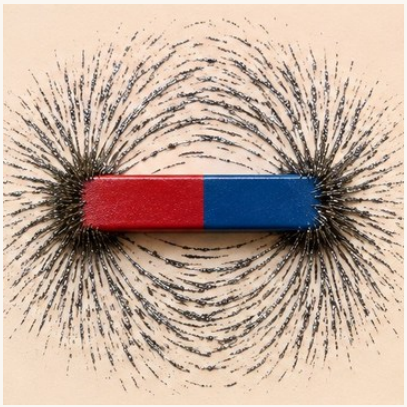
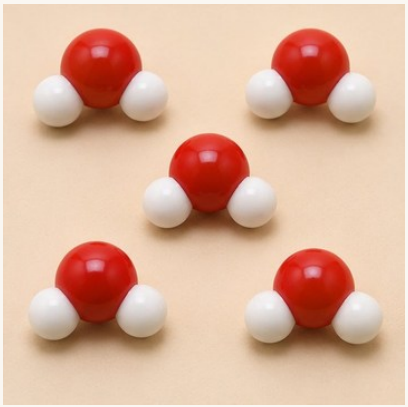
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Elements, compounds and mixtures


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02 What makes copper an element?

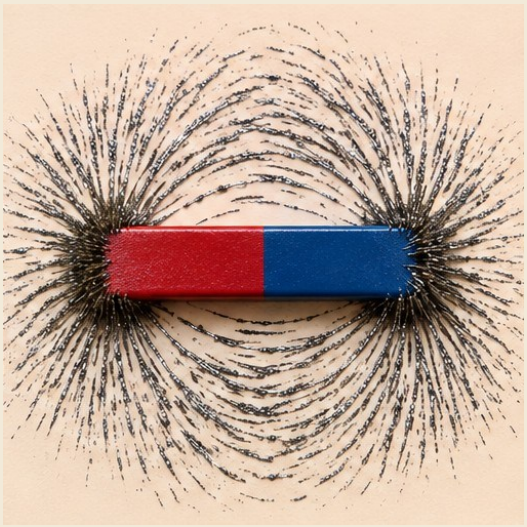
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Elements, compounds and mixtures

Separate a component



THE IDEA

Iron filings can be lifted out of a dry mixture with a magnet. A mixture contains substances physically combined.

The components can occur in different proportions and retain characteristic properties. Separation uses a difference such as magnetic attraction.

CHECK YOUR THINKING

Would using twice as much sulfur always make a new substance?

A Yes. Changing the quantities always makes a compound.

B No. The proportions of a mixture can vary.

B. No. The proportions of a mixture can vary.

A RELATED EXAMPLE

Two atoms, one element

An oxygen molecule contains two oxygen atoms bonded together. A molecule can contain atoms of just one element. In a particle model, matching colours represent the same kind of atom. The colours are a drawing convention.

Elements, compounds and mixtures

What makes copper an element?



THE IDEA

A piece of pure copper contains one kind of atom. An element cannot be broken into simpler substances by ordinary chemical reactions.

An atom is a unit of an element. Shape, colour and being solid do not by themselves prove purity.

CHECK YOUR THINKING

Can copper wire and copper sheet be the same element?

A Yes. Their shapes differ while their atoms are the same kind.

B No. Each shape is a different element.

A. Yes. Their shapes differ while their atoms are the same kind.

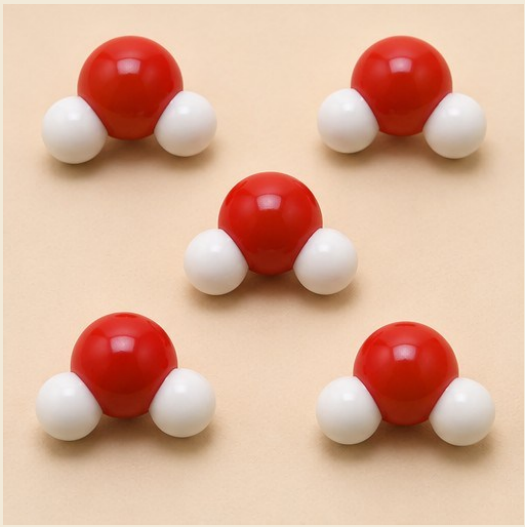
A RELATED EXAMPLE

Mixing or reacting?

Before heating, iron in an iron–sulfur mixture responds to a magnet. After a suitable chemical reaction, iron sulfide has different properties. Compare the product with the starting mixture. A compound is one substance even though it contains more than one element.

Elements, compounds and mixtures

A recipe nature keeps fixed



THE IDEA

A compound is more than a mixture. Water contains hydrogen and oxygen chemically combined in a fixed ratio. Its properties differ from those of the separate elements.

Mixing hydrogen and oxygen gases does not by itself make water. A chemical reaction is needed.

CHECK YOUR THINKING

Why will a filter not separate hydrogen from water?

A Hydrogen is bonded within water molecules.

B Hydrogen grains are simply too heavy to pass through.

A. Hydrogen is bonded within water molecules.

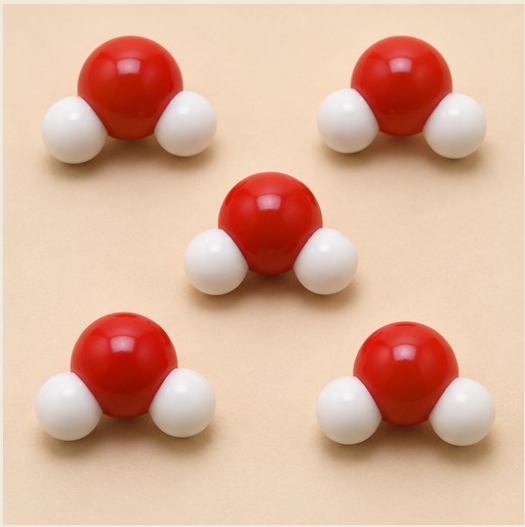
LOOK AGAIN

Why is salt water a mixture even when it looks uniform?

The amount of salt in salt water can vary. A uniform appearance means the mixture is well mixed, not that it contains only one chemical substance.

Elements, compounds and mixtures

Compare water with salt water



THE IDEA

Cup A contains pure water. Cup B contains salt dissolved in water. Adding more water changes the proportion of salt in B. It does not change what a water molecule is.

Use variable proportions and physical separation to explain the difference.

CHECK YOUR THINKING

Why is salt water a mixture?

A Anything that looks uniform must be a compound.

B Its proportions can vary, and evaporation can separate the salt.

B. Uniform mixtures exist. Salt water has variable proportions, and salt can be recovered physically.

LOOK AGAIN

What would evaporation leave behind in each cup?

Pure water leaves no dissolved salt behind. Salt water can leave crystals after its water evaporates.

Elements, compounds and mixtures

A uniform mix is still a mix



THE IDEA

A brass key looks like one material from every angle. Brass is an alloy, chiefly copper and zinc.

A uniform appearance does not prove something is pure. Naturally occurring minerals have characteristic compositions; rocks can contain several minerals.

CHECK YOUR THINKING

Would every sample of brass have exactly the same copper-to-zinc ratio?

A Yes. Every uniform material has a fixed chemical formula.

B No. Alloys can have different proportions.

B. No. Alloys can have different proportions.

LOOK AGAIN

Can you judge purity by looking at a smooth surface?

No. A polished alloy can look uniform and still contain more than one element. Composition needs other evidence.

ONE LAST CHALLENGE

Is the whole rock a pure substance?

A rock sample contains a visible speck of native gold as well as other minerals.



THE REVEAL

No. The sample contains more than one material.

The gold is an element. A rock that contains it can still be a mixture.

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