PHYSICS

BOOKS - U-LIKE PHYSICS (HINGLISH)

LIGHT - REFLECTION AND REFRACTION

Ncert Questions

1. Define the principal focus of a concave mirror.

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

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

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4. Why do we prefer a convexx mirror as a rear-view mirror in vehicles ?

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5. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

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

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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 ?

8. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass ? The speed of light in vacuum is $3 \times 10^8 ms^{-1}$.

9. Find out, the meidum 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 ?

12. Define 1 dioptre of power of a lens.

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

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

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

A. Water

B. Glass

C. Plastic

D. Clay

Answer: D

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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 principal focus and the centre of curvature.

B. At the centre of curvature.

C. Beyond the centre of curvature.

D. Between the pole of the mirror and its principal focus.

Answer: D

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3. Where should an object be placed in front of a convex lens to get a 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: B

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

A. Both concave

B. Both convex

C. The mirror is concave and the lens is 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 mirror, your image appears erect. The mirro 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. 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: C

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7. We wish to obtain an errect 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 is this case.

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8. 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.

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9. An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and the nature of the image formed.

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10. A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens ? Draw the ray diagram.

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

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12. The magnification produced by a plane mirror is +1. What does this mean ?

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13. 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 the image, its nature and size.

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

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

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

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Case Based Source Based Integrated Questions

1. A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens. This means that a lens is bound by at least one spherical surface. In such lenses, the other surface would be plane. A lens may have two pherical surfaces, bulging outwards. Such a lens is called a double convex lens. It is simply called a convex lens. It is thicker at the middle as compared to the edges. Convex lens converges

light rays as shown in Figure. Hence convex lenses are also called converging lenses. Similarly, a double concave lens is bounded by two spherical surfaces, curved inwards. It is thicker at the edges than at the middle. Such lenses diverge light rays as shown in Figure. Such lenses are also called diverging lenses. A double concave lens is simply called a concave lens.

What is a spherical lens ?

2. A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens. This means that a lens is bound by at least one spherical surface. In such lenses, the other surface would be plane. A lens may have two pherical surfaces, bulging outwards. Such a lens is called a double convex lens. It is simply called a convex lens. It is thicker at the middle as compared to the edges. Convex lens converges light rays as shown in Figure. Hence convex lenses are also called converging lenses. Similarly, a double concave lens is bounded by two

spherical surfaces, curved inwards. It is thicker at the edges than at the middle. Such lenses diverge light rays as shown in Figure. Such lenses are also called diverging lenses. A double concave lens is simply called a concave lens.

On which basic optical property does a lens work ?

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3. A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens. This means that a lens is bound by at least one spherical surface. In such lenses, the other surface would be plane. A lens may have two pherical surfaces, bulging outwards. Such a lens is called a double convex lens. It is simply called a convex lens. It is thicker at the middle as compared to the edges. Convex lens converges light rays as shown in Figure. Hence convex lenses are also called converging lenses. Similarly, a double concave lens is bounded by two spherical surfaces, curved inwards. It is thicker at the edges than at the middle. Such lenses diverge light rays as shown in Figure. Such lenses are

also called diverging lenses. A double concave lens is simply called a concave lens.

What is the name of the lens whose one surface is bulged outwards but the other surface is plane ?

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4. A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens. This means that a lens is bound by at least one spherical surface. In such lenses, the other surface would be plane. A lens may have two pherical surfaces, bulging outwards. Such a lens is called a double convex lens. It is simply called a convex lens. It is thicker at the middle as compared to the edges. Convex lens converges light rays as shown in Figure. Hence convex lenses are also called converging lenses. Similarly, a double concave lens is bounded by two spherical surfaces, curved inwards. It is thicker at the edges than at the middle. Such lenses diverge light rays as shown in Figure. Such lenses are also called diverging lenses. A double concave lens is simply called a

concave lens.

Distinguish between a converging and a diverging lens from their

(i) construction,

(ii) action point of view

5. Let us hold a concave mirror in our hand and direct its reflecting surface towards the sun. Direct the light reflected by the mirror on to a sheet of paper held close to the mirror. Move the sheet back and forth till we find a bright, sharp spot of light on the paper sheet. Hold on the mirror and the paper in the same position for some time. We observe that the paper at first begins to burn producing smoke and eventually it may even catch fire. This activity shows the converging action of concave mirror. The heat produced due to the concentration of sunlight ignites the paper.

On which physcial phenomena is action of a mirror based ? Define it.

6. Let us hold a concave mirror in our hand and direct its reflecting surface towards the sun. Direct the light reflected by the mirror on to a sheet of paper held close to the mirror. Move the sheet back and forth till we find a bright, sharp spot of light on the paper sheet. Hold on the mirror and the paper in the same position for some time. We observe that the paper at first begins to burn producing smoke and eventually it may even catch fire. This activity shows the converging action of concave mirror. The heat produced due to the concentration of sunlight ignites the paper.

Name the point where you observe bright sharp spot on the paper. Define it.

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7. Let us hold a concave mirror in our hand and direct its reflecting surface towards the sun. Direct the light reflected by the mirror on to a sheet of paper held close to the mirror. Move the sheet back and forth till

we find a bright, sharp spot of light on the paper sheet. Hold on the mirror and the paper in the same position for some time. We observe that the paper at first begins to burn producing smoke and eventually it may even catch fire. This activity shows the converging action of concave mirror. The heat produced due to the concentration of sunlight ignites the paper.

Draw a ray diagram to show converging action of a concave mirror.

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8. Let us hold a concave mirror in our hand and direct its reflecting surface towards the sun. Direct the light reflected by the mirror on to a sheet of paper held close to the mirror. Move the sheet back and forth till we find a bright, sharp spot of light on the paper sheet. Hold on the mirror and the paper in the same position for some time. We observe that the paper at first begins to burn producing smoke and eventually it may even catch fire. This activity shows the converging action of concave mirror. The heat produced due to the concentration of sunlight ignites the paper.

Can the same activity be performed by a convex mirror too ? Give reason of your answer.

9. Following table gives the numerical value of absolute refractive indices of several transparent media.

Transparent medium	Refractive Index	Transparent medium	Refractiv
Free space	1.000	Canada balsam	1.53
Air	1.0003	Rock salt	1.54
Ice	1.31	Carbon disulphide	1.63
Water	1.33	Dense flint glass	1.65
Alcohol	1.36	Ruby	1.71
Kerosene	1.44	Sapphire	1.77
Turpentine oil	1.47	Diamond	2.42
Crown glass	1.52		

Out of water and kerosene, which is optically denser and why ?

10. Following table gives the numerical value of absolute refractive indices of several transparent media.

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Alcohol	1.36	Ruby	1.71
Kerosene	1.44	Sapphire	1.77
Turpentine oil	1.47	Diamond	2.42
Crown glass	1.52		

Name the medium in which light travels with a smallest speed.

11. Following table gives the numerical value of absolute refractive indices

of several transparent media.

Transparent medium	Refractive Index	Transparent medium	Refractiv
Free space	1.000	Canada balsam	1.53
Air	1.0003	Rock salt	1.54
Ice	1.31	Carbon disulphide	1.63
Water	1.33	Dense flint glass	1.65
Alcohol	1.36	Ruby	1.71
Kerosene	1.44	Sapphire	1.77
Turpentine oil	1.47	Diamond	2.42
Crown glass	1.52		

Relative refractive index of Ruby with respect to alcohol is

A. 1.71

B. 1.36

C. $\dfrac{1.36}{1.71}$

D. $\dfrac{1.71}{1.36}$

Answer: D

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12. Following table gives the numerical value of absolute refractive indices

of several transparent media.

Transparent medium	Refractive Index	Transparent medium	Refractiv
Free space	1.000	Canada balsam	1.53
Air	1.0003	Rock salt	1.54
Ice	1.31	Carbon disulphide	1.63
Water	1.33	Dense flint glass	1.65
Alcohol	1.36	Ruby	1.71
Kerosene	1.44	Sapphire	1.77
Turpentine oil	1.47	Diamond	2.42
Crown glass	1.52		

If speed of light in free space is $3 \times 10^8 ms^{-1}$, then in a rock salt crystal

light travels with a speed :

A. $1.95 \times 10^8 ms^{-1}$

B. $4.62 \times 10^8 ms^{-1}$

C. $1.54 \times 10^8 ms^{-1}$

D. $3 \times 10^8 ms^{-1}$

Answer: A

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1. For a spherical mirror focal length 'f' and radius of curvature 'R' are correlated as :

A. f = R

B. f = 2R

C. $f = \dfrac{R}{2}$

D. $f = \dfrac{1}{R}$

Answer: C

2. When a ray of light travelling parallel to the principal axis of a concave mirror strikes at the polished surface of mirror, the reflected ray

    A. is sent back along the same direction

    B. passes through the principal focus of mirror

    C. passes through the centre of curvature of mirror

    D. passes through the pole of mirror

Answer: B

3. No matter how far or close you stand from a mirror, your image is always virtual and erect. The mirror is

A. convex mirror

B. plane mirror

C. concave mirror

D. either a convex or a plane mirror

Answer: D

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

A. When object is kept at centre of curvature of the mirror.

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

C. When object is placed at principal focus of the mirror

D. When object is placed between its focus point and centre of curvature

Answer: D

5. A linear object is placed at a distance equal to focal length of a convex mirrro. Its image is formed

    A. at infinite distance

    B. at the principal focus of mirror

    C. behind the mirror at a distance $\dfrac{f}{2}$

    D. in front of mirror at a distance $\dfrac{f}{2}$

Answer: C

6. As per the cartesian sign convention followed for mirrors and lenses

A. focal length of concave mirror and concave lens is negative

B. focal length of concave mirror and convex lens is negative

C. focal length of convex mirror and convex lens is negative

D. focal length of convex mirror and concave lens is negative

Answer: A

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7. In a convex mirror for any position of the object in front of mirror, the image formed is

A. situated between pole and principal focus of mirror

B. virtual and erect

C. diminished in size

D. all of these

Answer: D

8. An object is placed at a distance of 15 cm from a concave mirror and its real image is formed at 30 cm in front of that mirror. The focal length of the mirror is

A. $+20$ cm

B. -20 cm

C. -10 cm

D. $+10$ cm

Answer: C

9. A ray of light AM is incident on a concave mirror as shown below. Then which of the following ray diagrams is correct for the reflected ray ?

A. Fig. A

B. Fig. B

C. Fig. C

D. Fig.D

Answer: C

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10. 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. All types of mirrors and lenses

Answer: D

11. A concave mirror is used to form an image of the sun on a white screen. If the lower half of the mirror is covered with a black paper, the effect on the image formed on the screen would be

    A. to make the image less bright than before

    B. to make the lower half of the image disappear

    C. to prevent the image from being focussed

    D. to make the image smaller in size

Answer: A

12. 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 convex mirrors

Answer: B

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13. The angle of incidence of any light ray passing through the centre of curvature of a spherical mirror is

A. $0°$

B. $45°$

C. $90°$

D. $60°$

Answer: A

14. In case of a real and inverted image the magnification of a mirror is

    A. positive and large

    B. negative

    C. positive and small

    D. negative and large

Answer: B

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

    A. 30 cm in front of mirror

B. 15 cm in front of mirror

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

D. Less than 15 cm in front of mirror

Answer: A

16. A virtual, erect and magnified image of an object is to be produced with a concave mirror of focal length 12 cm. Object may be placed at a distance of

A. 10 cm from the mirror

B. 15 cm from the mirror

C. 24 cm from the mirror

D. 48 cm from the mirror

Answer: A

17. Figure shows path of a ray of light trvelling from a transparent medium A to another transparent medium B. Refractive index of medium B relative to medium A is

A. $\sqrt{2}$

B. $\dfrac{1}{\sqrt{2}}$

C. $\sqrt{\dfrac{3}{2}}$

D. $\sqrt{\dfrac{2}{3}}$

Answer: A

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

A. more than one

B. less than one

C. equal to one

D. zero

Answer: B

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19. Four students traced the path of a ray of light coming from air and passing through a rectangular glass slab as shown in the figure. Which of the plot is correct ?

A. Plot A

B. Plot B

C. Plot C

D. Plot D

Answer: C

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20. Refractive index of glass is $\dfrac{3}{2}$ and the refractive index of water is $\dfrac{4}{3}$.

Then the refractive index of glass with respect to water is

A. $\dfrac{3/2}{4/3}$

B. $\dfrac{3}{2} \times \dfrac{4}{3}$

C. $\dfrac{3}{2} + \dfrac{4}{3}$

D. $\dfrac{3}{2} - \dfrac{4}{3}$

Answer: A

21. A light ray passes through the focus point of a convex lens and is then incident on the lens. Which of the following figure depicts the correct path of light beam ?

A. Fig. A

B. Fig. B

C. Fig. C

D. Fig.D

Answer: A

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22. To form an erect image twice the size of an object by using a convex lens of focal length 20 cm, the object should be placed at a distance 'd' from the optical centre of lens. Here 'd' is

A. $d < 20$ cm

B. d = 20 cm

C. $d > 20$ cm

D. d = 40 cm

Answer: A

23. The power (P) of a lens of focal length (f) is given by

A. P = f

B. $P = \dfrac{1}{f}$

C. $P = -\dfrac{1}{f}$

D. $P = -f$

Answer: B

24. SI unit of power is

A. dioptre

B. decibel

C. metre

D. $[\text{metre}]^{-2}$

Answer: A

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25. Focal length of a convex lens is 25 cm. Its power is

A. $+4$ D

B. -4 D

C. -0.4 D

D. $+0.4$ D

26. A ray of light continues to move along the same path while passing through an air-glass interface. The angle of incidence for the light ray is

A. $90°$

B. $45°$

C. $0°$

D. $120°$

27. In adjoining figure an optical device is placed inside the box drawn. Light beam entering into the box and emerging out of box have also been shown. The box is

    A. a concave lens

    B. a glass slab

    C. a glass prism

    D. a convex lens

Answer: D

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28. An object is placed at a distance of 40 cm from a convex lens and its real and inverted image of same size is formed on a screen placed on other side of lens. The focal length of lens is

A. $+40$ cm

B. $+20$ cm

C. -20 cm

D. $+80$ cm

Answer: B

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29. Twp lenses of power +12 D and -2 D are placed in contact. The focal length of the combination is

A. $+10$ cm

B. $+12.5$ cm

C. $+16.6$ cm

D. $+8.3$ cm

Answer: A

30. The focal length of a convex lens is 18 cm and the size of the image is a quarter of the object. The object is situated at a distance of

    A. 90 cm

    B. 54 cm

    C. 22.5 cm

    D. 60 cm

Answer: A

31. The image of an object formed by an optical device is always virtural and small. The device may be

    A. A convex lens

B. a concave mirror

C. a glass plate

D. a concave lens

Answer: D

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32. We have a concave mirror of 10 cm focal length. Minimum distance between a real object and its real image formed by the mirror will be-

A. 10 cm

B. 20 cm

C. 40 cm

D. 0

Answer: D

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33. Which of the following can make a parallel beam of light when 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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34. A 10 mm long awl pin in placed vertically in front of a concave mirror. A 5 mm long image of the awl pin is formed at 30 cm in front of the mirror. The focal length of this mirror is

    A. -30 cm

B. -20 cm

C. -40 cm

D. -60 cm

Answer: B

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35. 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 or less than one depending upon the position of the object in front of it.

Answer: A

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36. Which of the following statement is true ?

A. A convex lens has 4 D power having a focal length + 0.25 m

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

C. A concave lens has 4 D power having a focal length + 0.25 m

D. A concave lens has -4 D power having a focal length + 0.25 m

Answer: A

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37. The focal length of a plane mirror is

A. 0

B. ∞

C. It does not have a focal length

D. None of the above

Answer: B

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38. A girl is standing in front of a magic mirrro. 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 order of combinations for the magic mirror from the top is

A. Convex, plane and concave

B. Plane, convex and concave

C. Concave, plane and convex

D. Convex, concave and plane

Answer: C

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39. A convex lens of power +4 D is brought in contact with a concave lens of power -2 D. The power of the lens combination is

    A. $+6$ D

    B. $+2$ D

    C. -2 D

    D. -6 D

Answer: B

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True Or False

1. As per new Cartesian sign convention, the focal length of a concave mirror as well as a concave lens is taken to be negative.

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2. A concave mirror forms a virtual, erect and enlarged image when an object is placed between principal focus and centre of curvature of the mirror.

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3. When a light ray passes obliquelly from an optically denser medium to an optically rarer medium, the ray bends away from the normal drawn on the refracting surface at the point of incidence.

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4. An optically denser medium is that in which speed of light is more than that in air or vaccum.

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5. According to lens formual we have $\dfrac{1}{v} + \dfrac{1}{u} = \dfrac{1}{f}$, where u = distance of the object from the lens, v = distance of the image from the lens and f = focal length of given lens.

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6. Power of a convex lens A of focal length 20 cm is more than that of a lens B of focal length 10 cm.

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7. A convex lens behaves as a converging lens but a concave lens behaves as a diverging lens.

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8. An object is situated at a distance of 10 cm from the optical centre of a convex lens of focal length 20 cm. The image formed on the screen is found to be an erect and enlarged image.

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9. For refraction of light through a glass slab the angle of emergence is equal to the angle of incidence.

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Fill In The Blanks

1. A light incident on a plane mirror subtends an angle of $60°$ from the surface of mirror. The angle of reflection is _____.

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2. The focal length of a concave mirror is 16 cm. Its radius of curvature is _____.

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3. Two times magnified image is formed by a concave mirror when an object is placed 30 cm in front of the mirror. The distance of image from the mirror is _____.

▶ View Text Solution

4. As per new Cartesian coordinate system for spherical mirrors the focal length of a concave mirror is assigned a _____ sign and that of a convex mirror is assigned a _____ sign.

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5. Speed of light in a glass sample is $2.0 \times 10^8 ms^{-1}$. Its refractive index is _____.

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6. Principal focus of a _____ mirror is a real point but for a _____ mirror it is a virtual point.

> ▶ View Text Solution

7. Speed of light in diamond is _____ because its refractive index is _____ in nature.

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8. Refractive index of glass with respect to water is $\dfrac{9}{8}$. The refractive index of water with resptect to glass is _____.

9. Absolute refractive index of a transparent cannot be less than

_____.

10. Value of speed of light in vacuum is _____ ms^{-1}

11. Real image of an object, formed by a mirror or a lens, is always an

_____ image.

12. Focal length of a lens is + 20 cm. Its power is _____.

13. Image of a real object placed in front of a lens is always virtual, erect and diminished one. The lens is a _____ lens.

14. _____ of a lens is a point situated on its principal axis, a ray of light passing through which goes straight without any deviation.

15. Magnification of a lens $m = \dfrac{h'}{h}$ _____.

Assertion Reason Questions

1. Assertion (A) : A ray of light passing through the centre of curvature of a spherical mirror retraces its path after reflection from the mirror.

Reason (R) : A ray of light passing through the centre of curvature of a spherical mirror is incident normally on the surface of the mirror.

    A. Both (A) and (R) are true and (R) is correct explanation of the assertion.

    B. Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

    C. (A) is true but (R) is false.

    D. (A) is false but (R) is true.

Answer: A

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2. Assertion (A) : Glass is optically denser than water.

Reason (R) : An optically denser medium is that in which speed of light is

comparatively less.

A. Both (A) and (R) are true and (R) is correct explanation of the

assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of

the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: A

▶ **View Text Solution**

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3. Assertion (A) : Magnification of a real image is negative but

magnification of a virtual image is positive.

Reason (R) : Real image is an inverted image but virtual image is an erect

image.

A. Both (A) and (R) are true and (R) is correct explanation of the

assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of

the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: A

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4. Assertion (A) : A convex lens forms a virtual, erect and enlarged image

of an object situated between the lens and its principal focus.

Reason (R) : A convex lens is a diverging lens.

A. Both (A) and (R) are true and (R) is correct explanation of the

assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of

the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: C

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5. Assertion (A) : SI unit of refractive index is m s^{-1}

Reason (R) : Glass is said to be optically denser thn kerosene because

optical density of glass is greater than that of kerosene.

A. Both (A) and (R) are true and (R) is correct explanation of the

assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of

the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: D

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6. Assertion (A) : A convex lens is called a convergent lens but a concave lens acts as a divergent lens.

Reason (R) : A convergent lens is that which always forms a real image of a real object and a divergent lens is that which can never form a real image.

A. Both (A) and (R) are true and (R) is correct explanation of the assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: C

7. Assertion (A) : Speed of light in water is $2.25 \times 10^8 ms^{-1}$

Reason (R) : The refractive index of water is 4/3.

   A. Both (A) and (R) are true and (R) is correct explanation of the assertion.

   B. Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

   C. (A) is true but (R) is false.

   D. (A) is false but (R) is true.

Answer: A

8. Assertion (A) : Distance of real image formed by a mirror is taken to be negative but for a lens we take it with positive sign.

Reason (R) : A mirror forms real image of an object in front of it but real image formed by a lens lies on other side of lens.

A. Both (A) and (R) are true and (R) is correct explanation of the assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: A

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9. Assertion (A) : Large sized concave mirrors are used to concentrate thermal radiation in solar furnaces.

Reason (R) : A convex mirror is fitted in automobiles so as to increase the field of view of the vehicle driver.

A. Both (A) and (R) are true and (R) is correct explanation of the assertion.

B. Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

C. (A) is true but (R) is false.

D. (A) is false but (R) is true.

Answer: B

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Very Short Answer Questions

1. Why do we see our image in a shining spoon ?

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2. Define real image of an object.

3. What do you mean by pole of a spherical mirror ?

4. What is the centre of curvature of a spherical mirror ?

5. Define principal axis of a spherical mirror.

6. A ray of light moving along the principal axis is falling on a concave mirror. In which direction is it reflected ?

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7. At what position the object be placed in front of a concave mirror to form a real image of the same size ?

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8. Complete the path of ray of light after reflection at the mirror in the given diagram Figure.

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9. Copy the figure in your answer book and show the direction of the light ray after reflection.

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10. 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 ?

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11. A ray of light is incident on a convex mirror as shown in Figure. Redraw the diagram after completing the path of the light ray after reflection from the mirror.

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12. What do you mean by principal focus of a concave mirror ?

13. Draw ray diagram to shown the principal focus of a (i) concave mirror, (ii) convex mirror.

14. What is the SI unit of refractive index ?

15. Give a formula to find refractive index of a glass slab in terms of angle of incidence and angle of refraction.

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

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17. Define refractive index of a medium.

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18. Refractive index of water with respect to air is 1.33. What is the refractive index of air with respect to water ?

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19. A ray of light strikes the glass slab at an angle of $90°$ from its surface. What is the angle of incidence and the angle of refraction ?

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20. Complete the following diagram

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21. Why does a ray of light bend from its path when it travels from one medium to another ?

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22. What happens to a ray of light when it travels from one medium to another having equal refractive index ?

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23. If a light ray IM is incident on the surface AB as shown, identify the correct emergent ray.

27. What is lateral displacement of a light ray passing through a glass slab ?

28. What are the two factors on which the lateral displacement of an emergent ray from a glass slab depends ?

29. For the same angle of incidence of $45°$, the refraction angle in three transparent media A, B and C are $25°$, $30°$ and $35°$, respectively. In which medium is the speed of light minimum and in which mediym maximum ?

30. Define optical centre of a spherical lens.

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31. Define a lens.

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32. When a convex lens is focussed on a distant object, where will the image be formed ?

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33. Define power of a lens and write its SI unit.

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34. Write the relationship between the SI unit of the power of a lens and SI unit of focal length.

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35. Redraw the given diagram and show the path of the refracted ray.

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36. An image of the same size of an object is formed in a convex lens. Where is the object situated and where is the image formed ?

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37. Name the type of lens used to obtain (i) an erect, enlarged and virtual image of an object, (ii) an erect, diminished and virtual image of an

object.

38. Redraw the given diagram and show the path of the refracted ray.

39. State the condition under which a light ray passes undeviated through a lens.

40. Redraw the given diagram and show the path of the refracted ray.

41. Name the lens which can be used as a magnifying glass.

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42. Which type of lens has a negative power ?

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43. Two thin lenses of power P_1 and P_2 are placed in contact. What is the power of the combination ?

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44. What is the difference between virtual image of an object formed by a convex lens and that formed by a concave lens ?

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45. During its passage from one medium to another, where does a light ray change its path ?

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46. The refractive index of glass is 1.5. What is meant by this statement ?

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47. Refractive index of glass, kerosene and water are 1.5, 1.44 and 1.33 respectively. Arrange them in ascending order of their optical density.

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48. The power of a lens is +5 D. Find its focal length in metres.

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49. What do you mean by -ve and +ve sign of magnification ?

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Short Answer Questions

1. State laws of reflection of light. List four characteristics of the image formed by a plane mirror.

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2. Define a spherical mirror. State its two types and distinguish between them.

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3. Define the following terms in the context of spherical mirrors :

Pole, centre of curvature, principal axis, and principal focus.

4. Draw the following diagram in which a ray of light is incident on a concave/convex mirror, on your answer sheet. Show the path of this ray, after reflection, in each case.

5. (a) How can you identify the three types of mirrors without touching them ?

(b) What do you mean by focal length of a spherical mirror ?

6. 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.

7. State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.

8. 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 situatioon also to justify your answer.

9. Draw ray diagrams to show the formation of images when the object is placed in front of a concave mirror :

(i) between its pole and focus point,

(ii) between its centre of curvature and focus point.

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10. 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.

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11. If the image formed by a 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 ray diagram to justify your answer. Where and why do we generally use this type of mirror ?

12. State the nature, position and relative size of the image formed by a convex mirror when object is (i) at infinity and (ii) between infinity and pole of the mirror. Draw ray diagrams too.

13. 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 use ?

(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.

14. What is mirror formula ? Under what conditions is it valid ? Obtain an expression for magnification of an image formed by a concave mirror.

15. 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.

16. A convex mirror used for rear view on an automobile has radius of curvature of 3.00 m. If a bus is located at 5.0 m from the mirror, find the position, nature and size of the image.

17. An object 2.0 cm high is placed 20.0 cm in front of a concave mirror of focal length 10.0 cm. Find the distance from the mirror at which a screen should be placed in order to obtain a sharp image. What will be the size and nature of the image formed ?

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18. An object 4.0 cm in size, is placed 25.0 cm in front of a concave mirror of focal length 15.0 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image ? Find the nature and the size of the image.

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19. 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.

20. State the laws of refraction of light.

Explain the term absolute refractive index of a meidum and write an expression to relate it with the speed of light in vaccum.

21. (a) What do you mean by refractive index of one transparent medium with respect to another ? How is it related to absolute refractive indices of two media ?

(b) Can absolute refractive index of a medium be less than one ? Given reason.

22. Draw a ray diagram to show refraction through a rectangular glass slab. How is the emergent ray related to incident ray ? What is its lateral displacement ?

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23. What is the principle of eversibility 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.

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24. (i) The refractive index of diamond is 2.42. What is the meaning of this statement ?

(ii) Name a liquid whose mass density is less than of water but it is optically denser than water.

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25. (a) Define absolute refractive index of a medium.

(b) Light enters from air into water which has a refractive index of 1.33 $\left(\text{or} \ \dfrac{4}{3} \right)$. Calculate the speed of light in water. The speed of light in air is $3.0 \times 10^8 m/s$.

26. (a) What do you mean by refractive index of one medium with respect to another ?

(b) The absolute refractive refractive indices of benzene and kerosene are 1.50 and 1.44 respectively. What is the refractive index of benzene with respect to kerosene ?

27. (a) Define optical centre of a lens. What happens when a ray of light passes through the optical centre of lens ?

(b) Define principal focus and focal length of a lens. Draw ray diagram to show the position of principal focus of a lens.

28. Show the path of a refracted ray formed on refraction through a spherical lens, when (i) incident ray is parallel to the principal axis of lens, (ii) incident ray passes through principal focus (or is directed towards the principal focus) of lens. Draw ray diagrams too.

29. (a) State the new Cartesian sign convention for lenses.

(b) Define magnfication produced by a lens. How is it related to the object and image distance ?

30. (a) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.

(b) In the above ray diagram mark the object-distance (u) and the image-distance (v) with their proper signs (+ve or -ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the convex lens in this case.

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31. A 2.0 cm 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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32. 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.

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33. 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 (i) position, (ii) nature, and (iii) size of the image formed.

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34. 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.

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35. 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.

36. Find the power of a convex lens which forms a real, and inverted image of magnification -1 of an object placed at a distance of 20 cm from its optical centre.

37. (a) Draw a ray diagram to show the formation of image of an object placed between infinity and optical centre of a concave lens.

(b) A concave lens of focal length 15 cm forms an image 10 cm from the

lens. Calculate (i) the object distance, (ii) the nature and magnification of the image formed.

38. An object placed on a metre scale at 8 cm mark was focussed on a white screen placed at 92 cm mark, using a converging lens placed on the scale at 50 cm mark.

(i) Find the focal length of the converging lens.

(ii) Find the position of the image formed if the object is shifted towards the lens at a position of 29 cm.

(iii) State the nature of the image formed if the object is further shifted towards the lens.

39. 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.

Draw a ray diagram to show the formation of image in above situation.

40. A real image, $\frac{2}{3}$ rd 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.

41. Two lenses of power +3.5 D and -1.5 D are placed in contact. What is the power and focal length of the combination ? If an object be placed at a distance of 0.8 m from the lens combination, where is the image formed ?

42. (a) 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.

(b) You are provided with two convex lenses of focal length 15 cm and 25 cm respectively. Which of the two is of larger power ? Give reason for your answer.

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Long Answer Questions

1. 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.

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2. 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.

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3. Draw neat diagrams to show changes in images formed by a concave mirror, as an object is brought closer to it from infinity to just near its pole. Write the nature and size of the image in each case.

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4. Draw the ray diagram in each of the following cases to show the position and nature of the image formed when the object is placed :

(a) at the centre of curvature of a concave mirror.

(b) between the pole P and focus F of a concave mirror.

(c) between the pole P and infinity of a convex mirror.

(d) at 2F of a convex lens.

(e) at infinity in front of concave lens.

5. 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 relate 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 $2 \times 10^8 ms^{-1}$, find the speed of light in (i) vacuum, (ii) water.

6. (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 vaccum.

(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 $2 \times 10^8 ms^{-1}$, calculate

the speed of light in (i) vaccum (ii) medium 'A'.

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7. (a) Define the term absolute refractive index. The absolute refractive

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

(b) Refractive indices of media A, B, C and D are given below :

Media	A	B	C	D
Refractive Index	1.33	1.44	1.52	1.65

In which of these four media is the speed of light (i) minimum and (ii)

maximum ? Find the refractive index of medium C with respect to medium

B.

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8. 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 a ray diagram to justify your answer of part (ii).

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9. Can you obtain the nature, position and relative size of images formed by a lens by drawing the ray diagrams ? If yes, draw neat ray diagrams to find different types of images formed by a convex lens.

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10. A student want to project the image of a candle flame on the walls of school laboratory by using a lens :

(a) Which type of lens should he use and why ?

(b) At what distance in terms of focal length 'f' of the lens should he place the candle flame so as to get (i) a magnified, and (ii) a diminished image respectively on the wall ? Draw ray diagram to show the formation of the image in each case.

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11. (a) "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it." Draw ray diagram to justify this statement statiny the position of the object with respect to the lens in each case.

(b) 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.

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12. (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 $\frac{1}{3}$ rd of its size. Find the distance of the object from the lens.

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

(b) State and define the SI 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.

14. 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	-100	$+25$
2	-60	$+30$
3	-40	$+40$
4	-30	$+60$
5	-25	$+100$
6	-15	$+120$

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

(b) Write the seril 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.

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