2.2 Solutions

Chemistry NC link:
- mixtures, including dissolving
- the identification of pure substances.

Working Scientifically NC link:
- interpret observations and data, including identifying patterns and using observations, measurements, and data to draw conclusions.

Band	Outcome	Checkpoint	
		Question	Activity
Developing	Identify a solvent, solute, and solution in a given scenario (Level 4).	B, 1, 3	WS, Main 2, Plenary 1, Homework
	State a solution contains dissolved particles (Level 3).	A, C, 3	Plenary 2
	Use data to decide if a substance is a solution or not (Level 4).	2	Main 2
Secure	Describe solutions using key words (Level 5).	A, 3	WS
	Use the particle model to explain dissolving (Level 6).	C, 1, 3	WS, Plenary 2, Homework
	Use data to predict how much solute is dissolved in a solution or the mass of a solution (Level 6).	2	Maths, Main 2
Extending	Explain the relationship between solutes, solvents, and solutions (Level 7).	3	WS, Plenary 1
	Draw particle diagrams to represent solutions and pure substances (Level 7).	3	Main 2, Homework
	Explain the applications of solution chemistry to different contexts (Level 8).		Main 2

Maths
Students carry out subtractions to determine the mass of solutes in solution.
Students also interpret numerical data from a table to draw a line graph and answer questions.

Literacy
Students plan ways to explain dissolving to a KS2 audience in the student-book activity, using scientific terminology in the explanation.

APP
Students use models to explain how substances dissolve (AF1), record observations in tables and graphs (AF3), and draw conclusions from experimental data (AF5).

Key Words
solution, dissolve, solvent, solute

Answers from the student book

In-text questions	**A** A mixture of a liquid with a solid or gas dissolved in it. **B** coffee powder **C** Solvent particles surround solute particles. The particles are arranged randomly and can move around.
Activity	**Solution masses** mass of solution = 3 g + 100 g = 103 g **Modelling dissolving** Credit sensible suggestions for how a model for dissolving can be set up. For example, small handfuls of beans can be placed carefully at different intervals throughout a container of rice. The rice represents solvent particles and the beans represent solute particles. When mixed, the content is shaken until the beans are scattered throughout the rice.

Summary Questions	**1** solution, solute, solvent, water, salt (5 marks) **2** Since pure water has a density of 1 g/cm^3, Laura should find the masses of each liquid on a mass balance. The liquid with a mass of 200 g will be pure water and the other two liquids will be solutions. (3 marks) **3** Visual summary example answers (6 marks): Definitions of the key words solute, solvent, and solution How dissolving requires solvent particles to surround the solute particles All particles are freely moving in a solution Use of mass to identify solvents from solutions Examples of different solutions, stating the solutes and solvents used Particle diagrams to illustrate the points above

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Starter	Support/Extension	Resources
When does dissolving occur? (5 min) Ask students to make a list of times when they dissolve something, and to describe in their own words what happens when substances are dissolved. This is a useful starting point to gauge student preconceptions before the lesson. **Do all substances dissolve?** (5 min) Demonstrate salt dissolving in water in a beaker and ask the question 'Has the salt disappeared?'. This is a common misconception as the salt can no longer be seen. Some students should be able to point out that salt must still be present since the water would taste salty.	**Extension**: Encourage students to explain their observations using scientific terminology and in terms of particles. **Extension**: Encourage students to explain observations using particles.	
Main	**Support/Extension**	**Resources**
Introducing solutions (10 min) Using an everyday example such as adding coffee powder to water, define solute as the substance being dissolved (coffee powder), solvent as the substance doing the dissolving (water), and the resulting mixture as the solution (coffee). Demonstrate the conservation of mass by dissolving a known mass of coffee powder in a known mass of water (mass of coffee solution = mass of coffee powder + mass of water). Ask students to suggest possible applications of the conservation of mass (to identify pure solvents from solutions). **Solution or not?** (35 min) Students watch a demonstration (which can be turned into a student-led investigation if time) on the solubility of different solutes in a range of solvents, recording observations in a results table. Students then carry out a short task about the conservation of mass, plotting a graph, and identifying unknown substances as solvents or solutions given their volumes and masses.	**Support**: A support sheet is available with a graph grid for students to plot numerical data. **Extension**: Students should consider the advantages and disadvantages of the method investigated in deciding if an unknown sample is a solvent or a solution.	**Practical**: Solution of not? **Skill sheet**: Recording results **Skill sheet**: Drawing graphs
Plenary	**Support/Extension**	**Resources**
Solutes, solvents, and solutions (5 min) Students match the key words solute, solvent, and solution to images on the interactive resource. Students should then explain how the key words relate to one another. **Modelling dissolving** (10 min) Students design and perform role plays to describe what happens to particles when a solute dissolves. Students should ensure that their role plays illustrate the difference between solutes, solvents, and solutions.	**Extension**: Encourage students to link the three terms using the particle model. **Extension**: Students should evaluate the strengths and weaknesses of each role play.	**Interactive**: Solutes, solvents, and solutions
Homework		
Students identify one example of dissolving that happens in the home, and draw particle diagrams to illustrate this process. They write a description of their observations, and identify the solute, solvent, and solution.		

Resources