4. Reflection of light

Very Short Answer Type Questions-Pg-173

1. Question

What happens when a ray of light falls normally (or perpendicular) on the surface of a plane mirror?

Answer

When a ray of light falls normally (or perpendicular) on the surface of a plane mirror, it means that angle of incidence is 0^o. According to second law of reflection, angle of incidence is equal to the angle of reflection. Therefore, angle of reflection will also be zero. Thus, the light ray will be reflected back along the same path.

2. Question

A ray of light is incident normally on a plane mirror at an angle 30°. What is the angle of reflection?

Answer

Second law of reflection says that angle of incidence is equal to the angle of reflection.

Angle of incidence =30°

Thus, angle of reflection=30°

3. Question

A ray of light strikes a plane mirror at an angle of 40° to the mirror surface. What will be the reflection?

Answer

Angle made by the incident ray with respect to mirror surface = 40°

Therefore, angle of incidence= 90° - 40° = 50°

Second law of reflection says that angle of incidence is equal to the angle of reflection.

Therefore, angle of reflection= angle of incidence = 50°

4. Question

A ray of light is incident normally on a plane mirror. What will be the:

(a) Angle of incidence?

(b) Angle of reflection?

Answer

(a) Angle of incidence is 0°

(b) Angle of reflection is 0°

5. Question

What type of image is formed?

(a) In a plane mirror?

(b) On a cinema screen?

Answer

(A) In a plane mirror image formed is Virtual image

(b) On a cinema screen image formed is Real image

6. Question

What kind of mirror is required for obtaining a virtual image of the same size as the object?

Answer

Plane mirror is required for obtaining a virtual image of the same size as the object

7. Question

What is the name of the phenomenon in which the right side of an object appears to be the left side of the image in a plane mirror?

Answer

The name of the phenomenon in which the right side of an object appears to be the left side of the image in a plane mirror is Lateral inversion

8. Question

Name the phenomenon responsible for the following effect:

When we sit in front of a plane mirror and write with our right hand, it appears in the mirror that we are writing with the left hand.

Answer

The phenomenon responsible for the effect that when we sit in front of a plane mirror and write with our right hand, it appears in the mirror that we are writing with the left hand is Lateral inversion

9. Question

If an object is placed at a distance of 10 cm in from of a plane mirror, how far would it be from it's from?

Answer

Since, when the object is kept in front of the mirror then the image is formed behind the mirror at the same distance as the object distance from the mirror.

Object and mirror distance =10 cm

Mirror and image distance =10 cm

Therefore, the distance between image and object =10+10=20cm

10. Question

Which property of light makes a pencil cast a shadow when it is held in front of a light source?

Answer

The property of light makes a pencil cast a shadow when it is held in front of a light source is that light travels in a straight line.

11. Question

The image seen in a plane mirror cannot be formed on a screen. What name is given to this type of image?

Answer

The name given to this type of image is Virtual image.

12. Question

Fill in the following blanks with a suitable word:

When light is reflected, the angles of reflections and incidence are _____

Answer

Equal

13. Question

State whether the following statement is true or false:

A student says that an object can be seen because light is reflected back by the object to our eyes.

Answer

False

14. Question

Where is the image when you look at something in a mirror?

Answer

The image is formed behind the mirror when we look at something in a mirror

15. Question

A ray of light strikes a plane mirror such that its angle of incidence is 30°. What angle the reflected ray make with the mirror surface?

Answer

Second law of reflection says, angle of incidence is equal to the angle of reflection.

Angle of incidence=30°

Such that angle of reflection=30°

Now, the angle made by the reflected ray with mirror surface=90°-30°=60°

Short Answer Type Questions-Pg-173

16. Question

What is the difference between a real image and a virtual image? Give one example of each type of image.

Answer

Since light rays pass through a real image thus it can be obtained on a screen like image formed on a cinema screen whereas light rays do not actually pass through a virtual image thus it cannot be formed on screen like image formed by a plane mirror.

17. Question

The letter E is placed in front of a plane mirror:

(a) How would its image look like when seen in a plane mirror?

(b) What is the name of the phenomenon involved?

Answer

(a) Image of E will look like when seen in a plane mirror as Ǝ

(b) The name of the phenomenon involved is lateral inversion

18. Question

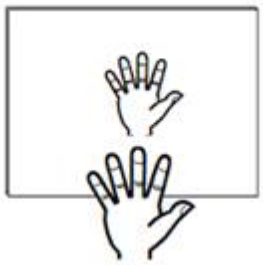
What is lateral inversion? Explain by giving a suitable example.

Answer

When an object is placed in front of a plane mirror, then the left side of the object appears to become right side of the image; and the right side of the object appears to become the left side of the image.

The change of the sides of an object and its mirror image is called lateral inversion.

Example. When we hold our hand in front of a mirror the thumb on right appears to be on left.



19. Question

Write the word AMBULANCE as it would appear when reflected in a plane mirror. Why is it sometimes written in this way (as its mirror image) on the front of an ambulance?

Answer

The word AMBULANCE it would appear like this ƎɔNAJUBMA when reflected in a plane mirror.

It is sometimes written in this way on the front of an ambulance so that while driving, if we see in our rear-view mirror that a hospital van is coming from behind, then we will get the laterally inverted image of ƎɔNAJUBMA and read it as AMBULANCE and give way for it to pass through.

20. Question

What are the important difference between looking at a photograph of your face and looking at yourself in a plane mirror?

Answer

The important difference between looking at a photograph of our face and looking at ourselves in a plane mirror is that the image of our face in a plane mirror is laterally inverted, so right is left and left is right. However, in a photograph of our face this does not happen.

21 A. Question

A wall reflects light and a mirror also reflects light. What difference is there in the way they reflect light?

Answer

The difference between reflection of light from wall and mirror is that the reflection from wall is a diffuse reflection as it has rough surfaces. A parallel beam of light incident on it is reflected in different directions.

Whereas by a mirror it is a regular reflection as mirror surface is smooth. A parallel beam of light incident on it gets scattered by making reflected rays in different directions.

21 B. Question

Which type of reflection of light leads to the formations of images?

Answer

Regular reflection is the type of reflection of light that leads to the formations of images

22. Question

What is the difference between regular reflection of light and diffuse reflection of light? What type of reflection of light takes place from?

(a) A cinema screen

(b) A plane mirror

(c) A cardboard

(d) Still water surface of a lake

Answer

The difference between regular reflection of light and diffuse reflection of light is that in regular reflection, a parallel beam of incident light is reflected as a parallel beam only in one direction; while in diffuse reflection, a parallel beam of incident light is reflected in different directions.

(a) The type of reflection of light that takes place from a cinema screen is Regular reflection

(b) The type of reflection of light that takes place from a plane mirror is Regular reflection

(c) The type of reflection of light that takes place from a cardboard is diffuse reflection

(d) The type of reflection of light that takes place from still water surface of a lake is Regular reflection

23. Question

What can you see in a completely dark room? If you switch on an electric bulb in this dark room as a light source, explain how you could now see:

(a) The electric bulb

(B) a piece of white paper.

Answer

When we see in a completely dark room, we see nothing as there is any light in the dark room.

(a) If we switch on an electric bulb in this dark room as a light source we can see bulb due to the light emitted by it.

(b) If we switch on an electric bulb in this dark room as a light source we can see a piece of white paper as it reflects the light from the bulb falling on it.

24 A. Question

A boy with a mouth 5 cm wide stands 2 m away from a plane mirror. Where is his image and how wide is the image of his mouth ?

Answer

Height of mouth = 5cm

Mouth mirror distance = 2m

Second law of reflection says, angle of incidence is equal to the angle of reflection.

Thus, the image will form 2 m behind the mirror and the width of the image of boy's mouth will be 5 cm.

24 B. Question

The boy walks towards the mirror at a speed of 1m/s. At what speed does his image approach him?

Answer

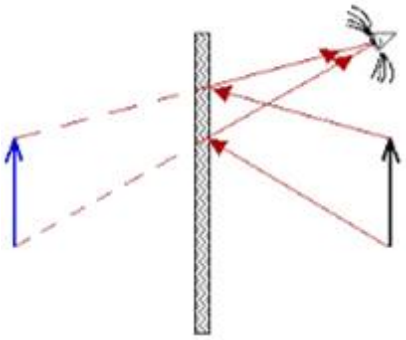
When the boy walks towards the mirror at a speed of 1 m/s, his image will also appear to move towards the mirror at the same speed of 1 m/s. So, the speed at which his image approach him will be 1 m/s + 1 m/s = 2 m/s.

25 A. Question

An extended object in the form of an arrow pointing upwards has been placed in front of a plane mirror Draw a labeled ray-diagram to show the formation of its image.

Answer

An extended object in the form of an arrow pointing upwards has been placed in front of a plane mirror. Tithe labeled ray-diagram to show the formation of its image is



25 B. Question

State the uses of plane mirrors.

Answer

Uses of Plane mirrors:

(I) Plane mirrors are used to see ourselves. Example mirror on our dressing table is plane mirror.

(ii) Inside the walls of certain shops to make them look bigger.

(iii) Plane mirrors are used to make periscopes.

(iv) At blind turns of some busy roads so that drivers can see the vehicles coming from the other side and prevent accidents.

Long Answer Type Questions-Pg-174

26. Question

What is meant by 'reflection of light'? Define the following terms used in the study of reflection of light by drawing a labeled ray-diagram:

(a) Incident ray

(b) Point of incidence

(c) Normal

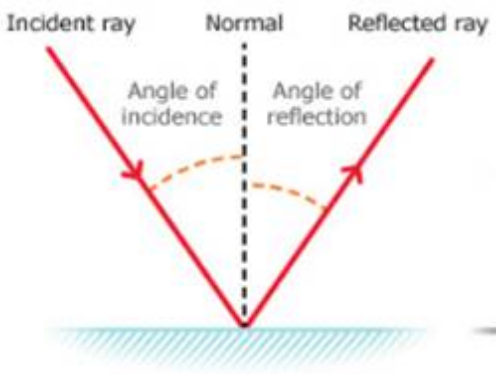
(d) Reflected ray

(e) Angle of incidence

(f) Angle of reflection

Answer

The process of bouncing back off the light rays which fall on the surface of an object is called reflection of light.



(a) Incident ray: This is the ray of light that falls on the mirror surface.

(b) Point of incidence: This is the point at which the incident ray falls on the mirror.

(c) Normal: The line at right angle to the mirror surface at the point of incidence is called normal.

(d) Reflected ray: The ray of light which is reflected back by the mirror is called the reflected rays.

(e) Angle of incidence: The angle made by the incident ray with the normal at the point of incidence is called angle of incidence.

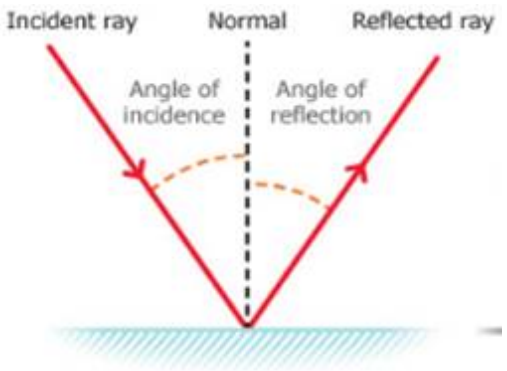
(f) Angle of reflection: The angle made by the reflected ray with the normal at the point of incidence is called angle of reflection.

27. Question

State and explain the laws of reflection of light at a plane surface (like a plane), with the help of a labeled ray-diagram. Mark the angles of 'incidence' and 'reflection' clearly on the diagram. If the angle of reflection is 47.5°, what will be the angle of incidence?

Answer

Laws of reflection of light states that:



First law of reflection: The incidence ray, the reflected ray and the normal (at the point of incidence), all lie in the same plane.

For e.g. in the figure, the incident ray, the reflected ray and the normal, all lie in the same plane, the plane of paper.

Second law of reflection: The angle of reflection is always equal to the angle of incidence.

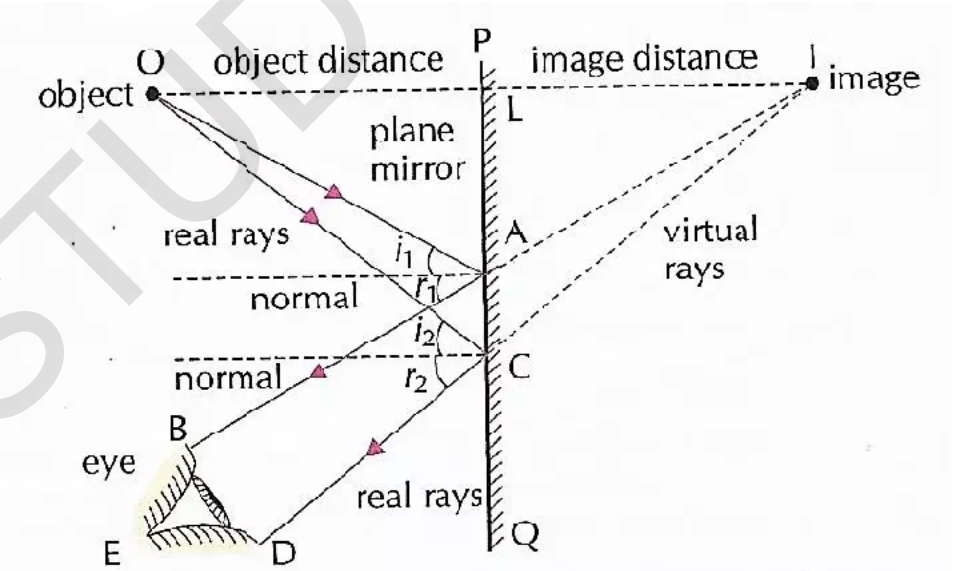
For e.g.

If angle of reflection is 45°, then the angle of incidence will also be 45°.

28. Question

With the help of a labeled ray-diagram, describe how a plane mirror forms an image of a point source of light placed in front of it. State the characteristics of the image formed in a plane mirror.

Answer



Characteristics of Image formed in plane mirror are:-1. Virtual Images are formed.2. Image formed is upright3. Object Distance is same as Image Distance4. Size of the Image formed is same as size of the object

29 A. Question

Explain why, though both a plane mirror and a sheet of paper reflect light but we can see the image of our face in a plane mirror but not in a sheet of paper.

Answer

Though both a plane mirror and a sheet of paper reflect light but we can see the image of our face in a plane mirror but not in a sheet of paper as images are formed by reflection of light which takes place in case of a plane mirror. In case of a sheet of paper, diffuse reflection takes place.

29 B. Question

The image in a plane mirror is virtual and laterally inverted. What does this statement mean?

Answer

The image is virtual and laterally inverted means that it cannot be obtained on a screen and is reversed sideways that is the right of the object is the left of the image and vice versa.

29 C. Question

Write all the capital letters of the alphabet which look the same in a plane mirror.

Answer

All the capital letters of the alphabet which look the same in a plane mirror are A, H, I, M, 0, T, U, V, W, X, Y

Multiple Choice Questions (MCQs)-Pg-174

30. Question

The angle of reflection is equal to the angle of incidence:

A. Never

B. Sometimes

C. Under special conditions

D. Always

Answer

Second law of reflection says that angle of incidence is equal to the angle of reflection.

31. Question

The angle between an incident ray and the plane mirror is 30°. The total angle between the incident ray and reflected for this ray will be:

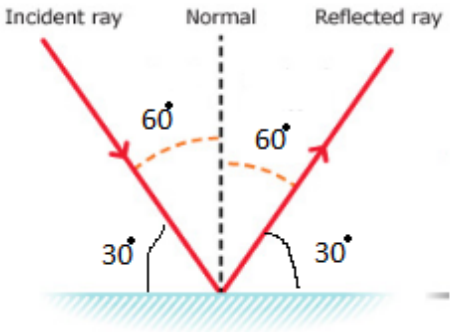
A. 30°

B. 60°

C. 120°

D. 90°

Answer



32. Question

A ray of light is incident on a plane mirror making an angle of 90° with the mirror surface. The angle of reflection for this ray of light will be:

A. 0°

B. 90°

C. 45°

D. 60°

Answer

Angle of incidence = 0°

Therefore, Angle of reflection = 0°

33. Question

The image of an object formed by a plane mirror is:

A. Real

B. virtual

C. diminished

D. upside-down

Answer

The image of an object formed by a plane mirror is virtual.

34. Question

The image of an object formed by a plane mirror is:

A. Virtual, behind the mirror and enlarged.

B. Real, at the surface of the mirror and enlarged.

C. Virtual, behind the mirror and of the same size as the object.

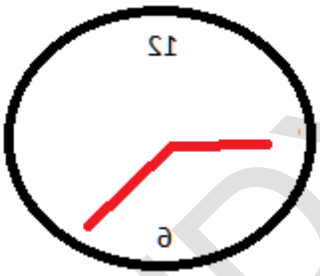
D. Real, behind the mirror and of the same size as the object.

Answer

The image of an object formed by a plane mirror is Virtual, behind the mirror and of the same size as the object.

35. Question

The figure given alongside shows the image of a clock as seen I a plane mirror. The correct time is:



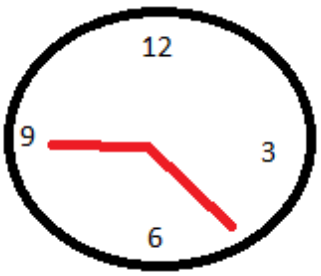
A. 9.25

B. 2.35

C. 6.45

D. 2.25

Answer



Questions Based on High Order Thinking Skills (HOTS)-Pg-175

36. Question

A man stands 10 m in front of a large plane mirror. How far must he walk before he is 5 m away from his image?

Answer

Initially,

Man and the mirror distance= 10m.

Man and his image distance= 10+10=20m

Now, New distance between the man and his image= 5 m when the distance between man and mirror is 2.5 m.

Therefore, distance he has to walk towards the mirror = 10 m - 2.5m = 7.5 m.

37. Question

An object is placed 20 cm in front of a plane mirror. The mirror is moved 2 cm towards the object. The distance between the positions of the original and final images seen in the mirror is:

A) 2 cm

B) 4 cm

C) 10 cm

D) 22 cm

Answer

Initially, object and mirror distance= 20 cm

Image and mirror distance = 20 cm

Now, mirror is moved 2 cm towards the object,

New distance between object and mirror = 20 cm - 2 cm = 18 cm

New distance between mirror and image = 20 cm - 2 cm = 18 cm,

It is 2 cm less than the distance in initial case.

The total distance between the positions of the original and final images is 2 cm + 2 cm = 4 cm since, the mirror has also moved 2 cm away from the position of original image.

38. Question

A man sits in an optician's chair, looking into a plane mirror which is 2 m away from him and views the image of a chart which faces the mirror and is 50 cm behind his head. How far away from his eyes does the chart appear to be?

Answer

Man and the mirror distance= 2 cm

Man and the chart distance = 50 cm = 0.5 m

Chart and mirror distance = 0.5 m + 2 m = 2.5 m

Mirror and the image of the chart distance = 2.5 m

Now, man and the image of chart distance

= man and the mirror distance + mirror and the image of the chart distance

= 2 m + 2.5 m

= 4.5 m

39. Question

A ray of light strikes a plane mirror PQ at an angle of incidence of 30°, is reflected from the plane mirror and then strikes a second plane mirror QR placed at right angles to the first mirror. The angle of reflection at the second mirror is:

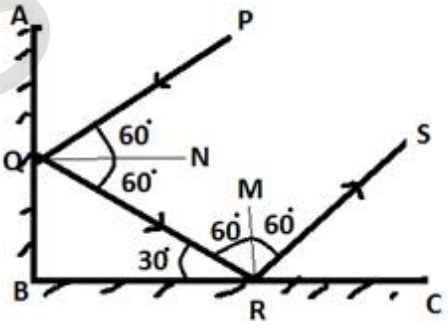
A) 30°

B) 45°

C) 60°

D) 90°

Answer

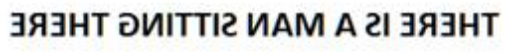


Ray PQ strikes the mirror AB at Q and gets reflected along QR according to the laws of reflection. The ray QR incident on mirror BC makes an angle of 30°

with the mirror. So, the angle of incidence on this mirror is 90° - 30° = 60°. Hence, the angle of reflection is also 60°.

40. Question

Explain how to read the following message which was found on some blotting paper:



Answer

The impression on blotting paper is the mirror image of the written message;

THERE IS A MAN SITTING THERE

Very Short Answer Type Questions-Pg-178

1. Question

Name the spherical mirror which has:

(a) Virtual principal focus.

(b) Real principal focus.

Answer

(a) The spherical mirror which has virtual principal focus is convex mirror

(b) The spherical mirror which has real principal focus is Concave mirror

2. Question

Out of convex mirror and concave mirror, whose focus is situated behind the mirror?

Answer

Focus of convex mirror is situated behind the mirror.

3. Question

Find the focal length of a concave mirror whose radius of curvature is 30 cm.

Answer

Radius of curvature (R) = 30cm

Focal length (f) =?

We know that

f = R/2

=30/2

f = 15cm

4. Question

If the focal length of a convex mirror is 28 cm, what is its radius of curvature?

Answer

Focal length (f) = 28 cm

Radius of curvature (R) =?

We know that

f = R/2

28=R/2

R= 28 x 2

R = 56 cm

5. Question

Fill in the following blanks with suitable words:

(a) Parallel rays of light are reflected by a _____ to a point called the principal focus.

(b) The focal length of a concave mirror is the distance from the principal focus to the ___.

(c) A_____ converges rays of light whereas a _____ diverges rays of light.

(d) For a convex mirror, parallel rays of light appear to __ from a point called the principal focus

Answer

(a) Concave mirror

(b) Mirror

(c) Concave mirror; convex mirror

(d) Diverge

Short Answer Type Questions-Pg-179

6. Question

What is a spherical mirror? Distinguish between a concave mirror and a convex mirror.

Answer

Spherical mirror are those mirror whose reflecting surface is the part of a hollow sphere of glass. The two types of spherical mirrors are:

1) concave mirrors

2) convex mirrors

concave mirror	convex mirror
Spherical mirror in which the reflection of light takes place at concave surface (or bent-in surface)	Spherical mirror in which the reflection of light takes place at the convex surface (or bulging out surface).
Concave mirror converges the parallel rays of light that fall on it	Convex mirror diverges the parallel rays of light that fall on it.

7. Question

Name the two types of spherical mirrors. What type of mirror is represented by the:

(a) Back side of a shining steel spoon?

(b) Front side of a shining steel spoon?

Answer

Two types of spherical mirrors are: Concave mirror and convex mirror

Type of mirror represented by the:

(a) Back side of a shining steel spoon is convex mirror

(b) Front side of a shining steel spoon is concave mirror

8. Question

What is the relation between the focal length and radius of curvature of a spherical mirror (concave mirror or convex mirror)? Calculate the focal length of a spherical mirror whose radius of curvature is 26 cm.

Answer

For a spherical mirror the principal focus (F) lies exactly mid-way between the pole (P) and centre of curvature (C). So, the relation between focal length (f) of a spherical mirror and radius of curvature (R) is

$f=R/2$

Radius of curvature (R) = 26cm

Focal length (f) =?

We know that

f=R/2

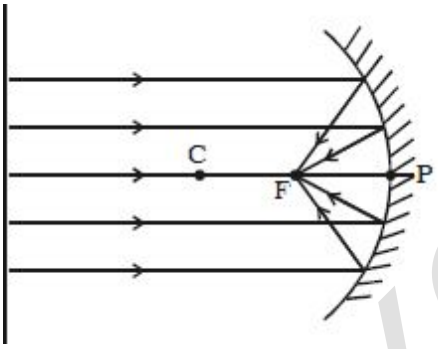
=26/2

f =13cm

9. Question

Explain with a suitable diagram, how a concave mirror converges a parallel beam of light rays. Mark clearly the pole, focus and centre of curvature of concave mirror in this diagram.

Answer

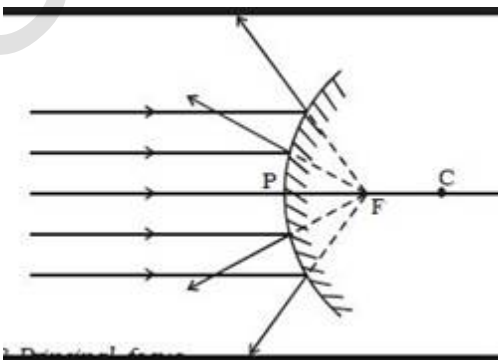


Since a concave mirror converges a parallel beam of light rays thus all the light rays parallel to the principal axis of a concave mirror, converge at the principal focus (F) after reflection from the mirror.

10. Question

Describe with a suitable diagram, how a convex mirror diverges a parallel beam of light rays. Mark clearly the pole, focus and centre of curvature of convex mirror in this diagram.

Answer



Since a convex mirror diverges a parallel beam of light rays thus all the light rays which are parallel to the principal axis of a convex mirror, appear to diverge from the principal focus (F) after reflection from the mirror.

Long Answer Type Questions-Pg-179

11. Question

Define

(a) Center of curvature

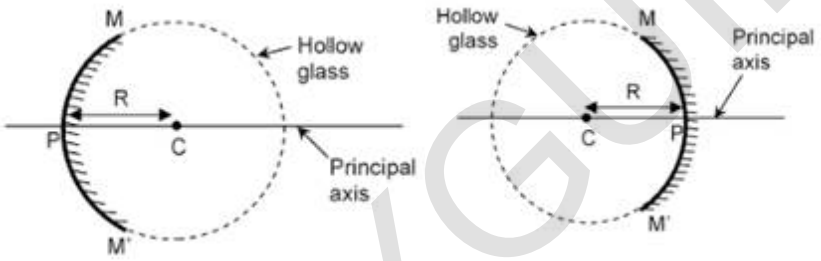
(b) Radius of curvature

(c) Pole

(d) Principal axis, and

(e) Aperture, of a spherical mirror with the help of a labeled diagram.

Answer



(a) Centre of curvature: center of the hollow sphere of glass of which the mirror is a part.

(b) Radius of curvature: radius of the hollow sphere of glass of which the mirror is a part.

(c) Pole: The centre of a spherical mirror is called its pole.

(d) Principal axis: The straight line passing through the centre of curvature and pole of a spherical mirror is called its principal axis.

(e) Aperture: The portion of a mirror from which the reflection of light actually takes place is called the aperture of the mirror.

12 A. Question

Define

(i) principal focus of a concave mirror, and

(ii) Focal length of a concave mirror.

Answer

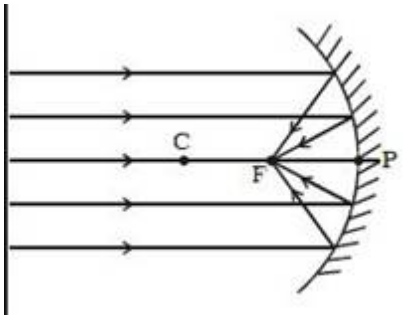
(a) (i) the principal focus of a concave mirror is a point on its principal axis to which all the parallel light rays; (b) Converge after reflection from the concave mirror.

(ii) The focal length of a concave mirror is the distance between its pole and the principal focus.

12 B. Question

Draw diagram to represent the action of a concave mirror on a beam of parallel light rays. Mark on this diagram principal axis, focus F, center of curvature C, pole P and focal length f, of the Concave mirror.

Answer



13 A. Question

What is meant by?

(i) principal focus of a convex mirror, and

(ii) Focal length of a convex mirror?

Answer

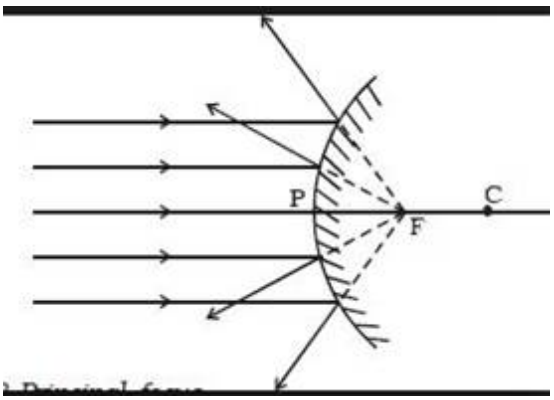
(i) Principal focus of a convex mirror: The principal focus of a convex mirror is a point on its principal axis from which all the parallel light rays; diverge after being reflected from the convex mirror.

(ii) The focal length of a convex mirror is the distance between its pole (P) and principal focus (F).

13 B. Question

Draw diagram to show the action of convex mirror on a beam of parallel light rays. Mark on this diagram principal axis, focus F, center of curvature C, pole P and focal length f, of the convex mirror.

Answer



Multiple Choice Questions (MCQs)-Pg-179

14. Question

In a convex spherical mirror, reflection of light takes place at:

A. A bulging-out surface

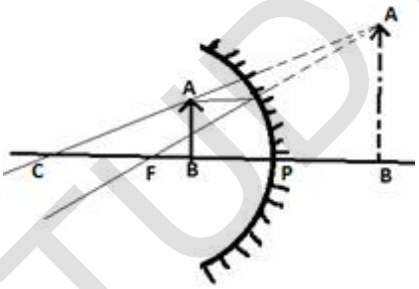
B. A bent-in surface

C. A flat surface

D. An uneven surface

Answer

In a convex spherical mirror, reflection of light takes place at a bulging-out surface.



15. Question

A diverging mirrors:

A. A plane mirror

B. A concave mirror

C. A convex mirror

D. A shaving mirror

Answer

A convex mirror diverges the rays falling on it.

16. Question

If R is the radius of curvature of a spherical mirror and f is its focal length, then:

A. R = f B. R = 3f

C. R = f D. R = 2f

Answer

F = R/2

17. Question

The focal length of a spherical mirror of radius of curvature 38 cm is:

A. 10 cm

B. 19 cm

C. 20 cm

D. 30cm

Answer

F =R/2 = 38/2 = 19 cm

18. Question

If the focal length of a spherical mirror is 12.5 less cm, its radius of curvature will be:

A. 15 cm

B. 25cm

C. 20 cm

D. 35 cm

Answer

F = R/2

R = 2f = 2 x 12.5 cm = 25 cm

Questions Based on High Order Thinking Skills (HOTS)-Pg-179

19. Question

A communications satellite in orbit sends a parallel beam of signals down to earth. If these signals obey the same laws of reflection as light and are to be focused onto a small receiving aerial, what should be the best shape of the metal 'dish' used to collect them?

Answer

Concave metal dish: It will collect the parallel beam of satellite signals at its focus where receiving aerial is fixed.

20. Question

When a spherical mirror is held towards the sun and its sharp image is formed on a piece of carbon paper for some time, a hole is burnt in the carbon paper.

(a) What is the nature of spherical mirror?

(b) Why is a hole burnt in the carbon paper?

(c) At which point of the spherical mirror the carbon paper is placed?

(d) What name is given to the distance between spherical mirror and carbon paper?

(e) What is the advantage of using a carbon paper rather than a white paper?

Answer

(a) Concave mirror

(b) A lot of sun's heat rays are concentrated at the point of sun's image which burn the hole in carbon paper

(c) At the focus

(d) Focal length

(e) A black carbon paper absorbs more heat rays and hence burns a hole more easily (than a white paper).

Very Short Answer Type Questions-Pg-189

1. Question

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

Answer

At the centre of curvature, concave mirror forms a real image equal in size to the object.

2. Question

Where should an object be placed in front of the concave mirror so as to obtain its virtual, erect and magnified image?

Answer

Object should be placed between pole and focus in front of the concave mirror so as to obtain its virtual, erect and magnified image.

3. Question

For which positions of the object does a concave mirror produce an inverted, magnified and real image?

Answer

Object should be placed between focus and center of curvature to produce an inverted, magnified and real image.

4. Question

If an object is placed at the focus of a concave mirror, where is the image formed?

Answer

If an object is placed at the focus of a concave mirror, the image is formed at infinity.

5. Question

If an object is at infinity (very large distance) in front of a concave mirror, where is the image formed?

Answer

The image is formed at focus, if an object is at infinity (very large distance) in front of a concave mirror.

6. Question

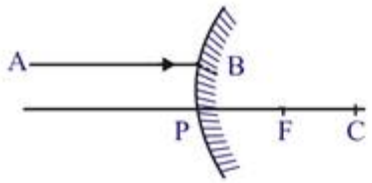
For what position of an object, a real and diminished image is formed by a concave mirror?

Answer

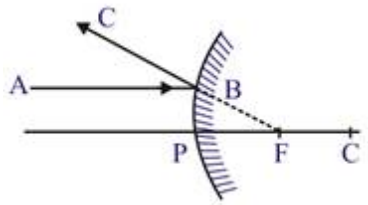
a real and diminished image is formed by a concave mirror when object is placed beyond center of curvature.

7. Question

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



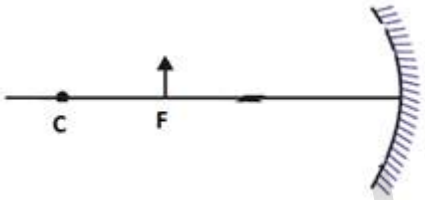
Answer



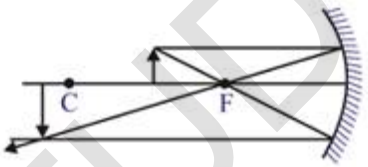
Direction of light ray after reflection is like this.

8. Question

Draw the following diagram in your answer book and show the formation of image of the object AB with the help of suitable rays :

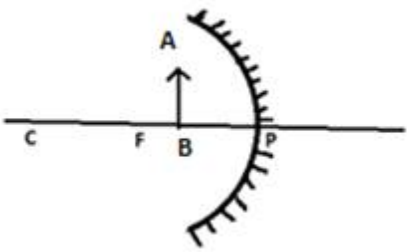


Answer

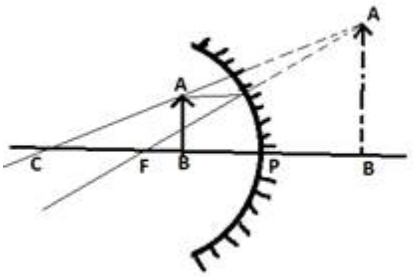


9. Question

Draw the following diagram in your answer book and show the formation of image with the help of suitable rays:



Answer



10. Question

Which type of mirror could be used as a dentist's mirror?

Answer

Concave mirror could be used as a dentist's mirror.

Short Answer Type Questions-Pg-189

11. Question

Which kind of mirror is used in the headlights of a car? Why is it used for this purpose?

Answer

Concave mirror is used in the headlights of a car.

It is used in headlights as when bulb is placed at the focus of a concave mirror , then diverging light ray is reflected to produce a strong, parallel side beam of light.

12. Question

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

Answer

When a ray of light passes through the centre of curvature of a concave mirror gets reflected back along the same path as it falls normally (perpendicularly) on the mirror surface; angle of reflection is 0° and the angle of incidence is also 0°

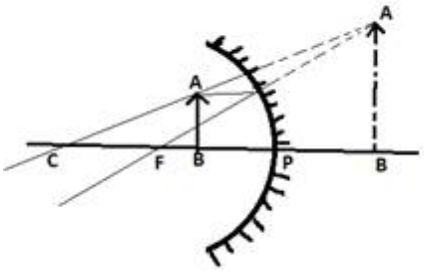
13. Question

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

Answer

Minimum two rays are required.

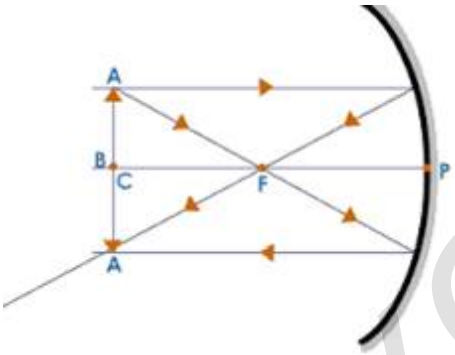
Ray diagram for the formation of a virtual image by a concave mirror:



14. Question

With the help of a ray diagram, determine the position, nature and size of the image formed of an object placed at the centre of curvature of a concave mirror.

Answer

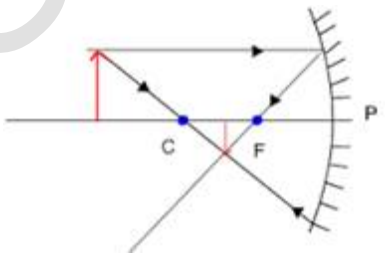


When an object is placed at the centre of curvature of a concave mirror, the image formed is at the centre of curvature, is real and inverted and is of same size as the object.

15. Question

Describe with the help of a diagram, the nature, size and position of the image formed when an object is placed beyond the centre of curvature of a concave mirror.

Answer

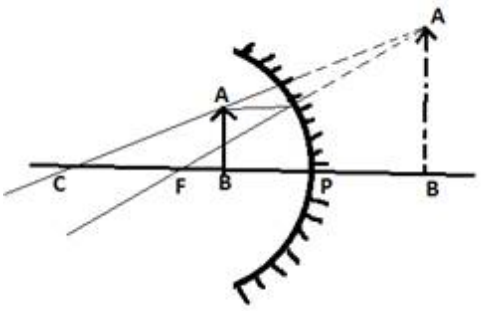


When an object is placed beyond the centre of curvature (C) of a concave mirror, the image is between the focus and centre of curvature, is real and inverted and is smaller than the object (or diminished).

16. Question

If an object is placed at a distance of 8 cm from a concave mirror of focal length 10 cm, discuss the nature of the image formed by drawing the ray diagram.

Answer



The focal length of the mirror is PF = 10 cm.

The object is placed at B such that

object distance, PB = 8 cm.

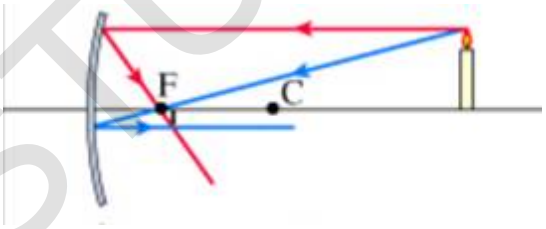
This means that the object lies between the pole and focus of the concave mirror.

The image formed is virtual, erect and magnified behind the mirror.

17. Question

Draw a ray diagram showing how a concave mirror can be used to produce a real, inverted and diminished image of an object.

Answer

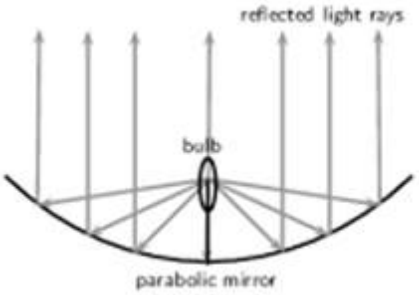


18. Question

Which mirror is used as a torch reflector ? Draw a labelled diagram to show how a torch reflector can be used to produce a parallel beam of light. Where is the bulb placed in relation to the torch reflector?

Answer

For a torch reflector concave mirror is used.



Bulb is placed at the focus of the torch reflector.

19. Question

State where an object must be placed so that the image formed by a concave mirror is:

(a) erect and virtual.

(b) at infinity.

(c) the same size as the object.

Answer

(a) an object must be placed Between pole and focus of the mirror so that the image formed by a concave mirror is erect and virtual.

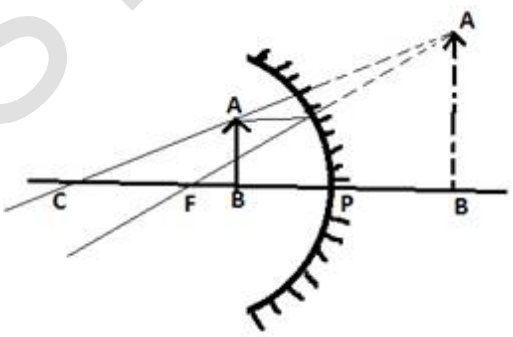
(b) an object must be placed At the focus of the mirror so that the image formed by a concave mirror is at infinity.

(c) an object must be placed At the centre of curvature of the mirror so that the image formed by a concave mirror is the same size as the object.

20. Question

With the help of a labelled ray diagram, describe how a converging mirror can be used to give an enlarged upright image of an object.

Answer



Converging mirror can be used to give an enlarged upright image of an object by placing the object between focus (F) and pole (P) of the concave mirror.

21. Question

Make labeled ray diagrams to illustrate the formation of :

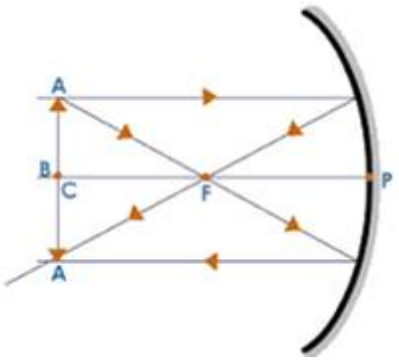
(a) a real image by a converging mirror.

(b) a virtual image by a converging mirror.

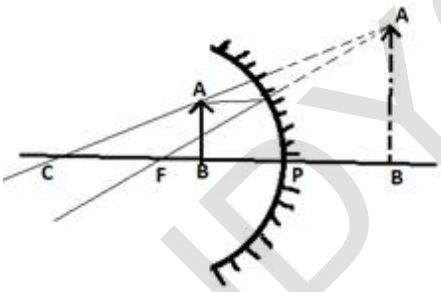
Mark clearly the pole, focus, centre of curvature and position of object in each case.

Answer

(a) A real image by a converging mirror



(b) A virtual image by a converging mirror



22. Question

Briefly describe how you would find the focal length of a concave mirror quickly but approximately.

Answer

To find the focal length of a concave mirror quickly but approximately we can apply few practical skills

1) When image is formed at focus that means object is at considerable distance.

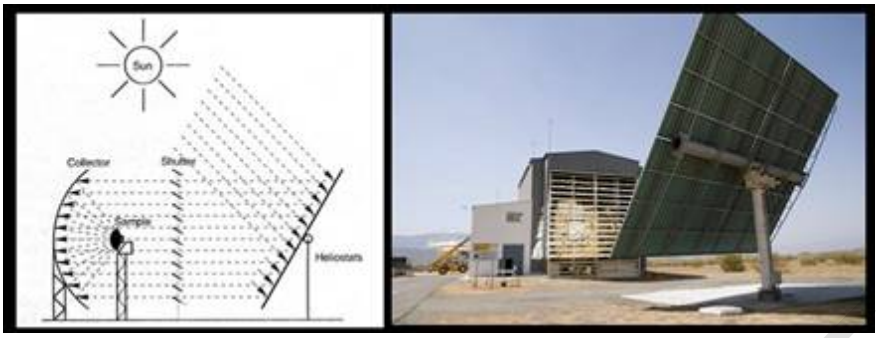
2) Sharp image is formed when object is at focus such that focallength is equal to object distance.

23. Question

Which type of mirror is used in a solar furnace? Support your answer with reason.

Answer

Concave mirror is used in a solar furnace.



at the focus the solar furnace is placed of a large concave reflector.

When parallel rays of light from sun fall on the surface of the concave mirror, rays gets reflected and meet at the focus of the mirror due to the converging nature of concave mirror. Thus, the furnace kept at the focus becomes very hot

24. Question

Name the type of mirror used by dentists. How does it help ?

Answer

Concave mirror is used by dentists.

Since the tooth looks much bigger through concave mirror hence it becomes easy to examine the defect in the tooth.

25. Question

Explain why, concave mirrors are used as shaving mirrors.

Answer

Concave mirrors are used as shaving mirrors as when the face is placed close to a concave mirror the concave mirror produces a magnified and erect image of the face so that it becomes easier to make a smooth shave.

26. Question

Give two uses of concave mirrors. Explain why you would choose concave mirrors for these uses.

Answer

Uses of concave mirror

(i) Concave mirror are used by dentists. Since the tooth looks much bigger through concave mirror hence it becomes easy to examine the defect in the tooth.

(ii) Concave mirrors are used as shaving mirrors as when the face is placed close to a concave mirror the concave mirror produces a magnified and erect image of the face so that it becomes easier to make a smooth shave.

Long Answer Type Questions-Pg-190

27 A. Question

Draw ray-diagrams to show the formation of images when the object is placed in front of a concave mirror (converging mirror):

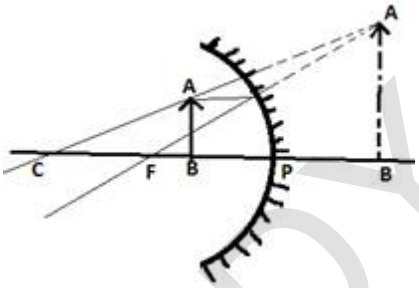
(i) between its pole and focus

(ii) between its centre of curvature and focus

Describe the nature, size and position of the image formed in each case.

Answer

(i)

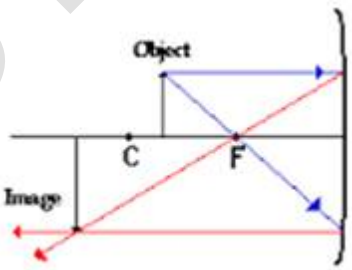


Nature: Virtual, erect

Size: magnified

Position: Behind the mirror

(ii)



Nature: real, inverted

Size: magnified

Position: on the same side as object

27 B. Question

State one use of concave mirror based on the formation of image as in case (i) above.

Answer

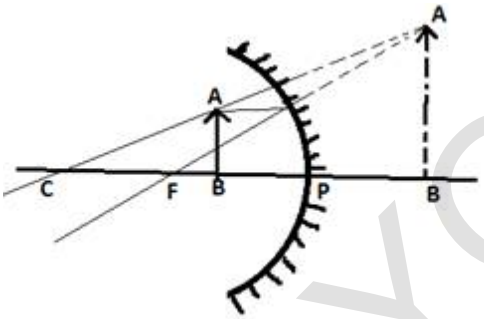
Concave mirror are used by dentists. Since the tooth looks much bigger through concave mirror hence it becomes easy to examine the defect in the tooth.

28 A. Question

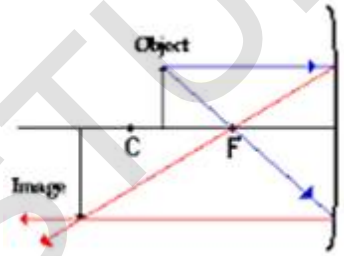
Give two circumstances in which a concave mirror can form a magnified image of an object placed in front of it. Illustrate your answer by drawing labelled ray diagrams for both.

Answer

(i) When the object is placed between the pole and focus of a concave mirror, a magnified image is formed.



(ii) When the object is placed between the focus and the centre of curvature of a concave mirror, a magnified image is formed.



28 B. Question

Which one of these circumstances enables a concave mirror to be used as a shaving mirror?

Answer

A concave mirror can be used as a shaving mirror when the object is placed between the pole and focus of a concave mirror.

Multiple Choice Questions (MCQs)-Pg-190

29. Question

The real image formed by a concave mirror is larger than the object when the object is :

A. between focus and centre of curvature.

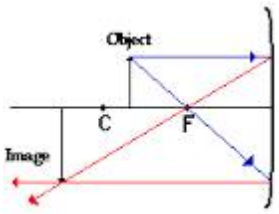
B. distance less than the focal length

C. curvature at a distance equal to radius of curvature

D. at a distance greater than radius of curvature

Answer A

Answer



30. Question

The real image formed by a concave mirror is smaller than the object if the object is :

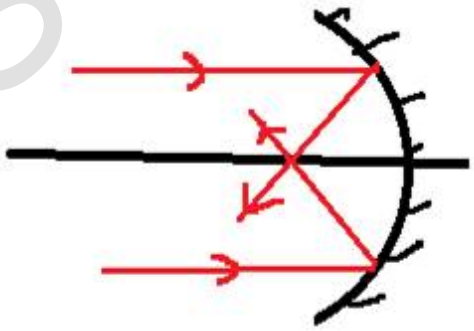
A. between centre of curvature and focus

B. at a distance equal to focal length

C. at a distance equal to radius of curvature

D. at a distance greater than radius of curvature

Answer



31. Question

The image formed by a concave mirror is virtual, erect and magnified. The position of object is :

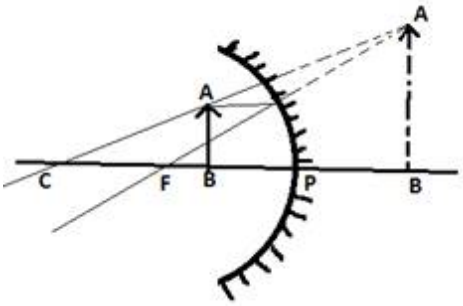
A. between pole and focus

B. between focus and centre of curvature

C. at pole

D. at focus

Answer



32. Question

The image formed by a concave mirror is real, inverted and of the same size as the object. The position of the object must then be:

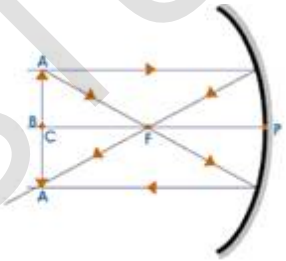
A. at the focus

B. between the centre of curvature and focus

C. beyond the centre of curvature

D. at the centre of curvature

Answer



33. Question

The image formed by a concave mirror is real, inverted and highly diminished (much smaller than the object). The object must be:

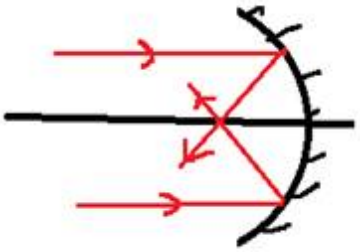
A. between pole and focus

B. at infinity

C. at the centre of curvature

D. at focus

Answer



34. Question

The angle of incidence for a ray of light passing through the centre of curvature of a concave mirror is:

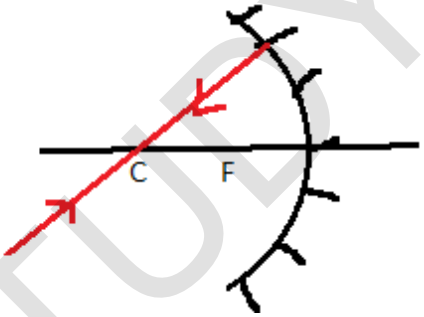
A. 45°

B. 0°

C. 90°

D. 180°

Answer



35. Question

In the concave reflector of a torch, the bulb is placed:

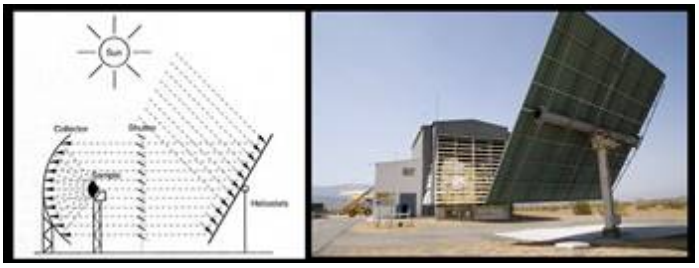
A. at the focus of reflector

B. between the pole and focus of reflector

C. between focus and centre of curvature of reflector

D. at the centre of curvature of reflector

Answer



36. Question

The focal length of a small concave mirror is 2.5 cm. In order to use this concave mirror as a dentist's mirror, the distance of tooth from the mirror should be :

A. 1.5 cm

B. 2.5 cm

C. 4.5 cm

D. 3.5 cm

Answer

Focal length = 2.5 cm

To use as dentist mirror the image should be bigger and thus more than f.

Questions Based on High Order Thinking Skills (HOTS)-Pg-191

37. Question

An object is 200 mm in front of a concave mirror which produces an upright image (erect image). The radius of curvature of the mirror is:

A) less than 200 mm

B) between 200 mm and 400 mm

C) exactly 400 mm

D) more than 400 mm

Answer

(D) Since the image formed is upright, the object lies within the focus of the concave mirror.

So, f > 200 mm

We know R = 2f

So, R > 400 mm

i.e. Radius of curvature is more than 400 mm.

38. Question

A virtual, erect and magnified image of an object is to be produced with a concave mirror of focal length 14 Cm. Which of the following object distance should be chosen for this purpose ?

(i) 10 Cm (ii) 15 Cm (iii) 20 Cm

Give reasons for your choice.

Answer

10 cm, as image formed is virtual, erect and magnified if the object is placed between the pole and focus of the concave mirror only.

39. Question

A concave mirror has a focal length of 22 Cm. At which of the following distance should a person hold his face from this concave mirror so that it may act as a shaving mirror ?

(a) 45 cm

(b) 20 cm

(c) 25 cm

(d) 30 cm

Give reason for your choice.

Answer

20 cm, the image formed is erect and magnified only if the object is placed between the pole and focus of the concave mirror.

40. Question

An object is placed at the following distances from a concave mirror of focal length 16 cm, turn by turn:

(a) 36 cm

(b) 32 cm

(c) 21 cm

(d) 9 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

(i) A magnified real image - 21 cm - When the object is placed between focus and centre of curvature.

(ii) A magnified virtual image - 9 cm -When the object is placed within its focus.

(iii) A diminished real image - 36 cm -When the object is placed beyond the centre of curvature.

(iv) An image of same size as the object - 32 cm -When the object is at the centre of curvature.

Very Short Answer Type Questions-Pg-192

1. Question

According to the "New Cartesian Sign Convention" for mirrors, what sign has been given to the focal length of:

(i) a concave mirror?

(ii) a convex mirror ?

Answer

(i) According to the "New Cartesian Sign Convention" for mirrors, Negative sign has been given to the focal length of a concave mirror.

(ii) According to the "New Cartesian Sign Convention" for mirrors, Positive sign has been given to the focal length of a convex mirror.

2. Question

Which type of mirror has :

(a) positive focal length?

(b) negative focal length?

Answer

(a) Convex mirror has positive focal length.

(b) Concave mirror has negative focal length.

3. Question

What is the nature of a mirror having a focal length of, +10 cm ?

Answer

the nature of a mirror having a focal length of, +10 cm is Convex mirror

4. Question

What kind of mirror can have a focal length of, - 20 cm ?

Answer

Concave mirror has a focal length of - 20 cm

5. Question

Complete the following sentence:

All the _____ are measured from the Pole of a spherical mirror.

Answer

distances

6. Question

What sign (+ve or -ve) has been given to the following on the basis of Cartesian Sign Convention?

(a) Height of a real image.

(b) Height of a virtual image.

Answer

(a) sign (+ve or -ve) that has been given to the Height of a real image. on the basis of Cartesian Sign Convention is Negative

(b) sign (+ve or -ve) that has been given to the Height of a virtual image on the basis of Cartesian Sign Convention is Positive

Short Answer Type Questions-Pg-192

7. Question

Describe the New Cartesian Sign Convention used in optics. Draw a labelled diagram to illustrate this is convention.

Answer

According to the New Cartesian Sign Convention:

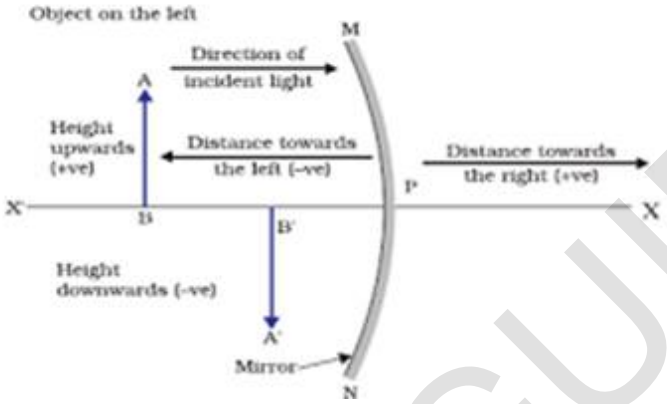
(i) All the distances are measured from pole of the mirror.

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

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

(iv) Distances measured upward and perpendicular to the principal axis are taken as positive.

(v) Distance measured downward and perpendicular to the principal axis are taken as negative.



8. Question

Giving reasons, state the 'signs' (positive or negative) which can be given to the following:

(a) object distance (u) for a concave mirror or convex mirror

(b) image distances (v) for a concave mirror

(c) image distances (v) for a convex mirror

Answer

(a) According to sign convention, distances measured against the direction of incident light are taken as negative such that Object distance (u) for a concave mirror or convex mirror is always negative.

(b) According to sign convention, distances measured in the same direction as that of incident light are taken as positive and distances measured against the direction of incident light are taken as negative such that if the image is formed on the left side of the mirror, then the image distance (v) will be negative and if the image is formed on the right side of the mirror, then the image distance (v) will be positive.

(c) According to sign convention, distances measured in the same direction as that of incident light are taken as positive such that Image distances (v) for a

convex mirror is always positive.

Multiple Choice Questions (MCQs)-Pg-193

9. Question

According to New Cartesian Sign Convention:

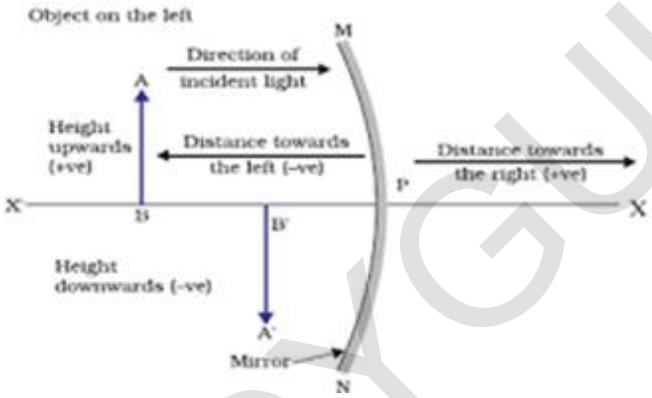
A. focal length of concave mirror is positive and that of convex mirror is negative

B. focal length of concave mirror is negative and that of convex mirror is positive

C. focal length of both concave and convex mirrors is negative

D. focal length of both concave and convex mirrors is positive

Answer



10. Question

One of the following does not apply to a concave mirror. This is:

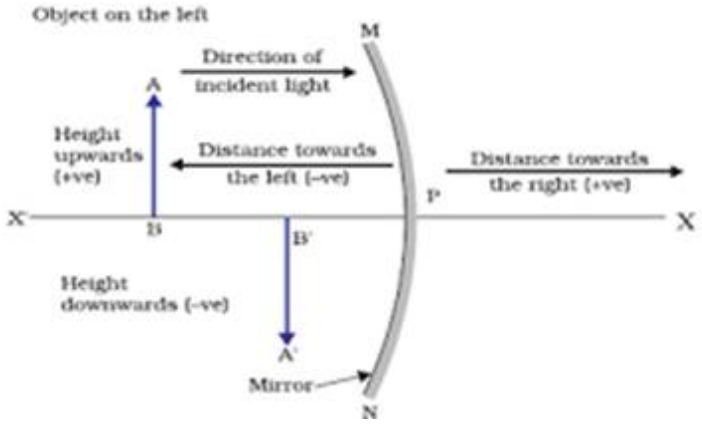
A. focal length is positive

B. image distance can be positive or negative

C. image distance is always negative

D. height of image can be positive or negative

Answer



Very Short Answer Type Questions-Pg-198

1. Question

If the magnification of a body of size 1 m is 4, what is the size of the image ?

Answer

.

Size of object, $h_1 = 1$ m

Magnification, $m = 4$

Size of image, $h_2 = ?$

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

$$4 = \frac{h_2}{1}$$

$$h_2 = 4\text{m}$$

2. Question

What is the position of the image when an object is placed at a distance of 20 cm from a concave mirror of focal length 30 cm ?

Answer

Object distance, u = -20 cm

Focal length, f = -30 cm (concave mirror)

Image distance, v =?

We know that

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-20)}=\frac{1}{(-30)}$$

$$\Rightarrow \quad \frac{1}{v}=1/60$$

$$\therefore \quad v = 60\ cm$$

3. Question

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

(a) + 4, and (b) - 2 ?

Answer

(a) the nature of image formed by a concave mirror is Virtual and erect

(b) the nature of image formed by a concave mirror is Real and inverted

4. Question

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

Answer

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

Or

$$\frac{1}{\text{image distance}}+\frac{1}{\text{object distance}}=\frac{1}{\text{focal length}}$$

where,

v=distance of image from mirror
u=distance of object from mirror
f=focal length of mirror.

5. Question

Write the mirror formula. Give the meaning of each symbol which occurs in it.

Answer

Mirror formula is given below

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

Or

$$\frac{1}{\text{image distance}}+\frac{1}{\text{object distance}}=\frac{1}{\text{focal length}}$$

where,

v=distance of image from mirror
u=distance of object from mirror
f=focal length of mirror.

6. Question

What is the ratio of the height of an image to the height of an object known as ?

Answer

magnification.

7. Question

Define linear magnification produced by a mirror.

Answer

The ratio of the height of image to the height of object is known as linear magnification.

$$m = \frac{\text{Height of image}}{\text{Height of object}}$$

8. Question

Write down a formula for the magnification produced by a concave mirror.

(a) in terms of height of object and height of image

(b) in terms of object distance and image distance

Answer

(a) Magnification produced by a concave mirror in terms of height of object and height of image is

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

(b) Magnification produced by a concave mirror in terms of height of object and height of image is

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

where, h_2= height of image

h_1= height of object

v= image distance

u= object distance

9. Question

Describe the nature of image formed when the object is placed at a distance of 20 cm from a concave mirror of focal length 15 cm.

Answer

Here, u = - 20 cm; f = -15 cm

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-20)}=\frac{1}{-15}$$

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{20}-\frac{1}{15}=-\frac{1}{60}$$

$$\therefore \quad v = -60 \text{ cm}$$

So, image will be real and inverted

10. Question

Fill in the following blanks with suitable words :

(a) If the magnification has a _____ sign, then image is virtual and erect

(b) If the magnification has a _____ sign, then the image is real and inverted

Answer

(a) plus

(b) minus

Short Answer Type Questions-Pg-198

11. Question

An object is placed at a distance of 10 cm from a concave mirror of focal length 15cm.

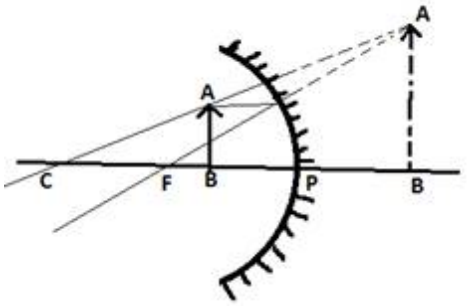
(a) Draw a ray diagram for the formation of image.

(b) Calculate the image distance.

(c) State two characteristics of the image formed.

Answer

(a)



(b) f=-15cm, u=-10cm, v=?

We know that

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-10)}=\frac{1}{(-15)}$$

$$\Rightarrow \quad \frac{1}{v}=-\frac{1}{15}+\frac{1}{10}=\frac{1}{30}$$

$$\therefore \quad v = 30\ \text{cm}$$

(c) Characteristics of image formed is virtual and erect.

12. Question

If an object of 10 cm height is placed at a distance of 24 cm from a concave mirror of focal length 12 cm, find the position, nature and height of the image.

Answer

h_1=10cm, u=-24cm, f=-12cm

We know that1/v +1/u = 1/f ⇒ 1/v + 1/(-24)= 1/(-12)⇒ 1/v =(-1/24)⇒ v =-24 cm

m = h_2 / h_1= - v / u = -(-24)/(-24)= -1⇒ h_2 / h_1 = -1⇒ h_2 = -1× h_1⇒ h_2= - 10 cm the image formed will be of same height at a distance of 24 cm from the mirror and would be inverted in nature

13. Question

At what distance from a concave mirror of focal length 10 cm should an object 2 cm long be placed in order to get an erect image 6 cm tall ?

Answer

f=(-10cm)h_1=2cm h_2=6cm (erect image)u =?

We know that:

$$m = \frac{h_2}{h_1} = \frac{6}{2} = 3$$

$$and$$

$$m = \ -\left(\frac{v}{u}\right) = 3$$

$$\Rightarrow 3u = \ -v$$

$$\Rightarrow \ v = (-3u)$$

$$Putting\ the\ values\ in\ mirror\ formula:$$

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

$$We\ get: -$$

$$\frac{1}{(-3u)} + \frac{1}{u} = \frac{1}{(-10)}$$

$$\Rightarrow \frac{1}{u}(1 - \frac{1}{3}) = \frac{1}{(-10)}$$

$$\Rightarrow \frac{2}{3u} = \frac{1}{(-10)} (Cross - Multiplying\ to\ find\ u)$$

$$\Rightarrow u = -6.66cm$$

The object should be placed at a distance of 6.66 cm on the left side of the concave mirror.

14. Question

When an object is placed at a distance of 15 cm from a concave mirror, its image is formed at 10 cm in front of the mirror. Calculate the radius of curvature of the mirror.

Answer

u=-15cm, v=-10cm

f=?

We know that

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

$$\Rightarrow \quad \frac{1}{(-10)}+\frac{1}{(-15)}=\frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f}=-\frac{1}{10}-\frac{1}{15}=\frac{-3-2}{30}=-\frac{5}{30}=-\frac{1}{6}$$

$$\therefore \quad f=-6\,cm$$

∴ The focal length of the concave mirror is 6 cm

Radius of curvature = 2f = 12 cm.

15. Question

An object 3 cm high is placed at a distance of 8 cm from a concave mirror which produces a virtual image 4.5 cm high:

(i) What is the focal length of the mirror?

(ii) What is the position of image?

(iii) Draw a ray-diagram to show the formation of image.

Answer

given: Height of the object h_1=3 cm,distance between object and mirror u=-8 cm, Height of the image h_2=6 cm (virtual image)**Formula used:1.** magnification $M=\frac{H_2}{H_1}=\frac{-v}{u}$ where,M is the magnification of the image H_2 is the height of the imageH_1 is the height of the objectv is the distance between image and mirroru is the distance between object and mirror**2.** Mirror formula $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$ F is the focal length of the mirrorv is the distance between the image and the mirroru is the distance between the object and mirrorputting the value in equation(1), we get

$M=\frac{H_2}{H_1}=\frac{4.5}{3}=1.5$ but we also know that

$M=\frac{-v}{u}=1.5$

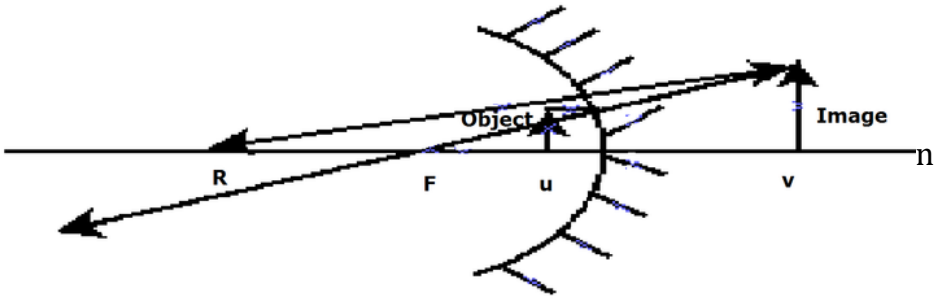
This means that the image will

$v=-1.5\times u=-1.5\times -8=12\ cm$

form at a distance of 12 cm behind the mirror i.e. virtual image is formedPutting the value in equation(2), we get

$\frac{1}{f}=\frac{1}{12}-\frac{1}{8}=\frac{2-3}{24}=-\frac{1}{24}$ f=-24 cm the focal length of the convex

mirror used is 24 cmthe Ray diagram is:



16. Question

A converging mirror forms a real image of height 4 cm of an object of height 2 cm placed 20 cm away from the mirror:

(i) Calculate the image distance.

(ii) What is the focal length of the mirror?

Answer

$h_2 = -4cm$ (real image)
$h_1 = 2$ cm
$u = -20cm$
(i) v=?

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

$$\Rightarrow \frac{-4}{2}=-\frac{v}{-20}$$

$\Rightarrow v = -40$ cm
Image forms in front of the concave mirror.
(ii)f=?

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

$$\frac{1}{-40}+\frac{1}{-20}=\frac{1}{f}$$

$$\frac{1}{f}=-\frac{1}{40}-\frac{1}{20}=\frac{-1-2}{40}=-\frac{3}{80}$$

$f = -26.6$ cm

17. Question

An object of size 9.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed so that a sharp focused image can be obtained? Find the size and nature of image.

[Hint. Find the value of image distance (v) first. The screen should be placed from the mirror at a distance equal to image distance].

Answer

Given : $h_1 = 9$ cm u=-27cm, f=-18cm,

We know that

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

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{(-18)}-\frac{1}{(-27)}$$

$$=-\frac{1}{18}+\frac{1}{27}=\frac{-3+2}{54}=-\frac{1}{54}$$

$\therefore \quad v = -54$ cm

The screen should be placed at a distance of 54 cm in front of the concave mirror.

And

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

$$\Rightarrow \quad -\frac{(-54)}{(-27)}=\frac{h_2}{9}$$

$$\Rightarrow \quad h_2 = -18 \text{ cm}$$

Image is 18cm in size, real and inverted.

18. Question

An object 3 cm high is placed at a distance of 10 cm in front of a converging mirror of focal length 20 cm.

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

Answer

U = 10 cm

F = 20 cm

Height of object = 3 cm

Such that using the mirror formula, we get

v = +20 cm;

The image formed is behind the converging mirror; Virtual and erect ; 6 cm high

19. Question

A concave mirror has a focal length of 4 cm and an object 2 cm tall is placed 9 cm away from it. Find the nature, position and size of the image formed.

Answer

Focal length = 4cm

Height of object = 2cm

Object distance from mirror = 9 cm

Such that after using mirror formula we get image distance , v =-7.2 cm

the nature, position and size of the image formed is real and inverted ; at a distance of 7.2 cm in front of concave mirror and 1.6 cm high.

20. Question

When an object is placed 20 cm from a concave mirror, a real image magnified four times is formed. Find:

(a) the focal length of the mirror.

(b) Where must the object be placed to give a virtual image three times the height of the object?

Answer

Given:-

u =-20cm, m=- 4, for the real image

(a) We know that

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

$$\therefore \quad m = \quad 4 = -\frac{v}{(-20)}$$

$$\Rightarrow \quad v = -80 \text{ cm}$$

We have

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

$$\Rightarrow \quad \frac{1}{(-80)}+\frac{1}{(-20)}=\frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f}=-\frac{1}{80}-\frac{1}{20}=\frac{-1-4}{80}=-\frac{1}{16}$$

$$f = -16 \text{ cm}$$

(b) For virtual image m=4 and f=-15cm

We know that

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

$$\therefore \quad m = 4 = -\frac{v}{u} \Rightarrow \quad v = -4u$$

We have,

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

$$\Rightarrow \quad \frac{1}{-4u}+\frac{1}{u}=\frac{1}{(-15)}$$

$$\Rightarrow \quad \frac{-1+4}{4u}=-\frac{1}{15}$$

$$\Rightarrow \quad u = 11.2 \text{ cm}$$

So object should be placed 11.2 cm from the concave mirror

21. Question

A dentist's mirror has a radius of curvature of 3 cm. How far must it be placed from a small dental cavity to give a virtual image of the cavity that is magnified six times ?

Answer

R=-3cm (concave mirror)

m= (virtual image)

$f=\frac{R}{2}=-\frac{3}{2}=-1.5\,cm$

and

$m = 6 = -\frac{v}{u} \quad \Rightarrow \quad v = -6u$

We have,

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

$\Rightarrow \quad \frac{1}{-6u}+\frac{1}{u}=\frac{1}{(-1.5)}$

$\Rightarrow \quad \frac{5}{6u}=-\frac{1}{1.5}$

$\Rightarrow \quad u=-\frac{5 \times 1.5}{6} = -1.25\ cm$

The mirror should be placed 1.25 cm away from the dental cavity.

22. Question

A large concave mirror has a focus length of 0.75 cm. A person stands 10 m in front of the mirror. Where is the person's image ?

Answer

u=-10m

f = 0.75 m

We know,

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

$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-10)}=\frac{1}{(-0.75)}$

$\Rightarrow \quad \frac{1}{v}=\frac{1}{10}-\frac{1}{0.75}=\frac{1}{10}-\frac{100}{75}$

$=\frac{1}{10}-\frac{4}{3}=\frac{3-40}{30}=-\frac{37}{30}$

$\therefore \quad v=-\frac{30}{37}=-0.81\ m$

The person's image will be 0.81 m in front of concave mirror.

0.81 m in front of the concave mirror

23. Question

An object of 5.0 cm size is placed at a distance of 20.0 cm from a converging mirror of radius of curvature 30.0 cm. At what distance from the mirror

should a screen be placed to get the sharp image ? Also calculate the size of the image.

Answer

Radius of curvature = 30.0 cm

F = R/2 = 30/2 = 15 cm

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$
$$\frac{1}{v}+\frac{1}{(-20)}=\frac{1}{(-15)}$$
$$\frac{1}{v}=\frac{1}{20}-\frac{1}{15}$$
$$\frac{1}{v}=\frac{-5}{300}$$
$$v=-60\,cm$$

The screen should be placed 60 cm in front of the mirror.

And

$$m=\frac{h_2}{h_1}=-\frac{v}{u}$$
$$\frac{h_2}{5}=-\frac{(-60)}{(-20)}$$
$$h_2=-15cm$$
$$height\ of\ image=15cm$$

24. Question

A concave mirror produces three times enlarged virtual image of an object placed at 10 cm in front of it. Calculate the focal length of the mirror.

Answer

m=3 (virtual image)

u=-10cm

R=?

We know that

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

$$3 = \frac{-v}{(-10)}$$

$$v = 30cm$$

and

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

$$\frac{1}{30} + \frac{1}{(-10)} = \frac{1}{f}$$

$$\frac{-20}{300} = \frac{1}{f}$$

$$f = -15cm$$

Focal length of the mirror is 15 cm.

25. Question

A bright object 100 mm high stands on the axis of a concave mirror of focal length 100 mm and at a distance of 300 mm from the concave mirror. How big will the image be ?

Answer

h1=100mm, f=-100mm, u=-300mm, h1=?

We have:

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

$$\frac{1}{v} + \frac{1}{(-300)} = \frac{1}{(-100)}$$

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

$$\frac{1}{v} = \frac{-200}{30000}$$

$$\frac{1}{v} = \frac{-2}{300}$$

$$v = -150\,mm$$

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

$$-\frac{-150}{-300} = \frac{h_2}{100}$$

The image will be 50 mm high.

26. Question

How far should an object be placed from the pole of a converging mirror of radius of curvature 40 cm to form a real image of the size exactly 4th the size of the object?

Answer

Radius of curvature = 40 cm

F = R/2 = 40/2 = 20 cm

f=-20cm, m=-1/4 (real image)

We know that

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

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

$$u = 4v$$

so

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

$$\frac{1}{v} + \frac{1}{4v} = \frac{1}{(-20)}$$

$$\frac{5}{4v} = -\frac{1}{20}$$

$$v = -\frac{100}{4} = -25 \text{ cm}$$

$$\therefore$$

$$u = 4v$$

$$u = 4x(-25)$$

$$= -100 \text{ cm}$$

27. Question

When an object is placed at a distance of 50 cm from a concave spherical mirror, the magnification produced is, $-\frac{1}{2}$ Where should the object be placed to get a magnification of, -1/8?

Answer

Case 1:

u=-50cm

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

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

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

$v=-25\text{cm}$

We know, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

$\Rightarrow \frac{1}{-25}+\frac{1}{-50}=\frac{1}{f}$

$\Rightarrow \frac{-3}{50}=\frac{1}{f}$

$\Rightarrow f=\frac{-50}{3}\text{cm}$

Case 2:

$m=-\frac{1}{8}$

$f=\frac{-50}{3}\text{cm}$

$m=-\frac{1}{8}=-\frac{v}{u}$

$v=\frac{u}{8}$

Now,

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

$\frac{8}{u}+\frac{1}{u}=\frac{-3}{50}$

$\frac{9}{u}=\frac{-3}{50}$

u = - 150 cm

28. Question

An object is placed (a) 20 cm, (b) 4 cm, in front of a concave mirror of focal length 12 cm. Find the nature and position of the image formed in each case.

Answer

(a) The image distance from the pole is -30 cm; the nature and position of the image formed in each case is that image is formed at a distance of 30 cm in front of mirror (on its left side); Real and inverted

(b) The image distance from the pole is + 6 cm; the nature and position of the image formed in each case is that image is formed at a distance of 6 cm behind the mirror (on its right side); Virtual and erect

29. Question

A concave mirror produces a real image 1 cm tall of an object 2.5 mm tall placed 5 cm from the mirror. Find the position of the image and the radius of curvature of the mirror.

Answer

h2=1cm=10mm (real image), h1=2.5mm, u=-5cm=-50mm

$$m = -\frac{h_2}{h_1}$$
$$m = -\frac{10}{2.5}$$
$$m = -4$$
and we know that
$$m = -\frac{v}{u}$$
$$-4 = -\frac{v}{(-50)}$$
$$v = -200mm$$
$$v = -20cm$$

The image is formed 20 cm in front of the mirror.

And,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$
$$\frac{1}{-20} + \frac{1}{-5} = \frac{1}{f}$$
$$\frac{1}{f} = \frac{-25}{100}$$
$$f = -4cm$$

Radius of curvature = 2f = -8 cm

30. Question

A man holds a spherical shaving mirror of radius of curvature 60 cm at a distance of 15 cm, from his nose. Find the position of image, and calculate the magnification.

Answer

Radius of curvature, R=-60cm

F = R/2 = 60/2 = 30cm

f=-30cm, u=-15cm

We have

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$
$$\frac{1}{v}+\frac{1}{-15}=\frac{1}{-30}$$
$$\frac{1}{v}=\frac{1}{15}+\frac{1}{-30}$$

$$\frac{1}{v}=\frac{1}{30}$$
$$v = 30cm$$

$$m=-\frac{v}{u}$$
$$m=-\frac{30}{-15}$$
$$m = 2$$

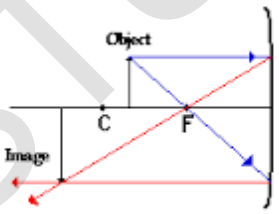
So, the image is formed 30 cm behind the mirror and the magnification is +2.

Long Answer Type Questions-Pg-199

31 A. Question

An object is placed just outside the principal focus of concave mirror. Draw a ray diagram to show how the image is formed, and describe its size, position and nature.

Answer



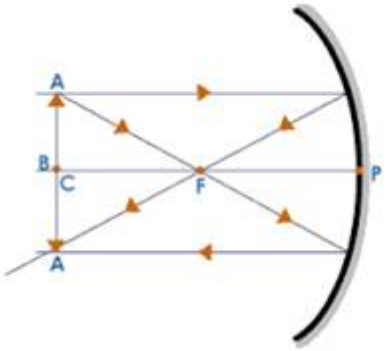
The image is formed beyond the centre of curvature of the mirror and the nature of the image is real, inverted and magnified.

31 B. Question

If the object is moved further away from the mirror, what changes are there in the position and size of the image ?

Answer

If the object is moved further away from the mirror, the image is formed nearer to the mirror and its size goes on decreasing.



31 C. Question

An object is 24 cm away from a concave mirror and its image is 16 cm from the mirror. Find the focus and radius of curvature of the mirror.

Answer

u=-24cm

v=-16cm

R=?, m=?

we know that

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

$$\frac{1}{-16}+\frac{1}{-24}=\frac{1}{f}$$

$$\frac{-5}{48}=\frac{1}{f}$$

$$f=-9.6\,cm$$

$$R=2f$$

$$=2\times-9.6=-19.2\,cm$$

Multiple Choice Questions (MCQs)-Pg-199

32. Question

Linear magnification produced by a concave mirror may be :

A. m≤1

B. m≥1

C. 1<m≥1

D. 1<m>1

Answer

| Magnification, m = v/u

33. Question

Magnification produced by a convex mirror is always :

A. m> 1

B. m<1

C. m = 1

D. 1> m<1

Answer

Magnification, m = v/u

34. Question

Magnification produced by a plane mirror is:

| A. m>1

B. m<1

C. m = 0

D. m = 1

Answer

Magnification, m = v/u

m= 1/1 = 1

35. Question

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

A. between pole and focus

B. between focus and centre of curvature

C. at the centre of curvature

D. beyond the centre of curvature

Answer

Magnification, m = v/u

36. Question

A concave mirror produces a magnification of + 3. The object is placed:

A. at the focus

B. between focus and centre of curvature

C. between focus and pole

D. beyond the centre of curvature

Answer

Magnification, m = v/u

37. Question

If a magnification of, -2.5 (minus two point one) is to be obtained by using a converging mirror, then the object has to be placed:

A. between pole and focus

B. at the centre of curvature

C. beyond the centre of curvature

D. at infinity

Answer

Magnification, m = v/u

38. Question

In order to obtain a magnification of,- 0.9 (minus 0.9) with a concave mirror, the object must be placed:

A. at the focus

B. between pole and focus

C. between focus and centre of curvature

D. beyond the centre of curvature

Answer

Magnification, m = v/u

39. Question

An object is placed at a large distance in front of a concave mirror of radius of curvature 60 cm. The image will be formed in front of the mirror at a distance of :

A. 20 cm

B. 30 cm

C. 40 cm

D. 50 cm

Answer

R = 60 cm

f = -30 cm

40. Question

In order to obtain a magnification of, -1.5 with a concave mirror of focal length 20 cm, the object will have to be placed at a distance :

A. between 6cm and 20 cm

B. between 40 cm and 20 cm

C. between 48 cm and 40 cm

D. beyond 64 cm

Answer

m = -1.5 = v/u

such that v = -1.5u

f = -20 cm

using mirror formula, find u

41. Question

Linear magnification (m) produced by a rear view mirror fitted in vehicles:

A. m = 1

B. m >1

C. m <1

D. 1<m>1

Answer

Magnification, m = v/u

Questions Based on High Order Thinking Skills (HOTS)-Pg-200

42. Question

Between which two points of concave mirror should an object be placed to obtain a magnification of :

(a) - 3 (b) + 2.5 (c) - 0.4

Answer

(a) mirror should an object be placed Between focus and centre of curvature to obtain a magnification of -3

(b) mirror should an object be placed Between pole and focus to obtain a magnification of 2.5

(c) mirror should an object be placed Beyond the centre of curvature to obtain a magnification of -0.4

43. Question

At what distance from a concave mirror of focal length 20 cm should an object be placed so that:

(a) its real image is formed 20 cm from the mirror?

(b) its virtual image is formed 20 cm from the mirror?

Answer

(a) f=- 20 cm

v=-20cm (real image)

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

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

$$\frac{1}{u}=\frac{-1}{20}+\frac{1}{20}=\frac{0}{20}$$

u = infinity

(b) f=- 20 cm

v=20 cm (virtual image)

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

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

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

u = - 10 cm

44. Question

If a concave mirror has a focal length of 20 cm, find the two positions where an object can be placed to give, in each case, an image twice the height of the object.

Answer

$f = -20cm$

Case 1: m=2 (Image is virtual and erect)

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

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

$\Rightarrow v=-2u$

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

$\frac{1}{-2u}+\frac{1}{u}=\frac{1}{-20}$

$\frac{1}{2u}=\frac{-1}{20}$

$u=-10cm$

Case 2:m=-2 (Image is real and inverted)

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

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

$v=2u$

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

$\frac{1}{2u}+\frac{1}{u}=\frac{1}{-20}$

$\frac{3}{2u}=\frac{-1}{-20}$

$u=30\ cm$

45. Question

A mirror forms an image which is 30 cm from an object and thrice its height.

(a) Where must the mirror be situated?

(b) What is the radius of curvature?

(c) Is the mirror convex or concave?

Answer

Let the image formed is virtual and erect.

$v - u = 30\,cm$

$m = 3$

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

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

$v = -3u$

$-3u - u = 30cm$

$u = \frac{-30}{4} = \frac{-15}{2}$

(b) $v = -2u = 15\ cm$

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

$\frac{1}{15} - \frac{2}{15} = \frac{1}{f}$

$\frac{1}{f} = \frac{-1}{15}$

$f = -15\ cm$

$R = 2f = -30\ cm$

(c) the mirror is concave mirror.

Very Short Answer Type Questions-Pg-205

1. Question

What type of image/images are formed by:

(a) a convex mirror?

(b) a concave mirror?

Answer

(a) Virtual and erect image is formed by a convex mirror.

(b) Virtual and erect; Real and inverted images are formed by a concave mirror.

2. Question

Which mirror has a wider field of view ?

Answer

Convex mirror

3. Question

If you want to see an enlarged image of your face, state whether you will use a concave mirror or a convex mirror?

Answer

Concave mirror will be used to see an enlarged image of our face

4. Question

Which mirror always produces a virtual, erect and diminished image of an object ?

Answer

Convex mirror

5. Question

An object is placed at a long distance in front of a convex mirror of radius of curvature 38cm. State the position of its image.

Answer

the position of its image is At focus ; 19 cm behind convex mirror

6. Question

Name the spherical mirror which can produce a real and diminished image of an object.

Answer

Concave mirror can produce a real and diminished image of an object.

7. Question

Name the spherical mirror which can produce a virtual and diminished image of an object.

Answer

Convex mirror can produce a virtual and diminished image of an object.

8. Question

One wants to see a magnified image of an object in a mirror. What type of mirror should one use?

Answer

Concave mirror should be used to get a magnified image of an object in a mirror.

9. Question

Name the mirror which can give:

(a) an erect and enlarged image of an object.

(b) an erect and diminished image of an object.

Answer

(a) Concave mirror can give an erect and enlarged image of an object.

(b) Convex mirror can give an erect and diminished image of an object.

10. Question

State whether the following statement is true or false: A converging mirror is not used as a rear-view mirror.

Answer

True

11. Question

What type of mirror could be used:

(a) as a shaving mirror?

(b) as a shop security mirror?

Answer

(a) Concave mirror could be used as a shaving mirror.

(b) Convex mirror could be used as a shop security mirror.

12. Question

Which type of mirror is usually used as a rear-view mirror in motor cars ?

Answer

Convex mirror is usually used as a rear-view mirror in motor cars

13. Question

What kind of mirrors are used in shopping centres to watch the activities of the customers?

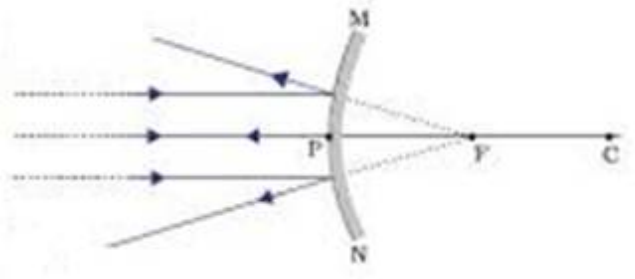
Answer

Convex mirrors are used in shopping centres to watch the activities of the customers

14. Question

A ray of light going towards the of a convex mirror becomes parallel to the principal axis after reflection from the mirror. Draw a labelled diagram to represent this situation.

Answer



15. Question

Fill in the following blank with a suitable word:

A ray of light which is parallel to the' principal axis of a _____, appears to be coming from focus after reflection from the mirror.

Answer

convex mirror

Short Answer Type Questions-Pg-205

16. Question

Why does a driver prefer to use a convex mirror as a rear-view mirror in a vehicle ?

Answer

A driver prefers to use a convex mirror as a rear-view mirror because convex mirror produces an erect image of the objects as well as has wider field of view.

17. Question

Why can you not use a concave mirror as a rear-view mirror in vehicles?

Answer

We cannot use a concave mirror as a rear-view mirror in vehicles as concave mirror produces **inverted images** due to which all the vehicles will be seen running upside down in the mirror.

18. Question

Where would the image be formed by a convex mirror if the object is placed:

(a) between infinity and pole of the mirror?

(b) at infinity ?

Draw labelled ray-diagrams to show the formation of image in both the cases.

Answer

(a) Image will form between pole and focus by a convex mirror if the object is placed by a convex mirror if the object is placed

(b) Image will form At focus by a convex mirror if the object is placed by a convex mirror if the object is placed

19. Question

The shiny outer surface of a hollow sphere of aluminium of radius 60cm is to be used as a mirror :

(a) What will be the focal length of this mirror?

(b) Which type of spherical mirror will it provide ?

(c) State whether this spherical mirror will diverge or converge light rays.

Answer

(a) R=60cm

f=?

We know that

f=R/2 = 60/2 = 30 cm

(b) It will provide convex mirror

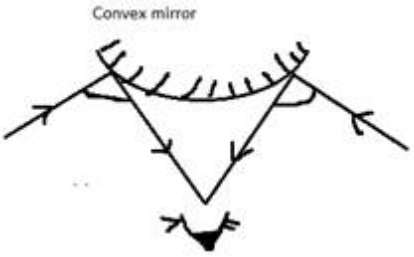
(c) diverge light rays.

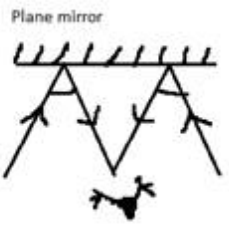
20. Question

What is the advantage of using a convex mirror as a rear-view mirror in vehicles as compared to a plane mirror? Illustrate your answer with the help of labelled diagrams.

Answer

The advantage of using a convex mirror as a rear-view mirror in vehicles as compared to a plane mirror is that a convex mirror has a wider field of view as compared to a plane mirror. which enables driver to view much larger area of the traffic behind him.





21. Question

Give two uses of a convex mirror. Explain why you would choose convex mirror for these uses.

Answer

Two uses of convex mirror:

1) Convex mirrors are used inside buildings:

Large hospitals, offices or stores sometimes make use of convex mirrors in order to let people see what is around a corner to avoid people running into each other and prevent minor/major collisions.

2) Convex mirrors are used in vehicles:

They are used as a rear view mirror in vehicles because the mirror can diverge a beam of light and makes a virtual image. And as the focal length and radius of curvature of the convex mirror are virtual the image is always produced up the right way and that too smaller in size than the actual size of the object. So the mirror is able to give a wide view of the field.

22. Question

What would your image look like if you stood close to a large :

(a) convex mirror?

(b) concave mirror ?

Give reasons for your answer.

Answer

(a) Our image will be diminished, virtual and erect if we stand close to a large convex mirror because when the object lies anywhere between the pole and inifinity, the concave mirror forms a diminished, virtual and erect image.

(b) image will be enlarged, virtual and erect if we stand close to a large concave mirror because when the object lies within the focus of a concave mirror, it forms an enlarged, virtual and erect image.

23. Question

Which of the following are concave mirrors and which convex mirrors ? Shaving mirrors, Car headlight mirror, Searchlight mirror, Driving mirror, Dentist's inspection mirror, Torch mirror, Staircase mirror in a double- decker bus, Make-up mirror, Solar furnace mirror, Satellite TV dish, Shop security mirror.

Answer

Concave	Convex
Shaving mirror	Driving mirror
Car headlight mirror	Staircase mirror in a double-decker bus
Searchlight mirror	Shop security mirror
Dentist's inspection mirror	
Torch mirror	
Make -up mirror	
Solar furnace mirror	
Satellite TV dish	

24. Question

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

Answer

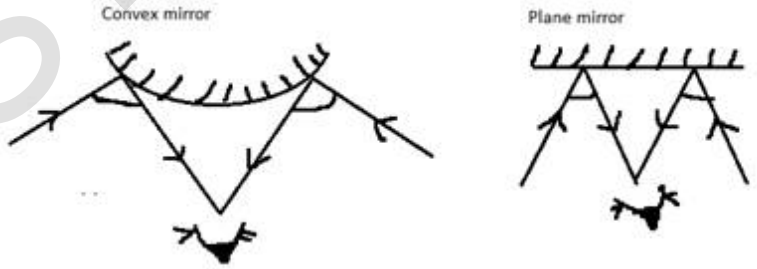
We can distinguish between a plane mirror, a concave mirror and a convex mirror by bringing our face close to each mirror, turn by turn.

Plane mirror	Concave mirror	Convex mirror
Image is of same size	Image is magnified	Image is diminished

25. Question

If a driver has one convex and one plane rear-view mirror, how would the images in each mirror appear different?

Answer



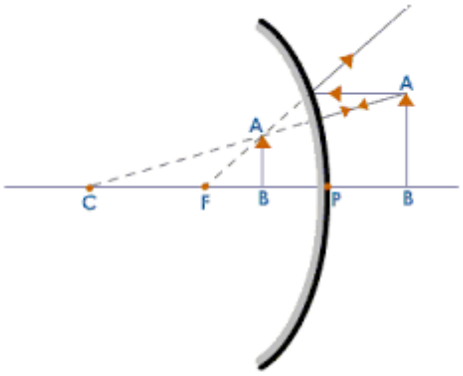
The images formed in the convex rear-view mirror will be smaller than those formed in the plane rear-view mirror.

Long Answer Type Questions-Pg-206

26 A. Question

Draw a labelled ray diagram to show the formation of image of an object by a convex mirror. Mark clearly the pole, focus and centre of curvature on the diagram.

Answer



26 B. Question

What happens to the image when the object is moved away from the mirror gradually?

Answer

the size of the image goes on decreasing.

26 C. Question

State three characteristics of the image formed by a convex mirror.

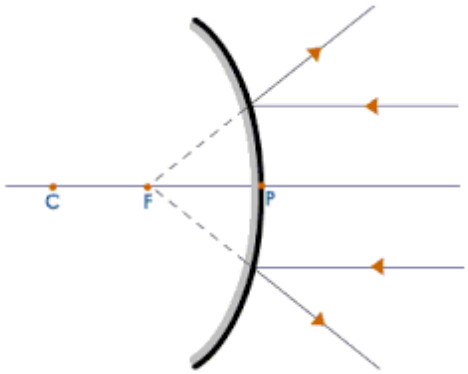
Answer

virtual, erect and diminished.

27 A. Question

Draw a labelled ray diagram to show the formation of image in a convex mirror when the object is at infinity. Mark clearly the pole and focus of the mirror in the diagram.

Answer



27 B. Question

State three characteristics of the image formed in this case.

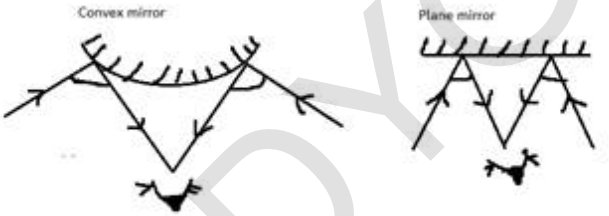
Answer

Nature of image is virtual, erect, diminshed.

27 C. Question

Draw diagram to show how a convex mirror can be used to give a large field of view.

Answer



Multiple Choice Questions (MCQs)-Pg-206

28. Question

The image formed by a spherical mirror is virtual. The mirror will be

A. concave

B. convex

C. concave/convex

D. metallic

Answer

Image formed can be virtual in both the mirror cases that is concave as well as convex.

29. Question

Whatever be the position of the object, the image formed by a mirror is virtual, erect and smaller than the object. The mirror then must be :

A. concave

B. convex

C. plane

D. metallic

Answer

Image formed can be virtual in both the mirror cases that is concave as well as convex.

30. Question

The mirror used by a dentist to examine the teeth of a person is :

A. concave

B. convex

C. plane

D. metallic

Answer

Concave mirror will be used to see an enlarged image of our teeth

31. Question

If the image formed is always virtual, the mirror can be :

A. concave or plane

B. convex or plane

C. concave/convex

D. plane

Answer

Image formed by plane mirror and convex mirror is always virtual.

32. Question

A concave mirror cannot be used as :

A. a dentist's mirror

B. a torch reflector

C. a magnifying mirror

D. arear view mirror

Answer

Convex mirror is used as a rear view mirror.

33. Question

A boy is standing in front of and close to a special mirror. He finds the image of his head bigger than normal, the middle part of his body of the same size, and his legs smaller than normal. The special mirror is made up of three types of mirrors in the following order from top downwards :

A. Concave, Plane, Convex

B. Plane, Convex, Concave

C. Convex, Plane, Concave

D. Convex, Concave, Plane

Answer

Plane mirror	Concave mirror	Convex mirror
Image is of same size	Image is magnified	Image is diminished

34. Question

The mirror which can form a magnified image of an object is :

A. concave

B. convex

C. plane

D. metallic

Answer

Concave mirror will be used to see an enlarged image.

35. Question

A real image of an object is to be obtained. The mirror required for this purpose is :

A. concave

B. convex

C. plane

D. metallic

Answer

Concave and plane always gives virtual

36. Question

Consider two statements A and B given below :

A : real image is always inverted

B : virtual image is always erect

Out of these two statements :

A. only A is true

B. only B is true

C. both A and B are true

D. Neither A and B is true

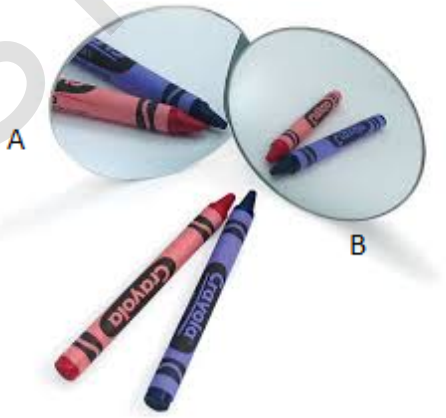
Answer

Plane mirror and convex mirror gives virtual and erect image.

Questions Based on High Order Thinking Skills (HOTS)-Pg-207

37. Question

The diagrams show the appearance of crayons when placed in front of and close to two mirrors A and B, turn by turn.



(a) Which mirror is convex?

(b) Which mirror is concave ? Give reasons for your choice.

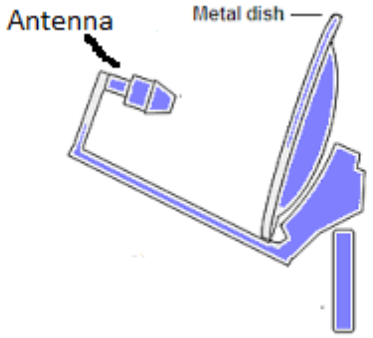
Answer

(a) Mirror B is convex ; It forms a smaller image of crayon

(b) Mirror A is concave ; It forms a larger image of crayon

38. Question

The diagram shows a dish antenna which is used to receive television signals from a satellite. The antenna (signal detector) is fixed in front of the curved dish.



(a) What is the purpose of the dish?

(b) Should it be concave or convex ?

(c) Where should the antenna be positioned to receive the strongest possible signals ?

(d) Explain what change you would expect in the signals if a larger dish was used.

Answer

(a) the purpose of the dish is To collect a large amount of TV signals from the satellite

(b) It should be Concave mirror.

(c) the antenna be positioned to receive the strongest possible signals At the focus of the dish.

(d) If larger dish was used stronger signals will be received .

39. Question

A man standing in front of a special mirror finds his image having a very small head, a fat body and legs of normal size. What is the shape of :

(a) top part of the mirror?

(b) middle part of the mirror ?

(c) bottom part of the mirror? Give reasons for your choice.

Answer

(a) the shape of top part of the mirror is Convex mirror as it forms smaller image

(b) the shape of middle part of the mirror is Concave mirror as it forms bigger image

(c) the shape of bottom part of the mirror is Plane mirror as it forms image of same size.

40. Question

Two big mirrors A and B are fitted side by side on a wall. A man is standing at such a distance from the wall that he can see the erect image of his face in both the mirrors. When the man starts walking towards the mirrors, he finds that the size of his face in mirror A goes on decreasing but that in mirror B remains the same.

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

(b) mirror A is plane and mirror B is concave

(c) mirror A is concave and mirror B is plane

(d) mirror A is convex and mirror B is plane

Answer

(d) Mirror A is convex and mirror B is plane

Short Answer Type Questions-Pg-209

1. Question

An object is kept at a distance of 5 cm in front of a convex mirror of focal length 10 cm. Calculate the position and magnification of the image and state its nature.

Answer

Object distance = 5cm

Focal length = 10 cm

Image distance after using the formula = 3.3 cm

Magnification = v/u = 3.3/5 = 0.66

Nature of the image is virtual and erect.

2. Question

An object is placed at a distance of 10 cm from a convex mirror of focal length 5 cm.

(i) Draw a ray-diagram showing the formation of image.

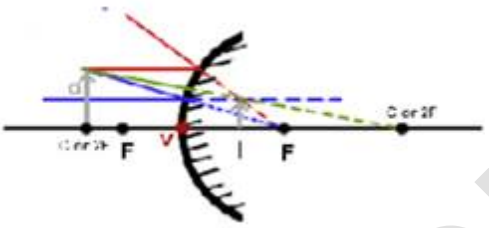
(ii) State two characteristics of the image formed.

(iii) Calculate the distance of the image from mirror.

Answer

Object distance = 10cm

Focal length = 5 cm

(1) 

(ii) The image formed is Virtual and erect as well as Diminished.

(iii) Using the mirror formula,

Image formation = 3.3 cm behind the convex mirror

3. Question

An object is placed at a distance of 6 cm from a convex mirror of focal length 12 cm. Find the position and nature of the image.

Answer

Object distance = 6 cm

Focal length = 12 cm

Uisng mirror formula,

Image distance = 4 cm behind the mirror

The natue of the image is Virtual and erect

Magnification , m = v/u = 4/6 = 0.66 ,

Hence the image formed is diminished.

4. Question

An object placed 20 cm in front of a mirror is found to have an image 15 cm

(a) in front of it,

(b) behind the mirror.

Find the focal length of the mirror and the kind of mirror in each case.

Answer

Object distance, u = -20cm

(a) Image distance = -15 cm

Using the mirror formula, we get

focal length= $\frac{60}{7}$ cm

The kind of mirror is concave mirror.

(b) Image distance = 15cm

Using the mirror formula, we get

focal length = 60 c-m

The kind of mirror is convex mirror.

5. Question

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

Answer

Height of object = 2.5cm

Object distance from mirror = -25cm

Focal length = -20cm

Using the mirror formula,

Image distance, v = 11.1 cm

Thus, the image is formed 11.1 cm behind the convex mirror and is Virtual and erect.

Magnification, m = v/u = 1.1 cm tall

6. Question

A convex mirror used as a rear-view mirror in a car has a radius of curvature of 3 m. If a bus is located at a distance of 5 m from this mirror, find the position of image. What is the nature of the image ?

Answer

Radius of curvature , R = 3m

F = R/2 = 3/2 = 1.5 m

Object distance from mirror = (-5m)= u(As it is on left of the mirror)

Using the mirror formula, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ Putting the Values in above equation

$$\frac{1}{v}-\frac{1}{5}=\frac{1}{1.5}$$

$$\therefore \frac{1}{v}=\frac{1}{1.5}+\frac{1}{5}$$

we get:- $$\Rightarrow \frac{1}{v}=\frac{10}{15}+\frac{1}{5}$$

$$\Rightarrow \frac{1}{v}=\frac{10+3}{15}=\frac{13}{15}$$

$$\therefore v=\frac{15}{13}=1.15$$

Image distance = 1.15 m behind the mirror;

The nature of the image formed is Virtual and erect

7. Question

A diverging mirror of radius of curvature 40 cm forms an image which is half the height of the object. Find the object and image positions.

Answer

Radius of curvature , R = 40 cm

F = R/2 = 40/2 = 20 cm

Magnification, m = 1/2

v/u = 1/2

such that u = 2v

Using the mirror formula,

Object distance = 20cm

And the image distance = 10cm

behind the mirror

8. Question

The radius of curvature of a convex mirror used as a rear view mirror in a moving car is 2.0 m. A truck is coming from behind it at a distance of 3.5 m. Calculate

(a) position, and

(b) size, of the image relative to the size of the truck. What will be the nature of the image ?

Answer

Radius of curvature , R = 2m

F = R/2 = 2/2 = 1 m

Object distance from mirror = 3.5m

Using the mirror formula,

(a) Image distance is 0.77 m behind the mirror

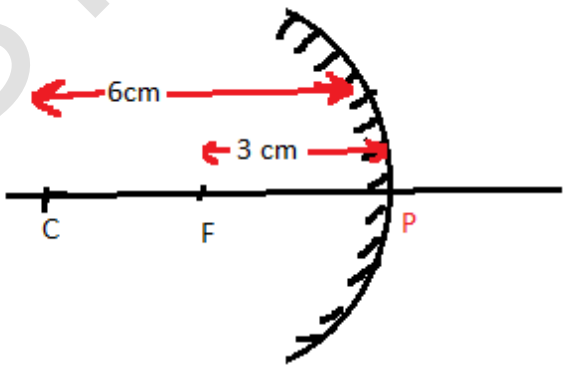
(b)m = v/u = 4.5 ; The nature of the image is Virtual and erect

Long Answer Type Questions-Pg-209

9 A. Question

Draw a diagram to represent a convex mirror. On this diagram mark principal axis, principal focus F and the centre of curvature C if the focal length of convex mirror is 3 cm.

Answer



9 B. Question

An object 1 cm tall is placed 30 cm in front of a convex mirror of focal length 20 cm. Find the size and position of the image formed by the convex mirror.

Answer

Focal length = 3cm

Height of object = 1cm

Object distance = -20cm

Using mirror formula,

Image distance = 0.4 cm and size of the image is 12 cm behind the mirror

Questions Based on High Order Thinking Skills (HOTS)-Pg-209

10. Question

A shop security mirror 5.0 m from certain items displayed in the shop produces one-tenth magnification.

(a) What is the type of mirror ?

(b) What is the radius of curvature of the mirror ?

Answer

(a) the type of mirror is Convex mirror

(b) Magnification = 1/10 = v/u

u = 10v

Object distance = 5m

Using mirror formula,

Focal length = 4.5m

Radius of curvature = 2f=9m0

11. Question

An object is placed 15 cm from

(a) a converging mirror, and

(b) a diverging mirror, of radius of curvature 20 m. Calculate the image position and magnification in each case.

Answer

(a) Object distance = 15cm

Radius of curvature = 20m

F = R/2 = 20/2 = 10m

Using mirror formula for concave lens,

Image distance, v = -30 cm

The image is formed 30 cm in front of converging mirror;

Magnification, m = v/0u = -2

(b) Object distance = 15cm

Radius of curvature = 20m

F = R/2 = 20/2 = 10m

Using mirror formula for convex lens,

Image distance v = + 6 cm

The image is formed 6 cm behind the diverging mirror ;

Magnification, m = v/u =0.4

12. Question

An object 20cm from a spherical mirror gives rise to a virtual image 15 cm behind the mirror. Determine the magnification of the image and the type of mirror used.

Answer

Object distance , u = -20cm

Image distance, v = 15cm

Magnification, m = v/u = + 0.75 ;

The type of mirror used is Convex mirror