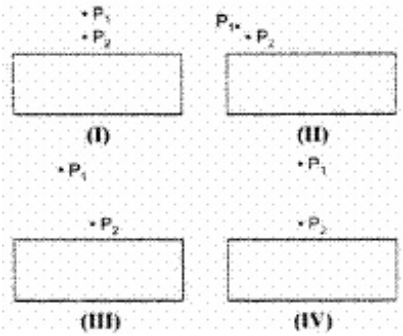
**CBSE Test Paper 04**

**Chapter 10 Reflection and Refraction**

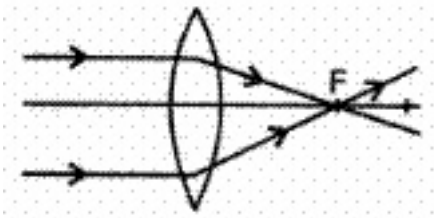
1. The two dots $P_1$ and $P_2$ shown in each of the following diagrams, I, II, III and IV denote the position of two pins in respect of distance and direction for performing an experiment on tracing the path of a ray of light passing through a rectangular glass slag. In which one of the four cases, one is likely to get best result ? **(1)**



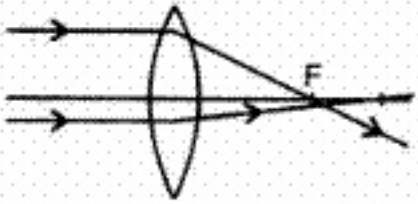

   a. II
   b. III
   c. I
   d. IV

2. Which of the following diagrams give a correct picture? **(1)**

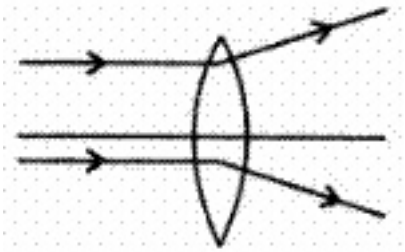
a.

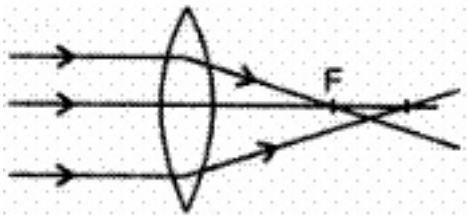



b.

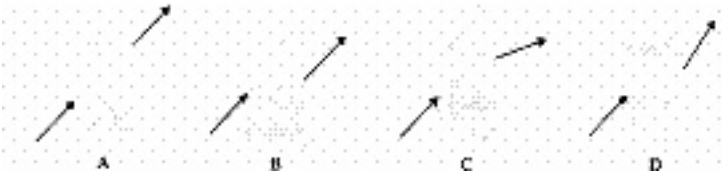



c.



d. 


3. Four students showed the following traces of the path of a ray of light passing through a rectangular glass slab. **(1)**




The trace most likely to be correctly is that of student

1. A
2. B
3. D
4. C

4. If $f_1$ and $f_2$ are the focal lengths of two lenses, what is the relation for equivalent focal length? **(1)**

a. $\frac{2(f_1 + f_2)}{2f_1 \times f_2}$
b. $\frac{f_1 \times f_2}{f_1 + f_2}$
c. $\frac{2f_1 \times f_2}{f_1 + f_2}$
d. $\frac{f_1 + f_2}{f1 \times f2}$

5. A student is to find the focal length of a **(1)**

(i) concave mirror,

(ii) convex lens by using a distant object.

He will observe that the screen is on the same side as the object

i. in both the cases
ii. in case (ii) but not in case (i)
iii. in case (i) but not in case (ii)
iv. in neither of the two cases

6. What is magnification of lens? **(1)**

7. Find out, from Table (10.3), the medium having highest optical density. Also, find the medium with lowest optical density. **(1)**

8. Give the cartesian sign convention for: **(1)**

    a. height of a real image, and
    b. height of a virtual image.

9. What is refractive index ? **(1)**

10. A mirror has magnification 0.4, what type of the mirror is that? and what type of the image is formed ? **(3)**

11. How is focal length related to radius of curvature of the mirror ? **(3)**

12. Find the position, nature and size of the image formed by a convex lens of focal length 12 cm of an object 5 cm high placed at a distance 20 cm from it. **(3)**

13. Define the term power of a lens. Give its SI unit. State whether the power of a converging lens is positive or negative. **(3)**

14. i. Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.
    ii. In the above ray diagram mark the object distance (u) and the image distance (v) with their proper signs (+ ve or - ve as per the new cartesian sign convention) and state how these distances are related to the focal length (f) of the convex lens in this case.
    iii. Find the power of convex lens which forms a real and inverted image of magnification -1 of an object placed at a distance of 20 cm from its optical centre. **(5)**

15. An object 5 cm high is placed at a distance of 10 cm from a convex mirror of radius of curvature 30 cm. Find the nature, position and size of the image. **(5)**

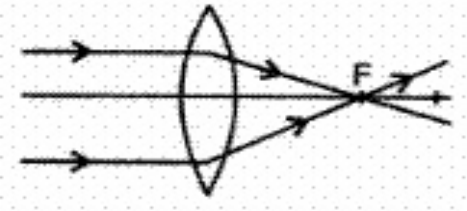
## CBSE Test Paper 04

## Chapter 10 Reflection and Refraction

### Answers

1. b. III

   **Explanation:** Not too large or not too small is the angle of incidence. General range (30°- 60°).

2. a. 


   **Explanation:** All rays passing parallel to the axis will pass through the focus after refraction in the lens.

3. b. B

   **Explanation:** The emergent ray, from the rectangular glass slab, is parallel to the incident ray and is laterally displaced to the left (or lower side) of the incident ray.

4. b. $\frac{f_1 \times f_2}{f_1 + f_2}$

   **Explanation:** The net power of the lenses placed in contact is given by the algebraic powers of the individual powers.

   Equivalent power of the lens combination $P = P_1 + P_2$

   $\therefore \frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$ where $f_1$ and $f_2$ are the focal lengths of the two lenses, and F is the focal length of the combination.

   $\frac{1}{F} = \frac{f_1 + f_2}{f_1 \times f_2} \Longrightarrow F = \frac{f_1 \times f_2}{f_1 + f_2}$

5. c. in case (i) but not in case (ii)

   **Explanation:** Mirror reflects while the lens refracts the light.

6. Magnification of a lens is to the ratio of the height of the image formed by lens to the actual height of object.

   If h is the height of the object and h' the height of the image formed by lens, then magnification $m = \frac{h'}{h}$

If u and v are the distances of object and image

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

7. As per table, diamond has highest optical density (2.42). Medium with lowest optical density is air (1.0003)

8. (a) - ve, and (b) + ve.

9. The ratio between the sine of angle of incidence (in air) to the sine of angle of refraction (in a denser medium) is called refractive index.

10. It is a convex mirror since the magnification is positive as well as less than one. Image is diminished and erect.

11. R = 2 $f$ or $f = \frac{R}{2}$

12. F = 12 cm

    h = 5 cm

    v = -20 cm

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

    $\frac{1}{12} = -\left(\frac{1}{-20}\right) + \frac{1}{v}$

    $\frac{1}{v} = \frac{1}{20} - \frac{1}{12}$

    $\frac{1}{v} = -\frac{12+20}{240} = \frac{08}{240}$

    $v = \frac{240}{8} = 30cm.$

    The positive sign of v shows that the image formed on the other side of the optical centre of the lens.

    $m = \frac{v}{u} = \frac{30}{-20} = -1.5$

    m is negative so the image is real and inverted hence it is formed below principal axis.

    $\frac{h_1}{h} = \frac{v}{u}$

    $\frac{h_1}{5} = -1.5$

    $h_1 = -1.5 \times 5$

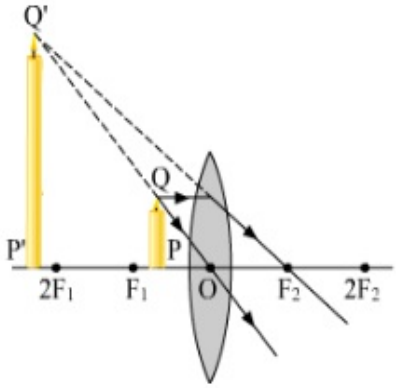
    $h_1 = -7.5cm$. The image is enlarged,

13. Power of a lens is defined as the reciprocal of its focal length f (in metres).

    P = $\frac{1}{f(in\ \mathrm{m})}$

    The Si unit of power of a lens is Diopter. The power of a converging lens is positive as f is +ve.

14. i.




    ii. U is -ve,V is -ve. By lens formula:

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

    $\Rightarrow \quad \frac{-1}{v} - \left(-\frac{1}{u}\right) = \frac{1}{f} \Rightarrow \frac{-1}{v} + \frac{1}{u} = \frac{1}{f}$

    $\Rightarrow \quad \frac{-u+v}{uv} = \frac{1}{f} \Rightarrow \quad f = \frac{uv}{v-u}$

    This is a required relation between u, v and f in the case when object is placed between optical centre and principal focus of convex lens

    iii. Given, m =-1

    u = -20 cm

    $\therefore$ m= $\frac{v}{u} \Rightarrow -1 = \frac{v}{-20}$

    $\Rightarrow$ v = 20 cm

    By lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

    $\Rightarrow \quad \frac{1}{20} - \left(\frac{-1}{20}\right) = \frac{1}{f} \Rightarrow \frac{1}{20} + \frac{1}{20} = \frac{1}{f}$

    $\Rightarrow \quad \frac{1}{10} = \frac{1}{f} \Rightarrow \ f \ = \ 10\ cm$

    $\therefore \ Power, \ p \ = \ \frac{1}{f} = \frac{1}{10\times10^{-2}} = 10D$

    $\Rightarrow$ P = 10 D

15. Here u = - 10 cm (u is always negative), v = ?

    $f = \ \frac{r}{2} = \frac{+30}{2} \ or \ f \ = +15cm$

    f and r for convex mirror are always positive.

Using the formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ we have $\frac{1}{15} = \frac{1}{v} - \frac{1}{10}$ or

$\frac{1}{v} = \frac{1}{15} + \frac{1}{10} = \frac{5}{30}v$

v = +6 cm

or ∴ Image is 6 cm behind the mirror (right or mirror).

It is virtual and errect.

Magnification $m = -\frac{v}{u} = \frac{-(+6)}{-10} = 0.6$

Hence image is 0.6 times the size of the object.

Again $m = \frac{h_2}{h_1}$ where $h_2$ is the size of the image and $h_1$ the size of the object.

∴ $h_2 = mh_1 = 0.6(5) = 3$ cm.

Hence image is 3 cm. high.