



# Hard and soft materials

Every material is different. We call these differences **PROPERTIES**. Hardness is one important property of materials.

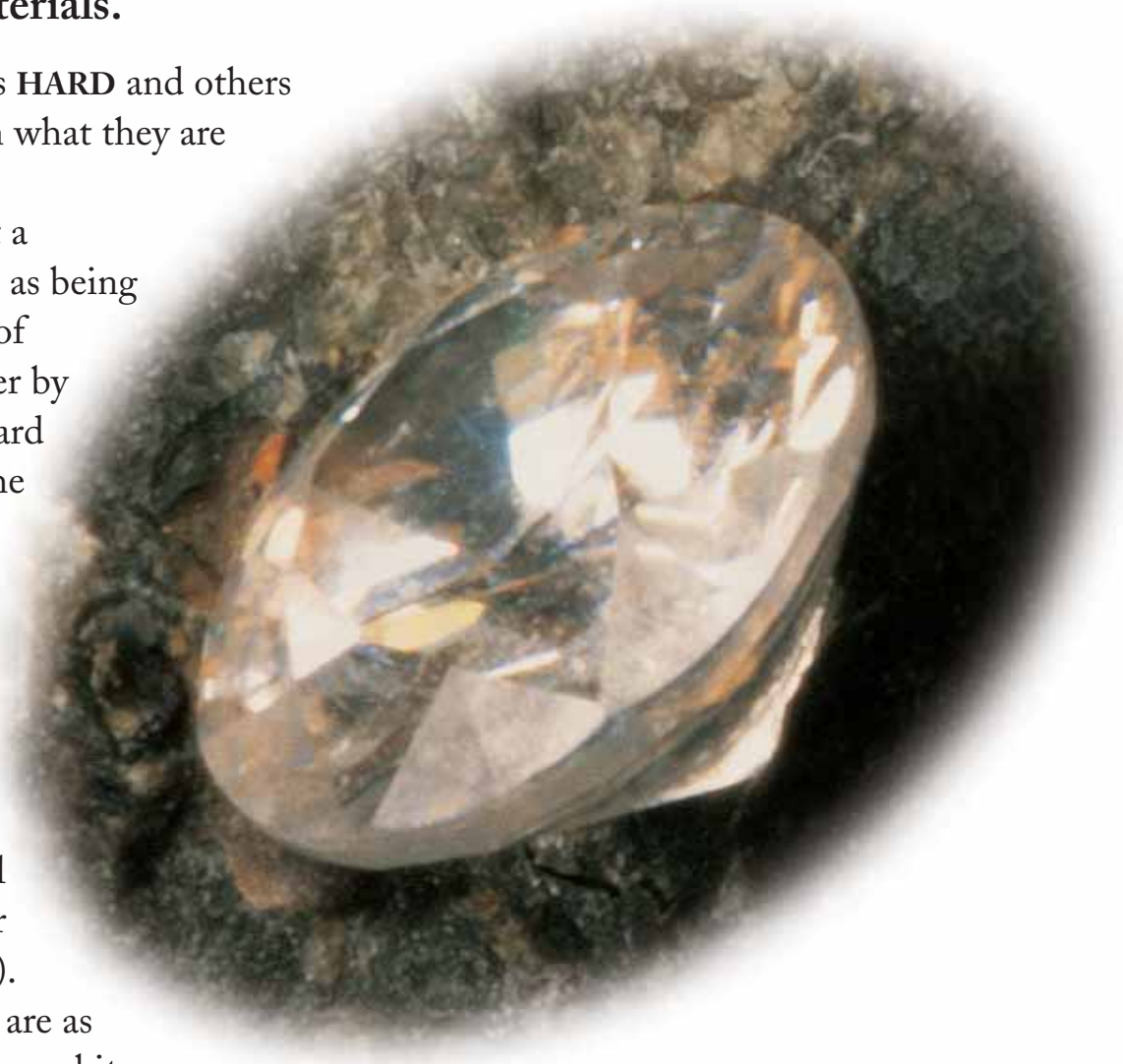
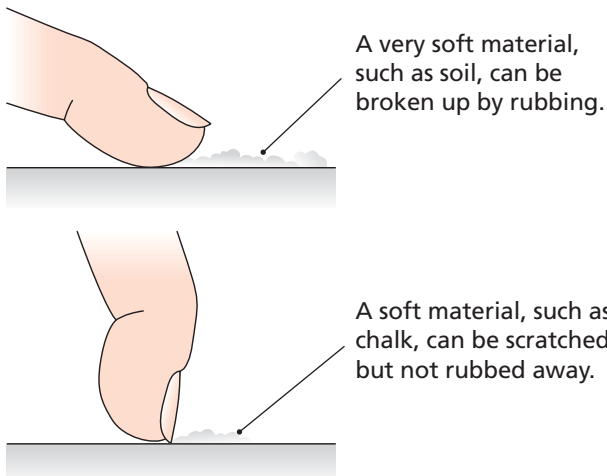
Why are some materials **HARD** and others **SOFT**? It all depends on what they are made of (Picture 1).

One way to think about a material is to imagine it as being made up of tiny blocks of material all held together by glue. If the blocks are hard and the glue is tough, the whole material is hard, but if the blocks or the glue are weak, then the material is soft\*.

## A rub and scratch test

A very soft material will rub away using just your finger (Pictures 2 and 4).

But not many materials are as soft as this. Those that are a bit harder can be scratched with a fingernail.



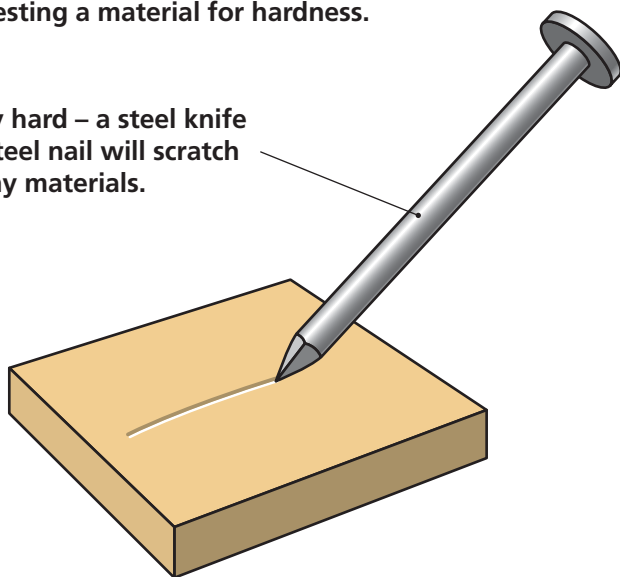
▲ (Picture 1) The world's hardest natural material is a diamond. You can't cut a diamond. All you can do is split it into smaller pieces.

◀ (Picture 2) If a material is very soft, it will easily be rubbed away. An eraser, or rubber, is used in just this way. It is softer than paper, so it won't harm the paper and yet it is harder than the mark made by a pencil. So the eraser rubs the pencil mark away, and the paper rubs the eraser away.

(\*NOTE: Do not confuse soft with flexible, such as when you touch woollen cloth.)

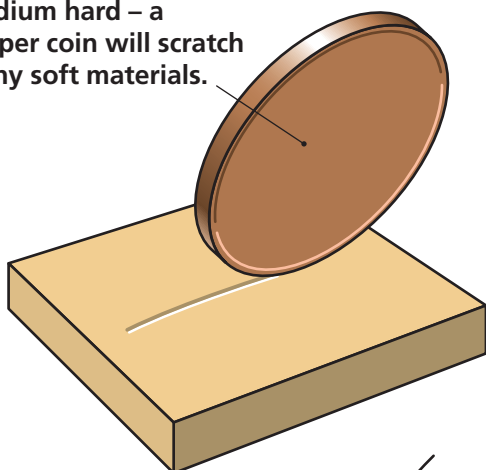
▼ (Picture 3) Here is a simple way of testing a material for hardness.

Very hard – a steel knife or steel nail will scratch many materials.

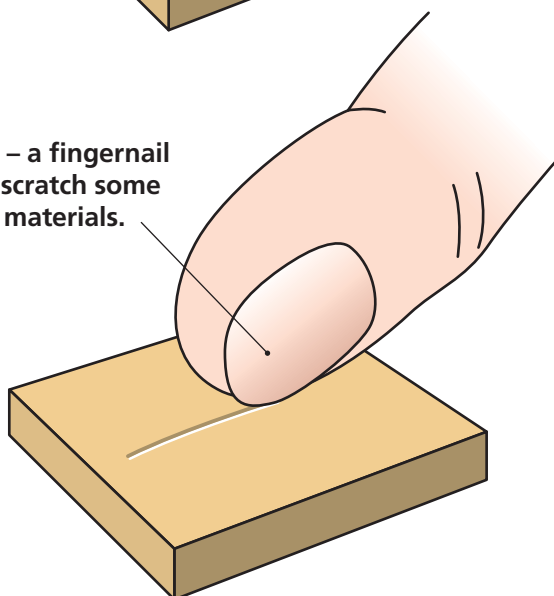


Care with sharp objects

Medium hard – a copper coin will scratch many soft materials.



Soft – a fingernail will scratch some soft materials.



You can compare the hardness of all sorts of materials using just a steel knife or steel nail, a copper coin and your fingernail (Picture 3).

Steel is a very hard material. It will scratch the copper coin. That means the copper is softer than steel. But a fingernail can't scratch the coin, so the copper is harder than the fingernail.

Now, with just these three materials, you can test the hardness of any material you choose.

## Choosing a suitable material

Why would you want to know if a material is hard or soft? Well, what if you wanted to cut something? You would want to use a hard material for the knife. It would have to be hard if it were to cut other materials.

Another use for a hard material would be as a case to protect TVs, computers and other delicate or soft materials. Hard plastic is often used for this.



▲ (Picture 4) The lead in a pencil is softer than paper. As the pencil is drawn across the paper, some of the pencil lead is rubbed off on the surface of the paper, leaving a pencil mark.

## Summary

- Materials vary in their hardness.
- We can test for hardness with simple materials.
- We usually choose the hardness to match what we want the material to do.