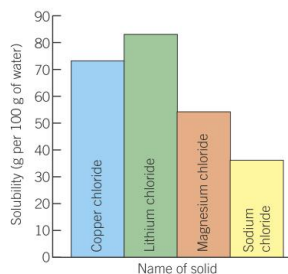


## 2.3 Solubility

### Learning objectives

After this topic you will be able to:

- explain what a saturated solution is
- explain the meaning of solubility.



### Key Words

saturated solution, solubility, soluble, insoluble

**Imagine a glass of water. Could you dissolve more salt, or more sugar, in the water? How could you find out?**

At room temperature you can dissolve more than 200 g of sugar in 100 g of water. That's more than 40 teaspoons. But if you add even more sugar to the solution, it just falls to the bottom. It does not dissolve. You have made a **saturated solution**.

A saturated solution contains the maximum mass of a substance that will dissolve. There is always some undissolved substance in the container.

You can make a saturated solution of salt (sodium chloride) by adding more than 36 g of salt to 100 g of water.

**A State the meaning of the term saturated solution.**

### What is solubility?

The mass of solute that dissolves in 100 g of water to make a saturated solution is called the **solubility** of the solute. Every substance has its own solubility. The table gives solubility values for sugar and salt.

Substance	Solubility at 20 °C (g/100 g of water)
sugar (sucrose)	202
salt (sodium chloride)	36

The data shows that more sugar than salt can dissolve in 100 g of water. Sugar is more **soluble** than salt. The greater the mass of a substance you can dissolve in 100 g of water, the more soluble the substance.

The bar chart opposite shows the solubilities of four more substances.

**B Name the most and least soluble substances shown on the bar chart.**

Some substances cannot dissolve in water. They are **insoluble**. Chalk (calcium carbonate) and sand (silicon dioxide) are insoluble in water.

### How does temperature affect solubility?

Think again about dissolving sugar. Can you dissolve more sugar in hot water, or in cold water?

Temperature (°C)	Solubility of sugar (g/100 g of water)
20	202
40	236
60	289
80	365
100	476

The data shows that the higher the temperature, the greater the mass of sugar that dissolves.

Most substances get more soluble as temperature increases. But the increase is greater for some substances than for others. Compare the solubility values of sugar at 20 °C and at 100 °C to those of salt.

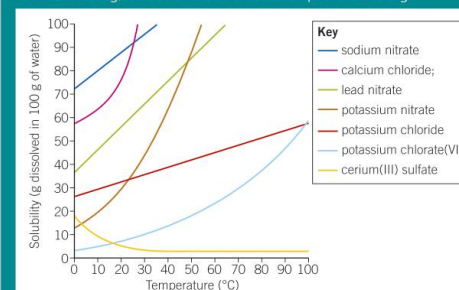
Temperature (°C)	Solubility of salt (g/100 g of water)
20	36
100	39



▲ The solubility of potassium manganate (VII) is 6.3 g/100 g of water at 20 °C.

### Grappling with graphs

The graph shows how the solubilities of six substances change with temperature. With a partner, take it in turns to choose a line on the graph and describe what it shows. Next, compare pairs of curves. Finally, choose two curves to compare in writing.



● C2 Chapter 2: Separation techniques

### Fantastic Fact

One of the most soluble salts is potassium nitrite. You can dissolve 306 g of this salt in 100 g of water at 20 °C.

### Summary Questions

- 1 Write four sentences from the sentence starters and ends below.

**Sentence starters**   **Sentence ends**

A saturated solution...   ...does not dissolve.  
 ...is the mass of substance that dissolves in 100 g of water.

An insoluble substance ...   ...is a solution that contains the greatest mass of solid that can dissolve.  
 Solubility ...   ...contains undissolved solid.

(4 marks)

- 2 Plot the values in the table on a graph, and draw the line or curve of best fit. Describe the relationship shown.

Temperature (°C)	Solubility of zinc bromide (g/100 g of water)
20	446
40	590
60	616
80	647
100	669

(4 marks)

- 3 Design an experiment that you could do to compare the solubility of sugar and salt.

(6 marks)