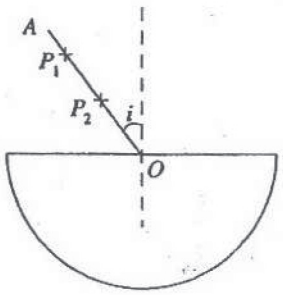
You are to trace the passage of a light ray through a semicircular glass block and find a value for the refractive index, (n_g) of the glass. The block is kept on a sheet of white paper and two pins P_1 and P_2 are placed vertically along the line OA as shown in the figure. Here O is the centre of the straight edge of the block.



(a) Give the experimental steps needed to trace the passage of the light ray AO through the block using two other pins.

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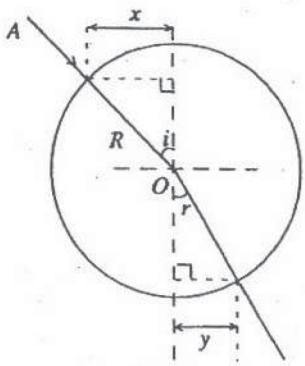
(b) Once the refracted ray is traced-out, a circle of radius R is drawn as shown in the diagram with O as the centre, and the distances x and y are measured.



(i) Write down sin i in terms of x and R.

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(ii) Hence find an expression for n_g in terms of x and y.

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(c) What is the advantage of selecting R to be as large as possible?

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(d) If you are asked to determine n_g by plotting a suitable graph, give the essential steps that you would follow.

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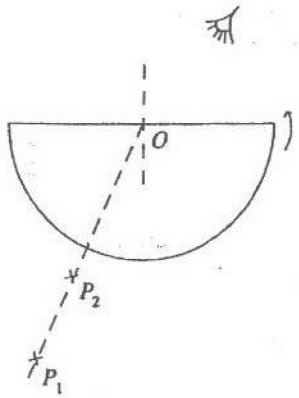
(e) A student suggests another method of determining n_g by measuring the critical angle (C) for the glass-air interface. In this method, the two pins are placed in front of the curved surface of the block as shown, and the images formed due to refraction from the glass-air interface are viewed, while rotating the block slowly about O in the anti-clockwise direction.



(i) Give the experimental steps that you would follow in order to determine C.

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(ii) Write down an expression for n_g in terms of C.

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(f) The first method mentioned may give a more accurate value for n_g than the second. What is the reason for this?

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