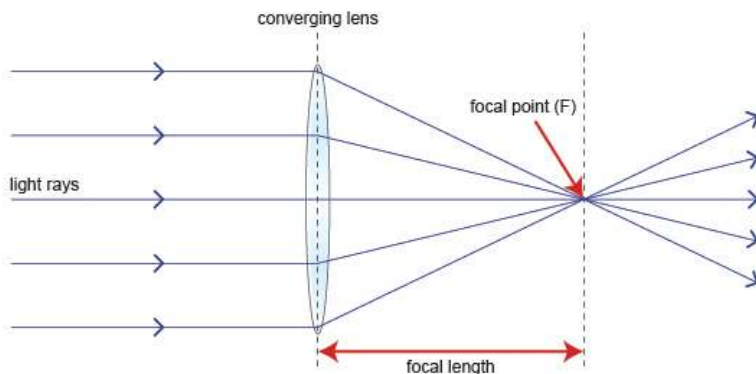


# THIN CONVERGING LENS

## ACTION OF A BEAM OF LIGHT ON A THIN CONVERGING LENS

**Lens:** A lens is transparent block that causes light to refract (changes the direction the light travels in).



A converging lens (or convex lens) is curved on both sides. This means the light rays coming out of it come together at a point - they converge.

**Note:** The fact that a double convex lens is thicker across its middle is an indicator that it will converge rays of light that travel parallel to its principal axis.

### Key terms:

- **Focal point:** The point at which the light rays meet is called the focal point.
- **Focal length:** The distance between the centre of a lens and its principal focus is called as the focal length.

The focal length is found by focusing a distant object on a piece of paper through the lens. The focal length is the distance between the centre of the lens and the image.

- **Principal focus :** The principal focus of a convex lens is the point on the principal axis where rays incident parallel to the principal axis will pass through, that point after getting refracted by the lens.
- **Principal axis:** The horizontal line passing through the optic centre of a lens is called as the principle axis.

## RAY DIAGRAMS:

The position and the nature of the image formed by a lens depends upon the:

- Focal length of the length
- The distance of the object to the lens

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1. Draw a ray starting at the top of the object and passing through the centre of the lens.

2. Draw a ray starting from the top of the object, then passing through F and then parallel to the principal axis after refraction.

3. Draw a ray from the top of the object parallel to the principle axis and cutting through F behind the lens after getting refracted.

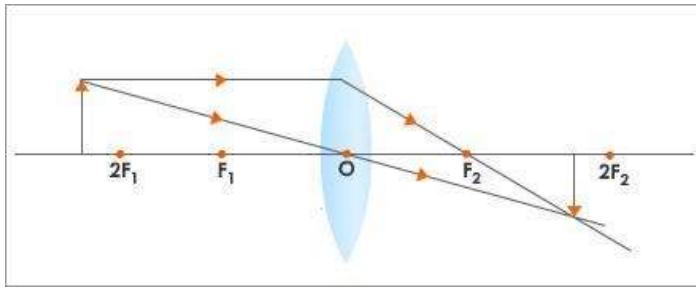
Note: It is enough to draw ray 1 and ray 2 or ray 1 and ray 3 for locating the position of the image.

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### Constructions

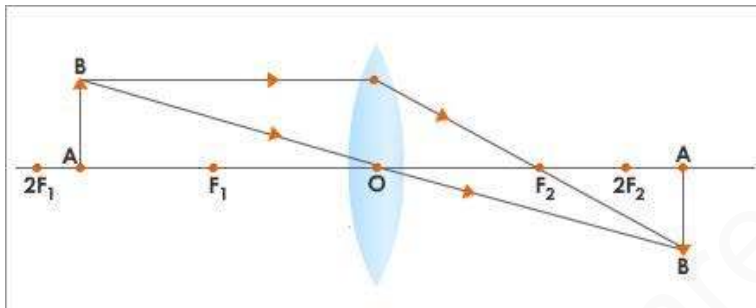
- When the object is beyond 2F.
  - When the object is between F and 2F.
  - When the object is at 2F.
  - When the object is between F and the lens.
- =====

When the object is beyond 2F:



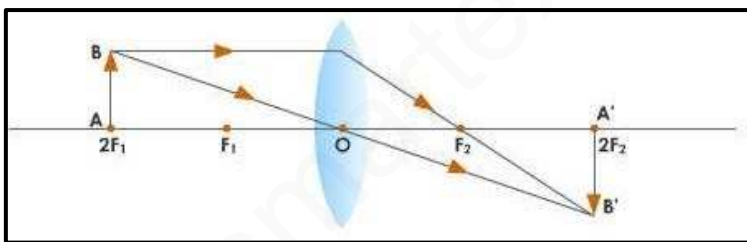
Object	Image
Beyond 2F	Between F and 2F
	Diminished image
	Real image, Inverted

When the object is between F and 2F:



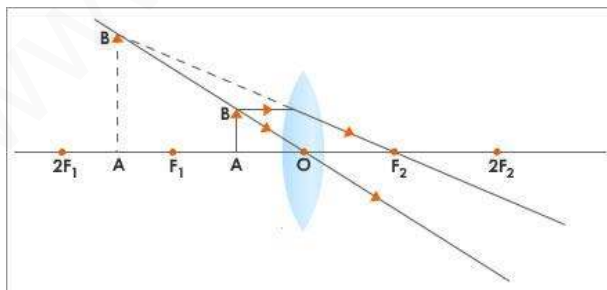
Object	Image
Between F and 2F	Beyond 2F
	Magnified image
	Real image, Inverted

When the object is at 2F



Object	Image
At 2F	At 2F
	Image size = Object size
	Real image, Inverted

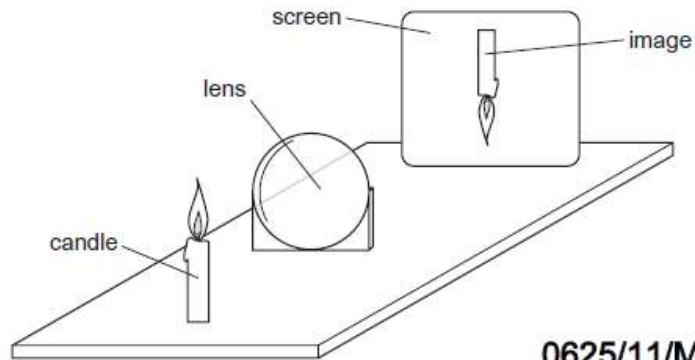
When the object is between F and the lens:



Object	Image
Between F and lens	Behind the object
	Magnified image
	Virtual image, Upright

APPLICATION BASE QUESTIONS-MCQ

22 A thin converging lens is used to produce, on a screen, a focused image of a candle.



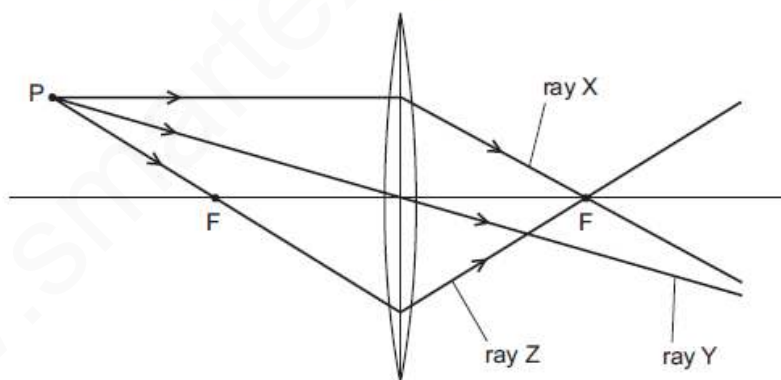
Various focused images are produced on the screen by moving the lens and the screen backwards and forwards.

Which statement is **always** correct?

- A The image is at the principal focus (focal point) of the lens.
- B The image is bigger than the object.
- C The image is closer to the lens than the object is.
- D The image is inverted.

21 A student draws three rays of light from point P through a converging lens.

Each point labelled F is a principal focus of the lens.



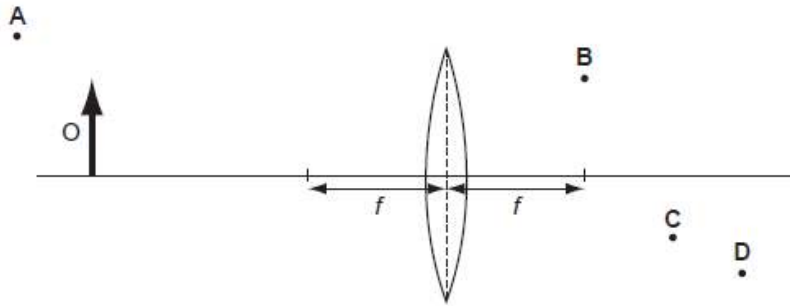
Which of the rays are drawn correctly?

- A ray Y only
- B ray Z only
- C ray X and ray Y
- D ray X and ray Z

22 An object O is placed in front of a converging lens of focal length  $f$ .

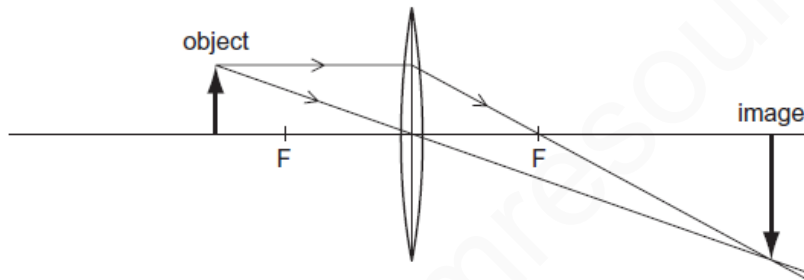
At which point will the top of the image be seen?

0625/11/O/N/09



23 A thin converging lens forms an image.

0625/11/O/N/12



What is the nature of this image and can it be formed on a screen?

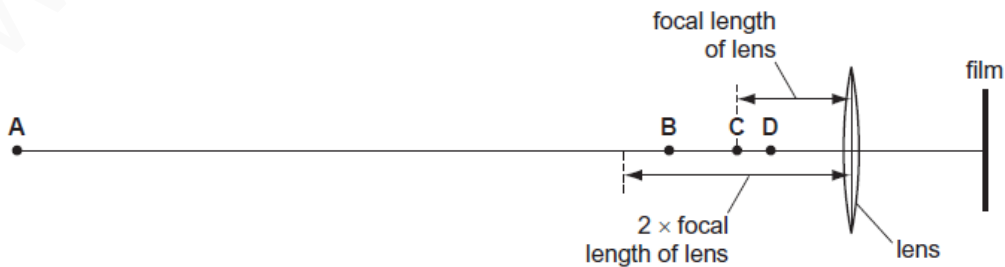
0625/11/O/N/12

	nature of image	can be formed on a screen?
A	not real	no
B	not real	yes
C	real	no
D	real	yes

23 The converging lens in a camera is used to make an image on a film.

0625/13/O/N/12

At which labelled point could a large object be placed so that it makes a smaller image?



6 Fig. 6.1 shows an object, the tip of which is labelled O, placed near a lens L.

The two principal foci of the lens are  $F_1$  and  $F_2$ .

M/J/08-P31

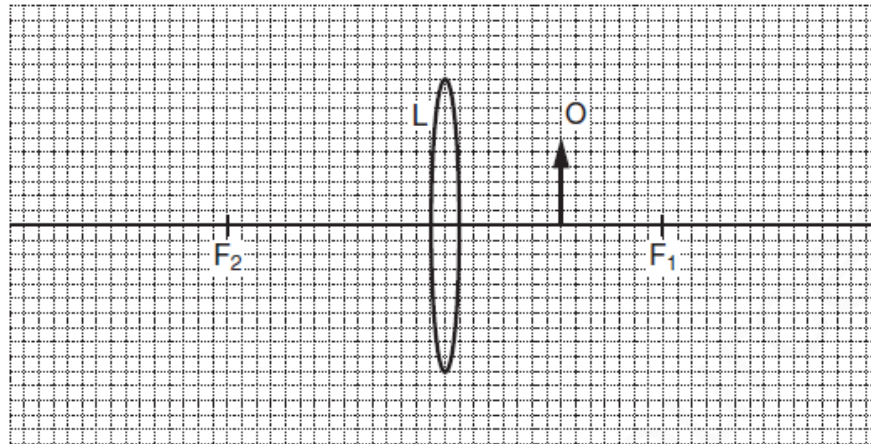


Fig. 6.1

- (a) On Fig. 6.1, draw the paths of two rays from the tip of the object so that they pass through the lens and continue beyond.

Complete the diagram to locate the image of the tip of the object. Draw in the whole image and label it I. [3]

- (b) Describe image I.

.....  
.....  
.....  
..... [3]

[Total: 6]

7 (a) What is meant by the *focal length* of a converging lens? M/J/11-P33

.....  
.....[1]

(b) An object is placed in front of a converging lens. A real image is formed, as shown in Fig. 7.1. The converging lens is not shown.



Fig. 7.1

(i) Explain what is meant by a *real image*.  
.....[1]

(ii) Rays of light from point A on the object form point B on the image.

On Fig. 6.1, draw

1. a ray to find the position of the converging lens, showing the lens as a vertical straight line in this position,
2. a ray to find the position of a principal focus of the lens, marking this position F,
3. a third possible ray from A to B. [3]

(iii) The distance between the object and the lens is increased. State any changes which take place in

1. the distance of the image from the lens,  
.....
2. the size of the image.  
.....[2]

[Total: 7]