DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

PHYSICS 49

SYLLABUS : RAY OPTICS-1 (Reflection on plane mirrors and curved mirrors)

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.22) : There are 22 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

Q.1 Find the number of images formed by two mutually perpendicular mirrors –

(a) 3 (b) 4 (c) 1 (d) 2

Q.2 The angle θ between two plane mirrors producing five images of a given object is given by.

(a) $30^\circ \le \theta \le 72^\circ$ (b) $45^\circ \le \theta \le 72^\circ$

(c) $60^\circ \le \theta \le 72^\circ$ (d) $15^\circ \le \theta \le 72^\circ$

Q.3 Two mirrors are inclined at an angle of 50º. Then what is the number of images formed for an object placed in between the mirrors ?

(a) 3 (b) 6 (c) 1 (d) 7

Q.4 Two plane mirrors are inclined at an angle θ. A ray of light is incident on one mirror at an angle of incidence i. The ray is reflected from this mirror, falls on the second mirror from where it is reflected parallel to the first mirror. What is the value of i, the angle of incidence in terms θ ?

(a) $2\theta - 90^\circ$ (b) $4\theta - 90^\circ$

(c) $\theta - 90^\circ$ (d) $3\theta - 90^\circ$

Q.5 A girl stands at a distance 30 cm from the mirror. She is able to see her erect image but of 1/5 height of actual height. The mirror will be :

(a) plane mirror (b) concave mirror

(c) convex mirror (d) plane convex mirror

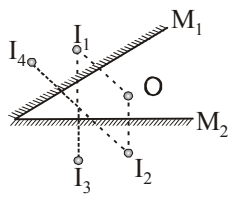
RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

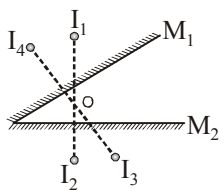
Space for Rough Work

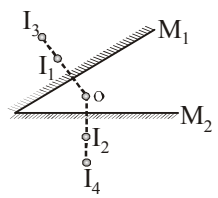
Q.6 An object is placed at a distance of 50 cm from a convex mirror. A plane mirror is placed in front of the convex mirror in such a way that it convers half of the convex mirror. If the distance between object and plane mirror is 30 cm then there is no parallax between the images formed by two mirrors , the radius of curvature of convex mirror will be :

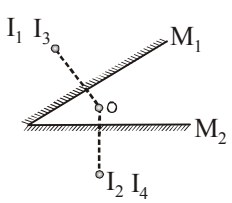
(a) 50 cm (b) 25 cm (c) 12.5 cm (d) 100cm

Q.7 Two plane mirrors are inclined at an angle of 30°. Then the first four images of an object O placed between the two mirrors are correctly represented by

(a) 

(b) 

(c) 

(d) 

Q.8 The plane of a mirror makes an angle of 30° with horizontal. If a vertical ray is incident on a mirror, then what is the angle between mirror and reflected ray ?

(a) 60° (b) 90° (c) 45° (d) 30°

Q.9 Two plane mirrors are placed at an angle α so that a ray parallel to one mirror gets reflected parallel to the second mirror after two consecutive reflections. The value of α will be

(a) 30° (b) 60° (c) 75° (d) 90°

Q.10 A 0.2 cm high object is placed 15 cm from a concave mirror of focal length 5 cm. Find position and size of the image.

(a) 7.5 cm, 0.1 cm. (b) 7.5 cm, 0.4 cm.

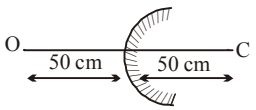
(c) 10.0 cm, 0.5 cm. (d) 7.5 cm, 0.4 cm.

Q.11 A 0.5 cm high object is placed at 30 cm from a convex mirror whose focal length is 20 cm. Find the position and size of the image.

(a) 12 cm, 0.2 cm (b) 18 cm, 0.2 cm

(c) 6 cm, 0.5 cm (d) 5 cm, 0.1 cm

Q.12 There is a convex mirror of radius 50 cm. The image of a point at a distance 50 cm from the pole of mirror on its axis will be formed at :



(a) infinity

(b) pole

(c) focus

(d) 16.67 cm behind the mirror

Q.13 A particle is moving at a constant speed v_0 from a large distance towards a concave mirror of radius R along its principle axis. Find the speed of the image formed by the mirror as a function of the distance u of the particles from the mirror.

(a) $\left(\frac{R}{2u-R}\right)^2 .v_0$ (b) $\left(\frac{R}{2u+R}\right)^2 .v_0$

(c) $\left(\frac{2R}{2u-R}\right)^2 .v_0$ (d) None of these

Q.14 A short linear object of length b lies along the axis of a concave mirror of focal length f at a distance u from the pole of the mirror. Find the approximate size of the image.

(a) $b\left(\frac{f}{u-f}\right)^2$ (b) $b\left(\frac{f}{u+f}\right)^2$

(c) $b\left(\frac{2f}{u-f}\right)^2$ (d) None of these

Q.15 The relation between the linear magnification m, the object distance u and the focal length f for a spherical mirror is

(a) $m=\frac{f-u}{f}$ (b) $m=\frac{f}{f-u}$

(c) $m=\frac{f+u}{f}$ (d) $m=\frac{f}{f+u}$

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ

Space for Rough Work

Q.16 An object of length 1 cm is placed at a distance of 15 cm from a concave mirror of focal length 10 cm. The nature and size of the image are

(a) real, inverted, 1.0 cm (b) real, inverted, 2.0 cm

(c) virtual, erect, 0.5 cm (d) virtual, erect, 1.0 cm

Q.17 In an experiment to determine the focal length (f) of a concave mirror by the u - v method, a student places the object pin A on the principal axis at a distance x from the pole P. The student looks at the pin and its inverted image from a distance keeping his/her eye in line with PA. When the student shifts his/her eye towards left, the image appears to the right of the object pin. Then,

(a) $x < f$ (b) $f<x<2f$ (c) $x = 2f$ (d) $x > 2f$

Q.18 Two plane mirrors are inclined to each other at some angle. A ray of light incident at 30° on one, after reflection from the other retraces its path. The angle between the mirrors is

(a) 30° (b) 45° (c) 60° (d) 90°

Q.19 A convex mirror is used to form the image of an object. Which of the following statements is wrong ?

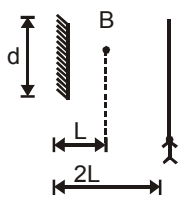
(a) The image lies between the pole and the focus

(b) The image is diminished in size

(c) The image is erect

(d) The image is real

Q.20 A point source of light B is placed at a distance L in front of the centre of a mirror of width 'd' hung vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance $2L$ from it as shown in fig. The greatest distance over which he can see the image of the light source in the mirror is



(a) $d/2$ (b) d (c) $2d$ (d) $3d$

Q.21 A concave mirror of focal length f_0(in magnitude) produces a real image n time the size of the object. What is the distance of the object from the mirror?

(a) $\frac{-(n+1)}{n}f_0$ (b) $\frac{(n+1)}{n}f_0$ (c) $\frac{(n-1)}{n}f_0$ (d) $\frac{-(n^2+1)}{n}f_0$

Q.22 The focal length of a concave mirror is 30 cm. Find the position of the object in front of the mirror, so that the image is three times the size of the object.

(a) 20 cm (only) (b) 40 cm (only)

(c) 30 cm (only) (d) 20 cm or 40 cm

DIRECTIONS (Q.23-Q.25) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct

(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.23 A plane mirror reflecting a ray of incident light is rotated through an angle θ about an axis through the point of incidence in the plane of the mirror perpendicular to the plane of incidence, then

(1) The reflected ray rotates through an angle 2θ

(2) The incident ray is fixed

(3) The reflected ray does not rotate

(4) The reflected ray rotates through an angle θ

Q.24 The light reflected by a plane mirror will not form a real image

(1) If the rays incident on the mirror are diverging

(2) Under no circumstances

(3) If the object is real

(4) If the rays incident on the mirror are converging

RESPONSE GRID					
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ
	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	

Space for Rough Work

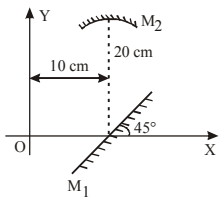
Q.25 Which of the following form(s) a virtual and erect image for all positions of the object?

(1) Convex lens (2) Concave lens

(3) Convex mirror (4) Concave mirror

DIRECTIONS (Q.26-Q.27) : Read the passage given below and answer the questions that follows :

A plane mirror (M_1) and a concave mirror (M_2) of focal length 10 cm are arranged as shown in figure. An object is kept at origin. Answer the following questions. (Consider image formed by single reflection in all cases)



Q.26 The co-ordinates of image formed by plane mirror are

(a) (–20 cm, 0) (b) (10 cm, – 60 cm)

(c) (10 cm, –10 cm) (d) (10 cm, 10 cm)

Q.27 The co-ordinates of image formed by concave mirror are

(a) (10 cm, – 40 cm) (b) (10 cm, – 60 cm)

(c) (10 cm, 8 cm) (d) None of these

DIRECTIONS (Qs. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 **Statement-1:** The mirrors used in search lights are parabolic and not concave spherical.

Statement-2: In a concave spherical mirror the image formed is always virtual.

Q.29 **Statement-1:** When an object is placed between two plane parallel mirors, then all the images found are of different intensity.

Statement-2: In case of plane parallel mirrors, only two images are possible.

Q.30 **Statement-1:** The size of the mirror doesn't affect the nature of the image.

Statement-2: Small mirror always forms a virtual image.

RESPONSE GRID	25. ⓐⓑⓒⓓ 26. ⓐⓑⓒⓓ 27. ⓐⓑⓒⓓ 28. ⓐⓑⓒⓓ 29. ⓐⓑⓒⓓ 30. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 49 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	30	Qualifying Score	50
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

PHYSICS SOLUTIONS

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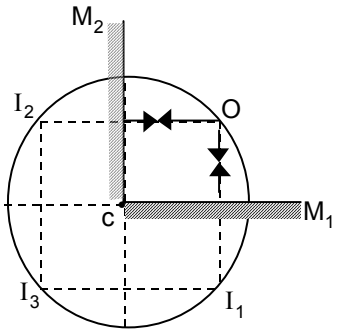
(1) (a) Here, $n = \frac{360}{\theta} = \frac{360}{90} = 4$

$\therefore$ n is an even number.



Thus, number of images formed = n – 1 = 3. All these three images lie on a circle with centre at C (The point of intersection of mirrors M_1 and M_2) and whose radius is equal to the distance between C and object.

(2) (c) Here, $[n] = 5 \Rightarrow n - 1 \le 5 \le n$

$\therefore \frac{360}{\theta} - 1 \le 5 \le \frac{360}{\theta}$

or, $\theta \ge \frac{360}{6}$ or $\theta \le \frac{360}{5}$

$\therefore 60^\circ \le \theta \le 72^\circ$

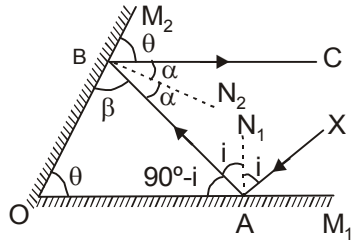
(3) (d) For the given $\theta = 50^\circ$,

$n = \frac{360}{\theta} = \frac{360}{50} = 7.2$

The integer value of (7.2) is 7.

Thus number of images formed is 7.

(4) (a) The situation is illustrated in figure.



XA is the incident ray. BC is the final reflected ray. It is given that BC is parallel to mirror M_1. Look at the assignment of the angles carefully. Now N_2 is normal to mirror M_2. Therefore $\beta = \theta$

Then from Δ OAB

$\theta + \beta + 90^\circ - i = 180^\circ$

or $\theta + \theta + 90^\circ - i = 180^\circ$ or $i = 2\theta - 90^\circ$

Thus if the angle of incidence is $i = 2\theta - 90^\circ$, then the final reflected ray will be parallel to the first mirror.

(5) (c) Small and erect image is formed only by convex mirror. Plane mirror from images equal to object and concave mirror form images bigger than object.

(6) (b) The image will be formed by the plane mirror at a 30 cm behind it, while the image by convex mirror will be formed at 10 cm behind the convex mirror.

Since for convex mirror u = – 50 cm

v = 10 cm

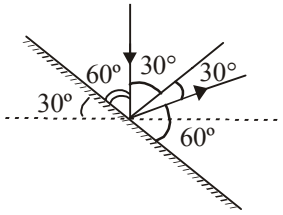
$\frac{1}{f} = \frac{1}{-50} + \frac{1}{10} = \frac{-1+5}{50} = \frac{4}{50}$

$f = \frac{50}{4} = 12.5$ cm

Therefore the radius of curvature of convex mirror is r = 2 f = 25 cm

(7) (a) The image of object O from mirrror M_1 is I_1 and the image of I_1 (the vitual object) from mirror M_2 is I_3. The image of object O from mirror M_2 is I_2 and the image of I_2 (the virtual object) from mirror M_1 is I_4. Notice that this interpretation, according to ray diagram rules, is valid only for Fig. (A). All others are inconsistent.

(8) (a) Angle betwen incident ray and mirror = 90° – 30° = 60°

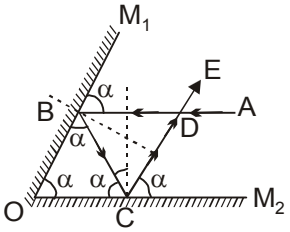


By law of reflection $\angle i = \angle r$

So angle of reflection $\angle r = 30^\circ$.

Hence angle between mirror and reflected ray = 60°

(9) (b) As shown in figure, ray AB goes to mirror M_1, gets reflected and travels along BC and then gets reflected by M_2 and goes in CD direction. If the angle between M_1 and M_2 be α, then

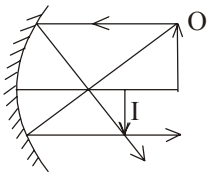


In Δ OBC, $\angle$OBC and $\angle$OCB are equal to α

$\therefore 3\alpha = 180^\circ$

$\alpha = 60^\circ$

(10) (a) Here, Object distance , $u = -15$cm
focal length , $f = -5$ cm
Object height, $h_0 = 0.2$ cm



We know, mirror formula,

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

$$\Rightarrow V = \frac{uf}{u-f}$$

$$= \frac{(-15)(-5)}{-15+5} = -7.5 \text{ cm}$$

Again, magnification,

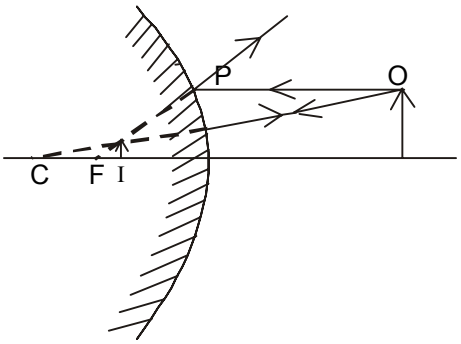
$$m = -\frac{v}{u} = -\frac{-7.5}{-15} = -\frac{1}{2}$$

Now, $|m| = \frac{h_i}{h_o}$

$$\Rightarrow h_i = |m| h_o = \frac{0.2}{2} \text{ cm} = 0.1 \text{ cm}$$

Thus, the image is formed at 7.5 cm from the pole of the mirror and its size is 0.1 cm.

(11) (a)



Here, Object distance, $u = -30$ cm
Focal length, $f = +20$ cm

We know, mirror formula, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

$$\Rightarrow v = \frac{uf}{u-f} = \frac{-30\times 20}{-30-20} = +12 \text{ cm}$$

Again, magnification ,

$$m = \frac{-v}{u} = \frac{-12\text{cm}}{30\text{cm}} = \frac{2}{5}$$

Now, Image height $= m \times$ object height

$$= \frac{2}{5}\times 0.5 \text{ cm} = 0.2 \text{ cm}$$

Thus the image is formed behind the mirror at a distance of 12 cm from the pole. Image height is 0.2 cm.

(12) (d) $u = -50$ cm , $f = 25$cm

$$\frac{1}{25} = -\frac{1}{50}+\frac{1}{v} ;$$

$$\frac{1}{v} = \frac{1}{25}+\frac{1}{50} = \frac{2+1}{50} = \frac{3}{50}$$

$$v = \frac{50}{3} = 16.6 \text{ cm}.$$

(13) (a) We know, $\frac{1}{v}+\frac{1}{u}=\frac{2}{R}$

$$\Rightarrow v = \frac{uR}{2u-R}$$

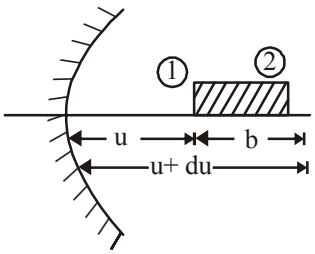
$$\frac{dv}{dt} = \frac{(2u-R).R - uR.2}{(2u-R)^2}.\frac{du}{dt}$$

$$= -\left(\frac{R}{2u-R}\right)^2.\frac{du}{dt}$$

$$\therefore \text{ Speed of image } \left|\frac{dv}{dt}\right| = \left(\frac{R}{2u-R}\right)^2.$$

$$\left|\frac{du}{dt}\right| = \left(\frac{R}{2u-R}\right)^2 V_0$$

(14) (a) For shrot linear object du and dv represent size of object and image respectively.



We know, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

$$\Rightarrow dv = -\frac{v^2}{u^2}.du$$

$$\Rightarrow |db| = \frac{v^2}{u^2}|du|$$

$$= \left(\frac{f}{f-u}\right)^2.b$$

15. (b) $\therefore m = -\frac{v}{u}$. Also $\frac{1}{f}=\frac{1}{v}+\frac{1}{u} \Rightarrow \frac{u}{f}=\frac{u}{v}+1$

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

$$\text{so } m = \frac{f}{f-u}$$

16. (b) Given u = – 15 cm, f = – 10 cm, O = 1 cm

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f},\ \frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-10}-\frac{1}{-15}$$

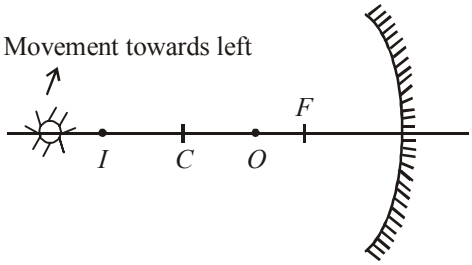
$\therefore$ v = – 30 cm

$$\frac{I}{O}=-\frac{v}{u}=-\frac{-30}{-15}=-2$$

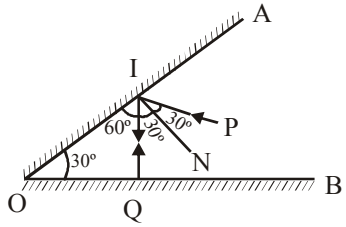
I = – 2 × 1 = – 2 cm

Image is inverted and on the same side (real) of size 2 cm.

17. (b) As shown in the figure, when the object (O) is placed between F and C, the image (I) is formed beyond C. It is in this condition that when the student shifts his eyes towards left, the image appears to the right of the object pin.



18. (a)



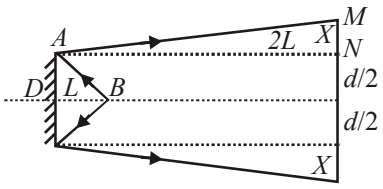
$\angle i = \angle r = 30°$

$\therefore$ $\angle OIQ = 60°$

$\therefore$ IOQ = 90° – 60° = 30°

19. (d) The image formed by a convex mirror is always virtual.

20. (d) From the ray diagram.



In ΔANM and ΔADB

$\angle ADB = \angle ANM = 90°$

$\angle MAN = \angle BAN$ (laws of reflection)

Also $\angle BAN = \angle ABD$

$\Rightarrow$ $\angle MAN = \angle ABD$

$\therefore$ ΔANM is similar to ΔADB

$$\therefore \quad \frac{x}{2L}=\frac{d/2}{L} \text{ or } x=d$$

So, required distance $= d + d + d = 3d$.

21. (a) $m = -n$; $m = \dfrac{f}{f-u}$

$$-n=\frac{-f}{-f-u} \Rightarrow nf+nu=-f$$

$$nu=-f-nf \quad \Rightarrow u=\frac{-(n+1)}{n}f$$

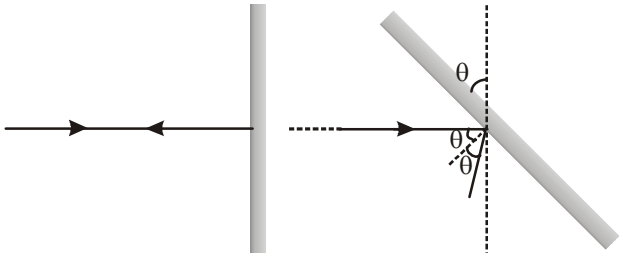
22. (d) Here image can be real or virtual. If the image is real f = –30, u = ?, m = –3

$$m=\frac{f}{f-u} \Rightarrow -3=\frac{-30}{-30-u}\ ;\ u=-40 \text{ cm.}$$

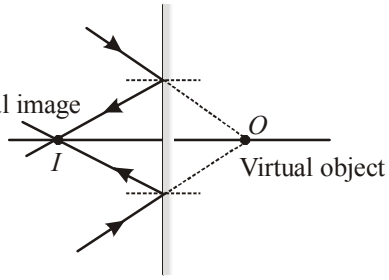
If the image is virtual

$$m=\frac{f}{f-u} \Rightarrow 3=\frac{-30}{-30-u} \Rightarrow u=-20 \text{ cm.}$$

23. (b) By keeping the incident ray is fixed, if plane mirror rotates through an angle θ reflected ray rotates through an angle 2θ

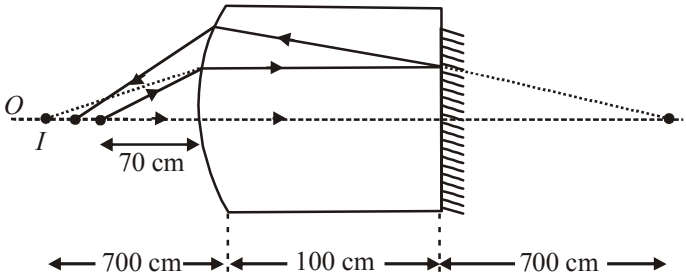


24. (d)



25. (b,c) Convex mirror and concave lens form, virtual image for all positions of object.

(26) (a); (27) (d)



$$\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}, \text{ when } x=70 \text{ cm}$$

$$\frac{1.5}{v}-\frac{1.2}{-70}=\frac{1.5-1.2}{20}$$

$$\Rightarrow v=\frac{20\times 70\times 1.5}{-1.2\times 20+0.3\times 70}$$

$\Rightarrow v = -700$ cm

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

$$\frac{1.2}{v} - \frac{1.5}{900} = \frac{1.2 - 1.5}{-20}$$

$$\Rightarrow v = \frac{900 \times 200 \times 1.2}{1.5 \times 200 - 900 \times 3}$$

$\Rightarrow v = -90$ cm

Similarly, for x = 80 cm

$v = 80$ cm

and for $x = 90$ cm

$v = 70$ cm

28. (d)

29. (d) When an object is placed between two plane parallel mirrors, then infinite number of images are formed. Images are formed due to multiple reflections. At each reflection, a part of light energy is absorbed. Therefore, distant images get fainter.

30. (d) The size of the mirror does not affect the nature of the image except that a bigger mirror forms a brighter image.