PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

REFLECTION AND REFRACTION

Problem

1. Find the focal length of a convex mirror of radius of curvature 1 m.

2. An object $4cm$ in size is placed at a distance of $25.0cm$ from a concave mirror of focal length 15.0 cm. Find the position, nature and height of the image.

3. (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?

4. A converging mirror forms a real image of height 4 cm, of an object of height 1 cm placed 20 cm away from the mirror. Calculate the image distance. What is the focal length of the mirror ?

    A. -80 cm , -16 cm

    B. 80 cm , 16 cm

    C. -60 cm , -12 cm

    D. NONE

Answer: A

5. An object of height 1.2 m is placed before a concave mirror of focal length 20 cm so that a real image is formed at a distance of 60 cm from it. Find the position of the object ? What will be the height of image formed ?

6. A $4.5cm$ needle is placed 12 cm away from a convex mirror of focal length 15 cm. Give the location of the image and the magnification. Describe what happens as the needle is moved farther from the mirror.

    A. 6 cm , 0.718

    B. 6.7 cm , 0.558

    C. Cannot be determined

    D. NONE OF THESE

Answer: B

7. An arrow 2.5 cm high is placed at a distance of 25 cm from a diverging mirror of focal length 20 cm. Find the nature, position and size of the image formed.

8. The image formed by a convex mirror of focal length 20 cm is a quarter of the object.

What is the distance of the object from the mirror?

A. 50 cm

B. 45 cm

C. 90 cm

D. 60 cm

Answer: D

9. (a) If the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtural, 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.

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10. 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.

11. When a concave mirror is placed facing the sun, the sun's rays converge to a point 10 cm from the mirror. Now if you place a 2 cm long candle flame 20 cm away on the principal axis of the mirror, where would you place a screen to obtain the image of the candle? What would be the size of the image? Draw a ray diagram to justify your answer.

12. Light travels through water with a speed of $2.25 \times 10^8 m/s$. What is the refractive index of water ? Given speed of light in vacuum $= 3 \times 10^8 m/s$.

A. 1.41

B. 1.47

C. 1.33

D. 1.5

Answer: C

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13. Light travels from a rarer medium 1 to a denser medium 2. The angle of incidence and refraction are respectively $45°$ and $30°$. Calculate the refractive index of second medium with respect to the first medium.

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14. In problem 2, what is the refractive index of medium 1 w.r.t. medium 2 ?

15. A pond of depth 20 cm is filled with water of refractive index $4/3$. Calculate apparent depth of the tank when viewed normally.

16. How much time will light take to cross 2 mm thick glass pane if refractive index of glassis $3/2$?

17. 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. $\angle i = \angle e < \angle r$

Answer: B

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18. A student has to project a three times magnified image of a candle flame on a wall. Name the type of the lens (converging/diverging) required for the

purpose. If the candle flame is at a distance of 6 m from the wall, find the focal length of the lens.

A. converging , $f = 1.125m$

B. converging , $f = 1.125cm$

C. diverging, $f = 1.125m$

D. diverging, $f = 1.125cm$

Answer: A

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19. A $2.0cm$ tall object is placed perpendicular to the principal axis of a convex lens of focal length 10 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image. Also, find its magnification.

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20. A concave lens has focal length of 15 cm. At what distance should an object from the lens be placed so that it forms an image at 10 cm

from the lens ? Also, find the magnification of the lens.

21. A concave lens of focal length 25 cm and a convex lens of focal length 20 cm are placed in contact with each other. What is the power of this combination ? Also, calculate focal length of the combination.

A. $0.5D$, $10cm$

B. $1D$, $100cm$

C. $-1D$, $100cm$

D. $1.5D$, $50cm$

Answer: B

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22. Rohit focussed the image of a candle flame on a white screen using a convex lens. He noted position of candle $= 26.0cm$, position of convex lens $= 50.0cm$ and position of

screen $= 74.0cm.$

(i) What is focal length of convex lens?

(ii) Where will the image be formed if he shifts the candle towards the lens at a position of 38 cm ?

(iii) Draw a ray diagram to show the formation of image in (ii) above.

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23. A convex lens of focal length 20 cm is placed in contact with a concave lens of focal

length 10 cm. What is the focal length and power of the combination ?

24. 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 power of this lens is 10 D, what is its focal length in cartesian system ?

Ncert Question

1. Define the principal focus of a concave mirror.

2. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?

3. Name a mirror that can give an erect and enlarged image of an object.

4. In motor vehicles, a convex mirror is attached near the driver's seat to give him the view of the traffic behind. What is the special function of this convex mirror which a plane mirror can not do ?

5. Find the focal length of a convex mirror of radius of curvature 1 m.

6. A concave mirror produces three times magnified real image of an object placed at 10 cm in front of it. Where is the image located ?

7. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal ? Why ?

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8. The refraction index of glass is 1.5. Find the speed of light in glass.

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9. Find out, from Table 10.3, the medium having highest optical density. Also find the medium with lowest optical density.

10. You are given kerosene, turpentine and water. In which of these does the light travel fastest ?

11. The refractive index of diamond is 2.42. What is the meaning of this statement ?

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12. Define one dioptre of power of a lens.

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13. A convex lens forms a real and inverted image of a needle at a distance of $50cm$ from it. Where is the needle placed in front of the convex lens if the image is equal to size of the object ? Also, find the power of the lens.

14. Find the power of a concave lens of focal length $2m$.

1. Which one of the following materials cannot be used to make a lens ?

A. Water

B. Glass

C. Plastic

D. Clay

Answer: D

2. The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object?

    A. between the focus and centre of curvature,

    B. at the centre of curvature,

    C. beyond the centre of curvature,

D. between the pole of the mirror and

focus.

Answer: D

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3. Where should an object be placed in front

of a convex lens to get a real to get real image

of the size of the object ?

A. At the principal focus of the lens,

B. At twice the focal length,

C. At infinity,

D. Between the optical centre of the lens and its principal focus.

Answer:

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4. A spherical mirror and a thin spherical lens have each a focal length of $-15cm$. The mirror and lens are likely to be

A. Both concave.

B. Both convex

C. The mirror concave, but the lens convex.

D. The mirror is convex, but the lens is

concave.

Answer: A

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5. No matter how far you stand from a spherical mirror, your image appears erect. The mirror is likely to be

A. Plane

B. concave

C. convex

D. either plane or convex.

Answer: D

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6. Which of the following lenses would you prefer to use while reading small letters found in a dictionary ?

A. Convex lens of focal length 50 cm

B. A concave lens of focal length 50 cm

C. A convex lens of focal length 5 cm

D. A concave lens of focal length 5 cm.

Answer:

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7. We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror? What is the nature of the image? Is the image larger or smaller than the object? Draw a ray diagram to show the image formation in this case.

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

(a) Head lights of a car.

(b) Side rear view mirror of a vehicle.

(c) Solar furnace.

Support your answer with reason.

9. One half of a convex lens is covered with a black paper. Will this lens produce a complete

image of the object? Verify your answer experimentally. Explain your observations.

10. An object $5cm$ in length is held $25cm$ away from a converging lens of focal length $10cm$. Then the position and height of the image is

    A. 50/3 cm , 3.33 cm

    B. -50/3 cm , -3.33 cm

    C. 50/3 cm , -3.33 cm

D. -50/3 cm , 3.33 cm

Answer: C

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11. A concave lens has focal length of 15 cm. At what distance should an object from the lens be placed so that it forms an image at 10 cm from the lens ? Also, find the magnification of the lens.

A. $- 30cm$

B. $+30cm$

C. $-60cm$

D. $-45cm$

Answer: A

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12. An object is placed at a distance of $10cm$ from a convex mirror of focal length $15cm$. Find the position and nature of the image ?

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13. The magnification produced by a plane mirror is $m = +1$. What does this mean ?

14. An object $5.0 cm$ in length is placed at a distance of $20 cm$ in front of a convex mirror of radius of curvature $30 cm$. Find the position of image, its nature and size.

15. An object of size $7.0cm$ is placed at $27cm$ in front of a concave mirror of focal length $18cm$. At what distance from the mirror, should a screen be placed, so that a sharp focussed image can be obtained ? Find the size and nature of the image ?

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16. Find the focal length of a lens of power $-2.0D$. What type of lens is this ?

17. A doctor has prescribed lens of power $+1.5D$. Find the focal length of the lens. Is the prescribed lens diverging or converging ?

Short Answer Question

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

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

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

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

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

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

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

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4. How is the refractive index of a medium related to the speed of light ? Obtain an expression for refractive index of a medium

with respect to another in terms of speed of light in these two media ?

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

A. 1.5

B. 1.33

C. 1.45

D. 2.40

Answer: D

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

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

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

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9. What should be the angle between two plane mirrorrs so that whatever be the angle

of incidence, the incident ray and the reflected ray from the two mirrorrs be parallel to each other

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

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

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

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

(e) at infinity

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

(a) between optical centre and focus of the lens

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

(c) at twice the focal length of the lens

(d) at infinity , (e) at the focus of the lens

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

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

(a) between focus and twice the focal length

of the lens

(b) beyond twice the focal length of the lens

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

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

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

7. Size of image of an object by a mirror having a focal length of $20cm$ is observed to be reduced to $\frac{1}{3}rd$ of the size ? At what distance the object has been placed from the mirror ? What is the nature of the image and the mirror ?

8. Define power of a lens. What is its unit ? One student uses a lens of focal length $50cm$ and

another of $-50cm$. What is the nature of the lens and its and power used by each of the them ?

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

Position of candle $= 12.0cm$

Position of convex lens $= 50.0cm$

Position of the screen $= 88.0cm$

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

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

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

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

1. If the magnification of a body of size 1 m is 2, what is the size of the image ?

A. 1.5 m

B. 2.5 m

C. 2 m

D. 4 m

Answer: C

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2. What is the power of a concave lens of focal length $25cm$?

    A. 4 dioptre

    B. 3 dioptre

    C. - 4 dioptre

    D. None of these

Answer:

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3. What will be the focal length of a lens whose power is given as $+2.0D$?

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

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

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

(e) at infinity

5. What is the value of focal length of a plane mirror ?

6. A ray of light is incident on a convex mirror as shown in Fig.

Redraw the above diagram after completing the path of the light ray after reflection from the mirror.
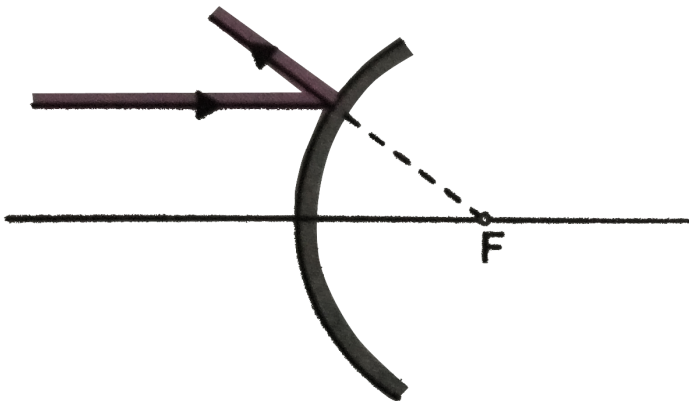
7. Copy Fig. in your answer book and show the direction of the light ray after reflection.
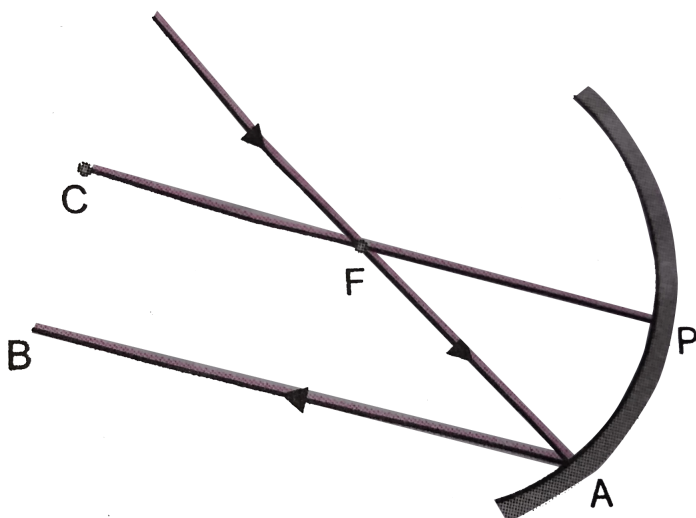
8. The refractive index of diamond is 2.42. What is the meaning of this statement ?

9. Three students A, B and C focussed a distant building on a screen with 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

Answer: A

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10. Draw Fig (a) in your answer book and show

the formation of image of the object AB with
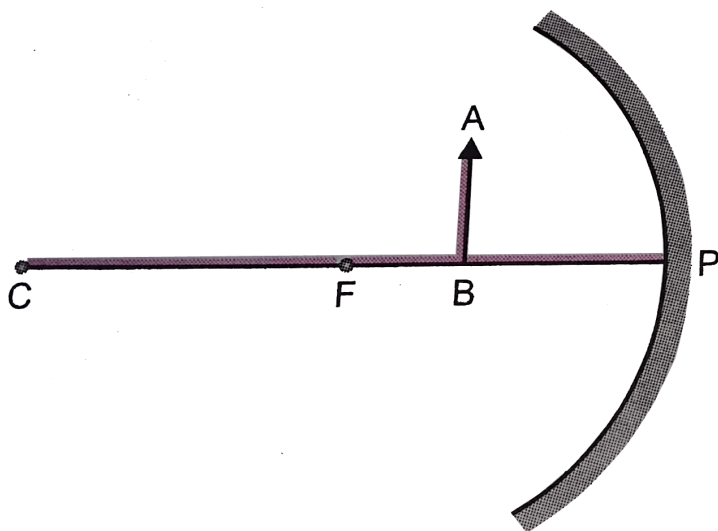
the help of suitable rays.

11. Draw Fig. in your answer book and show the

formation of image of the object AB with the
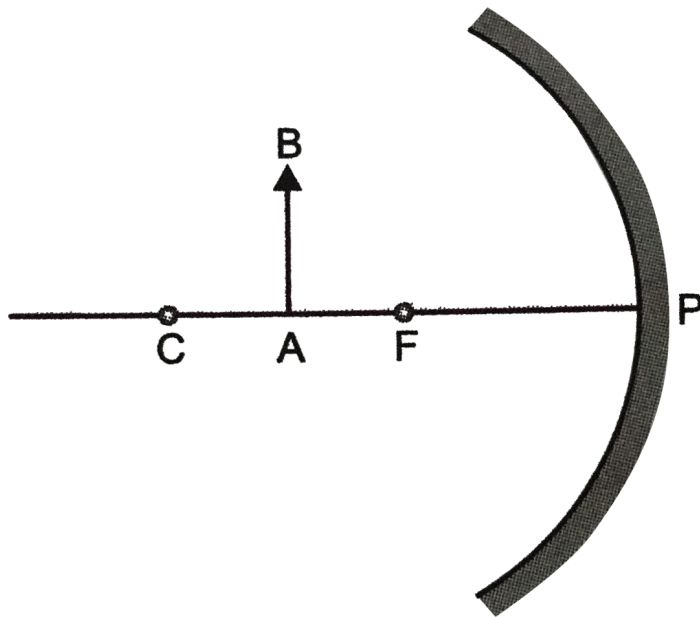
help of suitable rays.

12. Draw Fig. in your answer book and show the formation of image with the help of

suitable rays.
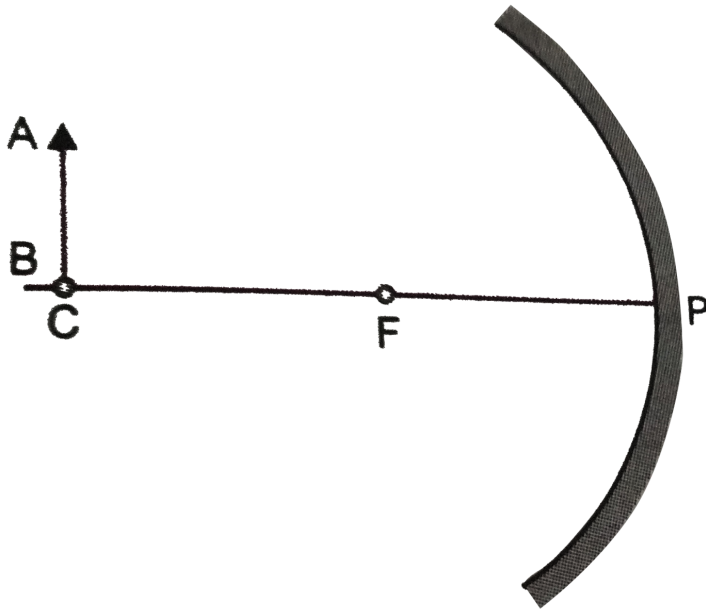
13. Which property of concave mirror is utilized for using them as shaving mirrors ?

14. Why does a ray of light bend when it travels from one medium to another.

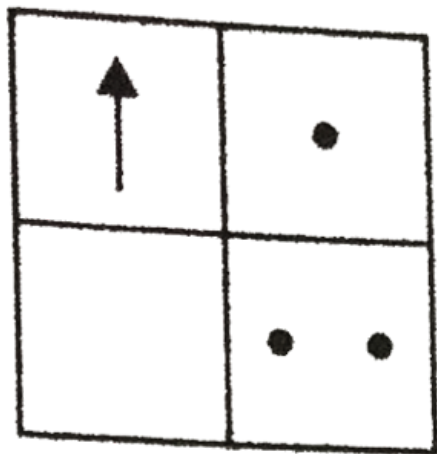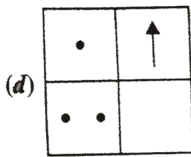**15.** Draw the given diagram, Fig. in your answer book and complete it for the path of ray of

light beyond the lens.
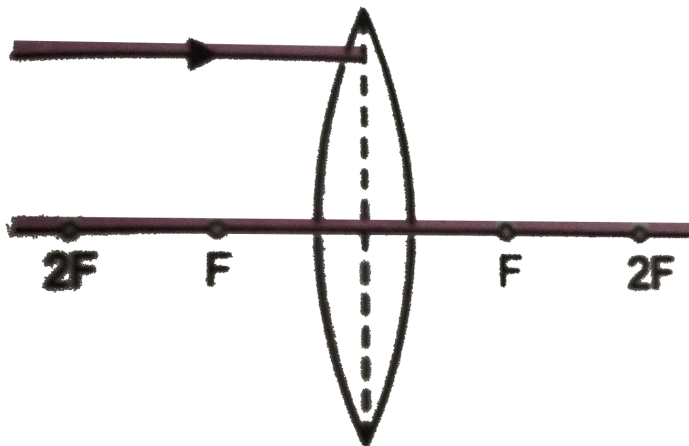
16. if you focus the image of a distant object, whose shape is given below, on a screen using a convex lens, the shape of the image of this

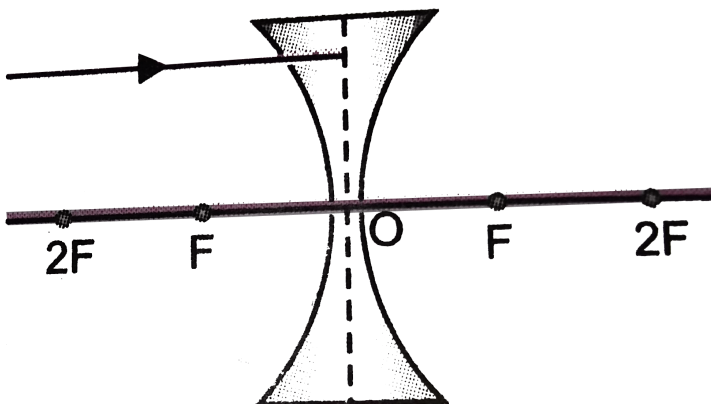object   on   the   screen   would   be   :

A. (a)

B. (b)

C. (c)

(d)

D.
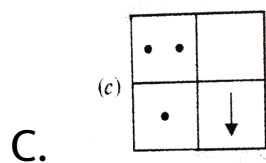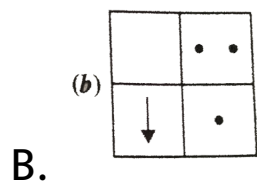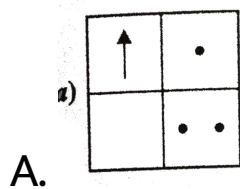
Answer: B

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17. Take down this diagrams, Fig. on to your answer book and complete the path of the

2F   F   O   F   2F

rays.

18. Take down Fig. on to your answer book and complete the path of the ray.

19. The range of wavelength of the visible light is

20. Which colour of the light has the longest wavelength?

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21. Can light travel in vacuum ? If yes, with what speed ?

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22. What is the speed of light in air ?

23. What is a ray light ?

24. Name the best reflector of light.

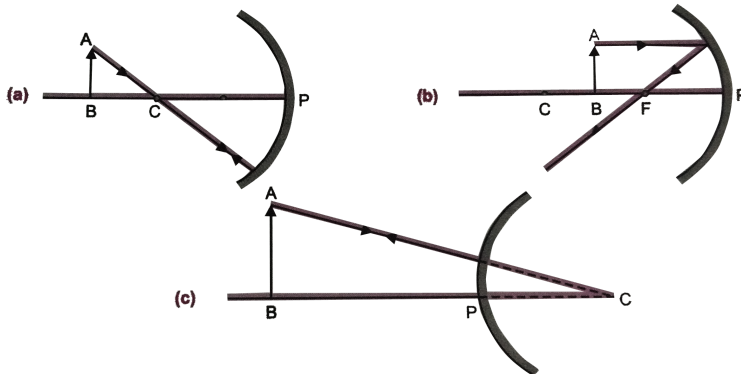**25.** On what factors does the focal length of a spherical mirror depend ?

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26. Do the laws of reflection change, when we use a spherical mirror instead of a plane mirror ?

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27. Complete the following ray diagrams. State the size and nature of image formed in each case.

28. Can an object be virtual ?

29. Can a real image be taken on a screen ?

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30. Do lights rays actually pass through a real image ?

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31. Do lights rays actually pass through a virtual image ?

32. How do you draw normal to a spherical mirror at a particular point?

33. Which of the mirrors is diverging: concave or convex?

34. Which of the mirrors is converging: concave or convex?

35. What is the relation between focal length and radius of curvature of a concave mirror? Does the same relation hold for a covcave mirror?

36. (a) The magnification of a concave mirror is - 1. What is the position of the object? (b) The magnification of a spherical mirror is ± 2. What kind of mirror can it be?

37. What is the ratio of object distance to image distance in case of a concave mirror when its magnification is 0.5?

38. The focal length of a convex mirror is 12.5 cm. How far is it centre of curvature (i) from the pole (ii)from the focus?

39. A ray of light passing through centre of curvature of a concave mirror retraces its path on reflection. Why ?

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40. A ray of light passing through focus of a concave mirror becomes parallel to the principal axis of the mirror on reflection. Comment. Is the reverse true ?

41. Does the position, size and the nature of the image formed by a concave mirror depend on the position of the object?

42. Where is the image formed when an object is at large distance from a concave mirror?

43. Where should an object be placed in front of a concave mirror to obtain an image, which is real, inverted and reduced in size?

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44. For what position of an object, a concave mirror forms a real image equal in size to the object?

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45. Is the position of image same as the position of object when object and image sizes are equal in a mirror?

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46. Can a concave mirror form a virtual image of same size as the object?

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47. Which mirror has a wider field of view ?

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48. A ray of light falling normally on a plane mirror retraces its path on reflection.

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49. A ray of light passing through centre of curvature of a spherical mirror retraces its

path on reflection from the mirror.

50. A concave mirror is used as doctor's head mirror.

51. In the mirror formula, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$, f does not change when u is changed.

52. Where should an object be placed so that a real and inverted image of the same size is obtained by a convex lens?

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53. An object 2 cm high is placed at a distance 2 f from a convex lens. What is the height of the image formed ?

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54. What is the largest value of refractive index? Name the medium.

55. (a) A ray of light in air enters glass. Does it bend towards normal ?

(b) If the same ray enters water, which way will it bend?

56. (a) A water tank appears $1 \cdot 5$ m deep. What is it actual depth ? Given refractive index of water w.r.t. air is $4/3$.

(b) If $1 \cdot 5$ m were actual depth of water tank, what would be its apparent depth?

57. (a) What is the speed of light in water of refractive index $4/3$?

(b) Light travels in a medium with a velocity of

$2 \times 10^8 m/s$. What is refractive index of the medium?

58. (a) Can you measure rough focal length of a convex lens? If yes, why?

(b) Can you measure rough focal length of a concave lens ? If not, why not?

59. (a) The linear magnification of a concave lens is always positive. Why?

(b) The linear magnification of a convex lens may be positive or negative. Why ?

60. What is the unit of refractive index?

61. (i) Rohit claims to have obtained an image twice the size of the object with a concave lens. Is he correct? Give reason for your answer.

(ii) Where should an object be placed in case of a convex lens to form an image of same size as of the object? Show with the help of ray diagram, the position and nature of image formed?

(iii) With the help of ray diagram, illustrate the change in position, size and nature of image

formed if convex lens in case of (ii) is replaced by a concave lens of same focal length.

62. Arrange air, glass and water in terms of decreasing refractive index.

63. Which is denser optically out of alcohol with $n = 1 \cdot 36$ and carbon disulphide with

$n = 1 \cdot 63$?

64. The image formed by a convex lens is always real. Is it true?

65. a convex lens forms a virtual image of an object. What is the position of the object ?

66. For what position of an object a real, diminshed image is formed by a convex lens?

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67. Where should an object be placed in order of to use a convex lens as a magnifying glass?

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68. What is the difference between lens formula and mirror formula?

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69. Define one dioptre of power of a lens.

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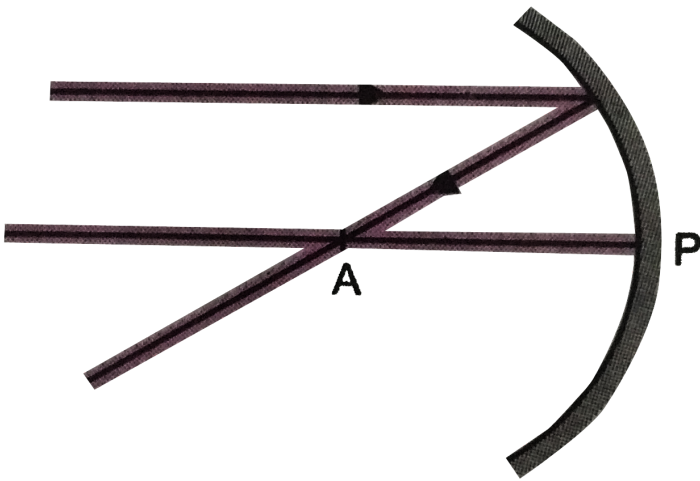
70. How is the power of a lens related to its focal length?

71. What is meant by number of lens?

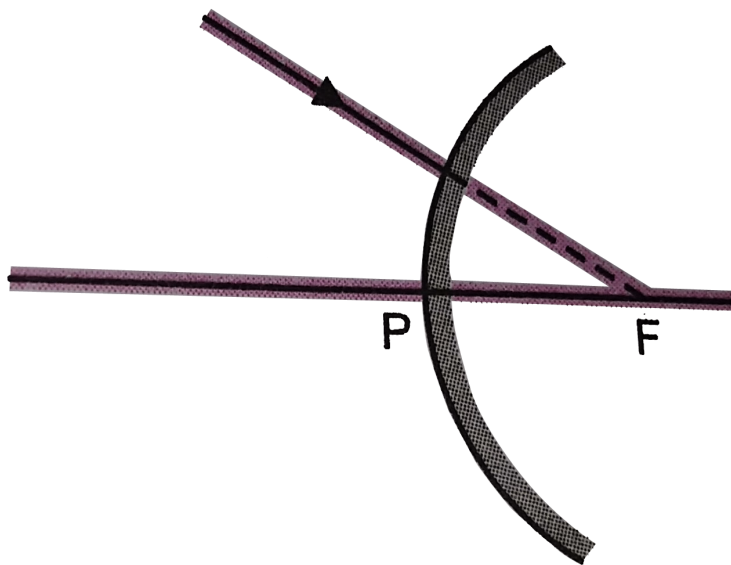**72.** Look at . What is the radius of curvature of the spherical mirror? Given PA=10 cm.

73. Draw the reflected ray when ray the incident ray were to pass through focus of the
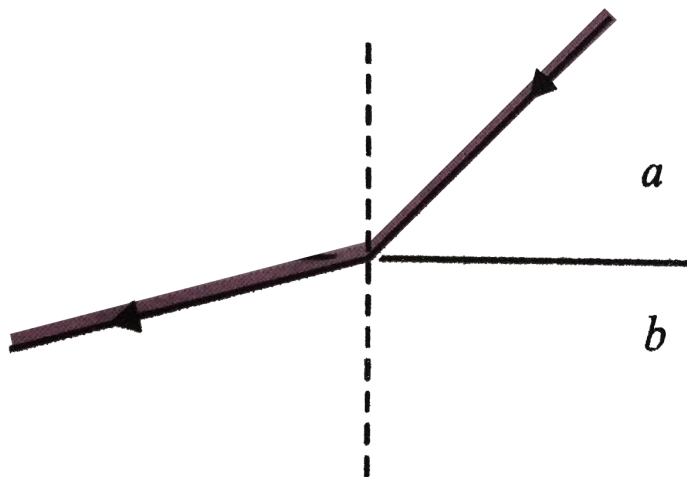
mirror.

P   F

▶ Watch Video Solution

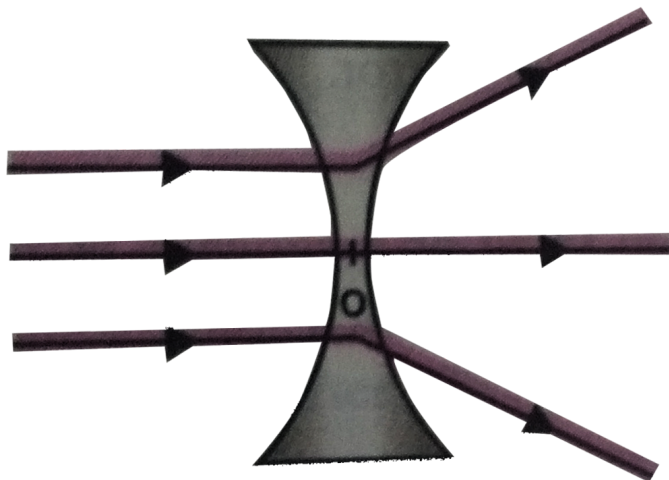**74.** What is the cause of refraction of light ?

▶ Watch Video Solution

75. A ray of light is refracted. Which medium a or b is optically denser than the other ?

76. A parallel beam of light passes through a lens held at O as shown in Fig. What is the

nature of the lens?

77. Explain why, a ray of light passing through the centre of curvature of a convace mirror gets reflected back along the same path.

78. What is the nature of the image formed by a concave mirror if the magnification produced by the mirror is +3?

79. The refractive index of carbon disulphide is $1 \cdot 63$. What is the meaning of this statemnet in relation to speed of light?

80. The outer surface of a hollow sphere of aluminium of radius 50 cm is to be used as a mirror. What will be the focal length of this mirror? Which type of spherical mirror will it provide?

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81. Between which two points of a concave mirror should an object be placed to obtain a

magnification of -3?

Short Q A

1. Give the characteristics of image formed by a plane mirror.

2. An object is placed at 0.06 m from a convex lens of focal length 0.1m. Calculate the position of the image?

3. An object is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position and nature of the image.

4. A 3 cm tall object is placed 18 cm in front of a concave mirror of focal length 12 cm. At what distance from the mirror should a screen be placed to see a sharp image of the object on the screen. Also calculate the height of the image formed.

5. Light enters from air into diamond, which has a refractive index of 2.42. Calculate the

speed of light in diamond. The speed of light in air is $3 \times 10^8 m/s$.

6. With respect to air, the refractive index of ice is $1 \cdot 31$ and that of rock salt is $1 \cdot 54$. Calcualte the refractive index of rock salt w.r.t ice.

7. Draw a labelled ray diagram to locate the image of an object fromed by a convex lens of focal length 20 cm when the object is placed 30 cm away from the lens.

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

9. Explain briefly the following day to day events:

(a) A swimming pool appears shallower than what it actually is.

(b) A convex lens can be used as a magnifier, but a concave lens cannot be.

(c) A convex mirror is used as a rear view mirror by the drivers of motor vehicles.

(d) A concave mirror is used by ENT specialists.

(e) A convex mirror is used as a refleactor in street lamps.

10. How will you distinguish between a plane mirror, a convex mirror and a concave mirror without touching them?

11. Is optical density of a medium same as its mass density ? Name a transparent medium which has smaller mass density, but is optically denser.

12. An object is held at a distance of 20cm from a concave lens of focal length 80 cm. What is the position and size of the image if the object is 2 cm high ?

13. Draw ray diagrams to represent the nature, position and relative size of the lens for the

object placed:

a) at $2F_1$,

b) between F_1 and the optical center O of the lens.

Which of the above two cases shows the use of convex lens as a magnifying glass? Give reasons for your choice.

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14. 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.

15. A ray of light falling normally on a plane mirror retraces its path on reflection.

16. What is the basic difference between a concave mirror and a convex mirror?

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17. The principal focus of a convex mirror lies at the back of the mirror. Comment .

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18. How do you measure quickly the approximately focal length of a concave mirror?

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19. What is meant by linear magnification of a concave mirror?

> ▶ Watch Video Solution

20. State the expression for linear magnification of a concave mirror in terms of object distance and image distance.

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21. What is the nature of image formed when an object is held at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm?

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22. A concave mirror of focal length 20 cm is to be used as a shaving mirror. Which of the following is the suitable object distance from the mirror ?

(i)10 cm (ii)20 cm (iii) 30 cm.

23. The image of a distant object is formed at 30 cm from a concave mirror. What is the focal length of the mirror?

24. The radius of curvature of a concave mirror is 50 cm. Where should an object be held from the mirror so as to form its image at infinity?

25. A man standing in front of a special mirror finds his image having a small face, big tummy

and legs of normal size. What are the shapes of three parts of the mirror?

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26. An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List our characterisitic of the image formed by the mirror

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27. Can you change focal length of a given spherical mirror by changing the object distance from the mirror?

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28. Can you change linear magnification of a spherical mirror by changing the object distance from the mirror?

▶ **Watch Video Solution**

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

30. For the same angle of incidence in media P,Q and R, the angles of refraction are $35°$, $25°$, $15°$ respectively. In which medium will the velocity of light be minimum?

31. An object is placed at a distance of 40 cm in front of a convex mirror of radius of curvature 40 cm. List four characteristic of the image formed by the mirror.

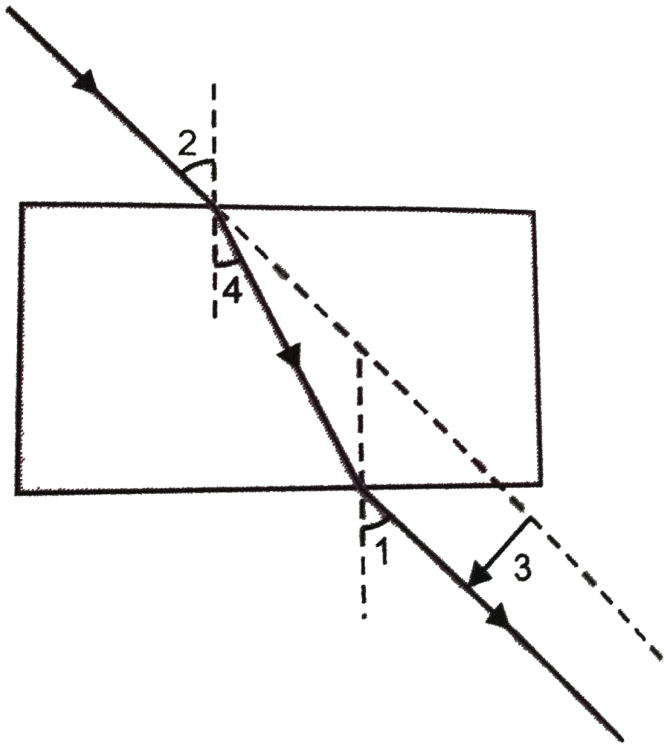**32.** A ray of light travelling in air is incident on a rectangular glass slab. What will happen?

33. If rafractive index of glass w.r.t. air is $3/2$, what is the refractive index of air w.r.t. glass?

34. 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

Answer: B

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35. The refractive index of glass is $3/2$ and refractive index of water is $4/3$. What would be the refractive index of water with respect to glass ? Does light travel faster in glass than in water?

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36. A coin in a glass beaker appears to rise as the beaker is slowly filled with water. Why?

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37. A tank of water is 4 m deep. How deep does it appear when seen normally?

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38. What is meant by optical centre of a lens?

39. Define first principal focal length of a convex lens.

40. Give three basic differences between real image and virtual image.

41. What is linear magnification produced by a lens? How is it related to object distance and image distance?

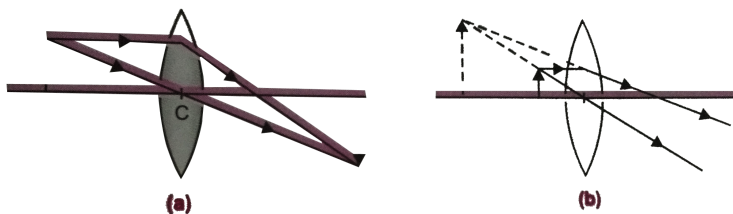**42.** When is magnification positive or negative ?

43. In which of the following cases, linear magnification is positive?

(a)   **(b)**

44. 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 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 ?
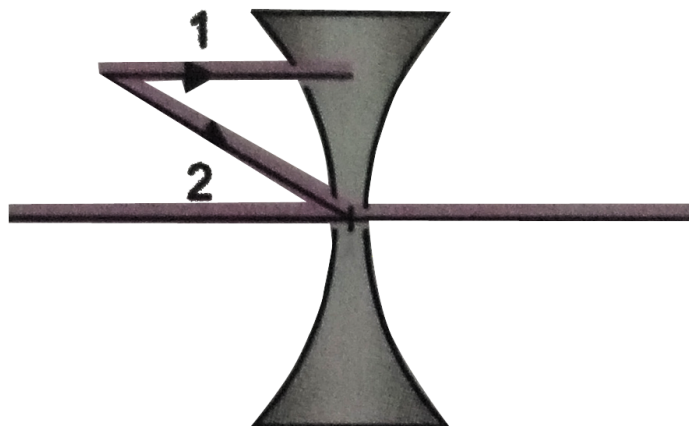
(c) What difference is seen in the intensity (brightnees) of the image of the flame on the screen ?

(d) What is seen on the when the flame is very close (at about 5 cm) to the lens ?

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45. Draw the refracted rays corresponding to incident ray 1 and 2

46. A ray of light passing through A retraces its path on reflection from a concave mirror. If

$PA = 30cm$, what is the focal length of the mirror ?

A. 60cm

B. 20cm

C. 30cm

D. 15cm

Answer: D

47. You are given a concave mirror of focal length 20 cm and a candle. Where will you hold the candle to form a virtual, erect and magnified image of the candle flame ? Draw the necessary ray diagram.

48. Can you change focal length of a given spherical mirror by changing the object distance from the mirror?

49. The linear magnification of a concave mirror can be positive or negative. Why?

50. You are given a convex lens of focal length 30 cm. At what distance from the lens should you hold a candle flame to observe.

(a) a real and magnified image of the flame ?

(b) a virtual and magnified image of the flame?

(c) a real, inverted and smaller image of the flame?

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51. When is linear magnification of a convex lens positive and when is it negative? What should be the corresponding distance of the object from convex lens of focal length 50 cm?

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52. A real, inverted image of the size of object is to be formed by holding the object at 1 meter from a convex lens, What should be the focal length of the lens? Draw the course of rays.

53. A convex lens is used to focus the rays from the far off light bulb at a distance of one meter from the lens. What should be the focal

length of the lens ? Draw a ray diagram to show the formation of image.

54. Trace the course of a ray of ligth through a rectangular glass slab. From the plot discuss what happens when

(i) ray goes from a rarer to a denser medium ?

(ii) ray goes from a denser to a rarer medium?

55. What is Snell's law of refraction? What does it imply?

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56. From the course of a ray of light through a rectangular glass slab, explain what is lateral displacement and net deviation?

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57. In an experiment with a rectangular glass slab, for an angle of incidence of $60°$ in air, angle of refraction is measured to be r_1. When the glass slab is replaced by a hollow slab filled with water, angle of refraction is measured to be r_2. Show that $r_2 > r_1$. Justify your answer.

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Short Q A 3 Marks

1. Calculate the distance at which an object should be placed in front of a convex lens of focal length 10 cm to obtain a virtual image of double its size.

2. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination is

3. An object 4 cm in height, is placed at 15cm 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?

4. 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.

5. A concave mirror has a focal length of 20 cm. Find the position or positions of an object for which the image-size is double of the object-size.

6. An object 3 cm high is held at a distance of 50 cm from a diverging mirror of focal length

25 cm. Find the nature, position and size of the image formed.

7. A concave mirror has a focal length of 20 cm. Find the position or positions of an object for which the image-size is double of the object-size.

8. The linear magnification of a convex mirror of focal length 15 cm is $\dfrac{1}{3}$. What is the distance of the object from the focus of the mirror ?

9. An object is held at 30 cm in front of a convex mirror of focal length 15 cm. At what distance from the convex mirror should a

plane mirror be held so that images in the two mirrors coincide with each other?

10. A concave lens made of a material of refractive index n_1 is kept in a medium of refractive index n_2. A parallel beam of light is incident on the lens. Complete the path of rays of light emerging from the concave lens (i) $n_1 > n_2$ (ii) $n_1 = n_2$ (iii) $n_1 < n_2$.

11. Find the position, nature and size of the image formed by a convex lens of focal length 20 cm of an object 4 cm high placed at a distance of 30cm from it.

12. 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 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 (brightnees) of the image of the flame on the screen ?

(d) What is seen on the when the flame is very close (at about 5 cm) to the lens ?

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13. A convex lens has focal length of 30cm. Calculate at what distance should the object be placed from the lens so that it forms at 60 cm on the other side of the lens ? Find the magnification produced by the lens in this case.

14. Find the position, nature and size of the image of an object 3 cm high placed at a

distance of 9 cm from a concave mirror of focal length 18cm.

15. A ray of light passes from glass to air at an angle of $19.5°$. Calculate the angle of refraction, given refractive index of glass w.r.t. air is $3/2$.

16. A convex lens of power 3 D is held in contact with a concave lens of power -1D.A parallel beam of light is made to fall on the combination. At what distance from the combination will the beam get focussed?

A. $20cm$

B. $60cm$

C. $50cm$

D. $90cm$

Answer: C

17. Calculate two possible distances of an object from a convex lens of focal length 20 cm so as to obtain an image of double the size of the object.

18. An object 4 cm high is placed $40 \cdot 0$ cm in front of a concave mirror of focal length 20

cm. Find the distance from the mirror, at which a screen be placed in order to obtain a sharp image. Also, find the size and nature of the image formed.

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19. An object is placed at a distance of 12 cm in front of a concave mirror. It forms a real image four times larger than the object. Calculate the distance of the image from the mirror.

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20. A 5.0 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. By calculation, determine (i) the position (ii) the size of the image formed.

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21. An object is placed at a distance of 15 cm from a convex lens of focal length 20 cm. List

four characteristics (nature,position,etc.) of the image formed by the lens.

22. 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.

23. An object 3.0 cm high is placed perpendicular to the principal axis of a concave lens of focal length $7 \cdot 5$ cm. The image is formed at a distance of 5.0 cm from the lens. Calculate (i) distance at which object is placed, and (ii) size and nature of image formed.

24. A concave lens has focal length of $20cm$. At what distance from the lens a 5 cm tall object

be placed so that it forms an image at $15cm$ from the lens? Also, calculate the size of the image formed.

25. An object $50cm$ tall is placed on the principal axis of a convex lens. Its $20cm$ tall image is formed on the screen placed at a distance of $10cm$ from the lens. Calculate the focal length of the lens.

26. A concave mirror is used as a head mirror by ENT specialists. The same mirror can also be used as a shaving mirror. Why?

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

(a) Head lights of a car.

(b) Side rear view mirror of a vehicle.

(c) Solar furnace.

Support your answer with reason.

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28. How will you distinguish between a plane mirror, a convex mirror and a concave mirror without touching them?

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29. Explain the concept of absolute refractive index and relative refractive index of optical media.

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30. What is meant by the 'angle of incidence' and the 'angle of refraction' for a ray of light? Draw a labelled ray diagram to show the angle of incidence and the angle of refraction for a refracted ray of light.

31. What is meant by aperture, optical centre and principal axis of a spherical lens?

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32. What is power of a combination of lenses in contact ?

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

34. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 36 cm from it ? What

will be the magnification produced in this case?

35. At what distance should an object be placed from a lens of focal length 25 cm to obtain an image on a screen placed at a distance of $50cm$ from the lens ? What will be the magnification produced in this case?

1. (a) State the relation between object distance, image distance and focal length of a spherical mirror.

(b) Draw a ray diagram to show the image formed by a concave mirror when an object is placed between pole and focus of the mirror.

(c) A concave mirror of focal length 15 cm forms an image of an object kept at a distance of 10 cm from the mirror. Find the position, nature and size of the image formed by it.

2. Draw ray diagrams to show the formation of images when an object is brought closer to concave mirror, from infinity.

3. What are the uses of concave and convex mirrors ?

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

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5. In going from a rarer to a denser medium, a ray of light bends towards normal. And in going from a denser to a rarer medium, a ray of light bends away from normal. Explain why.

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6. Explain the two situations under which no refraction would occur.

7. From the course of a ray of light through a rectangular glass slab, explain what is lateral displacement and net deviation?

1. In the mirror formula, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$, f does not change when u is changed.

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2. The formula for linear magnification of a spherical mirror is $m = \dfrac{h_2}{h_1} = \dfrac{-v}{u}$. What determines the sign of m? What is the signification of the sign?

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3. Rahul find the rough focal length of a convex lens. He is trying same method to find the focal length of concave lens, will he be successful. Justify your answer with help of ray diagram.

4. On what factors does the focal length of a spherical mirror depend ?

5. An object is held at a distance of 60 cm from a convex mirror of focal length 20 cm. At what distance from the convex mirror, should a plane mirror be held so that images in the two mirrors coincide?

6. A convex lens made of a material of refractive index n_2 is kept in a medium of

refractive index n_1. A parallel beam of light is incident on the lens. Complete the path of rays of light emerging from the convex lens if

(i) $n_1 < n_2$ (ii) $n_1 = n_2$ (iii) $n_1 > n_2$.

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1. A spherical mirror in which reflecting surface is towards the centre of the sphere of which the mirror is a part, is called concave mirror,

i.e., reflection of light for this mirror occurs at concave surface or bent-in surface.

The rays of light incident on concave mirror in a direction parallel to the principal axis, actually meet at a single point F on the principal axis of the mirror. This point is called principal focus of the mirror.

Read the above passage and answer the following questions :

(i) Is principal focus of a concave mirror, a real point or a virtual point?

(ii) What happens in case of a convex mirror ?

(iii) Our teachers and parents advise us to stay focussed. What does it imply?

2. In case of both, convex mirror and concave mirror, any line passing through centre of curvature of the mirror is normal to the mirror. A ray of light falling normally on the mirror, retraces its path on reflection. This is because for a normaly ray, angle of incidence, $\angle i = 0°$. As angle of reflection is equal to

angle of incidence, i.e., $\angle r = \angle i$, therefore, $\angle r = 0°$. That is why the path of the ray normally on the mirror is retraced.

Read the above passage and answer the following questions :

(i) Do the rays passing through principal focus of mirror fall normally on the mirror. (ii) Which is closer to the mirror, principal focus or centre of curvature of the mirror ? (iii) What values of life do you learn from this concept?

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3. Power of a lens is a measure of the ability of the lens to converge the rays of light falling on it. Quantitatively, power of a lens = reciprocal of focal length of lens, i.e., $P = \dfrac{1}{f}$.

If a lens happens to diverge the ray of light falling on it, its power is said to be negative. Thus, power of a convex lens is positive and power of a concave lens is negative.

If P_1, P_2 are powers of two lenses held in contact with each other, the power of the combination is $P = P_1 + P_2$. Note that P_1, P_2 are to be added with proper sign.

Read the above passage and answer the following question:

(i) What is the SI unit of power?

(ii) Focal length of a concave lens is $20cm$. What is its power ?

(iii) What lessons of life do you learn from the relation $P = P_1 + P_2$?

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4. The formula governing reflection of light from a spherical mirror is

$$\frac{1}{v} + \frac{1}{u} = \frac{2}{R}, \text{where}$$

u = distance of object from pole of mirror,

v = distance of image from pole of mirror

f = focal length of mirror,

R = radius of curvature of mirror.

This is known as mirror formula and is applicable equally to concave mirror and convex mirror.

$$m = \frac{I}{O} = \frac{v}{u}$$

Read the above passage and answer the following questions :

(i) An object is held at a distance of $30cm$ in front of a concave mirror of radius of

curvature $40cm$. Calculate distance of the image from the object ? What is linear magnification of the mirror ?

(ii) The object is moved to a distance of $40cm$ in front of the mirror. How is focal length of mirror affected ?

(iii) What values of life do you learn from the mirror formula ?

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Mock Test

1. Draw on your answer book and show the path of reflected ray.
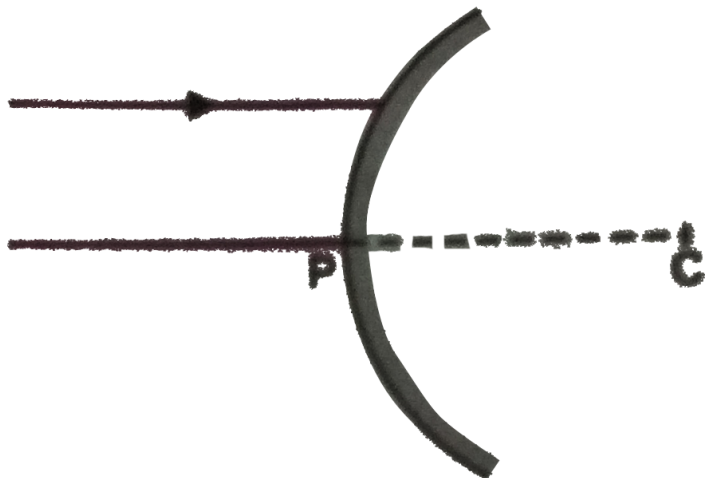
2. According to the "New Cartesian Sign Convention" for mirros, when sigh has been

given to the focal length of :

(i) a concave mirror ?

(ii) a convex mirror ?

3. What is the basic difference between reflection and refraction of light?

4. Define absolute refractive index of a medium. Find its value for glass in which speed of light is $2 \times 10^8 m/s$.

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5. The focal length of a convex mirror is 30cm. What is the distance of its centre of curvature from its focus?

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6. How will you distinguish between a plane mirror, a convex mirror and a concave mirror without touching them?

7. Draw the course of a rays for tracing image of an object held between pole and principal focus of a concave mirror. State the position and nature of image formed.

or

Draw the course of rays for tracing image of

an object held between optical centre and principal focus of a convex lens. State the nature of image formed.

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8. What is meant by linear magnification produced by a spherical mirror ? Obtain the formula in terms of object distance and image distnace.

▶ **Watch Video Solution**

9. An object is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position and nature of the image.

▶ **Watch Video Solution**
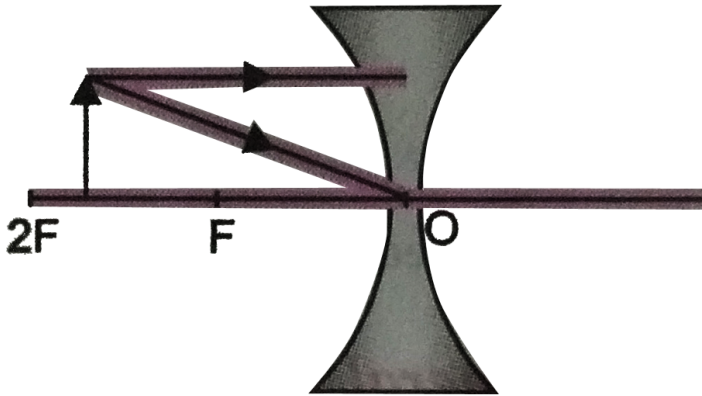
10.

Draw the figure on your answer book and complete the path of the rays, What is the nature of the image?

11. Find the position of an object, which when placed in front of a concave mirror of radius of curvature 40 cm produces a virtual image, which is twice the size of the object.

12. Explain with the help of a diagram, why a rod immersed partially in a transparent liquid appears to be bent at the surface of the liquid.

13. What is meant by power of a lens ? When is it positive or negative? Define one dioptre.

14. An object of height $2cm$ is held at a distance of $40cm$ in front of a concave lens of power $-5D$. Find the size of the image?

    A. 2/3 cm

    B. 4/3 cm

C. 7/8 cm

D. 2/5 cm

Answer: A

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15. State the three laws of refraction of light.

or

A convergent lens of power $5D$ is combined with a divergent lens of power $-3D$. What is the focal length of the combination?

16. (a) Discuss briefly the conditions for no refraction

(b) What is the difference between mirror formula and lens formula?

17. (a) State the relation between object distance, image distance and focal length of

the mirror. Give the New Cartesian Sign Conventions used.

(b) A concave mirror forms a virtual and erect image at a distance of 30 cm from the mirror when the object is held at 10 cm in front of the mirror. Calculate focal length of the mirror.

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18. Prove that a ray of light emerges from a rectangular glass slab in a direction parallel to

that in which it entered the glass slab. What is lateral displacement?

19. (a) How will you distinguish between convex lens and concave lense without touching them?

(b) Linear magnification of a concave lens is always positive, whereas that of a convex lens can be both, positive or negative . Why?

20. In going from a rarer to a denser medium, a ray of light bends towards normal. And in going from a denser to a rarer medium, a ray of light bends away from normal. Explain why.

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21. How many refractions does a ray of light undergo on passing through a glass slab? What is the net deviation of the ray ?

▶ **Watch Video Solution**

22. If glass slab is replaced by a hollow slab filled with water, will the net deviation change? For given angle of incidence, will the deviation of the ray in first refraction increase $3s$ or decreases compared to the one in glass slab?

23. Focal length of a convex lens in air is 25 cm. It is cut into two equal halves along its

principal axis. What will be the focal length of each half ?

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24. Two concave spherical mirrors are parts of two spheres of diameters 1:3. What is the ratio of their focal lengths?

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25. Can we find rough focal length of a convex mirror ? If yes, how? If no, why not?

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26. You are given a concave mirror of focal length 30 cm. How can you form a real image of the size of the object using this mirror?

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Problems For Practise

1. Focal length of a convex mirror is $50cm$. What is its radius of curvature?

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2. Radius of curvature of a concave mirror is 25 cm. What is its focal length?

▶ **Watch Video Solution**

3. A concave mirror produces 10 cm long image of an object of height 2 cm. What is the magnification produced?

▶ **Watch Video Solution**

4. An object 1 cm high is held near a concave mirror of magnification 10. How tall will be the image?

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5. Find the size, nature and position of image formed by a concave mirror, when an object of size 1 cm is placed at a distance of 15 cm. Given focal length of mirror is 10 cm.

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6. An object 2 cm high is placed at a distance of 16 cm from a concave mirror, which produces 3 cm high inverted image. What is the focal length of the mirror? Also, find the position of the image.

7. An erect image $3 \times$ the size of the object is obtained with a concave mirror of radius of curvature $36cm$. What is the position of the object ?

8. A 2.5 cm candle is placed 12 cm away from a convex mirror of focal length 30 cm. Give the

location of the image and the magnification.

9. An object is placed in front of a concave mirror of focal length 20 cm. The image formed is three times the size of the object. Calculate two possible distances of the object from the mirror?

A. $+40/5 cm, \ -80/3 cm$

B. $-40/3 cm, \ -80/3 cm$

C. $-20/3cm, \ -50/3cm$

D. $-40/3cm, \ +70/3cm$

Answer: B

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10. A concave mirror produces a real image 10 mm tall, of an object 2.5 mm tall placed at 5 cm from the mirror. Calculate focal length of the mirror and the position of the image?

A. $-4cm; \quad -20cm$

B. $-40cm; \quad -20cm$

C. $-2cm; \quad -10cm$

D. $-5cm; \quad -15cm$

Answer: A

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11. An object is placed at a large distance in

front of a convex mirror of radius of curvature

40 cm. How far is the image behind the mirror?

12. An object is placed 15 cm from a convex mirror of radius of curvature 90 cm. Calculate position of the image and its magnification.

13. The image formed by a convex mirror of focal length 30 cm is a quarter of the object. What is the distance of the object from the mirror?

14. When an object is placed at a distance 60 cm from a convex spherical mirror, the magnification produced is $1/2$. Where should

the object be placed to get a magnification of

$1/3$?

A. -200 cm

B. +150 cm

C. - 120 cm

D. None

Answer: C

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15. An object is placed $18cm$ in front of a mirror. If the image is formed at $4cm$ to the right of the mirror, calculate its focal length. Is the mirror convex or concave ? What is the nature of the image ? What is the radius of curvature of the mirror ?

A. 5.14 cm ; convex, erect and real ; 10.28 cm

B. 5.14 cm ; convex, diminished and virtual ; 10.28 cm

C. 5.14 cm ; concave, erect and real ; 10.28

cm

D. Edit 5.14 cm ; convex, erect and virtual ;

10.28 cm

Answer: D

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16. A convex mirror used for rear view on an

automobile has a radius of curvature of 3.00

m. If a bus is located at 5.00 m from this

mirror, find the position, nature and magnification of the image.

17. Calculate speed of light in water of refractive index $4/3$. Given speed of light in air $= 3 \times 10^8 m/s$.

18. A ray of light passes from air to glass $(n = 1.5)$ at an angle of $30°$. Calculate the angle of refraction.

19. A ray of light is incident on a glass slab at an angle of $45°$. If refractive index of glass be 1.6, what is the angle of refraction ?

A. $45.2°$

B. $30°$

C. $26.2°$

D. $15.2°$

Answer: C

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20. The refractive index of diamond is 2.47 and that of glass is 1.51. How much faster does light travel in glass than in diamond ?

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21. The refractive index of glycerine is 1.46. What is the speed of light in air if its speed in glycerine is $2.05x10^8 m/s$?

22. The refractive index of glass is 1.6 and that of diamond is 2.4. Calculate refractive index of diamond with respect to glass.

A. 1.5

B. 2.5

C. 2.0

D. 0.5

Answer: A

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23. In the above problem, what is the refractive

index of glass w.r.t diamond ?

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24. A ray of light is travelling from glass to air. The angle of incidence in glass is $35°$, and angle of refraction in air $60°$. What is the refractive index of glass w.r.t. air ? $[\sin 35° = (0.5736)]$

A. 1.9

B. 0.5

C. 1.51

D. 2.0

Answer: C

25. A ray of light is travelling is travelling from air to water. What is the angle of incidence in air, if angle of refraction in water is $41°$? Take refractive index of water $= 1.32$.

    A. $60°$

    B. $45°$

    C. $30°$

    D. $90°$

Answer: A

26. A tank of water is 4 m deep. How deep does it appear when seen normally?

27. What is the real depth of a swimming pool when its bottom appears to be raised by 1 m ? Given refractive index of water is $4/3$.

A. $2m$

B. $16m$

C. $4m$

D. $8m$

Answer: C

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28. A jar $15cm$ long is filled with a transparent

liquid. When viewed from the top, its bottom

appears to be $12cm$ below. What is the refractive index of the liquid ?

29. The image obtained with a convex lens is erect and its length is 4 times the length of the object. If the focal length of lens is $20cm$, calculate the object and image distances.

    A. - 15 cm, - 60 cm

    B. 45 cm . - 60 cm

C. 12 cm, 20 cm

D. None

Answer: A

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30. A needle placed $45cm$ from a lens forms an image on the screen placed 90 cm on the other side of the lens. Identify the type of the lens and determine its focal length. What is

the size of the image if the size of needle is

5.0cm ?

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31. A concave lens has a focal length of 50 cm.

Calculate its power.

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32. The image of a small electric bulb fixed on

the wall of a room is to be obtained on the

opposite wall $3m$ away by means of a large convex lens. What is the maximum possible focal length of the lens required for the purpose ?

33. Calculate the distance at which an object should be placed in front of a convex lens of focal length 10 cm to obtain a virtual image of double its size.

34. The image of the needle placed $10cm$ from a lens is formed on a wall $20cm$ on the other side of the lens. Find focal length of the lens and size of image formed, if the size of object needle is $2.5cm$.

35. An object is placed at a distance of $30cm$ from a concave lens of focal length $15cm$. Find the nature and position of the image.

36. An object of height $2cm$ is placed at a distance of 15 cm in front of a concave lens of power -10 dioptre. Find the size of the image.

37. A thin lens has a focal length of $-25cm$. What is the power of the lens? It is convex or concave ?

38. The power of lens is $2.5D$. What is its focal

length ?

39. A convergent lens of power 8 D is

combined with a divergent lens of power

$-10D$. Calculate focal length of the

combination.

40. A concave lens is kept in contact with a convex lens of focal length $20cm$. The combination works as a converging lens of focal length $100cm$. Calculate power of concave lens.

A. $+2D$

B. $-2D$

C. $+5D$

D. $-4D$

Answer: D

41. Find the focal length and nature of lens which should be placed in contact with a lens of focal length $10cm$ so that the power of the combination becomes 5 dioptre.

42. Study the given ray diagrams and select the correct statement from the following :
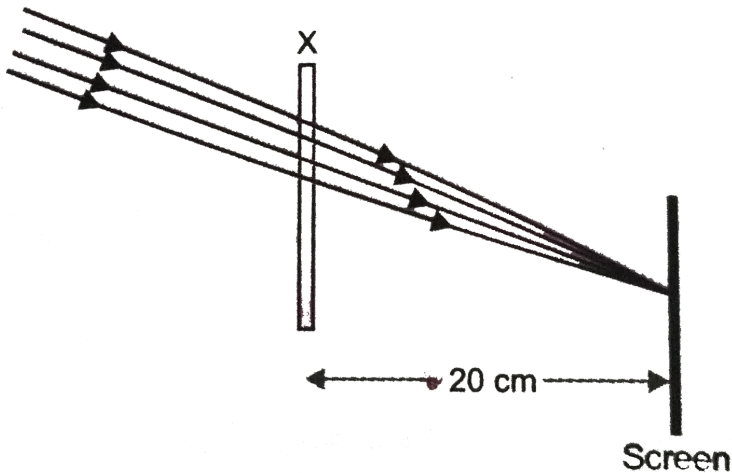
A. Device X is a concave mirror and device Y is a convex lens, whose focal lengths are $20cm$ and $25cm$ respectively.

B. Device X is a convex lens and device Y is a concave mirror, whose focal lengths are $10cm$ and $25cm$ respectively.

C. Device X is a concave lens and device Y is a convex mirror, whose focal lengths are $20cm$ and $25cm$ respectively.

D. Device X is a convex lens and device Y is a concave mirror, whose focal lengths are $20cm$ and $25cm$ respectively.

Answer: D

43. 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.

Answer: D

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Ncert Exemplar Problems

1. Which of the following can make a parallel beam of light from a point source is incident

on it ?

A. Concave mirror as well as convex lens

B. Convex mirror as well as concave lens

C. Two plane mirrors placed at $90°$ to each

other

D. Concave mirror as well as concave lens

Answer: A

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2. A $10mm$ long awl pin is placed vertically in front of a concave mirror. A $5mm$ long image of the awl pin is formed at $30cm$ in front of the mirror. The focal length of this mirror is

    A. $-30cm$

    B. $-20cm$

    C. $-40cm$

    D. $-60cm$

Answer: B

3. Under which of the following conditions a concave mirror can form a real image larger than the actual object ?

A. When the object is kept at a distance equal to its radius of curvature

B. When object is kept at a distance less than its focal length

C. When object is placed between the focus and centre of curvature.

D. When object is kept at a distance greater than its radius of curvature.

Answer: C

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4. Figure shows a ray of light as it travels from medium A to medium B. Refractive index of the

medium B relative to medium A is
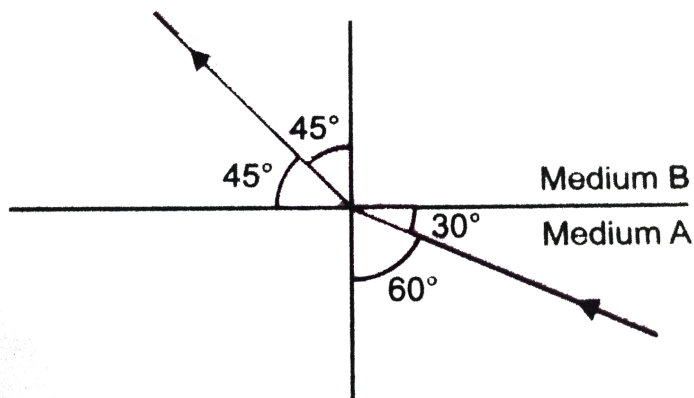
A. $\sqrt{3}/\sqrt{2}$

B. $\sqrt{2}/\sqrt{3}$

C. $1/\sqrt{2}$

D. $\sqrt{2}$

Answer: A

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5. A light ray enters from medium A to medium B as shown in Figure. The refractive index of medium A relative to B will be

Medium B
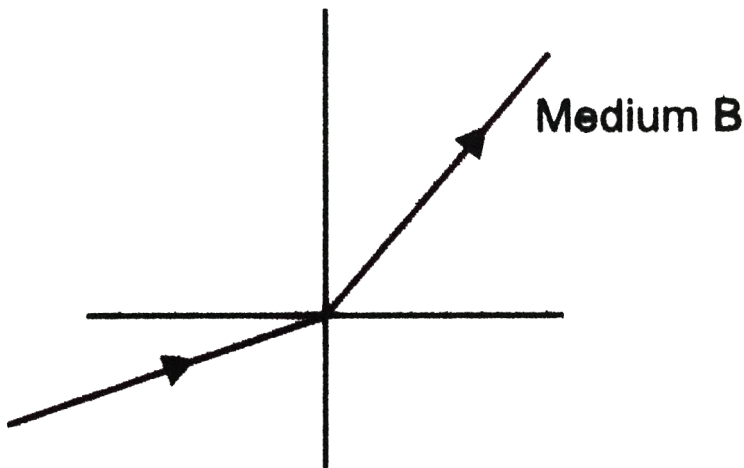
A. greater than unity

B. less than unity

C. equal to unity

D. zero

Answer: B

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6. Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in Figure. Which of the following could be inside

the box ?

Box
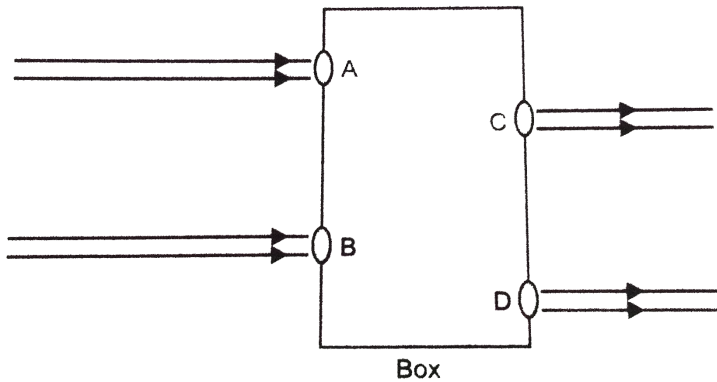
A. A rectangular glass slab

B. A convex lens

C. A concave lens

D. A prism

Answer: A

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7. A beam of light is incident through the holes on side A and emerges out of the holes on the other face of the box as shown in Figure. Which of the following could be inside the box ?
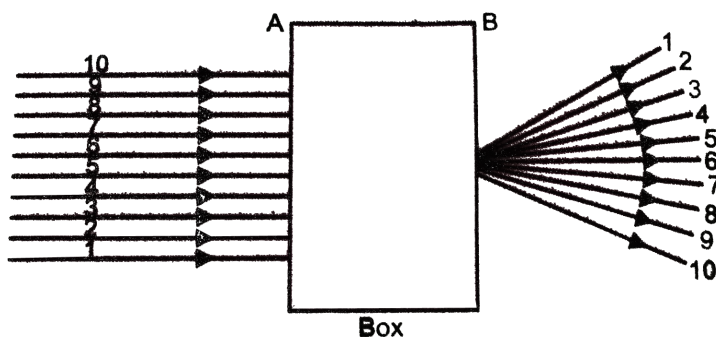
A. concave lens

B. Rectangular glass slab

C. Prism

D. Convex lens

Answer: D

8. Which of the following statements is true ?

A. A convex lens has 4 dioptre power

having a focal length $0.25m$

B. A convex lens has -4 dioptre power having a focal length $0.25m$

C. A concave lens has 4 dioptre power having a focal length $0.25m$

D. A concave lens has -4 dioptre power having a focal length of $0.25m$

Answer: A

9. Magnification produced by a rear view mirror fitted in vehicles

A. is less than one

B. is more than one

C. is equal to one

D. can be more than one depending upon the position of the object in front of it.

Answer: A

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10. Rays from Sun converge at a point $15cm$ in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object ?

A. $15cm$ in front of the mirror

B. $30cm$ in front of the mirror

C. between $15cm$ and $30cm$ in front of the mirror

D. more than $30cm$ in front of the mirror

Answer: B

11. A full length image of a distant tall building can definitely be seen by using

    A. a concave mirror

    B. a convex mirror

    C. a plane mirror

    D. both concave as well as plane mirror

Answer: B

12. In torches, search lights and headlights 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

Answer: B

13. The laws of reflection hold good for

A. plane mirror only

B. concave mirror only

C. convex mirror only

D. all mirrors irrespective of their shape

Answer: D

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14. The path of a ray light coming from air passing through a rectangular glass slab traced by four students are shown as A, B, C

and D in Figure. Which one of them is correct ?

A

B

C

D

A. A

B. B

C. C

D. D
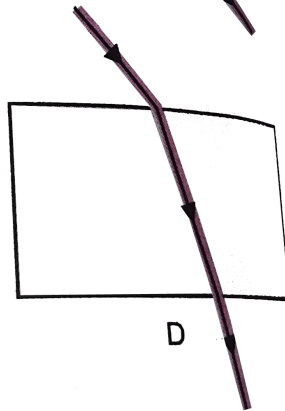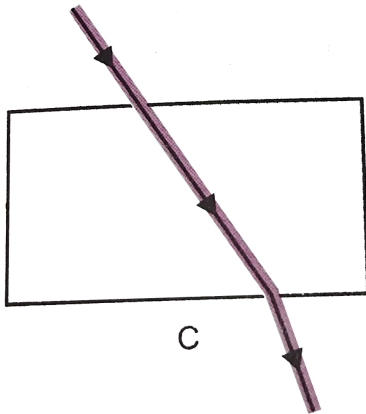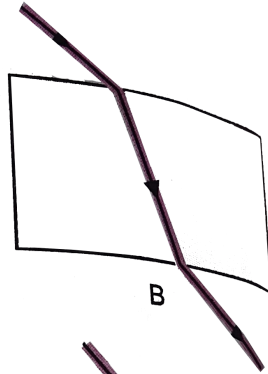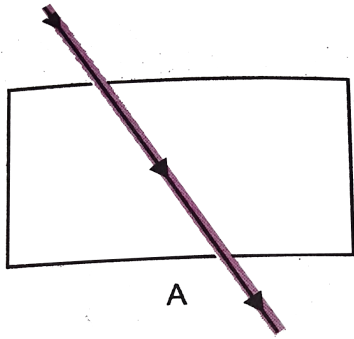
Answer: B

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15. You are given water, mustard oil, glycerine and kerosene. In which of these media a ray of light incident obliquely at same angle would bend the most ?

A. Kerosene

B. Water

C. Mustard oil

D. Glycerine

Answer: D

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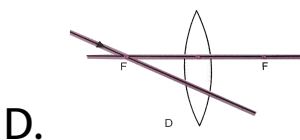**16.** Which of the following ray diagrams is correct for the ray of light incident on a
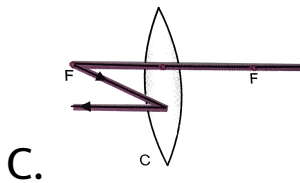
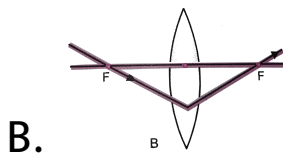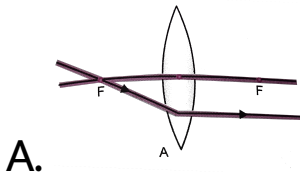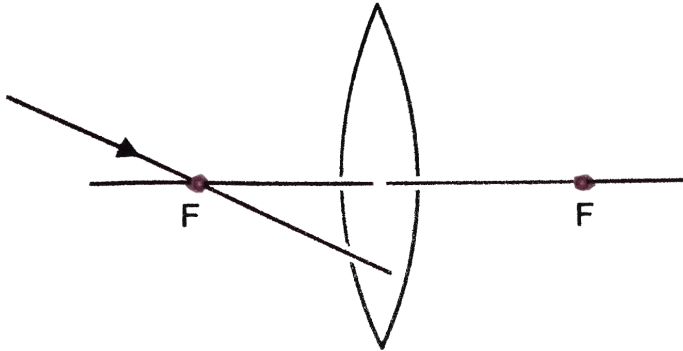concave mirror as shown in figure.

A.

B.

C.
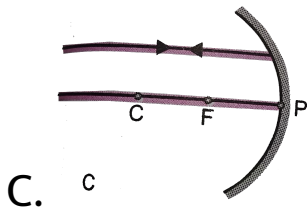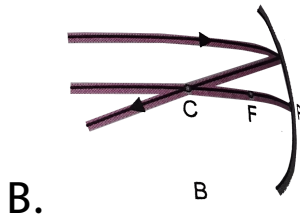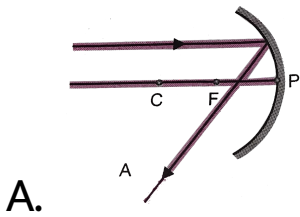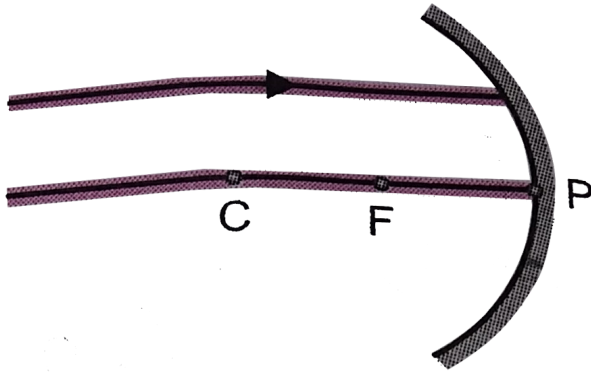
D.
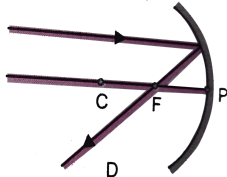
Answer: D

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17. Which of the following ray diagrams is correct for the ray of light incident on a lens

shown in Fig. ? Choices are given in Fig.

F   F

A.

B.

C.

D.

Answer: A

18. A child is standing in front of a magic of a 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. The following is the order of combinations for the magic mirror from the top.

A. Plane, convex and concave

B. Convex, concave and plane

C. Concave, plane and convex

D. Convex, plane and concave

Answer: C

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19. In which of the following, the image of an object placed at infinity will be highly diminished and point sized ?

A. Concave mirror only

B. Convex mirror only

C. Convex lens only

D. Concave mirror, convex mirror, concave

lens and convex lens

Answer: D

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