Swelling and shrinking

Both solids and liquids change in size as they become hotter and colder.

If you have ever looked at a thermometer, you will see that it contains a fine tube partly filled with liquid. As the temperature rises, the liquid swells and also rises in the tube. In this way, the swelling of the liquid measures the temperature.

All liquids will change in size, or **VOLUME**, as they change temperature. A simple thermometer can be made from a glass (not thin plastic) bottle, completely filled with water, and sealed with a tightly-fitting stopper that has a straw through it (Picture 1). As the temperature rises, the water swells, or **EXPANDS**, and begins to move up the straw. As the temperature falls, the water shrinks, or **CONTRACTS**, and the level of the liquid falls.

Making use of expansion

All solids expand when they get warmer, and contract when they cool. Blacksmiths and other craftsmen made

(Picture 1) A real thermometer inside a bottle thermometer. Both show how liquids swell as they get warmer and shrink as they cool.

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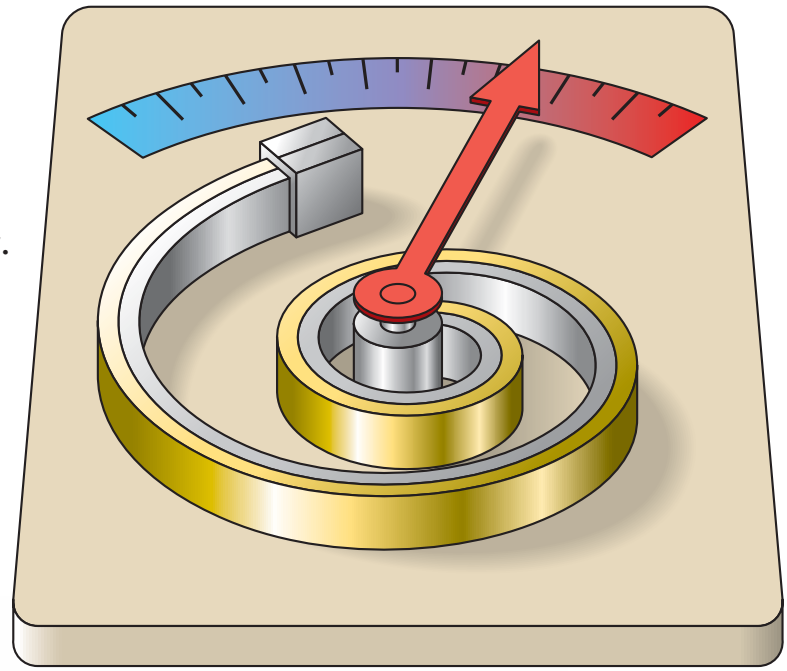
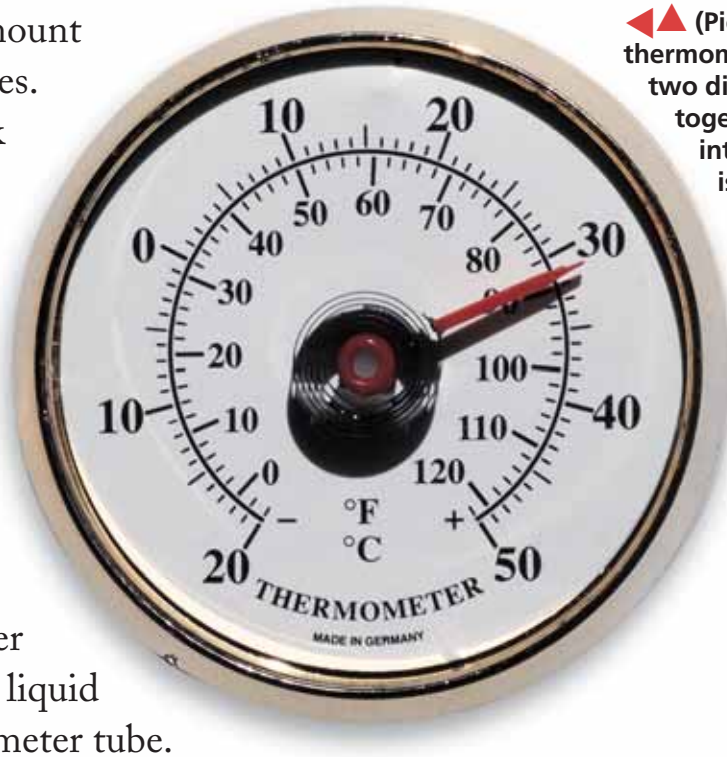
use of this property for hundreds of years. In the past, when they needed a tightly-fitting iron rim on a wooden wheel, for example, they would heat up the wheel rim until the iron was red hot. By this time it would have expanded enough to slip onto the wooden rim. Once the rim was in place, the iron would be drenched with water, cooling it down so that it shrank, gripping the rim firmly.



Expansion rates

Every substance expands or contracts by a unique amount as its temperature changes. In general, metals shrink and swell more than other solids.

Some thermometers make use of this fact (Picture 2).



(Picture 2) This thermometer uses strips of two different metals bound together. They are shaped into a spiral, and a pointer is attached to one end. The other end is fixed. When the temperature rises, the metals expand, and when the temperature falls the metals contract. These changes cause the needle to move.

Most liquids shrink and swell much more than any solid. Water will swell, for example, very much faster than glass. This is why a liquid can be used in a thermometer tube.

However, you need to be careful when heating liquids and solids. If you heated a full bottle of liquid with its stopper firmly in place, the liquid would try to swell more than the glass of the bottle and this could eventually cause the bottle to burst.

Summary

- **Both solids and liquids shrink when they get colder.**
- **Both solids and liquids swell when they get hotter.**
- **Every substance expands and contracts at its own rate.**

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