CBSE Test Paper 03

Chapter 10 Reflection and Refraction

1. A student has to do the experiment, on finding the focal length of a given concave mirror, by using a distant object. Out of the following set ups (A, B, C, D) available to her A. a screen, a mirror holder and a scaleB. a mirror holder, a screen holder and a scaleC. a screen holder and a scaleD. a mirror holder and a screen holder **(1)**

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

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

(1) Plane mirror	(A) Virtual image, inverted and large
(2) Concave lens	(B) Virtual image, erect and same size
(3) Convex lens	(C) Virtual image, positive focal length
(4) Convex mirror	(D) Real image, negative focal length, negative power

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

3. A ray passing through the focus and falling on a convex lens will: **(1)**

   a. retrace its path
   b. will emerge parallel to principal axis
   c. will emerge through focus on other side
   d. will emerge perpendicular to principal axis

4. When light enters from air to glass, which of the following changes**: (1)**

   A. Wavelength

B. Velocity

C. Frequency

D. Amplitude

a. A and D
b. B and C
c. A and C
d. A, B and D

5. A spherical mirror and thin spherical lens - each have a focal length of -15 cm. It is likely that**: (1)**

a. The mirror is convex, but the lens is concave.
b. Both are concave
c. Both are convex
d. The mirror is concave, but the lens is convex.

6. Name the type of mirror which always forms a virtual and diminished image. **(1)**

7. If the magnification of a body of size 1 m is 2. What is the size of the image? **(1)**

8. Name the kind of surfaces that **(1)**

i. Reflect
ii. Refract most of the light falling on them.

9. What is the unit of refractive index? **(1)**

10. How can you show that if a ray enters a rectangular glass slab obliquely and emerges from the opposite face, the emergent ray is parallel to the incident ray. **(3)**

11. A convex 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. **(3)**

12. A rod of length 10 cm lies along the principal axis of a concave mirror of 10 cm in such a way that the end closer to the pole is 20 cm away from it. Find the length of image? **(3)**

13. How would you decide the medium having highest optical density and medium with lowest optical density? **(3)**

14. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm. **(5)**

i. What should be the range of distance of an object placed in front of the mirror?
ii. Will the image be smaller or larger than the object? Draw ray diagram to show the formation of image in this case.
iii. Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer. Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.

15. A student wants to project the image of a candle flame on the walls of the school laboratory by using a mirror. **(5)**

i. Which type of mirror should he use and why?
ii. At what distance, in terms of focal length f of the mirror, should he place the candle flame to get the magnified image on the wall?
iii. Draw a ray diagram to show the formation of the image in this case.
iv. Can he use this mirror to project a diminished image of the candle flame on the same wall State 'how' , if your answer is 'yes' and why not', if your answer is 'no'.

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Answers

1. d. B

   Explanation: The mirror and the screen should be firmly placed for accurate measure of the separation.

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

   Explanation: The virtual image formed by a plane mirror is virtual, erect and of the same size as that of the object. According to New Cartesian Sign Convention, the focal length (and power) of a convex lens is positive, and that of a concave lens is negative. A concave lens always produces erect and virtual images. A convex mirror always forms virtual images that are erect and diminished. The focal length of a convex mirror is positive, and that of a concave mirror is negative. A convex lens produces real and enlarged images when the object is placed beyond the centre of curvature.

(1) Plane mirror	(B) Virtual image, erect and same size
(2) Concave lens	(D) Virtual image, negative focal length, negative power
(3) Convex lens	(A) Real image, inverted and large
(4) Convex mirror	(C) Virtual image, positive focal length

3. b. will emerge parallel to principal axis

   Explanation: The ray light passing through the principal focus of the convex lens will emerge as parallel to the principal axis after refraction from the convex lens.

4. d. A, B and D

   Explanation: When light enters from one medium into another, the frequency of light does not change. Speed, wavelength and amplitude may change depending upon the optical density of the two mediums.

5. b. Both are concave

Explanation: The spherical mirror and the spherical lens - both are concave. The distance of the principal focus measured from the pole is called the focal length. According to the New Cartesian Sign Convention, the focal length of a concave mirror as well as that of a concave lens is considered negative.

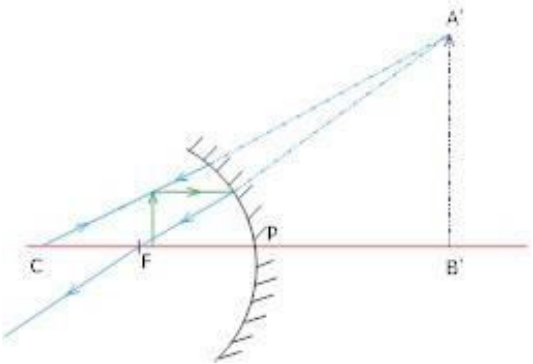
6. Convex mirror.

7. Height of object = h = 1 m
   Height of image = h' = ?
   Magnification = m = 2
   we know that,
   m = h'/h
   2 = h'/1
   h' = 2 m
   Height/size of image is 2 m

8. i. Polished opaque surfaces.
   ii. Transparent surfaces.

9. Refractive index has no units as it is a ratio of two similar physical quantities.

10. $\angle r_1 = \angle r_2$ (Alternate angles)
    At face AB $n_{21} = \frac{\sin i}{\sin r_1} \ldots\ldots (i)$
    At face CD $n_{21} = \frac{\sin e}{\sin r_2}$
    $\Rightarrow n_{12} = \frac{\sin r_2}{\sin e} \ldots\ldots\ldots (ii)$



From (i) & (ii)
$\frac{\sin i}{\sin r_1} = \frac{\sin e}{\sin r_2}$
$\Rightarrow i = e (\angle r_1 = \angle r_2)$

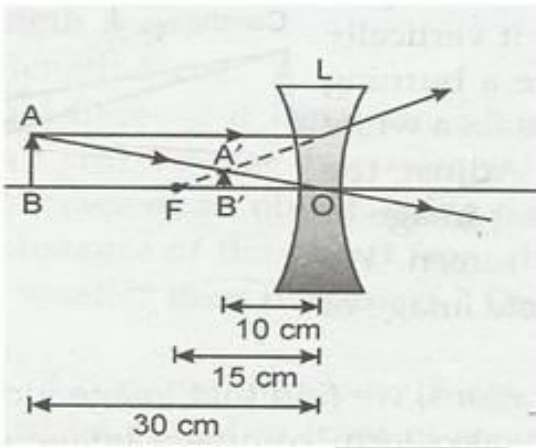
11. f = -15 cm, v = -10 cm

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

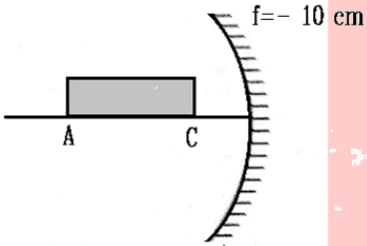
$\frac{1}{u} = \frac{1}{15} - \frac{1}{10} = -\frac{1}{30}$

u = -30 cm

Ray diagram as follows:



12. By mirror formula we have,



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

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

$\frac{1}{v_A} + \frac{1}{(-30)} = \frac{1}{-10}$

v_A = -15 cm

Also, image distance of C

v_C = -20 cm

The length of image = $|v_A - v_c|$

= |-15 - (-20)| = 5 cm

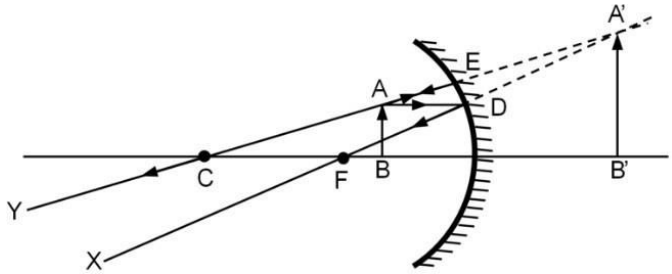
13. Optical density depends upon refractive index. Higher the refractive index, higher the optical density and vice versa.

Diamond (n = 2.42) is having maximum optical density and air (n = 1.0003) is having least optical density.

14. i. In concave mirror erect image is formed only when the object is placed between

pole and focus. Thus, range to obtain erect image is $0 < u < 12$.

ii. The image would be larger than the object

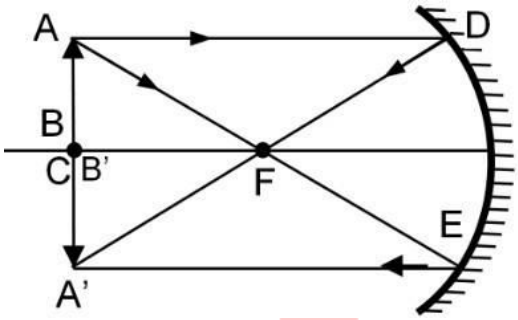


iii. If the object distance is 24 cm which is the approx position of centre of curvature, then the image will be formed at the same position. Here, f = -12 cm, u =-24 cm, v=?

By using mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{-12} - \frac{1}{(-24)}$$

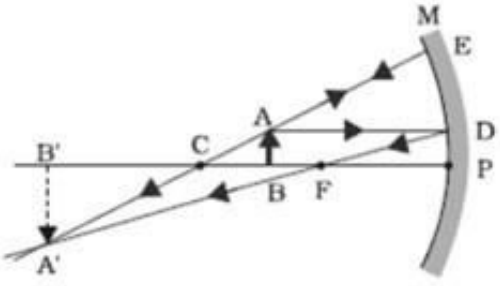
$\Rightarrow$ v = -24 cm



15. i. The student should use a Concave mirror because a concave mirror produces real images.

ii. To get magnified image, the student should put the candle flame between f and 2f.

iii. The ray diagram will be as follows:



iv. Yes, concave mirror can be used to obtain a diminished image. When the object is placed beyond 2f, then the image formed will be diminished one.