Date: 24/9/2021

Q1. Identify the device used as a spherical mirror or lens in following cases, when the image formed is virtual and erect in each case.

(a) Object is placed between device and its focus, image formed is enlarged and behind it.

(b) Object is placed between the focus and device, image formed is enlarged and on the same side as that of the object.

(c) Object is placed between infinity and device, image formed is diminished and between focus and optical centre on the same side as that of the object.

(d) Object is placed between infinity and device, image formed is diminished and between pole and focus, behind it.

Q2. Why does a light ray incident on a rectangular slab immersed in any medium emerges parallel to itself? Explain using a diagram.

Q3. A pencil when dipped in water in a glass tumbler appears to be bent at the interface of air and water. Will the pencil appear to be bent to the same extent, if instead of water we use liquids like, kerosene or turpentine. Support your answer with reason.

Q4. How is the refractive index of a medium related to the speed of light? Obtain an expression for refractive index of a medium with respect to another in terms of speed of light in these two media?

Q5. Refractive index of diamond with respect to glass is 1.6 and absolute refractive index of glass is 1.5. Find out the absolute refractive index of diamond.

Q6. A convex lens of focal length 20 cm can produce a magnified virtual as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?

Q7. Sudha finds out that the sharp image of the window pane of her science laboratory is formed at a distance of 15 cm from the lens. She now tries to focus the building visible to her outside window instead of the window pane without disturbing the lens. In which direction will she move the screen to obtain a sharp image of the building? What is the approximate focal length of this lens?

Q8. How are power and focal length of a lens releated? You are provided with two lenses of focal length 20 cm and 40 cm respectively. Which lens will you use to obtain more convergent light?

Q9. Under what condition in an arrangement of two plane mirrors, incident ray and reflected ray will always be parallel to each other, whatever may be angle of incidence. Show the same with the help of diagram.

Q10. Draw a ray diagram showing the path of rays of light when it enters with oblique incidence (i) from air into water; (ii) from water into air.

Q11. Draw ray diagrams showing the image formation by a concave mirror when an object is placed

(a) between pole and focus of the mirror. (b) between focus and centre of curvature of the mirror.

(c) at centre of curvature of the mirror. (d) a little beyond centre of curvature of the mirror.

(e) at infinity.

Q12. Draw ray diagrams showing the image formation by a convex lens when an object is placed

(a) between optical centre and focus of the lens.

(b) between focus and twice the focal length of the lens.

(c) at twice the focal length of the lens.

(d) at infinity.

(e) at the focus of the lens.

Q13. Write laws of refraction. Explain the same with the help of ray diagram,when a ray of light passes through a rectangular glass slab.

Q14. Draw ray diagrams showing the image formation by a concave lens when an object is placed

(a) at the focus of the lens.

(b) between focus and twice the focal length of the lens.

(c) beyond twice the focal length of the lens.

Q15. Draw ray diagrams showing the image formation by a convex mirror when an object is placed

(a) at infinity (b) at finite distance from the mirror.

Q16. The image of a candle flame formed by a lens is obtained on a screen placed on the other side of the lens. If the image is three times the size of the flame and the distance between lens and image is 80 cm, at what distance should the candle be placed from the lens? What is the nature of the image at a distance of 80 cm and the lens?

Q17. Size of image of an object by a mirror having a focal length of 20 cm is observed to be reduced to 1/3rd of its size. At what distance the object has been placed from the mirror? What is the nature of the image and the mirror?

Q18. Define power of a lens. What is its unit? One student uses a lens of focal length 50 cm and another of – 50 cm. What is the nature of the lens and its power used by each of them?

Q19. A student focussed the image of a candle flame on a white screen using a convex lens. He noted down the position of the candle screen and the lens as under

Position of candle = 12.0 cm

Position of convex lens = 50.0 cm

Position of the screen = 88.0 cm

(a) What is the focal length of the convex lens?

(b) Where will the image be formed if he shifts the candle towards the lens at a position of 31.0 cm?

(c) What will be the nature of the image formed if he further shifts the candle towards the lens?

(d) Draw a ray diagram to show the formation of the image in case (c) as said above.

Date: 24/9/2021

S1. (a) concave mirror (b) Convex lens (c) concave lens (d) convex mirror

S2. **Hint:** Draw the diagram and explain using laws of refractions at both the interfaces.

S3. **Hint:** No. Bending will be different in different liquids since velocity of light at the interface separating two media depends on the relative refractive index of the medium

S4. **Hint:**

$$n = \frac{c}{v}$$

$$n_{21} = \frac{v_1}{v_2}$$

S5. **Hint:**

$$n_{dg} = \frac{v_g}{v_d} = 1.6, \qquad n_g = \frac{c}{v_g} \quad \text{and} \quad n_d = \frac{c}{v_d}$$

Therefore,

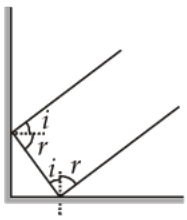
$$\frac{v_g}{v_d} \times \frac{c}{v_g} = n_d = 1.6 \times 1.5 = 2.40$$

S6. **Hint:** Statement is correct if the object is placed within 20 cm from the lens in the first case and between 20 cm and 40 cm in the second case.

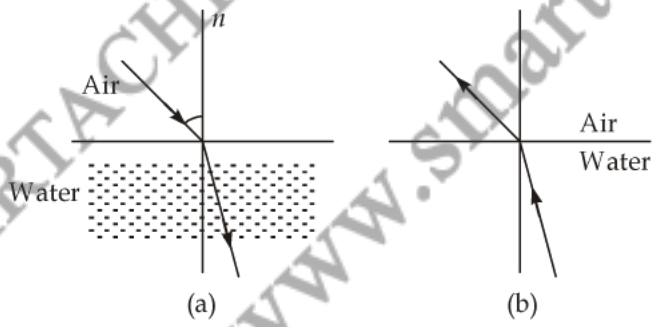
S7. **Hint:** Sudha should move the screen towards the lens so as to obtain a clear image of the building. The approximate focal length of this lens will be 15 cm.

S8. $P = \frac{1}{f}, P \propto \frac{1}{f}$. Power of a lens is inversely proportional to its focal length therefore lens having focal length of 20 cm will provide more convergence.

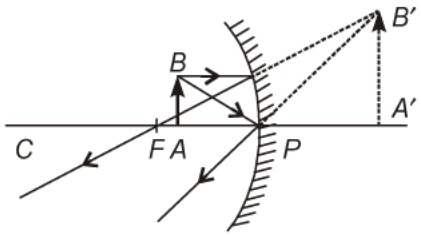
S9. When two plane mirros are placed at right angle to each other then the incident and reflected rays will always be parallel to each other



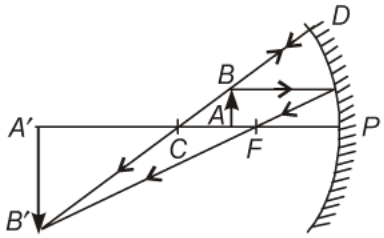
S10. **Hint:**



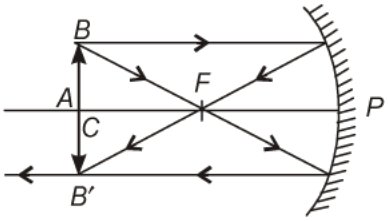
S11.



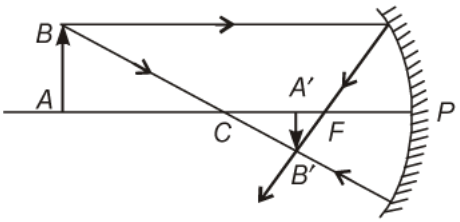
(a)



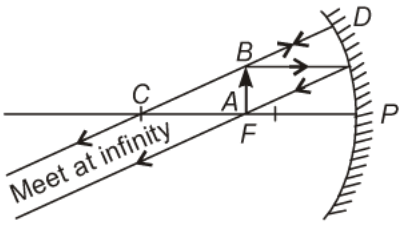
(b)



(c)



(d)



(e)

S12. Hint: Draw ray diagrams separately indicating the direction of incident.

S13. Hint: Draw ray diagrams indicating the direction of incident, refracted and emergent rays and explain.

S14. Hint: Draw ray diagrams separately indicating the direction of incident and refracted rays.

S15. Hint: Draw ray diagrams indicating the direction of incident ray and reflected ray.

S16. Hint: $m = -\frac{v}{u} = -3$, using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ calculate u.

$u = -\frac{80}{3}$ cm, image is real and inverted. The lens is convex.

S17. $m = \frac{1}{3}$. Using $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ calculate u; $u = -80$ cm. Image is real and inverted. Mirror is concave.

S18. Hint: $P = \frac{1}{f}$ where f is in metre. Its unit is Dioptre. Lens is convex in the first case and concave in the second case. Power is equal to 2 dioptre in the first case and – 2 dioptre in the second case.

S19. (a) Focal length = $\frac{38}{2}$ = 19 cm.

(b) The image will be formed at infinity

(c) Virtual and erect

(d)