measurements of angle of incidence i, angle of refraction r and angle of emergence e. Which one of the students has performed the experiment correctly? **(1)**

Student	Angle i	Angle r	Angle
I	60^o	35^o	59^o
II	45^o	40^o	40^o
II	35^o	30^o	40^o
IV	50^o	55^o	50^o

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

6. What is the radius of curvature of the spherical mirror in the figure given, if PA = 10 cm? **(1)**



7. Define one dioptre of power of a lens? **(1)**

8. Can a plane mirror be called a spherical mirror? **(1)**

9. What is the name given to change of path of light with change of medium? **(1)**

10. Distinguish between real and virtual image in a lens. **(3)**

11. With respect to air the refractive index of ice is 1.31 and that of rock salt is 1.54. Calculate the refractive index of rock salt with respect to ice? **(3)**

12. If p, q and r denote the object distance, image distance and the radius of curvature respectively, of a spherical mirror, then find out the relation between them. **(3)**

13. When a plane mirror is placed horizontally on the levelled ground at a distance of 40 m from the foot of a tower, the top of the tower and its image in the mirror subtend an angle of 90° at the eye. What is the height of the tower? **(3)**

14. An object 2 cm high is placed at a distance of 16 cm from a concave mirror which produces a real image 3 cm high. **(5)**

    1. Find the position of the image.
    2. What is the focal length of mirror?

15. Form the image in case an object is moved from infinity to the concave mirror. **(5)**

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Chapter 10 Reflection and Refraction

Answers

1. b. 1-A, 2-C, 3-B, 4-D

   Explanation: Refraction is the phenomenon of change in the direction of propagation of light when it passes from one transparent medium into another. Reflection is the phenomenon of bouncing of light from the interface of an opaque medium. When a ray of light passes from a denser medium to a rarer medium, the velocity of light increases. When a ray of light passes from a rarer medium to a denser medium, the velocity of light decreases.

(1) Refraction	(A) Bending of light
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(3) Rarer medium	(B) Velocity of light increases
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2. c. 9.8 cm

   Explanation: f = 11.8 - 2 = 9.8 cm

3. b. A convex lens of focal length 5 cm

   Explanation: A convex lens (converging lens) of focal length 5 cm should be used to read small letters in a dictionary. A convex lens of short focal length (5 cm) bends the light rays through large angles, by focussing them closer to the optical centre.

4. c. Remains the same

   Explanation: The frequency of light depends on the source of light and remains the same during refraction. The speed of the light changes when a ray of light passes from one medium to another. The speed of light is higher in a rarer medium than a denser medium. A ray of light travelling from a rarer medium to a denser medium slows down, due to which there is a change in the wave-length.

5. b. I

   Explanation: It is most accurate since ∠e is (nearly) equal to ∠i. The correct value of ∠e = 60^o.

6. We know that radius of curvature is twice the focal length f, so
   R = 2f = 2(PA) = 2(10) = 20 cm

7. Power of a lens is one dioptre if focal length of a lens is 1m

8. Yes, a plane mirror can be called a spherical mirror because it also obeys the laws of reflection just like the spherical mirror . The only difference is that the reflecting surface of spherical mirror is curved while that of plane mirror is straight having infinite focal length and infinite centre of curvature. It can be **called a spherical mirror** of radius of curvature equal to infinity.

9. Refraction can change path of light with change of medium.

10.

Real Image	Virtual image
1. The image can be captured on screen.	1. The image cannot be captured on screen.
2. The image is always inverted.	2. The image is always erict.
3. Light ray actually meet to form a real image.	3. Light ray do not meet to form a Virtual image

11. $(i) nia = \frac{ni}{na} = 1.31.....$
    $nra = \frac{nr}{na} = 1.54..... (ii)$
    $nri = \frac{nr}{ni} = \frac{nr}{\frac{na}{na}}$
    $nri = \frac{nr}{na} \times \frac{na}{ni} = \frac{1.54}{1.31} = 1.175$

12. From mirror formula, we have
    $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$
    Substitute the given values, we get

$\frac{1}{\frac{r}{2}} = \frac{1}{q} + \frac{1}{p}$

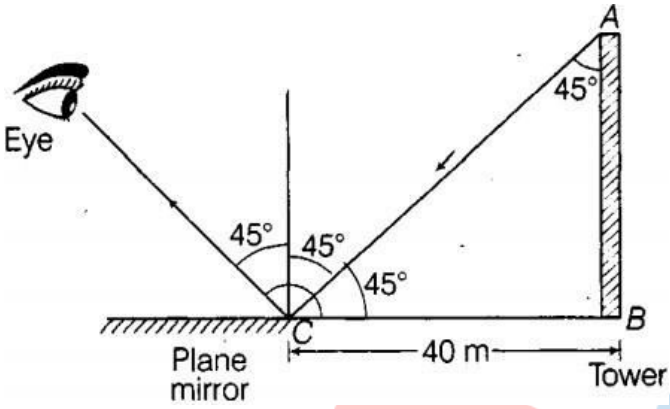
$\frac{2}{r} = \frac{p+q}{pq}$

or $\frac{r}{2} = \frac{pq}{p+q}$

$\therefore \quad r = \frac{2pq}{p+q}$

which is the required relation between the three variables.

13.



From the picture, we see that the complementary angle of depression of the light ray is 45°.

So, if AB is the tower, and CB is the distance between the tower and the mirror, then,

From the figure it is clear that

tan 45^o = h /40 (where h = AB is the height of tower)

1 = h/40

$\Rightarrow$h = 40 cm

14. Object height, h= +2 cm

Image height, h' = - 3 cm (real image hence inverted)

Object distance, u = -16 cm

Image distance, v -?

Focal length, f=?

(i) Position of image

From the expression for magnification

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

We have, v = $-u\frac{h'}{h}$

Putting values, we get v = $-(-16) \times \frac{-3}{2}$

v = -24 cm

The image is formed at distance of 24 cm in front of the mirror (negative sign means

object and image are on the same side).

(ii) Focal length of mirror

Using mirror formula, Putting values, we get

Using mirror formula,

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

Putting values, we get $\frac{1}{f} = \frac{1}{-16} + \frac{1}{-24}$

= $-\frac{3+2}{48}$

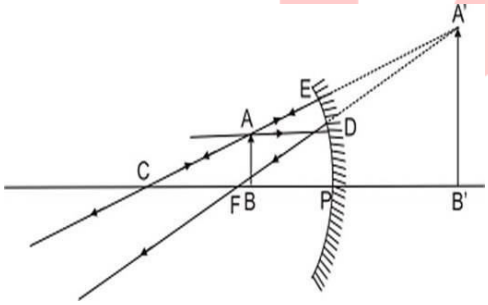
or f = $-\frac{48}{5}$

= -9.6 cm

15. Images formed by a concave mirror.

Object at Infinity. Two cases arise :

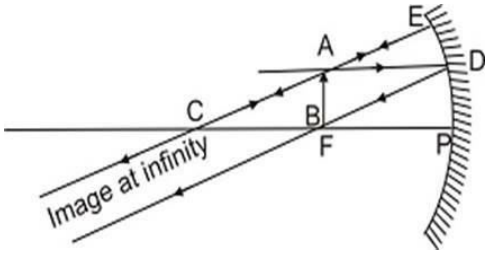
i. Object between F and P. A ray AD from A goes parallel to principal axis after reflection passes through F (rule 1). Another ray AE striking the mirror normally through C is reflected back (rule 3). They form virtual image of the object behind the mirror. The image is erect and enlarged.



Object between F and P. An erect, enlarged, virtual image is formed behind the mirror.

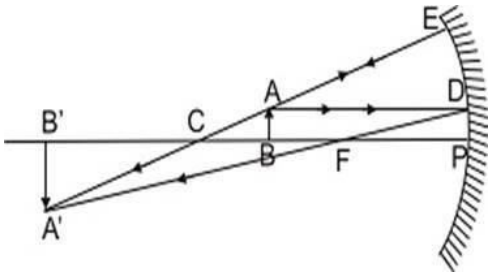
Images Formed by a Concave mirror

ii. Object at F. A ray AD parallel to principal axis passes through F. Another ray AE strikes the mirror normally at E is reflected back as it passes through C (Rule 3). They form image of object AB at infinity. The image is very much enlarged and is real and inverted.

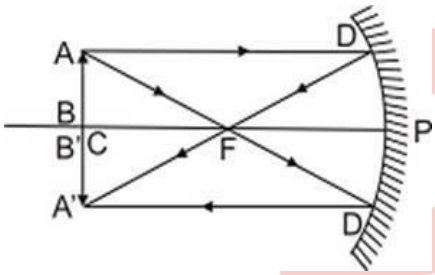


Object at E. Real, inverted, extremely enlarged image is formed at infinity.

iii. Object between F and C (f and 2f) A ray AD from object going parallel to principal axis is reflected towards F (Rule 1). Another ray AE through C is reflected back (Rule 3) forming image of A at A'. Similarly image of B is formed at B'. Image is real, inverted, enlarged and beyond C (2f) i.e. as shown in fig.

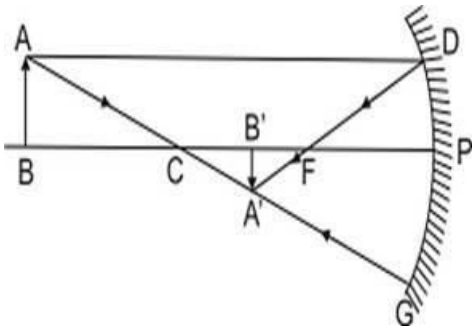


iv. Object at C i.e. at 2***f***. A ray AD from A parallel to principal axis after reflection from mirror passes through F (Rule 1). Another ray AD' from A through F, goes parallel to principal axis i.e. towards D'A' (rule 2) forming real, inverted image of AB at C i.e. at 2***f***. The image is of the same size as the object.



Object at C, Image is also at C. It is real.

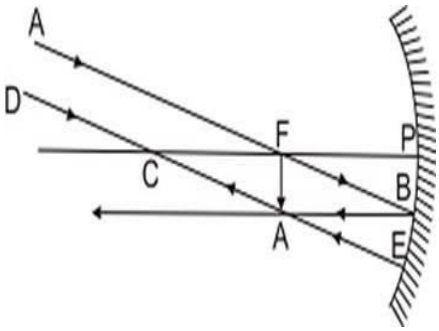
v. Object beyond C. A ray AD from A parallel to principal axis after reflection passes through F (Rule 1), Another ray from A through C, ray AG is reflected back along the same path (Rule 3), forming real, diminished, inverted image of AB is formed at A'B', between F and C.



Object beyond C, a real, inverted diminished image between F and C, inverted at C and is of same size as that of object.

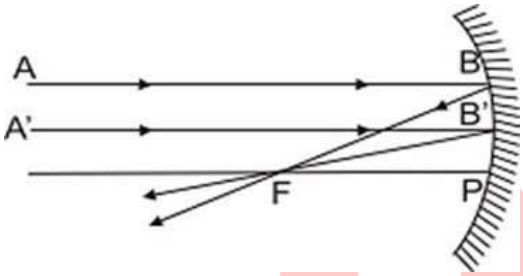
vi. When mirror is inclined so that the rays strike the mirror obliquely. The ray AB passing through F after reflection goes parallel to principal axis towards BA' (Rule 2). Another ray DE through C striking the mirror at E is reflected back. The two

form an image at A' Image is real, inverted, extremely diminished and at F.



Object at infinity, image at F. It is real, inverted, very much diminished.

vii. When mirror is in parallel plane to the object. In such a case, rays from infinity come parallel to principal axis. After reflection they pass through principal focus F (Rule 1). Image is extremely small, it is real, inverted and at principal focus.



Object at infinity, real extremely diminished image is formed at principal focus.

Position of Object	Position of Image	Size of the Image	Nature of Image
At infinity	At focus F	Highly diminished	Real and inverted
At C	At C	Same size	Real and inverted
At F	At infinity	Highly Enlarged	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
Between F and C	Beyond C	Enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect