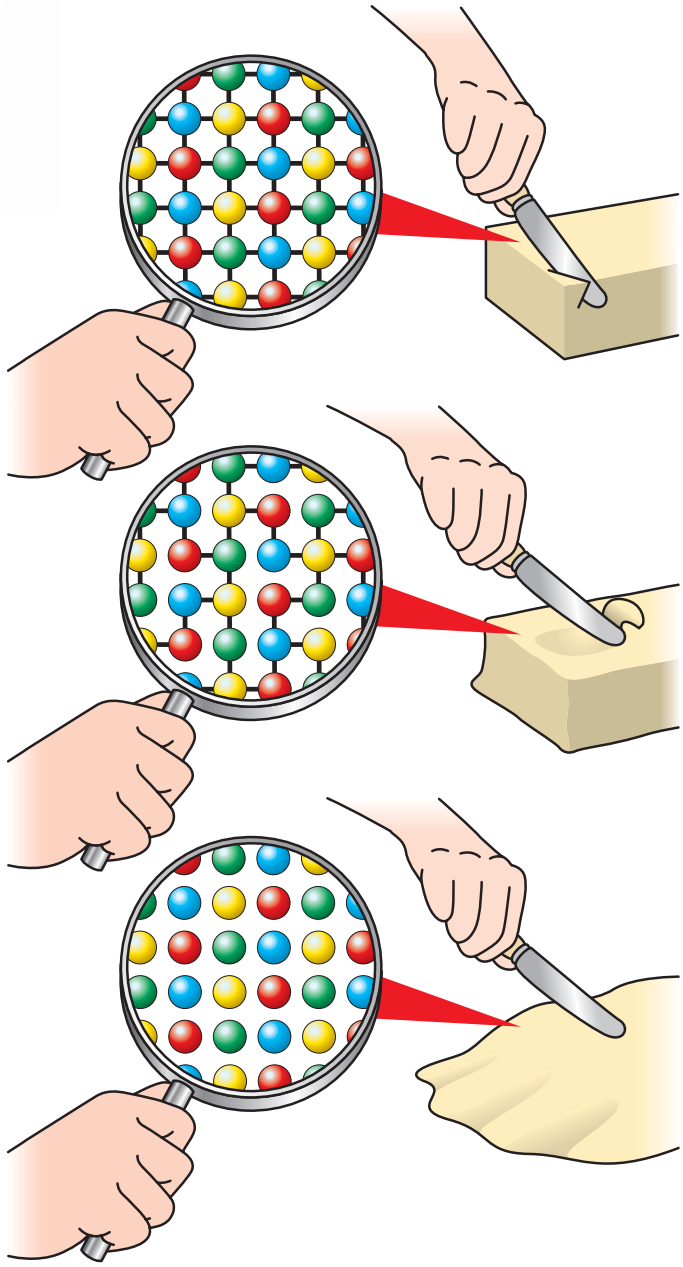
3 Why solids soften

When some solids get hot they gradually get softer as some substances in them melt but others do not.

(Picture 1) Fat is solid when it is cold but is soft at room temperature.

(Picture 2) As butter gets warmer, some of the links holding the particles together break, and the particles are free to move about. This is softening. When all the links break, the butter melts completely.



There are two kinds of materials: those that are made of just one substance, like water, and those that are made of a mixture of substances, such as chocolate, butter, glass and steel.

A pure substance, such as water, changes from a solid to a liquid suddenly. The temperature at which it does this is called the melting point. But mixtures of substances melt more gradually.

Solids get softer as they get hotter

Most substances are mixtures and so they melt over a range of temperatures. Thus, although chocolate melts at about 33°C, some of the substances in it will melt sooner. Chocolate then becomes soft.

If you put a tub of butter in a fridge so that it gets cold, and then scrape a knife across it, you will find that the butter is hard. If you then let the butter reach room temperature, you will find that it

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has softened and can be easily spread (Pictures 1 and 2).

This happens because butter is a mixture of different substances. Some substances in the mixture start to melt before others. The warmer the butter gets, the more parts of the mixture melt, until finally it has all melted and become runny.

Melting mixtures

Steel is another example. It is a mixture of iron, carbon and other substances. Steel begins to soften when the temperature is about 1,000°C, but it only completely melts at about 1,536°C. The amount of softening matches changes in colour of the steel. Hot steel changes colour first to red, then orange, then, when it is almost **MOLTEN**, it becomes yellow. In a steelworks, the steel is heated until it is yellow hot and soft, and is then sent through rollers that squash it into sheets (Picture 3).

Summary

- **Many materials get softer as they get hot.**
- **As substances in a material melt, the material becomes softer.**

▼ (Picture 3) A yellow-hot bar of softened steel being rolled into a sheet.