

# Light

## Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Waves
Topic	Light
Booklet	Question Paper

**Time Allowed:** 84 minutes

**Score:** /70

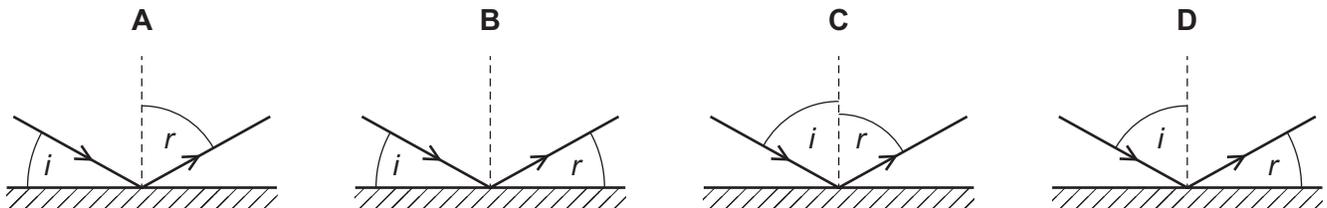
**Percentage:** /100

**Grade Boundaries:**

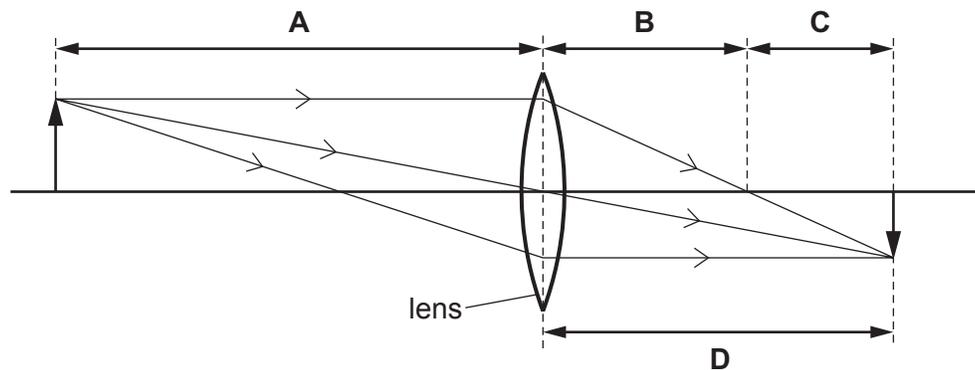
1 Light is incident on a mirror. The light is reflected from the mirror.

The angle of incidence is  $i$  and the angle of reflection is  $r$ .

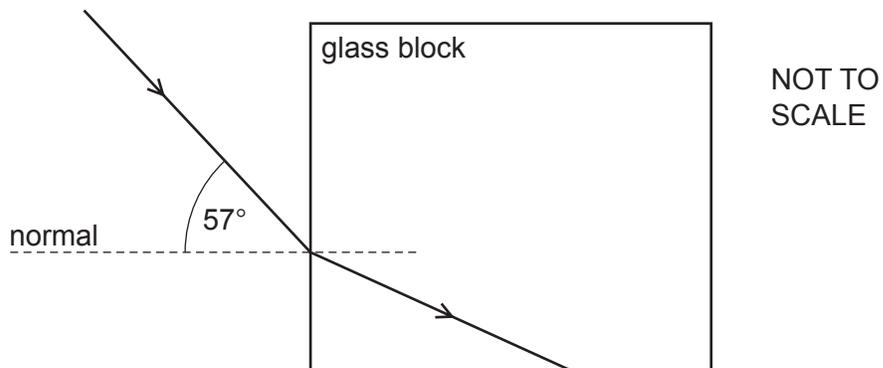
Which diagram correctly shows  $i$  and  $r$ ?



2 Which length is the focal length of the lens shown in the diagram?



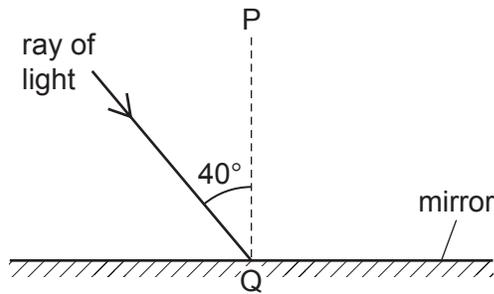
3 Light passes from air into a glass block of refractive index 1.5, as shown.



What is the angle of refraction in the glass and what is the critical angle?

	angle of refraction	critical angle
<b>A</b>	34°	42°
<b>B</b>	34°	60°
<b>C</b>	38°	42°
<b>D</b>	38°	60°

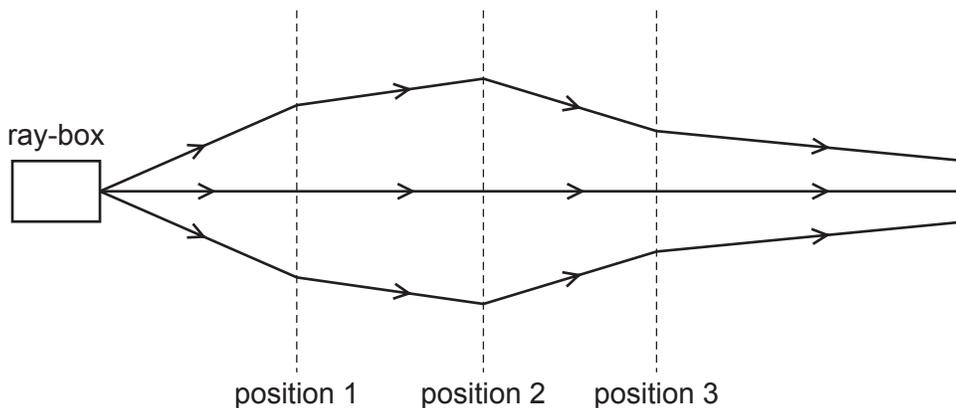
4 The diagram shows light incident on a plane mirror.



Which row gives the angle of reflection and the name of line PQ?

	angle of reflection	the line PQ is called the
<b>A</b>	40°	normal
<b>B</b>	40°	reflected ray
<b>C</b>	50°	normal
<b>D</b>	50°	reflected ray

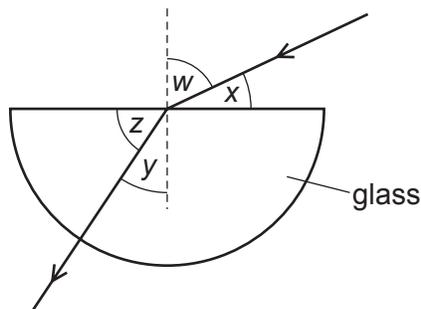
5 The rays of light from a ray-box pass through three lenses placed at positions 1, 2 and 3.



What type of lens is used at each position?

	position 1	position 2	position 3
<b>A</b>	converging	converging	converging
<b>B</b>	converging	converging	diverging
<b>C</b>	diverging	converging	diverging
<b>D</b>	diverging	diverging	converging

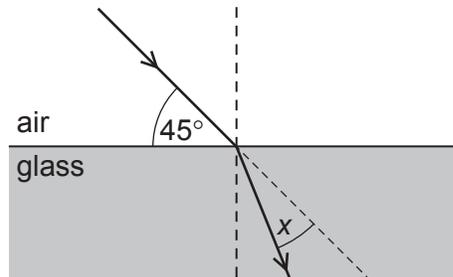
6 Light passes from air into a block of glass, as shown.



Which expression is equal to the refractive index of glass?

- A**  $\frac{\sin w}{\sin y}$      
 **B**  $\frac{\sin w}{\sin z}$      
 **C**  $\frac{\sin y}{\sin w}$      
 **D**  $\frac{\sin z}{\sin x}$

- 7 A ray of light is incident on the surface of a glass block, as shown in the diagram below.



The refractive index of the glass is 1.5.

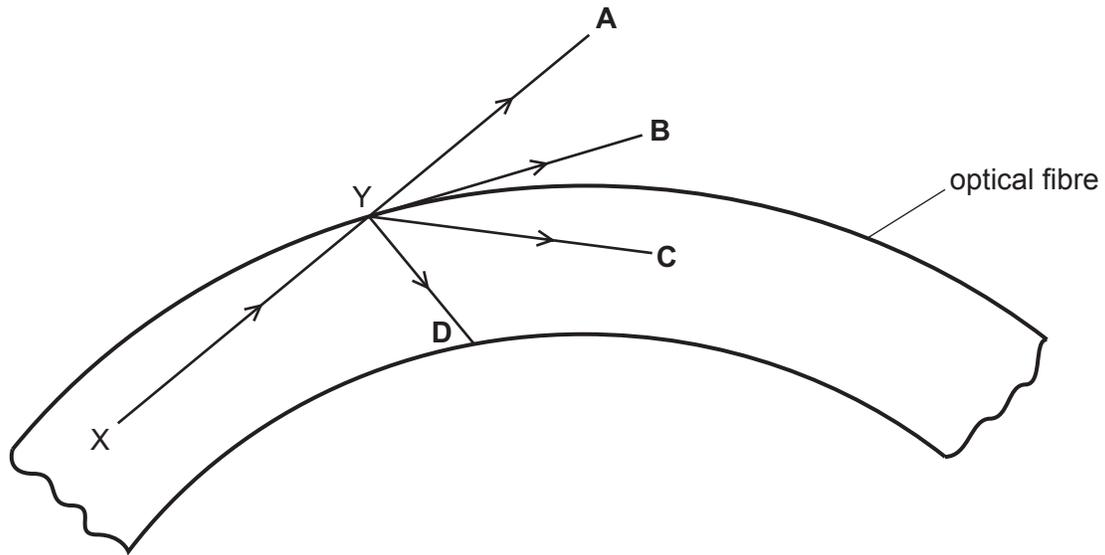
The light ray changes direction when entering the glass.

What is the angle  $x$  through which the ray moves?

- A**  $30^\circ$                       **B**  $28^\circ$                       **C**  $17^\circ$                       **D**  $15^\circ$
- 8 An image is formed by a thin converging lens when it is used as a magnifying glass.
- What is the correct description of the image?
- A** real and erect  
**B** real and inverted  
**C** virtual and erect  
**D** virtual and inverted

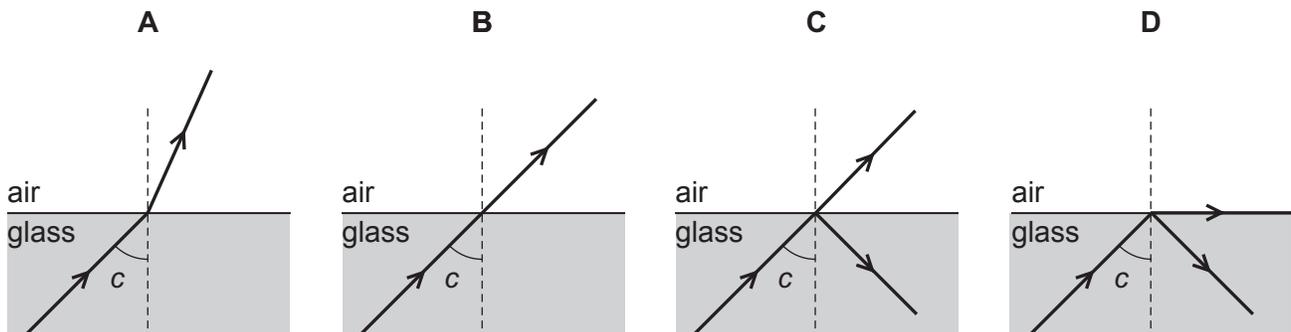
- 9 A ray of light travels from X to Y along an optical fibre. The angle of incidence at Y is greater than the critical angle.

In which direction does the ray of light travel after reaching point Y?

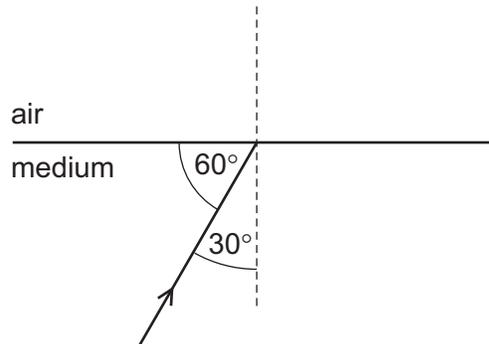


- 10 A ray of light in glass is incident on the surface at an angle  $c$ . The angle  $c$  is the critical angle.

Which diagram shows what happens to the light?



- 11 Which statement about red light and blue light is correct?
- A Red light has a higher frequency than blue light.
  - B Red light has a longer wavelength than blue light.
  - C Red light has the same speed in glass as blue light.
  - D Red light is refracted by a glass prism more than blue light.
- 12 A ray of light in a transparent medium of refractive index 1.8 is incident on the surface as shown. The light enters air.

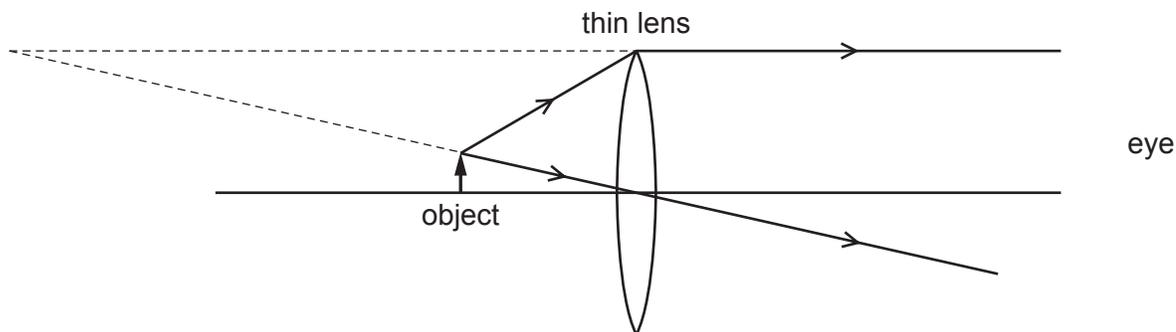


What is the angle between the refracted ray and the normal in air?

- A  $29^\circ$                       B  $33^\circ$                       C  $54^\circ$                       D  $64^\circ$

13 An object is viewed through a converging lens.

The diagram shows the paths of two rays from the top of the object to an eye.

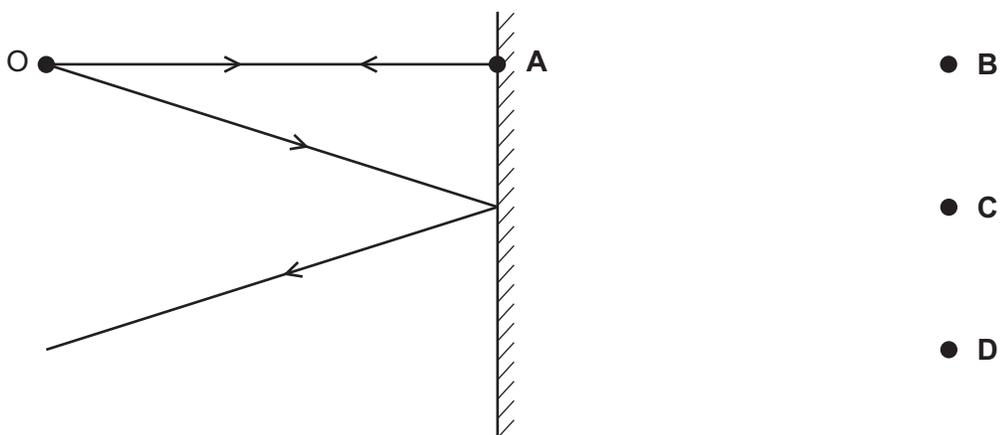


How does the image compare with the object?

- A It is larger and inverted.
- B It is larger and upright.
- C It is smaller and inverted.
- D It is smaller and upright.

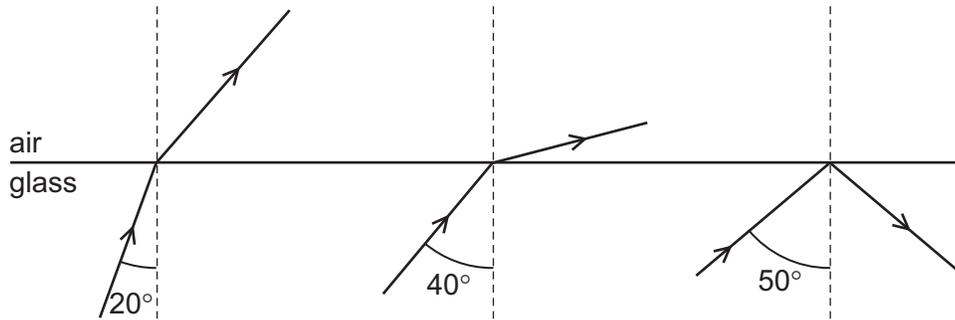
14 The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position is the image formed?



15 Three rays of light are incident on the boundary between a glass block and air.

The angles of incidence are different.



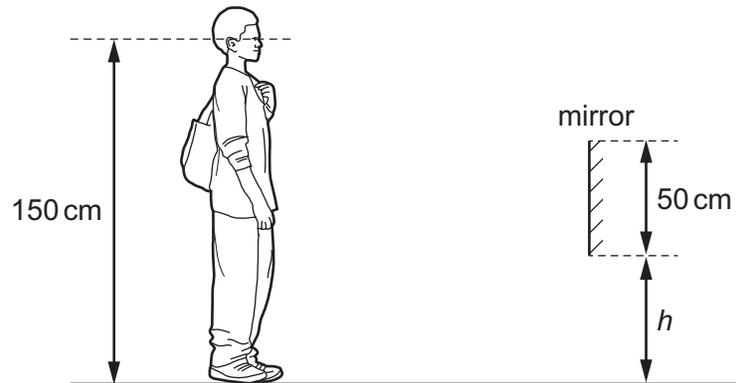
What is a possible critical angle for light in the glass?

- A** 15°      **B** 30°      **C** 45°      **D** 60°

16 Which row applies to a short-sighted eye viewing a distant object?

	position of the image	lens needed for correction
<b>A</b>	behind the retina	converging lens
<b>B</b>	behind the retina	diverging lens
<b>C</b>	in front of the retina	converging lens
<b>D</b>	in front of the retina	diverging lens

- 17 A shoe shop puts a mirror on the wall so that customers can look at their shoes.  
The length of the mirror is 50 cm. A customer has eyes 150 cm above ground level.

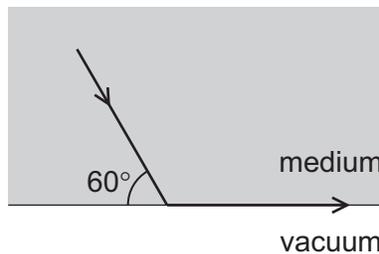


The bottom of the mirror is at height  $h$  above the ground.

What is the smallest value of  $h$  that allows the customer to see an image of his shoes in the mirror?

- A** 0                      **B** 25 cm                      **C** 50 cm                      **D** 75 cm

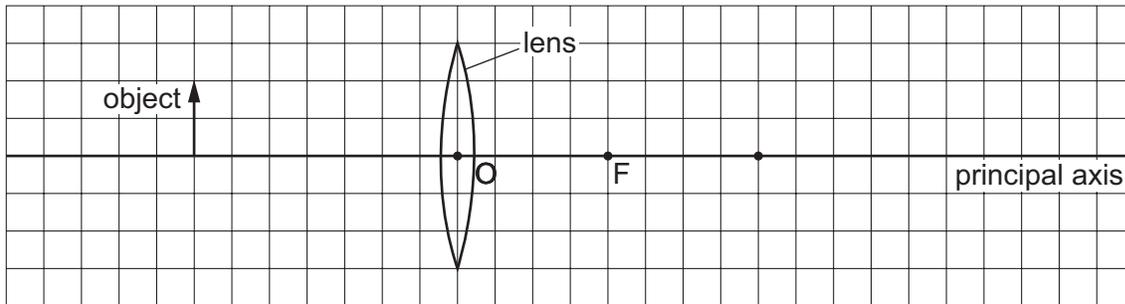
- 18 The diagram shows light travelling through a medium. The light reaches the boundary with a vacuum as shown. The light emerges travelling along the surface.



What is the refractive index of the medium?

- A**  $\frac{\sin 60^\circ}{\sin 30^\circ}$                       **B**  $\frac{\sin 60^\circ}{\sin 90^\circ}$                       **C**  $\frac{\sin 90^\circ}{\sin 30^\circ}$                       **D**  $\frac{\sin 90^\circ}{\sin 60^\circ}$

- 19 The diagram shows an object on the principal axis of a converging (convex) lens. A principal focus of the lens is at F.



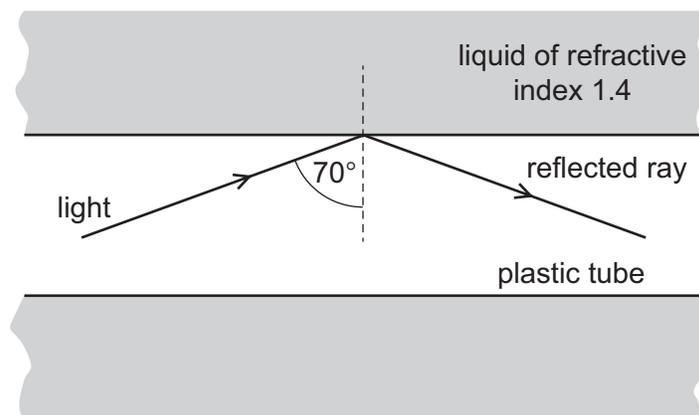
Where is the image formed by the lens?

- A between O and F
  - B between F and Q
  - C at Q
  - D to the right of Q
- 20 A digital camera uses a lens to produce a diminished (reduced in size) image on a light sensor.

Which row shows the correct type of lens and the nature of the image?

	type of lens	nature of image
<b>A</b>	converging	inverted
<b>B</b>	converging	upright
<b>C</b>	diverging	inverted
<b>D</b>	diverging	upright

- 21 A plastic tube is immersed in a liquid of refractive index 1.4. Light travelling in the plastic tube strikes the inside surface at an angle of incidence of  $70^\circ$ . The light undergoes total internal reflection.

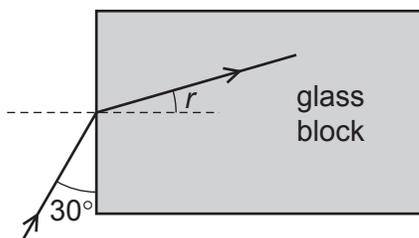


What describes the values of the critical angle in the plastic and the refractive index of the plastic?

	critical angle in plastic	refractive index of plastic
<b>A</b>	greater than $70^\circ$	greater than 1.4
<b>B</b>	greater than $70^\circ$	less than 1.4
<b>C</b>	less than $70^\circ$	greater than 1.4
<b>D</b>	less than $70^\circ$	less than 1.4

- 22 Which characteristics describe an image formed by a vertical plane mirror?
- A** real and inverted
  - B** virtual and not inverted
  - C** real and larger than the object
  - D** virtual and smaller than the object

23 A ray of light meets the face of a glass block at an angle of  $30^\circ$  as shown.



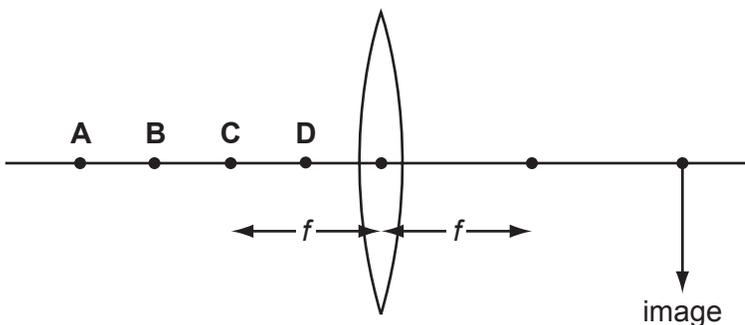
The refractive index of the glass is 1.5.

What is the angle of refraction  $r$  inside the glass block?

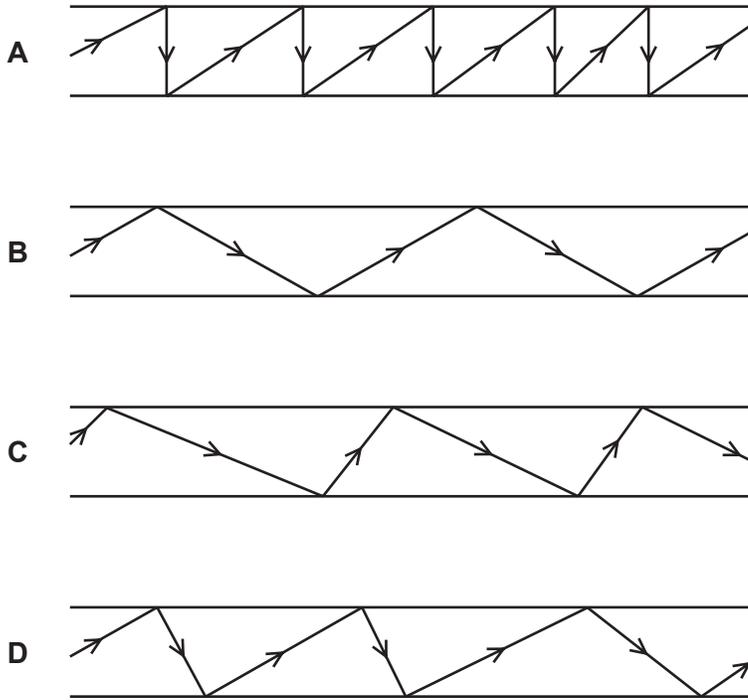
- A  $19^\circ$                       B  $20^\circ$                       C  $35^\circ$                       D  $40^\circ$

24 The diagram shows a thin converging lens of focal length  $f$ .

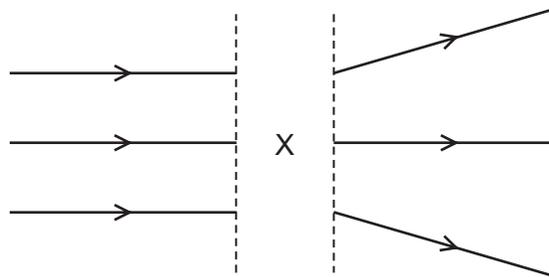
Where must an object be placed to produce a real image in the position shown?



25 Which diagram represents the reflection of light along an optical fiber?



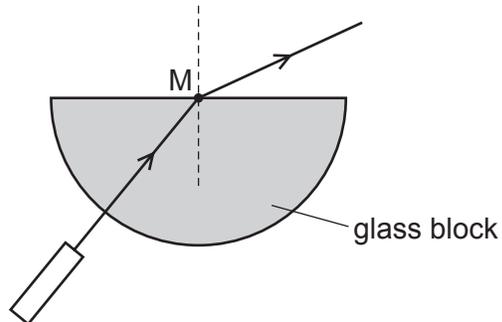
26 The diagram shows rays of light.



What is in the space labelled X?

- A a converging lens
- B a diverging lens
- C a plane mirror
- D a rectangular glass block

27 A ray of red light from a laser passes into a semi-circular glass block.



What is shown at M?

- A dispersion
- B rarefaction
- C reflection
- D refraction

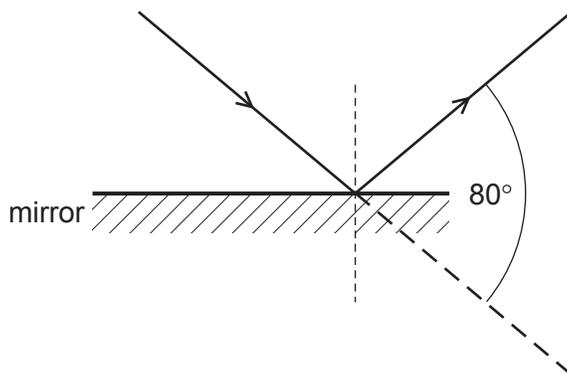
28 A ray of light strikes the surface of a glass block at an angle of incidence of  $45^\circ$ .

The refractive index of the glass is 1.8.

What is the angle of refraction inside the block?

- A  $23^\circ$
- B  $25^\circ$
- C  $45^\circ$
- D  $81^\circ$

29 Light is incident on a mirror and is reflected as shown.



What is the angle of incidence and the angle of reflection?

	angle of incidence / °	angle of reflection / °
<b>A</b>	40	40
<b>B</b>	40	50
<b>C</b>	50	40
<b>D</b>	50	50

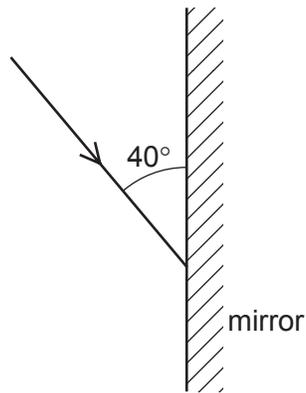
30 Light is incident on one face of a glass block at an angle of incidence of  $40^\circ$ . The glass block is in air.

The refractive index of the glass is 1.46.

What is the angle of refraction inside the glass block?

- A**  $26^\circ$       **B**  $27^\circ$       **C**  $58^\circ$       **D**  $70^\circ$

31 The diagram shows a ray of light directed at a plane mirror.

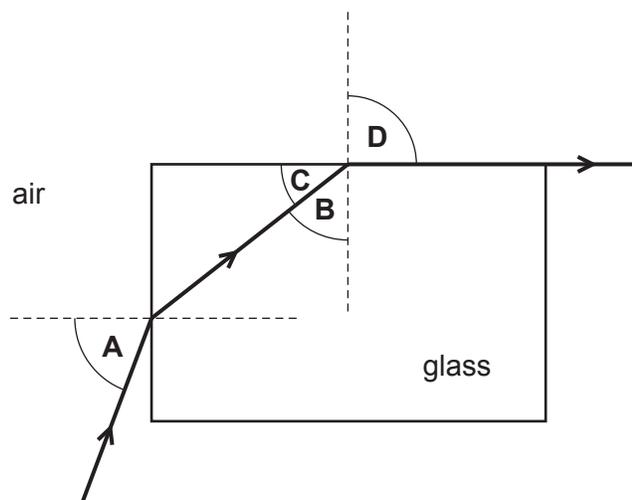


What are the angle of incidence and the angle of reflection?

	angle of incidence	angle of reflection
<b>A</b>	$40^\circ$	$40^\circ$
<b>B</b>	$40^\circ$	$50^\circ$
<b>C</b>	$50^\circ$	$40^\circ$
<b>D</b>	$50^\circ$	$50^\circ$

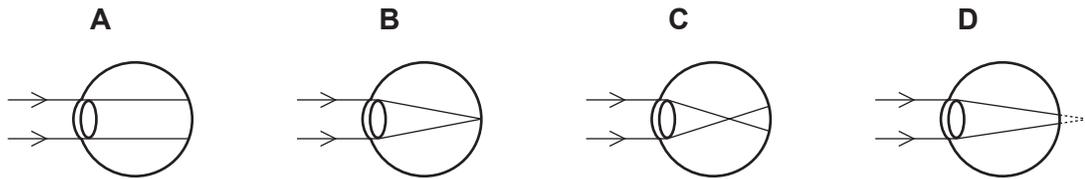
32 Light travels through a glass block as shown.

Which angle is the critical angle for light in the glass?



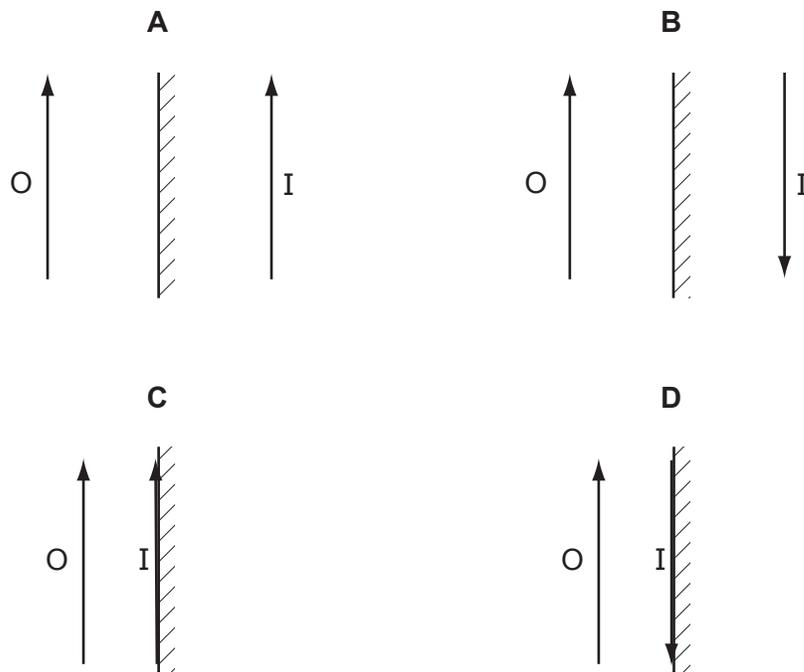
33 A man is short-sighted.

Which ray diagram shows what happens in his eye when he looks at a distant object?



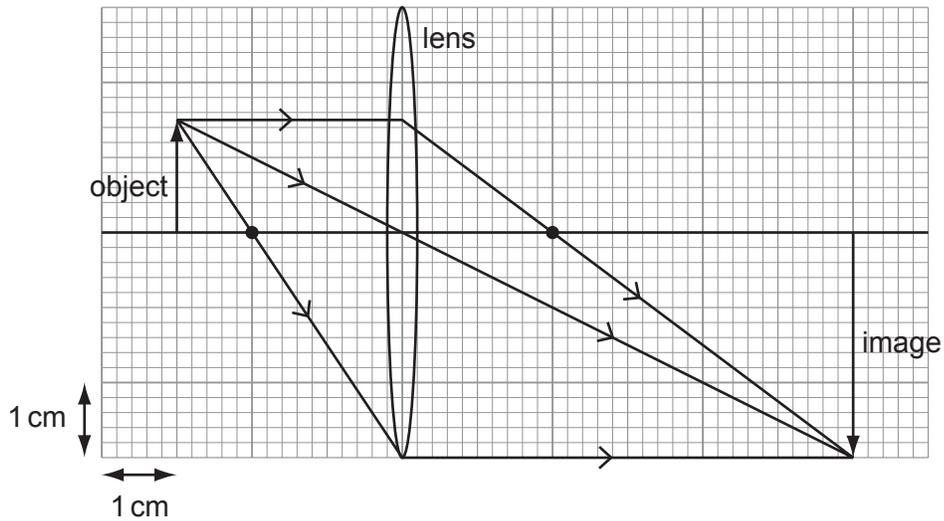
34 An object O is placed in front of a plane mirror.

Which diagram correctly represents the image I formed by the mirror?



35 An object of height 1.5 cm is placed in front of a converging lens of focal length 2.0 cm.

The arrangement is shown on the full-scale ray diagram.



What is the linear magnification produced by the lens?

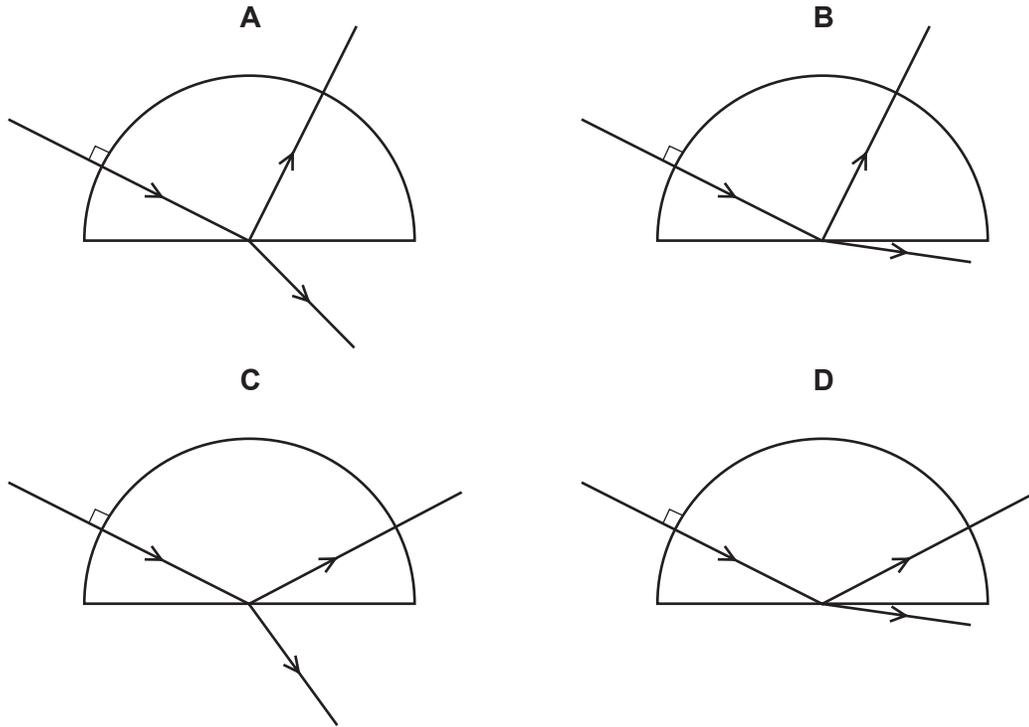
- A** 2.0                      **B** 3.0                      **C** 4.0                      **D** 6.0

36 An object is placed in front of a plane mirror. The image produced is

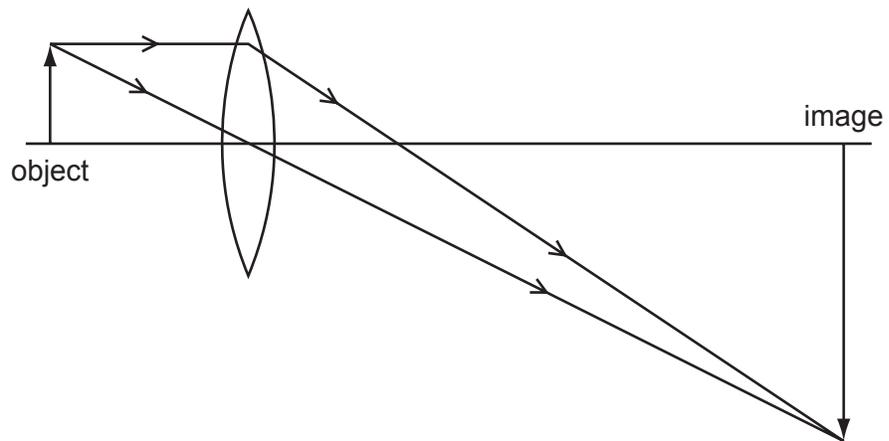
- A** real and smaller than the object.
- B** real and the same size as the object.
- C** virtual and smaller than the object.
- D** virtual and the same size as the object.

37 A ray of red light enters a semi-circular glass block normal to the curved surface.

Which diagram shows the partial reflection and refraction of the ray?



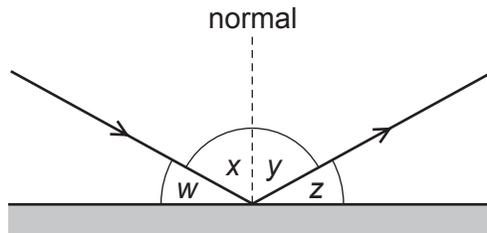
38 A lens is used to produce a magnified image, as shown in the scale diagram.



What is the linear magnification of the object?

- A 0.33      B 3.0      C 4.0      D 6.0

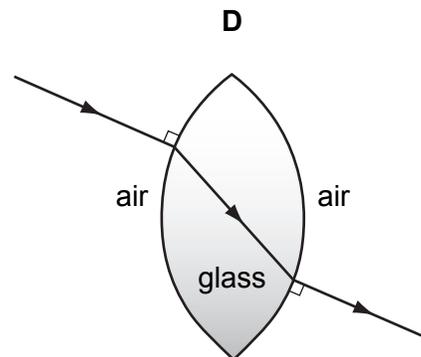
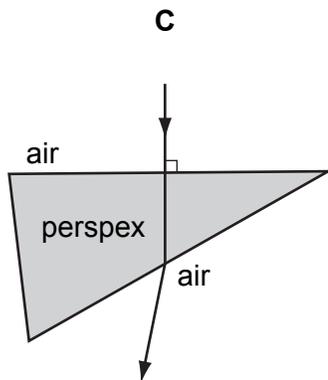
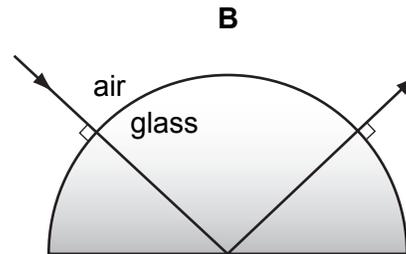
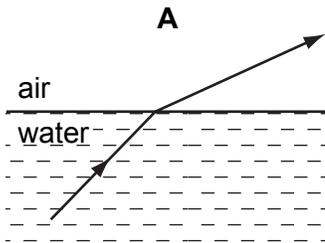
39 A ray of light strikes a plane mirror and is reflected.



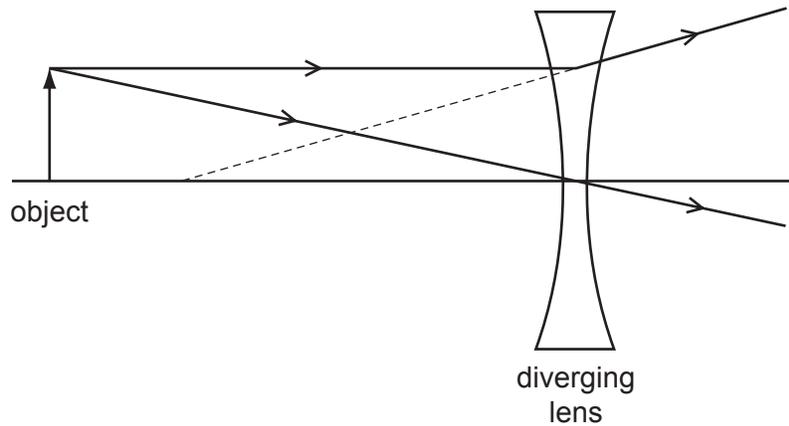
Which pair of angles **must** be equal in value?

- A**  $w$  and  $x$       **B**  $w$  and  $y$       **C**  $x$  and  $y$       **D**  $x$  and  $z$

40 In which diagram is the path of the light ray **not** correct?



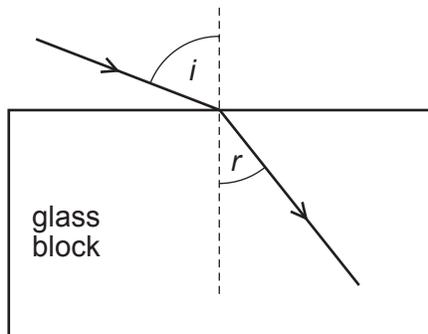
- 41 The ray diagram shows two rays from a point on an object placed in front of a diverging (concave) lens.



What are the properties of the image produced?

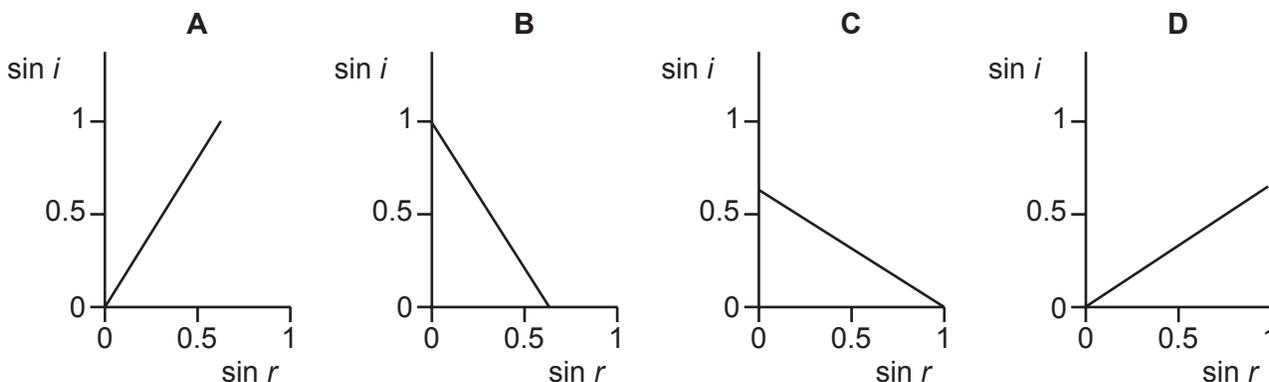
- A real and larger than the object
- B real and smaller than the object
- C virtual and larger than the object
- D virtual and smaller than the object

- 42 A ray of light enters a glass block at an angle of incidence  $i$ , producing an angle of refraction  $r$  in the glass.



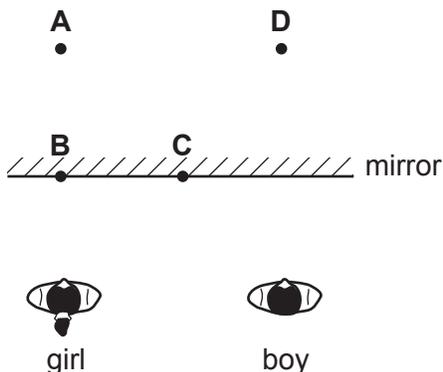
Several different values of  $i$  and  $r$  are measured, and a graph is drawn of  $\sin i$  against  $\sin r$ .

Which graph is correct?



- 43 A boy stands beside a girl in front of a large plane mirror. They are both the same distance from the mirror, as shown.

Where does the boy see the girl's image?



44 Convex lenses are used in cameras and as magnifying glasses.

Which types of image are formed?

	type of image in camera	type of image in magnifying glass
<b>A</b>	real	real
<b>B</b>	real	virtual
<b>C</b>	virtual	real
<b>D</b>	virtual	virtual

45 A student holds a sheet of paper with letters on it facing a plane mirror.

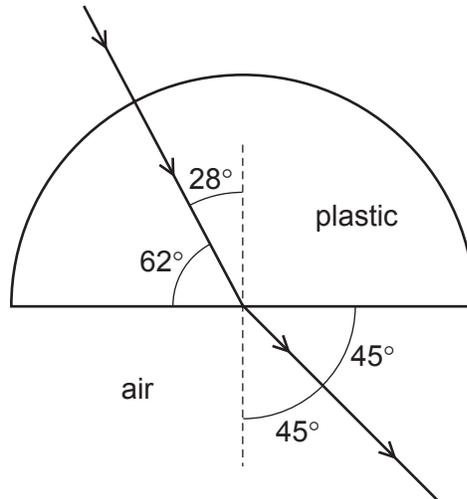
The letters on the paper are shown.



What does the student see in the mirror?

A                      B                      C                      D

46 A semi-circular block is made from a plastic. A ray of light passes through it at the angles shown.



To two decimal places, what is the refractive index of the plastic?

- A** 1.25      **B** 1.41      **C** 1.51      **D** 1.61

47 A ray of light strikes the surface of a glass block at an angle of incidence of  $45^\circ$ .

The refractive index of the glass is 1.5.

What is the angle of refraction inside the block?

- A**  $28^\circ$       **B**  $30^\circ$       **C**  $45^\circ$       **D**  $67^\circ$

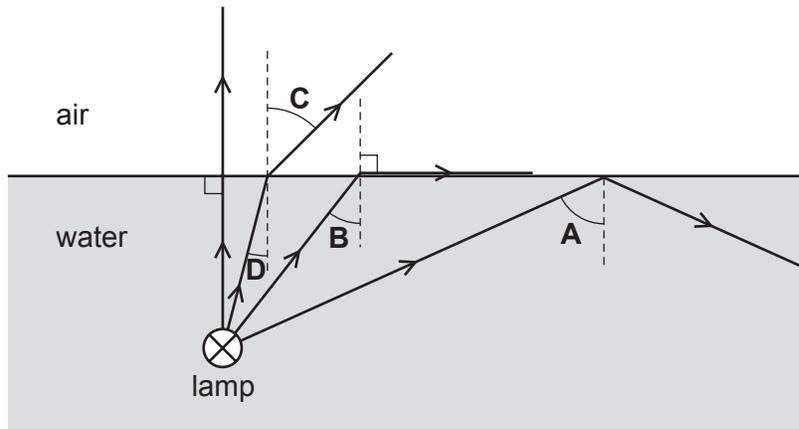
48 An object is viewed through a concave (diverging) lens.

What is the correct description of the image formed?

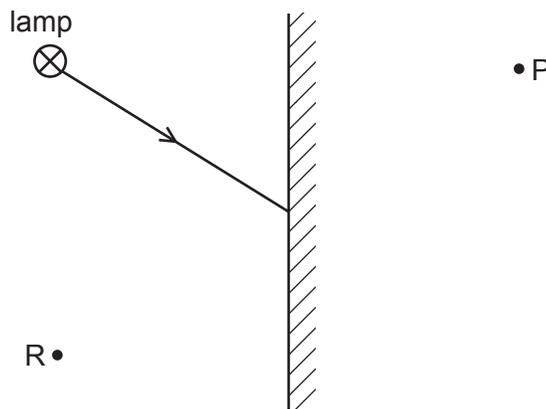
- A** real, inverted, magnified  
**B** real, upright, diminished  
**C** virtual, inverted, magnified  
**D** virtual, upright, diminished

49 The diagram shows four rays of light from a lamp below the surface of some water.

What is the critical angle for light in water?



50 The diagram shows a ray of light from one point on a lamp striking a plane mirror.

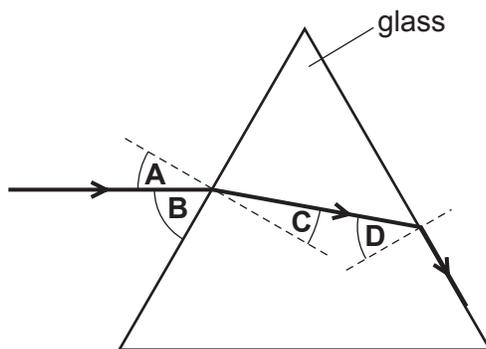


The image of the point on the lamp formed by the mirror is

- A at P and is real.
- B at P and is virtual.
- C at R and is real.
- D at R and is virtual.

51 The diagram shows the passage of a ray of light through a triangular glass block.

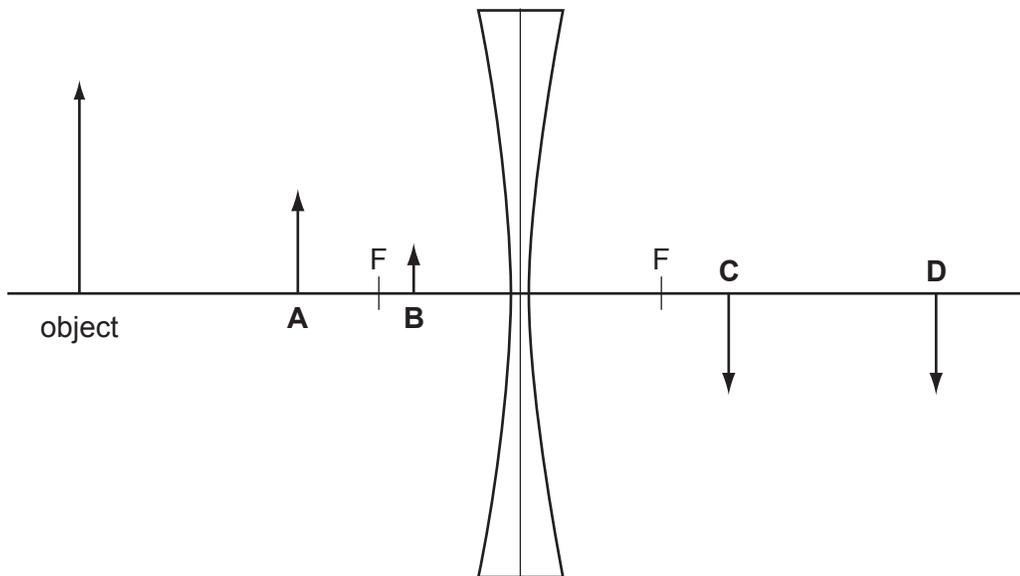
What is the critical angle of light in glass?



52 An object is placed in front of a diverging lens as shown on the scale diagram.

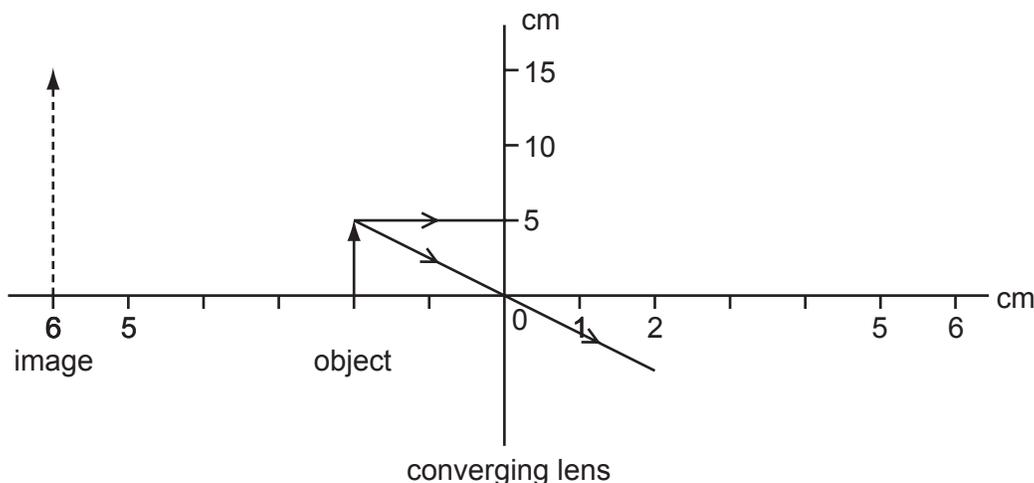
The principal focus F is marked on each side of the lens.

What is the position of the image formed by the lens?



53 An object 5.0 cm high is placed 2.0 cm from a converging (convex) lens which is being used as a magnifying glass.

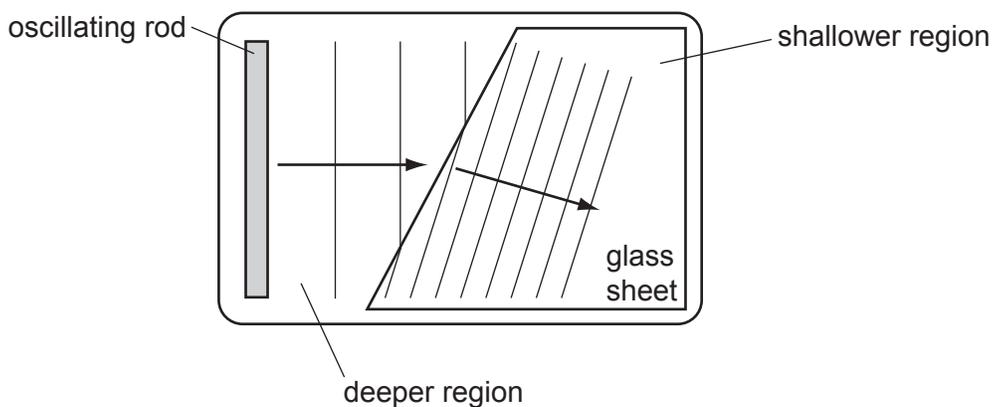
The image produced is 6.0 cm from the lens and is 15 cm high.



What is the focal length of the lens?

- A** 2.0 cm      **B** 3.0 cm      **C** 4.0 cm      **D** 6.0 cm

54 The diagram shows the refraction of water waves in a ripple tank. The water is shallower above the glass sheet.



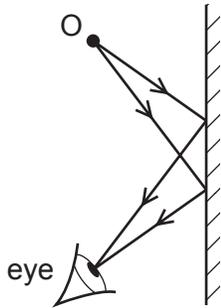
When crossing into the shallower region, what is the effect on the frequency and on the speed of the waves?

	wave frequency	wave speed
<b>A</b>	changes	changes
<b>B</b>	changes	unchanged
<b>C</b>	unchanged	changes
<b>D</b>	unchanged	unchanged

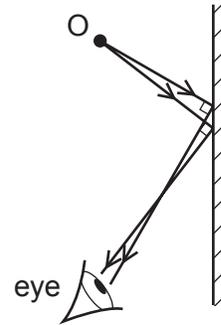
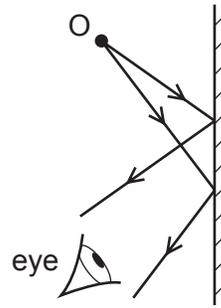
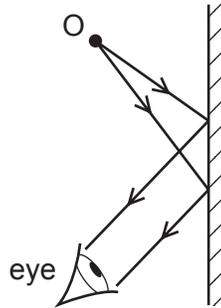
55 An eye views an object O by reflection in a plane mirror.

Which is the correct ray diagram?

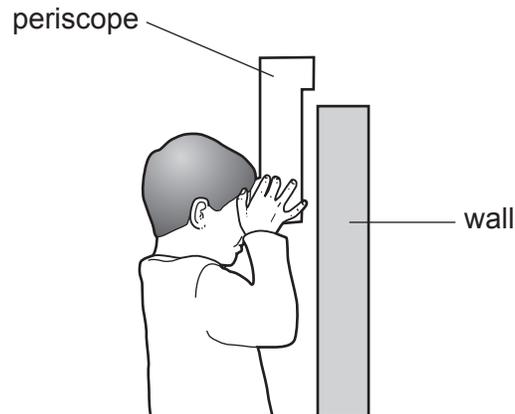
**A**



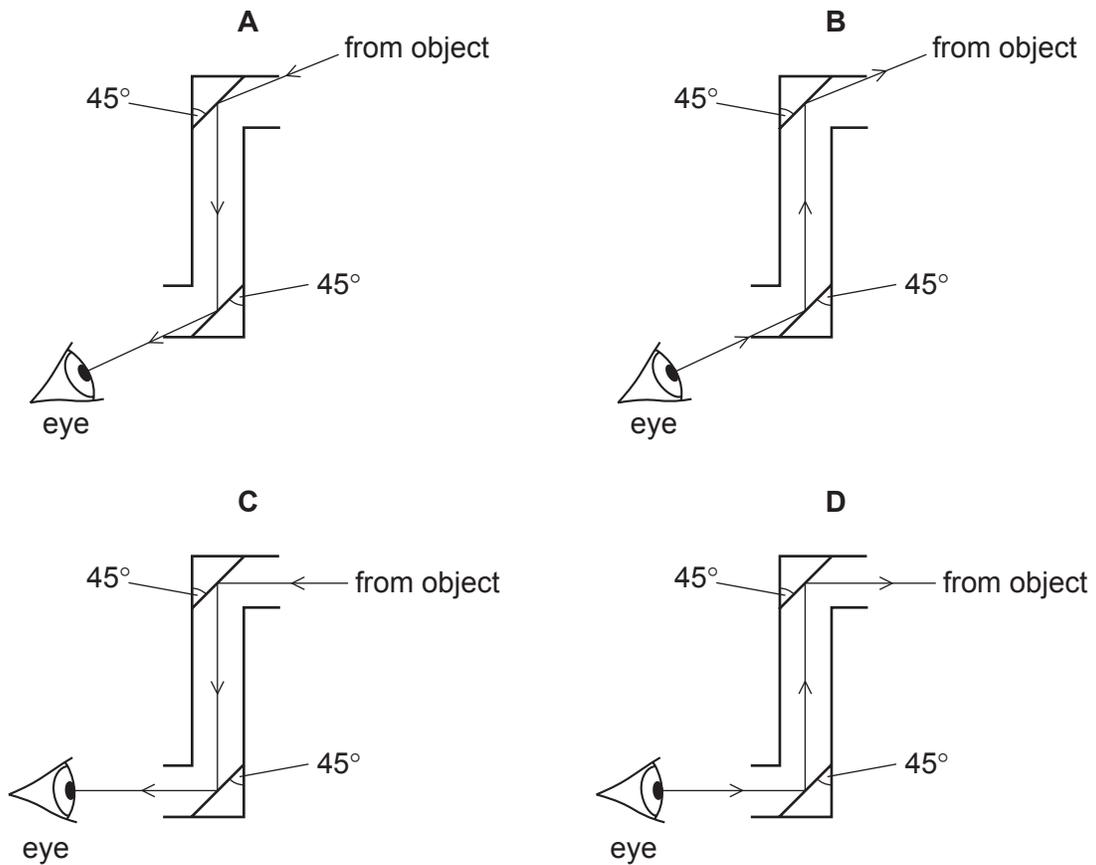
**B**



56 The diagram shows a child using a periscope to look at an object on the other side of a wall.



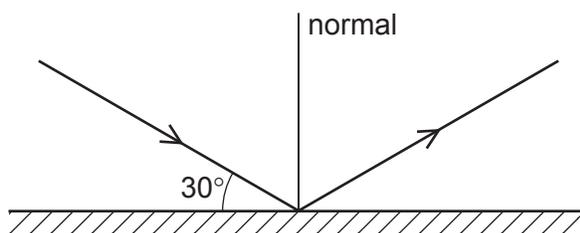
Which diagram shows a correctly drawn ray of light from the object?



57 What happens to light as it passes from glass into air?

- A Its frequency decreases because its speed decreases.
- B Its frequency increases because its speed increases.
- C Its wavelength decreases because its speed decreases.
- D Its wavelength increases because its speed increases.

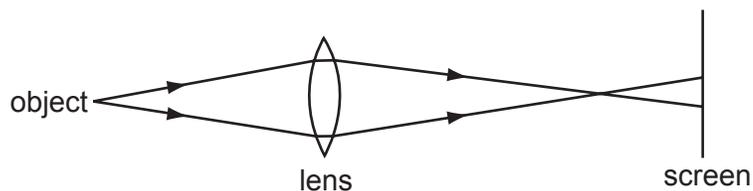
58 The diagram shows a ray of light reflected from a plane mirror.



What is the angle of reflection?

- A 30°                      B 60°                      C 90°                      D 120°

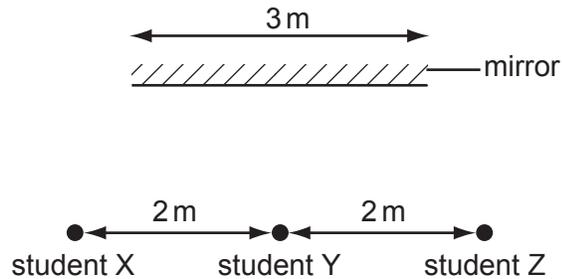
59 A lens forms a blurred image of an object on a screen.



How can the image be focussed on the screen?

- A by moving the object away from the lens and screen
- B by moving the screen away from the lens and object
- C by using a brighter object at the same position
- D by using a lens of longer focal length at the same position

60 Three students stand 2 m apart in front of a plane mirror which is 3 m long.



Student Y is standing opposite the mid-point of the mirror.

How many students can see the images of the other two?

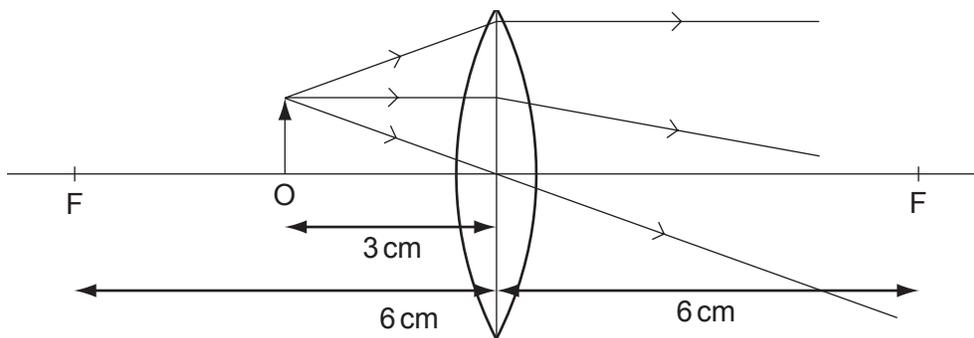
- A** 0                      **B** 1                      **C** 2                      **D** 3

61 The human eye has a converging lens system that produces an image at the back of the eye.

An eye views a distant object. What type of image is produced?

- A** real, erect, same size  
**B** real, inverted, diminished  
**C** virtual, erect, diminished  
**D** virtual, inverted, magnified

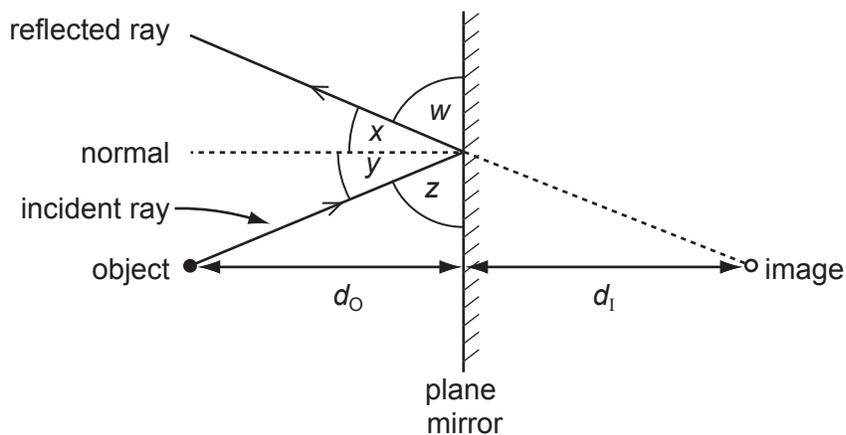
62 The diagram shows an object O placed 3 cm away from a converging lens of focal length 6 cm.



What type of image is produced?

- A real, erect and diminished
- B real, inverted and magnified
- C virtual, erect and magnified
- D virtual, inverted and diminished

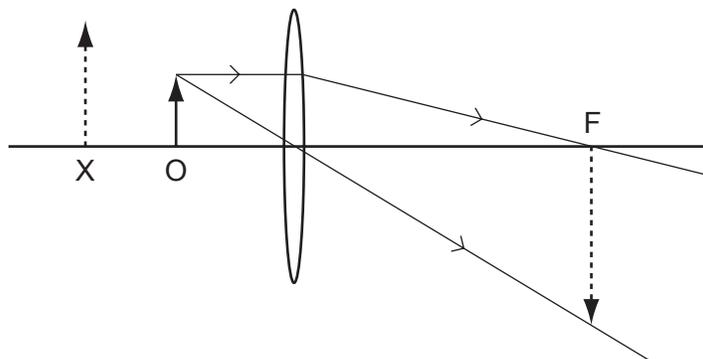
63 An image is formed in a plane mirror.



Which statement must be correct?

	angles	distances
<b>A</b>	$w = y$	$d_o = d_i$
<b>B</b>	$w = z$	$d_o$ is greater than $d_i$
<b>C</b>	$x = y$	$d_o = d_i$
<b>D</b>	$x = z$	$d_o$ is greater than $d_i$

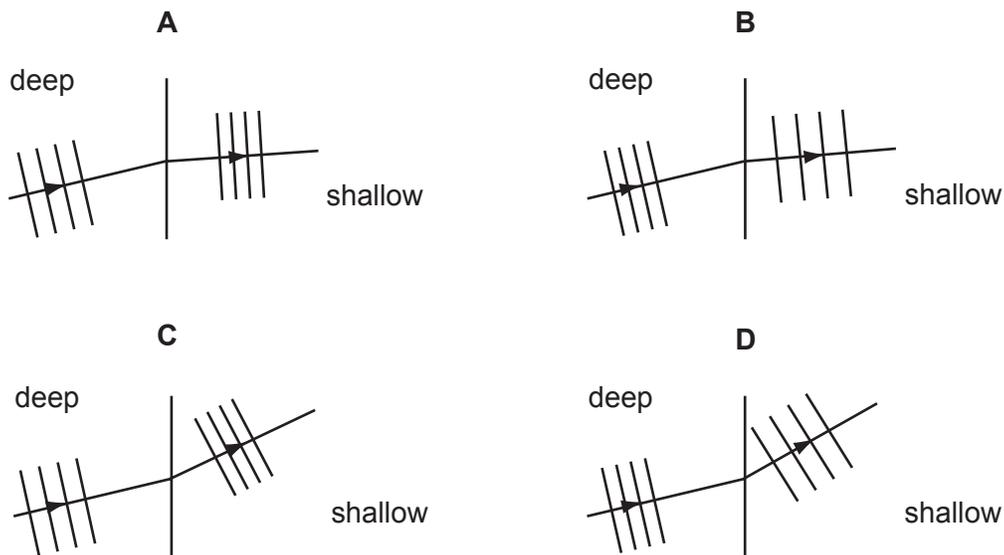
64 A student starts to draw a ray diagram for an object at O, near a thin convex lens, but is not sure whether the image is formed at X or at F.



The correctly drawn image is

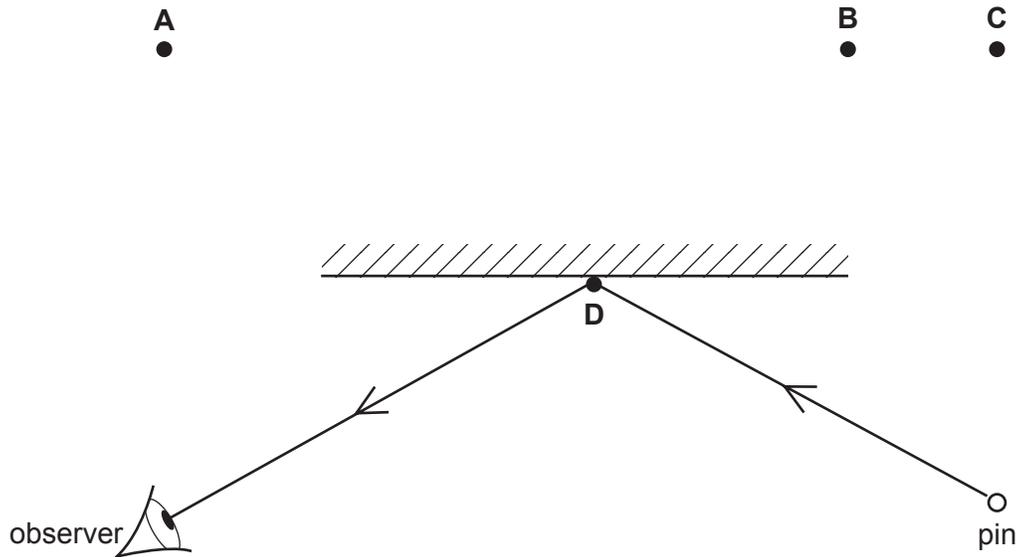
- A real and formed at F.
- B real and formed at X.
- C virtual and formed at F.
- D virtual and formed at X.

65 Which diagram correctly shows water waves travelling through deep water to shallower water?



66 A pin is placed in front of, and to the right of, a plane mirror as shown.

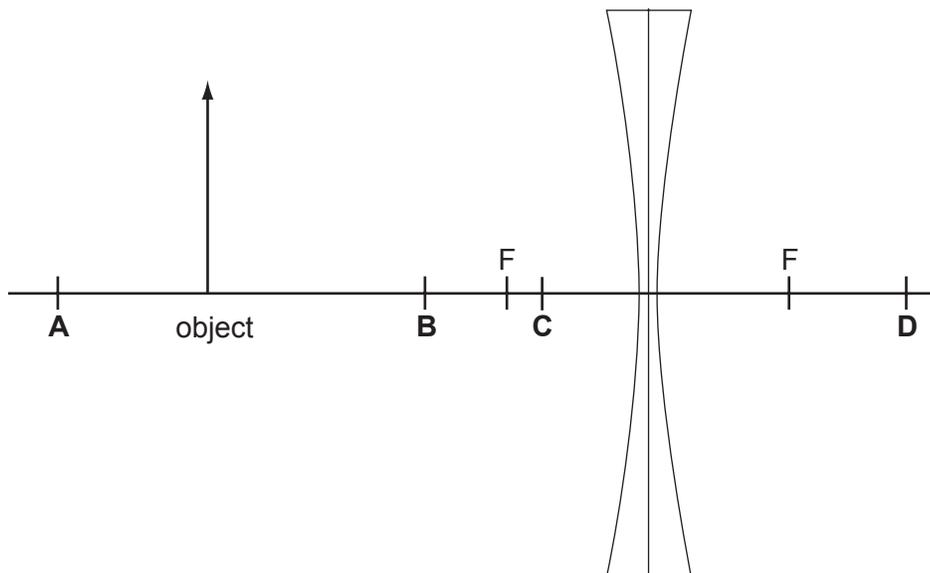
Where is the image of the pin?



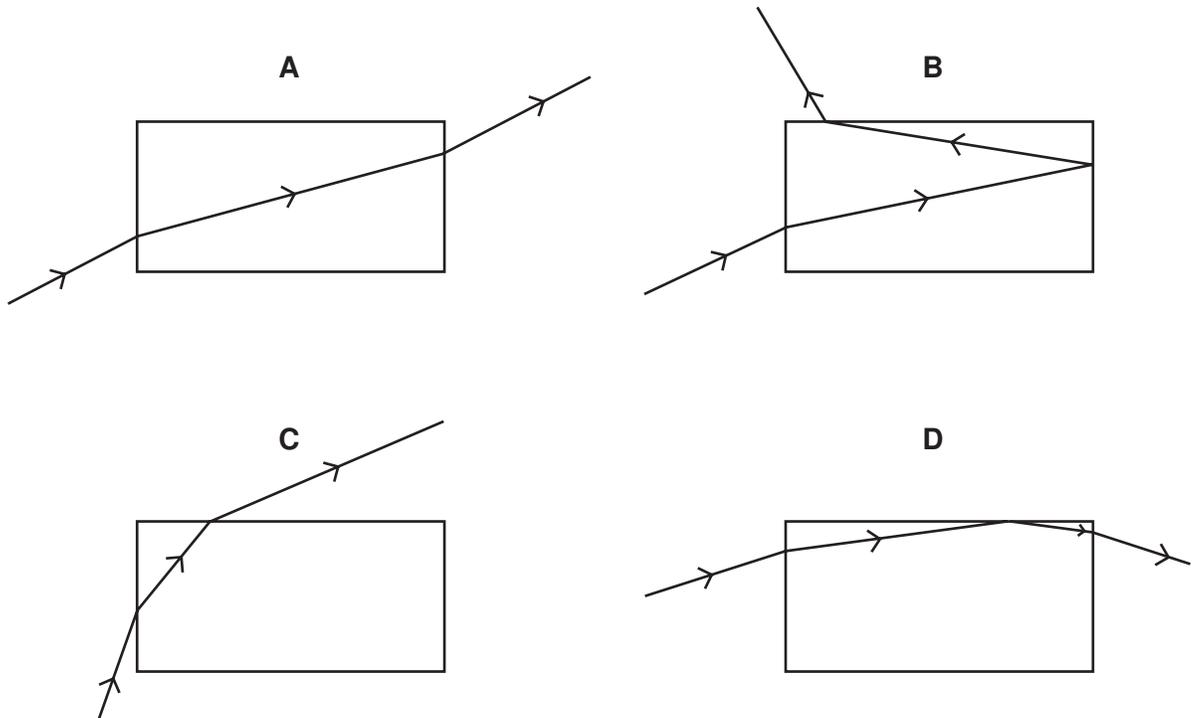
67 An object is placed in front of a diverging lens as shown on the scale diagram.

The principal focus F is marked on each side of the lens.

At which position will the image be formed?



- 68 A ray of light is incident on one side of a rectangular glass block. Its path is plotted through the block and out through another side. Which path is **not** possible?



- 69 What is true for real images formed by a converging lens?
- A They are inverted.
  - B They are on the same side of the lens as the object.
  - C They can never be shown on a screen.
  - D They cannot be seen by the human eye.

70 The diagram shows two divergent rays of light from an object **O** being reflected from a plane mirror.

At which position will the image be formed?

