DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | **Start Time :** | **End Time :**

PHYSICS

CP21

SYLLABUS : Ray Optics and Optical Instruments

Max. Marks : 74 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 20 Questions divided into 5 sections.
  Section I has **5** MCQs with ONLY 1 Correct Option, **3** marks for each correct answer and **–1** for each incorrect answer.
  Section II has **4** MCQs with ONE or MORE THAN ONE Correct options.
  For each question, marks will be awarded in one of the following categories:
  Full marks: **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  Partial marks: **+1** For darkening a bubble corresponding to each correct option provided NO INCORRECT option is darkened.
  Zero marks: If none of the bubbles is darkened.
  Negative marks: **–2** In all other cases.
  Section III has **4** Single Digit Integer Answer Type Questions, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section IV has Comprehension/Matching Cum-Comprehension Type Questions having **5** MCQs with ONLY ONE correct option, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section V has **2** Matching Type Questions, **2** mark for the correct matching of each row and 0 marks in all other cases.
- You have to evaluate your Response Grids yourself with the help of Solutions.

Section I - Straight Objective Type

This section contains 5 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

1. A thin convex lens made from crown glass $\left(\mu = \frac{3}{2}\right)$ has focal length f. When it is measured in two different liquids having refractive indices $\frac{4}{3}$ and $\frac{5}{3}$, it has the focal lengths f_1 and f_2 respectively. The correct relation between the focal lengths is:

(a) $f_1 = f_2 < f$

(b) $f_1 > f$ and f_2 becomes negative

(c) $f_2 > f$ and f_1 becomes negative

(d) f_1 and f_2 both become negative

2. Light is incident from a medium into air at two possible angles of incidence (A) 20° and (B) 40°. In the medium, light travels 3.0 cm in 0.2 ns. The ray will :

(a) suffer total internal reflection in both cases (A) and (B)

(b) suffer total internal reflection in case (B) only

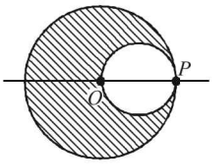
(c) have partial reflection and partial transmission in case (B)

(d) have 100% transmission in case (A)

RESPONSE GRID	1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ

Space for Rough Work

3. A transparent sphere of radius R has a cavity of radius $R/2$ as shown in figure. Find the refractive index of the sphere if a parallel beam of light falling on left surface focuses at point P.



(a) $\mu = \frac{3+\sqrt{5}}{2}$ (b) $\mu = \frac{3-\sqrt{5}}{2}$

(c) $\mu = 3+\sqrt{5}$ (d) $\mu = \frac{1+\sqrt{5}}{2}$

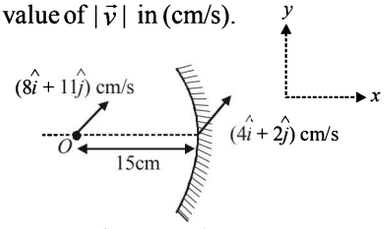
4. A point object is located at a distance 15cm. from the pole of a concave mirror of focal length 10cm on its principal axis is moving with a velocity $(8\hat{i}+11\hat{j})$ cm/s and velocity of mirror is $(4\hat{i}+2\hat{j})$ cm/s as shown. If $\vec{v}$ is the velocity of image, then find the value of $|\vec{v}|$ in (cm/s).

(a) 20

(b) 30

(c) 10

(d) 40



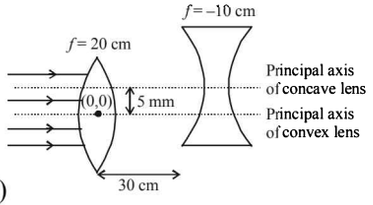
5. If the optical axis of convex and concave lenses are separated by a distance 5 mm as shown in the figure. Find the coordinate of the final image formed by the combination if parallel beam of light is incident on convex lens, origin is at optical centre.

(a) (25 cm, 0.5 cm)

(b) (25 cm, 0.25 cm)

(c) (25 cm, – 0.5 cm)

(d) (25 cm, – 0.25 cm)



Section II - Multiple Correct Answer Type

This section contains 4 multiple correct answer(s) type questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONE OR MORE** is/are correct.

6. A plano–convex lens is made of a material of refractive index n. When a small object is placed 30 cm away in front of the curved surface of the lens, an image of double the size of the object is produced. Due to reflection from the convex surface of the lens, another faint image is observed at a distance of 10 cm away from the lens. Which of the following statement(s) is(are) true?

(a) The refractive index of the lens is 2.5

(b) The radius of curvature of the convex surface is 45 cm

(c) The faint image is erect and real

(d) The focal length of the lens is 20 cm

7. An object of length 2 cm is placed perpendicular to the principal axis of a convex lens of focal length 12 cm. If the object is at a distance of 8 cm from lens, then

(a) height of the image is 6 cm

(b) image formed is erect

(c) magnification is 3

(d) image distance is 24 cm

8. Remote objects are viewed through a converging lens with a focal length $F = 9$ cm placed at a distance $a = 36$cm in front of the eye. Assume that the radius r of the pupil is approximately 1.5 mm. Choose the correct options.

(a) The minimum radius of the screen that should be placed behind the lens so that the entire field of view is covered is 0.5mm.

(b) The minimum radius of the screen that should be placed behind the lens so that the entire field of view is covered is 1.0 mm.

(c) The screen must be placed in the plane S with its centre at point B.

(d) The screen must be placed perpendicular to the plane S with its centre at point B.

9. A planet is observed by an astronomical refracting telescope having an objective of focal length 16 m and an eyepiece of focal length 2 cm.

(a) The distance between the objective and the eyepiece is 16.02 m

(b) The angular magnification of the planet is – 800

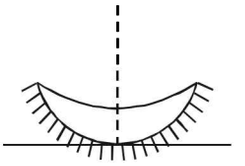
(c) The image of the planet is inverted

(d) The objective is larger then the eyepiece

Section III - Integer Type

This section contains 4 questions. The answer to each of the questions is a single digit integer ranging from 0 to 9.

10. The convex surface of a thin concavo-convex lens of glass of refractive index 1.5 has a radius of curvature 20 cm. The concave surface has a radius of curvature 60 cm. The convex side is silvered and placed on a horizontal surface.

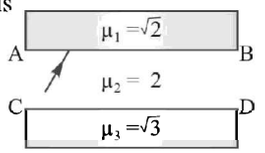


At 3x distance (in centimetre) should a pin be placed on the optical axis such that its image is formed at the same place. Calculate the value of x.

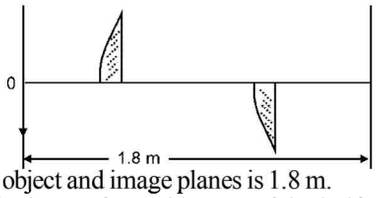
RESPONSE GRID								
	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ
	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓪①②③④⑤⑥⑦⑧⑨

Space for Rough Work

11. AB and CD are surfaces of two slabs as shown in figure. The medium between the slabs has refractive index 2, refractive index of slab above AB is $\sqrt{2}$ and below CD is $\sqrt{3}$. (10x)° is the minimum angle of incidence, so that the ray is totally reflected by both the slabs. Find the value of x.



12. A thin plano-convex lens of focal length *f* is split into two halves and one of the halves is shifted along the optical axis.



The separation between object and image planes is 1.8 m. The magnification of the image formed by one of the half-lenses is 2. If $\frac{x}{5}$ is the focal-length of the lens (in m) then find the value of x.

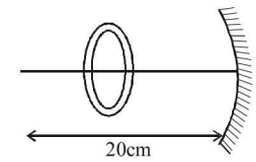
13. A telescope has an objective of focal length 50 cm and an eye piece of focal length 5 cm. The least distance of distinct vision is 25 cm. The telescope is focussed for distinct vision on a scale 200 cm away from the objective. Calculate x, if $\frac{425}{x}$ is the separation (in cm) between the objective and the eye-piece.

Section IV - Comprehension/Matching Cum-Comprehension Type

Directions (Qs. 14 and 15) : Based upon the given paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

PARAGRAPH

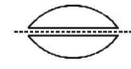
A concave mirror of radius of curvature 20cm is shown in the figure. A circular disc of diameter $(1.0 + 0.2t)$ cm is placed on the principal axis of mirror with its plane perpendicular to the principal axis at a distance 15cm from the pole of the mirror.



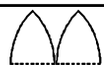
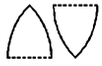
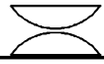
14. The image formed by the mirror will be in the shape of a
(a) circular disc
(b) elliptical disc with major axis horizontal
(c) elliptical disc with major axis vertical
(d) distorted disc

15. In the above question, the area of the image of the disc at $t = 1$ second is
(a) $1.2\pi\,cm^2$ (b) $1.44\pi\,cm^2$
(c) $1.52\pi\,cm^2$ (d) $1.64\pi\,cm^2$

Directions (Qs. 16-18) : This passage contains a table having 3 columns and 4 rows. Based on the table, there are three questions. Each question has four options (a), (b), (c) and (d) **ONLY ONE** of these four options is correct.

A lens of focal length f is cut into two equal parts as shown in figure.  or  ,

Column I shows different combinations of these two parts. Column II gives equivalent focal length of the combination and column III the corresponding power.

Column I		Column II		Column III	
I.		(i)	∞	(P)	1/2f
II.		(ii)	f/2	(Q)	0
III.		(iii)	f	(R)	1/f
IV.		(iv)	2f	(S)	2/f

16. If focal length of complete lens is f, then the correct matching is
(a) III (iii) R (b) III (ii) R (c) III (i) R (d) III (ii) Q

17. If focal length of the complete lens is f= 10cm, then focal length of the combination shown in figure Column I (IV) is 10cm. Which of the following is the correct matching satisfying the above condition?
(a) IV (iii) R (b) IV (i) R (c) IV (ii) S (d) IIII (i) Q

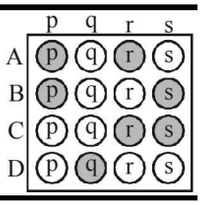
18. Which of the following options shows the correct matching?
(a) I (ii) S (b) II (i) Q (c) III (iv) R (d) Both (a) and (b)

RESPONSE GRID				
11. ⓪①②③④⑤⑥⑦⑧⑨	12. ⓪①②③④⑤⑥⑦⑧⑨			
13. ⓪①②③④⑤⑥⑦⑧⑨	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	
17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ			

Space for Rough Work

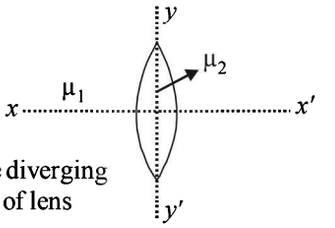
Section V - Matrix-Match Type

This section contains 2 questions. It contains statements given in two columns, which have to be matched. Statements in column I are labelled as A, B, C and D whereas statements in column II are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-p, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



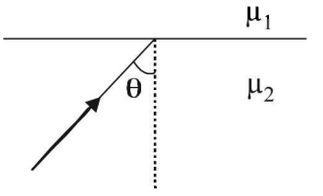
19. A convex lens of refractive index μ_2 is kept in a medium of refractive index μ_1 as shown.

Match the two columns:



Column-I	Column-II
(A) On increasing value of μ_1 lens will be	(p) $\lvert f\rvert$ increases and lens will be converging
(B) If $\mu_1 > \mu_2$	(q) $\lvert f\rvert$ may decrease or increase and lens will be diverging
(C) When lens is cut into two parts along yy', then for any one part	(r) $\lvert f\rvert$ increases and nature of lens remains unchanged
(D) μ_1 is increased but $\mu_1 < \mu_2$	(s) $\lvert f\rvert$ increases then decreases

20. A ray of light strikes at the boundary separating two media at angle θ . μ_1 and μ_2 are refractive indices of media with ($\mu_2 > \mu_1$).



Column I	Column II
(A) When $\theta < \sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$ then deviation in the path of ray is	(p) $\frac{\pi}{2} - \sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$
(B) Maximum deviation in the path of ray for refraction at boundary	(q) $\pi - 2\sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$
(C) Maximum deviation in the path of ray for reflection at the boundary	(r) Zero
(D) Deviation in the path at grazing angle of incidence	(s) $\sin^{-1}\left(\frac{\mu_2}{\mu_1}\sin\theta\right) - \theta$

RESPONSE GRID	19. A - (p)(q)(r)(s); B - (p)(q)(r)(s); C - (p)(q)(r)(s); D - (p)(q)(r)(s) 20. A - (p)(q)(r)(s); B - (p)(q)(r)(s); C - (p)(q)(r)(s); D - (p)(q)(r)(s)

DAILY PRACTICE PROBLEM DPP CP21 - PHYSICS			
Total Questions	20	Total Marks	74
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	24	Qualifying Score	35

$$\text{Net Score} = \sum_{i=1}^{V}\left[\left(\text{correct}_i \times MM_i\right) - \left(In_i - NM_i\right)\right]$$

Space for Rough Work