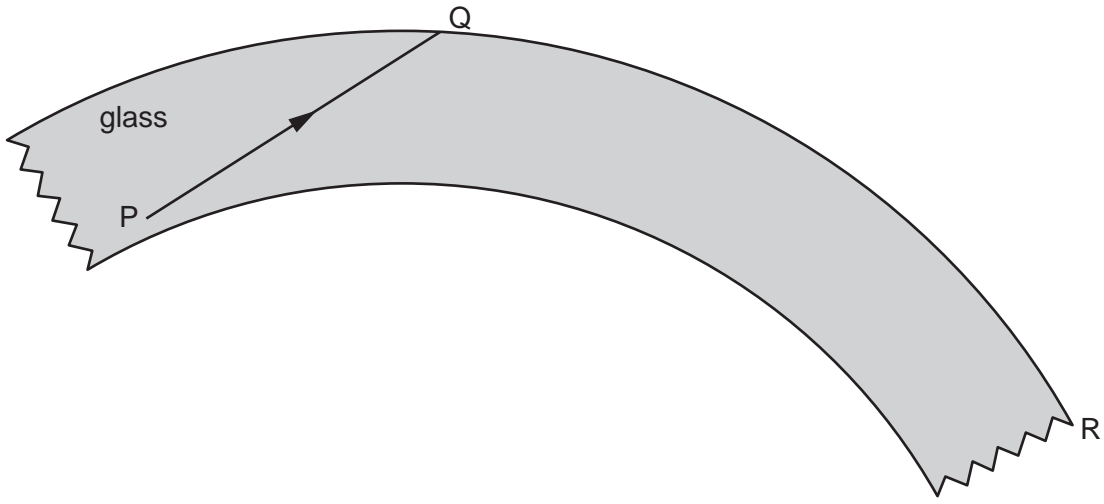


1 Fig. 6.1 shows part of the path of a ray of light PQ travelling in an optical fibre.



**Fig. 6.1**

PQ undergoes total internal reflection at Q.

**(a)** Explain what is meant by *total internal reflection*, and state the conditions under which it occurs.

.....

.....

.....

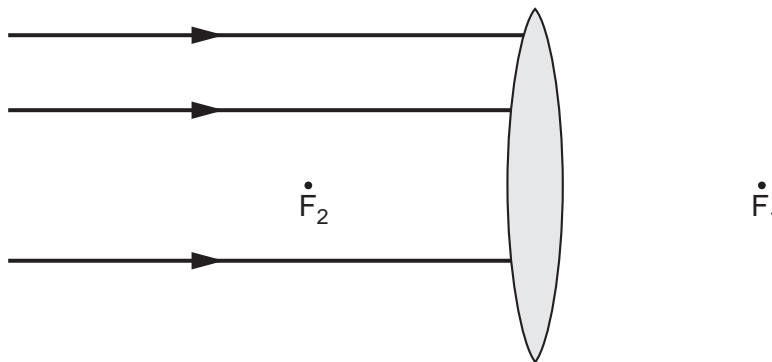
.....

..... [3]

**(b)** Carefully complete the path of the ray of light, until it reaches the end R of the optical fibre. [2]

[Total: 5]

- 2 Fig. 9.1 shows three rays of light, parallel to the axis of a thin converging lens. The rays strike the first surface of the lens.  $F_1$  and  $F_2$  are the two principal foci of the lens.



**Fig. 9.1**

- (a) Describe and explain what happens to the top ray as it enters the lens.

.....

.....

.....

.....

.....

.....

..... [3]

- (b) On Fig. 9.1, use a ruler to,
- (i) complete the three rays through the lens, until they reach about 5 cm to the right of the lens, [2]
  - (ii) draw a fourth ray, parallel to the others on the left of the lens, which passes through  $F_2$ , until it reaches about 5 cm to the right of the lens. [1]

**(c)** A lens such as that shown in Fig. 9.1 can be used as a magnifying glass.

**(i)** On Fig. 9.1, show with an X where the object could be positioned for the lens to be used as a magnifying glass. [1]

**(ii)** State 3 characteristics of the image formed by a magnifying glass.

1. ....

2. ....

3. .... [2]

[Total: 9]

- 3 In Fig. 9.1, a ray of light TRS is shown entering, passing through and leaving a semicircular glass block.

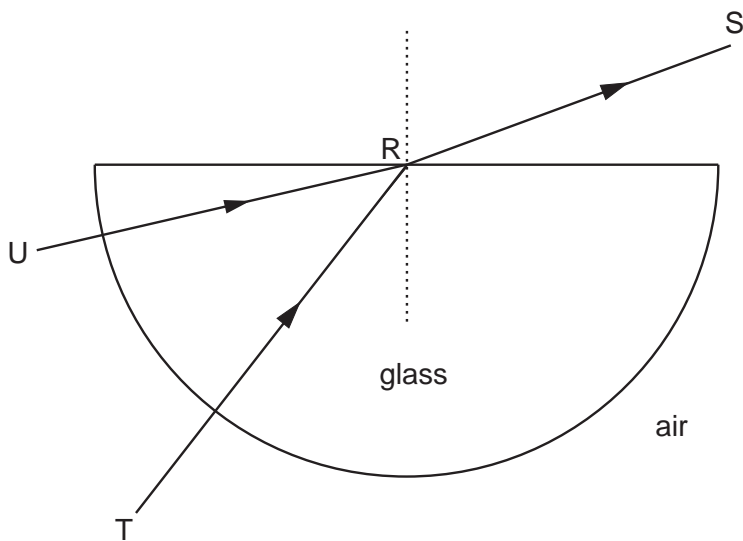


Fig. 9.1

- (a) As the light enters the block, its frequency remains constant.

State what happens to

- (i) the speed of the light as it enters the block,

.....

- (ii) the wavelength of the light as it enters the block.

..... [2]

- (b) The refractive index of the glass is 1.48.

The speed of light in air is  $3.00 \times 10^8$  m/s.

Calculate the speed of the light in the glass. State the equation you use.

speed = ..... [2]

- (c) Another ray of light enters the block along UR.

On Fig. 9.1, draw a line to show what happens to this ray after it has reached R. [2]

[Total: 6]

- 4 In an optics lesson, a Physics student traces the paths of three rays of light near the boundary between medium A and air. The student uses a protractor to measure the various angles.

Fig. 8.1 illustrates the three measurements.

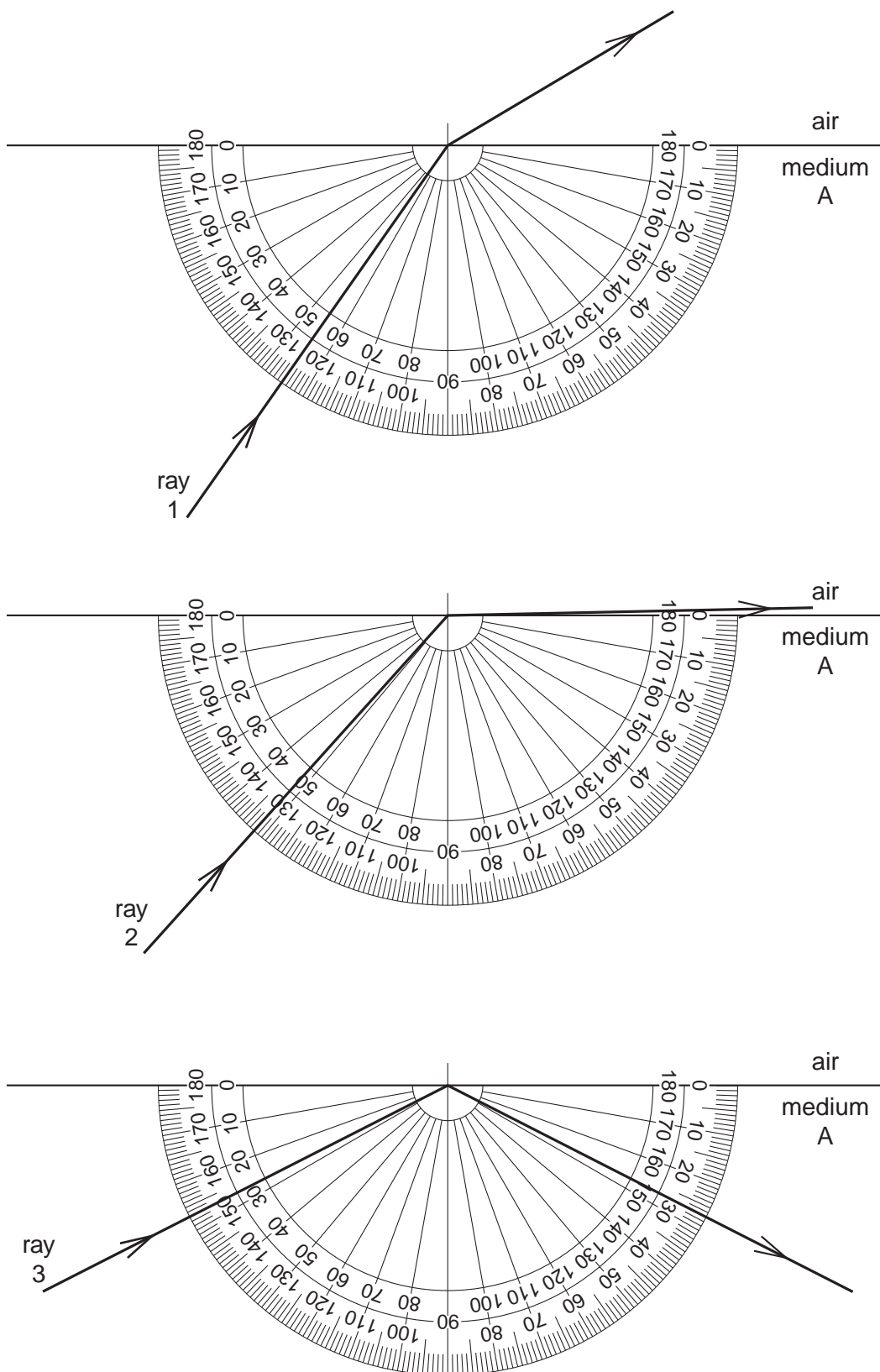


Fig. 8.1

(a) State which is the optically denser medium, A or air, and how you can tell this.

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

(b) State in which medium the light travels the faster, and how you know this.

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

(c) State the critical angle of medium A.

.....[1]

(d) State the full name for what is happening to ray 3.

.....[1]

(e) The refractive index of medium A is 1.49.

**Calculate** the value of the angle of refraction of ray 1, showing all your working.

angle of refraction = ..... [2]

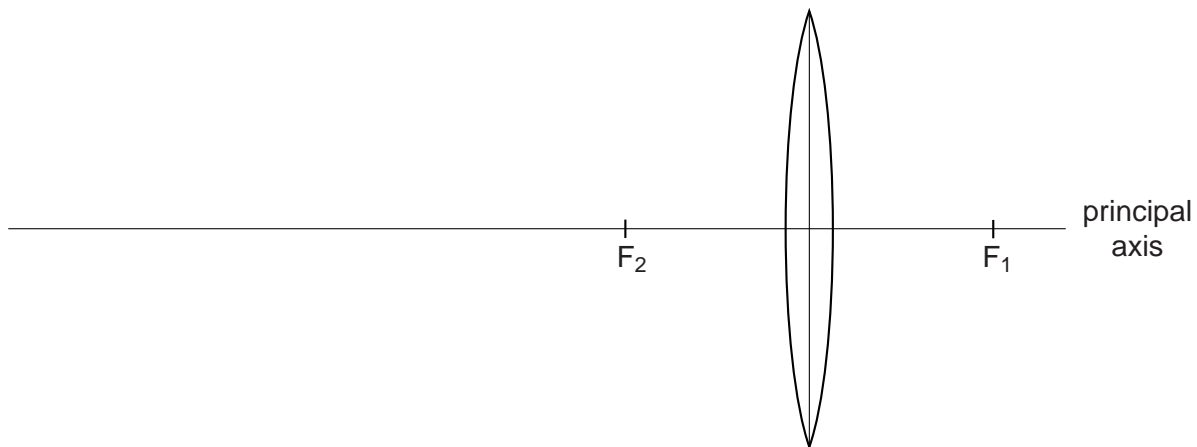
(f) The speed of light in air is  $3.0 \times 10^8$  m/s.

Calculate the speed of light in medium A, showing all your working.

speed of light = ..... [2]

[Total: 8]

5 Fig. 8.1 shows a thin converging lens. The two principal foci are shown.



**Fig. 8.1**

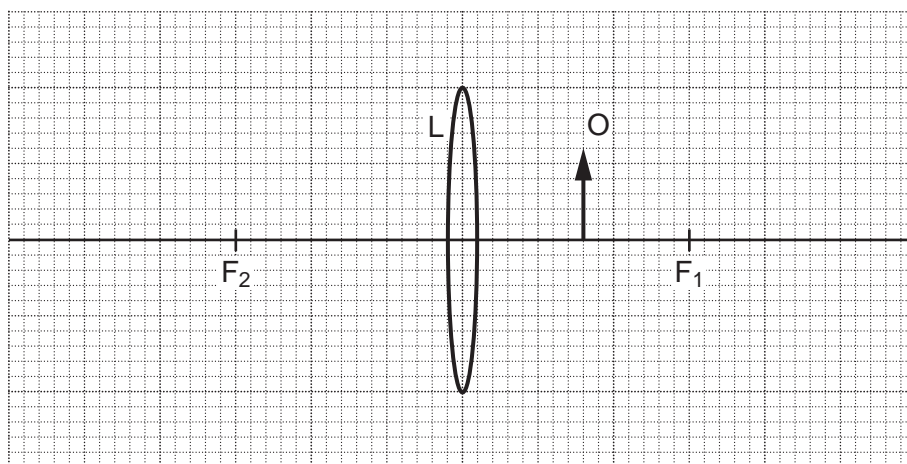
A vertical object, 2 cm tall, is to be positioned to the left of the lens, with one end on the principal axis.

On Fig. 8.1,

- (a) draw the object in a position which will produce a virtual image, labelling the object with the letter O, [1]
- (b) draw two rays showing how the virtual image is formed, [2]
- (c) draw in the image, labelling it with the letter I. [1]

[Total: 4]

- 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  $F_2$ .



**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]