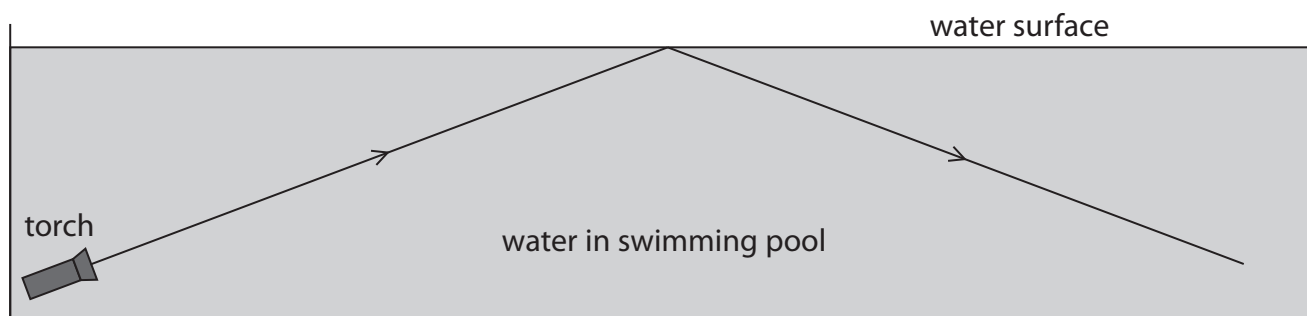


**11** This question is about how light travels in water.

(a) Diagram 1 shows a ray of light from a torch submerged in a swimming pool.

The ray of light does not pass through the water surface.



**Diagram 1**

(i) State the name of this process.

(1)

(ii) Draw the normal on diagram 1 where the ray of light meets the water surface.

(1)

(iii) Measure the angle of incidence.

(1)

angle of incidence = .....

(iv) State the angle of reflection.

(1)

angle of reflection = .....

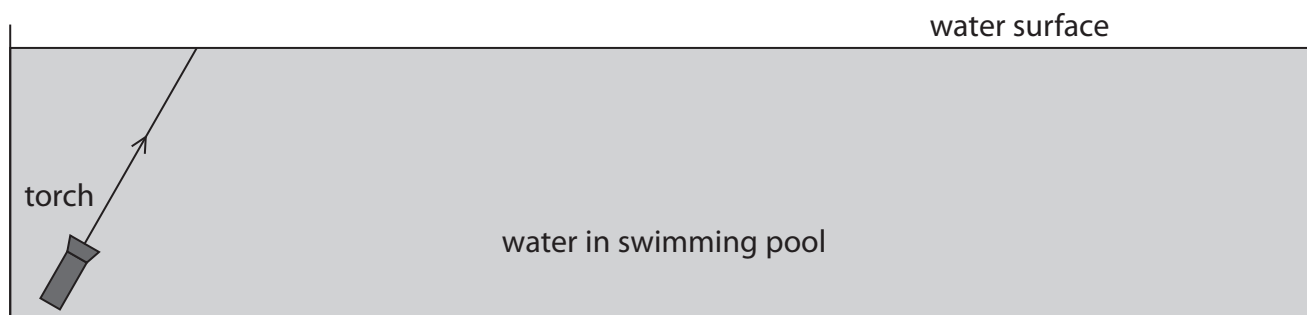
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(b) The torch is moved and the ray of light now passes through the water surface.



**Diagram 2**

(i) Draw a line on diagram 2 to continue the path of the ray of light.

(2)

(ii) State the name of this process.

(1)



(c) (i) State the equation linking critical angle and refractive index.

(1)

(ii) The refractive index of water is 1.33

Calculate the critical angle for the boundary between water and air.

Give your answer to three significant figures.

(3)

critical angle = .....

(iii) The torch is moved again so that the ray of light now meets the water surface at an angle of incidence of  $52^\circ$ .

Explain what happens to this ray of light.

(2)

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**(Total for Question 11 = 13 marks)**

