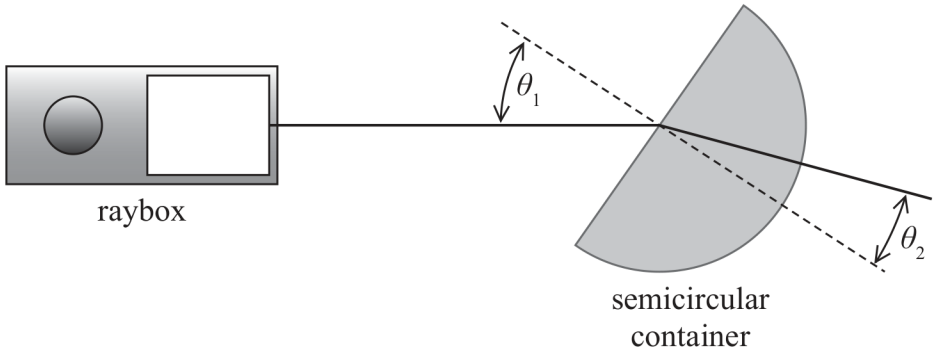
3 A student investigated the refraction of light as it travelled into salt solutions of different densities.

For a salt solution, as the density increases, the speed of light in the salt solution decreases.

She put the salt solution into a transparent semicircular container, as shown.



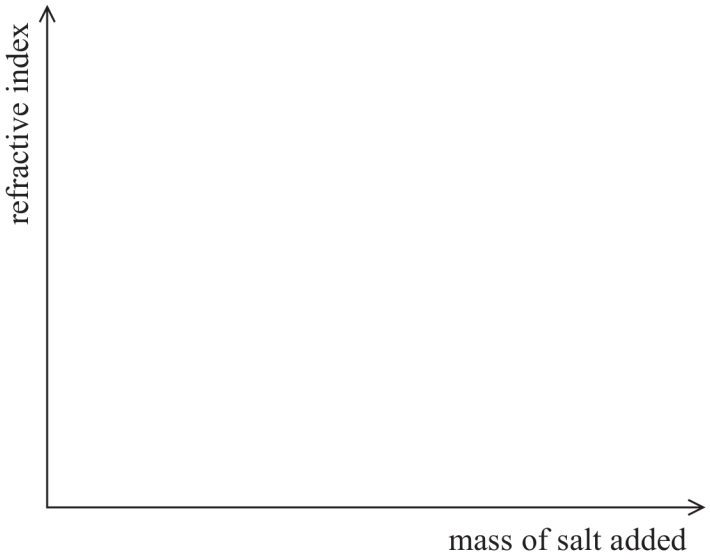
(a) Describe a method the student could use to determine the density of the salt solution.

(3)

(b) The student increased the density of the salt solution by adding different masses of salt.

Sketch, on the axes below, a graph to show how the refractive index of the salt solution varies with the mass of salt added.

(2)



(c) The relationship between the refractive index n, the angle of incidence θ_1 and the angle of refraction θ_2 is given by the equation

$$\sin\theta_1 = n\sin\theta_2$$

Describe a graphical method she could use to determine n.

(4)

(d) The student measured only one pair of angles for each salt solution.

The measurements the student recorded for one salt solution were:

Angle of incidence θ_1	33.0°
Angle of refraction θ_2	24.0°
Refractive index n	1.34

(i) The uncertainty in the measurement of the angles was ± 0.5°.

Calculate the maximum and minimum values of n.

(3)

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Maximum value of n = ...

Minimum value of n = ...

(ii) Calculate the percentage uncertainty in the student's value of n.

(2)

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Percentage uncertainty = ...

(Total for Question 3 = 14 marks)