

Light – Reflection, Refraction and Total Internal Reflection – LQ I

14. 1999/I/5

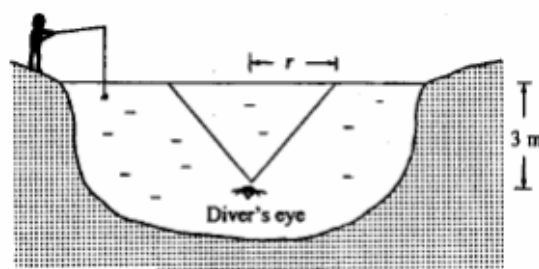


Figure 5

A diver stays at a depth of 3 m under water in a lake. When the diver looks upwards, the scene above the water surface is compressed into a circular patch of radius r at the water surface. (See Figure 5). The refractive index of water is 1.33.

- (a) Calculate
- (i) the critical angle of the water,
 - (ii) the radius r . (4 marks)
- (b) A fisherman stands beside the lake as shown in Figure 5. Can the diver see the fisherman? Draw a ray diagram to illustrate your answer. (2 marks)

16. 2000/I/1

An illuminated object is placed 30 cm in front of a convex lens and a sharp image is formed on a screen on the other side of the lens. The image is of the same size as the object.

- (a) Is the image real or virtual? Explain your answer. (2 marks)
- (b) In Figure 1, draw a ray diagram to show how the image of the illuminated object is formed. Hence, or otherwise, determine the focal length of the lens. (4 marks)

18. 2001/I/3



Figure 2

A student holds a lens above a picture and the image observed is shown in Figure 2.

- (a) What kind of lens is used by the student? Explain your answer. (2 marks)
- (b) Sketch a ray diagram to show how the image in Figure 2 is formed. (3 marks)

25. 2002/I/11



Figure 17

Kitty designs a simple peephole which is installed at an entrance door to identify visitors (see Figure 17). The peephole consists of a metal tube with a concave lens of focal length 10 cm fixed inside.

- (a) A visitor stands at a distance 30 cm in front of the peephole (see Figure 18 on next page).
- In Figure 18, draw the refracted rays of the three incident rays and the image formed. (4 marks)
 - Find the magnification of the image formed. (2 marks)
- (b) Suggest one reason to explain why the concave lens inside the peephole cannot be replaced by a convex lens. (2 marks)

26. 2003/I/2

- (a) A ray of light travels from water to air with an angle of incidence 30° . The refractive index of water is 1.33.
- Find the angle of refraction of the ray in air. (2 marks)
 - Find the critical angle of water. (2 marks)
- (b)

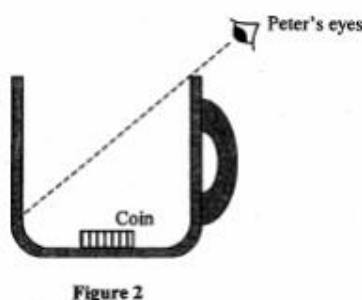


Figure 2

Peter places a coin in an empty cup. As shown in Figure 2, he **cannot** see the coin. After pouring some water into the cup, he finds that he can see the coin without changing the position of the cup or his eyes. In Figure 2, draw a ray diagram to illustrate how Peter can see the coin. (2 marks)

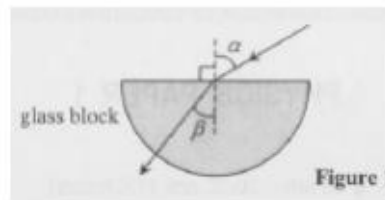
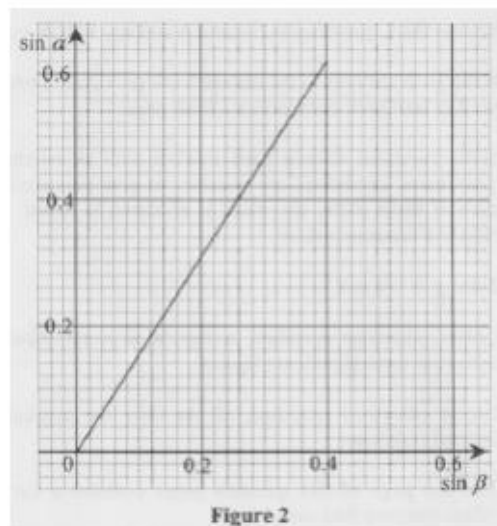


Figure 1 shows a set-up used to study the relationship between the angle of incidence α and the angle of refraction β of a ray of light travelling from air into a semi-circular glass block. Figure 2 shows a graph of $\sin \alpha$ against $\sin \beta$.



- Find the slope of the graph in Figure 2 and state its physical meaning. (3 marks)
- Philip predicts that if α is increased to 50° , total internal reflection will occur. Explain whether he is correct or not. (2 marks)