UNIQUE STUDY POINT
IMP QUESTIONS BASED ON PLANE MIRROR: CLASS X
LIGHT:

Question 1:

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

ANSWER:

When a ray of light falls normally (or perpendicularly) on the surface of a plane mirror, it gets reflected along the same path because the angles of incidence and reflection are both equal to zero.

Question 2:

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

ANSWER:

The angle of reflection is 30° as the angle of incidence is equal to the angle of reflection, in accordance with the first law of reflection.

Question 3:

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

ANSWER:

The angle of reflection is 50°, in accordance with the first law of reflection, which states that the angle of incidence is equal to the angle of reflection.
Here, the angle of incidence = 90° - 40° = 50°(the angle of incidence is the angle between the incident ray and the normal).

Question 4:

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) The angle of incidence is 0° because the incident ray is parallel to the normal.
(b) The angle of reflection is 0° in accordance with the first law of reflection, which states that the angle of incidence is equal to the angle of reflection.

Question 5:

What type of image is formed:

(*a*) in a plane mirror?
(*b*) on a cinema screen?

ANSWER:

(a) The image formed in a plane mirror is virtual because it is formed inspite of there not being an actual meeting of the light rays.
(b) The image formed on a cinema screen is real because it is formed due to an actual meeting of the light rays.

Question 6:

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

ANSWER:

A plane mirror is required in order to obtain a virtual image of the same size as the object, as this is one of the properties of a plane mirror.

Question 7:

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:

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

Question 8:

Name the phenomenon responsible for the following effect:
When we sit in front of a plane mirror and write with our right hand, if appears in the mirror that we are writing with the left hand.

ANSWER:

The phenomenon of lateral inversion is the reason for the given effect.

Question 9:

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

ANSWER:

It will be 20 cm away from its image. This is because the distance of the plane mirror from the object is equal to its distance from the image.

Question 10:

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

ANSWER:

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

Question 11:

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

ANSWER:

An image that cannot be formed on a screen is called a virtual image.

Question 12:

Fill in the following blank with a suitable word:
When light is reflected, the angles of incidence and reflection are ....

ANSWER:

When light is reflected, the angles of incidence and reflection are <u>equal</u>.

Question 13:

State whether the following statement is true of false:
A student says that we can see an object because light from our eyes is reflected back by the object.

ANSWER:

False.We can see an object because light, on being reflected from the object, is scattered and diffused.

Question 14:

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

ANSWER:

When we look at something in a mirror, the image formed is behind it.

Question 15:

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

ANSWER:

The reflected ray makes an angle of $60°$ with the mirror surface because:
angle of incidence = angle of reflection = $30°$, and
angle of the reflected ray with the mirror surface = $90°$ - angle of reflection = $90°$ - $30°$ = $60°$.

Question 16:

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

ANSWER:

S. No.	Real Image	Virtual Image
1	An image that can be projected on a screen is called a real image.	An image that cannot be projected on a screen is called a virtual image.
2	The light rays actually meet at the point of image formation.	The light rays do not actually meet at the point of image formation, but appear to meet there.
3	Example: the image formed on the screen in a cinema hall.	Example: the image formed by a plane mirror.

Question 17:

The letter F 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) The image of the letter F will appear laterally inverse, like this:

Ⅎ

(b) The phenomenon involved is lateral inversion.

Question 18:

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

ANSWER:

When an object is placed in front of a plane mirror, the right side of the object appears as the left side in its image; and the left side of the object appears as the right side in the image. This change of sides of an object and its mirror image is called lateral inversion. For example, the right hand of a person appears as the left hand in the image formed by a plane mirror.

Question 19:

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 would appear as ƎƆИA⅃UᙠMA when reflected in a plane mirror. It is written this way so as to help a person driving a vehicle ahead of the ambulance to read it as AMBULANCE when he/she sees the rear view mirror. This is because the rear view mirror forms a laterally inverted image.

Question 20:

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

ANSWER:

Photograph	Image in a Plane Mirror
A photograph is made when a real image is projected on a photographic film.	The image formed by a plane mirror is virtual and cannot be taken on a photograph.
The image is smaller in size compared to the actual object.	The image is the same size as the object.

Question 21:

(*a*) A wall reflects light and a mirror also reflects light. What difference is there in the way they reflect light?
(*b*) Which type of reflection of light leads to the formation of images?

ANSWER:

(a)

S.No.	Wall Reflected Light	Mirror Reflected Light
1	Light rays are reflected in all directions due to the rough surface.	Light rays are reflected in one direction only due to the smooth surface.

(b) Regular reflection from smooth surfaces like mirrors leads to the formation of images.

Question 22:

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:

Regular Reflection	Diffused Reflection
In regular reflection, light is reflected in one direction only because of the smooth surface of the plane.	In diffused reflection, light is reflected in all directions because of the rough surface of the plane.

S.No.	Type of Surface	Type of Reflection
a	Cinema screen	Diffused reflection
b	Plane mirror	Regular reflection
c	Cardboard	Diffused reflection
d	Still water surface of a lake	Regular reflection

Question 23:

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:

We cannot see anything in a dark room as there is no light present.
(a) We see the electric bulb because it produces light that reaches our eyes directly.
(b) We see a piece of white paper due to the diffused reflection of light from the surface of the paper.

Question 24:

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

ANSWER:

(a) The image formed is 2m behind the mirror and 5 cm wide. The reason being, a plane mirror forms an image of the same size as the object, and at the same distance behind the mirror as that of the object from the mirror.
(b) The image approaches him at a speed of 2 m/s . The reason being, the image moves at a speed of 1 m/s and
 the relative speed of the image will be equal to the sum of the speeds of the image and the boy.

Question 25:

(*a*) An extended object in the form of an arrow pointing upward has been placed in front of a plane mirror. Draw a labelled ray-diagram to show the formation of its image.
(*b*) State the uses of plane mirrors.

ANSWER:

(a)
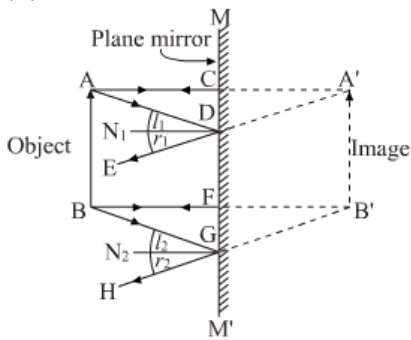
The formation of image of an extended object
(here an arrow *AB*) in a plane mirror.

(b) Uses of a plane mirror:

1. Plane mirrors are used to see ourselves. Example, mirrors in a bathroom.
2. Plane mirrors are fixed on the inner walls of certain shops (like jewellery shops) to make them look bigger.
3. Plane mirrors are fitted at blind turns of some busy roads so that drivers can see the vehicles coming from the other side and prevent accidents.
4. Plane mirrors are used in periscopes.

Question 26:

What is meant by 'reflection of light'? Define the following terms used in the study of reflection of light by drawing a labelled 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 sending back light rays that fall on the surface of an object is called reflection of light. (Figure)
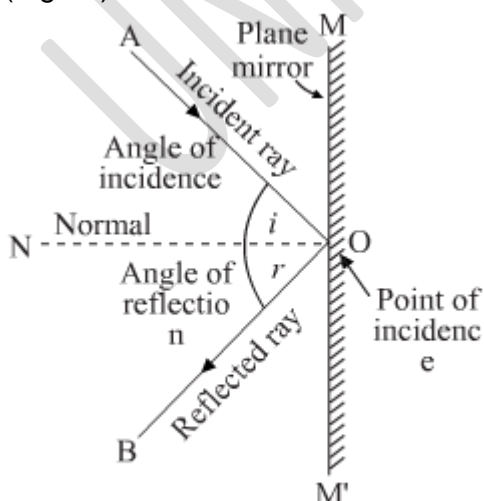
Reflection of light from a plane mirror.

(a) Incident ray: The ray of light that falls on a mirror is called the incident ray. In the figure, AO is the incident ray of light. The incident ray gives the direction of the light falling on the mirror.

(b) Point of incidence: The point at which the incident ray falls on a mirror is called the point of incidence. In the figure, the point O on the surface of the mirror is the point of incidence.

(c) Normal: The normal is a line at right angles to the mirror surface at the point of incidence. In the figure, the line ON is the normal to the mirror surface at point O.

(d) Reflected ray: The ray of light that is sent back by the mirror is called the reflected ray. In the figure, OB is the reflected ray of light. The reflected ray of light shows the direction in which the light travels after being reflected from the mirror.
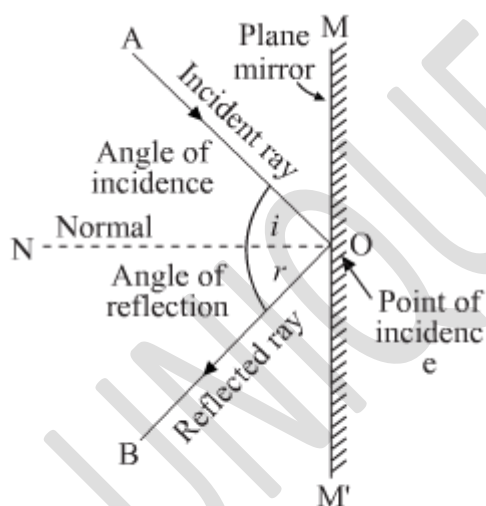
(e) Angle of incidence: The angle of incidence is the angle made by the incident ray with the normal at the point of incidence. In the figure, the angle AON is the angle of incidence. The angle of incidence is denoted by the letter i.

(f) Angle of reflection: The angle of reflection is the angle made by the reflected ray with the normal at the point of incidence. In the figure, the angle NOB is the angle of reflection. The angle of reflection is denoted by the letter r.

Question 27:

State and explain the laws of reflection of light at a plane surface (like a plane mirror), With the help of a labelled 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:

Reflection of light from a plane mirror.

a) The two laws of reflection are:

1. The angle of incidence is always equal to the angle of reflection . If the angle of incidence is i and the angle of reflection is r, then, according to the first law of reflection, $\angle i = \angle r \angle i = \angle r$.

For example, if one measures the angle of reflection <NOB (in the figure), one will find that it is exactly equal to the angle of incidence <AON.

2. The second law of reflection states that the incident ray, the reflected ray and the normal (at the point of incidence), all lie in the same plane. For example, in the figure, the incident ray AO, the reflected ray OB and the normal ON, all lie in the same plane.

(b) If the angle of reflection is 47.5°, the angle of incidence will also be 47.5° in accordance with the first law of reflection, which states that the angle of reflection is always equal to the angle of incidence.

Question 28:

With the help of a labelled 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:
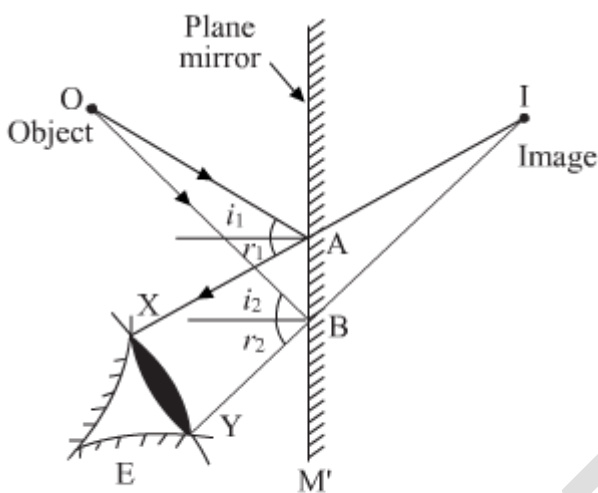
Formation of image in a plane mirror

Consider a small object (a point source of light), placed in front of a plane mirror MM' (figure 1). The mirror will form an image I of the object O. This process of image formation is explained as follows:

The object O gives out light rays in all directions. Now, a ray of light OA, coming from the object O, is incident on the plane mirror at point A. OA gets reflected in the direction AX in accordance with the law of reflection, which states that the angle of reflection r_1 equals the angle of incidence i_1. Another ray of light OB, coming from the object O, strikes the mirror at point B. OB gets reflected in the direction BY, thus, making the angle of reflection r_2 equal to the angle of incidence i_2.
The two reflected rays AX and BY are divergent and cannot meet on the left side. Let's produce the reflected rays AX and BY backwards. They meet at a point I behind the mirror. When the reflected rays AX and BY enter the eye of a person at position E, the eye sees the rays in the direction in which they enter. So, the person looking into the mirror from position E sees the reflected rays as if they are coming from the point I behind the mirror. Thus, the point I is the image of the object O formed by the plane mirror.
The image produced by the plane mirror is virtual, laterally inverse and of the same size as the object.

Question 29:

(*a*) 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.
(*b*) The image in a plane mirror is virtual and laterally inverted. What does this statement mean?
(*c*) Write all the capital letters of the alphabet which look the same in a plane mirror.

ANSWER:

(a) This is because there occurs regular reflection from a plane mirror, which has a smooth surface. Since the particles of the smooth surface are facing one direction, a beam of parallel light rays falling on it is reflected as a beam of parallel light rays in one direction only. These rays meet when produced backwards to form a virtual image of the light source.

However, in the case of a rough paper, a parallel beam of incident light is reflected in different directions (diffused reflection). So, the light rays don't meet to form an image of the object.

(b) This statement implies that the image formed by a plane mirror cannot be produced on a screen. Thus, it is a virtual image. Further, in the image formed, the right side of an object appears as the left side and vice-versa. This is called lateral inversion.

(c) All the capital letters of the alphabet that look the same in a plane mirror are W, X, V, A, H, M, O, I and T.

Question 30:

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

(*a*) always
(*b*) sometimes
(*c*) under special conditions
(*d*) never

ANSWER:

(a) Always,
In accordance with the first law of reflection, which states that the angle of reflection is equal to the angle of incidence.

Question 31:

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

(*a*) 30°
(*b*) 60°
(*c*) 90°
(*d*) 120°

ANSWER:

(b) 120°
Since, angle of incidence = 90° - angle between plane mirror and incident ray = 90° - 30° = 60°
and according to first law of reflection, angle of incidence = angle of reflection = 60°
Total angle between incident ray and reflected ray = 60° + 60° = 120°.

Question 32:

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*) 45°
(*b*) 90°
(*c*) 0°
(*d*) 60°

(c) 0°
since angle of incidence = 0° .
According to the first law of reflection, the angle of incidence is equal to the angle of reflection.

Question 33:

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

(*a*) virtual
(*b*) real
(*c*) diminished
(*d*) upside-down

(a) Virtual

The reason being, the image cannot be projected on a screen.

Question 34:

The image formed by a plane mirror is :

(*a*) virtual, behind the mirror and enlarged.
(*b*) virtual, behind the mirror and of the same size as the object.
(*c*) real, at the surface of the mirror and enlarged.
(*d*) real, behind the mirror and of the same size as the object.

(b) Virtual, behind the mirror and of the same size as the object

The image formed by a plane mirror is virtual, behind the mirror and of the same size because it cannot be projected on a screen.

Question 35:

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

(*a*) 2.25
(*b*) 2.35
(*c*) 6.45
(*d*) 9.25

(d) 9.25,
since the image formed by a plane mirror is laterally inverted.

Question 36:

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:

Man should walk 7.5 m towards the mirror.
The reason being, the image formed by a plane mirror is the same distance behind the mirror as it is between the object and the mirror. A distance of 5m between man and his image means that the distance between him and the mirror = $\frac{5}{2}$= 2.5 m.
Thus, the distance he should walk = 10 - 2.5 = 7.5 m.

Question 37:

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:

(b) 4 cm

Question 38:

A man sits in an optician's chair looking into 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:

The image of the chart will appear 4.5 m away from the eye.
The image of the chart will form at a distance of 2 m + 0.5 m = 2.5 m behind the mirror. The reason being, the image formed by a plane mirror is at the same distance behind it as it is between the object and the mirror.
Thus,
distance of the chart's image from the eye = distance of man from the mirror + distance of image formed behind the mirror = 2 + 2.5 = 4 m.

Question 39:

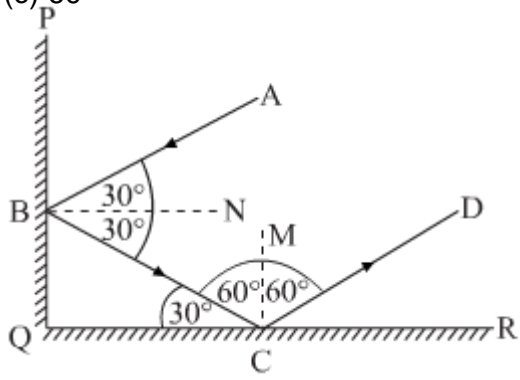A ray of light strikes a plane mirror *PQ* at an angle of incidence of 30°, is reflected from the plane mirror and then strikes a second plane mirror *QR* placed at right angles to the first mirror. The angle of reflection at the second mirror is:

(*a*) 30°
(*b*) 45°
(*c*) 60°
(*d*) 90°
Draw a ray-diagram to illustrate your answer.

ANSWER:

(c) 60°