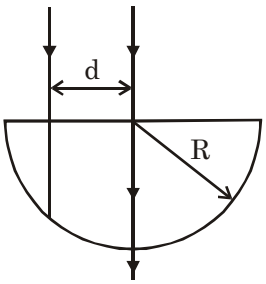
CLASS TEST

SECTION-I

Single Correct Answer Type **5 Q. [3 M (–1)]**

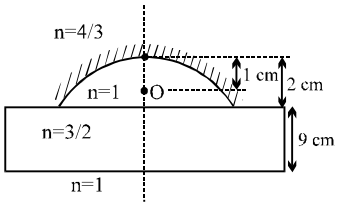
1. As shown, a narrow beam of light is incident onto a semi-circular glass cylinder of radius R. Light can exit the cylinder when the beam is at the centre. When the beam is moved parallarly to a distance d from the central line, no light can exit the cylinder from its lower surface. Find the refractive index of the glass.



(A) $\frac{R}{d}$ (B) $\frac{d}{R}$

(C) $\frac{R}{\sqrt{R^2-d^2}}$ (D) $\frac{\sqrt{R^2-d^2}}{R}$

2. A concave mirror of focal length 2 cm is placed on a glass slab as shown in the figure. Then the image of object O formed due to reflection at mirror and then refraction by the slab :



(A) will be virtual and will be at 2 cm from the pole of the concave mirror

(B) will be virtual and formed on the pole of the mirror

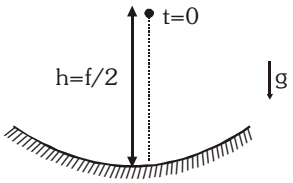
(C) will be real and on the object itself

(D) none of these

3. An object was placed upright 25 cm in front of a converging lens with a focal length of 20 cm. A concave mirror with a focal length of 15 cm was placed 120 cm behind the lens. Which of these describes the final image?

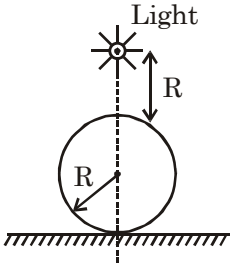
(A) real, enlarged (B) virtual, upright (C) virtual, inverted (D) inverted, diminished

4. A particle is dropped along the axis from a height $\frac{f}{2}$ on a concave mirror of focal length f as shown in figure. The maximum speed of image is :



(A) ∞ (B) $\frac{3}{4}\sqrt{3fg}$ (C) $\frac{3}{2}\sqrt{3fg}$ (D) None of these

5. An opaque sphere of radius R lies on a horizontal plane. A light source is placed above sphere as shown. Then



(i) area of shadow on the plane is $2\pi R^2$

(ii) area of shadow on the plane is $3\pi R^2$

(iii) if the sphere is just submerged in some liquid, area of the shadow on plane decreases

(iv) if the sphere is just submerged in some liquid, area of the shadow on plane increases

(A) (i), (ii) (B) (ii), (iii) (C) (i), (iii) (D) (ii), (iv)

Multiple Correct Answer Type 4 Q. [4 M (–1)]

6. A lens forms 3 times magnified image of an object on screen. When the distance between the screen and the lens is increased by 10 cm and object is also moved to get 5 times magnified image again on the screen. Then :-

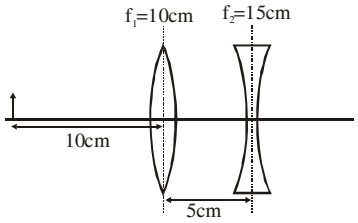
(A) Focal length of the lens is 5 cm

(B) Focal length of the lens is –5 cm

(C) The displacement of the object is 2/3 cm towards the lens

(D) The displacement of the object is 2/3 cm away the lens

7. An object is placed nearly at focus of a converging lens of focal length 10 cm as shown in figure. A diverging lens of focal length of 15 cm is placed 5 cm behind the converging lens as shown in the figure.



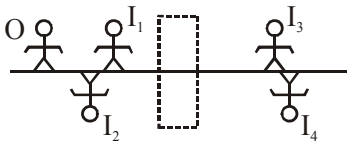
(A) Final image forms at the object

(B) Image forms at a distance 30 cm from concave lens

(C) Magnification of image is 1.5

(D) Magnification can not be determined.

8. In figure, stick figure O stands in front of a thin, symmetric mirror that is mounted within the boxed region; the central axis through the mirror is shown. The four stick figures I_1 to I_4 suggest general locations and orientations for the images that might be produced by the mirror. (The figure are only sketched in; their height and their distance from the mirror is not drawn to scale.)



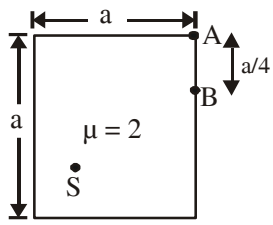
(A) I_4 cannot be a possible image

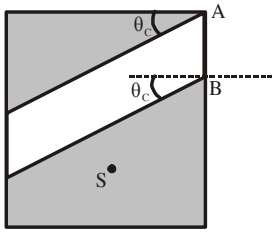
(B) I_1 cannot be a possible image.

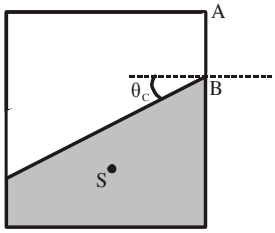
(C) If I_2 is an image, mirror must be concave only.

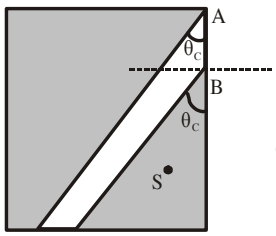
(D) If I_3 is an image, mirror must be convex only.

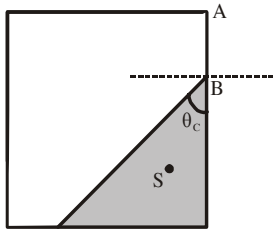
9. Figure shows a transparent block of front sides 'a' and 'a'. The third dimension of the block is negligible. A point source S which can emit light in all directions can move inside the block. It is desired that no direct light of 'S' should pass through AB. The region in which S should be present to satisfy this condition shown by shaded region. Choose correct option.



(A)


(B)


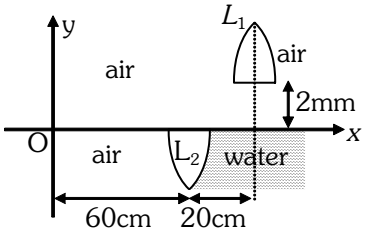
(C)


(D)


Linked Comprehension Type (1 Para × 3Q.) [3 M (-1)]
(Single Correct Answer Type)

Paragraph for Question 10 to 12

A point object O is placed at the origin of coordinate system. An equi–convex thin lens ($\mu_g = 1.5$) of focal length f=20 cm in air is placed so that its principal axis is along x–axis. Now the lens is cut at the middle (along the principal axis) and upper half is shifted along x–axis and y–axis by 20 cm and 2 mm respectively and right side of lower half is filled with water ($\mu_w = 4/3$) as shown in figure.



10. Total number of images formed by the combination will be

(A) 1 (B) 2 (C) 3 (D) 4

11. Coordinates of the image produced by the lens L_1 will be

(A) $\left(\frac{320}{3}\text{cm}, \frac{4}{3}\text{mm}\right)$ (B) $\left(\frac{160}{3}\text{cm}, \frac{8}{3}\text{mm}\right)$ (C) $\left(\frac{320}{3}\text{cm}, \frac{8}{3}\text{mm}\right)$ (D) $\left(\frac{160}{3}\text{cm}, \frac{4}{3}\text{mm}\right)$

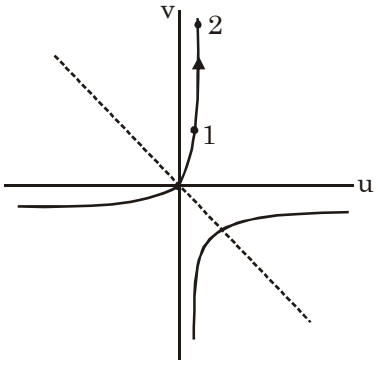
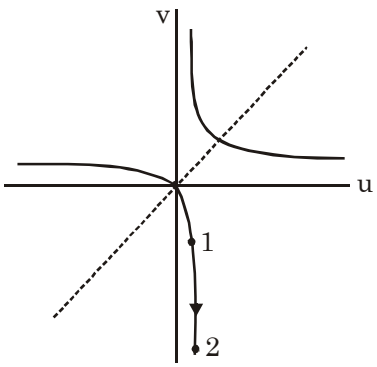
12. Coordinates of the image produced by the lens L_2 will be

(A) 140cm, 0 (B) 140cm, 20 (C) 70cm, 0 (D) 140cm, 30

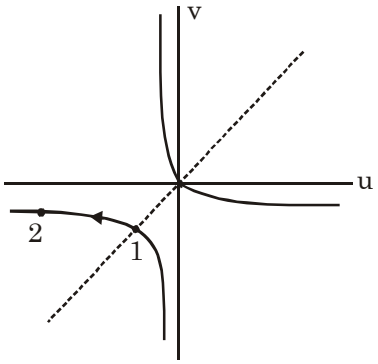
Matching list based comprehension Type (4 × 4 × 4) 1 Table × 3 Q. [3(–1)]
Single option correct (Three Columns and Four Rows)

Answer Q.13, Q.14 and Q.15 by appropriately matching the information given in the three columns of the following table.

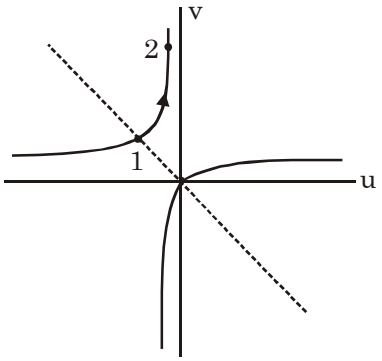
In the below question u and v represents distance of object and image from the lens/mirror. Both are measured using usual conventional method i.e. distance in the direction of incident rays are positive and opposite to incident rays are negative. Column 2 gives the nature of optical element and column 3 gives the variation of image distance from lens/mirror as object distance changes. To answer the related questions we have to consider the part of graph from 1 to 2 as shown in column 3.

Column-1	**Column-2**	**Column-3**
(I) $u < 0$ $v > 0$	(i) Convex mirror	(P) 
(II) $u > 0$ $v > 0$	(ii) Convex lens	(Q) 

(III) u < 0 v < 0 (iii) Concave mirror (R)



(IV) u > 0 v < 0 (iv) Concave lens (S)



13. In which of the following case. Real image of virtual object is moving away from mirror/lens:-
(A) (I) (iii) (R) (B) (II) (iv) (P) (C) (II) (ii) (P) (D) (III) (i) (S)

14. Which of the following represents real image of real object going towards mirror/lens :-
(A) (IV) (ii) (S) (B) (II) (i) (R) (C) (III) (iii) (R) (D) (I) (iii) (P)

15. Which represents real image of real object going away from mirror/lens :-
(A) (I) (ii) (S) (B) (III) (i) (P) (C) (III) (iv) (R) (D) (II) (iii) (Q)

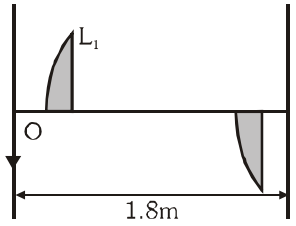
SECTION-III

Numerical Grid Type (Ranging from 0 to 9) 4 Q. [4 M (0)]

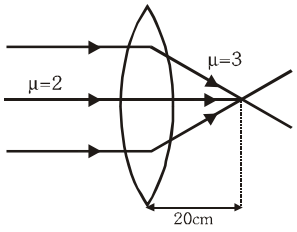
1. When a bright source is placed 30 cm in front of a lens there is an erect image 7.5 cm from the lens. There is also of faint inverted image 6 cm in front of the lens due to reflection from the front surface of the lens. When the lens is turned around this faint inverted image is seen 10 cm in front of the lens.

Refractive index of the lens is $1+\frac{x}{10}$. Find the value of x.

2. A thin plano-convex lens of focal length f is split into two halves, one of the halves is shifted along the optical axis. The separation between object and image plane is 1.8 m. The magnification of the image formed by one of the half lenses is 2. Find the focal length of the lens in decimetre. [1 decimeter = 10cm]

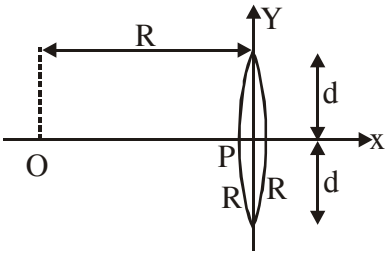


3. A convex lens is placed in such a way that the left side of lens has refractive index 2 and right of lens has refractive index 3. If parallel ray coming from left side focus at 20 cm from lens, the distance from lens where rays will focus if they are coming from right side is $\frac{20n}{3}$ cm. Find the value of n.



4. A biconvex thin lens of radius of curvature R is made up of variable refractive index $\mu = 2\left(1+\frac{|y|}{d}\right)$. Assume very small aperture 2d << R.

A point object O is placed at a disatnce R = 7.5 m on the principal axis from the lens (as shown). Due to variable refractive index of lens, there are infinite number of image on the principal axis. These image are spreaded over the length ℓ. Find the value of ℓ (in m).

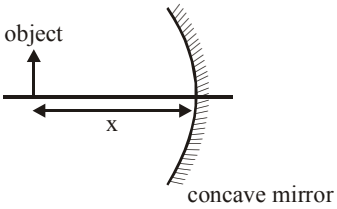


SECTION-IV

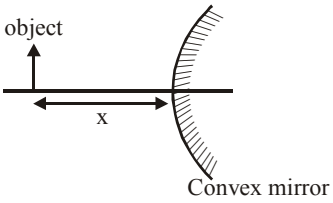
Matrix Match Type (4 × 5) 1 Q. [8 M (for each entry +2(0)]

1. In column I, all the objects (x ≥ 0) shown are real. In column II, nature of image is mentioned. Rays are paraxial, consider all the possibilities of nature of images then match column-I with column-II.

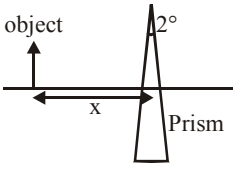
Column-I **Column-II**

(A) 

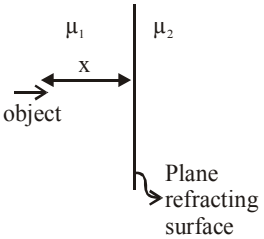
(P) Real

(B) 

(Q) Virtual

(C) 

(R) Magnified (Large)

(D) 

(S) Diminished (Small)

(T) Same size

CLASS TEST # 11 (TNAS) **ANSWER KEY**

SECTION-I

Single Correct Answer Type **5 Q. [3 M (–1)]**

1. Ans. (A) **2. Ans. (D)** **3. Ans. (A)** **4. Ans. (B)**

5. Ans. (B)

Multiple Correct Answer Type **4 Q. [4 M (–1)]**

6. Ans. (A,C) **7. Ans. (A,C)** **8. Ans. (A,B,C)** **9. Ans. (B, D)**

Linked Comprehension Type **(1 Para × 3Q.) [3 M (-1)]**

(Single Correct Answer Type)

10. Ans. (B) **11. Ans. (C)** **12. Ans. (A)**

Matching list based comprehension Type (4 × 4 × 4) **1 Table × 3 Q. [3(–1)]**

Single option correct **(Three Columns and Four Rows)**

13. Ans. (B) **14. Ans. (C)** **15. Ans. (A)**

SECTION-III

Numerical Grid Type (Ranging from 0 to 9) **4 Q. [4 M (0)]**

1. Ans. 6 **2. Ans. 4** **3. Ans. 2** **4. Ans. 6**

SECTION-IV

Matrix Match Type (4 × 5) **1 Q. [8 M (for each entry +2(0)]**

1. Ans. (A) P,Q,R,S,T; (B) Q,S,T; (C) Q,T; (D) Q,R,S,T