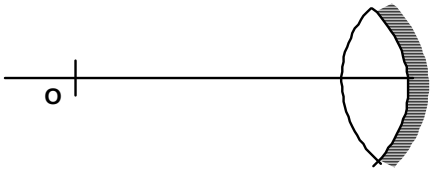
[SINGLE CORRECT CHOICE TYPE]

Q.1 One face of a biconvex lens of radius $R_1 = R_2 = 30$ cm and $\mu = 1.5$ is silvered as shown in the figure. The image of the object placed at a distance u = 60 cm is formed at **[3]**

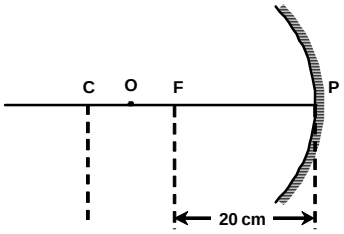


(A*) 60/7 cm infront of silvered face (B) 60/9 cm behind the silvered face
(C) 20/3 cm in front of silvered face (D) none of these

Q.2 A thin walled glass sphere of radius R is filled with water (μ = 4/3). An object is placed at distance 3R from the surface of the sphere. If the effect of the glass wall is neglected. Find the distance of the final image from the centre of sphere. **[3]**
(A) 3R (B) 2R (C*) 4R (D) ∞

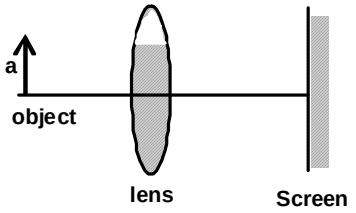
Q.3 A planoconvex lens has a thickness of = 4 cm. When placed on a horizontal surface (table), with the curved surface in contact with it, the apparent depth of the bottom most point of the lens is found to be t_1 = 3 cm. If the lens is inverted such that the plane face is in contact with the table, the apparent depth of the center of the plane surface is found to be t_2 = 25/8 cm. Find the focal length of the lens. **[3]**
(A) 50 cm (B*) 75 cm (C) 100 cm (D) 150 cm

Q.4 A point object 'O' is kept in front of a concave mirror of focal length 20 cm at a distance of 30 cm from the pole. The object is moving on the principal axis away from the pole with a velocity of 1 cm/second. The instantaneous velocity of the image is **[3]**



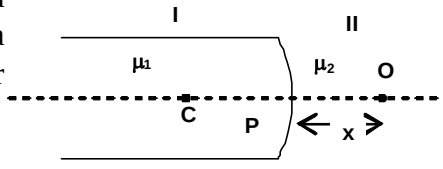
(A) 2 cm/sec towards the pole
(B) 4 cm/sec such that the image distance tends to increase
(C) 4 cm/sec away from the pole parallel to the principal axis
(D*) 4 cm/sec towards the pole and parallel to the principal axis

Q.5 An object of size a is placed in front of the converging lens and its image is obtained on the screen. Now (3/4)th size of the lens is covered as shown by the shaded portion **[3]**



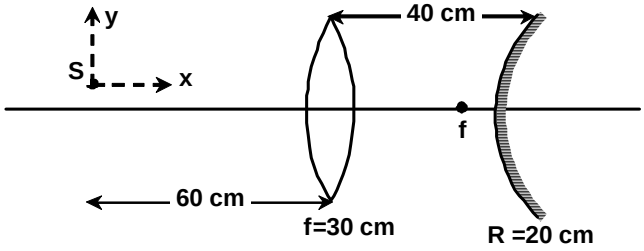
(A) Magnification of image reduces to 3/4.
(B) Magnification of image reduces to 1/4
(C*) Magnification remains same but brightness of image becomes 1/4.
(D) Magnification and brightness both become 1/4.

Q.6 Two media I and II of refractive indices 1 and 2 are separated by a spherical surface of radius R. A point object O, when placed at a distance x on the principal axis of the surface in medium II, forms a real image at an equal distance from the surface in medium I. For this to happen, **[3]**



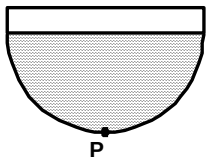
(A*) $\mu_1 > \mu_2$ (B) $\mu_1 = \mu_2$
(C) $\mu_1 < \mu_2$ (D) in all the above

Q.7 In the shown arrangement a point source of light S is placed 60 cm behind the convex lens of focal length 30 cm and 2 cm above the common principal axis of the convex lens and the convex mirror. Then the x-coordinate of the final image of the source is **[3]**



(A) 2 (B*) 0 (C) 120 (D) infinity

Q.8 A hemispherical bowl of radius 10 cm is filled with liquid of refractive index $\mu = 4/3$. A glass plate of refractive index 1.5 is placed on the top of bowl. If for the observer above the plate the shift in position of a point P on the bottom is 3 cm find the thickness of glass plate. **[3]**

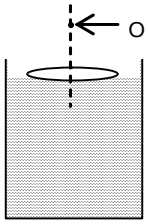


(A*) 1.5 cm (B) 1 cm
(C) 7 cm (D) 10 cm

Q.9 The velocity of a real object along the principal axis at an instant is 4 times the velocity of the virtual image for a lens. Then the ratio of focal length to image distance is **[3]**

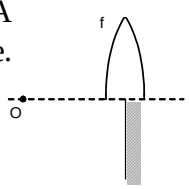
(A*) 2 : 1 (B) 1 : 2 (C) 4 : 1 (D) 1 : 4

Q.10 A point object O is placed at a distance of 20 cm in front of a equi-convex lens ($_a\mu_g = 1.5$) of focal length 10 cm . The lens is placed on a liquid of refractive index 2 as shown. Image will be formed at a distance h from lens. The value of h is **[3]**



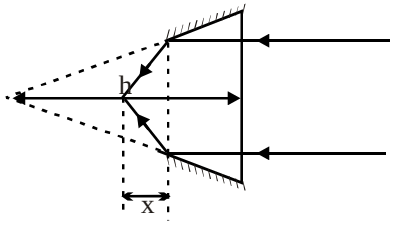
(A) 5 cm (B) 10 cm
(C) 20 cm (D*) 40 cm

Q.11 Half of a thin convex lens of focal length f and a plane mirror are in contact as shown. A point object is placed at point O. The real image and virtual image of the object coincide. The distance of the object from the plane mirror is **[3]**



(A) α (B*) 2f
(C) f (D) data insufficient

Q.12 From the base of a hollow cone of height h with a small angle at the top, a small ring was cut off and placed in front of a parallel beam of light (the figure is exaggerated for clarity). At what distance x will rays of light reflected from it intersect the axis of the cone. **[3]**



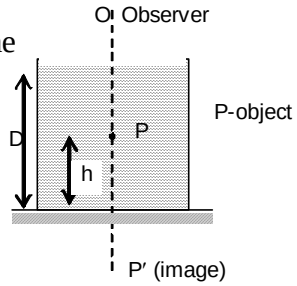
(A) h (B*) $\frac{h}{2}$ (C) $\frac{h}{\sqrt{2}}$ (D) $\sqrt{\frac{2}{3}}h$

[REASONING TYPE]

Q.13 An object P placed in a liquid of fixed volume is observed by an observer in air as shown in the figure then

Assertion (A): Separation between object and its image as seen by the observer vertically above is independent of liquid level above object.

Reasoning (R) : The separation between the object and image depends on the vertical position of observer and the height of liquid above the object. **[3]**



Which of the following is correct ?

(A) (A) is correct & (R) is correct explanation of (A).

(B) Both are correct. But (R) is not correct explanation of (A).

(C) (A) is incorrect & (R) is correct.

(D*) Both are incorrect.

Q.14 **Statement-1 :** If light enters from medium-1 into medium-2 and bends towards the normal, its wavelength in medium-2 is smaller than its wavelength in medium-1. **[3]**

Statement-2 : According to Cauchy's relation, $\mu = A + \frac{B}{\lambda^2}$

(A) Statement-1 is true, statement-2 is false.

(B) Statement-1 is false, statement-2 is true.

(C) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(D*) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

[MULTIPLE CORRECT CHOICE TYPE]

Q.15 A plano-convex lens has thickness of 4 cm and radius of curvature of its curved surface is 30 cm. Consider two cases **[4]**

(a) the parallel rays are incident on plane surface parallel to the principal axis.

(b) the parallel rays are incident on curved surface parallel to the principal axis. Which of the following is correct?

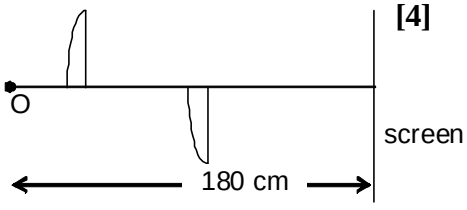
(A) The rays in both the cases will converge at same distance from the surface on which rays are incident.

(B) To calculate the focal length of lens $\frac{1}{f} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$ is applicable.

(C*) To calculate the position of image $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ should not be used.

(D) none of these.

Q.16 A thin convex lens is split into two halves. One of the halves is shifted along the optical axis. The separation between fixed luminous point object O and fixed screen is D = 180 cm. The magnification of image formed by one of the half lens is m = 2. It follows that **[4]**



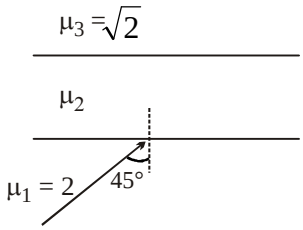
(A) The separation between the lens is 90 cm.

(B*) the separation between the lens is 60 cm

(C*) the focal length of the lens is 40 cm

(D) the focal length of the lens is 60 cm.

Q.17 In the **diagram** shown, a light ray is incident on the lower medium boundary at an angle 45° with the normal. Which of the following statements is/are true? **[4]**



(A*) If $\mu_2 > \sqrt{2}$ then angle of deviation is 45°

(B*) If $\mu_2 < \sqrt{2}$ then angle of deviation is 90°

(C) If $\mu_2 < \sqrt{2}$ then angle of deviation is 135°

(D) If $\mu_2 > \sqrt{2}$ then angle of deviation is 0°

Q.18 A toy solider is placed, in turn, in front of four mirror, A, B, C and D. The following table gives the object distances u and corresponding image distance v, all in centimeters. **[4]**

	A	B	C	D
u	–2	–4	–2	–6
v	–4	8	6	–2

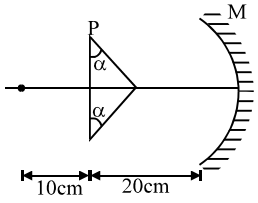
(A*) B has largest radius of curvature in modulus.
(B*) A has smallest radius of curvature in modulus.
(C) C is a convex mirror.
(D*) D is forming a real diminished image.

[SUBJECTIVE TYPE]

Q.19 At the bottom of the vessel filled with water, lies a flat mirror. A man leaning over the vessel, sees an image of his face in the mirror at a distance d = 25 cm from himself when the distance from the face to the surface is L = 5 cm. Determine the depth of the vessel in cm. refractive index of water is 4/3. **[5]**

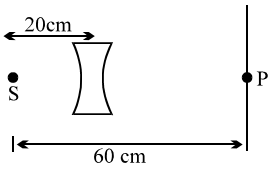
[Ans. 0010]

Q.20 O is the point object kept on the principal axis on a concave mirror M of radius of curvature 20 cm. P is a prism of angle $\alpha = 1.8°$. Light falling on the prism and then fall on the mirror. Find the distance between the images formed by the concave mirror due to this light. Take $\mu = 3/2$ for prism. **[5]**



[Ans.π/20 cm]

Q.21 A point source of light is placed 60cm away from screen. Intensity detected at point P is I. Now a diverging lens of focal length 20 cm is placed 20 cm away from S between S and P. The lens transmits 75% of light incident on it. Find the new value of intensity at P. **[5]**



[Ans. 0.27 I]