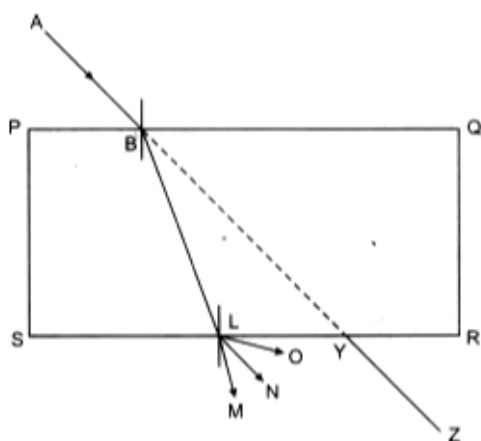


# LIGHT - REFLECTION AND REFRACTION WS 5

## Class 10 - Science

1. i. In refraction of light through a rectangular glass slab, the emergent ray is parallel to the direction of the incident ray. Why? [2]  
 ii. What happens when a light ray is incident normally on one of the faces of a rectangular glass slab?
2. What is a rainbow? Draw a labelled diagram to show its formation. [2]
3. The refractive index of a medium x with respect to a medium y is  $\frac{2}{3}$  and the refractive index of medium y with respect to medium z is  $\frac{4}{3}$ . Find the refractive index of medium z with respect to medium x. If the speed of light in medium x is  $3 \times 10^8 \text{ ms}^{-1}$ , calculate the speed of light in medium y. [2]
4. Draw ray diagram showing the image formation by a concave lens when an object is placed at the focus of the lens. [2]
5. If a light ray AB is incident on the surface PQ as shown, identify the correct emergent ray. [2]



6. Draw a ray diagram to represent the nature, position and size of the image formed by a convex lens for the object placed at
  - i. infinity
  - ii. Between  $F_1$  and optical centre (O)
 [2]
7. i. Draw a ray diagram to show the refraction of light through a glass slab and mark an angle of refraction and the lateral shift suffered by the ray of light while passing through the slab. [2]  
 ii. If the refractive index of glass for light going from air to glass is  $3/2$ , find the refractive index of air for light going from glass to air.
8. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass? The speed of light in vacuum is  $3 \times 10^8 \text{ ms}^{-1}$ . [2]
9. Obtain an expression for magnification of an image formed by a concave mirror. [2]
10. Draw ray diagram showing the image formation by a concave lens when an object is placed between focus and twice the focal length of the lens. [2]
11. A concave lens made of a material of refractive index  $n_1$  is kept in a medium of refractive index  $n_2$ . A parallel beam of light is incident on the lens. Trace the path of rays of light parallel to principal axis incident on the [2]

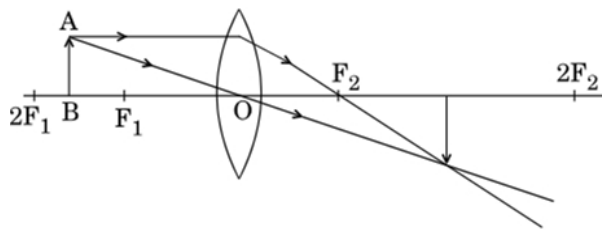
concave lens after refraction when

i.  $n_1 > n_2$

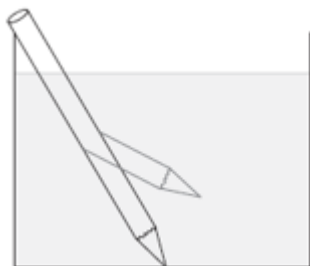
ii.  $n_1 = n_2$

Give reason for each.

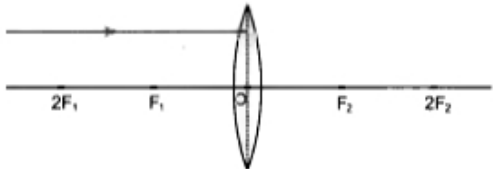
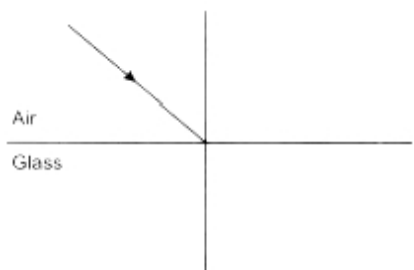
12. Draw ray diagram showing the image formation by a convex lens when an object is placed at infinity. [2]
13. Where should an object be placed in case of a convex lens to form an image of same size as of the object? Show with the help of ray diagram the position and the nature of the image formed. [2]
14. A doctor has prescribed a corrective lens of power +1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging? [2]
15. Study the following ray diagram and list two mistakes committed by the student while tracing it. Rectify these mistakes by drawing the correct ray diagram to show the real position and size of the image corresponding to the position of the object AB. [2]



16. 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? [2]
17. What is meant by power of a lens? What does its sign (+ve or -ve) indicate? State its SI unit. How is this unit related to focal length of a lens? [2]
18. Draw the path of a ray of light when it enters one of the faces of a glass slab at an angle of nearly  $45^\circ$ . Label on it (i) angle of refraction, (ii) angle of emergence and (iii) lateral displacement. [2]
19. For which position of the object does a convex lens form a virtual and erect image? [2]
20. Find the focal length of a lens of power -2.0 D. What type of lens is this? [2]
21. An object is kept at a distance of 1m from a lens of power +2D: [2]
  - i. Identify the type of lens.
  - ii. Calculate its focal length and distance of the image formed.



22. [2]
  - i. Which property of lightwave best described the above diagram?
  - ii. The image formed looks slightly bent. Why?
  - iii. On what factors the angle of refraction depends?
23. An object 3 cm high is placed 20 cm from convex lens of focal length 12 cm. Find the nature, position and height of the image. [2]
24. An object is placed at a distance of 15 cm from a convex lens of focal length 20 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. [2]
25. In what S.I unit is the power of lens stated? A convex lens has a focal length of 50 cm. calculate its power? [2]

26. A candle is placed at the focus of a convex lens. What is the nature of beam of light produced by the lens? [2]
27. a. The image of an object formed by a lens is of same size but inverted. If the object distance is 30 cm, calculate [2]
- The distance between the object and its image.
  - Focal length of the lens.
- b. Draw a ray diagram to show the image formed in above case.
28. Draw the given diagram in your answer-book and complete it for the path of ray of light beyond the lens. [2]
- 
29. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object? Also, find the power of the lens. [2]
30. Complete the following diagram: [2]
- 
31. A real image  $\frac{2}{3}$ <sup>rd</sup> of the size of an object is formed by a convex lens when the object is at a distance of 12 cm from it. Find the focal length of the lens. [2]
32. a. For the same angle of incidence of  $45^\circ$ , the refraction angle in two transparent media P and Q is  $20^\circ$  and  $30^\circ$  respectively. Which of the two is optically denser and why? [2]
- b. Define 1 diopetre power of a lens.
- c. Find the focal length of a lens of power + 0.5 D.
33. Define the term power of a lens. Give its SI unit. State whether the power of a converging lens is positive or negative. [2]
34. State laws of refraction of light. [2]
35. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? Also, find the magnification produced by the lens. [2]
36. a. If the image formed by a lens is diminished in size and erect, for all positions of the object what type of lens is it? [2]
- b. Name the point on the lens through which a ray of light passes undeviated.
- c. An object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from lens is 30 cm. Find
- the position,
  - the magnification and
  - the nature of the image formed.
37. A real image,  $\frac{4}{5}$  size of the object is formed 18 cm from a lens. Calculate focal length of the lens. [2]
38. What is the relationship between the refractive index of two media? [2]
39. Draw ray diagram showing the image formation by a convex lens when an object is placed at the focus of the [2]

lens.

40. Define the following terms in the context of a diverging mirror: [2]

- i. Principal focus
- ii. Focal length

Draw a labelled ray diagram to illustrate your answer.

41. Why does a ray of light bend when it travels from one medium into another? [2]

42. Draw the following diagrams in your answer book and show the formation of the image of object AB by completing the ray diagrams. [2]



43. A concave lens has focal length of 20 cm. At what distance from the lens a 5cm tall object be placed so that it forms an image at 15 cm from the lens? Also calculate the size of the image formed? [2]

44. A concave lens has a focal length of 10 cm. An object 2.5 cm high is placed 30 cm from the lens. Determine the position and size of the image. [2]

45. The refractive index of diamond is 2.42. What is the meaning of this statement? [2]

46. 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? [2]

47. Explain with the help of a ray diagram, why a pencil partly immersed in water appears to be bent at the water surface. [2]

48. a. Draw a ray diagram to show the formation of image by a concave lens when an object is placed in front of it. [2]  
 b. In the same diagram mark the object-distance ( $u$ ) and the image-distance ( $v$ ) with their proper signs (+ve or -ve as per the new Cartesian sign convention) and state how these distances are related to the focal length ( $f$ ) of the concave lens in this case.

- c. Find the nature and power of a lens which forms a real and inverted image of magnification - 1 at a distance of 40 cm from its optical centre.\*



- i. Name the phenomenon.
- ii. Write the laws of the following phenomenon that depicts in the above figure.
- iii. Refractive index of diamond with respect to glass is 1.6. If the absolute refractive index of glass is 1.5. Find out the absolute refractive index of the diamond?

50. Draw ray diagram showing the image formation by a concave lens when an object is placed beyond twice the focal length of the lens. [2]

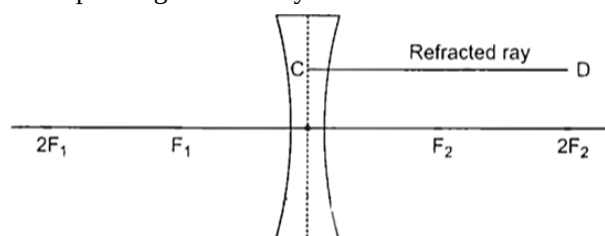
51. An object is placed at a distance of 30 cm from a concave lens of focal length 15 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. [2]

52. Differentiate between a luminous and non-luminous source of light. [2]

53. a. State Snell's law of refraction of light. [2]  
 b. When a ray of light travelling in air enters obliquely into a glass slab, it is observed that the light ray emerges parallel to the incident ray but it is shifted sideways slightly. Draw a labelled ray diagram to illustrate it.
54. An object of height 10 cm is placed 25 cm away from the optical center of a converging lens of focal length 15 cm. Calculate the image-distance and height of the image formed. [2]
55. A convex lens can form a (i) real, inverted and magnified image as well as (ii) virtual, erect and magnified image of an object. If the focal length of the lens is 10 cm, what should be the range of the object distance in both cases? Draw ray diagrams to justify your answer. [2]
56. The refractive indices of glass and water with respect to air are  $\frac{3}{2}$  and  $\frac{4}{3}$  respectively. If speed of light in glass is  $2 \times 10^8$  m/s, find the speed of light in water. [2]
57. Draw the ray diagram of ray entering a glass slab. Label angle of incidence, refraction and emergence. [2]
58. State the laws of refraction of light. Explain the term **absolute refractive index of a medium** and write an expression to relate it with the speed of light in vacuum. [2]
59. Distinguish between real and virtual image in a lens. [2]
60. What is the power of lens ? What is its SI unit ? [2]
61. The image of an object formed by a lens is of magnification -1. If the distance between the object and its image is 60 cm, what is the focal length of the lens? If the object is moved 20 cm towards the lens, where would the image be formed? State reason and also draw a ray diagram in support of your answer. [2]
62. Find the power of a concave lens of focal length 2m? [2]
63. What are the laws of refraction of light ? How can these be verified experimentally ? [2]
64. A teacher gives a convex lens and a concave mirror of focal length of 20 cm each to his student and asks him to find their focal lengths by obtaining the image of a distant object. The student uses a distant tree as the object and obtains its sharp image, one by one, on a screen. The distances  $d_1$  and  $d_2$  between the lens/mirror and the screen in the two cases and the nature of their respective sharp images are likely to be [2]  
 a. (20 cm, 40 cm) and (erect and erect)  
 b. (20 cm, 40 cm) and (inverted and inverted)  
 c. (20 cm, 20 cm) and (inverted and inverted)  
 d. (20 cm, 40 cm) and (erect and inverted)

Give reason for your answer.

65. The diagram below shows the refracted CD through a concave lens. Complete the diagram by drawing the corresponding incident ray. [2]



66. The absolute refractive indices of glass and water are  $\frac{4}{3}$  and  $\frac{3}{2}$  respectively. If the speed of light in glass is  $2 \times 10^8$  m/s, calculate the speed of light in [2]  
 i. vacuum  
 ii. water.
67. Draw ray diagram showing the image formation by a convex lens when an object is placed between optical centre and focus of the lens. [2]

68. A ray of light traveling in air enter obliquely into water. Does the light ray bend towards normal or away from normal? Why? [2]
69. Draw ray diagram showing the image formation by a convex lens when an object is placed at twice the focal length of the lens. [2]
70. Define power of a lens. The focal length of a lens is - 10 cm. Write the nature of the lens and find its power. If an object is placed at a distance of 20 cm from the optical center of this lens, according to the New Cartesian Sign Convention, what will be the sign of magnification in this case? [2]
71. Find the power of a concave lens of focal length 2 m. [2]
72. If the image formed by a lens for all positions of an object placed in front of it is always erect and diminished, what is the nature of this lens? Draw a ray diagram to justify your answer. [2]
73. 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 the 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? [2]
74. Analyse the following observation table showing variation of image-distance (v) with object distance (u) in case of a convex lens and answer the questions that follow without doing any calculations: [2]

S. No.	Object distance u (cm)	Image distance v (cm)
1.	-100	+ 25
2.	-60	+ 30
3.	-40	+ 40
4.	-30	+ 60
5.	-25	+ 100
6.	-15	+ 120

- What is the focal length of the convex lens? Give reason to justify your answer.
  - Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion?
  - Select an appropriate scale and draw a ray diagram for the observation at S.No. 2.
  - Also find the approximate value of magnification.
75. What is meant by power of a lens? Write its SI unit. A student uses a lens of focal length 40 cm and another of -20 cm. Write the nature and power of each lens. [2]