

Class 10 Science Chapterwise PYQs

2026 – 2005 | All CBSE Board Papers

Chapter-wise previous year questions, sorted by marks and year

Chapter 9: Light - Reflection and Refraction

Questions

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|------------------------------------|--|
| • 1-Mark Questions | 87 questions · Section A · MCQ |
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1-Mark Questions (87 questions · Section A · MCQ)

Q1. A convex lens of focal length 15 cm, is forming a real image. If the size of image is same as the size of object, then position of object and position of image will be, respectively :

- (A) -15 cm and -15 cm from lens
- (B) -15 cm and +15 cm from lens
- (C) -30 cm and +30 cm from lens
- (D) -30 cm and -30 cm from lens

[2026]

Q2. Read the following passage and answer the question : Lenses can form different types of images depending upon their focal length and position of object. A convex lens can create real, inverted or virtual, erect images, while a concave lens forms only virtual and diminished images. The focal length determines the power of lens. Convex lenses have positive focal length while concave lenses have negative focal length by convention. When lenses are placed together, their combined power is determined by

the sum of their individual powers. Ray diagrams help to visualize how light converges or diverges through lens to form an image.

- (a) A convex lens of focal length 20 cm is used to form an image. If an object is placed at 40 cm from the lens, what will be the position and nature of image ?

[2026]

- Q3. Illustrate the formation of image with the help of ray diagram, when the object is placed between the optical centre and principal focus of concave lens.

[2026]

- Q4. From the following options choose the one which gives negative magnification greater than one :

- (A) Concave mirror; Nature of image - real
- (B) Concave mirror; Nature of image - virtual
- (C) Convex mirror; Nature of image - real
- (D) Convex mirror; Nature of image - virtual

[2026]

- Q5. Rays from the sun converge at a point 25 cm behind a convex lens. The distance at which an object be placed in front of the lens to get a virtual image, is:

- (A) 20 cm
- (B) 40 cm
- (C) 50 cm
- (D) More than 50 cm

[2026]

- Q6. Mirror 'X' is used to concentrate sunlight in solar furnace and Mirror 'Y' is fitted on the side of the vehicle to see the traffic behind the driver. Which of the following statements are true for the two mirrors ? (i) The image formed by mirror 'X' is real,

diminished and at its focus. (ii) The image formed by mirror 'Y' is virtual, diminished and erect. (iii) The image formed by mirror 'X' is virtual, diminished and erect. (iv) The image formed by mirror 'Y' is real, diminished and at its focus.

- (A) (i) and (ii)
- (B) (ii) and (iii)
- (C) (i) and (iv)
- (D) (iii) and (iv)

[2025]

Q7. If the absolute refractive indices of two media X and Y are $\frac{6}{5}$ and $\frac{4}{3}$ respectively, then the refractive index of Y with respect to X will be :

- (A) $\frac{10}{9}$
- (B) $\frac{9}{10}$
- (C) $\frac{9}{8}$
- (D) $\frac{8}{9}$

[2025]

Q8. An object is placed at a distance of 30 cm from the pole of a concave mirror. If its real and inverted image is formed at 60 cm in front of the mirror, the focal length of the mirror is :

- (A) -15 cm
- (B) -20 cm
- (C) +20 cm
- (D) +15 cm

[2025]

Q9. A candle flame is placed in front of the reflecting surface of a convex mirror of focal length f . If the distance of the flame from the pole of the mirror is ' f ', its image is formed:

- (A) at infinite distance from the mirror
- (B) behind the mirror at the principal focus

- (C) behind the mirror at a distance $2f$
- (D) behind the mirror at a distance $\frac{f}{2}$

[2025]

Q10. To get an image of magnification -1 on a screen using a lens of focal length 20 cm, the object distance must be :

- (A) Less than 20 cm
- (B) 30 cm
- (C) 40 cm
- (D) 80 cm

[2025]

Q11. An optical device 'X' is placed obliquely in the path of a narrow parallel beam of light. If the emergent beam gets displaced laterally, the device 'X' is :

- (A) plane mirror
- (B) convex lens
- (C) glass slab
- (D) glass prism

[2025]

Q12. In order to obtain large images of the teeth of patients, the dentist holds the concave mirror in such a manner that the teeth are positioned

- (A) at the focus of mirror.
- (B) between pole and focus of the mirror.
- (C) between focus and centre of curvature of the mirror.
- (D) at the centre of curvature of the mirror.

[2025]

Q13. Identify from the following the ray diagram which shows the correct path of the

reflected ray for the ray incident on a concave mirror as shown :

- (A) (A)
- (B) (B)
- (C) (C)
- (D) (D)

[2025]

Q14. At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen ?

- (A) Beyond twice the focal length of the lens.
- (B) At the principal focus of the lens.
- (C) At twice the focal length of the lens.
- (D) Between the optical centre of the lens and its principal focus.

[2024]

Q15. Absolute refractive index of glass and water is $\frac{3}{2}$ and $\frac{4}{3}$ respectively. If the speed of light in glass is 2×10^8 m/s, the speed of light in water is :

- (A) $\frac{9}{4} \times 10^8$ m/s
- (B) $\frac{5}{2} \times 10^8$ m/s
- (C) $\frac{7}{3} \times 10^8$ m/s
- (D) $\frac{16}{9} \times 10^8$ m/s

[2024]

Q16. How will the image formed by a convex lens be affected, if the upper half of the lens is wrapped with a black paper ?

- (A) The size of the image formed will be one-half of the size of the image due to complete lens.
- (B) The image of upper half of the object will not be formed.
- (C) The brightness of the image will reduce.
- (D) The lower half of the inverted image will not be formed.

[2024]

Q17. A highly polished surface such as a mirror reflects most of the light falling on it. In our daily life we use two types of mirrors - plane and spherical. The reflecting surface of a spherical mirror may be curved inwards or outwards. In concave mirrors, reflection takes place from the inner surface, while in convex mirrors reflection takes place from the outer surface. Define the principal axis of a concave mirror.

[2024]

Q18. A ray of light is incident on a concave mirror, parallel to its principal axis. If this ray after reflection from the mirror passes through the principal axis from a point at a distance of 10 cm from the pole of the mirror, find the radius of curvature of the mirror.

[2024]

Q19. An object is placed in front of a convex mirror at infinity. According to the New Cartesian Sign Convention, the sign of the focal length and the sign of the image distance in this case are respectively :

- (A) +, -
- (B) -, +
- (C) -, -
- (D) +, +

[2023]

Q20. A student wants to obtain an erect image of an object using a concave mirror of 10 cm focal length. What will be the distance of the object from the mirror?

- (A) Less than 10 cm
- (B) 10 cm
- (C) between 10 cm and 20 cm
- (D) more than 20 cm

[2023]

Q21. To obtain a magnification of +2 with a concave mirror of radius of curvature 60 cm the object distance must be:

- (A) -90 cm
- (B) -45 cm
- (C) -30 cm
- (D) -15 cm

[2023]

Q22. In torch lights and head lights of vehicles, the bulb is placed:

- (A) between the pole and the focus of the reflector.
- (B) very near to the focus of the reflector.
- (C) between the focus and centre of curvature of the reflector.
- (D) at the centre of curvature of the reflector.

[2023]

Q23. The laws of reflection hold true for:

- (A) plane mirrors only
- (B) concave mirrors only
- (C) convex mirrors only
- (D) all reflecting surfaces

[2020]

Q24. When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is:

- (A) real
- (B) inverted
- (C) virtual and inverted
- (D) virtual and erect

[2020]

Q25. A real image is formed by the light rays after reflection or refraction when they: (A) actually meet or intersect with each other. (B) actually converge at a point. (C) appear to meet when they are produced in the backward direction. (D) appear to diverge from a point. Which of the above statements are correct?

- (A) (A) and (D)
- (B) (B) and (D)
- (C) (A) and (B)
- (D) (B) and (C)

[2020]

Q26. Consider the following properties of virtual images: (A) cannot be projected on the screen (B) are formed by both concave and convex lens (C) are always erect (D) are always inverted The correct properties are:

- (A) (A) and (D)
- (B) (A) and (B)
- (C) (A), (B) and (C)
- (D) (A), (B) and (D)

[2020]

Q27. Study the given ray diagrams and select the correct statement from the following:

- (A) Device X is a concave mirror and device Y is a convex lens, whose focal lengths are 20 cm and 25 cm respectively.
- (B) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 10 cm and 25 cm respectively.
- (C) Device X is a concave lens and device Y is a convex mirror, whose focal lengths are 20 cm and 25 cm respectively.
- (D) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively.

[2017]

Q28. A student obtains a blurred image of a distant object on a screen using a convex lens.

To obtain a distinct image on the screen he should move the lens

- (A) away from the screen
- (B) towards the screen
- (C) to a position very far away from the screen
- (D) either towards or away from the screen depending upon the position of the object

[2017]

Q29. A student very cautiously traces the path of a ray through a glass slab for different values of the angle of incidence ($\angle i$). He then measures the corresponding values of the angle of refraction ($\angle r$) and the angle of emergence ($\angle e$) for every value of the angle of incidence. On analysing these measurements of angles, his conclusion would be

- (A) $\angle i > \angle r > \angle e$
- (B) $\angle i = \angle e > \angle r$
- (C) $\angle i < \angle r < \angle e$
- (D) $\angle i = \angle e < \angle r$

[2017]

Q30. Three students A, B and C focussed a distant building on a screen with the help of a concave mirror. To determine focal length of the concave mirror they measured the distances as given below: Student A: From mirror to the screen Student B: From building to the screen Student C: From building to the mirror Who measured the focal length correctly:

- (A) Only A
- (B) Only B
- (C) A and B
- (D) B and C

[2017]

Q31. If you focus the image of a distant object, whose shape is given below, on a screen using a convex lens, the shape of the image of this object on the screen would be:

- (A) (A)
- (B) (B)
- (C) (C)
- (D) (D)

[2017]

Q32. The correct sequencing of angle of incidence, angle of emergence, angle of refraction and lateral displacement shown in the following diagram by digits 1, 2, 3 and 4 is:

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

[2017]

Q33. An optical device has been given to a student and he determines its focal length by focusing the image of the sun on a screen placed 24 cm from the device on the same side as the sun. Select the correct statement about the device.

- (A) Convex mirror of focal length 12 cm
- (B) Convex lens of focal length 24 cm
- (C) Concave mirror of focal length 24 cm
- (D) Convex lens of focal length 12 cm

[2017]

Q34. To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distant object formed by the mirror on a screen. The image obtained on the screen, as compared to the object is always:

- (A) Laterally inverted and diminished
- (B) Inverted and diminished
- (C) Erect and diminished
- (D) Erect and highly diminished

[2016]

Q35. Suppose you have focused on a screen the image of candle flame placed at the farthest end of the laboratory table using a convex lens. If your teacher suggests you to focus the parallel rays of the sun, reaching your laboratory table, on the same screen, what you are expected to do is to move the:

- (A) lens slightly towards the screen
- (B) lens slightly away from the screen
- (C) lens slightly towards the sun
- (D) lens and screen both towards the sun

[2016]

Q36. In your laboratory you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle i$) and in each case measure the values of the corresponding angle of refraction ($\angle r$) and angle of emergence ($\angle e$). On the basis of your observations your correct conclusion is:

- (A) $\angle i$ is more than $\angle r$, but nearly equal to $\angle e$
- (B) $\angle i$ is less than $\angle r$, but nearly equal to $\angle e$
- (C) $\angle i$ is more than $\angle e$, but nearly equal to $\angle r$
- (D) $\angle i$ is less than $\angle e$, but nearly equal to $\angle r$

[2016]

Q37. In the following ray diagram the correctly marked angles are:

- (A) $\angle i$ and $\angle e$
- (B) $\angle A$ and $\angle D$
- (C) $\angle A$, $\angle e$ and $\angle D$
- (D) $\angle r$, $\angle A$ and $\angle D$

[2016]

Q38. Study the following diagram and select the correct statement about the device 'X'.

- (A) Device 'X' is a concave mirror of radius of curvature 12 cm

- (B) Device 'X' is a concave mirror of focal length 6 cm
- (C) Device 'X' is a concave mirror of focal length 12 cm
- (D) Device 'X' is a convex mirror of focal length 12 cm

[2015]

Q39. A student has obtained a point image of a distant object using the given convex lens. To find the focal length of the lens he should measure the distance between the:

- (A) lens and the object only
- (B) lens and the screen only
- (C) object and the image only
- (D) lens and the object and also between the object and the image

[2015]

Q40. Four students P, Q, R, and S traced the path of a ray of light passing through a glass slab for an angle of incidence 40° and measured the angle of refraction. The values as measured by them were 18° , 22° , 25° and 30° respectively. The student who has performed the experiment methodically is:

- (A) P
- (B) Q
- (C) R
- (D) S

[2015]

Q41. After tracing the path of a ray of light through a glass prism a student marked the angle of incidence ($\angle i$), angle of refraction ($\angle r$), angle of emergence ($\angle e$) and the angle of deviation ($\angle D$) as shown in the diagram. The correctly marked angles are:

- (A) (A)
- (B) (B)
- (C) (C)
- (D) (D)

[2015]

Q42. A student has obtained an image of a distant object on a screen to determine the focal length F_1 of the given lens. His teacher after checking the image, gave him another lens of focal length F_2 and asked to focus the same object on the same screen. The student found that to obtain a sharp image he has to move the lens away from the screen. From this finding we may conclude that both the lenses given to the student were:

- (A) Concave and $F_1 < F_2$
- (B) Convex and $F_1 < F_2$
- (C) Convex and $F_1 > F_2$
- (D) Concave and $F_1 > F_2$

[2014]

Q43. A student has obtained the image of a distant object with a concave mirror to determine its focal length. If he has selected a well illuminated red building as object, which of the following correctly describes the features of the image formed?

- (A) Virtual, inverted, diminished image in red shade
- (B) Real, erect, diminished image in pink shade
- (C) Real, inverted, diminished image in red shade
- (D) Virtual, erect, enlarged image in red shade

[2014]

Q44. A student has obtained a magnified image of a flame on a screen using a convex lens. To draw the corresponding ray diagram to show the image formation, which of the following two rays (whose paths after refraction are shown) should he select?

- (A) I and II
- (B) II and III
- (C) III and IV
- (D) I and IV

[2014]

Q45. A student was asked by his teacher to find the image distance for various object distances in case of a given convex lens. He performed the experiment with all precautions and noted down his observations in the following table:

S. No.	Object distance (cm)	Image distance (cm)
1	60	15
2		

checking the observation table the teacher pointed out that there is a mistake in recording the image distance in one of the observations. Find the serial number of the observation having faulty image distance.

- (A) 2
- (B) 3
- (C) 5
- (D) 6

[2014]

Q46. A student focussed the image of a distant object using a device 'X' on a white screen 'S' as shown in the figure. If the distance of the screen from the device is 40 cm, select the correct statement about the device.

- (A) The device X is a convex lens of focal length 20 cm.
- (B) The device X is a concave mirror of focal length 40 cm.
- (C) The device X is a concave mirror of radius of curvature 40 cm.
- (D) The device X is a convex lens of focal length 40 cm.

[2013]

Q47. A student obtained a sharp image of a burning candle, placed at the farther end of a laboratory table, on a screen using a concave mirror. For getting better value of focal length of the mirror, the subject teacher suggested him for focussing a well illuminated distant object. What should the student do?

- (A) He should move the mirror away from the screen.
- (B) He should move the mirror slightly towards the screen.
- (C) He should move the mirror as well as the screen towards the newly selected object.
- (D) He should move only the screen towards the newly selected object.

[2013]

Q48. After tracing the path of rays of light through a glass slab for three different angles of incidence, a student measured the corresponding values angle of refraction r and angle of emergence e and recorded them in the table given below:

S. No.	Angle of incidence (i)	Angle of refraction (r)	Angle of emergence (e)
I	30°	20°	30°
II	40°	25°	40°
III	50°	30°	50°

correct observations are:

- (A) I and II
- (B) I and III
- (C) I and III
- (D) II and III

[2013]

Q49. Select from the following the best set-up for tracing the path of a ray of light through a rectangular glass slab:

- (A) I
- (B) II
- (C) III
- (D) IV

[2013]

Q50. Study the following ray diagrams: The diagrams showing the correct path of the ray after passing through the lens are:

- (A) II and III only
- (B) I and II only
- (C) I, II and III
- (D) I, III and IV

[2013]

Q51. Out of the five incident rays shown in the figure find the three rays that are obeying

the laws of refraction and may be used for locating the position of image formed by a convex lens:

- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 3, 4 and 5
- (D) 1, 2 and 4

[2013]

Q52. A student has to determine the focal length of a concave mirror by obtaining the image of a distant object on a screen. For getting best result he should focus

- (A) a distant tree or an electric pole
- (B) a well-illuminated distant building
- (C) well-lit grills of the nearest window
- (D) a burning candle placed at the distant edge of the laboratory table

[2012]

Q53. A student obtained a sharp inverted image of a distant tree on a screen placed in front of the concave mirror. He then removed the screen and tried to look into the mirror. He would now see

- (A) a very blurred image of the wall opposite to the mirror
- (B) an erect and magnified image of the tree in the mirror
- (C) no image as the screen has been removed
- (D) a highly diminished inverted image of the tree at the focus of the mirror

[2012]

Q54. To determine the focal length of a convex lens, you should have

- (A) a convex lens and a screen
- (B) a convex lens and a lens holder
- (C) a lens holder, a screen holder and a scale
- (D) a convex lens, screen holders for them and a scale

[2012]

Q55. While performing the experiment on tracing the path of a ray of light through a rectangular glass slab, in which of the following experimental set-ups is a student likely to get best results? P_1 and P_2 are the positions of pins fixed by him.

- (A) I
- (B) II
- (C) III
- (D) IV

[2012]

Q56. Four students showed the following traces of the path of a ray of light passing through a rectangular glass slab. The trace most likely to be correct is that of student

- (A) I
- (B) II
- (C) III
- (D) IV

[2012]

Q57. To determine focal length of a concave mirror a student obtains the image of a well lit distant object on a screen. To determine the focal length of the given concave mirror he needs to measure the distance between:

- (A) mirror and the object
- (B) mirror and the screen
- (C) screen and the object
- (D) screen and the object and also mirror and the screen

[2012]

Q58. A student obtained a sharp image of the grills of a window on a screen using a concave mirror. His teacher remarked that for getting better results a well lit distant object (preferably the sun) should be focussed on the screen. What should be done for this purpose?

- (A) Move the screen slightly away from the mirror
- (B) Move the mirror slightly towards the screen
- (C) Move the screen and the mirror away from the object
- (D) Move the screen and the mirror towards the object

[2012]

Q59. To determine the focal length of a convex lens by obtaining a sharp image of a distant object we generally follow the following steps which are not in proper sequence. (a) Hold the lens between the object and the screen (b) Measure the distance between the lens and the screen (c) Select a well lit distant object (d) Place a screen opposite to the object on the lab table (e) Adjust the position of the lens to form a sharp image The correct sequence of these steps is:

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

[2012]

Q60. A student traces the path of a ray of white light through a rectangular glass slab and marks the angles of incidence ($\angle i$), refraction ($\angle r$) and emergence ($\angle e$) as shown. Which angle or angles has he not marked correctly?

- (A) $\angle i$ only
- (B) $\angle i$ and $\angle r$
- (C) $\angle i$ and $\angle e$
- (D) $\angle r$ and $\angle e$

[2012]

Q61. While tracing the path of a ray of light passing through a rectangular glass slab a student tabulated his observations as given below: The correct observation is:

- (A) I
- (B) II

- (C) III
- (D) IV

[2012]

Q62. Parallel light rays from a distant object incident on a device 'X' form a point size image on a screen. The device 'X' must be

- (A) a concave mirror
- (B) a convex lens
- (C) a concave lens
- (D) either a concave mirror or a convex lens

[2012]

Q63. A student has to determine the focal length of a convex lens by obtaining the image of a distant object on a screen. Which of the following measures should he take to obtain better results? a. Select a lens of small diameter (say 3 cm). b. Select a lens of larger diameter (say 5 cm). c. Select an object very far from the lens. d. Select an object far, but not very far, from the lens. e. Keep all the lights of the room on. f. Keep minimum lights of the room on.

- (A) a, c and e
- (B) b, d and f
- (C) a, d and f
- (D) b, d and e

[2012]

Q64. Three students X, Y and Z are finding the focal length of the given concave mirror by obtaining the image of the object selected by them. X obtains the image of the grill of the nearest window of the lab. Y obtains the image of a white painted building near the lab and Z obtains a point size image of the sun. The most correct value of the focal length is obtained by

- (A) X
- (B) Y

- (C) Z
- (D) X and Y both

[2012]

Q65. The values of $\angle i$, $\angle r$ and $\angle e$ as measured by four students P, Q, R and S are tabulated below. The student who performed the experiment most carefully and methodically is

- (A) P
- (B) Q
- (C) R
- (D) S

[2012]

Q66. To find the focal length of a concave mirror, Sita should choose which one of the following set-ups?

- (A) A mirror holder and a screen holder
- (B) A screen holder and a scale
- (C) A mirror holder, a screen holder and a scale
- (D) A screen, a mirror, holders for them and a scale

[2011]

Q67. By using a convex lens, a student obtained a sharp image of his class-room window grill on a screen. In which direction should he move the lens to focus a distant tree instead of the grill?

- (A) Towards the screen
- (B) Away from the screen
- (C) Very far away from the screen
- (D) Behind the screen

[2011]

Q68. To determine the focal length of a convex lens by obtaining a sharp image of a distant object, the following steps were suggested which are not in proper sequence: I. Hold the lens between the object and the screen. II. Adjust the position of the lens to form a sharp image. III. Select a suitable distant object. IV. Measure the distance between the lens and the screen. The correct sequence of steps to determine the focal length of the lens is

- (A) III, I, II, IV
- (B) III, I, IV, II
- (C) III, IV, I, II
- (D) I, II, III, IV

[2011]

Q69. In these diagrams, the angle of refraction r has been correctly marked in which diagram?

- (A) I
- (B) II
- (C) III
- (D) IV

[2011]

Q70. For a ray of light passing through a glass slab, the lateral displacement was correctly measured as

- (A) AB
- (B) PQ
- (C) CD
- (D) PR

[2011]

Q71. To find the focal length of a concave mirror Rahul focuses a distant object with this mirror. The chosen object should be

- (A) a tree

- (B) a building
- (C) a window
- (D) the sun

[2011]

Q72. For finding the focal length of a convex lens by obtaining the image of a distant object, one should use as the object

- (A) a well lit distant tree
- (B) window grill in the class room
- (C) any distant tree
- (D) a lighted candle kept at the other end of the table

[2011]

Q73. Mohan obtained a sharp inverted image of a distant tree on the screen placed behind the lens. He then moved the screen and tried to look through the lens in the direction of the object. He would see

- (A) a blurred image on the wall of the laboratory
- (B) an erect image of the tree on the lens
- (C) no image as the screen has been removed
- (D) an inverted image of the tree at the focus of the lens

[2011]

Q74. Four students A, B, C and D traced the paths of incident ray and the emergent ray by fixing pins P and Q for incident ray and pins R and S for emergent ray for a ray of light passing through a glass slab. The correct emergent ray was traced by the student

- (A) A
- (B) B
- (C) C
- (D) D

[2011]

Q75. Rahim recorded the following sets of observations while tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. The correct observation is recorded at serial number

- (A) I
- (B) II
- (C) III
- (D) IV

[2011]

Q76. Dhoni obtained the image of a distant object on a screen by using a concave mirror. To find the focal length of the mirror he should measure the distance between

- (A) the mirror and the screen as well as between object and the screen
- (B) mirror and the screen
- (C) object and the screen
- (D) object and the mirror

[2011]

Q77. Which of the following can be used to find the focal length of a convex lens?

- (A) Object at a distance of 10 cm for a lens of focal length 30 cm
- (B) Light from a laboratory window
- (C) Light from the sun
- (D) Light from a tree next to the window

[2011]

Q78. Mohan, Sohan and Rahul separately measured the focal length of the same convex lens using the same distant tree as object. Mohan obtained a sharp image (distance = f_1). Sohan obtained a slightly smaller and blurred image (distance = f_2). Rahul obtained a slightly magnified and blurred image (distance = f_3). The three measured values of focal length are likely to be related as

- (A) $f_1 < f_2$ and $f_1 = f_3$
- (B) $f_1 < f_2$ and $f_1 < f_3$
- (C) $f_3 > f_1 > f_2$
- (D) $f_1 = f_2 = f_3$

[2011]

Q79. The best set-up of pins for the incident ray to trace the path of a ray of light through a rectangular glass slab is represented in the figure

- (A) I
- (B) II
- (C) III
- (D) IV

[2011]

Q80. While tracing the path of a ray of light through a rectangular glass slab, the four students I, II, III and IV arrived at the following different conclusions: Student I: Angle of incidence $>$ Angle of emergence. Student II: Angle of refraction $>$ Angle of emergence. Student III: Emergent ray is parallel to refracted ray. Student IV: Emergent ray is parallel to incident ray. The correct conclusion has been drawn by the student

- (A) I
- (B) II
- (C) III
- (D) IV

[2011]

Q81. Explain why a ray of light passing through the centre of curvature of a concave mirror gets reflected along the same path.

[2010]

Q82. What is the nature of the image formed by a concave mirror if the magnification

produced by the mirror is +3?

[2010]

Q83. Why does a ray of light bend when it travels from one medium into another?

[2009]

Q84. Draw the given diagram in your answer book and complete it for the path of a ray of light beyond the lens.

[2009]

Q85. The refractive index of diamond is 2.42. What is the meaning of this statement in relation to speed of light?

[2008]

Q86. Copy this figure in your answer-book and show the direction of the light ray after reflection:

[2008]

Q87. Where will the image be formed by a concave mirror when an object is placed between the pole and the focus point of the mirror?

[2005]

2-Mark Questions (74 questions · Section B · VSA)

Q1. The given figure shows image formation by a lens. Analyse the figure and answer the following questions :

(a) What is the type of lens used for image formation in the given ray diagram ?

(b) If the real image is formed at a distance of 30 cm from the lens and the size of image is twice the size of the object, then where was the object placed ?

[2026]

Q2. A lens combination consists of a convex lens of focal length 30 cm and a concave lens of focal length 15 cm placed together. Find the equivalent focal length and power of this lens combination.

[2026]

Q3. Two lenses are placed in contact. One is a concave lens with focal length 2 m and the other is a convex lens with focal length 1.5 m. What type of lens will the combination behave as (convex or concave) ? Give reason.

[2026]

Q4. A mirror always forms a virtual, erect and diminished image. Identify the mirror and draw a labelled ray diagram for image formation by this mirror.

[2026]

Q5. Draw the ray diagram for the image formation by a lens which shows a magnification of +2.

[2026]

Q6. With the help of the given ray diagram, calculate the refractive index of Medium 2 with respect to Medium 1. (Given that $\sqrt{3} = 1.732$)

[2026]

Q7. Use the above given ray diagram to calculate the angle of incidence. Given that the refractive index of Medium 2 with respect to the Medium 1 is $\sqrt{3}$.

[2026]

Q8. A ray of light enters into medium B from medium A as shown in the given figure:

- (a) Which one of these two media is optically denser than the other medium? Justify your answer.
- (b) If the speed of light in medium A is V_A and in medium B is V_B , then what is the refractive index of medium B with respect to medium A?

[2026]

Q9. Redraw the following ray diagrams in your answer book and show the path of reflected/refracted ray:

- (i) Ray directed towards a concave mirror (C and F marked).
- (ii) Ray directed towards a convex lens (F_1 and $2F_1$ marked).

[2026]

Q10. Draw the ray diagram showing refraction through a glass slab and write the relation between angle of incidence, angle of refraction and refractive index of glass.

[2026]

Q11. (a) Relate the speed of light in the given medium with its optical density.

- (b) Using the information given in the table below, arrange the medium A, B and C in the ascending order of their optical density.
- | Medium | Speed of light (m/s) |
|--------|----------------------|
| A | 2.25×10^8 |
| B | 2×10^8 |
| C | 2.08×10^8 |

[2026]

Q12. (a) Define absolute refractive index of an optical medium.

(b) Arrange these material mediums given in the table in increasing order of speed of light through them.

Material Medium	Refractive Index
A	1.50
B	1.46

[2026]

Q13. When an incident ray of light enters in a medium 'X' from medium 'Y', it bends away from the normal. Comment about the following:

(a) Speed of light in medium 'X' with respect to the speed of light in medium of 'Y'.

(b) Optical density of medium 'X' with respect to the optical density of medium 'Y'. Give reason for your answer in each case.

[2026]

Q14. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.

[2025]

Q15. An object is placed at a distance of 10 cm in front of a concave mirror of focal length 15 cm. Use mirror formula to determine the position of the image formed by this mirror.

[2025]

Q16. Out of the two lenses, one concave and the other convex, state which one will diverge a parallel beam of light falling on it. Draw a ray diagram to show the principal focus of the lens.

[2025]

Q17. A ray of light after refraction from a convex lens emerges parallel to its principal axis.

- (i) Draw a labelled ray diagram to show it.
- (ii) In this case, the incident ray before refraction from the lens passes through a point on its principal axis. Name the point.

[2025]

Q18. The values of absolute refractive indices of kerosene and water are 1.44 and 1.33 respectively. Compare the two media on the basis of their

- (a) optical density
- (b) mass density
- (c) relative speed of propagation of light. What do you infer on the basis of above comparisons ?

[2025]

Q19. When an incident ray of light enters a medium 'X' from air, it bends towards the normal. Infer about the following with respect to air :

- (a) Optical density of medium 'X'.
- (b) Speed of light through medium 'X'. Give reason for your answer in each case.

[2025]

Q20. During an experiment, a student observes that the given mirror is forming an erect and diminished image for all positions of the object placed in front of it. Based on this information, answer the following questions :

- (a) Identify the mirror.
- (b) Using new Cartesian sign convention, write the magnitude of the magnification in this case.
- (c) What will be the radius of curvature of the mirror if its focal length is 20 cm ?

[2025]

Q21. Study the figure in which the path of a ray of light going from Medium 1 to Medium 2 is shown.

- (a) Out of the two Media - Medium 1 and Medium 2, in which is the speed of light more ?
- (b) State reason of bending of the refracted ray away from the normal.
- (c) Express refractive index of Medium 2 with respect to Medium 1 in terms of speed of light in two media.

[2025]

Q22. A ray of light falls making an angle of incidence θ on the surface of a glass slab. Draw a labelled ray diagram to show its path. Also mark lateral displacement on it.

[2024]

Q23. Define the term absolute refractive index of a medium. A ray of light enters from vacuum to glass of absolute refractive index 1.5. Find the speed of light in glass. The speed of light in vacuum is 3×10^8 m/s.

[2024]

Q24. The heat produced at a point due to concentration of sunlight by a convex lens burns a paper.

- (a) Explain why it happens.
- (b) Name the term (in the context of the lens used) given to the point at which the paper starts burning. What does the bright spot formed on the paper represent ?

[2024]

Q25. (i) An object is placed at a distance of 10 cm from the pole of a convex mirror of focal length 15 cm. Find the position of the image.

[2024]

Q26. (ii) A mirror forms a virtual, erect and diminished image of an object. Identify the type of this mirror. Draw a ray diagram to show the image formation in this case.

[2024]

Q27. Define power of a lens. Find power of a lens whose focal length is 50 cm.

[2024]

Q28. "The linear magnification produced by a spherical mirror is + 3." Based on this statement answer the following questions :

(a) What is the type of mirror ?

(b) Where is the object located ?

(c) List two properties of the image formed (other than the size/magnification).

[2024]

Q29. A light ray enters from medium A to medium B as shown in the figure.

(a) Which one of the two media is denser w.r.t. other medium? Justify your answer.

(b) If the speed of light in medium A is v_1 and in medium B is v_2 , what is the refractive index of B with respect to A?

[2023]

Q30. (a) A ray of light starting from diamond is incident on the interface separating diamond and water. Draw a labelled ray diagram to show the refraction of light

in this case.

- (b) Absolute refractive indices of diamond and water are 2.42 and 1.33 respectively. Find the value of refractive index of water w.r.t. diamond.

[2023]

- Q31. List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining image of a distant object on a screen.

[2019]

- Q32. 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° . Label on it (i) angle of refraction, (ii) angle of emergence and (iii) lateral displacement.

[2019]

- Q33. A student traces the path of a ray of light through a glass prism as shown in the diagram, but leaves it incomplete and unlabelled. Redraw and complete the diagram. Also label on it $\angle i$, $\angle e$, $\angle r$ and $\angle D$.

[2019]

- Q34. The absolute refractive index of Ruby is 1.7. Find the speed of light in Ruby. The speed of light in vacuum is 3×10^8 m/s.

[2019]

- Q35. The power of a lens is +5 dioptres. What is the nature and focal length of this lens? At what distance from this lens should an object be placed so as to get its inverted image of the same size?

[2019]

Q36. List in proper sequence the steps of the experiment for determining the approximate focal length of a given concave mirror by obtaining the image of a distant object.

[2019]

Q37. A student has to trace the path of a ray of light passing through a rectangular glass slab for four different values of angle of incidence.

(a) Write two important precautions for this experiment.

(b) List two conclusions the student will draw based on his experiment.

[2019]

Q38. 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.

[2019]

Q39. A student has to trace the path of a ray of light through a glass prism. List four precautions he should observe for better results.

[2019]

Q40. Define absolute refractive index and express it mathematically.

[2019]

Q41. State laws of refraction of light.

[2019]

Q42. List four characteristics of the image formed by a concave mirror of focal length 40 cm

when the object is placed in front of it at a distance of 20 cm from its pole.

[2019]

Q43. Define refractive index of a transparent medium. The speed of light in a medium of absolute refractive index 1.5 is $2 \times 10^8 \text{ ms}^{-1}$. What is the speed of light in vacuum ?

[2019]

Q44. 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

- (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)

[2019]

Q45. Draw a labelled ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror. Mark the angle of incidence and angle of reflection on it.

[2019]

Q46. Draw a labelled ray diagram to show the path of the reflected ray corresponding to the ray which is directed towards the principal focus of a convex mirror. Mark the angle of incidence and angle of reflection on it.

[2019]

Q47. Draw a labelled ray diagram to show the path of the reflected ray corresponding to

the ray which is incident obliquely to the principal axis, towards the pole of a convex mirror. Mark the angle of incidence and angle of reflection on it.

[2019]

Q48. An object of height 4.0 cm is placed at a distance of 30 cm from the optical centre 'O' of a convex lens of focal length 20 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O' and principal focus 'F' on the diagram. Also find the approximate ratio of size of the image to the size of the object.

[2018]

Q49. If the image formed by a spherical mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it ? Draw a labelled ray diagram to support your answer.

[2018]

Q50. A student focuses the image of a candle flame, placed at about 2 m from a convex lens of focal length 10 cm, on a screen. After that he moves gradually the flame towards the lens and each time focuses its image on the screen. (A) In which direction does he move the lens to focus the flame on the screen? (B) What happens to the size of the image of the flame formed on the screen? (C) What difference is seen in the intensity (brightness) of the image of the flame on the screen? (D) What is seen on the screen when the flame is very close (at about 5 cm) to the lens?

[2017]

Q51. 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.

[2017]

Q52. A student places a candle flame at a distance of about 60 cm from a convex lens of

focal length 10 cm and focuses the image of the flame on a screen. After that he gradually moves the flame towards the lens and each time focuses the image on the screen.

- (a) In which direction - toward or away from the lens, does he move the screen to focus the image?
- (b) How does the size of the image change?
- (c) How does the intensity of the image change as the flame moves towards the lens?
- (d) Approximately for what distance between the flame and the lens, the image formed on the screen is inverted and of the same size?

[2017]

Q53. An object is placed at a distance of 30 cm in front of a convex mirror of focal length 15 cm. Write four characteristics of the image formed by the mirror.

[2017]

Q54. Trace the path of a ray of light incident at an angle of 45° on a rectangular glass slab. Write the measure of the angle of refraction, the angle of emergence and the lateral displacement suffered by the ray as it passes through the slab.

[2017]

Q55. Redraw the following diagram on your answer-sheet and show the path of the reflected ray. Also mark the angle of incidence ($\angle i$) and the angle of reflection ($\angle r$) on the diagram.

[2017]

Q56. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O', principal focus F and height of the image on

the diagram.

[2016]

Q57. Name the type of mirrors used in the design of solar furnaces. Explain how high temperature is achieved by this device.

[2016]

Q58. "The magnification produced by a spherical mirror is -3". List four informations you obtain from this statement about the mirror/image.

[2016]

Q59. 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 2×10^8 m/s, find the speed of light in water.

[2016]

Q60. To find the image-distance for varying object-distances in case of a convex lens, a student obtains on a screen a sharp image of a bright object placed very far from the lens. After that he gradually moves the object towards the lens and each time focuses its image on the screen.

(a) In which direction - towards or away from the lens - does the screen move to focus the object?

(b) What happens to the size of the image - does it increase or decrease?

(c) What happens when he moves the object very close to the lens?

[2015]

Q61. What is the magnification of the image formed by plane mirrors and why?

[2015]

Q62. What is meant by power of a lens?

[2015]

Q63. List four specific characteristics of the images of objects formed by convex mirrors.

[2015]

Q64. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray which is directed parallel to the principal axis of a convex mirror. Mark on it the angle of incidence and the angle of reflection.

[2014]

Q65. "A ray of light incident on a rectangular glass slab immersed in any medium emerges parallel to itself." Draw labelled ray diagram to justify the statement.

[2013]

Q66. To construct ray diagram we use two light rays which are so chosen that it is easy to know their directions after reflection from the mirror. List these two rays and state the path of these rays after reflection. Use these rays to locate the image of an object placed between centre of curvature and focus of a concave mirror.

[2012]

Q67. List four properties of the image formed by a plane mirror.

[2012]

Q68. To construct a ray diagram we use two light rays which are so chosen that it is easy to know their directions after refraction from the lens. List these two rays and state the

path of these rays after refraction. Use these two rays to locate the image of an object placed between 'F' and '2F' of a convex lens.

[2012]

Q69. State any four characteristics of the image of an object formed by a plane mirror.

[2011]

Q70. State the two laws of reflection of light.

[2011]

Q71. Define and show on a diagram, the following terms relating to a concave mirror:

(i) Aperture

(ii) Radius of curvature

[2011]

Q72. What is the minimum number of rays required for locating the image formed by a concave mirror for an object? Draw a ray diagram to show the formation of a virtual image by a concave mirror.

[2009]

Q73. Explain with the help of a diagram, why a pencil partly immersed in water appears to be bent at the water surface.

[2008]

Q74. With respect to air, the refractive indices of water and benzene are 1.33 and 1.50

respectively. Calculate the refractive index of benzene with respect to water.

[2005]

3-Mark Questions (75 questions · Section C · SA)

Q1. (a) Write the expression for the magnification produced by a lens in terms of object distance and image distance.

(b) A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. Calculate the size of the image formed, if the distance of the object from the lens is 10 cm.

[2026]

Q2. (a) State the laws which help to find out the angle of incidence and angle of reflection in the ray diagram given above.

(b) Find out the angle of incidence and angle of reflection in the given ray diagram.

[2026]

Q3. (a) Write the name of the lens and position of the object in front of it so that a virtual and magnified image is formed.

(b) An object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. If object is located at 30 cm from this lens, using lens formula find out the position and nature of the image formed.

[2026]

Q4. (a) Observe the given ray diagram and compare: (i) the speed of light in medium A and the speed of light in medium B. (ii) the optical densities of medium B and medium C.

(b) Draw a ray diagram for refraction where the optical density of medium 'A' becomes equal to the optical density of medium 'C' and optical density of medium 'B' is greater than the optical density of medium 'A' and medium 'C'.

[2026]

Q5. A mirror used for rear-view of an automobile has a focal length 2.0 m. If a car is located at 8.0 m from the mirror -

- (a) Find out the position of the image of this car as seen in the mirror.
- (b) Draw the ray-diagram for image formation by the rear-view mirror.

[2026]

Q6. (a) A ray of light after reflection from a concave mirror becomes parallel to its principal axis. Draw a labelled ray diagram to show this.

- (b) (i) Differentiate between the virtual images formed by a convex mirror and concave mirror. (ii) "The value of magnification 'm' for a mirror is -2." Calculate the height of object if the height of image is 20 cm.

[2026]

Q7. An object is placed at a distance of 30 cm in front of a convex lens of focal length 15 cm. Use lens formula to determine the position of the image. What will be the size of the image in this case?

[2026]

Q8. An object of height 6 cm is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 15 cm. Use lens formula to determine:

- (a) The distance of image from the optical centre.
- (b) The height of the image formed.

[2026]

Q9. Draw ray diagrams to show the nature, position and relative size of the image formed by a convex mirror when the object is placed (i) at infinity and (ii) between infinity

and pole P of the mirror.

[2025]

Q10. A convex lens forms an 8.0 cm long image of a 2.0 cm long object which is kept at a distance of 6.0 cm from the optical centre of the lens. If the object and the image are on the same side of the lens, find (i) the nature of the image, (ii) the position of the image, and (iii) the focal length of the lens.

[2025]

Q11. An object is placed at a distance of 20 cm from the optical centre of a concave lens and its image is formed on the same side of the lens as the object. If the distance of the image from optical centre of the lens is 10 cm, use lens formula to determine (i) focal length, and (ii) power of the lens in new Cartesian sign conventions.

[2025]

Q12. A convex mirror used for rear view on an automobile has a focal length of 1.5 m. If a 3 m high bus is located at 6.0 m from the mirror, use mirror formula to determine the position and size of the image of the bus as seen in the mirror.

[2025]

Q13. If we want to obtain a virtual and magnified image of an object by using a concave mirror of focal length 18 cm, where should the object be placed? Use mirror formula to determine the object distance for an image of magnification +2 produced by this mirror to justify your answer.

[2025]

Q14. A student placed a candle flame at different distances from a convex lens and focused its image on a screen. He recorded his observation in tabular form as given below :

S.No.	Distance
-------	----------

of flame from the lens (cm) </th> <th>Distance of the image from the lens

(cm) </th> </tr> <tr> <td>1 </td> <td>-90 </td> <td>+18 </td> </tr> <tr> <td>2 </td> <td>+18 </td> <td>-90 </td> <td>+18 </td> </tr>

the observation table and on the basis of your analysis only, answer the following questions (without doing any calculations) :

- (a) What is the focal length of the convex lens used ? Give reason to justify your answer.
- (b) Which one of the sets of observations is not correct and why ?
- (c) Draw ray diagram to show image formation for any correct set of observation.

[2025]

Q15. An object of size 5 cm is placed at a distance of 30 cm from the optical centre of a converging lens of focal length 20 cm. Use lens formula to determine the position and size of the image formed.

[2025]

Q16. An object is placed in front of a concave mirror of focal length 12 cm. If distance of the object from the pole of the mirror is 8 cm, then use mirror formula to determine the position of the image formed. Draw a labelled ray diagram to justify your answer in this case.

[2024]

Q17. (i) The image of an object formed by a mirror is real, inverted and is of magnification -1. If the image is at a distance of 30 cm from the mirror, where is the object placed ? Give reason to justify your answer.

(ii) Where would the image be if the object is moved 15 cm towards the mirror ? Draw ray diagram for the new position of the object to justify your answer.

[2024]

Q18. (a) Complete the following ray diagram to show the formation of image :

- (b) Mention the nature, position and size of the image formed in this case.
- (c) State the sign of the image distance in this case using the Cartesian sign convention.

[2023]

Q19. (a) The image of an object formed by a lens is of same size but inverted. If the object distance is 30 cm, calculate (i) The distance between the object and its image. (ii) Focal length of the lens.

- (b) Draw a ray diagram to show the image formed in above case.

[2023]

Q20. A student wants to project the image of a candle flame on a screen 60 cm in front of a mirror by keeping the candle at a distance of 15 cm from its pole.

- (a) Name the type of mirror used.
- (b) Also calculate : (i) Magnification of the image produced (ii) Distance between object and its image
- (c) Draw a ray diagram to show the image formation.

[2023]

Q21. A student has focussed the image of an object of height 3 cm on a white screen using a concave mirror of focal length 12 cm. If the distance of the object from the mirror is 18 cm, find the values of the following :

- (i) Distance of the image from the mirror
- (ii) Height of the image

[2023]

Q22. 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 centre of this lens, according to the New Cartesian Sign Convention, what will be the sign of magnification in this case ?

[2023]

Q23. (A) Define the following terms in the context of a diverging mirror :

(i) Principal focus

(ii) Focal length Draw a labelled ray diagram to illustrate your answer.

———— OR ————

(B) An object of height 10 cm is placed 25 cm away from the optical centre of a converging lens of focal length 15 cm. Calculate the image-distance and height of the image formed.

[2023]

Q24. The power of a lens is +4D. Find the focal length of this lens. An object is placed at a distance of 50 cm from the optical centre of this lens. State the nature and magnification of the image formed by the lens and also draw a ray diagram to justify your answer.

[2023]

Q25. (A) An object is kept at a distance of 1m from a lens of power +2D :

(i) Identify the type of lens.

(ii) Calculate its focal length and distance of the image formed.

———— OR ————

(B) Define the following terms in the context of a diverging lens :

(i) Principal focus,

(ii) Focal length. Draw a labelled ray diagram to illustrate your answer.

[2023]

Q26. The magnification produced when an object is placed at a distance of 20 cm from a spherical mirror is $+1/2$. Where should the object be placed to reduce the magnification to $+1/3$.

[2023]

Q27. (i) An object of 5 cm height is placed at a distance of 20 cm from the optical centre of a concave lens of focal length 18 cm. Calculate (1) image distance and (2) the magnification in this case.

(ii) Compare the values of magnification obtained by a concave lens and a convex lens when both the lenses form virtual images.

[2023]

Q28. (OR) 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.

[2023]

Q29. (OR) 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 centre of this lens, according to the New Cartesian Sign Convention, what will be the sign of magnification in this case?

[2023]

Q30. Why is Tyndall effect shown by colloidal particles? State four instances of observing the Tyndall effect.

[2020]

Q31. What happens after refraction, when :

- (i) a ray of light parallel to the principal axis passes through a concave lens ?
- (ii) a ray of light falls on a convex lens while passing through its principal focus ?
- (iii) a ray of light passes through the optical centre of a convex lens ?

[2020]

Q32. Draw ray diagrams for the following cases when a ray of light :

- (i) passing through centre of curvature of a concave mirror is incident on it.
- (ii) parallel to principal axis is incident on convex mirror.
- (iii) is passing through focus of a concave mirror incident on it.

[2020]

Q33. The diagram given below shows an object O and its image I. Without actually drawing the ray diagram, state the following :

- (i) Type of lens (Converging / Diverging)
- (ii) Name two optical instruments where such an image is obtained.
- (iii) List three characteristics of the image formed if this lens is replaced by a concave mirror of focal length 'f' and an object is placed at a distance ' $f/2$ ' in front of the mirror.

[2020]

Q34. (a) Water has refractive index 1.33 and alcohol has refractive index 1.36. Which of the two medium is optically denser ? Give reason for your answer.

(b) Draw a ray diagram to show the path of a ray of light passing obliquely from water to alcohol.

(c) State the relationship between angle of incidence and angle of refraction in the

above case.

[2020]

Q35. (a) State Snell's law of refraction of light.

(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.

[2020]

Q36. A concave mirror is used for image formation for different positions of an object. What inferences can be drawn about the following when an object is placed at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm?

(a) Position of the image

(b) Size of the image

(c) Nature of the image Draw a labelled ray diagram to justify your inferences.

[2020]

Q37. 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'.

[2020]

Q38. (a) For the same angle of incidence of 45° , the refraction angle in two transparent media P and Q is 20° and 30° respectively. Which of the two is optically denser and why?

(b) Define 1 dioptre power of a lens.

(c) Find the focal length of a lens of power + 0.5 D.

[2020]

Q39. Draw ray diagram in each of the following cases to show what happens after reflection to the incident ray when

- (a) it is parallel to the principal axis and falling on a convex mirror.
- (b) it is falling on a concave mirror while passing through its principal focus.
- (c) it is coming oblique to the principal axis and falling on the pole of a convex mirror.

[2020]

Q40. A child is standing in front of a magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. Explain the construction of the magic mirror using different types of mirrors. Also state the reasons in support of your answer.

[2020]

Q41. A student holding a mirror in his hand, directed the reflecting surface of the mirror towards the Sun. He then directed the reflected light on to a sheet of paper held close to the mirror.

- (a) What should he do to burn the paper?
- (b) Which type of mirror does he have?
- (c) Will he be able to determine the approximate value of focal length of this mirror from this activity? Give reason and draw ray diagram to justify your answer in this case.

[2019]

Q42. A 10 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 12 cm. The distance of the object from the lens is 18 cm. Find the nature,

position and size of the image formed.

[2019]

Q43. A concave mirror has a focal length of 20 cm. At what distance from the mirror should a 4 cm tall object be placed so that it forms an image at a distance of 30 cm from the mirror? Also calculate the size of the image formed.

[2019]

Q44. A real image $\frac{2}{3}$ 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.

[2019]

Q45. 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.

[2018]

Q46. 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.

[2018]

Q47. 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. If the numerical value of the power of this lens is 10 D, what is its focal length in the Cartesian system?

[2017]

Q48. An object 4 cm in height, is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed to obtain a sharp

image of the object? Calculate the height of the image.

[2017]

Q49. The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror? Find its focal length. If the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.

[2017]

Q50. Draw ray diagrams to show the formation of three times magnified (a) real, and (b) virtual image of an object by a converging lens. Mark the positions of O, F and 2F in each diagram.

[2017]

Q51. The magnification of an image formed by a lens is -1. If the distance of the image from the optical centre of the lens is 25 cm, where is the object placed? Find the nature and focal length of the lens. If the object is displaced 15 cm towards the optical centre of the lens, where would the image be formed? Draw a ray diagram to justify your answer.

[2017]

Q52. The magnification of an image formed by a lens is -1. If the distance between the object and its image is 60 cm, what is the distance of the object from the optical centre of the lens? Find the nature and focal length of the lens. If the object is displaced 20 cm towards the optical centre of the lens, where would the image be formed and what would be its nature? Draw a ray diagram to justify your answer.

[2017]

Q53. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it." State the nature of this lens and draw ray diagrams to

justify the above statement. Mark the positions of O, F and 2F in the diagram.

[2017]

Q54. The image of an object formed by a mirror is real, inverted and is of magnification -1. If the image is at a distance of 40 cm from the mirror, where is the object placed? Where would the image be if the object is moved 20 cm towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer.

[2016]

Q55. 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.

[2016]

Q56. The image formed by a spherical mirror is real, inverted and is of magnification -2. If the image is at a distance of 30 cm from the mirror, where is the object placed? Find the focal length of the mirror. List two characteristics of the image formed if the object is moved 10 cm towards the mirror.

[2016]

Q57. To construct a ray diagram we use two rays of light which are so chosen that it is easy to determine their directions after reflection from the mirror. Choose these two rays and state the path of these rays after reflection from a concave mirror. Use these two rays to find the nature and position of the image of an object placed at a distance of 15 cm from a concave mirror of focal length 10 cm.

[2015]

Q58. To construct ray diagrams, two rays of light are generally so chosen that it is easy to

determine their directions after reflection from a mirror. Choose two such rays and state the path/direction of these rays after reflection from a concave mirror. Use these two rays to find the position and nature of the image of an object placed at a distance of 8 cm from a concave mirror of focal length 12 cm.

[2015]

Q59. State the laws of refraction of light. If the speed of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$, find the speed of light in a medium of absolute refractive index 1.5.

[2014]

Q60. A spherical mirror produces an image of magnification -1 on a screen placed at a distance of 40 cm from the mirror:

- (i) Write the type of mirror.
- (ii) What is the nature of the image formed?
- (iii) How far is the object located from the mirror?
- (iv) Draw the ray diagram to show the image formation in this case.

[2014]

Q61. Mention the types of mirrors used as (i) rear view mirrors, (ii) shaving mirrors. List two reasons to justify your answers in each case.

[2013]

Q62. An object of height 6 cm is placed perpendicular to the principal axis of a concave lens of focal length 5 cm. Use lens formula to determine the position, size and nature of the image if the distance of the object from the lens is 10 cm.

[2013]

Q63. State the types of mirrors used for (i) headlights and (ii) rear view mirrors, in cars and

motorcycles. Give reason to justify your answer in each case.

[2012]

Q64. A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 24 cm. The distance of the object from the lens is 16 cm. Find the position, size and nature of the image formed, using the lens formula.

[2012]

Q65. State the type of mirror preferred as (i) rear view mirror in vehicles, (ii) shaving mirror. Justify your answer giving two reasons in each case.

[2012]

Q66. The image of a candle flame placed at a distance of 45 cm from a spherical lens is formed on a screen placed at a distance of 90 cm from the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 2 cm, find the height of its image.

[2012]

Q67. Name the type of mirror used in the following situations:

- (i) Headlights of a car
- (ii) Rear-view mirror of a vehicle
- (iii) Solar furnace Support your answer with reason.

[2012]

Q68. An object is placed between infinity and the pole of a convex mirror. Draw a ray diagram and also state the position, the relative size and the nature of the image formed.

[2011]

Q69. What is the principle of reversibility of light? Show that the incident ray of light is parallel to the emergent ray of light when light falls obliquely on a side of a rectangular glass slab.

[2011]

Q70. Draw the ray diagram and also state the position, the relative size and the nature of image formed by a concave mirror when the object is placed at the centre of curvature of the mirror.

[2011]

Q71. Define, 'refractive index of a transparent medium.' What is its unit? Which has a higher refractive index, glass or water?

[2011]

Q72. With the help of a ray diagram explain why a convex mirror is preferred for rear view mirrors in motor cars.

[2011]

Q73. What is understood by lateral displacement of light? Illustrate it with the help of a diagram. List any two factors on which the lateral displacement in a particular substance depends.

[2011]

Q74. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 24 cm from it on the other side? What will be the magnification produced in this case?

[2010]

Q75. A concave lens has focal length of 20 cm. At what distance from the lens should a 5 cm tall object be placed so that it forms an image at 15 cm from the lens? Also calculate the size of the image formed.

[2007]

4-Mark Questions (20 questions · Section D · Case Study)

Q1. The variation of image distance (v) with the object distance (u) for a convex lens is given in the following observation table. Analyse it and answer the questions given below: S.No. 1: $u = -150$ cm, $v = +30$ cm; S.No. 2: $u = -75$ cm, $v = +87.5$ cm; S.No. 3: $u = -50$ cm, $v = +50$ cm; S.No. 4: $u = -37.5$ cm, $v = +75$ cm; S.No. 5: $u = -30$ cm, $v = +150$ cm; S.No. 6: $u = -15$ cm, $v = +87.5$ cm.

- (a) Without calculation, find out the focal length of the given convex lens. Justify your answer.
- (b) Which one of the observations given in the table is not correct and why?
- (c) (i) Find out the value of magnification for $u = -30$ cm. Write the nature of the image formed. Give reason for your answer.

————— OR —————

- (c) (ii) Analyse the data given in the table above and draw the labelled ray diagram for $u = -30$ cm and $v = 150$ cm.

[2026]

Q2. The above ray diagram is to show image formation by a reflecting telescope. Reflecting telescope revolutionized our way of looking into the sky. Reflecting telescopes employ large mirrors to gather and focus light rather than relying solely on lenses as we do in the refracting telescopes. These telescopes utilize precisely shaped and polished mirrors to capture incoming light and reflect it to a focal point, where the telescope forms an image for observation. What kind of image of a star is seen by the observer in the eye-piece?

[2026]

Q3. (Case-based: reflecting telescope.) What kind of mirror is used in this reflecting telescope?

[2026]

Q4. (Case-based: reflecting telescope.) Explain with the reason, what kind of optical device (type of lens or mirror) is used at the eye-piece.

[2026]

Q5. (Case-based: reflecting telescope.) What is the role of plane mirror in image formation by this telescope?

[2026]

Q6. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors :

(i) In which one of the above cases the mirror will form a diminished image of the object ? Justify your answer.

[2024]

Q7. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors :

(ii) List two properties of the image formed in case 2.

[2024]

Q8. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors :

(iii) (A) What is the nature and size of the image formed by mirror C ? Draw ray diagram to justify your answer.

[2024]

Q9. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors :

- (iii) (B) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case.

[2024]

Q10. Hold a concave mirror in your hand and direct its reflecting surface towards the sun. Direct the light reflected by the mirror on to a white card-board held close to the mirror. Move the card-board back and forth gradually until you find a bright, sharp spot of light on the board. This spot of light is the image of the sun on the sheet of paper; which is also termed as 'Principal Focus' of the concave mirror.

- (a) List two applications of concave mirror.
- (b) If the distance between the mirror and the principal focus is 15 cm, find the radius of curvature of the mirror.
- (c) Draw a ray diagram to show the type of image formed when an object is placed between pole and focus of a concave mirror.

[2023]

Q11. (c) An object 10 cm in size is placed at 100 cm in front of a concave mirror. If its image is formed at the same point where the object is located, find : (i) focal length of the mirror, and (ii) magnification of the image formed with sign as per Cartesian sign convention.

[2023]

Q12. The ability of a medium to refract light is expressed in terms of its optical density. Optical density has a definite connotation. It is not the same as mass density. On comparing two media, the one with the large refractive index is optically denser

medium than the other. The other medium with a lower refractive index is optically rarer. Also the speed of light through a given medium is inversely proportional to its optical density.

- (i) Determine the speed of light in diamond if the refractive index of diamond with respect to vacuum is 2.42. Speed of light in vacuum is 3×10^8 m/s.

[2023]

- Q13. (ii) Refractive indices of glass, water and carbon disulphide are 1.5, 1.33 and 1.62 respectively. If a ray of light is incident in these media at the same angle (say θ), then write the increasing order of the angle of refraction in these media.

[2023]

- Q14. (iii) (A) The speed of light in glass is 2×10^8 m/s and in water is 2.25×10^8 m/s.

- (a) Which one of the two is optically denser and why ?
- (b) A ray of light is incident normally at the water-glass interface when it enters a thick glass container filled with water. What will happen to the path of the ray after entering the glass ? Give reason.

————— OR —————

- (iii) (B) The absolute refractive indices of water and glass are $4/3$ and $3/2$ respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (i) vacuum and (ii) water.

[2023]

- Q15. Many optical instruments consist of a number of lenses. They are combined to increase the magnification and sharpness of the image. The net power (P) of the lenses placed in contact is given by the algebraic sum of the powers of the individual lenses $P_1, P_2, P_3 \dots$ as $P = P_1 + P_2 + P_3 \dots$. This is also termed as the simple additive property of the power of lens, widely used to design lens systems of cameras, microscopes and telescopes. These lens systems can have a combination of convex lenses and also

concave lenses. What is the nature (convergent / divergent) of the combination of a convex lens of power + 4 D and a concave lens of power - 2 D?

[2023]

Q16. Calculate the focal length of a lens of power - 2.5 D.

[2023]

Q17. Draw a ray diagram to show the nature and position of an image formed by a convex lens of power + 0.1 D, when an object is placed at a distance of 20 cm from its optical centre.

[2023]

Q18. (OR) How is a virtual image formed by a convex lens different from that formed by a concave lens? Under what conditions do a convex and a concave lens form virtual images?

[2023]

Q19. A student took three concave mirrors of different focal lengths and performed the experiment to see the image formation by placing an object at different distances with these mirrors as shown in the following table.

Case No.	Object-distance	Focal length
I	45 cm	20 cm
II	30 cm	15 cm
III	20 cm	30 cm

Now answer the following questions:

- List two properties of the image formed in Case I.
- In which one of the cases given in the table, the mirror will form real image of same size and why?
- Name the type of mirror used by dentists. Give reason why do they use such type of mirrors.

[2023]

- Q20. (c)** Look at the table and identify the situation (object distance and focal length) which resembles the situation in which concave mirrors are used as shaving mirrors? Draw a ray diagram to show the image formation in this case.

[2023]

5-Mark Questions (64 questions · Section E · Long Answer)

- Q1. (i)** Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.
- (ii)** State Snell's law of refraction of light.
- (iii)** Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of : (I) object distance, and (II) magnification.

[2025]

- Q2. (i)** "In refraction of light through a rectangular glass slab, the emergent ray is always parallel to the direction of the incident ray." Why? Explain with the help of a ray diagram. What happens when a ray of light falls normally on one of the faces of a rectangular glass prism? Draw diagram.
- (ii)** An object is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 20 cm. Use Lens formula to determine the position of the image formed in this case.

[2025]

- Q3. (i)** A student wishes to study the image formation by a concave mirror using candle flame as object. State the type of the image formed by the mirror and mention the change in the image formed, if any, that he observes when the candle flame is gradually moved away from the pole of the mirror. Draw a ray diagram to show the image formation when the object distance is nearly equal to the radius of curvature of the mirror.
- (ii)** A convex mirror used for rear-view on an automobile has a focal length of 3.0 m. If

a bus is located at 6.0 m from this mirror, use mirror formula to find the position of the image of the bus as seen in the mirror.

[2025]

- Q4. (a)** Observe the following diagram and compare (i) speed of light and (ii) optical densities of the three media A, B and C. Also give justification for your answer of any one of the two cases in terms of refractive indices of A, B and C.
- (b)** Redraw the path of a ray of light through the three media, if the ray of light starting from medium A falls on the medium B (i) Obliquely and the optical density of medium B is made more than that of A and C. (ii) The ray falls normally from medium A to medium B.

[2025]

- Q5.** 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 :<table class='table table-striped style_table'><thead><tr><th>Observation Number</th><th>Object distance (u) in cm</th><th>Image distance (v) in cm</th></tr></thead><tbody><tr><td>1</td><td>-15</td><td>-60</td></tr><tr><td>2</td><td>-30</td><td>-30</td></tr><tr><td>3</td><td>-60</td><td>-15</td></tr><tr><td>4</td><td>-∞</td><td>∞</td></tr></tbody></table>
- Determine the focal length of the lens. Give reason for your answer.
- (b)** Find magnification of the image formed in Observation No. 3.
- (c)** The numerical value of magnifications in cases of observation 1 and 2 is same. List two differences in the images formed in these two cases.

[2025]

- Q6.** Upper half of a convex lens is covered with a black paper. Draw a ray diagram to show the formation of image of an object placed at a distance of 2F from such a lens. Mention the position and nature of the image formed. State the observable difference in the image obtained if the lens is uncovered. Give reason to justify your answer.

[2024]

Q7. An object is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 15 cm. Use lens formula to determine the distance of the image from the optical centre of the lens.

[2024]

Q8. (i) Draw a ray diagram to show the path of the refracted ray in each of the following cases : A ray of light incident on a concave lens (1) parallel to its principal axis, and (2) is directed towards its principal focus.

(ii) A 4 cm tall object is placed perpendicular to the principal axis of convex lens of focal length 24 cm. The distance of object from the lens is 16 cm. Find the position and size of image formed.

[2024]

Q9. (i) Draw a ray diagram to show the path of the reflected ray in each of the following cases : A ray of light incident on a convex mirror (1) parallel to its principal axis, and (2) is directed towards its principal focus.

(ii) A 1.5 cm tall candle flame is placed perpendicular to the principal axis of a concave mirror of focal length 12 cm. If the distance of the flame from the pole of the mirror is 18 cm, use mirror formula to determine the position and size of the image formed.

[2024]

Q10. The variation of image distance (v) with object distance (u) for a convex lens is given in the following observation table. Analyse it and answer the questions that follow :

- (i)** Without calculation, find the focal length of the convex lens. Justify your answer.
- (ii)** Which observation is not correct ? Why ? Draw ray diagram to find the position of the image formed for this position of the object.
- (iii)** Find the approximate value of magnification for $u = -30$ cm.

[2024]

- Q11. (b) (i)** Define principal axis of a lens. Draw a ray diagram to show what happens when a ray of light parallel to the principal axis of a concave lens passes through it.
- (ii)** The focal length of a concave lens is 20 cm. At what distance from the lens should a 5 cm tall object be placed so that its image is formed at a distance of 15 cm from the lens ? Also calculate the size of the image formed.

[2024]

- Q12. (a) (i)** State laws of reflection of light. **(ii)** An object of height 5.0 cm is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed, so that a focussed image is obtained on it ? Find the height of the image.

[2024]

- Q13. (b) (i)** State laws of refraction of light. **(ii)** Draw a ray diagram to show refraction of a ray of light through a rectangular glass slab. How is the emergent ray related to incident ray ? Mark lateral displacement in the diagram.

[2024]

- Q14. (a)** An object is placed in front of a convex lens of focal length f . If the distance of the object from the lens is $2f$, draw a ray diagram to show the formation of the image. Write the value of magnification in this case.

- (b)** A student has focussed the image of a candle flame on a white screen using a convex lens. The situation is as given below : Length of the flame = 2 cm Focal length of the lens = 12 cm Distance of the flame from the lens = 16 cm If the flame is perpendicular to the principal axis of the lens, calculate the values of the following : (i) Distance of the image from the lens (ii) Length of the image formed

[2023]

- Q15. (a)** Name the type of mirror that should be used to obtain the following types of images : (i) A magnified and virtual image of an object (ii) A diminished and virtual image of an object
- (b)** Draw labelled ray diagrams to justify your answers in each case mentioned above.
- (c)** Which of these mirrors can also be used to obtain a magnified and real image of an object ? State the position of the object in this case.

[2023]

- Q16. (a)** Draw a ray diagram for showing the convergence of a parallel beam of light by a concave mirror and mark the positions of pole and the centre of curvature in it.
- (b)** An object 4 cm in size is placed at 25 cm in front of a concave mirror of focal length 15 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image ? Find the nature and size of the image.
- (c)** List any two uses of a concave mirror.

[2023]

- Q17.** Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed:
- (i)** between optical centre and principal focus of a convex lens.
- (ii)** anywhere in front of a concave lens.
- (iii)** at 2F of a convex lens. State the signs and values of magnifications in the above mentioned cases (i) and (ii).

[2020]

- Q18.** An object 4.0 cm in size, is placed 25.0 cm in front of a concave mirror of focal length 15.0 cm.
- (i)** At what distance from the mirror should a screen be placed in order to obtain a sharp image?
- (ii)** Find the size of the image.

(iii) Draw a ray diagram to show the formation of image in this case.

[2020]

Q19. (a) A concave mirror of focal length 10 cm can produce a magnified real as well as virtual image of an object placed in front of it. Draw ray diagrams to justify this statement.

(b) An object is placed perpendicular to the principal axis of a convex mirror of focal length 10 cm. The distance of the object from the pole of the mirror is 10 cm. Find the position of the image formed.

[2020]

Q20. Define the following terms :

(i) Power of a lens

(ii) Principal focus of a concave mirror Write the relationship among the object distance (u), image distance (v) and the focal length (f) of a

(i) Spherical lens

(ii) Spherical mirror An object is placed at a distance of 10 cm from optical centre of a convex lens of focal length 15 cm. Draw a labelled ray diagram to show the formation of image in this case.

[2020]

Q21. (a) Draw and complete the following ray diagram on you answer sheet to show lateral displacement.

(b) Define absolute refractive index. Give its mathematical expression.

[2020]

Q22. Study the following diagrams : Identify Mirror 1 and Mirror 2 and state one use of

each.

[2020]

Q23. (a) Define power of a lens and write its SI unit. Name the type of lens whose power is negative.

(b) A convex lens forms a real and inverted image of finite size at a distance of 50 cm from it. Where is the object placed in front of the lens ? Give all possible positions of the object stating reason in each case.

(c) Draw labelled ray diagram for any one position of the object mentioned in (b) above.

[2020]

Q24. (a) A security mirror used in a big showroom has radius of curvature 5 m. If a customer is standing at a distance of 20 m from the cash counter, find the position, nature and size of the image formed in the security mirror.

(b) Neha visited a dentist in his clinic. She observed that the dentist was holding an instrument fitted with a mirror. State the nature of this mirror and reason for its use in the instrument used by dentist.

[2020]

Q25. Rishi went to a palmist to show his palm. The palmist used a special lens for this purpose.

(i) State the nature of the lens and reason for its use.

(ii) Where should the palmist place/hold the lens so as to have a real and magnified image of an object ?

(iii) If the focal length of this lens is 10 cm and the lens is held at a distance of 5 cm from the palm, use lens formula to find the position and size of the image.

[2020]

- Q26. (a)** Draw a labelled ray diagram to show the path of a ray of light incident obliquely on one face of a glass slab.
- (b)** Calculate the refractive index of the material of a glass slab. Given that the speed of light through the glass slab is 2×10^8 m/s and in air is 3×10^8 m/s.
- (c)** Calculate the focal length of a lens, if its power is -2.5 D.

[2020]

- Q27. (a)** A person suffering from myopia (near-sightedness) was advised to wear corrective lens of power -2.5 D. A spherical lens of same focal length was taken in the laboratory. At what distance should a student place an object from this lens so that it forms an image at a distance of 10 cm from the lens?
- (b)** Draw a ray diagram to show the position and nature of the image formed in the above case.

[2020]

- Q28. (a)** Complete the following ray diagram:
- (b)** Find the nature, position and size of the image formed.
- (c)** Use lens formula to determine the magnification in this case.

[2020]

- Q29.** An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm.
- (i)** Use lens formula to find the distance of the image from the lens.
- (ii)** List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.
- (iii)** Draw ray diagram to justify your answer of part (ii).

[2019]

Q30. An object is placed at a distance of 30 cm from a concave lens of focal length 30 cm.

- (i) Use lens formula to determine the distance of the image from the lens.
- (ii) List four characteristics of the image (nature, position, size, erect/inverted) in this case.
- (iii) Draw a labelled diagram to justify your answer of part (ii).

[2019]

Q31. A 6 cm tall object is placed perpendicular to the principal axis of a concave mirror of focal length 30 cm. The distance of the object from the mirror is 45 cm. Use mirror formula to determine the position, nature and size of the image formed. Also draw labelled ray diagram to show the image formation in this case.

[2019]

Q32. An object 6 cm in size is placed at 50 cm in front of a convex lens of focal length 30 cm. At what distance from the lens should a screen be placed in order to obtain a sharp image of the object? Find the nature and size of the image. Also draw labelled ray diagram to show the image formation in this case.

[2019]

Q33. (a) List four characteristics of the images formed by plane mirrors.

- (b) A 5 cm tall object is placed at a distance of 20 cm from a concave mirror of focal length 30 cm. Use mirror formula to determine the position and size of the image formed.

[2019]

Q34. (a) List four characteristics of the image formed by a convex lens when an object is placed between its optical centre and principal focus.

- (b) Size of the image of an object by a concave lens of focal length 20 cm is observed to

be reduced to $\frac{1}{3}$ of its size. Find the distance of the object from the lens.

[2019]

Q35. (a) List four characteristics of the image formed by a concave lens of focal length 20 cm when the object is placed at a distance of 40 cm from its optical centre.

(b) The size of image of an object by a convex lens of focal length 20 cm is observed to be reduced to $\frac{1}{3}$ of its size. Find the distance of the object from the optical centre of the lens.

[2019]

Q36. (a) A 5 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm. Find the position, nature and size of the image formed.

(b) Draw a labelled ray diagram showing object distance, image distance and focal length in the above case.

[2019]

Q37. A concave lens of focal length 60 cm is used to form an image of an object of length 9 cm kept at a distance of 30 cm from it. Use lens formula to determine the nature, position and length of the image formed. Also draw labelled ray diagram to show the image formation in the above case.

[2019]

Q38. 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:

S.No.	Object-Distance u	Image-Distance v
1	-100	+25

What is the focal length of the convex lens? Give reason to justify your answer.

- (b) Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion?
- (c) Select an appropriate scale and draw a ray diagram for the observation at S.No. 2. Also find the approximate value of magnification.

[2017]

- Q39. (a)** If the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtual, state the type of the mirror and also draw a ray diagram to justify your answer. Write one use such mirrors are put to and why.
- (b) Define the radius of curvature of spherical mirrors. Find the nature and focal length of a spherical mirror whose radius of curvature is +24 cm.

[2017]

- Q40.** 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:

S.No.	Object distance u (cm)	Image distance v (cm)
1	-90	+18
2		

What is the focal length of the convex lens? Give reason in support of your answer.

- (b) Write the serial number of that observation which is not correct. How did you arrive at this conclusion?
- (c) Take an appropriate scale to draw ray diagram for the observation at S. No. 4 and find the approximate value of magnification.

[2017]

- Q41. (a)** To construct a ray diagram we use two rays which are so chosen that it is easy to know their directions after reflection from the mirror. List two such rays and state the path of these rays after reflection in case of concave mirrors. Use these two rays and draw ray diagram to locate the image of an object placed between pole and

focus of a concave mirror.

- (b) A concave mirror produces three times magnified image on a screen. If the object is placed 20 cm in front of the mirror, how far is the screen from the object?

[2017]

Q42. 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

:<table border='1'><tr><th>S.No.</th><th>Object-Distance u (cm)</th><th>Image-Distance v (cm)</th></tr><tr><td>1</td><td>-60</td><td>+12</td></tr></table>

What is the focal length of the convex lens ? State reason for your answer.

- (b) For what object-distance (u) is the corresponding image-distance (v) not correct ? How did you arrive at this conclusion ?
- (c) Choose an appropriate scale to draw a ray diagram for the observation at S.No. 4 and find the approximate value of magnification.

[2017]

Q43. (a) Define the following terms in the context of spherical mirrors : (i) Pole (ii) Centre of curvature (iii) Radius of curvature (iv) Principal axis

- (b) Draw ray diagrams to show the principal focus of (i) a concave mirror, and (ii) a convex mirror.

- (c) In the following diagram, MM' is a concave mirror and AB is an object. Draw on your answer-sheet a ray diagram to show the formation of image of this object.

[2017]

Q44. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

- (i) What should be the range of distance of an object placed in front of the mirror?
- (ii) Will the image be smaller or larger than the object? Draw ray diagram to show the

formation of image in this case.

- (iii) Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer. Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.

[2016]

Q45. (a) Define optical centre of a spherical lens.

- (b) A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens? Find the size of the image also.

- (c) Draw a ray diagram to show the formation of image in above situation.

[2016]

Q46. (a) Define focal length of a divergent lens.

- (b) A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.

- (c) Draw a ray diagram to show the formation of image in the above situation.

[2016]

Q47. (a) 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.

- (b) The absolute refractive indices of two media 'A' and 'B' are 2.0 and 1.5 respectively. If the speed of light in medium 'B' is 2×10^8 m/s, calculate the speed of light in: (i) vacuum, (ii) medium 'A'.

[2015]

Q48. "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it". Draw ray diagrams to justify this statement stating the position of the object with respect to the lens in each case. An object of height 4 cm is placed at a distance of 20 cm from a concave lens of focal length 10 cm. Use lens formula to determine the position of the image formed.

[2015]

Q49. The image of a candle flame placed at a distance of 30 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 60 cm from the optical centre of the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 3 cm, find the height of its image.

[2015]

Q50. A student wants to project the image of a candle flame on the walls of school laboratory by using a mirror.

- (a) Which type of mirror should he use and why?
- (b) At what distance in terms of focal length 'f' of the mirror should he place the candle flame so as to get the magnified image on the wall?
- (c) Draw a ray diagram to show the formation of image in this case.
- (d) Can he use this mirror to project a diminished image of the candle flame on the same wall? State 'how' if your answer is 'yes' and 'why not' if your answer is 'no.'

[2014]

Q51. (a) State the laws of refraction of light. Give an expression to relate the absolute refractive index of a medium with speed of light in vacuum.

- (b)** The refractive indices of water and glass with respect to air are $\frac{4}{3}$ and $\frac{3}{2}$ respectively. If the speed of light in glass is $2 \times 10^8 \text{ ms}^{-1}$, find the speed of light in (i) air, (ii) water.

[2013]

Q52. List the new Cartesian sign convention for reflection of light by spherical mirrors. Draw a diagram and apply these conventions for calculating the focal length and nature of a spherical mirror which forms a $\frac{1}{3}$ times magnified virtual image of an object placed 18 cm in front of it.

[2012]

Q53. With the help of a ray diagram, state what is meant by refraction of light. State Snell's law for refraction of light and also express it mathematically. The refractive index of air with respect to glass is $\frac{2}{3}$ and the refractive index of water with respect to air is $\frac{4}{3}$. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (a) air, (b) water.

[2012]

Q54. List the sign conventions for reflection of light by spherical mirrors. Draw a diagram and apply these conventions in the determination of focal length of a spherical mirror which forms a three times magnified real image of an object placed 16 cm in front of it.

[2012]

Q55. State the law of refraction of light that defines the refractive index of a medium with respect to the other. Express it mathematically. How is refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light in two media A and B? State the name of this constant when one medium is vacuum or air. The refractive indices of glass and water with respect to vacuum are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (i) vacuum, (ii) water.

[2012]

Q56. List the sign conventions that are followed in case of refraction of light through spherical lenses. Draw a diagram and apply these conventions in determining the nature and focal length of a spherical lens which forms three times magnified real

image of an object placed 16 cm from the lens.

[2012]

Q57. State the laws of refraction of light. Write an expression to relate absolute refractive index of a medium with speed of light in vacuum. The refractive index of a medium 'x' with respect to 'y' is $\frac{2}{3}$ and the refractive index of medium 'y' with respect to 'z' is $\frac{4}{3}$. Calculate the refractive index of medium 'z' with respect of 'x'.

[2012]

Q58. (a) What is meant by 'power of a lens'?

(b) State and define the S.I. unit of power of a lens.

(c) A convex lens of focal length 25 cm and a concave lens of focal length 10 cm are placed in close contact with each other. Calculate the lens power of this combination.

[2011]

Q59. Draw a ray diagram to show the formation of image of an object between infinity and the optical centre of a concave lens. A concave lens of focal length 15 cm forms an image 10 cm from the lens. Calculate

(i) the distance of the object from the lens

(ii) the magnification for the image formed

(iii) the nature of the image formed

[2011]

Q60. (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?

(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 the lens is 30 cm. Find (i) the position, (ii) the magnification and (iii) the nature of the image formed.

[2011]

Q61. (a) One-half of a convex lens is covered with a black paper. Will such a lens produce an image of the complete object? Support your answer with a ray diagram.

(b) An object 5 cm high is held 25 cm away from a converging lens of focal length 10 cm. (i) Draw the ray diagram and (ii) Calculate the position and size of the image formed. (iii) What is the nature of the image?

[2011]

Q62. (a) Under what condition will a glass lens placed in a transparent liquid become invisible?

(b) Describe and illustrate with a diagram, how we should arrange two converging lenses so that a parallel beam of light entering one lens emerges as a parallel beam after passing through the second lens.

(c) An object is placed at a distance of 3 cm from a concave lens of focal length 12 cm. Find the (i) position and (ii) nature of the image formed.

[2011]

Q63. (a) With the help of a ray diagram explain why a concave lens diverges the rays of a parallel beam of light.

(b) A 2.0 cm tall object is placed perpendicular to the principal axis of a concave lens of focal length 15 cm. At what distance from the lens should the object be placed so that it forms an image 10 cm from the lens? Also find the nature and the size of image formed.

[2011]

Q64. Define the term, 'Critical Angle'. What is meant by 'total internal reflection'? State two

essential conditions for total internal reflection to take place. With the help of a ray diagram, illustrate an application of total internal reflection.

[2007]