Dissolving adds volume

When one substance dissolves in another, it does not disappear, so it must take up space.

When one substance dissolves in another, it seems to disappear. But if you taste water that has salt dissolved in it, it still tastes salty, so you know that the salt is simply mixed up with the water. This means that salty water contains both water and salt. It must take up more space than the water alone.

Model dissolving by using beads

Dissolving can be hard to imagine, so it can be easier to see what is going on by using glass beads of different colours.

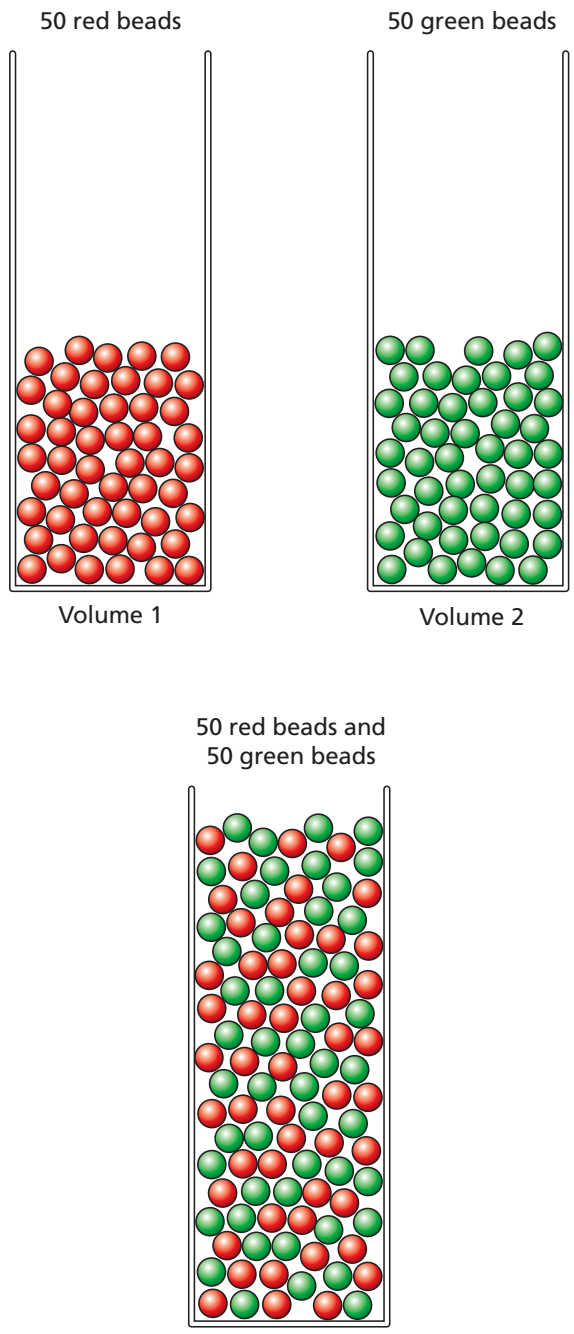
If you add a pile of red beads to a pile of green beads, the final pile will be bigger than either starting pile. In fact, it will be the same size as the two starting piles added together (Picture 1).

This is exactly the same when something dissolves. The only difference is that the 'beads' are too small to see. For example, if you dissolve sugar in water the grains of sugar are mixed up with the water, and they take up just as much space as they did before you dissolved them.

Sugar cube test

You can prove this by adding sugar cubes to water one at a time (Picture 2).

Begin with a clear jar, and pour 25ml of water into it. Mark the level of water on the jar with a felt-tip pen.



▲ **(Picture 1) When you mix grains of two substances together, the grains usually take up the same volume as the two substances did before they were mixed.**

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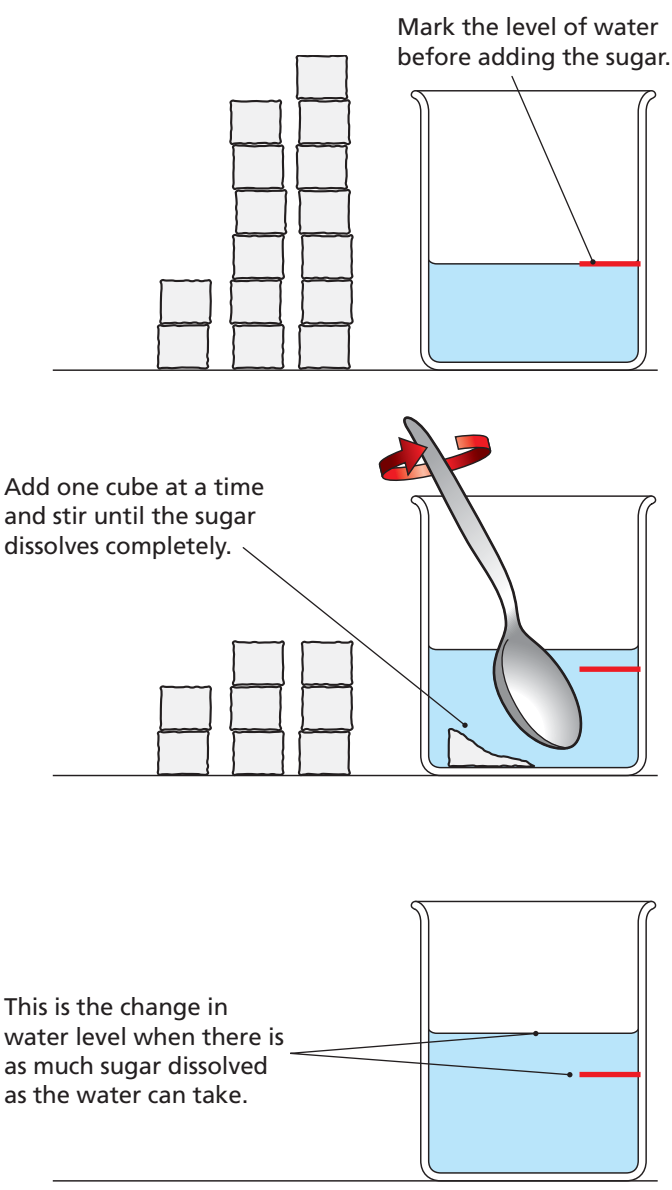
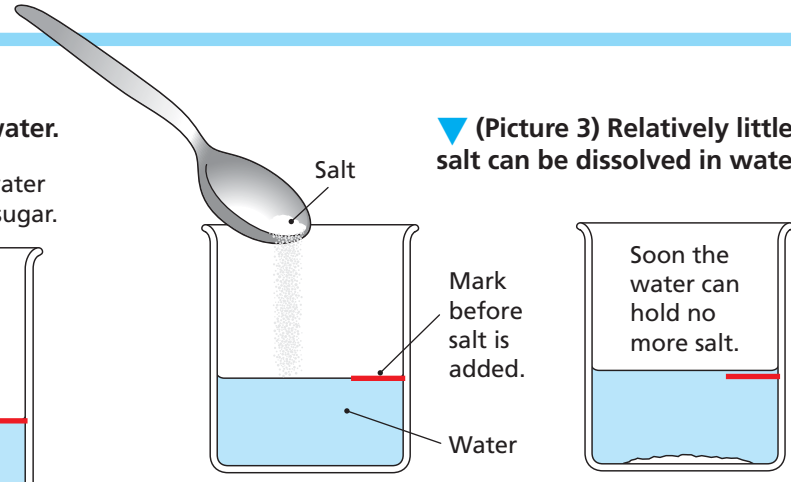
▼ **(Picture 2) A lot of sugar can be dissolved in water.**



Add sugar cubes one at a time and stir the solution after each addition.

When you have added the cubes, mark the level of water in the jar. If the sugar really did disappear, the water level would not change. On the other hand, if the sugar simply breaks down into tiny pieces that can no longer be seen, it would still be there and so you will see the level of the solution rise.

▼ **(Picture 3) Relatively little salt can be dissolved in water.**



In a glass jar containing 25ml of water, you might be able to add about 15 sugar cubes (depending on the type and size of the cubes) before no more will dissolve. When no more sugar cubes will dissolve, stop adding.

In fact, after about 15 cubes have been added, the level of sugar water is much higher than before the sugar was added. This shows that dissolving a solid in a liquid causes the total volume to increase.

Other volume changes

The same experiment can be repeated with table salt, or any other substance that dissolves, but a lot of sugar will dissolve in water (we say that sugar is very soluble) and so the change is easy to see. If you used salt, you would only get a slight increase in volume before you had dissolved as much salt as the water could hold (Picture 3).

Summary

- **When a solid dissolves, the solution takes up more space.**
- **The amount of space taken up depends on how much of the solid dissolves.**

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