DPP 02

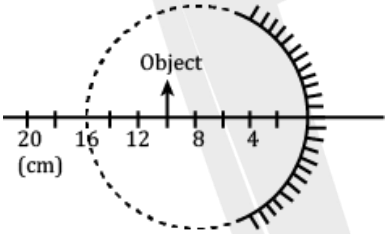
1. A short object of length L is placed along the principal axis of a concave mirror away from focus. The object distance is u. If the mirror has a focal length f, what will be the length of the image? You may take $L << |v - f|$.

2. A light ray parallel to the x-axis strikes the outer reflecting surface of a sphere at a point (2,2,0). Its center is at the point (0,0,-1). The unit vector along the direction of the reflected rays is $x\hat{i} + y\hat{j} + x\hat{k}$. Find the value of $\frac{yz}{x^2}$.

3. When an object is kept at a distance of 30 cm from a concave mirror, the image is formed at a distance of 10 cm from the mirror. If the object is moved with a speed of 9 cm s^{-1}, the speed (in cm s^{-1}) with which image moves at that instant is ____.

4. A thin rod of length $\frac{f}{3}$ is placed along the optic axis of a concave mirror of focal length f such that its image, which is real and elongated, just touches the rod. The magnification is _____.

5. A spherical mirror is obtained as shown in the figure from a hollow glass sphere. If an object is positioned in front of the mirror, what will be the nature and magnification of the image of the object?



(Figure drawn as schematic and not to scale)

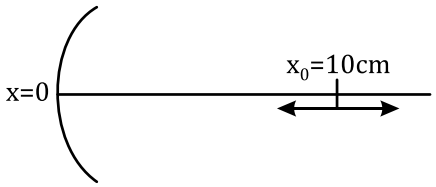
(A) Inverted, real and magnified

(B) Erect, virtual and magnified

(C) Erect, virtual and unmagnified

(D) Inverted, real and unmagnified

6. A particle is oscillating on the x-axis with an amplitude 2 cm about the point $x_0 = 10$ cm, with a frequency ω. A concave mirror of focal length 5 cm is placed at the origin (see figure). Identify the correct statements.



(a) The image executes periodic motion.

(b) The image executes non-periodic motion.

(c) The turning points of the image are asymmetric w.r.t. the image of the point at x = 10 cm.

(d) The distance between the turning points of the oscillation of the image is $\frac{100}{21}$ cm.

(A) b,d (B) b,c (C) a,c,d (D) a,d

7. A ray of light travelling in the direction $\frac{1}{2}(\hat{i}+\sqrt{3}\hat{j})$ is incident on a plane mirror. After reflection, it travels along the direction $\frac{1}{2}(\hat{i}-\sqrt{3}\hat{j})$. The angle of incidence is

(A) 30° (B) 45° (C) 60° (D) 75°

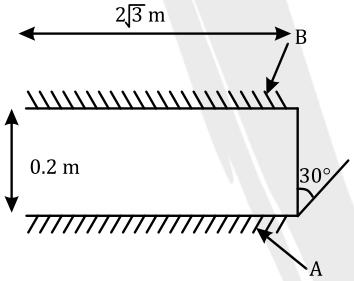
8. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at a relative speed of 15 ms^{-1}. The speed of the image of the second car as seen in the mirror of the first one is

(A) $\frac{1}{10}ms^{-1}$ (B) $\frac{1}{15}ms^{-1}$ (C) 10 ms^{-1} (D) 15 ms^{-1}

9. If two mirrors are kept at 60° to each other, then the number of images formed by them is

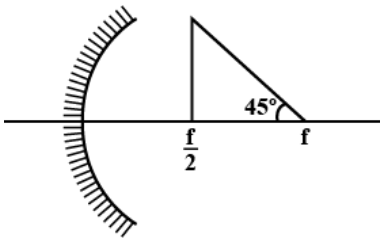
(A) 5 (B) 6 (C) 7 (D) 8

10. Two plane mirrors A and B are aligned parallel to each other, as shown in the figure. A light ray is incident at an angle 30° at a point just inside one end of A. The plane of incidence coincides with the plane of the figure. The maximum number of times the ray undergoes reflections (including the first one) before it emerges out is

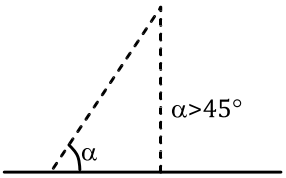


(A) 28 (B) 30 (C) 32 (D) 34

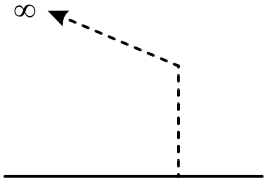
11. A wire is bent in the shape of a right angled triangle and is placed in front of a concave mirror of focal length f, as shown in the figure. Which of the figures shown in the four options qualitatively represent (s) the shape of the image of the bent wire? (These figures are not to scale).



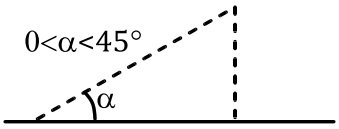
(A)



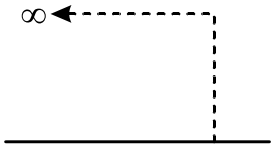
(B)



(C)



(D)

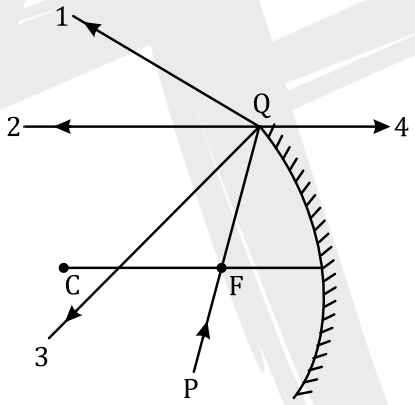


12. A short linear object of length b lies along the axis of a concave mirror of focal length f at a distance u from the pole of the mirror. The size of the image is approximately equal to

(A) $b\left(\frac{u-f}{f}\right)^{1/2}$ (B) $b\left(\frac{f}{u-f}\right)^{1/2}$

(C) $b\left(\frac{u-f}{f}\right)$ (D) $b\left(\frac{f}{u-f}\right)^{2}$

13. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1. 2, 3 and 4. Which of the four rays correctly shows the direction of reflected ray?



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

ANSWER KEY

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

2. $\left(\frac{-\hat{i}+8\hat{j}+4\hat{k}}{9}\right)$

3. (1)

4. (1.5)

5. (D)

6. (C)

7. (A)

8. (B)

9. (A)

10 (B)

11. (D)

12. (D)

13. (B)

Home Work

Ex. 1	Q. 11,19,
Ex. 2	Q. 12,13,19,
Ex.3	Q.
Ex.4	Q. 9,10,11,
Ex.5	Q. 2,8,14,1920