7 Boiling

When a liquid begins to bubble inside, the liquid is BOILING.

How do you know when water is boiling? You don't measure its temperature. You look at it and see if it is bubbling.

Why boiling gives bubbles

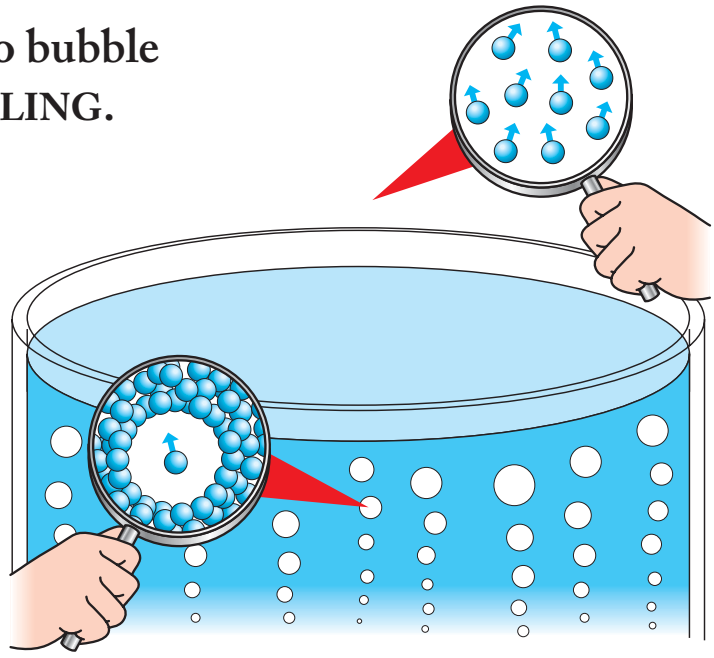
A boiling liquid is full of large, exploding bubbles. How do these bubbles form, and why do they grow?

Bubbling happens when a liquid has so much heat that particles start to shake themselves free of one another *inside* the liquid, as well as at the surface (Picture 1). The more this happens, the bigger the bubbles become. So, if you look at a gently boiling liquid you will see small bubbles, but a rapidly boiling liquid will be full of large bubbles.

In both cases, the bubbles contain vapour that has formed from the liquid. In boiling water, for example, the bubbles are full of water vapour. We call hot water vapour **STEAM** (Picture 2).

Why boiling takes time

There is a saying: "a watched pot never boils", meaning that you know the liquid is on the verge of boiling, but it seems to take for ever to boil. It takes time for a liquid to boil because the particles of liquid need to soak up a certain amount of heat before they can turn into a gas.



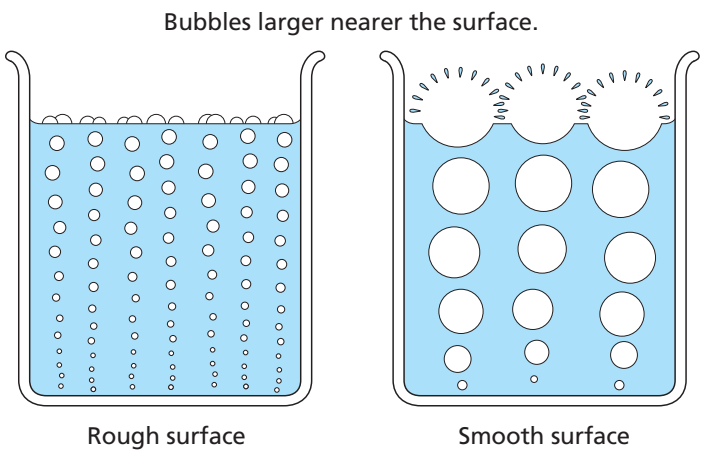
▲ **(Picture 1) The bubbles that form inside a boiling liquid are full of gas.**

▼ **(Picture 2) Water changes between liquid, vapour and liquid again near the spout of a kettle. The liquid boils inside the kettle and vapour is produced. The vapour comes out of the kettle and is invisible (look closely near the spout), but the vapour is quickly cooled by the air and turns back into fine, liquid droplets we call steam.**

Boiling safely

When a liquid boils, it is as hot as it can get. In the case of water this is 100°C. Splashes of boiling water and clouds of steam can be dangerous, so it is important to know how to boil water safely.

▼ (Picture 3) Boiling gently (left) and vigorously (right and below).



The safest kind of boiling is when the bubbles are small (Picture 3).

Bubbles start on the bottom of the pan at places where the surface is rough. Water boiled in a pan with a rough surface, such as an aluminium pan, produces lots of small bubbles. These break out onto the surface with small splashes.

Boiling with a glass saucepan can lead to big splashes. The reason is that glass is smooth, so there are fewer places for bubbles to start, so the bubbles tend to be larger, rush faster to the surface and break more vigorously.

To prevent accidents with splashing hot water and steam, it makes sense to boil a nearly full pan gently, or use a deep pan with only a small amount of liquid, if you are going to boil it fiercely.

SAFETY Never go near boiling water. Always get an adult to help.

SAFETY It is always safest to put a lid on a saucepan to prevent splashes from the boiling liquid. The lid has been left off this saucepan for the demonstration only.

Summary

- **Boiling happens when bubbles form inside a heated liquid.**
- **The bubbles are full of the vapour from the liquid. They are not full of air.**
- **The more fiercely a liquid is heated, the more vigorously it boils.**

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