

Testing materials to choose the right one

Grade 6 science (Year 7 · Class 6) · Lesson

Quick answer: Materials have properties such as hardness, electrical conductivity, magnetism and flexibility. Each property can be tested: scratching shows hardness, a bulb in a circuit shows conductivity, a magnet shows magnetism and bending shows flexibility. We choose materials whose properties match the job, and recycling uses these properties to sort waste.

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What are the properties of a material?

Every object is made of a material, such as metal, wood, glass, plastic or rubber. A **property** tells us how a material behaves, and we can test it. Scientists never choose a material by guessing: they compare properties.

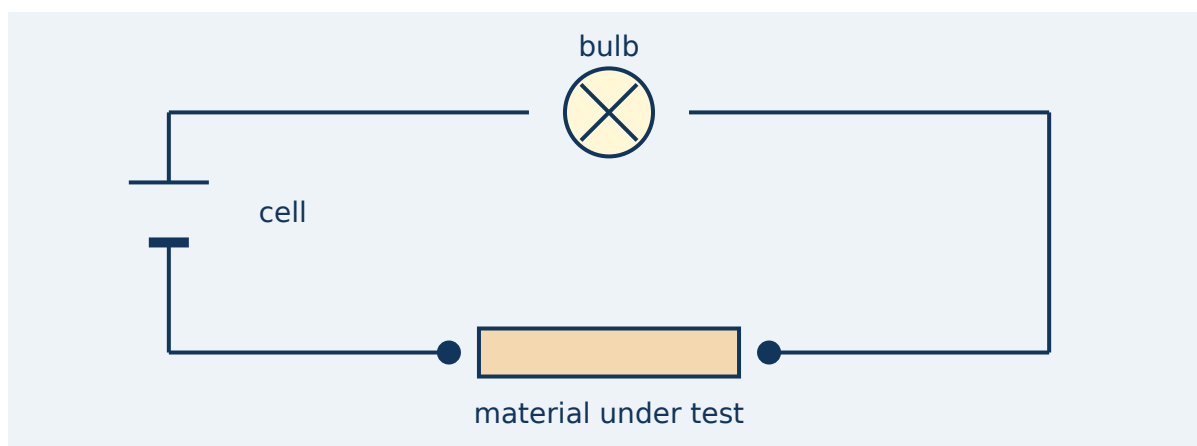
Definition

A **property** of a material is a feature we can observe or measure, such as hardness, electrical conductivity, magnetism or flexibility.

Property	Question it answers	Simple test	Example
Hardness	Does it resist scratching?	Scratch it with a steel nail	Glass is hard, chalk is soft
Electrical conductivity	Does it let current pass?	Put it in a circuit with a bulb	Copper conducts, rubber does not
Magnetism	Is it attracted by a magnet?	Hold a magnet near it	Iron and steel are attracted
Flexibility	Does it bend without breaking?	Bend a strip by hand	Rubber bends, glass snaps

How do you test electrical conductivity?

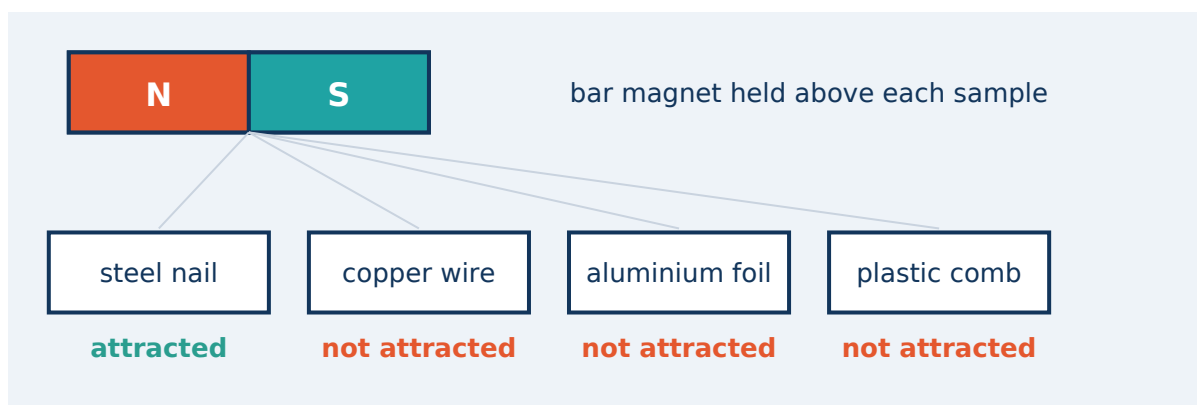
Build a circuit with a cell and a bulb, and leave a gap. Connect the material across the gap with two clips. If the bulb lights, the material is a **conductor**. If it stays off, the material is an **insulator**. All metals are good conductors, and so is graphite, the soft black material in pencils. Wood, plastic, glass and rubber are insulators.



Testing conductivity: the bulb lights only if the sample conducts.

How do you test magnetism?

Hold a magnet close to the sample. Only a few metals are attracted: iron, steel, nickel and cobalt. Many metals are not magnetic, for example copper, aluminium and gold. Steel food cans are attracted, but aluminium drink cans are not. A magnet can therefore sort a pile of mixed cans.



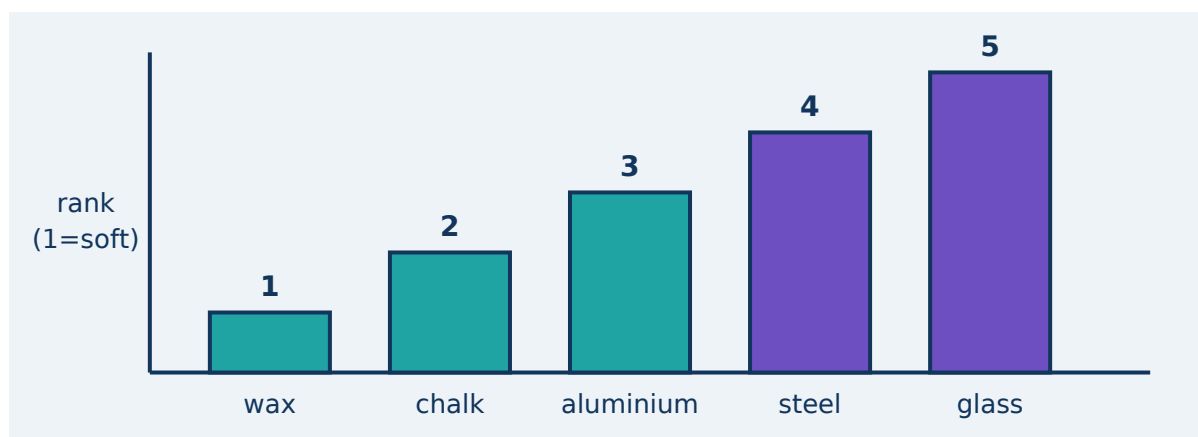
Only the steel nail is attracted by the magnet.

Key rule

Being a metal does not make a material magnetic. Test it with a magnet; never assume.

How do you compare hardness and flexibility?

In a scratch test, the harder material scratches the softer one. Repeating the test on several samples lets us rank them from softest to hardest. Flexibility is different from softness: a steel spring is hard yet flexible, while glass is hard yet brittle and snaps when bent.



A hardness ranking from scratch tests (rank 1 is the softest).

Worked example 1

Aarav scratches three strips. Strip X scratches strip Y. Strip Z scratches strip X. Strip Y scratches nothing. Order from softest to hardest.

Method: the strip that scratches nothing is softest, so Y is softest. X scratches Y, so X is harder than Y. Z scratches X, so Z is hardest. **Y, then X, then Z.**

How do you choose the right material?

List the properties the job needs, then pick the material that matches them. A good choice may need a combination: an electrical cable needs a conductor inside and an insulator outside.

Worked example 2

Chiamaka needs a handle for a hot cooking pot. It must not carry heat easily and must not melt below 150 °C. Candidates: copper (conducts heat well, melts at 1085 °C), wood (poor conductor, chars above 300 °C), plastic A (poor conductor, softens at 80 °C).

Copper fails because it carries heat to the hand. Plastic A fails because 80 °C is below 150 °C. **Wood is the best choice.**

Common mistake

Many students say a hard material is also a strong, unbreakable one. Glass is hard but brittle. Hardness is resistance to scratching, not to breaking.

Why does recycling depend on properties?

Recycling plants sort waste by properties. A magnet lifts steel cans from the belt. Metals are then melted and reshaped, which uses far less energy than extracting new metal from ore. Recycling aluminium saves about 95 % of the energy needed to make it from raw ore, and it keeps waste out of landfill.

Lina's tip

Before every test, write the property and your expected result in your notebook. When your result is a surprise, you have learned something new.

Key points to remember

- Hardness is resistance to scratching; the harder material scratches the softer one.
- Conductors light a bulb in a test circuit; insulators do not.
- Only iron, steel, nickel and cobalt are strongly magnetic.
- Hard is not the same as unbreakable: glass is hard but brittle.
- Recycling aluminium saves about 95 % of the energy of making new metal.

Testing materials to choose the right one: frequently asked questions

What is a property of a material?

A property is a feature of a material that you can observe or test, such as hardness, conductivity, magnetism or flexibility. Properties explain why a material suits a job.

Are all metals magnetic?

No. Only iron, steel, nickel and cobalt are strongly attracted by a magnet. Copper, aluminium, gold and silver are not magnetic, so a magnet can separate steel cans from aluminium cans.

What is the difference between a conductor and an insulator?

A conductor allows an electric current to pass through it, so a bulb in the circuit lights. An insulator does not, so the bulb stays off. Metals conduct, while plastic, wood and rubber insulate.

How can you test the hardness of a material?

Try to scratch the material with another material, such as a steel nail. The harder material scratches the softer one. Repeating this with several samples lets you rank them.

Why is recycling useful?

Recycling reuses materials such as metal and glass, which saves energy and raw materials and reduces waste in landfill. Aluminium recycling saves about 95 % of the energy used to make new aluminium.