

Solubility

This resource is part of the **Structure strips** series of resources, designed to support literacy in science teaching. More resources in this series can be found at: rsc.li/4aXYgzt.

Learning objectives

- 1 Interpret solubility curves.
- 2 Describe the difference between a concentrated and a dilute solution.
- 3 Describe the factors that can affect the solubility of a substance.

Introduction

Solubility is a very important property. Substances need to dissolve in order to carry out many chemical reactions, including those in the body.

For example, when someone takes a paracetamol tablet to treat their headache, the active ingredient, paracetamol, needs to be soluble so that it can be absorbed into the bloodstream and carried to the pain receptors. But the filler material (which bulks out the tablet to make it big enough for people to handle easily) is insoluble, so it passes through the digestive system without being absorbed.

How to use structure strips

Structure strips are a type of scaffolding that supports learners to retrieve information independently. You can use the structure strips to give an overview at the start of a topic, to activate prior knowledge or to summarise learning at the end of a topic. For more ideas on how to use structure strips with your learners, visit rsc.li/3EszCfr.

Structure strips have sections containing prompts, which are sized to suggest the amount that learners must write. Ask learners to glue the strips into the margin of their exercise books and to write their answers next to the sections, using full sentences or bullet points. When learners have finished using the structure strip, they will have a set of A4 notes and examples.

Scaffolding

- Encourage learners to use the suggested keywords in their answers. These link with our key terms support resources for **Elements, compounds and mixtures** (rsc.li/4j5xfyj and rsc.li/42AcGmK)
- To further support learners, include additional prompts in the structure strip. If learners are struggling to engage with the task, supply them with sentence starters created from the example answers.

- As learners grow in confidence, ask them to attempt the extension question first and then use the structure strip to improve or self-assess their answers.

Metacognition

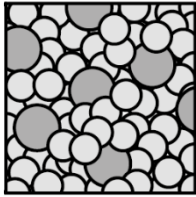
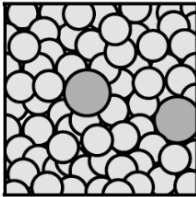
This resource supports learners to develop their metacognitive skills in three key areas:

- **Planning:** the strips provide scaffolding to plan the written response. Learners will need to decide where to gather information from (textbooks, own notes, revision websites). Ask learners: Is the source of information you are using reliable?
- **Monitoring:** learners are prompted by the questions in the structure strip and can check their own answers against the prompts. Ask learners: Have you covered all of the prompts in the space provided? Do you need to change anything to complete the task?
- **Evaluation:** learners can self-assess or ask a peer to check their work against the answers. Ask learners: Did you achieve what you meant to achieve? What will you do differently another time?

Example answers

Example answers for the structure strip are on page 3. Learners can write the answers as bullet points or prose.

Note: the definition of solubility used in the example answers reflects our key term definition by using mass as the measurement of the solvent, i.e. grams of solute/100 grams of solvent. This avoids small changes in volume from the process of dissolving or changes in temperature confusing measurements.

Solubility	Example answers
Define solubility.	Solubility is the maximum mass of a solute which can be dissolved in 100 grams of solvent at a particular temperature.
Describe how to work out the mass of solute dissolved in 50, 25, and 10 grams of solvent, if you know the solubility at a particular temperature.	To work out the mass of solute in 50 g of solvent, divide the solubility by two. To work out the mass of solute in 25 g of solvent, divide the solubility by four. To work out the mass of solute in 10 g of solvent, divide the solubility by ten.
Explain how a concentrated solution is different from a dilute solution. Use diagrams in your explanation.	A concentrated solution (diagram A) contains more dissolved solute particles in the same volume of solvent, than a dilute solution (diagram B).  Diagram A  Diagram B
Explain how a simple experiment can show whether a solid substance is soluble or insoluble in water. Use appropriate keywords.	Add a spatula of the solid to 100 cm³ (or other sensible volume) of water in a beaker and stir the mixture. A soluble substance would dissolve in the water. The solution would be clear/see-through. No solid would be visible. An insoluble substance would be visible in the water as a precipitate. There may be crystals in the bottom of the beaker or the mixture might appear cloudy/opaque.
Think about dissolving sugar lumps and sugar crystals in water. What factors can affect the sugar's solubility?	Particle size – sugar lumps would dissolve more slowly than sugar crystals. Temperature – sugar dissolves better in hot water than in cold water. Stirring – sugar dissolves in the water better if the mixture is stirred.

Extended answer question

Get learners to answer the question after they have attempted the structure strip. The structure strip activates the required knowledge which learners can then apply to the question.

Consider reframing the context of this question to one that your learners are more familiar with, to empower them to unlock their existing science capital. Read our article about targeting science capital (rsc.li/40FAMLPL).

Example answer to extended answer question

Look for six points backed up with evidence from the graph.

- All of the substances show an increase in solubility as temperature increases.
- KNO_3 has the widest solubility range of about 13–100 g/100 g of water across a temperature range of 0–about 55°C.
- NaCl has a relatively narrow range of about 34–40 g/100 g of water across a temperature range of 0–100°C.
- KClO_3 has a solubility range in between that of KNO_3 and NaCl . It is about 3–58 g/100 g of water across the temperature range of 0–100°C.
- NaCl and KNO_3 have the same solubility (around 35 g/100 g of water) at a temperature of around 24°C. And NaCl and KClO_3 have the same solubility (around 39 g/100 g of water) at a temperature of around 83°C.
- KClO_3 and KNO_3 do not have the same solubility at any temperature.