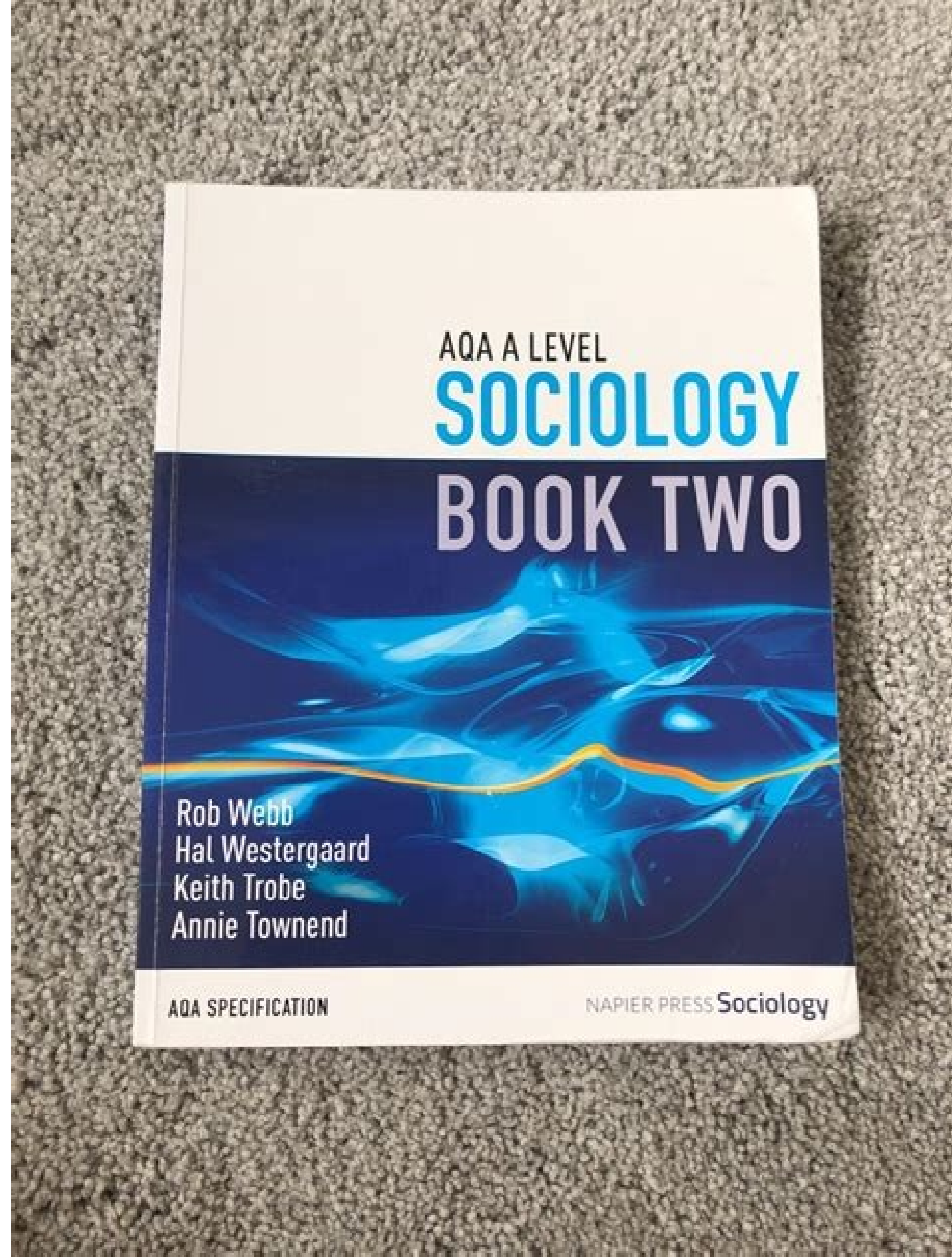


I'm not robot!



Refractive Index of Water

Aims

In this experiment you will measure the refractive index of a glass block and of pure water and determine the uncertainty in your measurements.

Safety

- Switch the ray box off if it becomes too hot.
- Do not switch electrical equipment on or off with wet hands.
- If glass blocks are used, take care with sharp edges.

Equipment, materials and method

- 1 For this experiment you will require an A3 sheet of drawing paper, a sharp pencil, two glass or perspex semicircular blocks, a ray box with a focusing lens, a protractor and a ruler, paper towels, a small beaker of pure water and a dropper.
- 2 Using a sharp pencil, draw two lines at right angles to each other in the centre of the A3 paper. Take care to draw thin and precise lines that intersect at exactly 90°. Place the glass block so that its edge is along one of the lines and the intersection of the two lines is exactly in the middle of the flat side. The line perpendicular to the flat side is a normal to the surface of this side of the block.

Part 1 Measurement of the refractive index of the glass block

Method

- 1 Direct a ray of light from the ray box so it passes through the curved side of the block without being refracted and also through the point where the two lines intersect, as shown in figure 1.

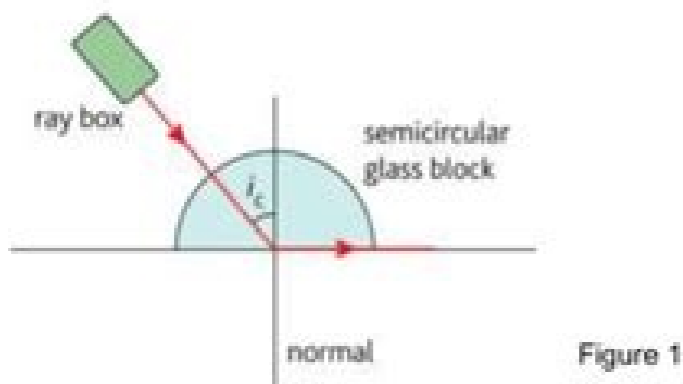


Figure 1

- 2 Adjust the angle of incidence of this light ray until it is equal to the critical angle i_c and the refracted light ray is parallel to the flat side of the block.
- 3 Trace the critical ray from the ray box to the block.
- 4 Remove the block and complete the path of the refracted ray through the block.
- 5 Measure the critical angle i_c as accurately as possible.
- 6 Repeat the measurement two more times. Record your measurements and their precision.

Questions

- 1 (a) Calculate the mean value of the critical angle i_c and estimate its uncertainty.
(b) Use the formula

Dithionite | Level 30000 | 3.3 Moles and volumes | Method sheet
OCR Chemistry A

Determining the conc. of HCl using a standard solution of sodium hydrogen carbonate

Specification references

- 2.7.4.10 (1) (4) (5)
- 2.7.4.10 (5)
- 2.7.4.10 (6)

Learning outcome

After completing the practical you should be able to:

- calculate the concentration of a solution using experimental data.

Background

You are going to use the standard solution of 1 mol dm⁻³ sodium hydrogen carbonate you prepared in 3.2 Practical. Sodium hydrogen carbonate is a weak base and sodium hydrogen carbonate is a weak acid solution of hydrogen ions and carbonate ions.

Safety

The solution of sodium hydrogen carbonate and hydrochloric acid are classified as Irritant (Xi) in their respective MSDS.

- Wear eye protection.

Equipment and materials

- burette
- 250 cm³ conical flask
- 25 cm³ pipette
- pipette filler
- methyl orange indicator
- 0.1 mol dm⁻³ sodium hydrogen carbonate solution (from previous experiment)
- hydrochloric acid of unknown concentration
- white tile
- distilled water

Dithionite | Level 30000 | 3.3 Moles and volumes | Method sheet
OCR Chemistry A

Method

Record your results in your results table.

- 1 Place the burette that contains distilled water and the hydrochloric acid. Fill the burette with hydrochloric acid and standardise the volume.
- 2 Rinse the pipette with distilled water and then with the sodium hydrogen carbonate solution.
- 3 Using a pipette and filler, add 25 cm³ of the sodium hydrogen carbonate solution to a conical flask and then add 5 cm³ of methyl orange indicator.
- 4 Place the white tile and conical flask underneath the burette. Carry out a titration by adding the hydrochloric acid to the sodium hydrogen carbonate solution, stopping the flow of acid when the colour has just changed from yellow to orange. Record the volume of acid needed for the colour change to take place.
- 5 Repeat the titration until you get concordant results (within 0.10 cm³).

Results

Complete a table, such as Table 1 in which you can record your results.

Table 1: Example results table

Titre / cm ³	Initial volume / cm ³	Final volume / cm ³	Titre / cm ³
1			
2			
3			

Questions

- 1 Calculate the concentration for the reaction between sodium carbonate and hydrochloric acid. Include state symbols. (2 marks)
- 2 Calculate the number of moles of sodium carbonate used in your titration. (1 mark)
- 3 Using the stoichiometric ratio from your equation, determine the number of moles of hydrochloric acid used. (1 mark)
- 4 Calculate the concentration of hydrochloric acid in:
 - a. mol dm⁻³ (1 mark)
 - b. g dm⁻³ (1 mark)

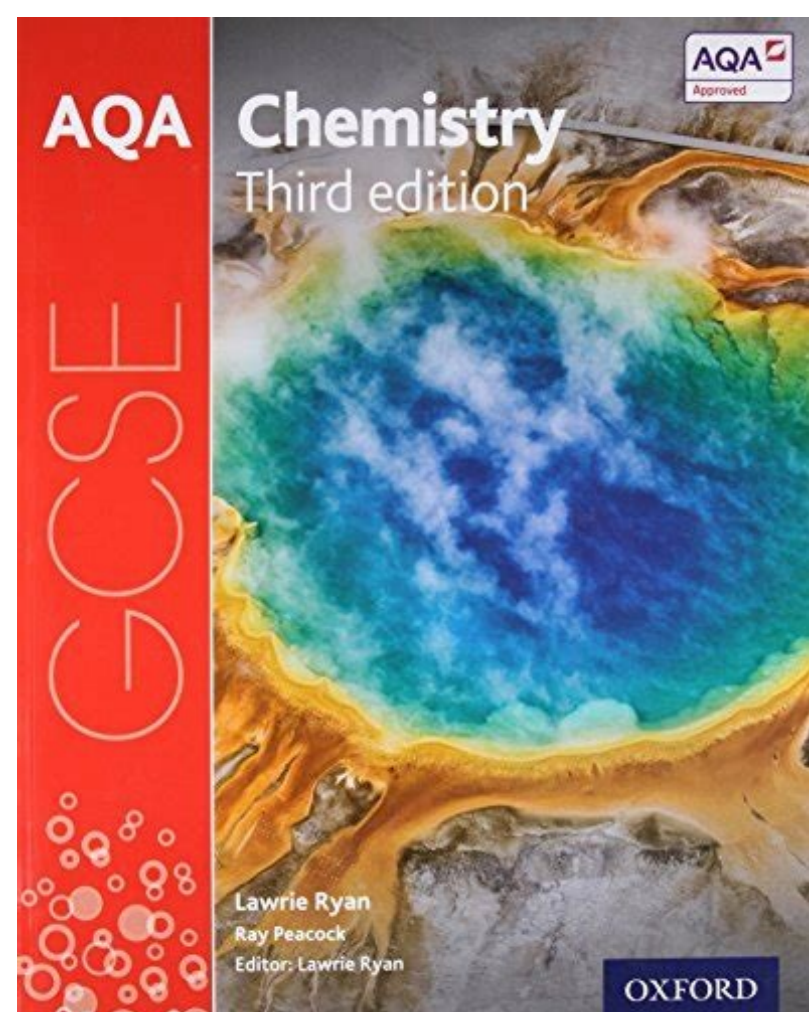
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AS-Level Chemistry

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The Revision Guide



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