Physics Chapter No:13 Propagation and Reflection Of Light

MCQs

Q1- In an astronomical telescope the focal length of objective lens is 100 cm and that of eyepiece is 2 cm. The magnifying power of the telescope for the normal eye is :
A) 1/50
B) 100
C) 10
D) 50

Q2- A ray reflected successively from two plane mirrors inclined at a certain angle undergoes a deviation of 3000 . Then the number of images observable is :
A) 60
B) 12
C) 11
D) 5

Q3- Light with wavelength of 6000 A0 units has a frequency :
A) 5×10^{17} Hz
B) 5×10^{16} Hz
C) 5×10^{15} Hz
D) 5×10^{14} Hz

Q4- Large aperture objects are used in telescopes because they :
A) Have better dispersion
B) Have less aberration
C) Have better resolution
D) Can see larger objects

Q5- At what distance from a screen will a 27 Cd lamp provide the same illumination as a 75 Cd lamp 15 m from the screen ?
A) 9 m
B) 6 m
C) 3 m
D) 1 m

Q6- Monochromatic light of frequency 5×10^4 Hz travelling in vacuum enters a medium of refractive index 1.5. Its wavelength in the medium is :
A) 5000 A0
B) 4000 A0
C) 5500 A0
D) 6000 A0

Q7- Two thin lenses, one of focal length +60 cm and the other of focal length -20 cm are kept in contact. Their combined focal length is
A) Minus 30 cm
B) Plus 30 cm
C) Minus 15 cm
D) Plus 30 cm

Q8- The focal length of a concave mirror is f and the distance of the object to the principal focus is p . Then the ratio of the size of the image to the size of the object is :

A) p/p
B) p/f
C) fp
D) (?pf)

Q9- For which of the given is luminous efficiency maximum ?
A) Sodium vapour lamp
B) Mercury vapour lamp
C) Arc lamp
D) Tungsten filament lamp

Q10- When light travels from one medium to other whose refractive index is different, then which of the given will change?
A) Wavelength and velocity
B) Frequency and wavelength
C) Frequency and wavelength
D) Frequency, wavelength and velocity

Q11- A blue object on a white background when seen through a blue filter will appear :
A) Black on a blue background
B) Blue on a white background
C) Blue on a red background
D) Invisible

Q12- In a photometer two sources of light when placed at 30 and 50 cm respectively produce shadow of equal intervals. Their candles are in the ratio of
A) 9/25
B) 16/25
C) 3/5
D) 6/25

Q13- Spherical air bubble in water will act as :
A) A concave lens
B) A convex lens
C) Plane-concave lens
D) Plane glass plate

Q14- A ray of light is incident on a plane mirror at an angle of incidence 300 . The ray after reflection is deviated through :
A) 30 degree
B) 60 degree
C) 90 degree
D) 120 degree

Q15- The number of images observable between two parallel mirrors is :
A) 2
B) 4
C) 6
D) Infinity

Q16- f = r/2 is valid :
A) For convex mirrors but not for concave mirrors
B) For concave mirrors but not for convex mirrors

C) For both convex and concave mirrors
D) Neither for convex mirrors nor for concave mirrors

Q17- Laser is :
A) Coherent and monochromatic only
B) Intense and monochromatic only
C) Intense and coherent only
D) Intense coherent and monochromatic

Q18- The focal length of a plano-convex lens having a radius of curvature of 10 cm for convex surface and a refractive index of 1.5 will be :
A) 20 cm
B) 15 cm
C) 10 cm
D) 5 cm

Q19- If in a plano-convex lens the radius of curvature of the convex surface is 10 cm and the focal length of the lens is 30 cm then the refractive index of the material of lens will be :
A) 1.33
B) 3
C) 1.66
D) 1.5

Q20- Total internal reflection of light is possible when light enters from :
A) Water to air
B) Air to water
C) Vacuum to air
D) Air to glass

Q21- Magnifying power of a compound microscope is the ratio of the angle formed by the final image to the angle formed by the object when :
A) Image is at the least distance of distinct vision and object may be anywhere
B) Object and image are both at infinity
C) Object and image are both at the least distance of distinct vision
D) Object is placed at the least distance of distinct vision and image may be at any place

Q22- When white light moves through vacuum :
A) Violet has greater speed than red
B) Red has greater speed than violet
C) All colours have the same speed
D) Different colours have different random speeds

Q23- Refractive index of a material for infrared light is :
A) Equal to that for red colour of light
B) Equal to that for ultraviolet light
C) Less than that for ultraviolet light
D) Greater than that for ultraviolet light

Q24- A hole is made in a convex lens . Then :
A) A hole appears in the image
B) Image size decreases
C) Image intensity decreases
D) No change

Q25- Critical angle of light passing from glass to air is minimum for :
A) Red
B) Green
C) Yellow
D) Violet

Q26- Which of the given is not true of an image formed by a plane mirror ?
A) It is erect
B) It is virtual
C) It is diminished
D) It is at the same distance as the object

Q27- Two lenses of power +3 and -1 diopters are placed in contact. The focal length of the combined lens is :
A) 100 cm
B) 25 cm
C) 50 cm
D) 30.3 cm

Q28- The focal length of a concave mirror is 50 cm. To obtain an inverted image two times the size of the object the object should be placed at :
A) 50 cm
B) 63 cm
C) 72 cm
D) 75 cm

Q29- What is the minimum distance between an object and its virtual image in case of a concave lens ?
A) 0
B) f
C) 2f
D) 4f

Q30- The focal length of lens depends on :
A) The radii of curvature of its surfaces
B) The refractive index of its material
C) The refractive index of the medium surrounding
D) All of the these factors

Q31- A parallel beam of light is incident on a converging lens parallel to its principal axis. As we move away from the lens on the other side on its principal axis the intensity of light
A) Remains constant
B) Continuously increases
C) Continuously decreases
D) First increases and then decreases

Q32- Using a convex lens, a clear image of candle flame is produced on a screen. How many other clear images can be received on this screen if only the lens is to be shifted ?
A) A large number
B) Only one more
C) Two more
D) None of these

Q33- A convex lens of power P is immersed in a water . How will its power change ?
A) Increases
B) Remain unchanged
C) Decreases
D) Increases for red colour and decreases for blue colour

Q34- In order to increase the magnifying power of a microscope :
A) The objective should have larger focal length and eyepiece should have small focal length
B) The focal power of the objective and the eyepiece should be larger
C) The objective should have small focal length and the eyepiece should have larger focal length
D) The focal length of the objective and the eyepiece should be large

Q35- The focal length of the object of microscope is
A) Greater than the focal length of eyepiece
B) Less than the focal length of eyepiece
C) Equal to the focal length of eyepiece
D) Arbitrary

Q36- In which of the given cases do we get very strong reflected rays and very weak refracted rays ?
A) Light passing from air to glass
B) Light passing from water to glass
C) Light passing from glass to diamond
D) Light passing from water to air

Q37- Light waves spreading from two sources produce interference only if they are :
A) Coherent
B) Transverse
C) Longitudinal
D) None of these

Q38- Which of the given can produce a virtual image larger in size than the object ?
A) Convcave lens
B) Convex lens
C) Convex concave lens
D) None of these

Q39- A lens has a power of +0.5D. It is:
A) A concave lens of local length 5 m
B) A convex lens of focal length 2 m
C) A convex lens of focal length 5 m
D) A concave lens of focal length 2 m

Q40- On heating a liquid the refractive index generally:
A) Increases
B) Decreases
C) Does not change
D) Increases or decreases depending upon rate of heating

Q41- A diverging lens will produce
A) Always a virtual image
B) Real or virtual image

C) Always real image
D) None of these

Q42- A hunter wants to shoot a fish whose image can be seen through clear water. It is to be aimed:
A) Below the image of fish
B) Above the image of fish
C) Directly towards the image
D) In any direction

Q43- When light enters from a rarer medium to a denser medium:
A) Its frequency changes
B) Wavelength does not change
C) Its wavelength changes
D) Both wavelength and frequency change

Q44- Refractive index:
A) Depends on the wavelength of light used to measure
B) Is actual property of the substance
C) Depends on the angle of incidence
D) None of these

Q45- An object is approaching a plane mirror at 5 cm/s. A stationary observer sees the image. At what speed will the image appear to approach the stationary observer?
A) 20 cm/s
B) 10 cm/s
C) 15 cm/s
D) 5 cm/s

Q46- If a diverging lens is to be used to form an image which is one fourth of the size of the object where must the object be placed?
A) 3f
B) 4f
C) 2f
D) F

Q47- Which of the given is NOT paired correctly?
A) Solar furnace-concave mirror
B) Rear -view mirror-convex mirror
C) Magnifying glass -convex lens
D) None of these

Q48- A concave lens from the image of an object which is :
A) Virtual inverted and diminished
B) Virtual upright and diminished
C) Virtual inverted and enlarged
D) Virtual upright and enlarged

Q49- A man runs towards the plane mirror at 2 m/s. The relative speed of his image with respect to him will be:
A) 4 ms^{-1}
B) 2 ms^{-1}

C) 8 ms^{-1}
D) 10 ms^{-1}

Q50- In order to obtain a magnification of, -0.6 (minus 0.6) 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

Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.
1	D	11	D	21	D	31	D	41	B
2	C	12	A	22	C	32	B	42	A
3	D	13	A	23	C	33	C	43	C
4	C	14	D	24	C	34	A	44	A
5	A	15	D	25	D	35	B	45	D
6	B	16	C	26	C	36	D	46	A
7	A	17	D	27	C	37	A	47	D
8	A	18	A	28	D	38	B	48	B
9	A	19	A	29	A	39	B	49	A
10	A	20	A	30	D	40	B	50	D

Questions

i) Define reflection of light. State the laws of reflection.

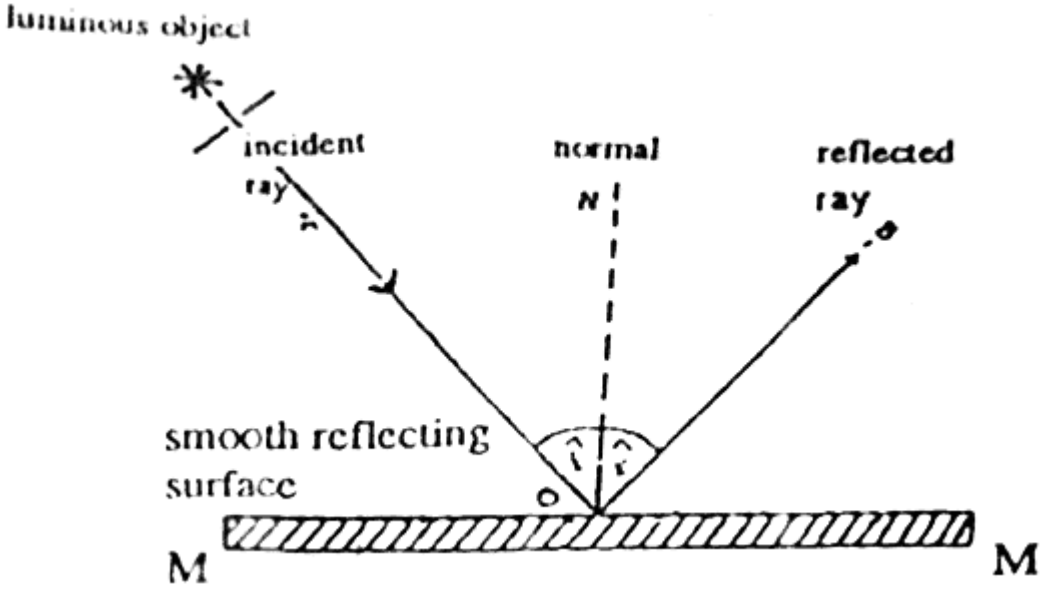
Answer:

REFLECTION OF LIGHT:

When light spreading from a source in one medium strikes the surface of another medium a part of it is sent back in the same medium or reflected, a part is absorbed and a part is transmitted into the other medium (or refracted) if it is transparent or translucent. The phenomenon of reflection is widely used in our life. For example the reflection of radar waves is used for safe take-off and landing of aeroplanes.

LAWS OF REFLECTION:

Light travels in a straight line in a homogeneous medium When light traveling in one medium strikes the surface of another medium a part of it is reflected in the same medium. Mirrors and highly polished opaque surfaces reflect light strongly.



From the figure it can be seen that the angles are found to be the same in magnitude. We also observe that the incident ray, reflected ray and the normal lie in the same plane satisfying the following conditions or laws

1. The angle of incidence is equal to the angle of reflection. Mathematically, we can express this as follows.

i.e.

$$m < \hat{i} = m < \hat{r}$$

2. **The incident ray, the reflected ray and the normal line lie in the same plane.**

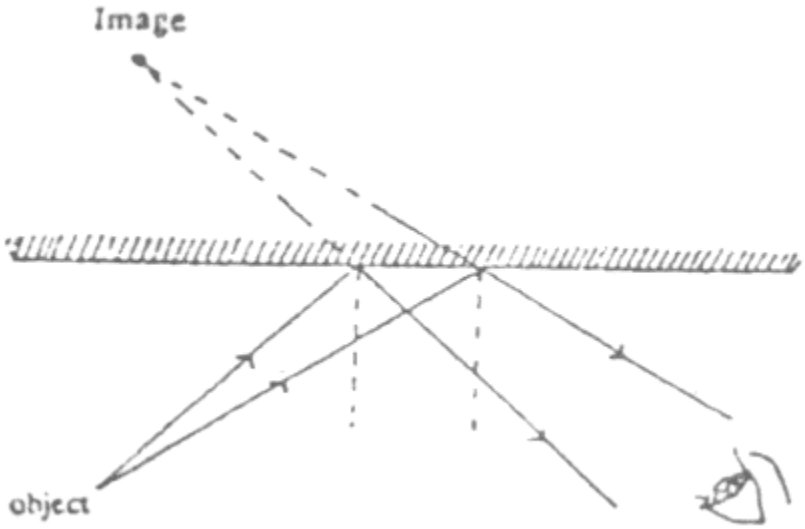
These are called the laws of reflection.

ii) Explain the formation of an image by a plane mirror.

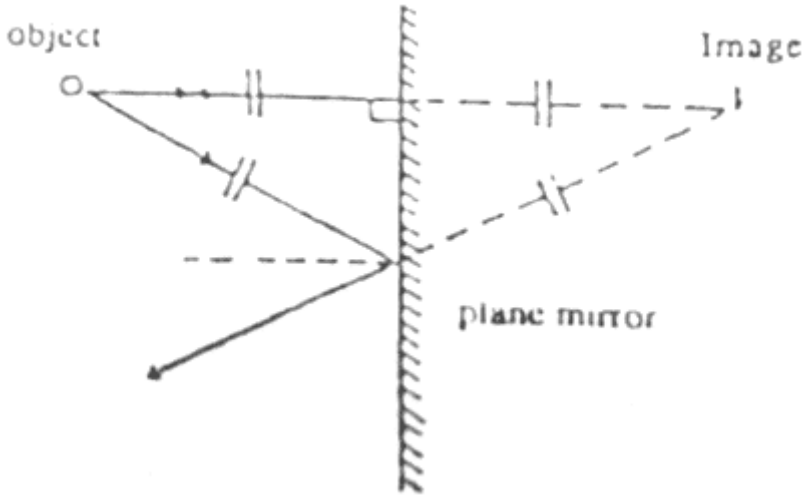
Answer:

IMAGE FORMED BY A PLANE MIRROR:

When we look into a plane mirror we see that those objects which are really in front of the mirror seem to be behind the mirror. The formation of images by a mirror is due to the fact that the rays travelling from an object to our eye change their direction after reflection so that they appear to come from points other than those from which they really started. We observe the image of an object in a direction in which the light rays enter our eye as shown in figure.



We can locate the image formed by a plane mirror using the rectilinear propagation of light and geometrical methods. Consider the following diagram as shown in figure.



Light rays coming from a luminous object O are reflected by the plane mirror M and enter our eye. The line Which joins the image I and the object O makes an angle of 90° with the surface of the mirror M. From the geometrical construction, the distance OM and IM are equal. Therefore, we feel that the light rays come from I but in fact they come from O and are reflected by the mirror. At the mirror surface we find that the angle of incidence is equal to the angle of reflection. Using the geometrical method, the image of a candle placed in front of a plane mirror can be located. Observing the images formed by a plane mirror we note four main characteristics of the images which are given as follows:

1. Images are found to be bilaterally inverted. That is, the right side of the object appears as the left side of the image.
2. Images are found to be of the same size as that of the object.
3. The image formed is found to be erect and virtual, that is, it cannot be obtained on a screen.
4. The Image is as far behind the mirror as the object is in front of the minor.

iii) What is meant by regular and irregular reflection of light? Describe the importance of irregular reflection in daily life.

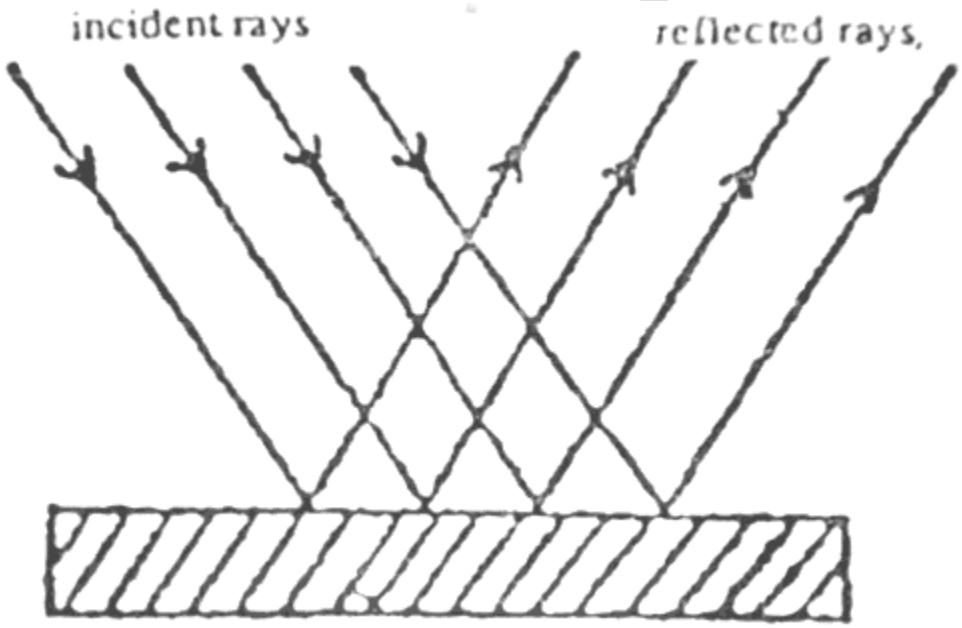
Answer:

REGULAR REFLECTION:

When parallel rays of light strike a smooth and shining surface, like a plane mirror, most of them are reflected in a particular direction. Such a reflection is called a regular reflection. It is also known as a specular reflection.

USE OF REGULAR REFLECTION:

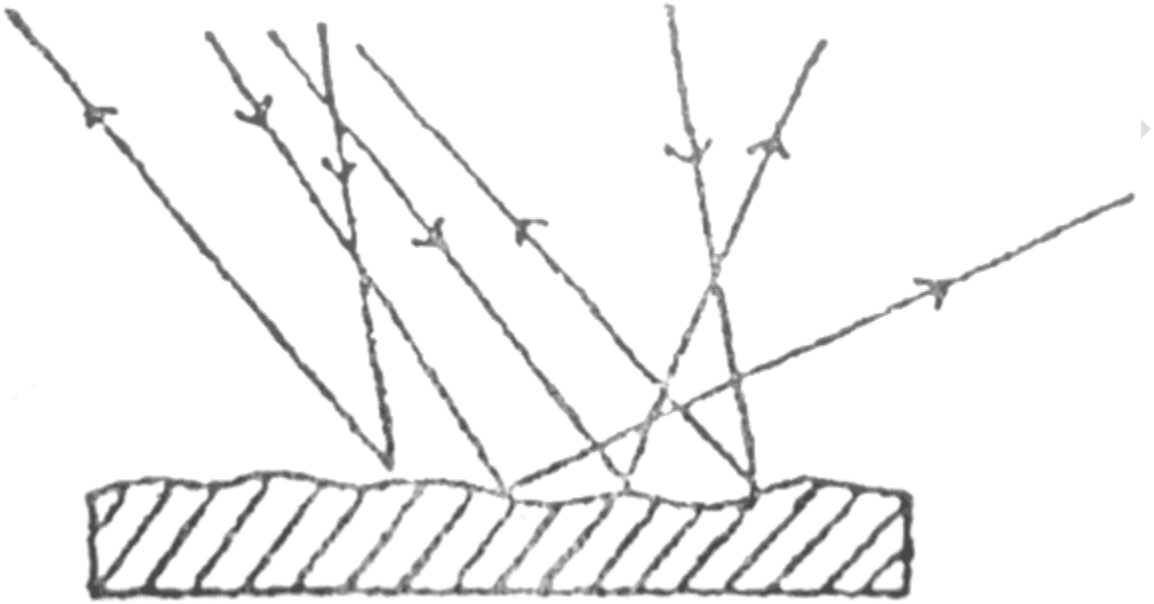
The regular reflection is used In Image formation by mirrors. Because of this regular reflection we can converge or diverge light rays according to our need using spherical reflecting surfaces.



IRREGULAR REFLECTION:

When a parallel beam of light is incident on surfaces like white paper, or a painted wall, the reflected beam is scattered in different directions. The reason for this random scattering is due to the highly irregular nature of these surfaces, which can be observed by using a microscope. Due to the roughness of the

surface, the angle of incidence is not the same for each ray, therefore, the reflected rays scatter in different directions. This type of reflection is known as diffuse or irregular reflection. This can be shown as



USE OF IRREGULAR REFLECTION:

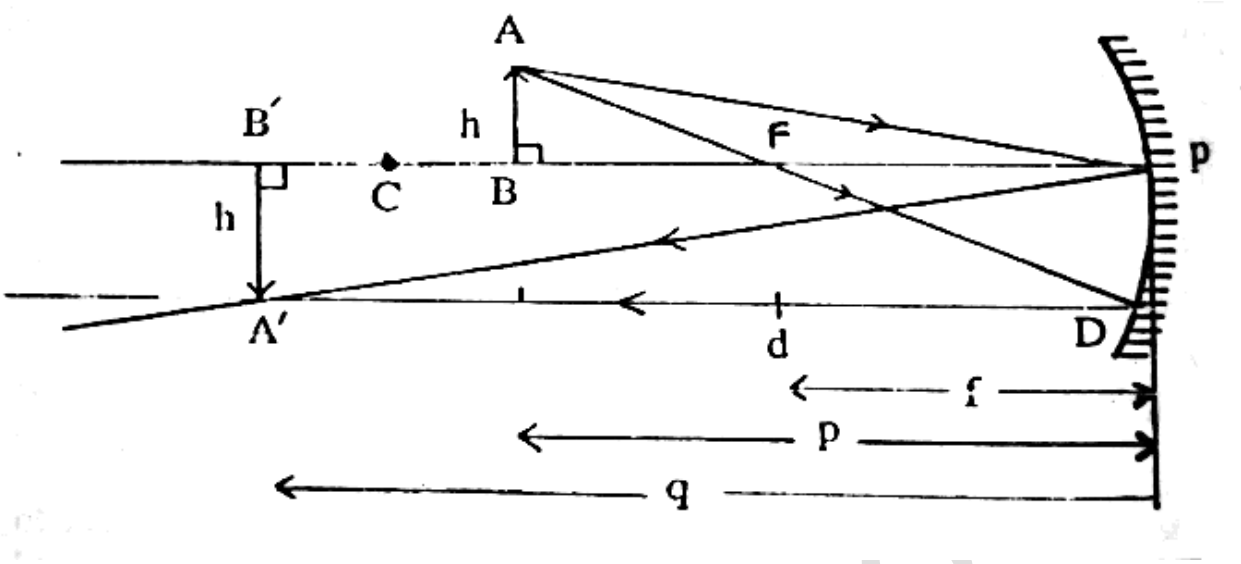
Irregular reflection is very important for us. The gradual change of light, by which we receive light at dawn or after sunset, is due-to irregular reflection of sunlight from the dust particles in air. All the non-luminous objects are visible due to the irregular reflection of light from their surfaces.

iv) Derive mirror equation using concave mirror.

Answer:

MIRROR FORMULA:

It is a relation between the distance of the object, image from the pole of the mirror and the focal length of the mirror. In order to derive a formula for the spherical mirrors consider the formation of an image by a concave mirror when an object is placed between the principal focus and centre of curvature of the mirror as shown in figure.



AB is an object placed before the mirror between the focus and the centre of curvature. Two rays AP and AD are incident on the mirror. Ray AP is reflected with the same angle along the direction PA obeying the law of reflection.

As triangles A' PB' and APB are similar. Therefore,

$$AB/ A' B' = PB/ PB'$$

Or $h_o/h_i = p/q$

Ray AD which passes through F becomes parallel to the principal axis PB. As triangles ABF and FPD are similar.

Therefore, $AB/DB = BF/ FP$

As AB = ho, DP = A' B' and A' B'=hi ,FP= f and BF= p - f

But as $h_o /h_i = (p - f)/f$

and $h_o/h_i = p/q$

Therefore $p/q = (p – f)/f$

Dividing both sides by p we get

$$p/pq = (p-f)/pf$$

$$1/q = 1/f – 1/p$$

Rearranging the above equation we get

$1/f = 1/p + 1/q$

The above equation is known as the mirror equation or minor formula.

v) What are spherical mirrors? Give some uses of spherical mirrors.

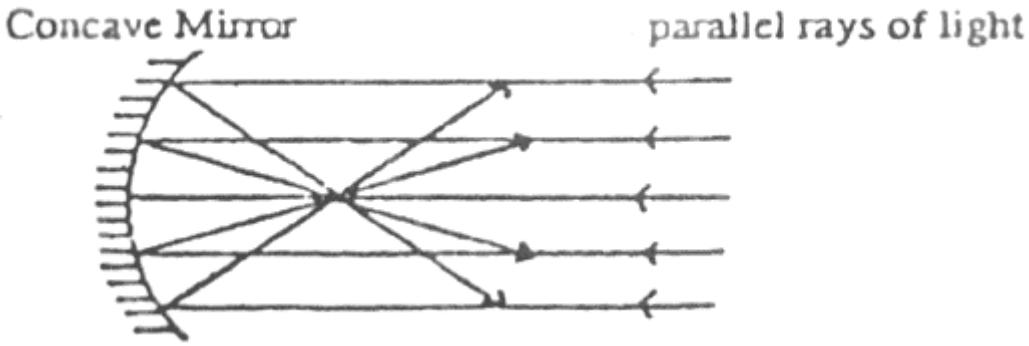
Answer:

SPHERICAL MIRRORS:

A spherical mirror may be considered as a section of a hollow sphere with one polished surface. There are two types of spherical mirrors

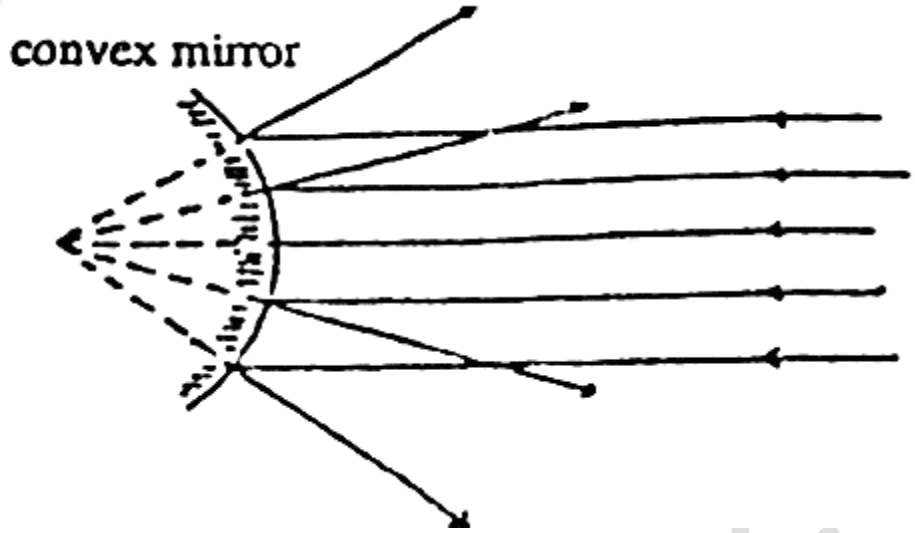
i) CONCAVE MIRROR:

If the inner side of the surface is polished to reflect light it is called a concave mirror. It. has an ability to converge a parallel beam of light. Therefore, it is also called a converging mirror as shown in the figure.



ii) CONVEX MIRROR:

If the outer side of the surface of the section is polished to reflect light it is called a convex mirror, it has an ability to diverge the parallel beam of light which is incident on it. Therefore, it is also known as a diverging mirror as shown in figure.



NOTE:

At every point in both types of spherical mirrors reflection takes place in accordance with the laws of reflection. Therefore every small section of a spherical mirror behaves like a plane mirror.

USES OF SPHERICAL MIRRORS:

There are several important uses of spherical mirrors some of them are given as follows:

i) A concave mirror is used in a microscope to illuminate the object. In a telescope it is used to concentrate the parallel beams of light coming from distant stars.

ii) Concave minors are used by the doctors in ophthalmoscopes, for the medical examination of ear, nose, throat, and eyes.

iii) Concave mirrors are used in searchlights and spotlights. They are also used in the headlights of automobiles.

vi) What is the difference between a real and a virtual image?

Answer:

Real Image	Virtual Image
1) Rays actually converge to form an image.	1) Rays appear to diverge to form an image.
2) Images can be obtained on screen.	2) Images cannot be taken on screen.
3) Image is inverted.	3) Image is erect.
4) Magnification is negative.	4) Magnification is positive.

vii) How a concave mirror is used in headlights and searchlights to throw light at a long distance?

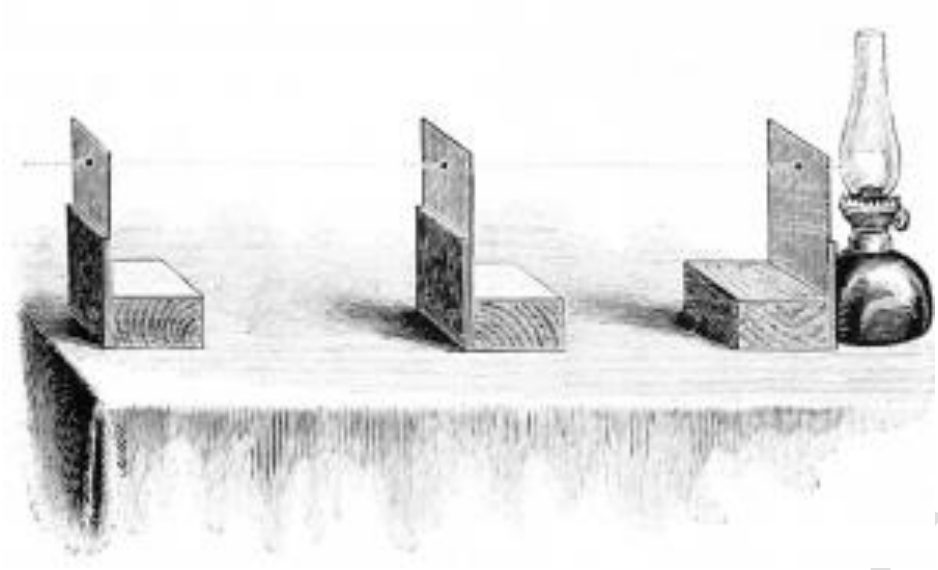
Answer:

In headlights and in searchlights the electric lamp is placed at the focal point of the concave mirror. So that light rays become parallel after reflection from concave mirror.so that these do not scatter and reach at searchlights distance.

Rectilinear Propagation of Light

How does light travel? If you stand up on a mountain you can see around you for miles and miles, how are you able to do that? This article will answer your questions on the propagation of light, more specifically the rectilinear propagation of light. Have you seen a lighthouse by the beach? The lights on a lighthouse rotate around the lighthouse so that it is visible from all sides. Why can't we see a lighthouse if the light isn't rotating?

You will understand the propagation of light with a simple experiment. Place a candle on a table and light it. Place three cardboard sheets blocking your view of the candle. In these cardboard sheets make three pinholes at equal heights such that the flame of the candle is visible through the cardboard sheets. Now view the flame through the holes, you'll find it visible. Now move one of the cardboard sheets and try to see the flame. Can you? On moving the cardboard sheet, you will see that the flame is no longer visible. Now bring the sheets back in line. The flame is visible again.

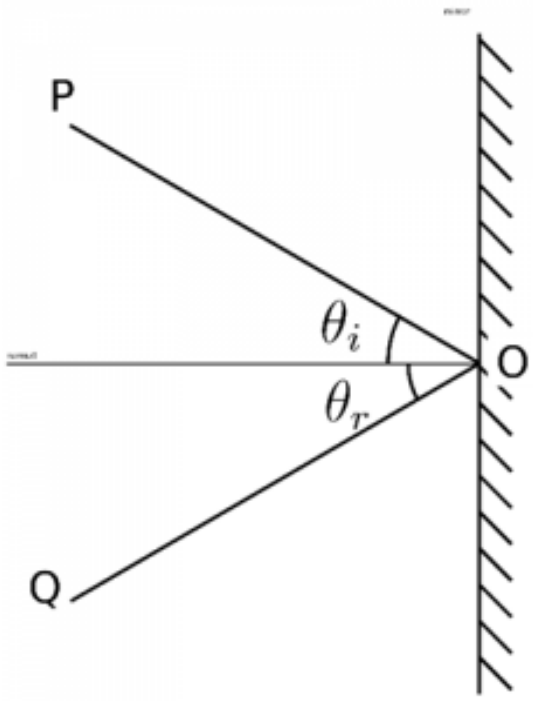


The light is visible only when all the three pinholes are aligned proving the rectilinear propagation of light

From this experiment, we can deduce that light moves from place to place through rectilinear propagation. Rectilinear is a fancy word for straight. Light travels from the source in a straight line. Let's examine another characteristic of light; The Reflection of Light.

Reflection of Light

Have you ever seen your reflection on a still surface of a lake? Surely, you must have seen a mirror. Why can we see our reflection on some surfaces and not others? Reflection of light is referred to the change in the direction of light upon striking a surface. This change in direction occurs whenever light hits a surface, irrespective of the texture or the nature of the surface.



Reflection of light from a surface

So what is the difference between a mirror and a wall? In layman's terms, reflection is dependent on the smoothness of the reflecting surface. For you to see your reflection, the reflection of light has to occur uniformly. For example, if you throw a ball at a rough surface it will bounce in a random direction. Similarly, the reflection of light on a rough surface is also random which does not lead to the formation of a clear reflection. This is though you can see your face in a steel plate, it is not as clear as a mirror.