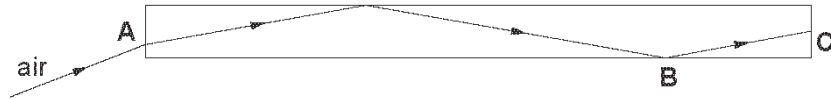


**WJEC Physics GCSE**  
**Topic 1.6: Total internal reflection**  
**Questions by topic**

1.

The diagram shows the path of a signal through a glass fibre.



(a) State the name given to the change in direction of the signal: [2]

(i) at A; .....

(ii) at B. ....

(b) (i) Give a reason why the signal changes direction at A. [1]

.....  
.....

(ii) State the two conditions needed for the signal to change direction at B. [2]

1. ....

2. ....

(c) Add a line to the diagram to show how the signal leaves the glass fibre at C. [1]

6

2.

(a) The diagrams below are drawings made by a student investigating how light rays pass through a semi-circular glass block.

Diagram A

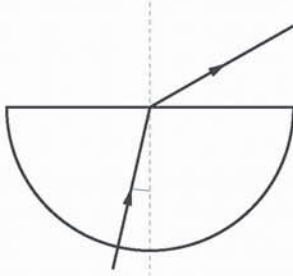


Diagram B

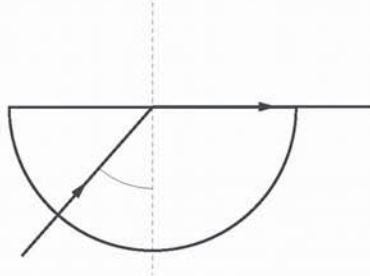
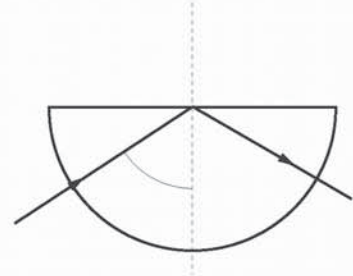


Diagram C



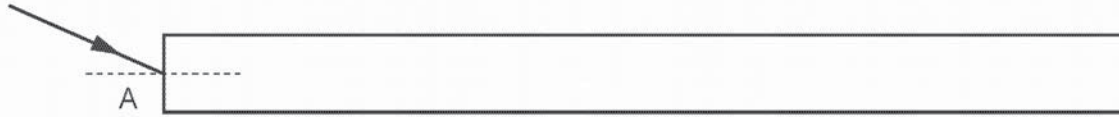
- (i) **Label the critical angle ( $c$ )** on the appropriate diagram above. [1]
- (ii) Describe and explain the observations shown in the drawings as fully as you can. [6 QWC]

You should:

- describe what happens to the light ray in each of the diagrams above;
- explain why the light ray follows the path shown in each diagram.

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings present.

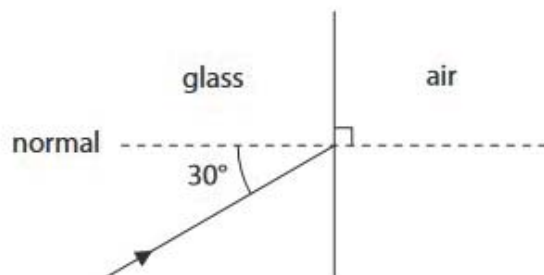
- (b) Complete the diagram below to show how the light entering at A travels along the optical fibre. [3]



3.

### Critical angle

(a) The diagram shows a ray of light incident on a boundary between air and glass.



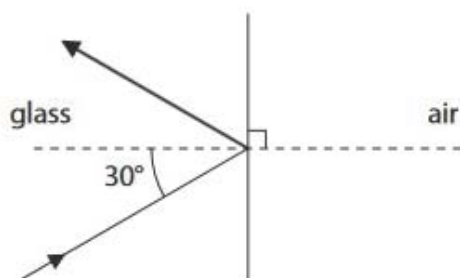
The critical angle for glass in air is  $42^\circ$ .

Which of these diagrams shows the ray of light after it meets the boundary between glass and air?

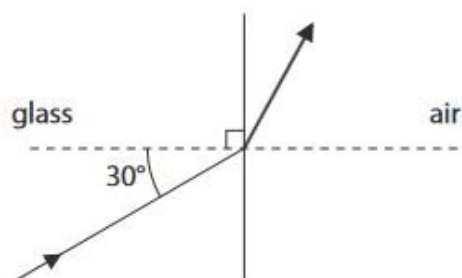
Put a cross (X) in the box next to your answer.

(1)

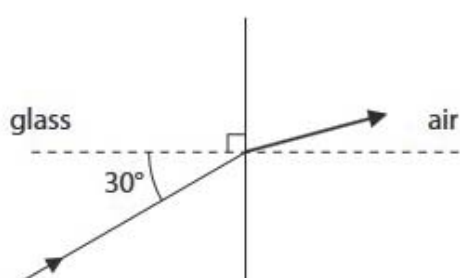
☐ A



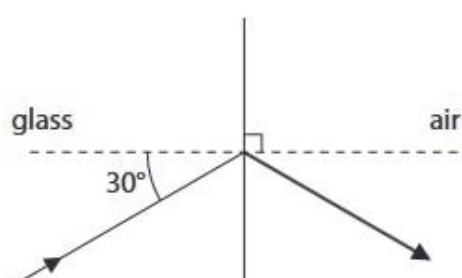
☐ B



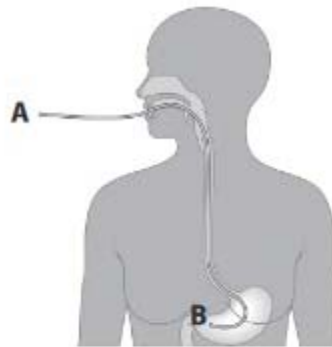
☐ C



☐ D



- (b) The diagram shows how an endoscope is used to see inside a person's stomach. Light is shone into the optical fibres in the endoscope at A and it comes out at B.



- (i) The cross-sectional area of an optical fibre is  $6.3 \times 10^{-6} \text{ m}^2$ .  
The intensity of the light entering the optical fibre is  $3.2 \times 10^7 \text{ W/m}^2$ .

Calculate the power of the light entering the optical fibre.

(3)

power = ..... W

- (ii) Explain why the power of the light at B is the same as the power of the light at A.

(2)

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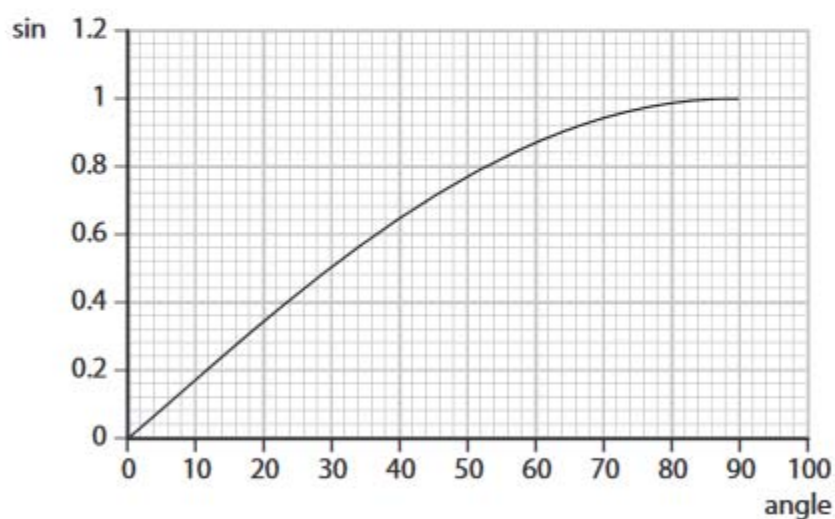
(c) The optical fibre cable in an endoscope has a refractive index of 1.70.

The critical angle for a material can be calculated using the equation

$$\sin c = \frac{1}{n}$$

where  $c$  is the critical angle  
and  $n$  is the refractive index

The graph shows the relationship between an angle and the sine of the angle.



Use the equation and the graph to calculate the critical angle for the optical fibre.

(2)

critical angle = .....°