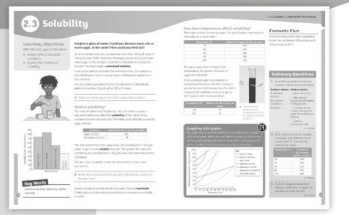
2.3 Solubility



Chemistry NC link:
- mixtures, including dissolving.

Working Scientifically NC link:
- select, plan, and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent, and control variables, where appropriate.

Band	Outcome	Checkpoint	
		Question	Activity
Developing	Describe what happens when a solute dissolves (Level 4).		Starter , Homework
	Describe how temperature affects solubility (Level 4).	2	Main 1, Plenary 1
	Plan how to find out how much of a solute dissolves at a given temperature, with help (Level 4).	3	Main 2
Secure	Explain what a saturated solution is (Level 5).	A, 1	Plenary 1
	Explain the meaning of solubility (Level 5).	1, 2	Plenary 1
	Plan an investigation to compare solubility with temperature, considering variables (Level 5).	3	Main 2
Extending	Explain why temperature affects the amount of solute dissolved in a solution (Level 7).	2	Maths, Plenary 2
	Explain what a solubility graph shows (Level 7).	B, 2	Maths, Main 1, Plenary 2
	Justify the choice of method chosen to investigate solubility of salt in seawater (Level 7).	3	Main 2

Maths
Students will extract and interpret information from tables and graphs when completing the student-book activity and summary questions, describing trends shown in graphs and extrapolating data beyond the regions shown.

Literacy
Students use scientific terminology to explain the relationship between solubility of different solutes, and how solubility differs with changing temperatures.

APP
Students will plan an investigation to investigate how solubility changes with temperature (AF4), record results in a suitable table (AF3), and draw conclusions from experimental data (AF5).

Key Words
saturated solution, solubility, soluble, insoluble

Answers from the student book

In-text questions	**A** A solution where no more solute will dissolve. **B** lithium chloride (most), sodium chloride (least)
Activity	**Grappling with graphs** Solubility increases with temperature for straight-line graphs (sodium nitrate, lead nitrate, potassium chloride, and sodium chloride). Lead nitrate has the steepest gradient (solubility increases the most for each degree of temperature increase) while sodium chloride has the shallowest gradient. Curves for calcium chloride, potassium nitrate, and potassium chlorate (VII) show a slow increase in solubility with temperature at first, before a rapid increase after a certain temperature. Credit use of the correct temperature. The curve for cerium (III) sulfate is the only one to show a decrease in solubility with temperature, to a constant solubility of 3 g/100 g of water from 30 °C onwards.

Summary Questions	**1** A saturated solution is a solution that contains the greatest mass of solid that can dissolve. A saturated solution contains undissolved solid. An insoluble substance does not dissolve. Solubility is the mass of substance that dissolves in 100 g of water. (4 marks) **2** Graph should show an upward curve of decreasing gradient. This shows that solubility increases with temperature but up to a limit of approximately 700 g/100 g of water. (4 marks) **3** Credit sensible suggestions for comparing solubilities. For example, heating 100 ml of water in a beaker to different temperatures and adding known amounts of salt and sugar in each beaker. Form saturated solutions at each temperature for each solute and plot the results on graph. (6 marks)

kerboodle

Starter	Support/Extension	Resources
Describing dissolving (5 min) Ask students to write a simple description of what happens when sugar dissolves in water. The idea of particles should be used in the explanation. This activity will serve to dispel any remaining misconceptions about dissolving from the previous lesson. **Dissolving substances** (10 min) Demonstrate the differences in solubility in 20 cm^3 of water for salt, calcium carbonate, and potassium permanganate. Explain that calcium carbonate is insoluble and hence all falls to the bottom, whilst the other two are both soluble, but a different amount of each can be added before the solid no longer dissolves and falls to the bottom. Explain when this happens a saturated solution has been made and that different substances have different solubility values.	**Extension**: Students may draw particle diagrams to explain the process of dissolving a particular solute. **Extension**: Ask students to suggest the relative solubilities of everyday substances, for example, sugar.	
Main	**Support/Extension**	**Resources**
Solubility graphs (10 min) Introduce the term solubility, and how this relates to saturated solutions. Explain that solubility graphs are used to compare solubility of different solutes, or to compare solubility at different temperatures. Discuss the solubility graphs on the corresponding student-book spread to ensure students are able to extract information and to quote solubility at given temperatures in the units g/100 g water. **Seawater solubility** (30 min) Students will plan a practical investigation to find out whether the solubility of salt in seawater differs according to the temperature of the region. Students carry out the investigation and record observations.	**Support**: Discuss the relevance of the units g/100 g water to facilitate students' understanding of solubility graphs and what the numbers mean. **Support**: Step-by-step guidance on writing a method and a partially filled results table are available on the support sheet.	**Practical**: Seawater solubility **Skill sheet**: Planning investigations **Skill sheet**: Recording results **Skill sheet**: Scientific apparatus
Plenary	**Support/Extension**	**Resources**
Understanding solubility (5 min) Students fill in the gaps in a short paragraph summarising solubility using the interactive resource. **Solubility graphs** (10 min) Discuss the solubility graphs shown in the corresponding student-book spread. Ask students to describe the trends shown in the graphs. Students should then use the graphs to state the solubility of particular solutes at given temperatures. This activity can be done on a mini-whiteboard.	**Extension**: Encourage students to give numerical examples of the difference in solubility at different temperatures using the graphs in the corresponding student-book spread. **Extension**: Students should offer an explanation for why the solubility of different substances varies with temperature.	**Interactive**: Understanding solubility
Homework		
Students complete the questions on the practical sheet, and write a short paragraph to explain why sugar crystals can sometimes be found at the bottom of a teacup after the tea has been drunk.		