**Question 1:**
Define the term power of a lens. In what unit is it expressed?
**Solution 1:**
The power of a lens is a measure of deviation produced by it in the path of rays refracted through it.
Its unit is Dioptre (D).

**Question 2:**
How is the power of a lens related to its focal length?
**Solution 2:**
Power of lens (in D) = $\frac{1}{\text{focal length (in metre)}}$

**Question 3:**
How does the power of a lens change is its focal length is doubled?
**Solution 3:**
If focal length of a lens doubled then its power gets halved.

**Question 4:**
How is the sign (+ Or -) of power of a lens related to its divergent or convergent action?
**Solution 4:**
The sign of power depends on the direction in which a light ray is deviated by the lens. The power could be positive or negative. If a lens deviates a ray towards its centre (converges), the power is positive and if it deviates the ray away from its centre (diverges), the power is negative.

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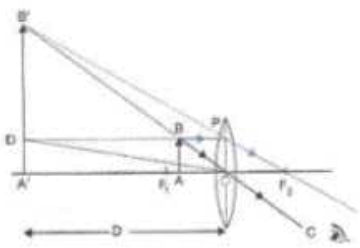
**Question 5:**
The power of a lens is negative. State whether it is convex or concave?
**Solution 5:**
It is a concave.

**Question 6:**
What is magnifying glass? State its two uses.
**Solution 6:**
Magnifying glass is a convex lens of short focal length. It is mounted in a lens holder for practical use.
It is used to see and read the small letters and figures. It is used by watch makers to see the small parts and screws of the watch.

**Question 7:**
Draw a neat labelled ray diagram to show the formation of image by a magnifying glass. State three characteristics of the image.
**Solution 7:**
Let the object (AB) is situated between focal length and optical centre of a convex lens then its image (A'B') will form on the same side of lens.




The image formed will be virtual, magnified and erect.

**Question 8:**
Where is the object placed in reference to the principal focus of a magnifying glass, so as to see its enlarged image? Where is the image obtained?
**Solution 8:**
The object is placed between the lens and principal focus.
The image is obtained between the lens and principal focus.

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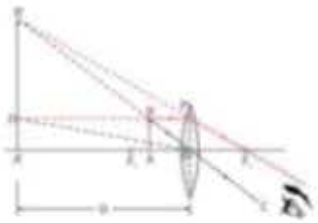


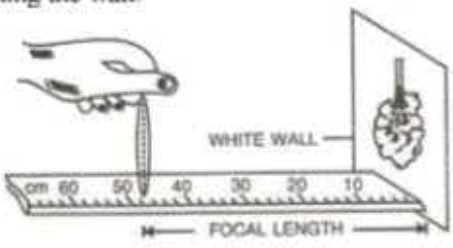
**Question 9:**
Define magnifying power of a simple microscope. How can it be increased?
**Solution 9:**
The magnifying power of the microscope is defined as the ratio of the angle subtended by the image at the eye to the angle subtended by the object (assumed to be placed at the least distance of distinct vision D = 25 cm) at the eye, i.e.,

Magnifying power = $1 + \frac{D}{F}$

Where F is the focal length of the lens.
The magnifying power of a microscope can be increased by using the lens of short focal length. But it cannot be increased indefinitely.

**Question 10:**
Describe in brief how would you determine the approximate focal length of a convex lens.
**Solution 10:**
The approximate focal length of a convex lens can be determined by using the principle that a beam of parallel rays incident from a distant object is converged in the focal plane of the lens.

In an open space, against a white wall, a metre scale is placed horizontally with its 0 cm end touching the wall.




By moving the convex lens to and fro along the scale, focus a distant object on wall. The image which forms on the wall is very near to the focus of the lens and the distance of the lens from the image is read directly by the metre scale. This gives the approximate focal length of the lens.

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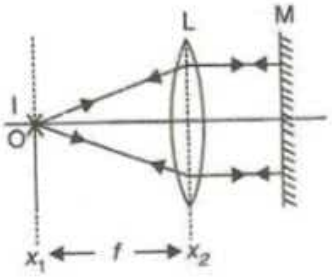
**Solution 11:**

(i)




(ii) The size of the image will be same as that of object.
(iii) The image formed will be real and inverted.
(iv) The distance of object O from optical lens will be equal to the focal length of the lens.
(iv) The position of the mirror from lens does not affect the formation of image as long as the rays from the lens fall normally on the plane mirror M.
(v)

**Question 12:**

Describe how you would determine the focal length of a converging lens, using a plane mirror and one pin. Draw a ray diagram to illustrate your answer.

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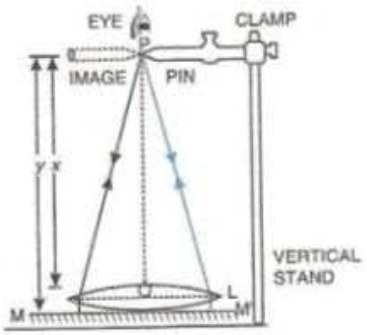
**Solution 12:**

To determine focal length by using plane mirror we need a vertical stand, a plane mirror, a lens and a pin.

Place the lens L on a plane mirror MM' horizontally. Arrange a pin P on the clamp of a vertical stand such that the tip of pin is vertically above the centre O of the lens.




Adjust the height of the pin until it has no parallax (i.e., when the pin and its image shift together) with its inverted image as seen from vertically above the pin.

Now measure the distance x of the pin from the lens and the distance y of the pin from the mirror, using a metre scale and a plumb line. Calculate the average of the two distances. This gives the focal length of the lens, i.e.,

$$F = \frac{x + y}{2}$$

**Question 13:**

State two applications each of a convex lens and a concave lens.

**Solution 13:**

The two applications of a convex lens are:-

(i) It is used as an objective lens in a telescope, camera, slide projector, etc.
(ii) With its short focal length it is also used as a magnifying glass.

The two applications of a concave lens are:-

(i) A person suffering from short sightedness or myopia wears spectacles having concave lens.
(ii) A concave lens is used as eye lens in a Galilean telescope to obtain an erect final image of the object.

**Question 14:**
How will you differentiate between a convex and a concave lens by looking at (i) a distant object, (ii) a printed page?
**Solution 14:**
(i) On seeing a distant object through the lens, if its inverted image is seen, then the lens is convex, and if the upright image is seen, then the lens is concave.
(ii) On keeping the lens near a printed page, if the letters appear magnified, then the lens is convex, and if the letters appear diminished, then the lens is concave.

## MULTIPLE CHOICE TYPE:

**Question 1:**
On reducing the focal length of a lens, its power:
(a) decreases
(b) increases
(c) does not change
(d) first increases then decreases
**Solution 1:**
Increases

Hint: Power (in Diopter) $= \frac{1}{\text{Focal length (in m)}}$

**Question 2:**
A magnifying glass forms:
(a) a real and diminished image
(b) a real and magnified image
(c) a virtual and magnified image
(d) a virtual and diminished image
**Solution 2:**
A virtual and magnified image

Hint: A magnifying glass forms a virtual, magnified and upright image on the same side as the object.

## NUMERICALS:

**Question 1:**
The power of a lens is + 2.0 D. Find its focal length and state the kind of the lens.
**Solution 1:**
P = +2.0D
$P = \frac{1}{\text{F(In metre)}}$



$\Rightarrow F = \frac{1}{P} = \frac{1}{2}$
F = 0.5 m or 50 cm

**Question 2:**
Express the power (with sign) of a concave lens of focal length 20 cm.
**Solution 2:**
$P = \frac{1}{\text{F(In metre)}}$
$\Rightarrow P = \frac{1}{0.2\ m} = 5\ D$
As it is a concave lens so power is negative
i.e. P = – 5 D