2 Heating

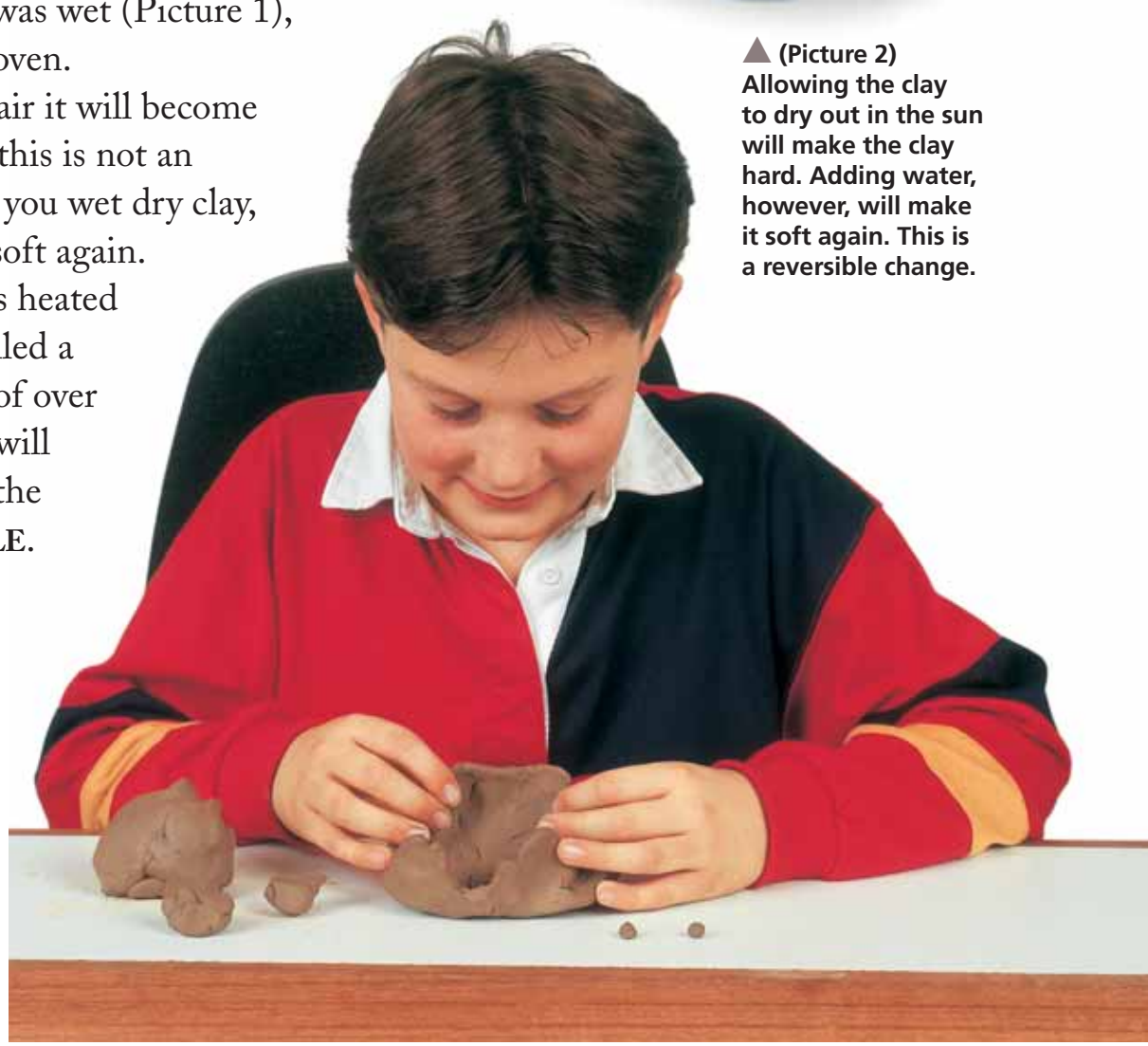
When a substance is heated, irreversible changes often occur.

When a **SOLID** is heated, it may **MELT** and become a liquid. This is what happens to wax, for example. It is a reversible change. But many substances change before they get hot enough to melt. These are irreversible changes.

Firing clay

Since ancient times, people have known that clay changes when it is heated. Some of the earliest things made were pottery, formed by shaping clay while it was wet (Picture 1), then heating it in an oven.
If clay is dried in the air it will become hard (Picture 2). But this is not an irreversible change; if you wet dry clay, the clay will become soft again.
However, if the clay is heated in a very hot oven, called a kiln, at temperatures of over 800˚C, then changes will take place that make the clay hard and **BRITTLE**.

▲ **(Picture 2) Allowing the clay to dry out in the sun will make the clay hard. Adding water, however, will make it soft again. This is a reversible change.**



▶ **(Picture 1) Moist clay is easy to form into a shape. At this stage it is very soft and is quite unsuitable for use as a container or an ornament.**

◀ **(Picture 3) Heating the clay in a special oven to over 800°C makes the clay hard. It is now pottery. Adding water will not soften it. This is an irreversible change.**

Adding water will not soften this clay. The heat has caused the clay to change irreversibly into a new material with new properties (Picture 3). This kind of pottery is called **EARTHENWARE**. Higher temperatures give stoneware and porcelain.

Cooking food

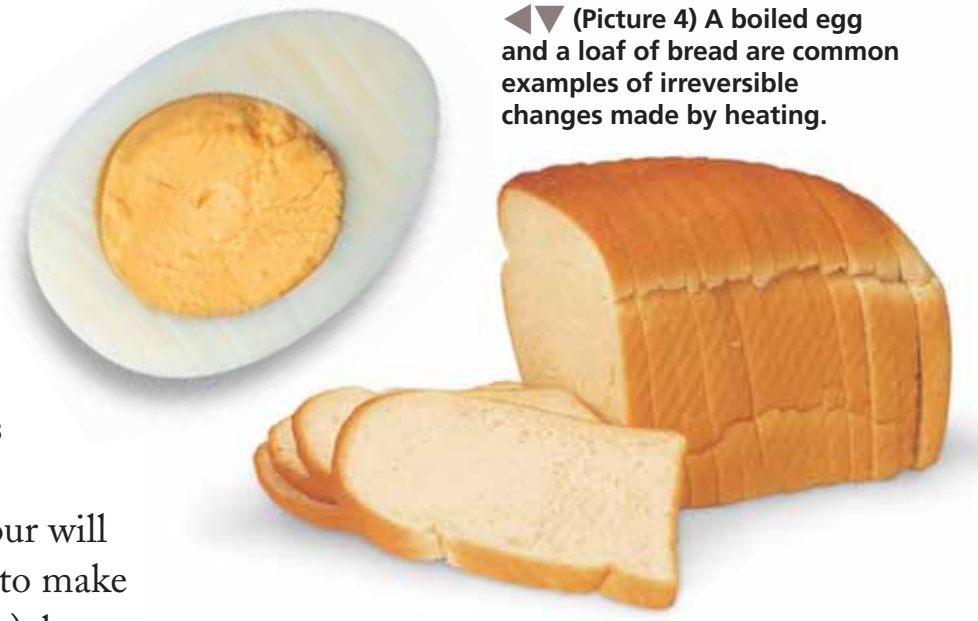
Every substance is affected by heat at a unique temperature. Most foods will change when they are heated to the **BOILING POINT** of water (100°C). This is why boiling is an important form of cooking.

Some foods that contain flour will also cook at this temperature (to make steamed puddings, for example), but other foods containing flour will not cook properly until they are heated to a higher temperature.

Bread and cakes need to be cooked at temperatures of about 180°C to 200°C.

The changes that take place when heating foods are far more complicated than those in clay. You can easily see some of the changes that occur when an egg is boiled (Picture 4).

The egg contains both white (which, uncooked, is almost colourless) and yolk (which is yellow). As the egg is heated, the yolk changes from a liquid to a solid. The white changes even more dramatically, from a liquid to a solid and also from **TRANSPARENT** to **OPAQUE**. None of these changes can be reversed.



◀▼ **(Picture 4) A boiled egg and a loaf of bread are common examples of irreversible changes made by heating.**

Summary

- **When substances are heated, changes often occur well below the temperatures at which the substances melt.**
- **Every substance changes at a unique temperature.**
- **Heating can cause substances to change from liquids to solids, or to become harder.**