5. Refraction of Light

Very Short Answer Type Questions-Pg-219

1. Question

If a ray of light goes from a rarer medium to a denser medium, will it bend towards the normal or away from it?

Answer

If a ray of light goes from a rarer medium to a denser medium, It will bend towards the normal.

2. Question

If a ray of light goes from a denser medium to a rarer medium, will it bend towards the normal or away from the normal ?

Answer

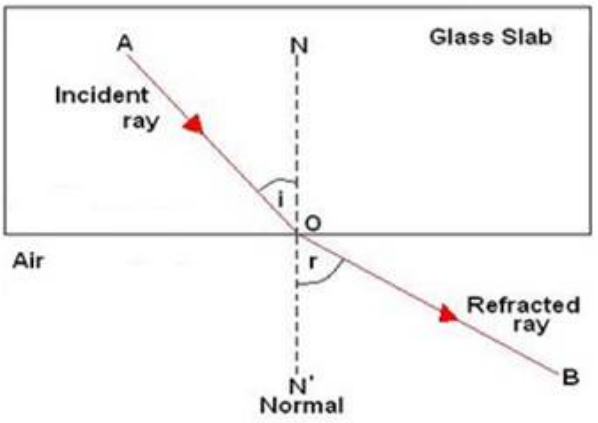
If a ray of light goes from a denser medium to a rarer medium, It will bend away from the normal.

3. Question

A beam of light travelling in a rectangular glass slab emerges into air. Draw a ray-diagram indicating the change in its path.

Answer

A beam of light travelling in a rectangular glass slab emerges into air. The ray diagram indicating its path is as shown.

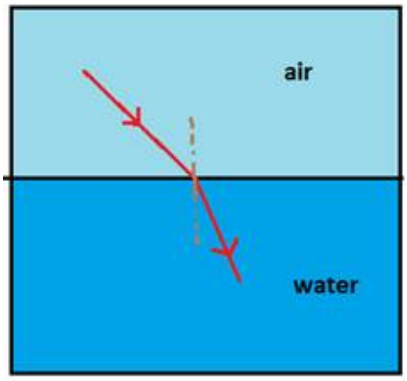


4. Question

A beam of light travelling in air is incident on water. Draw a ray-diagram indicating the change in its path in water.

Answer

A beam of light travelling in air is incident on water. the ray-diagram indicating the change in its path in water is

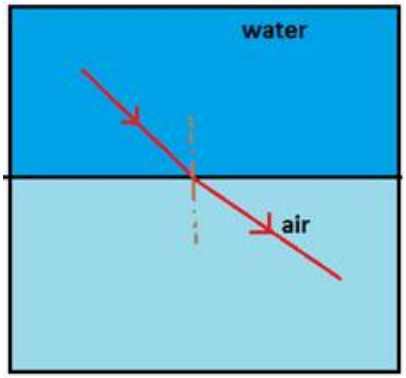


5. Question

A ray of light travelling in water emerges into air. Draw a ray-diagram indicating the change in its path.

Answer

A ray of light travelling in water emerges into air. The ray-diagram indicating the change in its path is

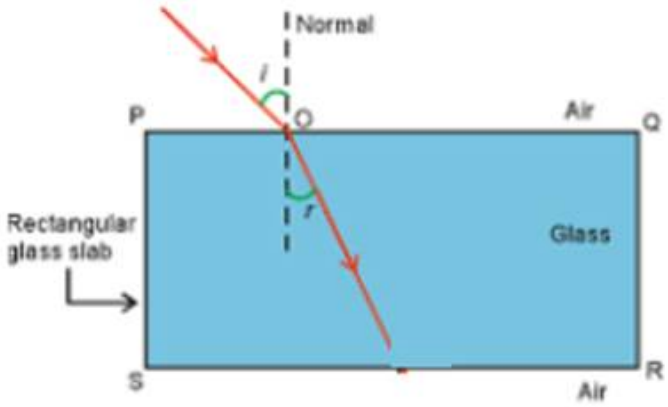


6. Question

A ray of light travelling in air is incident on a parallel-sided glass slab (or rectangular glass slab). Draw a ray-diagram indicating the change in its path in glass.

Answer

A ray of light travelling in air is incident on a parallel-sided glass slab (or rectangular glass slab). The ray-diagram indicating the change in its path in glass is



7. Question

A ray of light travelling in glass emerges into air. State whether it will bend towards the normal or away from the normal.

Answer

A ray of light travelling in glass emerges into air. The ray of light will bend away from the normal.

8. Question

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

Answer

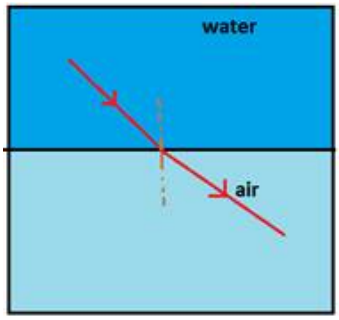
The ray of light bends towards the normal. This is because water is an optically denser medium than air.

9. Question

A ray of light goes from water into air. Will it bend towards the normal or away from the normal?

Answer

A ray of light goes from water into air. It will bend away from the normal.



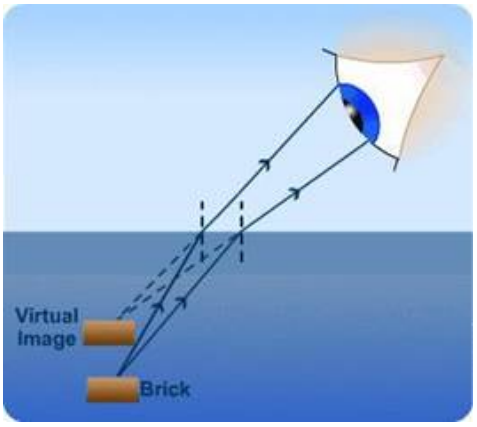
10. Question

State two effects caused by the refraction of light.

Answer

Two effects caused by refraction of light are:

1) A swimming pool always looks shallower than it really is, because the light coming from the bottom of the pool bends when it comes out at the surface due to refraction of light.



2) A straight stick which is immersed partly in water always looks to be bent at the surface of water, because the light coming from the stick bends when it comes out at the surface due to refraction of light.

11. Question

Name the phenomenon due to which a swimming pool appears less deep than it really is.

Answer

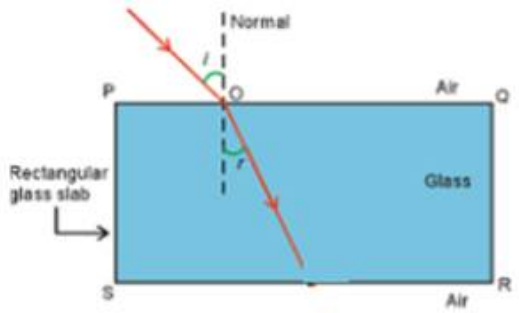
The phenomenon due to which a swimming pool appears less deep than it really is due to refraction of light.

12. Question

When a ray of light passes from air into glass, is the angle of refraction greater than or less than the angle of incidence?

Answer

When a ray of light passes from air into glass Angle of refraction is less than the angle of incidence

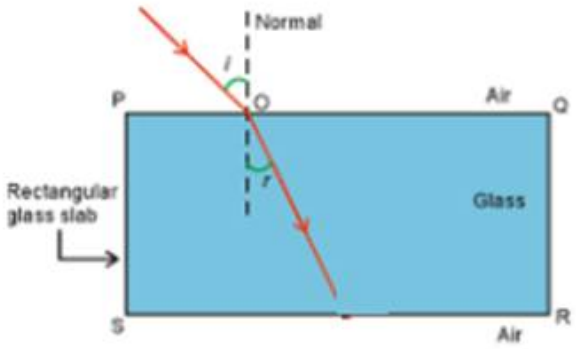


13. Question

A ray of light passes from air into a block of glass. Does it bend towards the normal or away from it?

Answer

A ray of light travelling from air to glass block, will bend towards the normal.

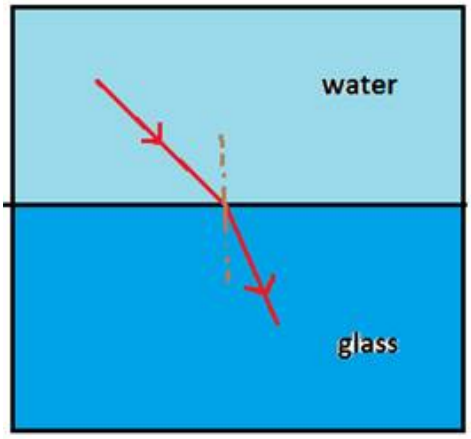


14. Question

As light rays pass from water into glass, are they refracted towards the normal or away from the normal?

Answer

A ray of light travelling from water into glass will bend towards the normal.



15. Question

In which material do you think light rays travel faster-glass or air?

Answer

air

16. Question

Which phenomenon of light makes the water to appear shallower than it really is?

Answer

Refraction of light makes the water to appear shallower than it really is.

17. Question

State whether the following statement is true or false: Refraction occurs because light speeds up in denser materials.

Answer

False.

18. Question

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

Answer

Due to the change in the speed of light.

19. Question

Fill in the following blanks with suitable words:

(a) Light travelling along a ___ is not refracted.

(b) Light bends when it passes from water into air. We say that it is ____

Answer

(a) normal

(b) refracted

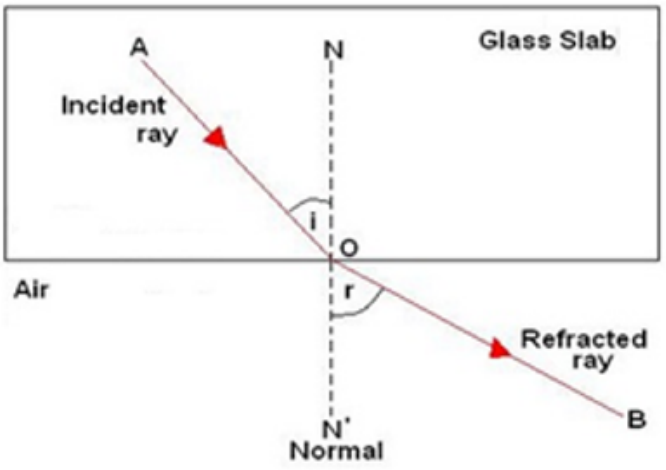
Short Answer Type Questions-Pg-220

20. Question

What is meant by 'refraction of light'? Draw a labeled ray diagram to show the refraction of light.

Answer

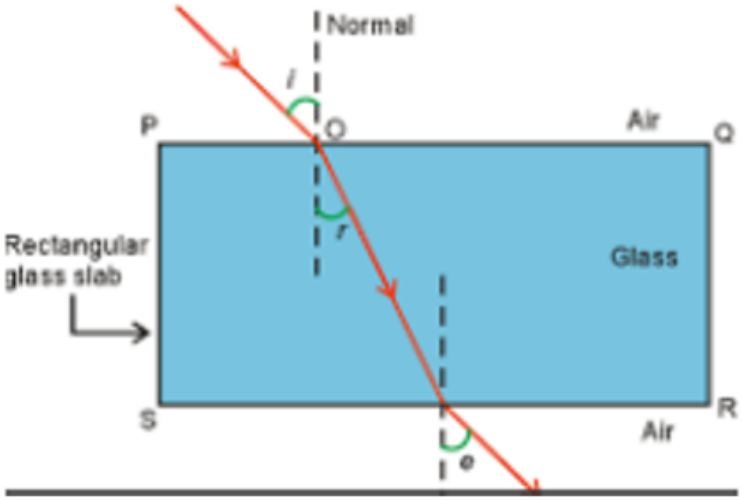
Refraction of light is the change in the direction of light when it passes from one medium to another.



21. Question

A ray of light travelling in air is incident on a rectangular glass block and emerges out into the air from the opposite face. Draw a labeled ray diagram to show the complete path of this ray of light. Mark the two points where the refraction of light takes place. What can you say about the final direction of ray of light?

Answer



A ray of light travelling in air is incident on a rectangular glass block and emerges out into the air from the opposite face. We can say about the final direction of the ray of light is that it is same as the incident direction.

22. Question

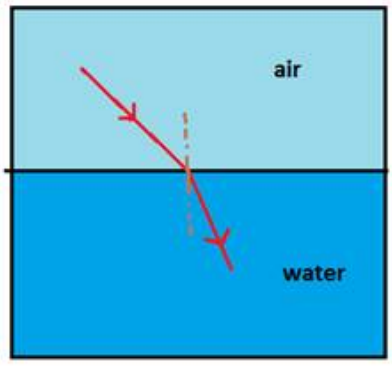
Draw a labeled ray diagram to show how a ray of light is refracted when it passes:

(a) From air into an optically denser medium.

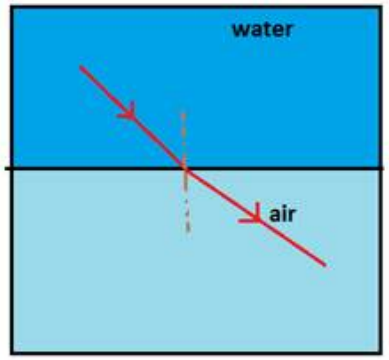
(b) From an optically denser medium into air.

Answer

(a) Ray of light travelling from air into an optically denser medium (water)



(b) Ray of light travelling from an optically denser medium(water) into air.



23. Question

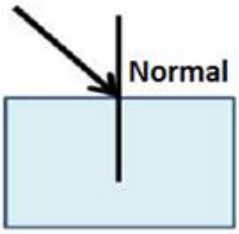
The diagram given alongside shows a ray of light entering a rectangular block of glass.

(a) Copy the diagram and draw the normal at the point of entry.

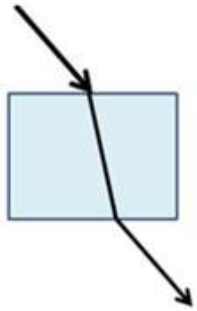
(b) Draw the approximate path of the ray of light through the glass block and out of the other side.

Answer

(a) a ray of light entering a rectangular block of glass will have normal as seen



(b) approximate path of the ray of light through the glass block and out of the other side is



24. Question

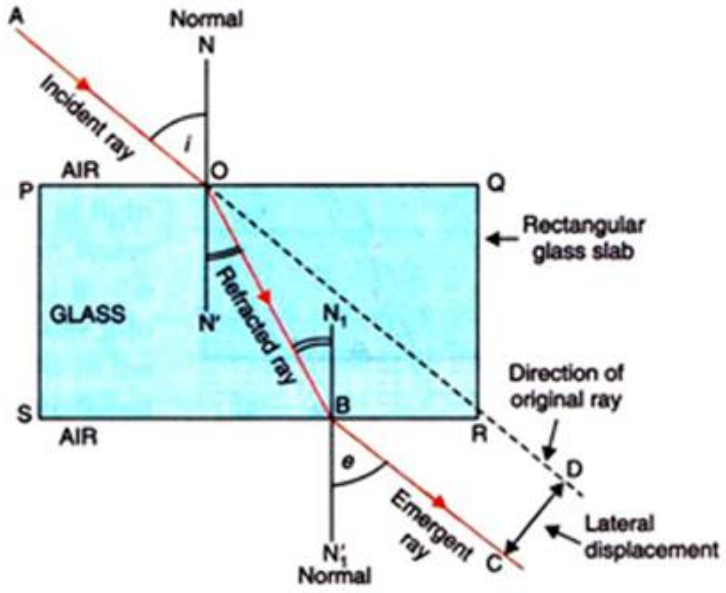
What is meant by the 'angle of incidence' and the 'angle of refraction' for a ray of light? Draw a labeled ray diagram to show the angle of incidence and the angle of refraction for a refracted ray of light.

Answer

Angle of incidence is the angle between the incident ray and normal at the point of incidence.

angle of refraction is the angle between the refracted ray and normal at the point of refraction.

a labeled ray diagram to show the angle of incidence and the angle of refraction for a refracted ray of light is



25. Question

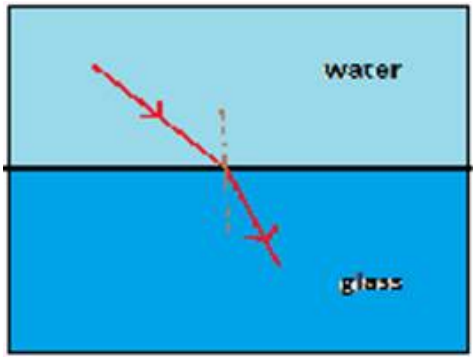
Light travels more quickly through water than through glass.

(a) Which is optically denser: water or glass?

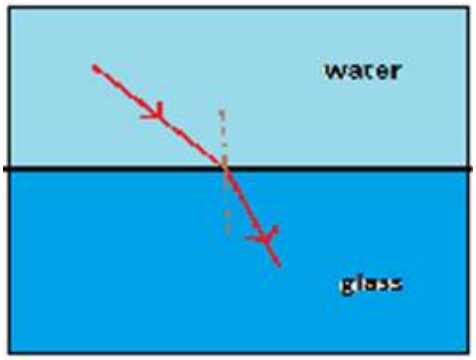
(b) If a ray of light passes from glass into water, which way will it bend: towards the normal or away from the normal?

Answer

(a) Light travels more quickly through water than through glass as Glass is optically denser than the water.



(b) If a ray of light passes from glass into water then the ray will bend away from the normal.



26. Question

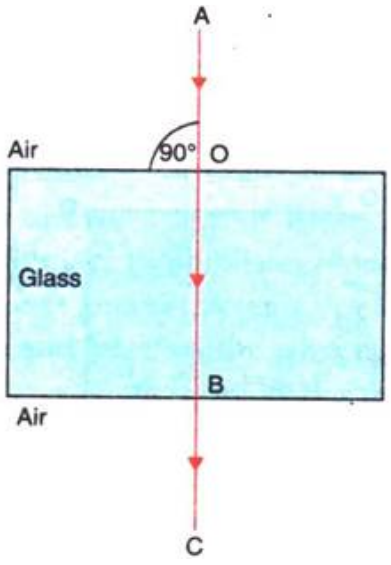
Draw a labeled ray diagram to show how a ray of light passes through a parallel sided glass block

(a) If it hits the glass block at 90° (that is, perpendicular to the glass block)

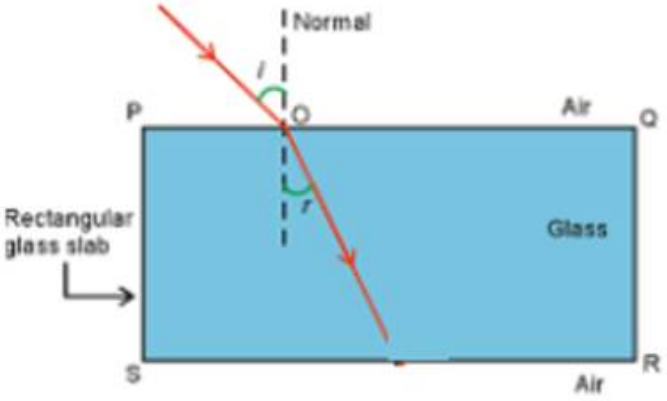
(b) If it hits the glass block at an angle other than 90° (that is, obliquely to the glass block).

Answer

(a) a labeled ray diagram of a ray of light that passes through a parallel sided glass block, if it hits the glass block at 90°



(b)a labeled ray diagram of a ray of light that passes through a parallel sided glass block, if ray of light hits the block other than the 90^{o}

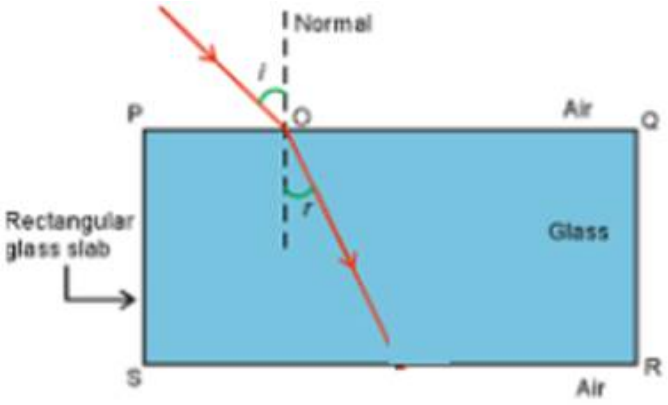


27. Question

When a light ray passes from air into glass, what happens to its speed? Draw a diagram to show which way the ray of light bends.

Answer

When a light ray passes from air into glass, the speed of the ray decreases.



The ray of light bends towards the normal.

Long Answer Type Questions-Pg-220

28 A. Question

Explain why, a stick half immersed in water appears to be bent at the surface. Draw a labeled diagram to illustrate your answer.

Answer

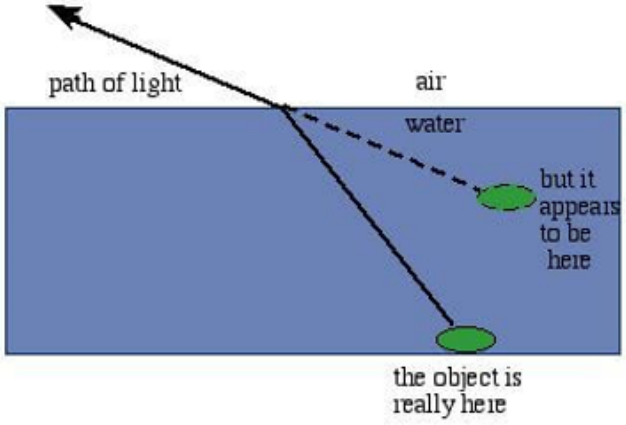
A straight stick which is immersed partly in water always looks to be bent at the surface of water, because the light coming from the stick bends when it comes out at the surface due to refraction of light.

28 B. Question

A coin in a glass tumbler appears to rise as the glass tumbler is slowly filled with water. Name the phenomenon responsible for this effect.

Answer

A coin or stone lying at the bottom of a container filled with water appears to be raised because of refraction of light.



29 A. Question

With the help of a labeled diagram, explain why a tank full of water appears less deep than it actually is.

Answer

If we look into a tank of water, it appears to be less deep than it really is because the refraction of light causes us to see a virtual image of the bottom of the pool coming from the water into the air.

29 B. Question

Name the phenomenon due to which a pencil partly immersed in water and held obliquely appears to be bent at the water surface.

Answer

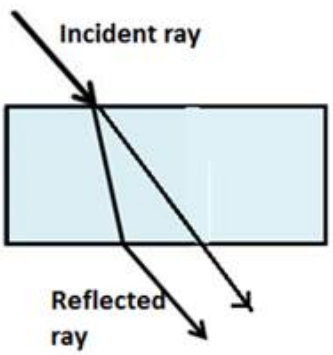
the phenomenon due to which a pencil partly immersed in water and held obliquely appears to be bent at the water surface is Refraction of light

30 A. Question

With the help of a diagram, show how when light falls obliquely on the side of a rectangular glass slab, the emergent ray is parallel to the incident ray.

Answer

when light falls obliquely on the side of a rectangular glass slab, the emergent ray is parallel to the incident ray.

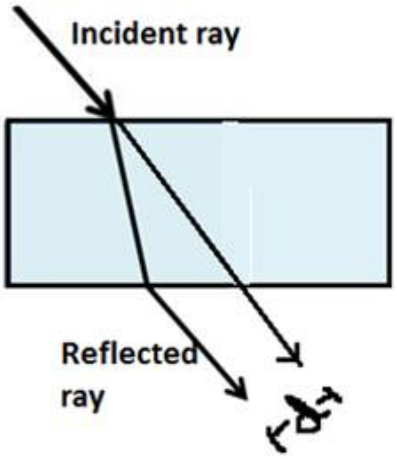


30 B. Question

Show the lateral displacement of the ray on the diagram.

Answer

The lateral displacement is shown by ‘d’.



30 C. Question

State two factors on which the lateral displacement of the emergent ray depends.

Answer

Factors on which the lateral displacement depends are:

(i) Angle of incidence

(ii) Thickness of glass slab

(iii) Refractive index of glass slab

31. Question

Explain with the help of a labeled ray diagram, why a pencil partly immersed in water appears to be bent at the water surface. State whether the bending of pencil will increase or decrease if water is replaced by another liquid which is optically more dense than water. Give reason for your answer.

Answer

the labeled ray diagram of a pencil partly immersed in water appears to be bent at the water surface.

The bending of pencil will increase decrease if water is replaced by another liquid which is optically more dense than water. The optically denser medium will cause more refraction (or more bending) of light rays

Multiple Choice Questions (MCQs)-Pg-221

32. Question

Light travelling from a denser medium to a rarer medium along a normal to the boundary:

A. Is refracted towards the normal

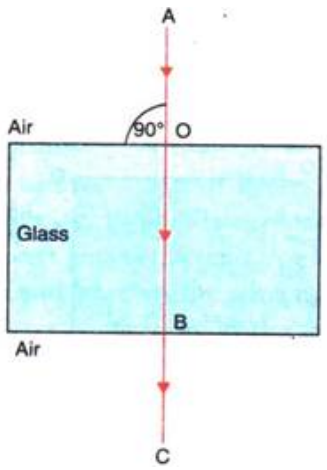
B. Is refracted away from the normal

C. Goes along the boundary

D. Is not refracted

Answer

Light travelling from a denser medium to a rarer medium along a normal to the boundary Is not refracted.



33. Question

A ray of light passes from glass into air. The angle of refraction will be:

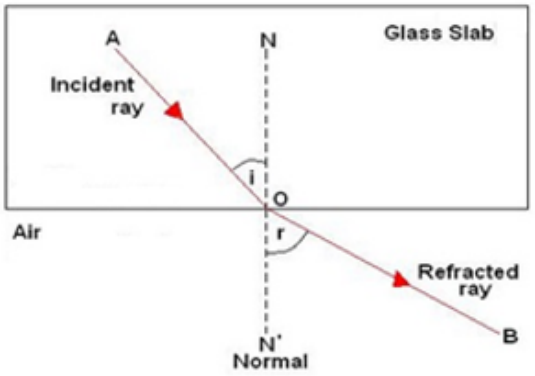
A. Equal to the angle of incidence

B. greater than the angle of incidence

C. Smaller than the angle of incidence

D. 45°

Answer



34. Question

A ray of light travelling in air goes into water. The angle of refraction will be:

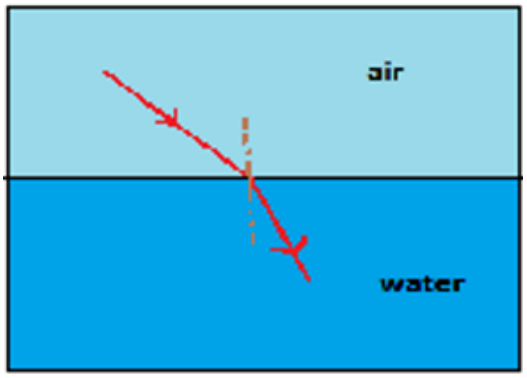
A. 90°

B. Smaller than the angle of incidence

C. Equal to the angle of incidence

D. Greater than the angle of incidence

Answer



35. Question

The speed of light in air is:

A. 3×10^8 cm/s

B. 3×10^8 km/s

C. 3×10^8 mm/s

D. 3×10^8 m/s

Answer

The speed of light in air is 3×10^8 m/s.

36. Question

When a ray of light travelling in glass enters into water obliquely:

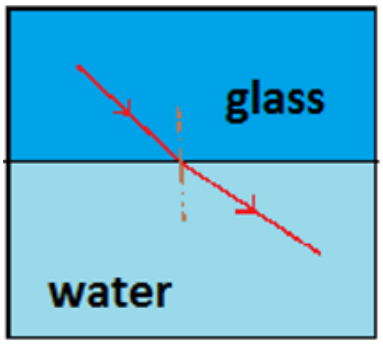
A. It is refracted towards the normal

B. It is not refracted at all

C. It goes along the normal

D. It is refracted away from the normal

Answer



37. Question

A ray of light travelling in water falls at right angles to the boundary of a parallel-sided glass block. The ray of light:

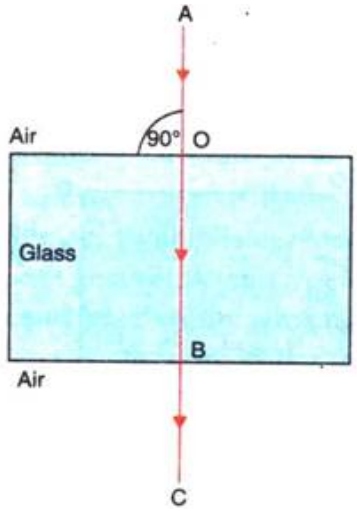
A. Is refracted towards the normal

B. Is refracted away from the normal

C. Does not get refracted

D. Is reflected along the same path.

Answer



38. Question

A ray of light passes from a medium X to another medium Y. No refraction of light occurs if the ray of light hits the boundary of medium Y at an angle of:

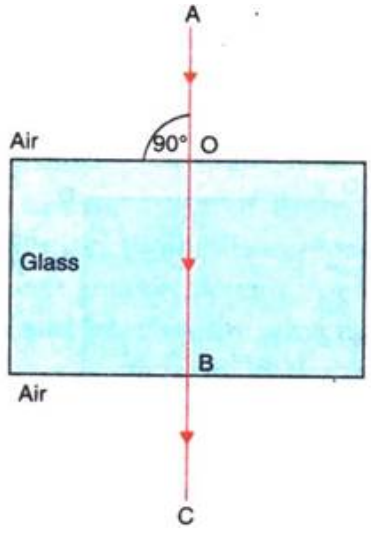
A. 0°

B. 45°

C. 90°

D. 120°

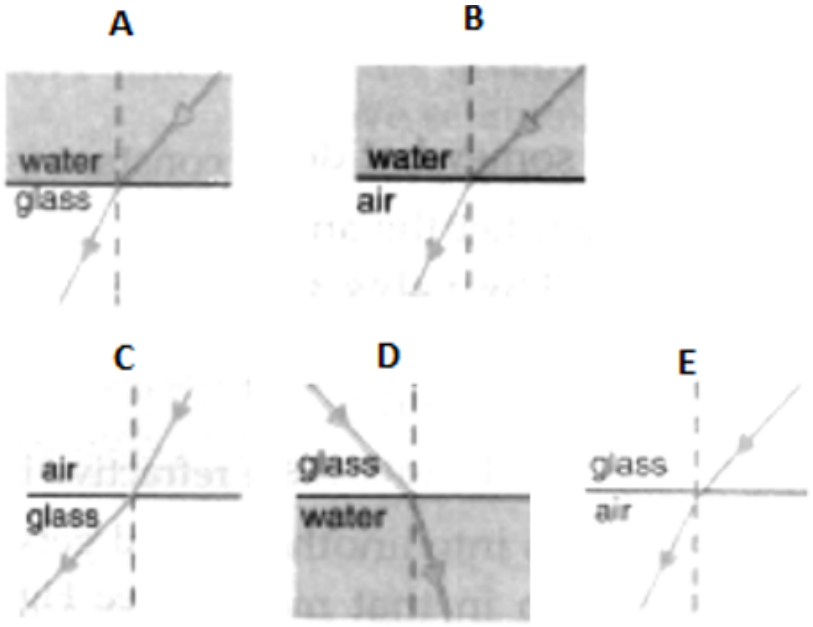
Answer



Questions Based on High Order Thinking Skills (HOTS)-Pg-221

39. Question

Which of the following diagrams shows the ray of light refracted correctly?



Answer

(A)

40. Question

A vertical ray of light strikes the horizontal surface of some water:

(a) What is the angle of incidence?

(b) What is the angle of refraction?

Answer

(a) the angle of incidence is 0^o

(b) the angle of refraction is 0^o

41. Question

How is the reflection of light ray from a plane mirror different from the refraction of light ray as it enters a block of glass?

Answer

the reflection of light ray from a plane mirror different from the refraction of light ray as when a ray of light enters a block of plane mirror the angle of reflection is equal to the angle of incidence but the angle of refraction is not equal to the angle of incidence when it enters a block of glass.

42. Question

How does the light have to enter the glass?

(a) To produce a large amount of bending?

(b) For no refraction to happen?

Answer

(a) the light have to enter the glass Obliquely To produce a large amount of angle of incidence

(b) the light have to enter the glass perpendicularly (at right angles) to the glass surface For no refraction to happen.

43 A. Question

How can you bend light away from the normal?

Answer

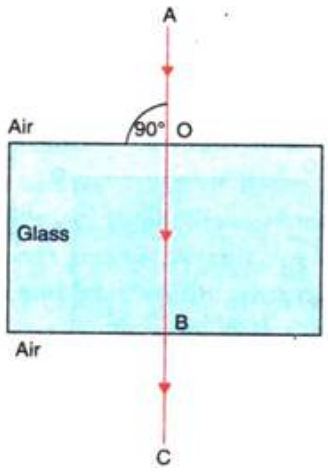
We can bend light away from the normal by making the light enter from a denser medium to a rarer medium.

43 B. Question

How must light travel out of a substance if it is not going to be refracted?

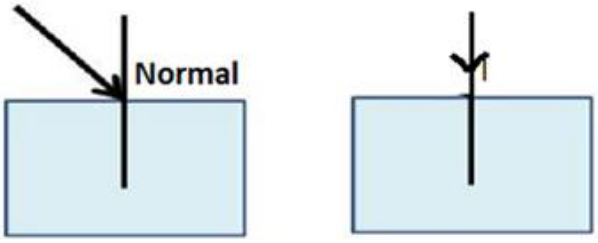
Answer

Incidence should be at right angle to the surface of substance.

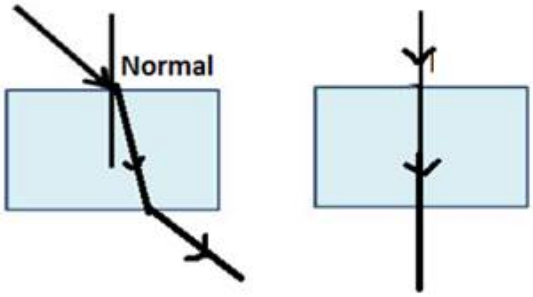


44. Question

Draw and complete the following diagrams to show what happens to the beams of light as they enter the glass block and then leave it:



Answer



Very Short Answer Type Questions-Pg-227

1. Question

What name is given to the ratio of sine of angle of incidence to the sine of angle of refraction?

Answer

The ratio of sine of angle of incidence to the sine of angle of refraction is called Refractive index

2. Question

Write the relation between the angle of incidence and the angle of refraction for a medium.

Answer

The relation between the angle of incidence and the angle of refraction for a medium is

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

3. Question

What is the unit of refractive index?

Answer

None

4. Question

Which has higher refractive index: water or glass?

Answer

Glass.

5. Question

Refractive indices of carbon disulphide and ethyl alcohol are 1.63 and 1.36 respectively. Which is optically denser?

Answer

Refractive indices of carbon disulphide = 1.63

Refractive indices of ethyl alcohol = 1.36

Thus, Carbon disulphide is more denser than the ethyl alcohol.

6. Question

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

Answer

refractive index of diamond = 2.42

Since, the relation between the angle of incidence and the angle of refraction for a medium is

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

This means that the ratio of the speed of light in air to the speed of light in diamond is equal to 2.42.

7. Question

If the refractive index for light going from air to diamond be 2.42, what will be the refractive index for light going from diamond to air?

Answer

the relation between the angle of incidence and the angle of refraction for a medium is

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

Thus, refractive index for light going from diamond to air = 0.41

8. Question

How is the refractive index of a material related to the speed of light in it?

Answer

the relation between the angle of incidence and the angle of refraction for a medium is

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

Hence, $\text{Refractive index of a material} = \frac{\text{Speed of light in vacuum}}{\text{speed of light in the material}}$

9. Question

State whether it is true or not:

When a ray of light goes from air into a clear material, you see the ray bend. How much the ray bends is determined by the Refractive index of the material.

Answer

True.

Short Answer Type Questions-Pg-228

10. Question

Give three examples of materials that refract light rays. What happens to the speed of light rays when they enter these materials?

Answer

water, glass and diamond.

When light rays enter these materials, their speed decreases.

11. Question

Define Snell's law of refraction. A ray of light is incident on a glass slab at an angle of incidence of 60°. If the angle of refraction be 32.7°, calculate the refractive index of glass. (Given: sin 60° = 0.866 and sin 30° = 0.5).

Answer

According to the Snell's law of refraction, the ratio of sine of angle of incidence to the sine of angle of refraction is constant for a given pair of media.

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

Given: Angle of incidence = 60^o

Angle of refraction = 30^o

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

$$\text{Refractive index} = \frac{\sin 60^\circ}{\sin 30^\circ}$$

$$\text{Refractive index} = \frac{0.866}{0.5}$$

$$= 1.732$$

12. Question

The speed of light in vacuum and in two different glasses is given in the table below:

Medium	Speed of light
Vacuum	3.00 x 108 m/s
Flint glass	1.86 x 10^8 m/s
Crown glass	1.97 x 108 m/s

(a) Calculate the absolute refractive indexes of flint glass and crown glass.

(b) Calculate the relative refractive index for light going from crown glass to flint glass.

Answer

The relation between the angle of incidence and the angle of refraction for a medium is

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

$$(a) n_{\text{flint}} = \frac{\text{speed of light in vacuum}}{\text{speed of light in flint glass}} = \frac{3 \times 10^8}{1.86 \times 10^8} = 1.61$$

Refractive indexes of flint glass = 1.61

$$n_{\text{crown}} = \frac{\text{speed of light in vacuum}}{\text{speed of light in crown glass}} = \frac{3 \times 10^8}{1.97 \times 10^8} = 1.52$$

Refractive indexes of crown glass = 1.52

$$(b)_{\text{crown}} n_{\text{flint}} = \frac{\text{speed of light in crown glass}}{\text{speed of light in flint glass}} = \frac{1.97 \times 10^8}{1.86 \times 10^8} = 1.059$$

The relative refractive index for light going from crown glass to flint glass = 1.059

13. Question

The speed of light in air is 3 x 10^8 m/s. In medium X its speed is 2 x 10^8 m/s and in medium Y the speed of light is 2.5 x 108 m/s. Calculate:

(a) air^{n}x = ?

(b) air^{n}y = ?

(c) a^{n}y

Answer

Given:

Speed of light in air = 3.0x10^8m/s

Speed of light in medium X = 2.0x10^8m/s

Speed of light in medium Y = 2.50x10^8m/s

(c) air^{n}x = ?

$$_{air}n_x = \frac{\text{speed of light in air}}{\text{speed of light in medium X}}$$

$$_{air}n_x = \frac{3.0\times10^8 m/s}{2.0\times10^8 m/s}$$

$$= 1.5$$

(d) air^{n}y = ?

$$_{air}n_y = \frac{\text{speed of light in air}}{\text{speed of light in medium y}}$$

$$_{air}n_y = \frac{3.0\times10^8 m/s}{2.50\times10^8 m/s}$$

$$= 1.2$$

(e) x^{n}y = ?

$$_{x}n_y = \frac{\text{speed of light in medium X}}{\text{speed of light in medium Y}}$$

$$_{x}n_y = \frac{2.0\times10^8 m/s}{2.50\times10^8 m/s}$$

$$= 0.8$$

14. Question

What is the speed of light in a medium of refractive index 1.4 if its speed in air is 3, 00,000 km/s?

Answer

Refractive index of medium = 1.4

Speed of light in air = 3,00,000km/s

We know that

$$\text{Refractive index of the medium} = \frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$$

$$1.4 = \frac{300000}{\text{speed of light in medium}}$$

$$\text{Speed of light in medium} = 214285714.2857143 \text{ Km/s}$$

15. Question

The refractive index of glass is 1.7. Calculate the speed of light in glass. The speed of light in air is 3.0 x 10^8 ms^{-1}

Answer

Given:-

Refractive index of glass = 1.7

Speed of light in air = 3.0x10^8m/s

We know that

$$\text{Refractive index of glass} = \frac{\text{Speed of light in air}}{\text{Speed of light in glass}}$$

$$1.7 = \frac{3 \times 10^8}{\text{speed of light in glass}}$$

$$\text{Speed of light in glass} = 1.76 \times 10^8 \text{ m/s}$$

16. Question

The speed of light in water is 2.25 x 10^8 m/s. If the speed of light in vacuum be 3 x 10^8 m/s, calculate the refractive index of water.

Answer

Speed of light in vacuum = 3.0 x 10^8m/s

Speed of light in water = 2.25 x 10^8m/s

Refractive index of water = ?

We know that

$$\text{Refractive index of water} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in water}}$$

$$\text{Refractive index of water} = \frac{3 \times 10^8}{2.25 \times 10^8} = 1.33$$

17. Question

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 3.0 x10^8 ms^{-1}.

Answer

Given:-

Refractive index of diamond = 2.42

Speed of light in air = 3.0x10^8m/s

We know that

$$\text{Refractive index of diamond} = \frac{\text{Speed of light in air}}{\text{Speed of light in diamond}}$$

$$2.42 = \frac{3 \times 10^8}{\text{Speed of light in diamond}}$$

$$\text{Speed of light in diamond} = 1.239 \times 10^8 \text{ m/s}$$

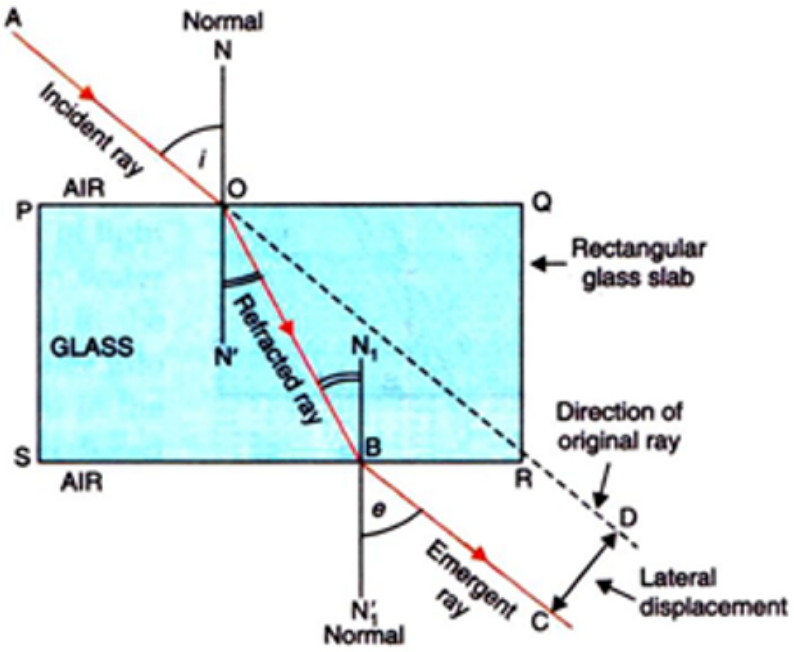
Long Answer Type Questions-Pg-228

18 A. Question

State and explain the laws of refraction of light with the help of a labeled diagram.

Answer

Laws of refraction:



first law of refraction states that, the incident ray, the refracted ray and the normal at the point of incidence, all lie in the same plane.

Second law of refraction states that, the ratio of the sine of angle of incidence to the sine of angle of refraction is constant for a given pair of media.

18 B. Question

What is meant by the refractive index of a substance?

Answer

The relation between the angle of incidence and the angle of refraction for a medium is known as refractive index of that medium.

$$\text{Refractive index} = \frac{\text{sine of the angle of incidence}}{\text{sine of the angle of refraction}}$$

18 C. Question

Light travels through air at 300 million ms^{-1}. On entering water it slows down to 225 million ms^{-1}. Calculate the refractive index of water.

Answer

Speed of light in air = 3×10^8 m/sec

Speed of light in water = 2.25×10^8 m/sec

We know that

$$\text{Refractive index of water} = \frac{\text{Speed of light in air}}{\text{Speed of light in water}}$$

$$\text{Refractive index of water} = \frac{3 \times 10^8}{2.25 \times 10^8} = 1.33$$

Multiple Choice Questions (MCQs)-Pg-228

19. Question

The refractive indices of four substances P, Q, Rand S are 1.50, 1.36, 1.77 and 1.31 respectively. The speed of light is the maximum in the substance:

A. P

B. Q

C. R

D. S

Answer

$$\text{Refractive index of y} = \frac{\text{Speed of light in x}}{\text{Speed of light in y}}$$

20. Question

The refractive indices of four materials A, B, C and D are 1.03, 1.13, 1.92 and 1.72 respectively. When the light rays pass from air into these materials, they refract the maximum in:

A. Material A

B. material B

C. Material C

D. material D

Answer

Refraction is maximum in the material with maximum refractive index.

21. Question

The refractive index of glass for light going from air to glass is $\frac{3}{2}$. The refractive index for light going from glass to air will be:

A. 1/3

B. 4/5

C. 4/6

D. 5/2

Answer

The refractive index for light going from glass to air = 1/ refractive index of glass for light going from air to glass = 2/3

22. Question

The refractive indices of four media A, B, C and Dare 1.44, 1.52, 1.65 and 1.36 respectively. When light travelling in air is incident in these media at equal angles, the angle of refraction will be the minimum:

A. In medium A

B. in medium B

C. In medium C

D. in medium D

Answer

The angle of reflection is minimum in the medium with more refractive index.

23. Question

The speed of light in substance X is 1.25×10^8 m/s and that in air is 3×10^8 m/s. The refractive index of this substance will be:

A. 2.4

B. 0.4

C. 4.2

D. 3.75

Answer

speed of light in substance X is 1.25×10^8 m/s

speed of light in substance air is 3×10^8 m/s

The refractive index of this substance will be speed of light in substance air/ speed of light in substance X

24. Question

The refractive indexes of four substances P, Q, R and S are 1.57, 1.54, 2.52 and 1.33 respectively. When light travelling in air is incident on these substances at equal angles, the angle of refraction will be the maximum in:

A. Substance P

B. substance Q

C. Substance R

D. substance S

Answer

the angle of refraction will be the maximum in substance with minimum refractive index.

25. Question

The refractive index of water is:

A. 1.33

B. 1.50

C. 2.42

D. 1.36

Answer

The refractive index of water is 1.33.

26. Question

The refractive index of water with respect to air is 4/3. The refractive index of air with respect to water will be:

A. 1.75

B. 0.50

C. 0.75

D. 0.25

Answer

The refractive index of air with respect to water = 1/ refractive index of water with respect to air

27. Question

Refractive indices of water, sulphuric acid, glass and carbon disulphide are 1.33, 1.43, 1.53 and 1.63 respectively. The light travels slowest in:

A. Sulphuric acid

B. glass

C. mithaen

D. carbon disulphide

Answer

The light travels slowest in material with maximum refractive index.

28. Question

The refractive index of glass with respect to air is 3/2 and the refractive index of water with respect to air is 4/3. The refractive index of glass with respect to water will be

A. 1.525

B. 1.225

C. 1.425

D. 1.125

Answer

refractive index of glass with respect to air is 3/2

the refractive index of water with respect to air is 4/3

refractive index of glass with respect to water will be 3/4 x 3/2 = 9/8 = 1.125

Questions Based on High Order Thinking Skills (HOTS)-Pg-229

29. Question

The following table gives the refractive indices of a few media:

	1	2	3	4	5
Medium:	Water	Crown glass	Rock salt	Ruby	Diamond
Refractive index:	1.33	1.52	1.54	1.71	2.42

Use this table to give an example of:

(i) a medium pair so that light speeds up when it goes from one of these medium to another.

(ii) A medium pair so that light slows down when it goes from one of these medium to another.

Answer

(i) Example of a medium pair so that light speeds up when it goes from one of these medium to another is Crown glass to water

(ii) Example of A medium pair so that light slows down when it goes from one of these medium to another is Water to diamond

30. Question

Refractive indices of four media A, B, C and Dare given below:

Medium	Refractive index
A	1.33
B	1.44
C	1.52
D	1.65

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

Answer

(i) Speed of light is maximum in A as it has least refractive index.

(ii) Speed of light is minimum in D as it has highest refractive index.

Very Short Answer Type Questions-Pg-239

1. Question

Name the lens which can concentrate sun's rays to a point and bum a hole in a piece of paper.

Answer

Converging lens is the lens which can concentrate sun's rays to a point and bum a hole in a piece of paper.

2. Question

Give the usual name for the following :

A point inside a lens through which the light passes undeviated.

Answer

A point inside a lens through which the light passes undeviated is called Optical centre

3. Question

A 1 cm high object is placed at a distance of 2f from a convex lens. What is the height of the image formed?

Answer

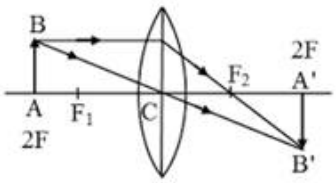
The height of the image formed is same as the height of the object that is 1 cm.

4. Question

If the image formed by a convex lens is of the same size as that of the object, what is the position of the image with respect to the lens?

Answer

the image formed by a convex lens is of the same size as that of the object At 2F

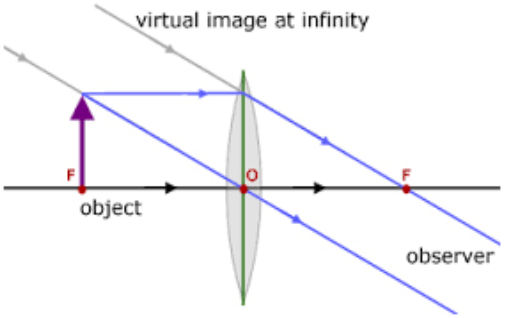


5. Question

If an object is placed at the focus of a convex lens, where is the image formed?

Answer

The image is formed at infinity.

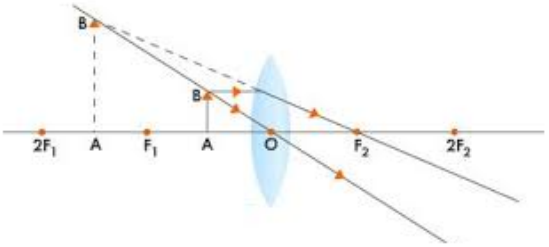


6. Question

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

Answer

Object should be placed at a distance less than focal length order to use a convex lens as a magnifying glass.

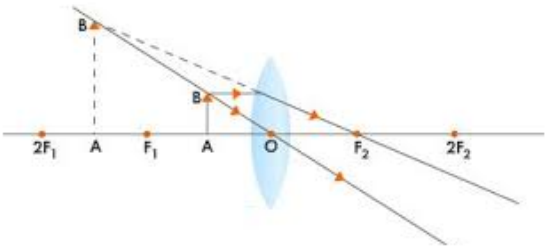


7. Question

Where should an object be placed in front of a convex lens so as to obtain its virtual, erect and magnified image?

Answer

The object should be placed within focus to obtain its virtual, erect and magnified image.

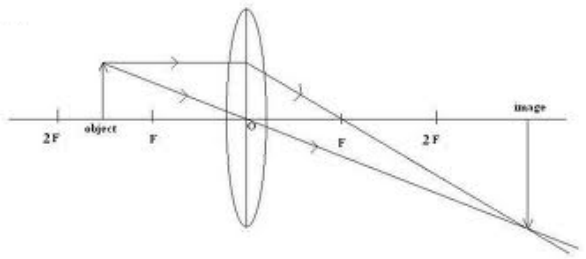


8. Question

Where an object should be placed in front of a convex lens so as to obtain its real, inverted and magnified image?

Answer

Object should be placed between f and 2f in front of a convex lens so as to obtain its real, inverted and magnified image.

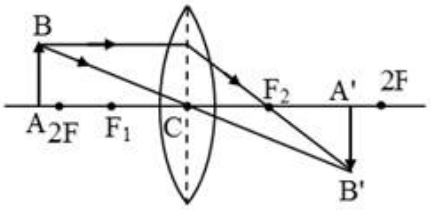


9. Question

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

Answer

Beyond 2F of an object a real, diminished image is formed by a convex lens.

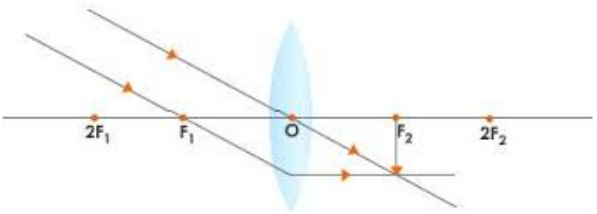


10. Question

If an object is at a considerable distance (or infinity) in front of a convex lens, where is the image formed?

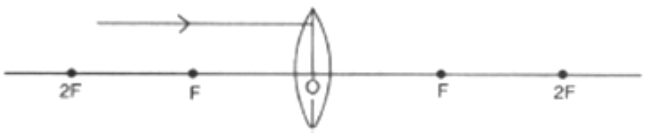
Answer

If an object is at a considerable distance (or infinity) in front of a convex lens, the image is formed at focus F

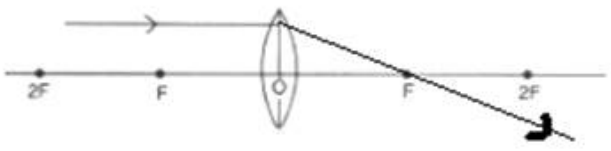


11. Question

Draw the given diagram in your answer book and complete it for the path of a ray of light after passing through the lens.



Answer



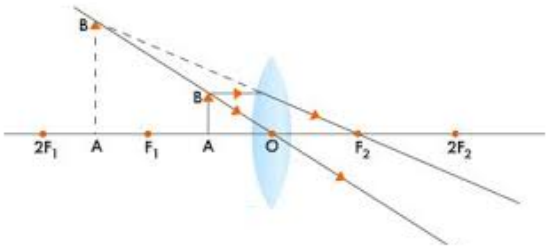
12. Question

What type of lens would you use as a magnifying glass? How close must the object be to the lens?

Answer

Convex lens would be used as a magnifying glass

The object must be within the focus of the lens.



13. Question

Name two factors on which the focal length of a lens depends.

Answer

Focal length of a lens depends on the

1) refractive index of the glass

2) the curvature of its two surfaces.

14. Question

State any two uses of convex lenses.

Answer

Two uses of convex lenses are that it can be used as a magnifying glass and for making a simple camera

15. Question

Fill in the following blanks with suitable words:

(a) _____ rays of light are refracted by a convex lens to a point called the focus.

(b) The image in a convex lens depends upon the distance of the object from the_____.

Answer

a) Parallel

b) lens

Short Answer Type Questions-Pg-240

16. Question

What is a lens? Distinguish between a convex lens and a concave lens. Which of the two is a converging lens: convex lens or concave lens?

Answer

A lens is a piece of transparent glass bound by two spherical surfaces..

Convex lens	Concave lens
A convex lens is thicker at the middle as compared to the edges	a concave lens is thicker at the edges as compared to the middle

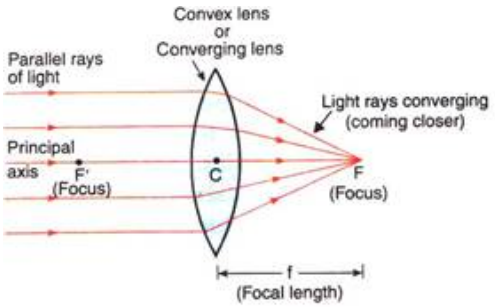
Convex lens is a converging lens.

17 A. Question

Explain with the help of a diagram, why the convex lens is also called a converging lens.

Answer

A convex lens also known as converging type because it converges a parallel beam of light rays passing through it.



17 B. Question

Define principal axis, principal focus and focal length of a convex lens.

Answer

The principal axis of a lens is a line passing through the optical centre of the lens and perpendicular to both the faces of the lens.

The principal focus of a convex lens is a point on its principal axis to which light rays parallel to the principal axis converge after passing through the lens.

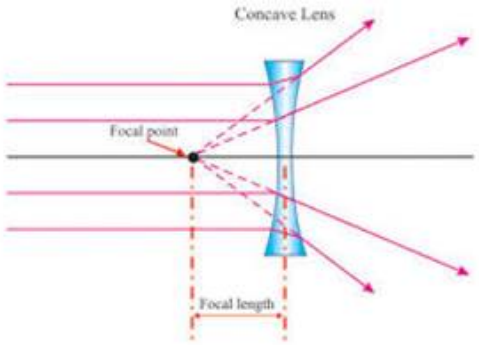
The focal length is the distance of the principle focus from the optical center of a lens.

18 A. Question

Explain with the help of a diagram, why the concave lens is also called a diverging lens.

Answer

A concave lens is known as diverging lens because it diverges the parallel rays of light passing through it.



18 B. Question

Define the principal focus of a concave lens.

Answer

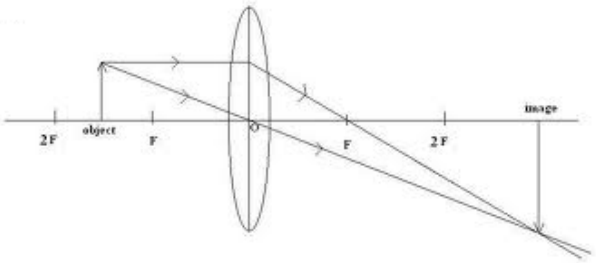
The principal focus of a concave lens is a point on its principal axis from which parallal light rays appear to diverge after passing through the lens.

19. Question

Draw a ray diagram to show the formation of a real magnified image by a convex lens. (In your sketch the position of object and image with respect to the principal focus of lens should be shown clearly).

Answer

the formation of a real magnified image by a convex lens..

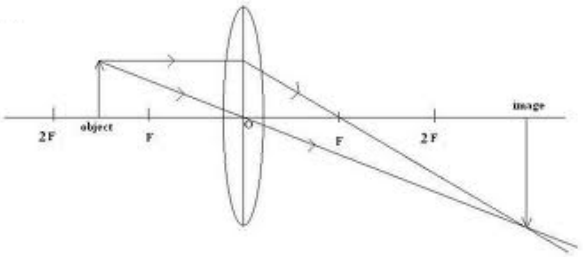


20. Question

Describe with the help of a ray-diagram, the formation of image of a finite object placed in front of a convex lens between f and 2f Give two characteristics of the image so formed.

Answer

If object is placed in between f and 2f, the image will form on the other side of the lens beyond 2f as shown below.



Characteristics of image formed is

a) real and inverted.

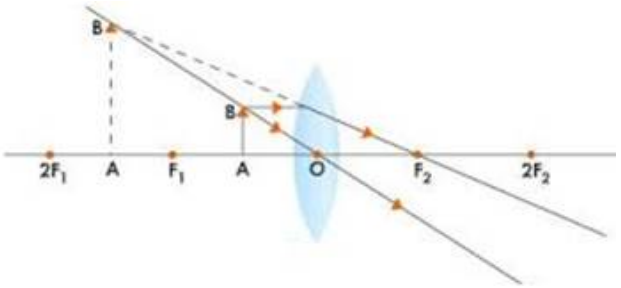
b) magnified.

21. Question

Describe with the help of a ray diagram the nature, size and position of the image formed when an object is placed in front of a convex lens between focus and optical center. State three characteristics of the image formed.

Answer

In the diagram, the object is placed in front of a convex lens between focus and optical centre. The image is formed on the same side as the object as shown below



Characteristics of image formed is

a. virtual and erect.

b. larger than the object

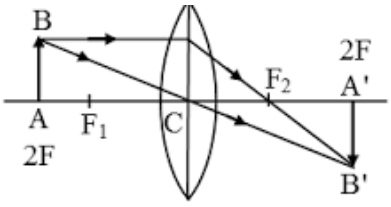
c. formed behind the object.

22. Question

An object is placed at a distance equal to 2f in front of a convex lens. Draw a labeled ray diagram to show the formation of image. State two characteristics of the image formed.

Answer

An object is placed at a distance equal to 2f in front of a convex lens. The ray diagram is as such



Characteristic of image formed is

a. real and inverted.

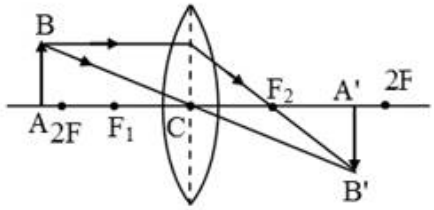
b. same size as the object.

23. Question

Describe with the help of a ray-diagram, the size, nature and position of the image formed by a convex lens when an object is placed beyond 2f in front of the lens.

Answer

The size, nature and position of the image formed by a convex lens when an object is placed beyond 2f in front of the lens is real, inverted and smaller than the object.



24. Question

Describe with the help of a ray diagram the nature, size and position of the image formed when an object is placed at infinity (considerable distance) in front of a convex lens. State three characteristics of the image so formed.

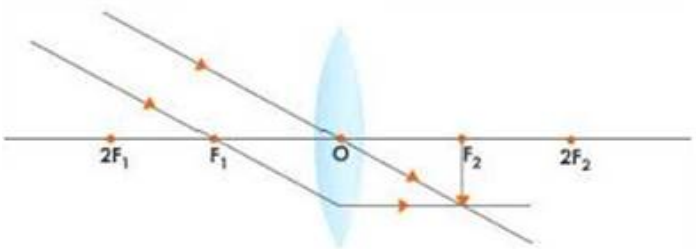
Answer

the nature, size and position of the image formed when an object is placed at infinity (considerable distance) in front of a convex lens is

a) real.

b) inverted.

c) highly diminished.

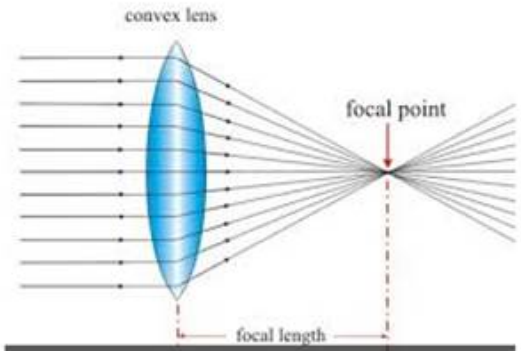


25 A. Question

What type of lens is shown in the diagram on the right ? What will happen to the parallel rays of light? Show by completing the ray diagram.

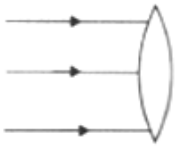
Answer

The lens shown in convex. the parallel rays will converge to a point called focus (F).



25 B. Question

Your eye contains a convex lens. Why is it unwise to look at the sun?



Answer

It is unwise to look at the sun because the convex lens focusses a lot of sun rays into our eyes and this may damage the eyes.

26. Question

Where the object must be placed for the image formed by a converging lens to be:

(a) Real, inverted and smaller than the object?

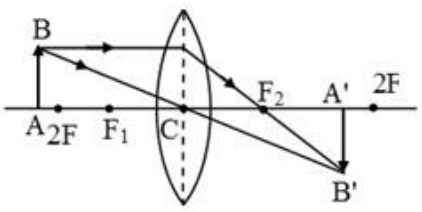
(b) Real, inverted and same size as the object?

(c) Real, inverted and larger than the object?

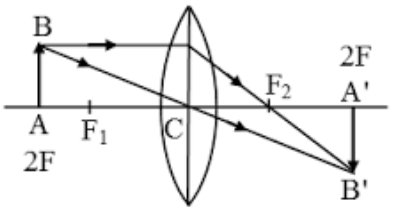
(D) Virtual, upright and larger than the object?

Answer

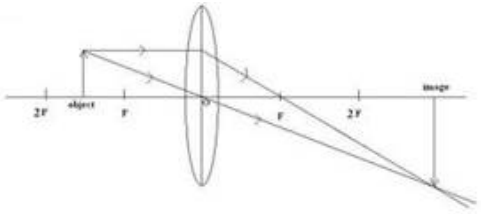
a) for the image formed by a converging lens to be Real, inverted and smaller than the object Beyond 2F



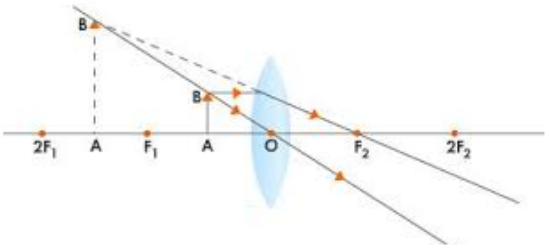
b) for the image formed by a converging lens to be Real, inverted and same size than the object At 2F.



c) for the image formed by a converging lens to be Real, inverted and larger than the object Between F and 2F



d) for the image formed by a converging lens to be Virtual, upright and larger than the object Between F and optical centre

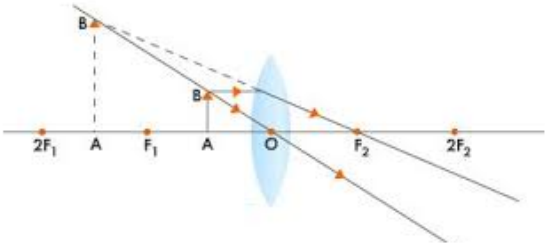


27. Question

Draw a diagram to show how a converging lens held close to the eye acts as a magnifying glass. Why is it usual to choose a lens of short focal length for this purpose rather than one of long focal length?

Answer

Converging lens as a magnifying glass:



It is usual to choose a lens of short focal length because smaller the focal length of a convex lens, greater will be its magnifying power as

$P = 1/f$

28. Question

How could you find the focal length of a convex lens rapidly but approximately?

Answer

Change the distance of the screen from the convex lens until a clear inverted image of the window is formed on the screen. Measure the distance of the screen from the lens with a scale. This distance will be the focal length of convex lens.

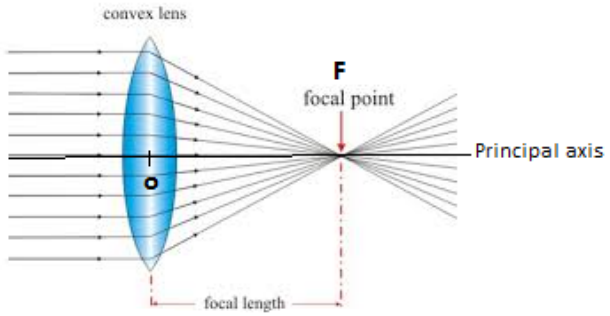
Long Answer Type Questions-Pg-240

29 A. Question

With the help of a labeled diagram explain how a convex lens converges a beam of parallel light rays.

Answer

according to the laws of refraction, when a beam of light rays parallel to one another and also to the principal axis of the convex lens fall on the lens, the incident rays pass through the lens, gets refracted and is focused on focus.



Mark the principal axis, optical centre, principal focus and focal length of the convex lens on the diagram.

29 B. Question

State whether convex lens has a real focus or a virtual focus.

Answer

real focus.

29 C. Question

List some things that convex lens and concave mirror have in common.

Answer

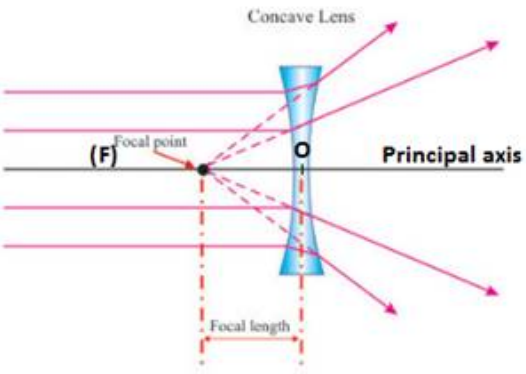
parallel rays of light coming from infinity converges at the focus.

30 A. Question

With the help of a labeled diagram, explain how a concave lens diverges a beam of parallel light rays.

Mark the principal axis, optical centre, principal focus and focal length of the concave lens on the diagram.

Answer



according to the laws of refraction, When a beam of light rays parallel to one another and also to the principal axis of the concave lens fall on the lens, the incident rays pass through the lens, gets refracted and when these diverging rays are produced backwards they appear to meet at a point F (focus) on the left side of the lens.

30 B. Question

State whether concave lens has a real focus or a virtual focus.

Answer

virtual focus.

30 C. Question

List some things that concave lens and convex mirror have in common.

Answer

parallel rays of light coming from infinity diverges at focus.

31. Question

Draw ray diagrams to represent the nature, position and relative size of the image formed by a convex lens for the object placed:

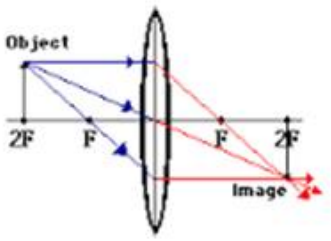
(a) At $2F_1$

(b) Between F1 and the optical centre 0 of the lens.

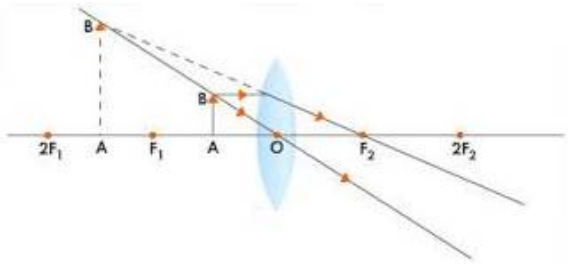
Which of the above two cases shows the use of convex lens as a magnifying glass? Give reasons for your choice.

Answer

(a) Object at 2F1 :



(b) Object between F1 and the optical centre O of the lens :

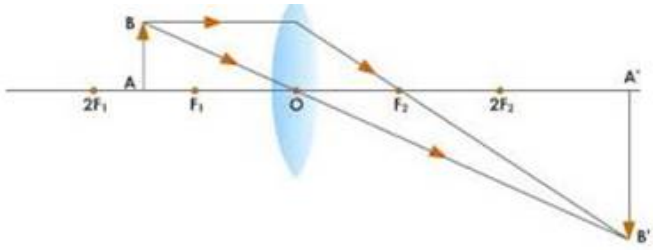


The case 2 shows the use of convex lens as a magnifying glass as the image formed is erect and magnified.

32 A. Question

An object is placed well outside the principal focus of a convex lens. Draw a ray diagram to show how the image is formed, and say whether the image is real or virtual.

Answer



32 B. Question

What is the effect on the size and position of the image of moving the object?

(i) towards the lens, and

(II) Away from the lens?

Answer

(i) the image size will keep on increasing if object is moved towards the lens, till the object reaches focus. After that, the size decreases but the image remains magnified.

(ii) If object is moved away from the lens, the size will keep on decreasing and the image keeps on shifting towards the lens.

33 A. Question

Explain what is meant by a virtual, magnified image.

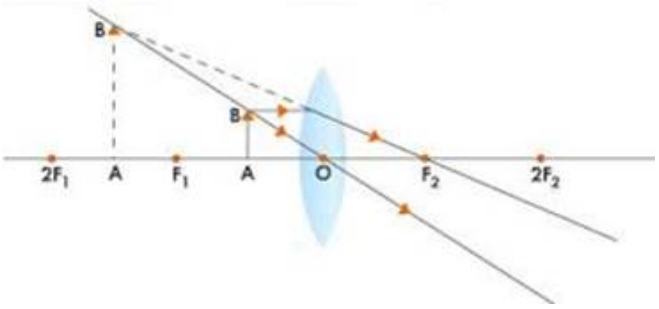
Answer

A virtual magnified image cannot be taken on a screen and whose size is larger than that of the object.

33 B. Question

Draw a ray diagram to show the formation of a virtual magnified image of an object by a convex lens. In your diagram, the position of object and image with respect to the principal focus should be shown clearly.

Answer



33 C. Question

Three convex lenses are available having focal lengths of 4 cm, 40 cm and 4 m respectively. Which one would you choose as a magnifying glass and why?

Answer

Convex lens having 4 cm focal length should be chosen because it will produce greatest magnification.

34 A. Question

Explain why, a real image can be projected on a screen but a virtual image cannot.

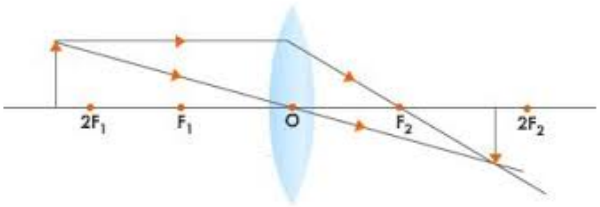
Answer

A real image is formed when rays actually meet and in a virtual image, light rays appear to meet at a point when produced backwards (but do not actually meet) after refraction through a lens.

34 B. Question

Draw a ray diagram to show the formation of a real diminished image of an object by a convex lens. In your diagram, the position of object and image with respect to the principal focus should be shown clearly.

Answer



34 C. Question

Name one simple optical instrument in which the above arrangement of convex lens is used.

Answer

A simple camera is a simple optical instrument in which the above arrangement of convex lens is used.

Multiple Choice Questions (MCQs)-Pg-241

35. Question

A convex lens has a focal length of 10 cm. At which of the following position should an object be placed so that this convex lens may act as a magnifying glass?

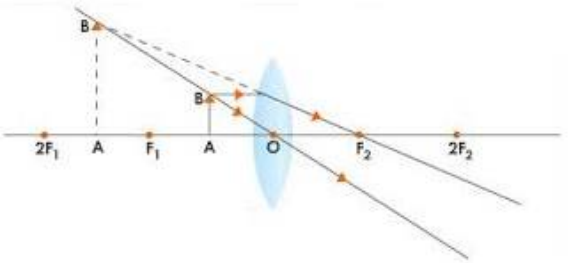
A. 15 cm

B. 7 cm

C. 20 cm

D. 25 cm

Answer



36. Question

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

A. Water

B. Glass

C. Plastic

D. Clay

Answer

Water, glass and plastic reflect light, but clay does not as it is opaque.

37. Question

A small bulb is placed at the focal point of a converging lens. When the bulb is switched on, the lens produces:

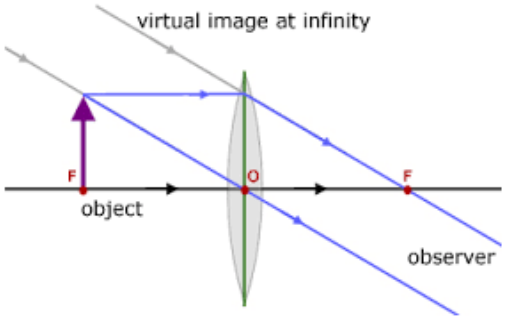
A. A convergent beam of light

B. A divergent beam of light

C. A parallel beam of light

D. A patch of coloured light

Answer



38. Question

An illuminated object is placed at a distance of 20 cm from a converging lens of focal length 15 cm. The image obtained on the screen is:

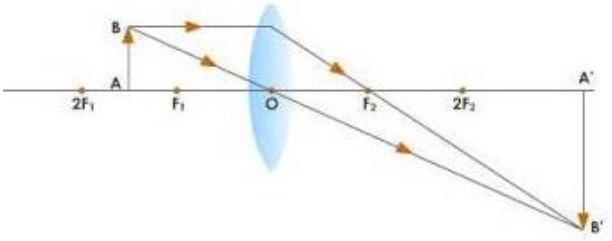
A. Upright and magnified

B. Inverted and magnified

C. Inverted and diminished

D. Upright and diminished

Answer



39. Question

An object is placed between f and 2f of a convex lens. Which of the following statements correctly describes its image?

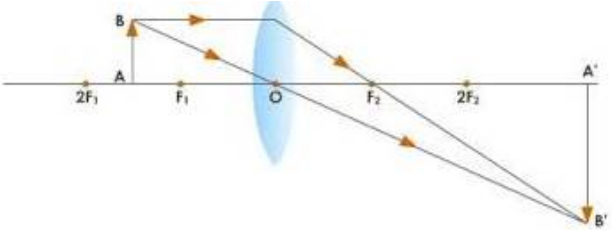
A. Real, larger than the object

B. Erect, smaller than the object

C. Inverted, same size as object

D. Virtual, larger than the object

Answer



40. Question

Which of the following can make a parallel beam of light when light from a bulb falls on it?

A. Concave mirror as well as concave lens

B. convex mirror as well as convex lens

C. Concave mirror as well as convex lens

D. convex mirror as well as concave lens

Answer

Concave mirror as well as convex lens makes a parallel beam of light when light from a bulb falls on it.

41. Question

In order to obtain a real image twice the size of the object with a convex lens of focal length 15 cm, the object distance should be:

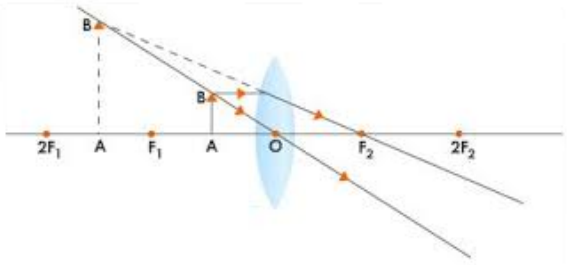
A. More than 5 cm but less than 10 cm

B. More than 10 cm but less than 15 cm

C. More than 15 cm but less than 30 cm

D. More than 30 cm but less than 60 cm

Answer



42. Question

A converging lens is used to produce an image of an object on a screen. What change is needed for the image to be formed nearer to the lens?

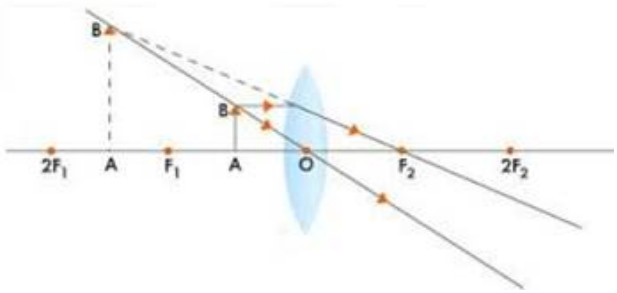
A. Increase the focal length of the lens

B. Insert a diverging lens between the lens and the screen

C. Increase the distance of the object from the lens

D. Move the object closer to the lens

Answer



In all the other cases image formed is real, inverted and magnified.

43. Question

A convex lens of focal length 8 cm forms a real image of the same size as the object. The distance between object and its image will be:

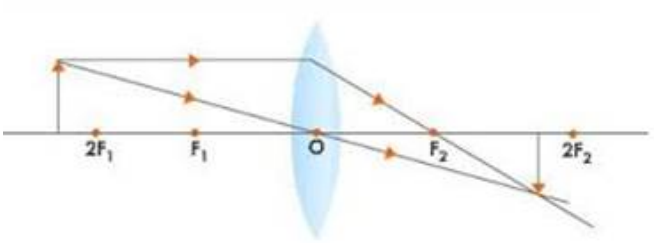
A. 8 cm

B. 16 cm

C. 24 cm

D. 32 cm

Answer



44. Question

A virtual, erect and magnified image of an object is to be obtained with a convex lens. For this purpose, the object should be placed:

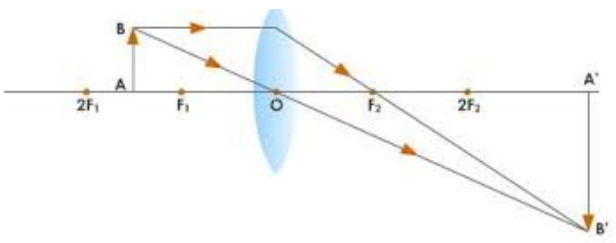
A. Between 2F and infinity

B. Between F and 2F

C. Between F and optical center

D. At F

Answer



45. Question

A burning candle whose flame is 1.5 cm tall is placed at a certain distance in front of a convex lens. An image of candle flame is received on a white screen kept behind the lens. The image of flame also measures 1.5 cm. If f is the focal length of convex lens, the candle is placed:

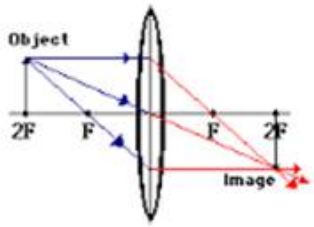
A. At f

B. Between f and 2 f

C. At 2 f

D. Beyond 2f

Answer



Questions Based on High Order Thinking Skills (HOTS)-Pg-242

46. Question

A lens of focal length 15 cm forms an erect image three times the size of the object. The distance between the object and image is:

(a) 20 cm (b) 16 cm

(c) 24 cm (d) 36 cm

Answer

(a)

Magnification, $m = \frac{v}{u}$

$3 = \frac{v}{u}$

$\Rightarrow v = 3u$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{3u} - \frac{1}{u} = \frac{1}{15}$

$\frac{-2}{3u} = \frac{1}{15}$

$\Rightarrow u =$ -10 cm

$v = 3 \times$ -10 cm = -30 cm

Distance between object and image=u-v= -10 cm + 30 cm = 20 cm

47. Question

If an object is placed 23 cm from a converging lens, the image formed is slightly smaller than the object. If the object is placed 21 cm from the lens, the image formed is slightly larger than the object. The approximate focal length of the lens is:

(a) 11 cm (b) 10 cm

(c) 18 cm (d) 20 cm

Answer

(a) 11 cm

The image is slightly smaller than the object when the object lies beyond 2f; and the image is slightly larger than the object when the object between f and 2f. This means that between 21 cm and 23 cm lies 2f. Out of the given options, 22 cm lies between 21 cm and 23 cm.

So, 2f = 22 cm

f = 11 cm

48. Question

Object is placed at the following distances from a convex lens of focal length 16 cm:

(a) 35 cm (b) 32 cm

(c) 20 cm (d) 10 cm

Which position of the object will produce?

(I) a magnified real image?

(ii) A magnified virtual image?

(iii) A diminished real image?

(iv) An image of same size as the object?

Answer

Here, f=16cm and 2f=32cm

(i) 20 cm (Because a magnified real image is formed when the object is placed between f and 2f)

(ii) 10cm (Because a magnified virtual image is formed when the object is placed between f and the lens)

(iii) 35cm (Because a diminished real image is formed when the object is placed beyond 2f)

(iv) 32cm (Because an image of same size as the object is formed when the object is placed at 2f)

49. Question

When an object is placed at a distance of 40 cm from a convex lens, an image of the same size as the object is formed. What will be the nature of image formed when the object is placed at a distance of?

(a) 10 cm from the lens?

(b) 20 cm from the lens?

Answer

Here, 2f = 34 cm, f = 17 cm

(a) When the object is placed at a distance of 10 cm from the lens, the object lies within the focus. Hence, the image formed is virtual, erect and magnified.

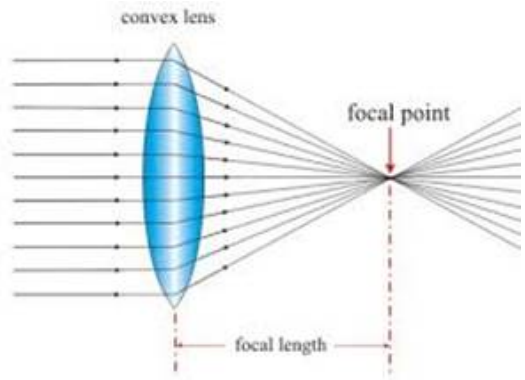
(b) When the object is placed at a distance of 20 cm from the lens, the object lies between f and 2f. Hence, the image formed is real, inverted and magnified.

50 A. Question

Draw a diagram to show how a converging lens focusses parallel rays of light.

Answer

a diagram to show how a converging lens focusses parallel rays of light.'

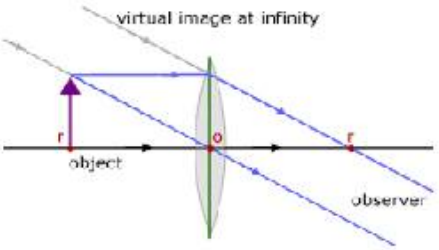


50 B. Question

How would you alter the above diagram to show how a converging lens can produce a beam of parallel rays of light?

Answer

we can alter the above diagram to show how a converging lens can produce a beam of parallel rays of light by Placing a source of light at the focus of the converging lens.



Very Short Answer Type Questions-Pg-246

1. Question

Write the formula for a lens connecting image distance (υ), object distance (u) and the focal length (f). How does the lens formula differ from the mirror formula?

Answer

the formula for a lens connecting image distance (υ), object distance (u) and the focal length (f) is

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

This is also known as the lens formula.

Mirror formula is

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

The lens formula has a minus sign (-) between 1/v and 1/u whereas the mirror formula has a plus sign (+) between 1/v and 1/u.

2. Question

Write down the magnification formula for a lens in terms of object distance and image distance. How does this magnification formula for a lens differ from the corresponding formula for a mirror?

Answer

Magnification (m) formula for a lens in terms of object distance (u) and image distance (v) is:

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

Magnification formula for a mirror in terms of object distance (u) and image distance (v) is:

$$m=-\frac{v}{u}$$

Magnification formula for a mirror has a minus sign (-) but the magnification formula for a lens has no minus sign.

3. Question

What is the nature of the image formed by a convex lens if the magnification produced by the lens is +3?

Answer

Virtual and erect is the nature of the image formed by a convex lens if the magnification produced by the lens is +3

4. Question

What is the nature of the image formed by a convex lens if the magnification produced by the lens is, - 0.5?

Answer

Real and inverted is the nature of the image formed by a convex lens if the magnification produced by the lens is, - 0.5.

5. Question

What is the position of image when an object is placed at a distance of 12 cm from a convex lens of focal length 12 cm?

Answer

u = -12 cm, f = 12 cm

We have

$$\frac{1}{v} - \frac{1}{-12} = \frac{1}{12}$$

$$\frac{1}{v} = 0$$

$$v = \frac{1}{0} = \infty$$

At infinity

6. Question

Describe the nature of image formed when an object is placed at a distance of 30 cm from a convex lens of focal length 15 cm.

Answer

the nature of image formed when an object is placed at a distance of 30 cm from a convex lens of focal length 15 cm is real and inverted.

7. Question

At what distance from a converging lens of focal length 14 cm must an object be placed in order that an image of magnification 1 will be produced?

Answer

$f = 14$ cm

$m = 1$

$m = \frac{v}{u} = 1$

$\Rightarrow v = u$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

Putting the value of v, u and f,

$\frac{1}{u} - \frac{1}{-u} = \frac{1}{14}$ (image distance is negative)

$\frac{2}{u} = \frac{1}{14}$

$u = 28$ cm

The object should be placed at a distance of 28 :m to from the lens (on the left side).

Short Answer Type Questions-Pg-246

8. Question

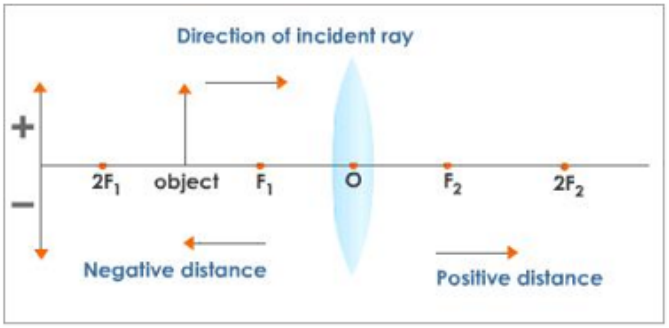
State and explain the New Cartesian Sign Convention for spherical lenses.

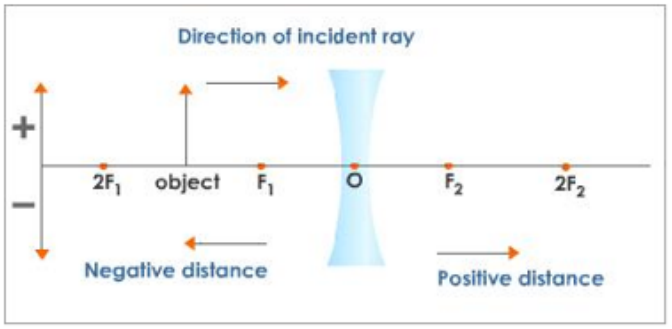
Answer

Following sign convention is used for measuring various distances during the formation of images by lenses:

(ii) The distances measured in the same direction as that of incident light are taken as positive.

(iii) The distances measured against the direction of incident light are taken as negative.





● All distances on the principal axis are measured from the optical center.

● The distances measured in the direction of incident rays are positive and all the distances measured in the direction opposite to that of the incident rays are negative.

● All distances measured above the principal axis are positive. Thus, height of an object and that of an erect image are positive and all distances measured below the principal axis are negative.

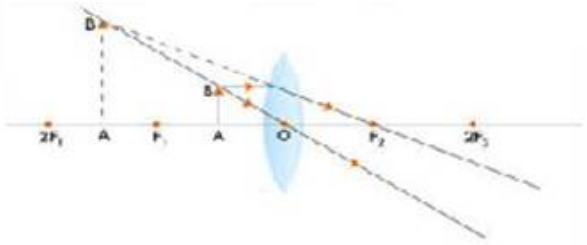
9. Question

An object 4 cm high is placed at a distance of 10 cm from a convex lens of focal length 20 cm. Find the position, nature and size of the image. Draw the diagram to represent the position.

Answer

$u = -10\,cm$
$h_1 = 4\,cm$
$f = 20\,cm$
$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
$\frac{1}{v} - \frac{1}{-10} = \frac{1}{20}$
$\frac{1}{v} = \frac{1}{20} - \frac{1}{10} = -\frac{1}{20}$
$v = -20\,cm$ (Image is 20 cm in front of the convex lens)
$m = \frac{v}{u} = \frac{20}{-10} = -2$
$m = \frac{h_2}{h_1} = -2$
$\frac{h_2}{4} = -2$
$h_2 = -8\,cm$
Image is 8 cm in size and is real and inverted.

the diagram to represent the position is



10. Question

A small object is so placed in front of a convex lens of 5 cm focal length that a virtual image is formed at a distance of 20 cm. Find the magnification.

Answer

$f = 5\,cm$

$v = -2$ cm (Virtual image)

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{-20} - \frac{1}{u} = \frac{1}{5}$

$\frac{1}{u} = -\frac{1}{20} - \frac{1}{5} = -\frac{5}{20}$

$u = -4$ cm

Magnification, $m = \frac{v}{u} = \frac{-20}{-4} = +5$

11. Question

Find the position and nature of the image of an object 8 cm high and 10 cm in front of a convex lens of focal length 6 cm.

Answer

Height of image = 8cm

$u = -10cm$

$f = 6cm$

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-10} = \frac{1}{6}$

$\frac{1}{v} = \frac{1}{6} - \frac{1}{10} = \frac{2}{30} = \frac{1}{15}$

$v = 15cm$

Image is formed 15 cm behind the mirror and the image formed is real and inverted.

12. Question

Calculate the focal length of a convex lens which produces a virtual image at a distance of 60 cm of an object placed 20 cm in front of it.

Answer

$v = -60\,cm$ (Virtual image)

$u = -20\,cm$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-60} - \frac{1}{-20} = \frac{1}{f}$$

$$\frac{-1+3}{60} = \frac{1}{f}$$

$$\frac{1}{30} = \frac{1}{f}$$

$f = 30\,cm$

13. Question

An object is placed at a distance of 100 cm from a converging lens of focal length 50 cm.

(i) What is the nature of image?

(ii) What is the position of image?

Answer

(i) Real and inverted

(ii) v = 50 cm; The image is formed 50 cm behind the convex lens (on its right side)

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{v} - \frac{1}{-100} = \frac{1}{50}$$

$$\frac{1}{v} = \frac{1}{50} - \frac{1}{100}$$

$$\frac{1}{v} = \frac{2-1}{100} = \frac{1}{50}$$

$v = 50\,cm$

Image is formed 50 cm behind the convex lens.

14. Question

A convex lens produces an inverted image magnified three times of an object placed at a distance of 15 from it. Calculate the image distance.

Answer

$m = -3$ (Inverted image)

$u = -15\,cm$

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

$$-3 = \frac{v}{-15}$$

$v = 45\,cm$

15. Question

A converging lens of focal length 10 cm is placed at a distance of 20 cm from a screen. How far from the lens should an object be placed so as to form its real image on the screen?

Answer

$f = 10\,cm$

$u = -20\,cm$

$v = +v$ (since image is real)

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-20} = \frac{1}{10}$

$\frac{1}{v} = \frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$

$v = 20\,cm$

16. Question

An object 10 cm high is held 25 cm away from a converging lens of focal length 10 cm. find the position, size and nature of the image formed. Also draw the ray diagram.

Answer

$h_1 = 10\,cm$

$u = -25\,cm$

$f = 10\,cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-25} = \frac{1}{10}$

$\frac{1}{v} = \frac{1}{10} - \frac{1}{25} = \frac{5-2}{50} = \frac{3}{50}$

$v = 16.6$

Image is 16.6 cm behind the convex lens.

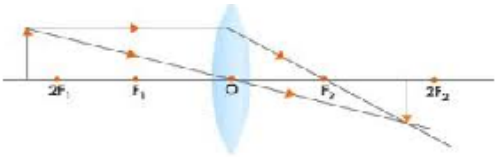
$m = \frac{v}{u} = \frac{50/3}{-25} = -\frac{2}{3}$ (Image is real and inverted)

$m = \frac{h_2}{h_1}$

$-\frac{2}{3} = \frac{h_2}{10}$

$h_2 = \frac{-20}{3} = -6.33\,cm$

Image is 6.33 cm in size and is real and inverted.



17. Question

At what distance should an object be placed from a convex lens of focal length 12 cm to obtain an image at 24 cm from it on the other side? What will be the magnification produced in this case?

Answer

$f = 1 \ \ cm$

$v = 24\,cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{24} - \frac{1}{u} = \frac{1}{1}$

$\frac{1}{u} = \frac{1}{24} - \frac{1}{12}$

$\frac{1}{u} = \frac{1-2}{24} = \frac{-1}{24}$

$u = -24$

$m = \frac{v}{u} = \frac{24}{-24} = -\ 1\ cm$

18. Question

An object 3 cm tall is placed on the axis of a convex lens of focal length 5 cm at a distance of 10 m from the optical center of the lens. Find the nature, position and size of the image formed. Which case of image formation by convex lenses is illustrated by this example?

Answer

Real and inverted;

v = + 5 cm ; The image is formed 5 cm behind the convex lens ; 0.01 cm

h_1 = 2 cm

f = 5 cm

u = –10m = –1000 cm

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-1000} = \frac{1}{5}$

$\frac{1}{v} = \frac{1}{5} = \frac{1}{1000} = \frac{200-1}{100} = \frac{199}{1000}$

v = 5.02 cm

The image is formed 5.02cm behind the convex lens and is real and inverted.

$m = \frac{v}{u} = \frac{5.02}{-1000} = -0.005$

$m = \frac{h_2}{h_1} = -0.005$

$\frac{h_2}{3} = -0.005$

$h_2 = -0.015\ cm$

Since the object distance is much greater than the focal length, this example illustrates the case when the object is placed at infinity.

19. Question

The filament of a lamp is 80 cm from a screen and a converging lens forms an image of it on a screen, magnified three times. Find the distance of the lens from the filament and the focal length of the lens.

Answer

Given:The filament of a lamp is 80 cm from a screen, T = -80 cmMagnification, m = 3

Formula used:

Magnification of the lens, m = v/uWherev is the image distance from the lensu is the object distance from the lens

$3 = \frac{v}{u}\ or\ v = 3u$ The distance of filament from the screen, T= Sum of the distance between the lens and filament(u) and the distance between the lens and the image(v)From the above statementT = u + v Putting the value in the above equation, we get80 cm = 4uobject distance, u =-20 cm

Thus, the distance of the lens from the filament = -20 cm ;The distance of the lens from the screen is 60 cm

Using the lens formula,

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ Wherev is the image distanceu is the object distancef is the focal lengthPutting the values in the above relation, we get $\frac{1}{F} = \frac{1+3}{60} = \frac{4}{60} = \frac{1}{15}$ f = + 15 cm

Thus, the focal length of the convex lens is +15 cm

20. Question

An erect image 2.0 cm high is formed 12 cm from a lens, the object being 0.5 cm high. Find the focal length of the lens.

Answer

Height of image = 2 cm

Image distance = 12 cm

Height of object= 0.5 cm

M = height of image/ height of object = 2/0.5 =- 4

M = v/u

-4 = 12/u

u =- 3 cm

using lens formula,

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

f = + 4.0 cm

21. Question

A convex lens of focal length 0.10 misused to form a magnified image of an object of height 5 m placed at a distance of 0.08 m from the lens. Calculate the position, nature and size of the image.

Answer

f = 0.10 m

m = 5 m

object distance (u) = 0.08 m

using the lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

v = - 0.40 m ;

The position of image is 0.40 m from the lens on the same side as the object

(on the left of lens);

The nature of image is virtual and erect; The size of image is 25 m.

22. Question

A convex lens of focal length 6 cm is held 4 cm from a newspaper which has print 0.5 cm high. By calculation, determine the size and nature of the image produced.

Answer

Focal length = 6 cm

Object distance = -4 cm

Height of object = 0.5 cm

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Size of the image = 1.5 cm high;

The nature of the image formed is Virtual, erect and magnified (3 times)

23. Question

Determine how far an object must be placed in front of a converging lens of focal length 15 cm in order to produce an erect (upright) image of linear magnification 4.

Answer

f = 10 cm

m = +4 (upright image)

$$m = \frac{v}{u} = 4$$

v = 4u

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{4u} - \frac{1}{u} = \frac{1}{15}$$
$$\frac{-3}{4u} = \frac{1}{15}$$
$$u = -11.25 \text{ cm}$$

The object must be placed 11.25 in front of the converging lens.

24. Question

A lens of focal length 20 cm is used to produce a ten times magnified image of a film slide on a screen. How far must the slide be placed from the lens ?

Answer

Focal length = 20 cm

M = 10 = $\frac{-v}{u}$

from above we get:-

V = -10u (From cross multiplying)

Using the lens formula,

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ Putting the values in above equation we get:-

$$\frac{1}{(-10u)} - \frac{1}{u} = \frac{1}{20}$$

$$\Rightarrow \frac{1}{u}\left(\frac{-1}{10} - \frac{1}{1}\right) = \frac{-11}{10} \times \frac{1}{u}$$

$$\Rightarrow \frac{-11}{10u} = \frac{1}{20}$$

Hence the slide should be placed 220cm behind the lens

$$\Rightarrow u = -22$$

$$\therefore v = -10 \times (-22) = 220$$

the slide be placed 220 cm behind the lens

25. Question

An object placed 4 cm in front of a converging lens produces a real image 12 cm from the lens.

(a) What is the magnification of the image?

(b) What is the focal length of the lens?

(c) Draw a ray diagram to show the formation of

Image. Mark clearly F and 2F in the diagram.

Answer

$u = -4\,cm$

$v = 12\,cm$ (Real image)

(a) $m = \frac{v}{u} = \frac{12}{-4} = -3$

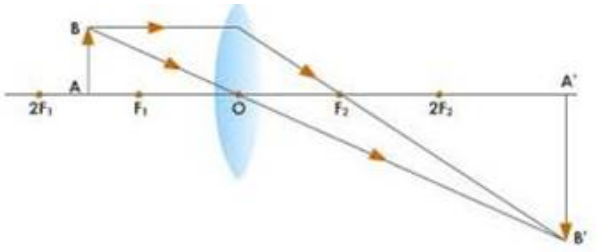
(b) Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{12} - \frac{1}{-4} = \frac{1}{f}$

$\frac{1+3}{12} = \frac{1}{f}$

$f = 3\,cm$

(c)



Long Answer Type Questions-Pg-247

26 A. Question

An object 2 cm tall stands on the principal axis of a converging lens of focal length 8 cm. Find the position, nature and size of the image formed if the object is:

(i) 12 cm from the lens

(ii) 6 cm from the lens

Answer

Height of object = 2 cm

Focal length = 8 cm

(i) Object distance (u)=12 cm

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance (v) = + 24 cm

; The image is 24 cm behind the lens ; The nature of the image formed is Real and inverted ;

Height of image = 4 cm

(ii) Object distance (u)= 6 cm

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance (v) = - 24 cm ; The image is 24 cm in front of the lens ; The nature of the image formed is Virtual and erect ;

Height of image = 8 cm

26 B. Question

State one practical application each of the use of such a lens with the object in position (i) and (ii).

Answer

(i) practical application of the use of such a lens with the object in position (i) is film projector

(ii) practical application of the use of such a lens with the object in position (i) is Used as a magnifying glass

27 A. Question

An object 3 cm high is placed 24 cm away from a convex lens of focal length 8 cm. Find by calculations, the position, height and nature of the image.

Answer

Height of object = 3 cm

Object distance = -24 cm

Using lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance (v) = + 12 cm ; The image is formed 12 cm behind the lens; 1.5 cm high; The nature of the image is Real and inverted

27 B. Question

If the object is moved to a point only 3 cm away from the lens, what are the new position, height and nature of the image?

Answer

Height of object = 3 cm

Object distance = -3 cm

Using lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance (v) =- 4.8 cm; The image is formed 4.8 cm in front of the lens (on its left side); 4.8 cm high ; The nature of the image is Virtual and erect

27 C. Question

Which of the above two cases illustrates the working of a magnifying glass?

Answer

Case b illustrates the working of a magnifying glass.

28 A. Question

Find the nature, position and magnification of the images formed by a convex lens of focal length 0.20 m if the object is placed at a distance of :

(i) 0.50 m (ii) 0.25 m (iii) 0.15 m

Answer

focal length = 0.20 m

(i) Object distance = 0.50 m

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance, v = + 0.33 m ; The image is formed 0.33 m behind the lens ; m = - 0.66 ; Real and inverted

(ii) Object distance = 0.25 m

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance, v = + 1.00 m ; The image is formed 1.00 m behind the lens ; m = - 4.0 ; Real and inverted

(iii) Object distance = 0.15 m

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Image distance, v = - 0.60 m ; The image is formed 0.60 m in front of the lens ; m = + 4.0; Virtual and erect

28 B. Question

Which of the above cases represents the use of convex lens in a film projector, in a camera, and as a magnifying glass?

Answer

the case that represents the use of convex lens in a film projector is (ii), in a camera is (i), and as a magnifying glass is (iii)

Multiple Choice Questions (MCQs)-Pg-247

29. Question

A spherical mirror and a spherical lens each have a focal length of, -15 cm. The mirror and the lens are likely to be:

A. Both concave.

B. Both convex.

C. The mirror is concave but the lens is convex.

D. The mirror is convex but the lens is concave.

Answer

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

Mirror formula is

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

30. Question

Linear magnification produced by a convex lens can be:

A. Less than 1 or more than 1

B. Less than 1 or equal to 1

C. More than 1 or equal to 1

D. Less than 1, equal to 1 or more than 1

Answer

$$m = \frac{h}{h'}$$

Where h' = size of the image
h = size of the object.

31. Question

Magnification produced by a concave lens is always:

A. More than 1

B. Equal to 1

C. Less than 1

D. More than 1 or less than 1

Answer

Magnification produce by concave mirror is less than 1 in two cases. As we know magnification is the enlargement of the object in form of image. And if the magnification is less then 1 then it is diminished. Also when object is placed at infinity or beyond centere of curvature then diminished image formed. That's why is concave mirror there r two cases when magnification is less than 1

32. Question

In order to obtain a magnification of, -3 (minus 3) with a convex lens, the object should be placed:

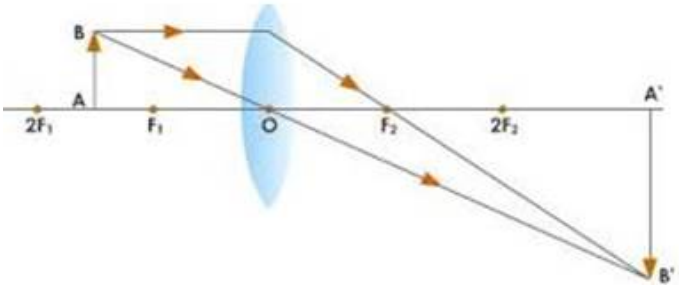
A. Between optical center and F

B. Between F and 2F

C. At 2F

D. Beyond 2F

Answer



33. Question

A convex lens produces a magnification of +5. The object is placed;

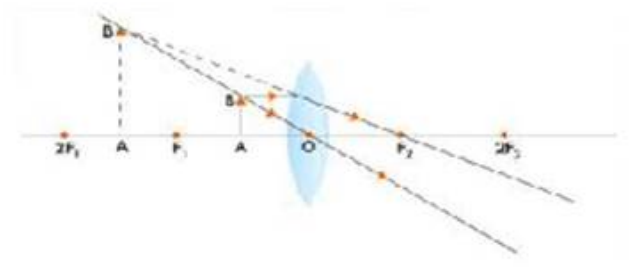
A. At focus

B. Between ƒ and 2f

C. At Less than ƒ

D. Beyond 2 ƒ

Answer



34. Question

If a Magnification of, -1 (minus 1) is obtained by using a converging lens, and then the object has to be placed:

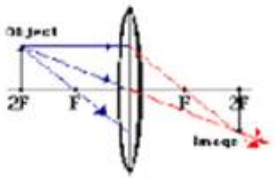
A. Within ƒ

B. At 2 ƒ

C. Beyond 2 ƒ

D. At infinity

Answer



35. Question

To obtain a magnification of, -0.5 with a convex lens, the object should be placed:

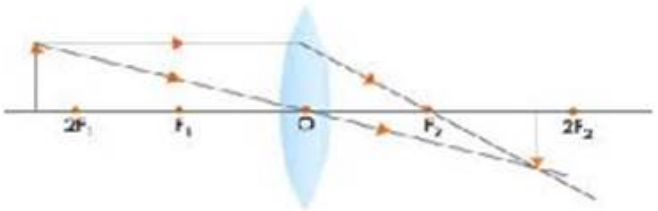
A. At F

B. Between Optical centre and F

C. Between F and 2F

D. Beyond 2F

Answer



36. Question

An object is 0.09 m from a magnification lens and the image is formed 36 cm from the lens the magnification produced is:

A. 0.4

B. 1.4

C. 4.0

D. 4.5

Answer

Object distance = 0.09 m

image distance = 36 cm

m = v/u

37. Question

To obtain a magnification of, -2 with a convex lens of focal length 10 cm, the object should be placed:

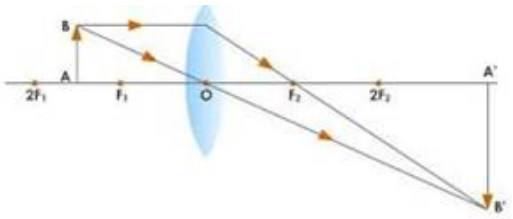
A. Between 5 cm and 10 cm

B. Between 10 cm and 20 cm

C. At 20 cm

D. Beyond 20 cm

Answer



38. Question

A convex lens of focal length 15 cm produces a magnification of +4. The object is placed:

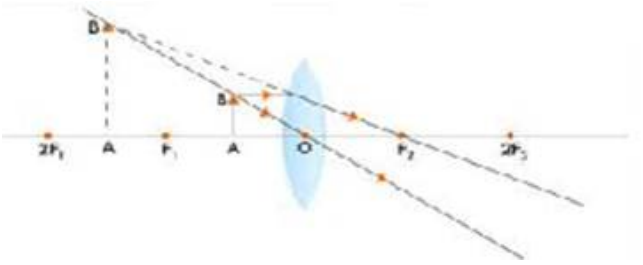
A. At a distance of 15 cm

B. Between 15 cm and 30 cm

C. At less than 15 cm

D. Beyond 30 cm

Answer



39. Question

If a magnification of, -1 is to be obtained by using converging lens of focal length 12 cm, and then the object must be placed:

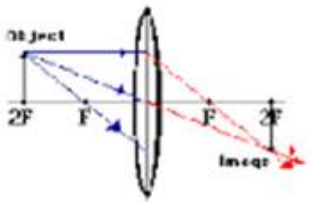
A. Within 12 cm

B. At 24 cm

C. T 6 cm

D. Beyond 24 cm

Answer



40. Question

In order to obtain a magnification of, -0.75 with a convex lens of focal length 8 cm, the object should be placed:

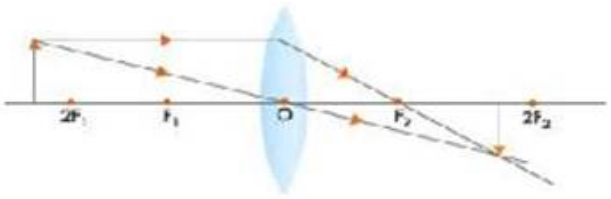
A. At less than 8 cm

B. Between 8 cm and 16 cm

C. Beyond 16 cm

D. At 16 cm

Answer



Questions Based on High Order Thinking Skills (HOTS)-Pg-248

41. Question

A student did an experiment with a convex lens. He put an object at different distances 25 cm, 30 cm, 40 cm, 60 cm and 120 cm from the lens. In each case he measured the distanced the distance of the image from the lens. His results were 100 cm, 24 cm, 60 cm, 30 cm and 40 cm, respectively. Unfortunately his results are written in wrong order.

(a) Rewrite the image distance in the correct order.

(b) What would be the image distance if the object distance was 90 cm?

(c) Which of the object distances gives the biggest image?

(d) What of the focal length of this lens?

Answer

(a) The image distance in correct order is

100 cm; 60 cm; 40 cm; 30 cm; 24 cm

(b) When u=-25 cm, v=100 cm

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{100}-\frac{1}{-25}=\frac{1}{f}$$

$$\frac{1}{f}=\frac{5}{100}$$

$$f=20\,cm$$

When u=-90 cm, v=?

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{v}-\frac{1}{-90}=\frac{1}{20}$$

$$\frac{1}{v}=\frac{1}{20}-\frac{1}{90}$$

$$\frac{1}{v}=\frac{7}{180}$$

$$v=25.7\,cm$$

(c) The object distance that gives the biggest image is

25 cm

(d) The focal length of this lens is

20 cm

42. Question

A magnifying lens has a focal length of 100 mm. An object whose size is 16 mm is placed at some distance from the lens so that an image is formed at a distance of 30 cm in front of the lens.

(a) What is the distance between the object and the lens?

(b) Where should the object is placed if the image is to form at infinity?

Answer

$f = 100\,mm$

$h_1 = 16\,mm$

$v = -30\,cm = -300\,cm$

(a) $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

$$\frac{1}{-300}-\frac{1}{u}=\frac{1}{100}$$

$$\frac{1}{u}=\frac{4}{300}$$

$u = 75\,cm$

Distance between object and lens is **75 cm**

(b) The object should be placed at the focus so that the image is formed at infinity.

So, u = -100 mm = -10 cm

The object should be placed 10 cm in front of the lens.

43. Question

A lens forms a real image 3 cm high of an object 1 cm high. If the separation of object and image is 15 cm, find the focal length of the lens.

Answer

$h_2 = -3\,cm$ (Real image)

$h_1 = 1\,cm$

Since, the separation of object and image is 15 cm

$-u + v = 15\,cm$

Magnification,

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

Putting the values of v, h2 , h1 in the above formula,

$$\frac{15+u}{u} = \frac{-3}{1}$$

$15 + u = -3u$

$u = -3.75\,cm$

$v = 15 + u = 15 + (-3.75) = 11.25\,cm$

UUsing len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{11.25} - \frac{1}{-3.75} = \frac{1}{f}$$

$f = 2.82\,cm$

44. Question

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

Answer

$h_1 = 50\,cm$

$h_2 = -20\,cm$ (Real image)

$v = 10\,cm$

Magnification,

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

Putting the values of v , h2 and h1

$$\frac{10}{u} = \frac{-20}{50}$$

$u = -25\,cm$

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{10} - \frac{1}{-25} = \frac{1}{f}$$

$$f = \frac{50}{7} = 7.14\,cm$$

Very Short Answer Type Questions-Pg-251

1. Question

If the image formed by a lens is always diminished and erect, what is the nature of the lens?

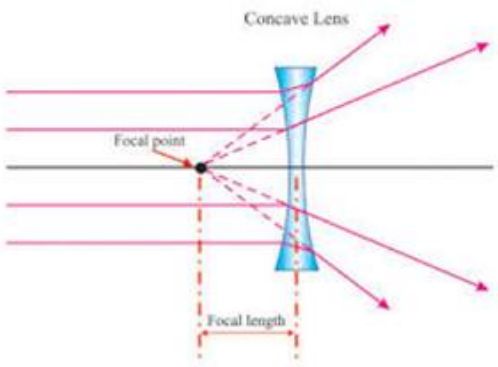
Answer

If the image formed by a lens is always diminished and erect, the nature of the lens is Concave lens.

2. Question

Copy and complete the diagram below to show what happens to the rays of light when they pass through the concave lens:

Answer



3. Question

Which type of lenses is?

(a) Thinner in the middle than at the edges?

(B) Thicker in the middle than at the edges?

Answer

(a) Concave lenses is Thinner in the middle than at the edges.

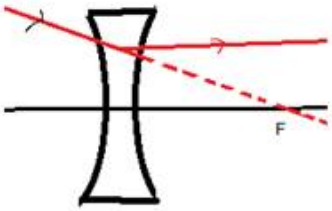
(b) Convex lenses is Thicker in the middle than at the edges.

4. Question

A ray of light is going towards the focus of a concave lens. Draw a ray diagram to show the path of this ray of light after refraction through the lens.

Answer

ray of light is going towards the focus of a concave lens. The ray diagram to show the path of this ray of light after refraction through the lens is as shown



5 A. Question

What type of images can a convex lens make?

Answer

Real and Virtual

5 B. Question

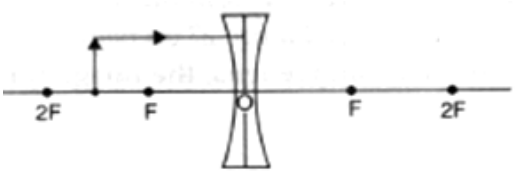
What type of image is always made by a concave lens?

Answer

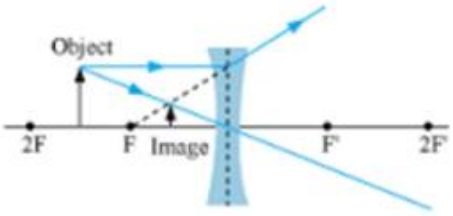
Virtual

6. Question

Take down this figure into your answer book and complete the path of the ray



Answer



7. Question

Fill in the following blanks with suitable words:

(a) A _____ lens converges rays of light, whereas a ___ lens diverges rays of light.

(b) Lenses refract light to form images: a _____ lens can form _____ images, but a diverging lens forms only _____ images.

Answer

(a) convex; concave

(b) both real and virtual; virtual

8. Question

Things always look small on viewing through a lens. What is the nature of the lens?

Answer

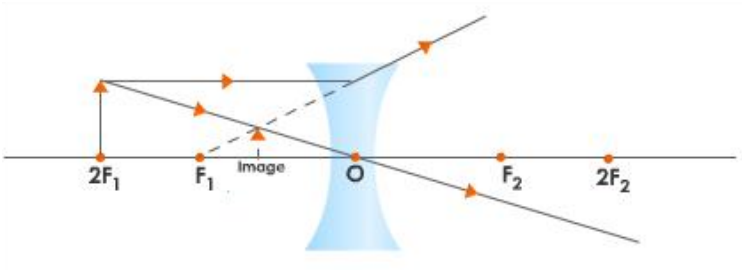
Things always look small on viewing through Concave lens

Short Answer Type Questions-Pg-252

9. Question

An object lies at a distance of 2f from a concave lens of focal length f. Draw a ray-diagram to illustrate the image formation.

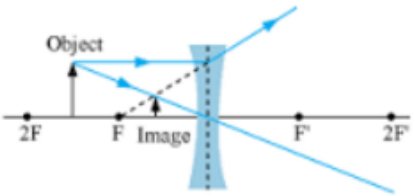
Answer



10. Question

Show by drawing a ray-diagram that the image of an object formed by a concave lens is virtual, erect and diminished.

Answer



11. Question

Give the position, size and nature of image formed by a concave lens when the object is placed:

(a) Anywhere between optical center and infinity.

(b) At infinity.

Answer

(a) the position, size and nature of image formed by a concave lens when the object is placed placed anywhere between optical centre and infinity, is between optical centre and focus. It is diminished, virtual and erect.

(b) the position, size and nature of image formed by a concave lens when the object is placed at infinity, is at focus. It is highly diminished, virtual and erect.

12. Question

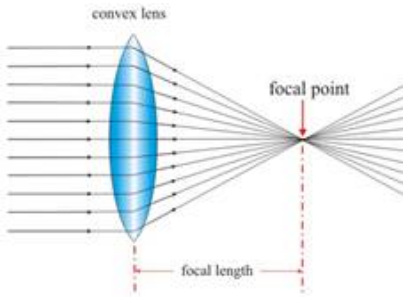
Which type of lens is?

(a) A converging lens, and which is

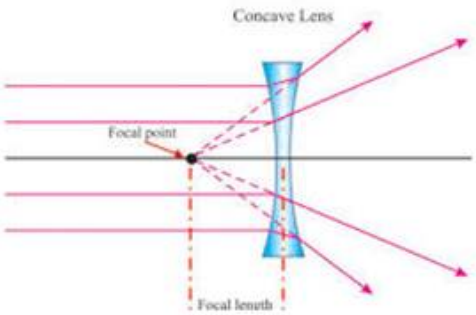
(b) A diverging lens? Explain your answer with diagrams.

Answer

(a) A convex lens is a converging lens because it converges a parallel beam of light rays passing through it at its focus.



b) A concave lens is a diverging lens because it diverges the parallel beam of rays passing through it.

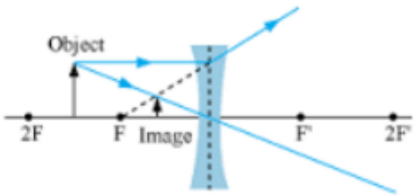


13. Question

With the help of a diagram, explain why the image of an object viewed through a concave lens appears smaller and closer than the object.

Answer

the image of an object viewed through a concave lens appears smaller and closer than the object As shown by the diagram,



14. Question

How would a pencil look like if you saw it through?

(a) A concave lens, and

(b) A convex lens? (Assume the pencil is close to the lens). Is the image real or virtual?

Answer

(a) a pencil will look Smaller if we saw it through a concave lens.

(b) a pencil will look Bigger if we saw it through a convex lens; The image formed is Virtual

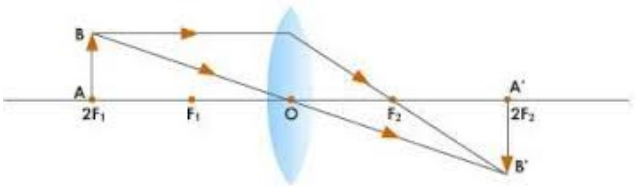
Long Answer Type Questions-Pg-252

15 A. Question

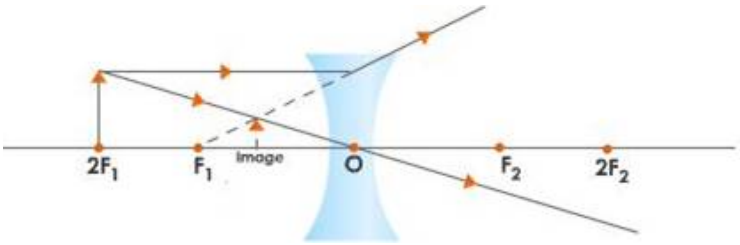
An object is placed 10 cm from a lens of focal length 5 cm. Draw the ray diagrams to show the formation of image if the lens is (i) converging, and (ii) diverging.

Answer

(i) the ray diagrams to show the formation of image if the lens is converging



(ii) the ray diagrams to show the formation of image if the lens is diverging



15 B. Question

State one practical use each of convex mirror, concave mirror, convex lens and concave lens.

Answer

One practical use each of convex mirror, concave mirror, convex lens and concave lens is

Use of convex mirror: As rear-view mirror in vehicles

Use of concave mirror: As shaving mirrors

Use of convex lens: For making simple camera

Use of concave lens: As eye-lens in Galilean telescope

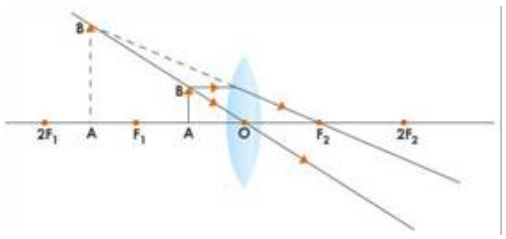
16 A. Question

Construct ray diagrams to illustrate the formation of a virtual image using (i) a converging lens, and

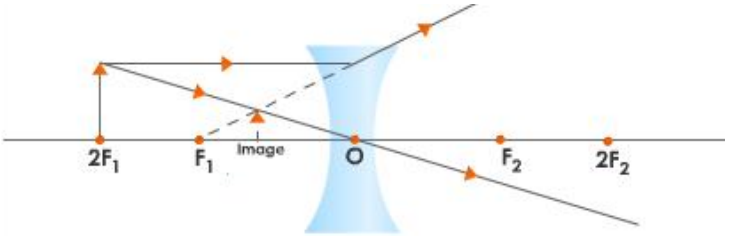
(ii) A diverging lens.

Answer

(i) Formation of virtual image using a converging lens:



(ii) Formation of virtual image using a diverging lens:



16 B. Question

What is the difference between the two images formed above?

Answer

The virtual image formed by a converging lens is magnified whereas that formed by a diverging lens is diminished

Multiple Choice Questions (MCQs)-Pg-252

17. Question

A diverging lens is used in:

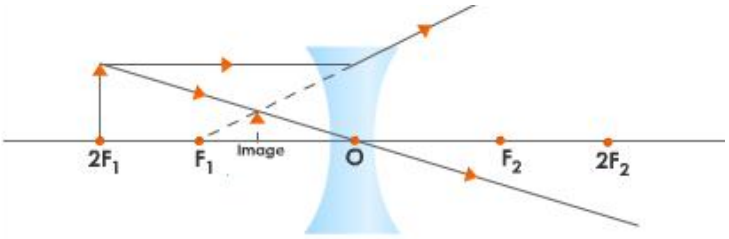
A. A magnifying glass

B. A car to see objects on rear side

C. Spectacles for the correction of short sight

D. A simple camera

Answer



18. Question

When an object is kept at any distance in front of a concave lens, the image foiled is always:

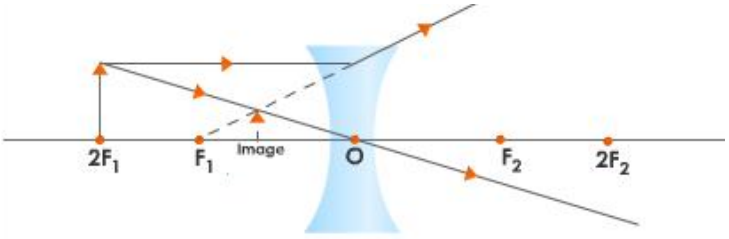
A. Virtual, erect and magnified

B. Virtual inverted and diminished.

C. Virtual, erect and diminished

D. Virtual, erect and same size as object

Answer



19. Question

When sunlight is concentrated on a piece of paper by a spherical mirror or lens, then a hole can be burnt in it. For doing this, the paper must be placed at the focus of:

A. Either a convex mirror or convex lens

B. either a concave mirror or concave lens

C. Either a concave mirror or convex lens

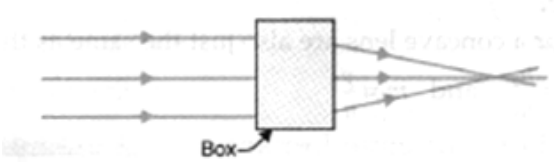
D. Either a convex mirror or concave lens

Answer

When sunlight is concentrated on a piece of paper by a spherical mirror or lens, then a hole can be burnt in it. For doing this, the paper must be placed at the focus of Concave mirror or convex lens.

20. Question

A beam of parallel light rays is incident through the holes on one side of a box and emerges out through the holes on its opposite side as shown in the diagram below:



Which of the following could be inside the box?

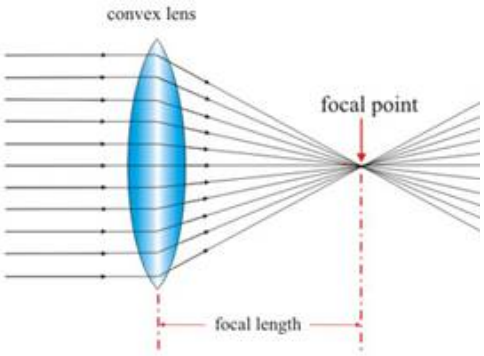
A. A rectangular glass block

B. A concave lens

C. A convex lens

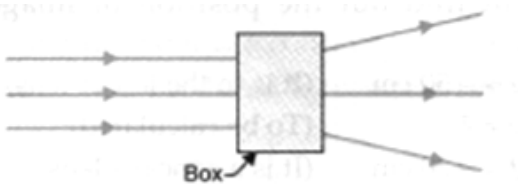
D. A glass prism

Answer



21. Question

A beam of light is incident through the holes on one side of a box and emerges out through the holes on its opposite side as shown in the following figure:



The box contains:

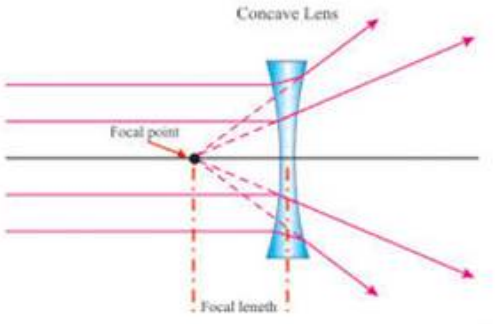
A. A glass prism

B. A concave lens

C. A convex lens

D. A parallel-sided glass slab

Answer



22. Question

Which of the following can form a virtual image which is always smaller than the object?

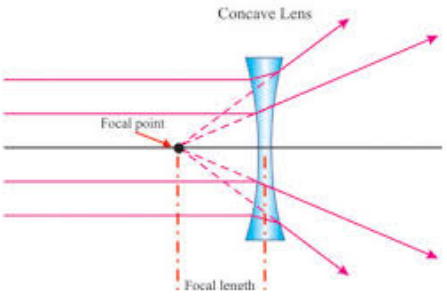
A. A plane mirror

B. a convex lens

C. A concave lens

D. a concave mirror

Answer



Questions Based on High Order Thinking Skills (HOTS)-Pg-253

23. Question

When an object is placed 20 cm in front of lens A, the image is real, inverted, magnified and formed at a great distance. When the same object is placed 20 cm in front of lens B, the image formed is real, inverted and same size as the object.

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

(b) What is the focal length of lens B?

(c) What is the nature of lens A?

(d) What is the nature of lens B?

Answer

(a) The object is placed at focus, so f=20 cm of lens A.

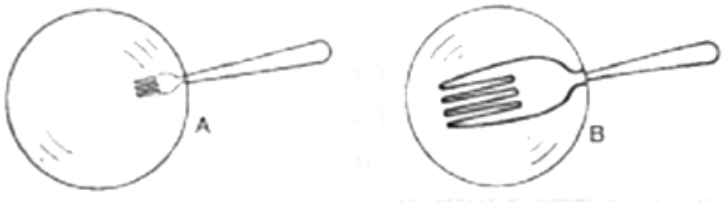
(b) the object is placed at a distance twice the focal length, so f=10 cm of lens B.

(c) the nature of lens A is Convex lens (since image is real).

(d) the nature of lens B is Convex lens (since image is real).

24. Question

When a fork is seen through lenses A and B one by one, it appears as shown in the diagrams. What is the nature of (i) lens A, and (ii) lens B? Give reason for your answer.



Answer

(i) The nature of lens A is Concave lens as image appears diminished.

(ii) The nature of lens B is Convex lens as image appears enlarged.

25. Question

What kind of lens can form?

(a) An inverted magnified image?

(b) An erect magnified image?

(c) An inverted diminished image?

(d) An erect diminished image?

Answer

(a) Convex lens can form An inverted magnified image.

(b) Convex lens can form An erect magnified image.

(c) Convex lens can form An inverted diminished image.

(d) Concave lens can form An erect diminished image.

Very Short Answer Type Questions-Pg-255

1. Question

The lens A produces a magnification of, - 0.6 whereas lens B produces a magnification of + 0.6.

(a) What is the nature of lens A?

(b) What is the nature of lens B?

Answer

(a) the nature of lens A is Convex lens

(b) the nature of lens B is Concave lens

2. Question

A 50 cm tall object is at a very large distance from a diverging lens. A virtual, erect and diminished image of the object is formed at a distance of 30 cm in front of the lens. How much is the focal length of the lens?

Answer

When an object is placed at a very large distance from a diverging lens, then image is formed at the focus of the lens.

Therefore, the focal length of the lens is 30 cm.

Short Answer Type Questions-Pg-256

3. Question

An object is placed at a distance of 4 cm from a concave lens of focal length 8 cm. Find the position and nature of the image.

Answer

$u = -4\,cm$

$f = -8\,cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-4} = \frac{1}{-8}$

$\frac{1}{v} = -\frac{1}{8} - \frac{1}{4}$

$\frac{1}{v} = \frac{-3}{8}$

$v = -8/3\,cm$

Image is formed 2.67cm front of the concave lens.

Image is virtual and erect.

4. Question

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

Answer

$f = -15\,cm$

$v = -10\,cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

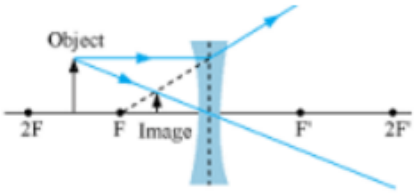
$\frac{1}{-10} - \frac{1}{u} = \frac{1}{-15}$

$\frac{1}{u} = -\frac{1}{10} + \frac{1}{15}$

$\frac{1}{u} = \frac{-2}{60}$

$u = -30\,cm$

Object is at 30 cm from the concave lens (on left side).



Here object distance = 30 cm

Focal length = 15 cm

Image distance = 10 cm

5. Question

An object 60 cm from a lens gives a virtual image at a distance of 20 cm in front of the lens. What is the focal length of the lens? Is the lens converging or diverging? Give reasons for your answer.

Answer

u = -60 cm

v = -20 cm

Using lens formula on solving, we get

Focal length = -30 cm

The lens is diverging as the focal length is negative.

6. Question

A concave lens of 20 cm focal length has an object kept at a distance of 60 cm in front of the mirror. Compute the image distance.

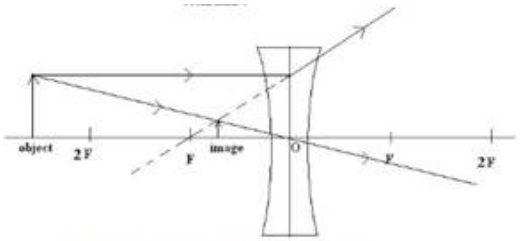
Answer

Focal length, f = -20 cm

Object distance, u = -60cm

Using lens formula,

Image distance = -15 cm



7. Question

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

Answer

$f = -20\ cm$

$v = -10\ cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{-10} - \frac{1}{u} = \frac{1}{-20}$$

$$\frac{1}{u} = -\frac{1}{10} + \frac{1}{20}$$

$$\frac{1}{u} = \frac{-1}{20}$$

$u = -20\ cm$

8. Question

Calculate the image distance for an object of height 12 mm at a distance of 0.20 m from a concave lens of focal length 0.30 m?

Answer

$h_1 = 12\,mm = 0.012\,m$

$u = -0.20\,m$

$f = -0.30\,m$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} - \frac{1}{-0.20} = \frac{1}{-0.30}$$

$$\frac{1}{v} = \frac{-1}{0.30} - \frac{1}{0.20}$$

$v = -0.12\,m$

Image is virtual and erect.

9. Question

A concave lens has a focal length of 20 cm. At what distance from the lens a 5 cm tall object is placed so that it forms an image at 10 cm from the lens? Also calculate the size of the image formed.

Answer

$f = -20\,cm$

$h_1 = 5\,cm$

$v = -15\,cm$ (Concave lens forms virtual image)

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-10} - \frac{1}{u} = \frac{1}{-20}$$

$$\frac{1}{u} = -\frac{1}{10} + \frac{1}{20}$$

$$\frac{1}{u} = \frac{-1}{20}$$

$u = -20\,cm$

Object should be placed 60 cm to the left of the lens.

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

$$\frac{-15\,cm}{-20cm} = \frac{h_2}{5}$$

$h_2 = 3.75\,cm$

Image formed is $3.75\,cm$ high.

10. Question

An object is placed 20 cm from

(a) A converging lens, and

(b) A diverging lens, of focal length 15 cm. Calculate the image position and magnification in each case.

Answer

$u = -20\,cm$

(a) f=15 cm (for converging lens)

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$v = 60\,cm$

Magnification,

$$m = \frac{v}{u} = \frac{60}{-20} = -3$$

(b) f=-15 cm (for diverging lens)

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$v = -8.57\,cm$

Magnification,

$$m = \frac{-v}{u} = \frac{-8.57}{-20} = +0.42$$

11. Question

A 2.0 cm tall object is placed 40 cm from a diverging lens of focal length 15 cm. Find the position and size of the image.

Answer

$h_1 = 2\,cm$

$u = -40\,cm$

$f = -15\,cm$

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$v = -10.90\,cm$

Magnification,

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

Putting the value,

$$\frac{-10.90}{-40} = \frac{h_2}{2}$$

$h_2 = 0.54\,cm$

Long Answer Type Questions-Pg-256

12. Question

Find the position and size of the virtual image formed when an object 2 cm tall is placed 20 cm from:

(i) a diverging lens of focal length 40 cm.

(ii) A converging lens of focal length 40 cm.

Answer

$h_1 = 2cm$

$u = -20cm$

(i) f=-40cm (Diverging lens)

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$v = -13.33cm$$

Magnification,

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

$$\frac{-13.33}{-20} = \frac{h_2}{2}$$

$$h_2 = 1.33cm$$

(ii) f=40 cm (Diverging lens)

Using Len's formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$v = -40cm$$

Magnification,

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

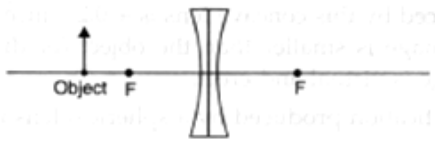
$$\frac{-40}{-20} = \frac{h_2}{2}$$

$$h_2 = 4cm$$

13 A. Question

A small object is placed 150 mm away from a diverging lens of focal length 100 mm.

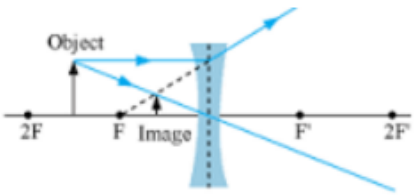
(i) Copy the figure below and draw rays to show how an image is formed by the lens.



(ii) Calculate the distance of the image from the lens by using the lens formula.

Answer

(i)



(ii) object distance =150 mm

Focal length = 100mm

Using len's formula,

Image distance, v =- 60 mm

13 B. Question

The diverging lens in part (a) is replaced by a converging lens also of focal length 100 mm. The object remains in the same position and an image is formed by the converging lens. Compare two properties of this image with those of the image formed by the diverging lens in part (a).

Answer

focal length = 100mm

Using len's formula,

v = + 300 mm;

The image formed by converging lens is real, inverted and magnified (2 times). It is formed behind the converging lens. On the other hand, the image formed by diverging lens is virtual, erect and diminished. It is formed in front of the diverging lens.

Multiple Choice Questions (MCQs)-Pg-256

14. Question

A concave lens produces an image 20 cm from the lens of an object placed 30 cm from the lens. The focal length of the lens is:

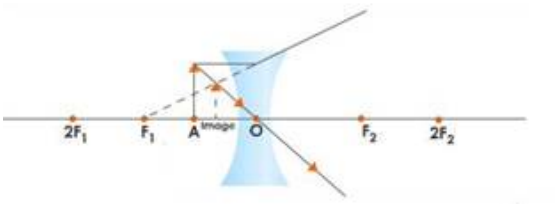
A. 50 cm

B. 40 cm

C. 60 cm

D. 30 cm

Answer



15. Question

Only one of the following applies to a concave lens. This is:

A. Focal length is positive

B. Image distance can be positive or negative

C. Height of image can be positive or negative

D. Image distance is always negative

Answer

Image is always formed in front of the mirror thus can not be negative.

16. Question

The magnification produced by a spherical mirror and a spherical lens is + 0.8.

A. The mirror and lens are both convex

B. The mirror and lens are both concave

C. The mirror is concave but the lens is convex

D. The mirror is convex but the lens is concave

Answer

Concave lens and convex mirror forms a virtual and erect image.

17. Question

The magnification produced by a spherical lens and a spherical mirror is+ 2.0.

A. The lens and mirror are both concave

B. The lens and mirror are both convex

C. The lens is convex but the mirror is concave

D. The lens is concave but the mirror is convex

Answer

Magnification of a convex and concave mirror is always positive.

Questions Based on High Order Thinking Skills (HOTS)-Pg-257

18. Question

A camera fitted with a lens of focal length 50 mm is being used to photograph a flower that is 5 cm in diameter. The flower is placed 20 cm in front of the camera lens.

(a) At what distance from the film should the lens be adjusted to obtain a sharp image of the flower?

(b) What would be the diameter of the image of the flower on the film?

(c) What is the nature of camera lens?

Answer

(a) focal length, f = 50mm

object distance, u = -20 cm

Using len's formula,

Image distance, v = + 6.66 cm ;

The film should be at a distance of 6.66 cm behind the camera lens

(b) the diameter of the image of the flower on the film is 1.66 cm

(c) the nature of camera lens is Convex lens

19. Question

An object is 2m from a lens which forms an erect image half (exactly) the size of the object. Determine the focal length of the lens. What type of lens is this?

Answer

$u = -2\,m$

$m = +\frac{1}{2}$ (Erect image)

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

$\frac{1}{2} = \frac{v}{-2}$

$v = -1\,m$

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{-1} - \frac{1}{-2} = \frac{1}{f}$

$f = -0.5 \quad m = -50 \quad cm$

It is a concave lens.

20. Question

An image formed on a screen is three times the size of the. Object. The object and screen are 80 cm apart when the image is sharply focused.

(a) State which type of lens is used.

(b) Calculate focal length of the lens.

Answer

(a) Since the image is formed on a screen, it must be a real image.

Hence, the lens should be a convex lens.

(b) m=-3 (Real and inverted image)

$-u+v=80cm$

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

$-3 = \frac{80+u}{u}$

$-3u = 80+u$

$u = -20cm$

$v = 80+u = 80+(-20) = 60cm$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

On putting the value of v and u, we get

$f = +15cm$

Very Short Answer Type Questions-Pg-261

1. Question

The lens A has a focal length of 25 cm whereas another lens B has a focal length of 60 cm. Giving reason state, which lens has more power : A or B.

Answer

Focal length of lens A = 25cm

Focal length of lens B = 60cm

Thus, Lens A has more power and It has shorter focal length

2. Question

Which causes more bending (or more refraction) of light rays passing through it : a convex lens of long focal length or a convex lens of short focal length ?

Answer

Convex lens of short focal length causes more bending (or more refraction) of light rays passing through it.

3. Question

Name the physical quantity whose unit is dioptre.

Answer

Power of a lens has unit as dioptre.

4. Question

Define 1 dioptre power of a lens.

Answer

1 diopter is the power of a lens whose focal length is 1 metre.

5. Question

Which type of lens has (a) a positive power, and (b) a negative power ?

Answer

a) Convex lens has Positive power.

b) Concave lens has Negative power.

6. Question

Which of the two has a greater power: a lens of short focal length or a lens of large focal length ?

Answer

Lens of short focal length has a greater power

7. Question

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

Answer

Power of lens is reciprocal of its focal length in metres.

P = 1/f

8. Question

Which has more power : a thick convex lens or a thin convex lens, made of the same glass ? Give reason for your choice.

Answer

Thick convex lens has more power as It has shorter focal length

9. Question

The focal length of a convex lens is 50 cm. What is its power ?

Answer

focal length = 50 cm = 0.50 m

P = 1/f = 1/0.50 = +2 D

10. Question

What is the power of a convex lens of focal length 0.25 m ?

Answer

f = 0.25 m

P = 1/f = 1/0.25 = +4 D

11. Question

A converging lens has a focal length of 50 mm. What is the power of the lens ?

Answer

focal length = 50 mm = 0.05 m

P = 1/f

= 1/0.05

= +20 D

Power is 20 Dioptre.

12. Question

What is the power of a convex lens whole focal length is 80 cm ?

Answer

Focal length = 80 cm = 0.8 m

P = 1/f

= 1/0.8

= +1.25 D

Power is +1.25 Dioptre.

13. Question

A diverging lens has a focal length of 3 cm. Calculate the power.

Answer

Here, f = -3 cm = -0.03 m (Diverging lens)

P = 1/f

= 1/(-0.03)

= -33.33 D

Power of the diverging lens is -33.33 Dioptre.

14. Question

The power of a lens is + 0.2 D. Calculate its focal length.

Answer

P = +0.2 D

P = 1/f

f = 1/P = 1/0.2 = +5 m

Focal length = 5m

15. Question

The power of a lens is, - 2 D. What is its focal length ?

Answer

Power of a lens = -2 D

P = 1/f

f = 1/P = 1/(-2) = -0.5 m = -50 cm

Focal length is -50 cm.

16. Question

What is the nature of a lens having a power of + 0.5 D ?

Answer

nature of a lens having a power of + 0.5 D is Convex lens

17. Question

What is the nature of a lens whose power is,- 4 D?

Answer

the nature of a lens whose power is,- 4 D is Concave lens

18. Question

The optician's prescription for a spectacle lens is marked+ 0.5 D. What is the: (a) nature of spectacle lens?

(b) focal length of spectacle lens ?

Answer

(a) nature of spectacle lens is Convex lens

(b) Power of a lens = +0.5 D

P = 1/f

f = 1/P = 1/(+0.5) = +2 m

Focal length is 2 m.

19. Question

A doctor has prescribed a corrective lens of power, -2 D. Find the focal length of the lens. Is the prescribed lens diverging or converging ?

Answer

P = -2 D

P = 1/f

f = 1/P = 1/(-2) = -0.5 m = -50 cm

Since focal length is negative, it is a diverging lens.

20. Question

A lens has a focal length of, 10 cm. What is the power of the lens and what is its nature ?

Answer

f = 10 cm = 0.1 m

P = 1/f = 1/(0.1) = 10 D

It is a convex lens.

21. Question

The focal length of a lens is +150 mm. What kind of lens is it and what is its power ?

Answer

f = 150 mm = 0.15 m

P = 1/f = 1/0.15 = +6.6.D

kind of lens is Convex lens ; its power is + 6.6 D

22. Question

Fill in the following blanks with suitable words :

(a) The reciprocal of the focal length in ___ gives you the power of the lens, which is measured in.....

(b) For ____ lenses, the power is positive while for diverging lenses, the power is negative

Answer

(a) metres; dioptres

(b) converging, diverging

Short Answer Type Questions-Pg-262

23. Question

An object of height 4 cm is placed at a distance of 1S cm in front of a concave lens of power, -10 dioptres. Find the size of the image.

Answer

$h = 4cm$

$u = -15cm$

$P = -10D$

$P = \frac{1}{f}$

$f = \frac{1}{P}$

$= -10\,cm$

Using Lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$v = -6\,cm$

Magnification, $m = \frac{h'}{h} = \frac{v}{u}$

$\frac{h'}{4} = \frac{-6}{-15}$

$h' = 1.6\,cm$

24. Question

An object of height 4.2S mm is placed at a distance of 10 cm from a convex lens of power +S D. Find (i) foe length of the lens, and (ii) size of the image.

Answer

$$h = 4.25\,mm = 42.5\,cm$$

$$u = -10cm$$

(i) $P=\frac{1}{f}$

$$f = \frac{1}{P} = \frac{1}{5} = 0.2\,m = 20\,cm$$

(ii) Uisng len's formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$v = -20\,cm$$

Magnification,

$$m = \frac{h'}{h} = \frac{v}{u}$$

$$\Rightarrow \frac{h'}{42.5} = \frac{-20}{-10}$$

$$h' = 85\,cm = 8.5\,mm$$

25. Question

A convex lens of power S D and a concave lens of power 7.5 D are placed in contact with each other. What is the:

(a) power of this combination of lenses?

(b) focal length of this combination of lenses ?

Answer

Power of convex lens = 5 D

Power of concave lens = -7.5 D

(a) Power of the combination of the lens = P1+ P2 = 5 – 7.5= -2.5 D

(b) P = 1/f

f = 1/P = 1/ -2.5 = -40 cm

26. Question

A convex lens of focal length 2S cm and a concave lens of focal length 10 cm are placed in close contact with one another.

(a) What is the power of this combination?

(b) What is the focal length of this combination?

(c) Is this combination converging or diverging ?

Answer

Focal length of convex lens= 25 cm = 0.25 m

Power = 1/f = 1/0.25 = + 4 D

Focal length of concave lens = -10 cm = -0.1 m

Power = 1/f = -1/0.1 = - 10 D

(a) Power of combination = P1+ P2 = 4 D – 10 D = -6 D

(b) f = 1/ P = 1/ -6 = -16.66 cm

(c) This combination is Diverging

27. Question

The power of a combination of two lenses X and Y is S D. If the focal length of lens X be 1S cm :

(a) calculate the focal length of lens Y.

(b) state the nature of lens Y.

Answer

Power of combination = 5 D

Focal length of X = 15 cm= 0.15 m

Power of X = 1/ 0.15 = 6.67 D

(a) Power of Y = 5 – 6.67 = -1.67 D

f = 1/P = - 60 cm

(b) Nature of lens is Concave lens

28. Question

Two lenses A and B have focal lengths of+ 20 cm and, -10 cm, respectively.

(a) What is the nature of lens A and lens B?

(b) What is the power of lens A and lens B?

(c) What is the power of combination if lenses A and B are held close together?

Answer

Focal length of lens A = +20 cm = 0.20m

Power of lens A = 1/f = 1/0.20 = +5D

Focal length of lens B = - 10 cm = -0.1 m

Power of lens B = 1/f = 1/-0.1 = -10 D

(a) Lens A is convex and Lens B is concave

(b) Power of lens A = + 5 D; Power of lens B = -10 D

(c) power of combination = P1+ P2 = 5 D -10D = -5D

Long Answer Type Questions-Pg-262

29 A. Question

What do you understand by the power of a lens ? Name one factor on which the power of a lens depend.

Answer

Power of lens is reciprocal of its focal length in metres.

P = 1/f

It depends on the focal length of the lens.

29 B. Question

What is the unit of power of a lens? Define the unit of power of a lens.

Answer

Unit of lens is dioptre (D)

29 C. Question

A combination of lenses for a camera contains two converging lenses of focal lengths 20 cm and 40 cm and a diverging lens of focal length 50 cm. Find the power and focal length of the combination.

Answer

Focal length of 1 lens = 20 cm = 0.2 m

Power 1 = 1/ 0.2 = +5 D

Focal length of 2^{nd} lens = 40 cm = 0.4 m

Power 2 = 1/ 0.4 = 0.25 D

Power = P1 + P2 = +5D + 0.25 D = + 5.25 D ;

P = 1/f

f = + 18.18 cm

30 A. Question

Two lenses A and B have power of (i) + 2 D and (ii) - 4 D respectively. What is the nature and f length of each lens ?

Answer

Power of lens A = +2D

Power of lens B = -4 D

Lens A is convex; f =+50 cm; Lens B is concave ; f =- 25 cm

30 B. Question

An object is placed at a distance of 100 cm ,from each of the above lenses A and B. Calculate (i) image distance, and (ii) magnification, in each of the two cases.

Answer

Lens A : v = +100 cm ; m = - 1 ; Lens B : v = -20 cm ; m = 0.2

Multiple Choice Questions (MCQs)-Pg-262

31. Question

The focal lengths of four convex lenses P, Q, R and S are 20 cm, 15 cm, 5 cm and 10 cm, respectively. lens having greatest power is:

A. P

B. Q

C. R

D. S

Answer

P = 1/f

32. Question

A converging lens has a focal length of 50 cm. The power of this lens is:

A. + 0.2 D

B. - 2.0 D

C. + 2.0 D

D. - 0.2 D

Answer

P = 1/f (m)

33. Question

A diverging lens has a focal length of 0.10 m. The power of this lens will be:

A. + 10.0 D

B. + 1.0 D

C. - 1.0 D

D. - 10.0 D

Answer

P = 1/f (m)

34. Question

The power of a lens is + 2.0 D. Its focal length should be :

A. 100 cm

B. 50 cm

C. 25 cm

D. 40 cm

Answer

P = 1/f (m)

35. Question

If a spherical lens has a power of,- 0.25 D, the focal length of this lens will be:

A. - 4 cm

B. - 400 mm

C. - 4 m

D. - 40 m

Answer

P = 1/f (m)

36. Question

The power of a concave lens is 10 D and that of a convex lens is 6 D. When these two lenses are placed in contact with each other, the power of their combination will be :

A. + 16 D

B. + 4 D

C.-16 D

D. - 4 D

Answer

P = 1/f (m)

37. Question

The power of a converging lens is 4.5 D and that of a diverging lens is 3 D. The power of this combination of lenses placed close together is :

A. + 1.5 D

B. + 7.5 D

C. - 7.5 D

D. - 1.5 D

Answer

P = 1/f (m)

38. Question

A convex lens of focal length 10 cm is placed in contact with a concave lens of focal length 20 cm. The focal length of this combination of lenses will be :

A. + 10 cm

B. + 20 cm

C. - 10 cm

D. - 20 cm

Answer

P = 1/f (m)

P = P1 + P2 + P3 ……..

Questions Based on High Order Thinking Skills (HOTS)-Pg-263

39. Question

The optical prescription for a pair of spectacles is:

Right eye: - 3.50 D Left eye: - 4.00 D

(a) Are these lenses thinner at the middle or at the edges?

(b) Which lens has a greater focal length?

(c) Which is the weaker eye?

Answer

Right eye : - 3.5 D

Left eye : -4 D

(a) These lens are thinner at the middle

(b) Lens of lower power:- 3.50 D has a greater focal length

(c) Left eye is the weaker eye

40. Question

A person got his eyes tested by an optician. The prescription for the spectacle lenses to be made reads:

Left eye: + 2.50 D Right eye: + 2.00 D

(a) State whether these lenses are thicker in the middle or at the edges.

(b) Which lens bends the light rays more strongly?

(c) State whether these spectacle lenses will converge light rays or diverge light rays.

Answer

Left eye: + 2.50 D

Right eye: + 2.00 D

(a) These lens are thicker in the middle

(b) Lens having greater power of + 2.50 D will bend the light rays more strongly

(c) these spectacle lenses will Converge light rays.