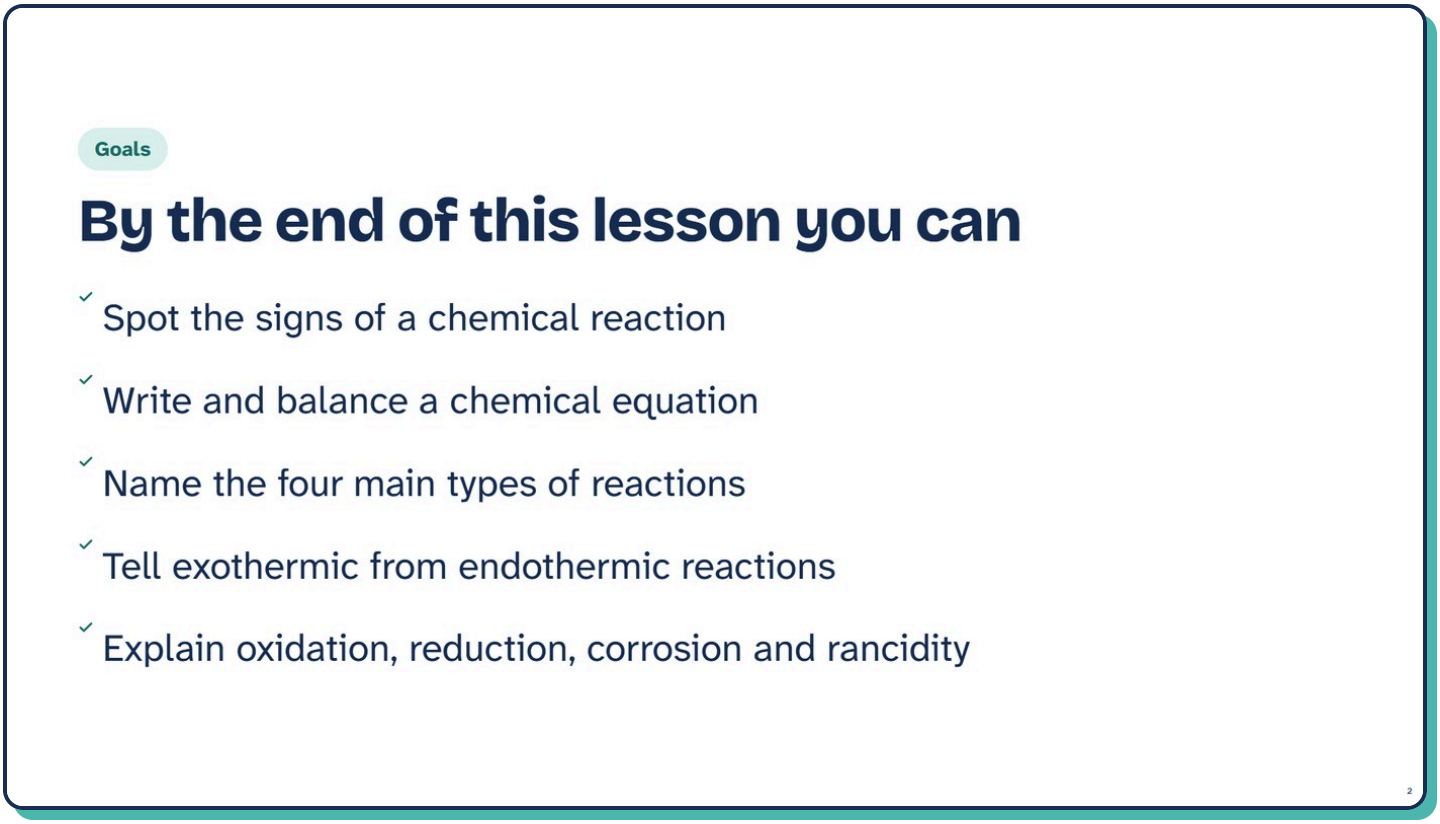


Chemical Reactions and Equations

Teacher notes

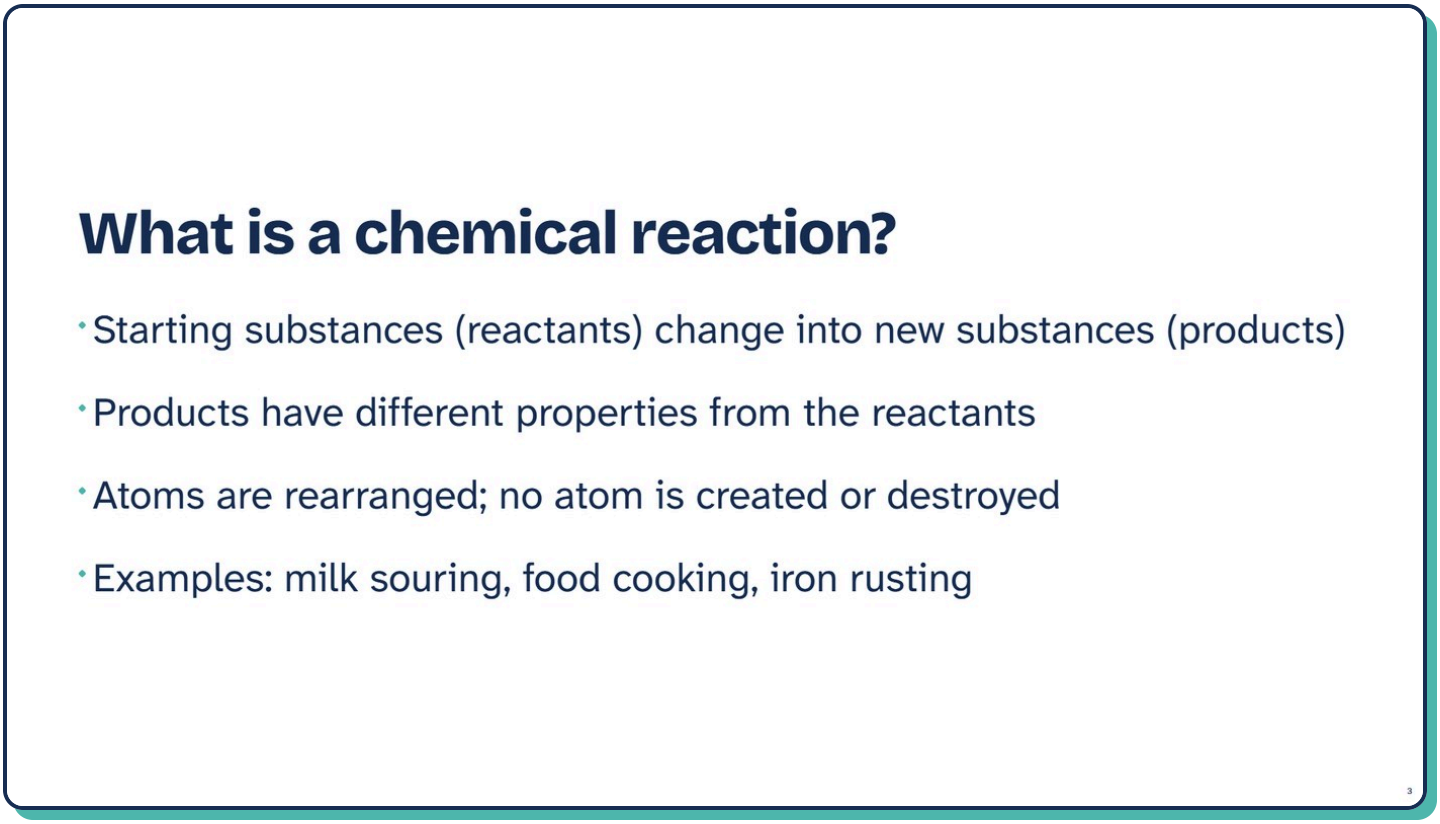
Open with a quick question: what changes when milk turns sour, or when an iron gate rusts? Collect answers and point out that in both cases a new substance forms. Tell the class that today they will learn to describe such changes in the short, exact language of chemistry.



By the end of this lesson you can

Teacher notes

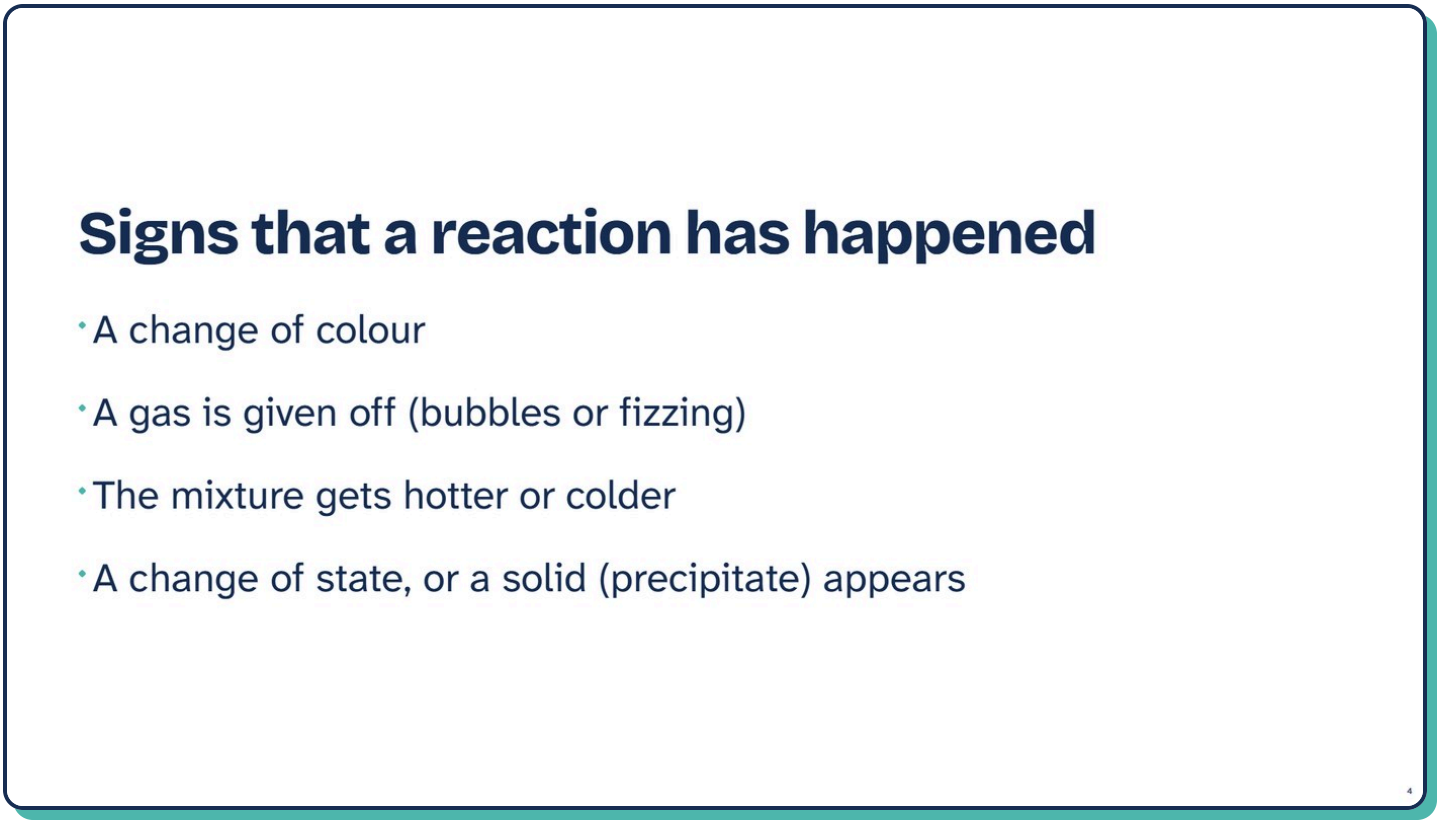
Read the objectives aloud and ask students which one sounds hardest. Promise that balancing, usually the scariest, will be done step by step with a familiar example.



What is a chemical reaction?

Teacher notes

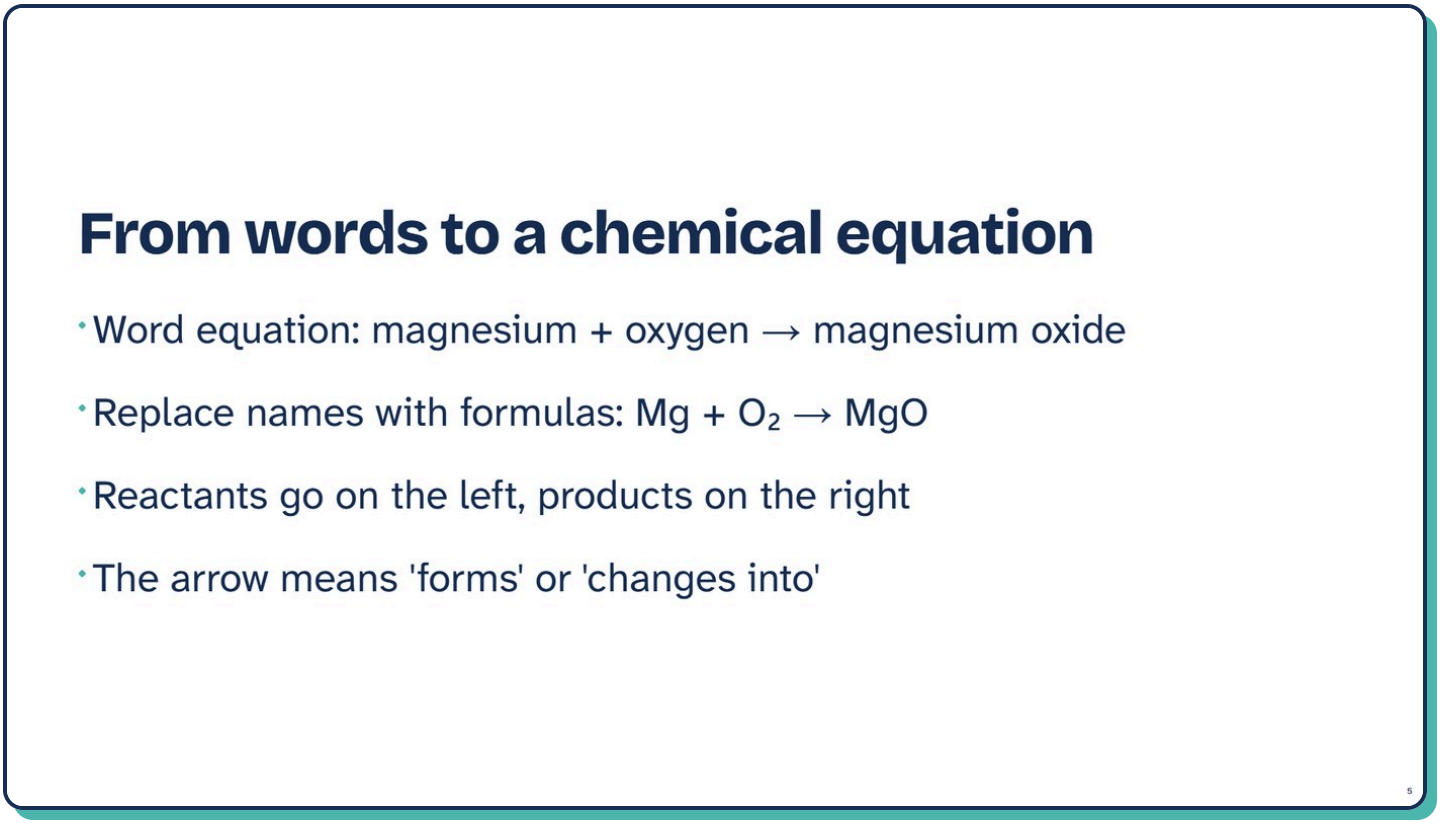
Contrast with a physical change such as ice melting, where no new substance forms. Ask: is dissolving sugar in water a chemical reaction? It is not, because the sugar can be recovered by evaporating the water.



Signs that a reaction has happened

Teacher notes

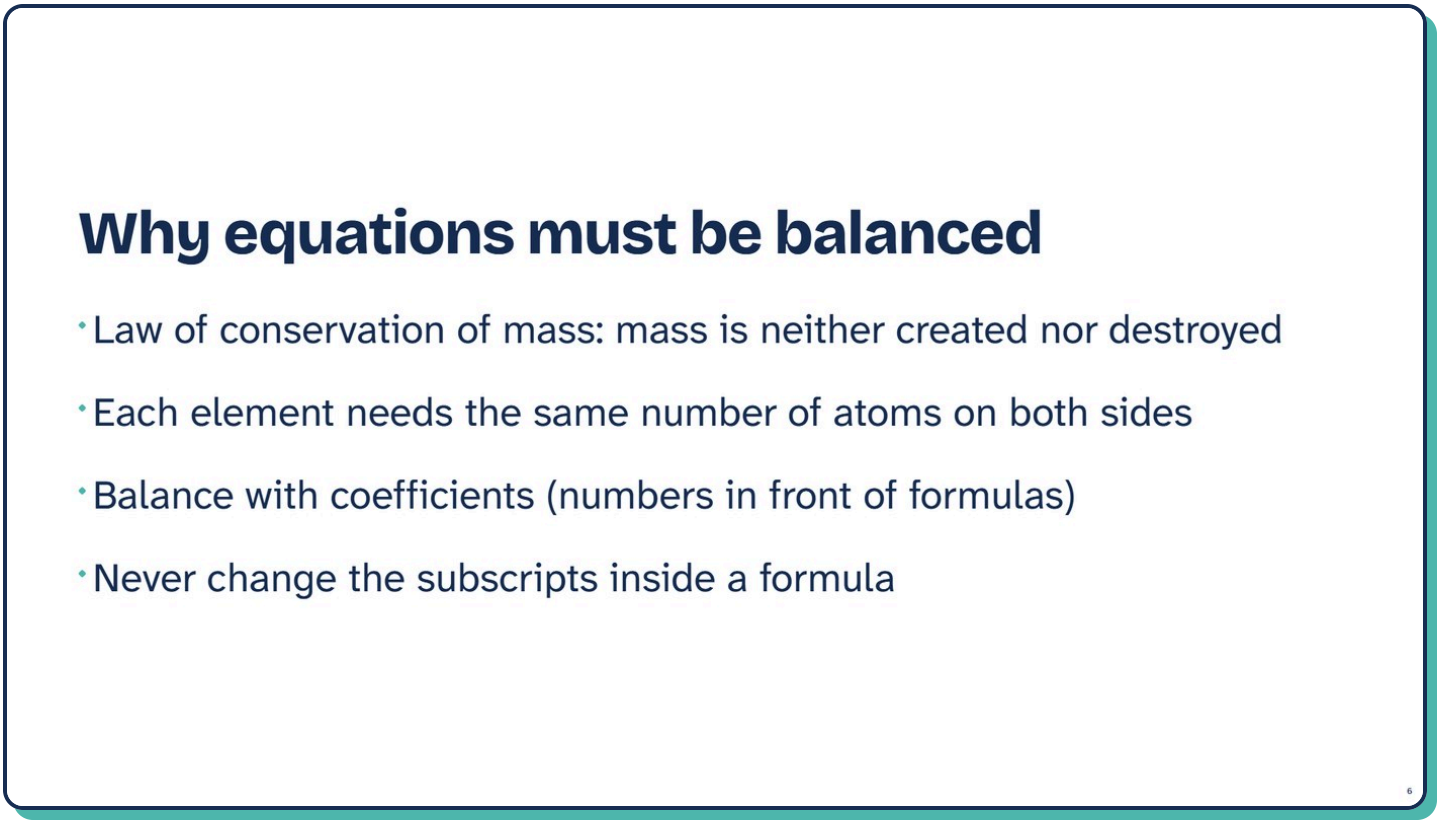
Burn a small magnesium ribbon only as a teacher demonstration with tongs and eye protection: it gives a dazzling white flame and leaves white magnesium oxide. Warn students never to look straight at the flame. A sign such as a colour change hints at a reaction but does not prove one on its own.



From words to a chemical equation

Teacher notes

Show that the formula version is shorter and tells us exactly which atoms are involved. Ask a student to count the oxygen atoms on each side of $Mg + O_2 \rightarrow MgO$; they will find two on the left and one on the right, which sets up the next slide.



Why equations must be balanced

Teacher notes

Balanced form: $2Mg + O_2 \rightarrow 2MgO$. Explain that changing O_2 to O or MgO to MgO_2 would describe different substances, which is why only coefficients may change. A common mistake is to write the coefficient as a subscript.

Worked example

Balancing the burning of methane (natural gas)

- Skeleton equation: $CH_4 + O_2 \rightarrow CO_2 + H_2O$
- Carbon: one on each side, already balanced
- Hydrogen: 4 on the left, so write $2H_2O$
- Oxygen: now 4 on the right, so write $2O_2$
- Balanced: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Balancing the burning of methane (natural gas)

Teacher notes

Natural gas, used for cooking and heating in millions of homes, is mostly methane, so this reaction happens in every gas flame. Work through each step on the board and recount every element at the end. Ask students to balance $H_2 + O_2 \rightarrow H_2O$ on their own before moving on.

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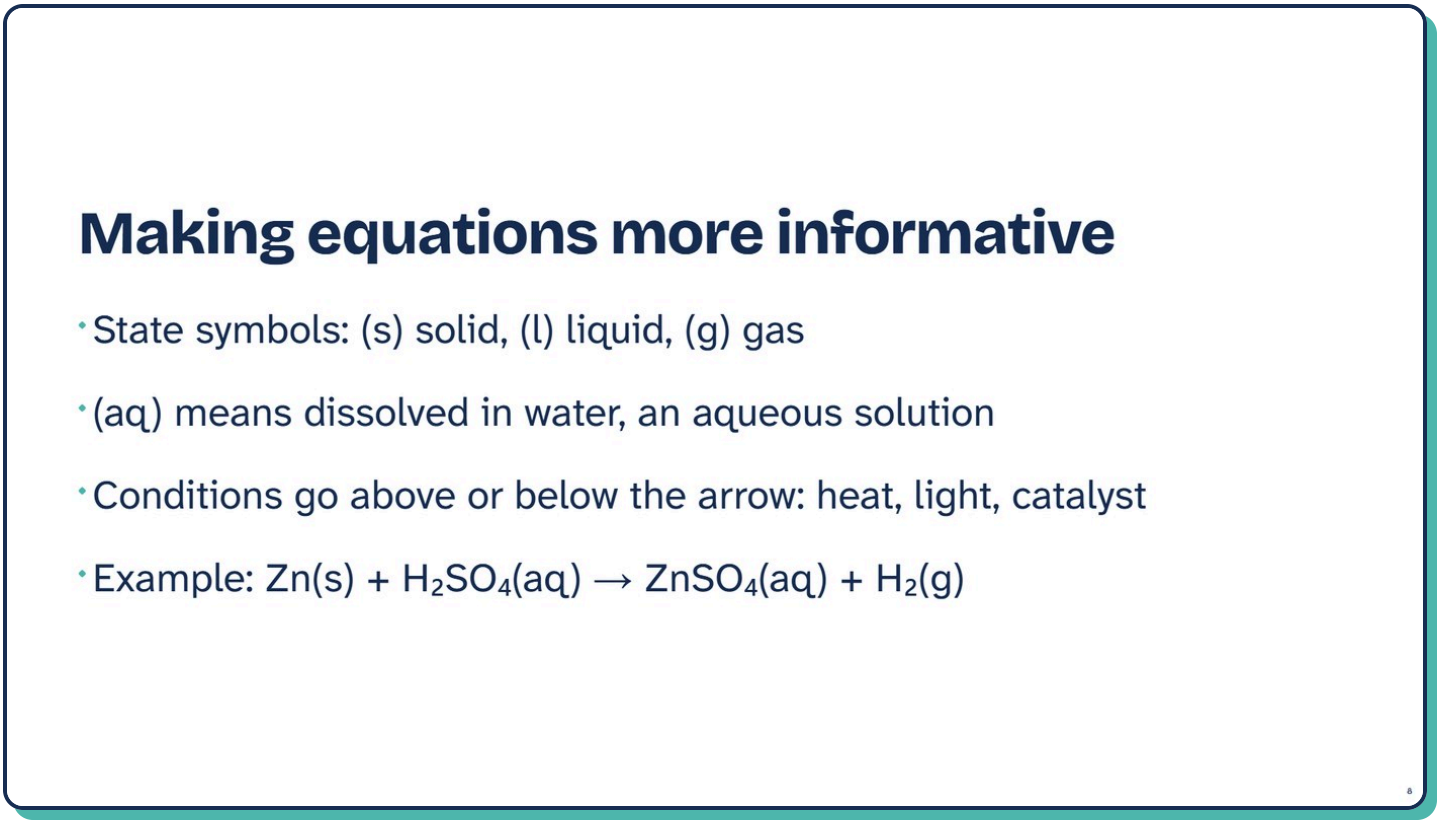
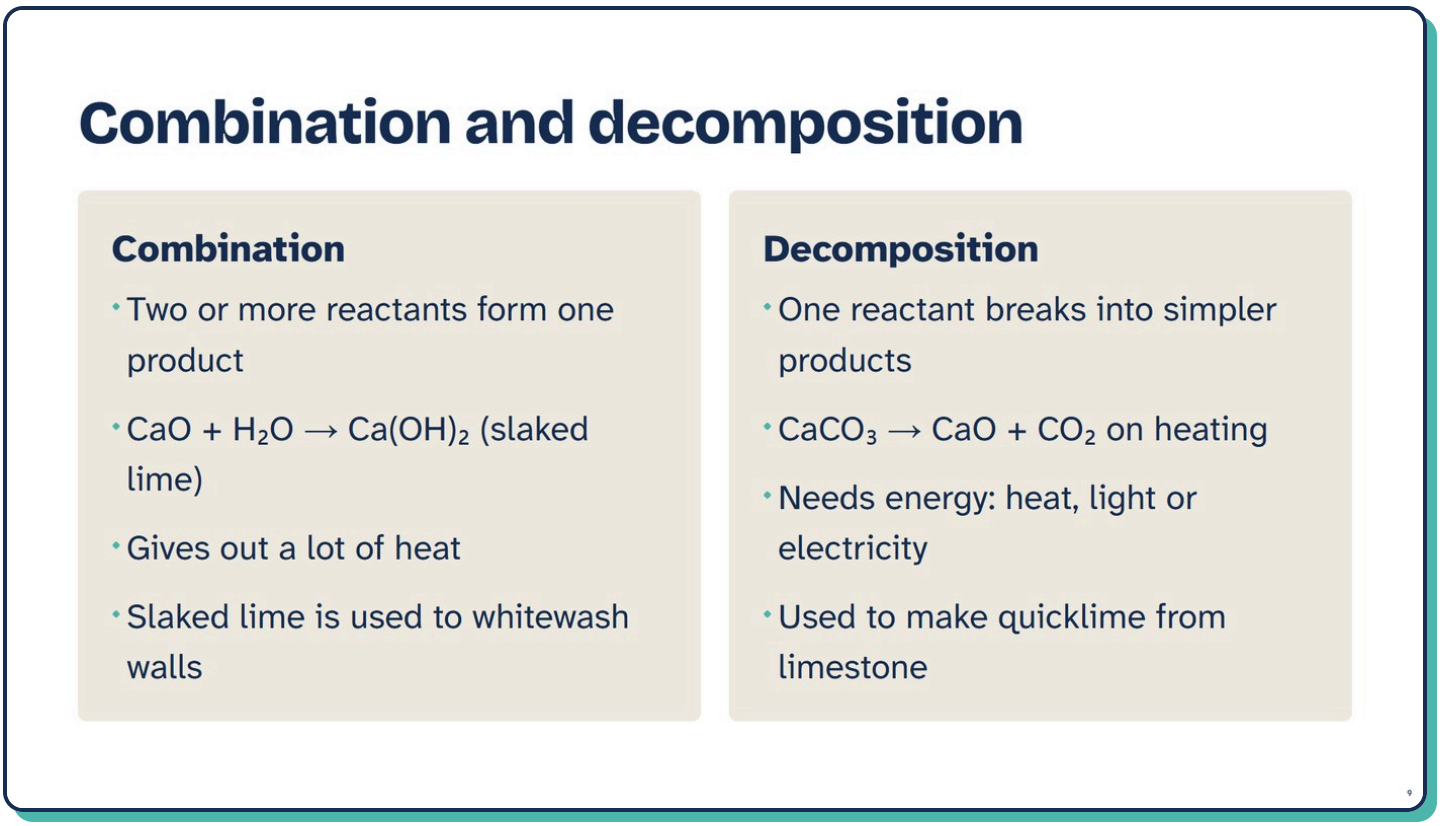


Making equations more informative

Teacher notes

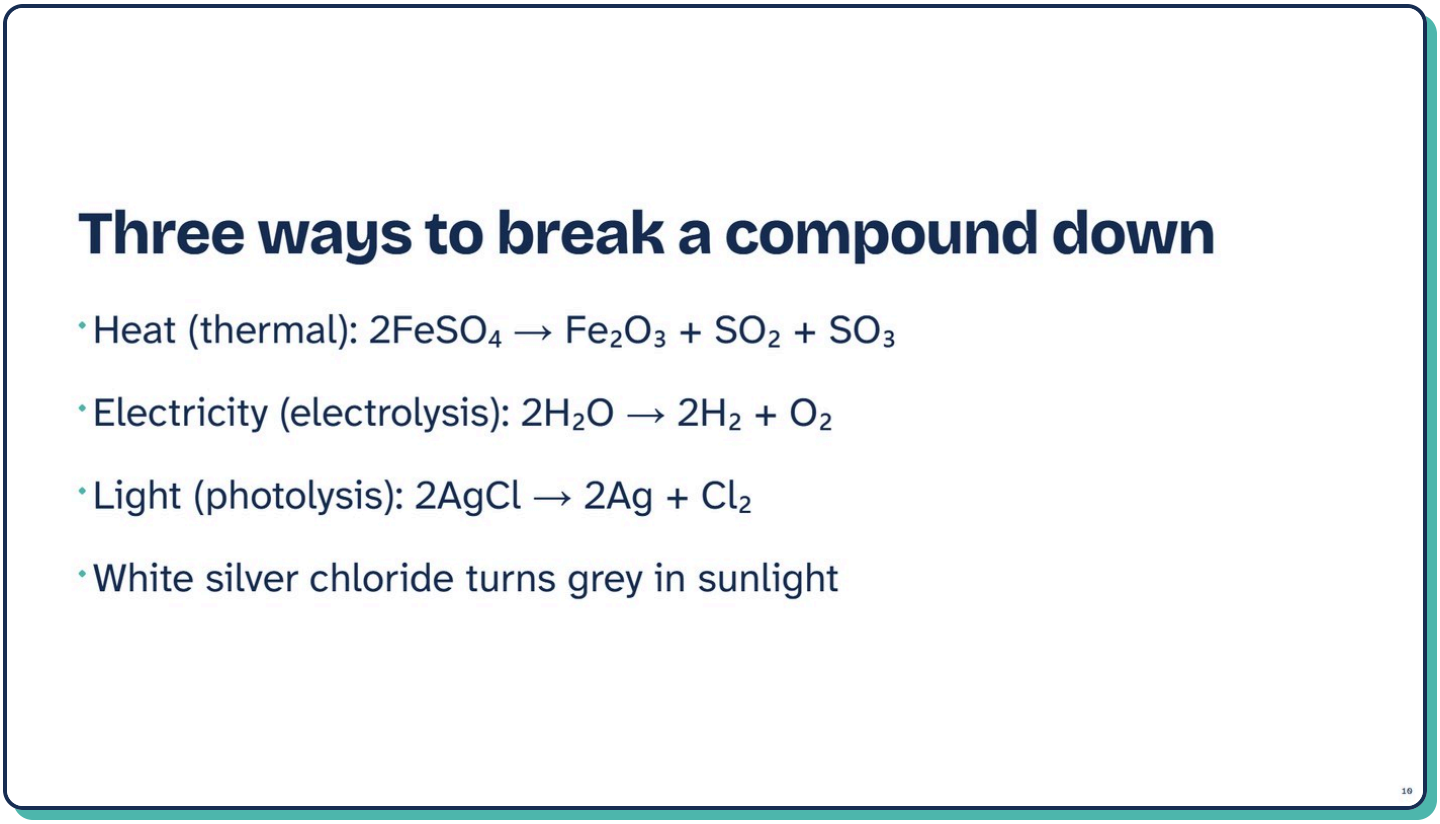
State symbols are often optional unless a question asks for them, but they make an equation much clearer. Ask: in the zinc example, which product would you see as bubbles? The answer is hydrogen gas.



Combination and decomposition

Teacher notes

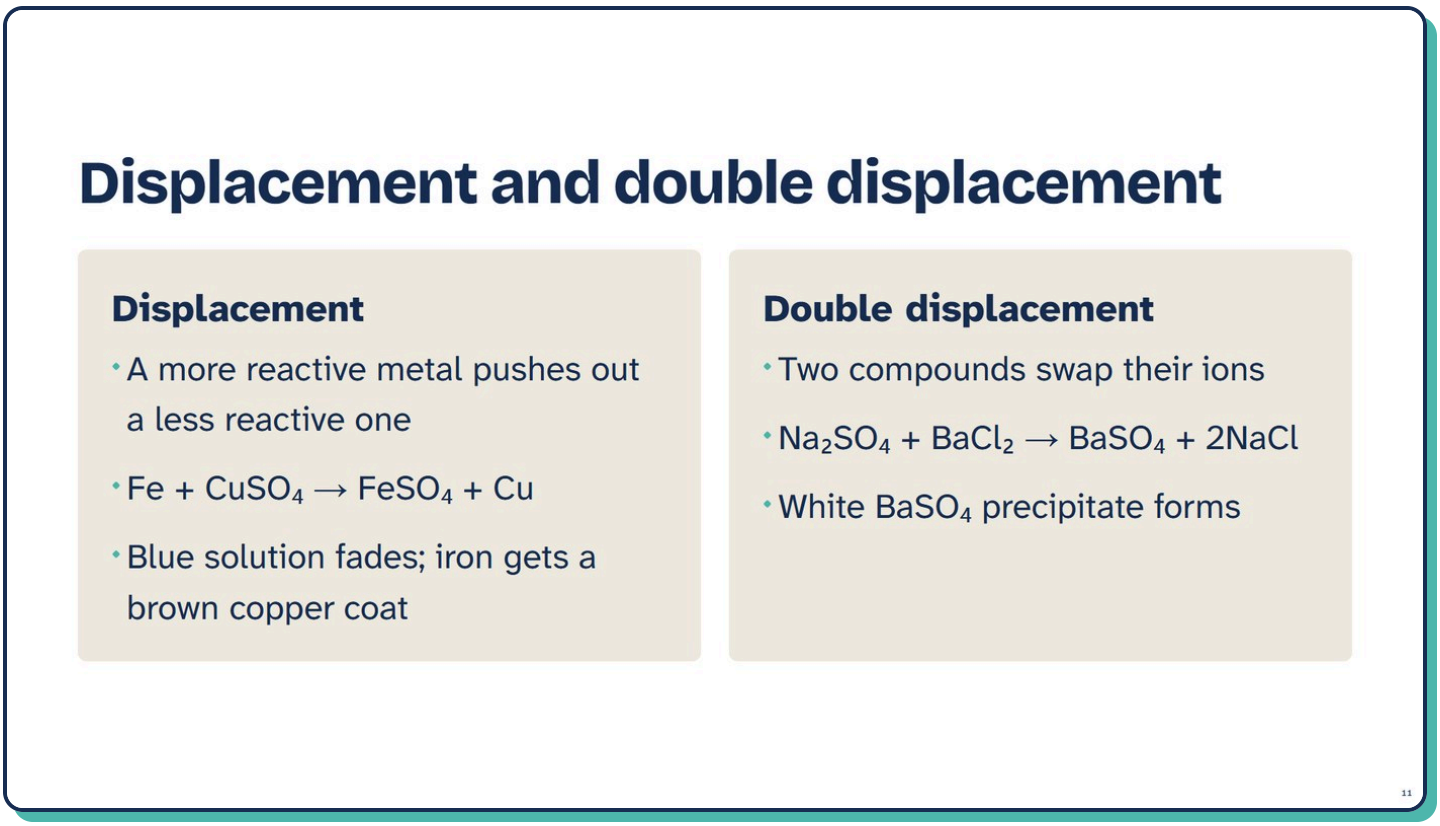
Point out that one reaction is roughly the reverse pattern of the other: many things combine into one, or one thing splits into many. Adding quicklime to water must be done carefully because the mixture gets very hot. Ask students to classify $2Mg + O_2 \rightarrow 2MgO$; it is a combination reaction.



Three ways to break a compound down

Teacher notes

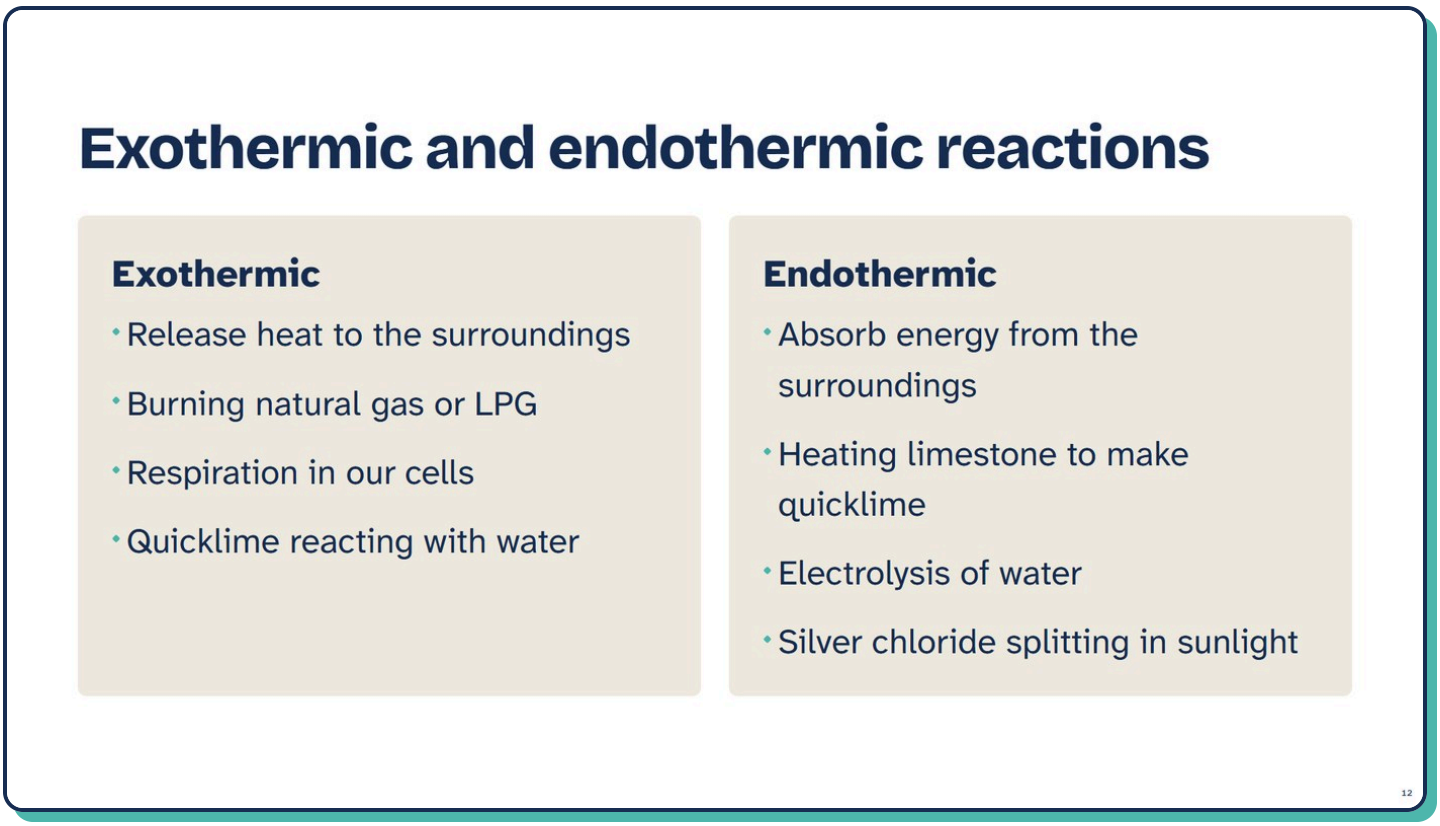
In the electrolysis of water, the volume of hydrogen collected is twice that of oxygen, which matches the 2 : 1 ratio in the equation. The action of light on silver salts was the basis of black-and-white photography. Heating ferrous sulphate gives off gases with a sharp smell, so it should be done only under supervision.



Displacement and double displacement

Teacher notes

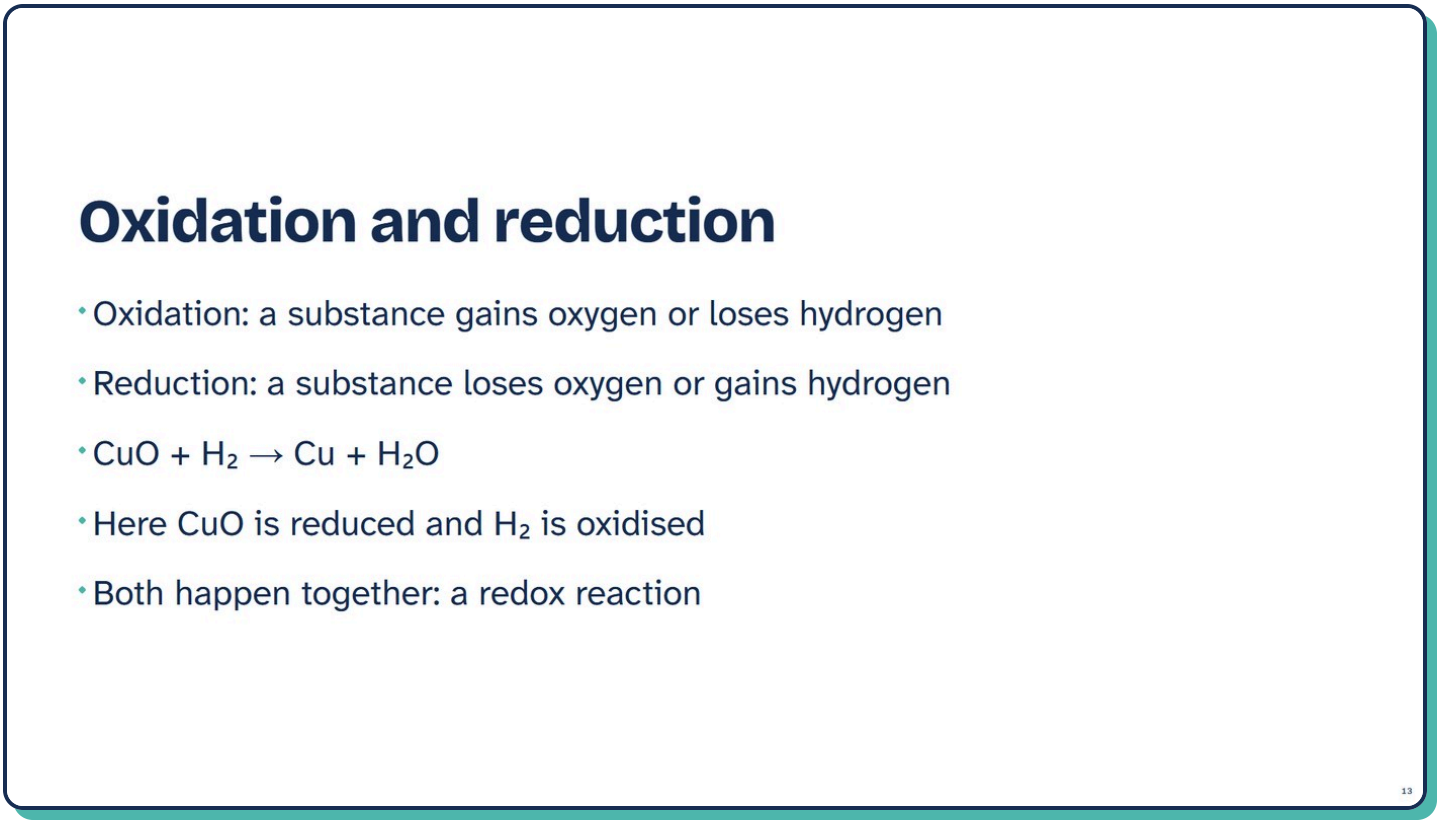
Iron is more reactive than copper, so it displaces copper from copper sulphate solution. A reaction that produces an insoluble solid is also called a precipitation reaction. Ask: would copper displace iron from iron sulphate? No, because copper is less reactive.



Exothermic and endothermic reactions

Teacher notes

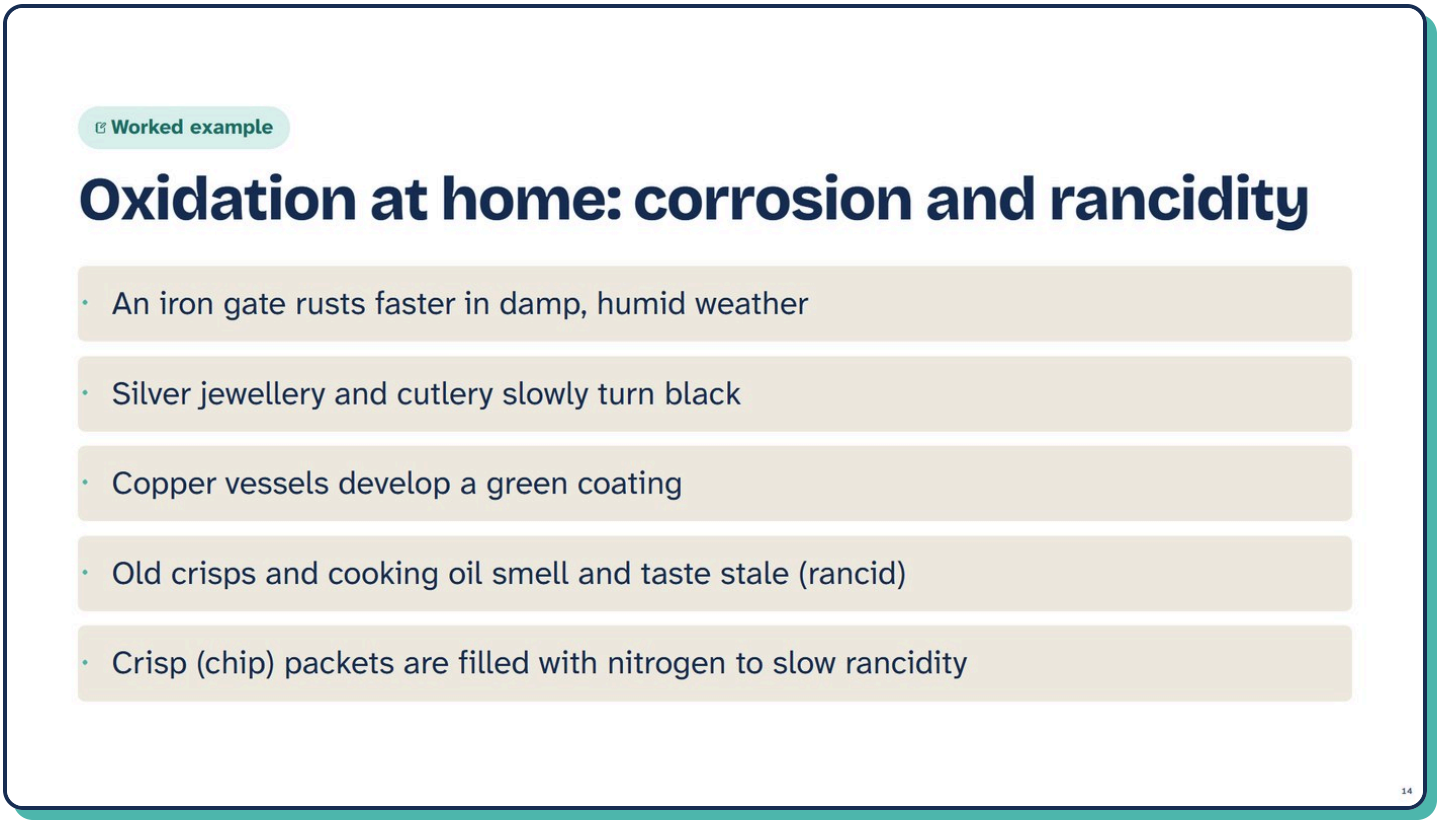
Respiration is exothermic: glucose reacts with oxygen and releases the energy our body uses. Most decomposition reactions are endothermic because energy is needed to break the reactant apart. Ask students which type a burning candle is.



Oxidation and reduction

Teacher notes

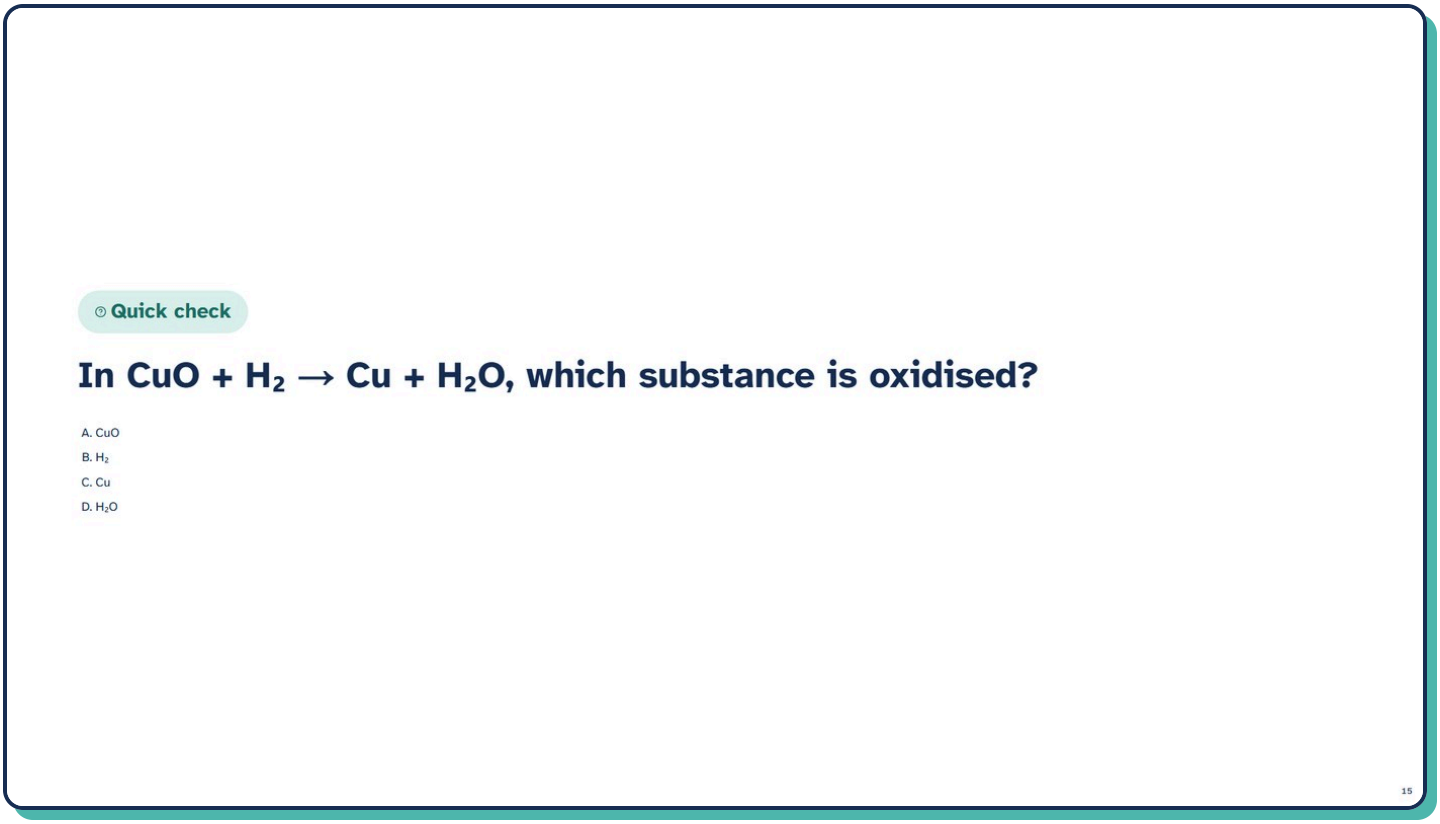
Heating copper powder in air forms black copper oxide, $2Cu + O_2 \rightarrow 2CuO$, which is oxidation. Passing hydrogen over hot copper oxide turns it back to brown copper. A common misconception is that oxidation always needs oxygen gas; losing hydrogen also counts.



Oxidation at home: corrosion and rancidity

Teacher notes

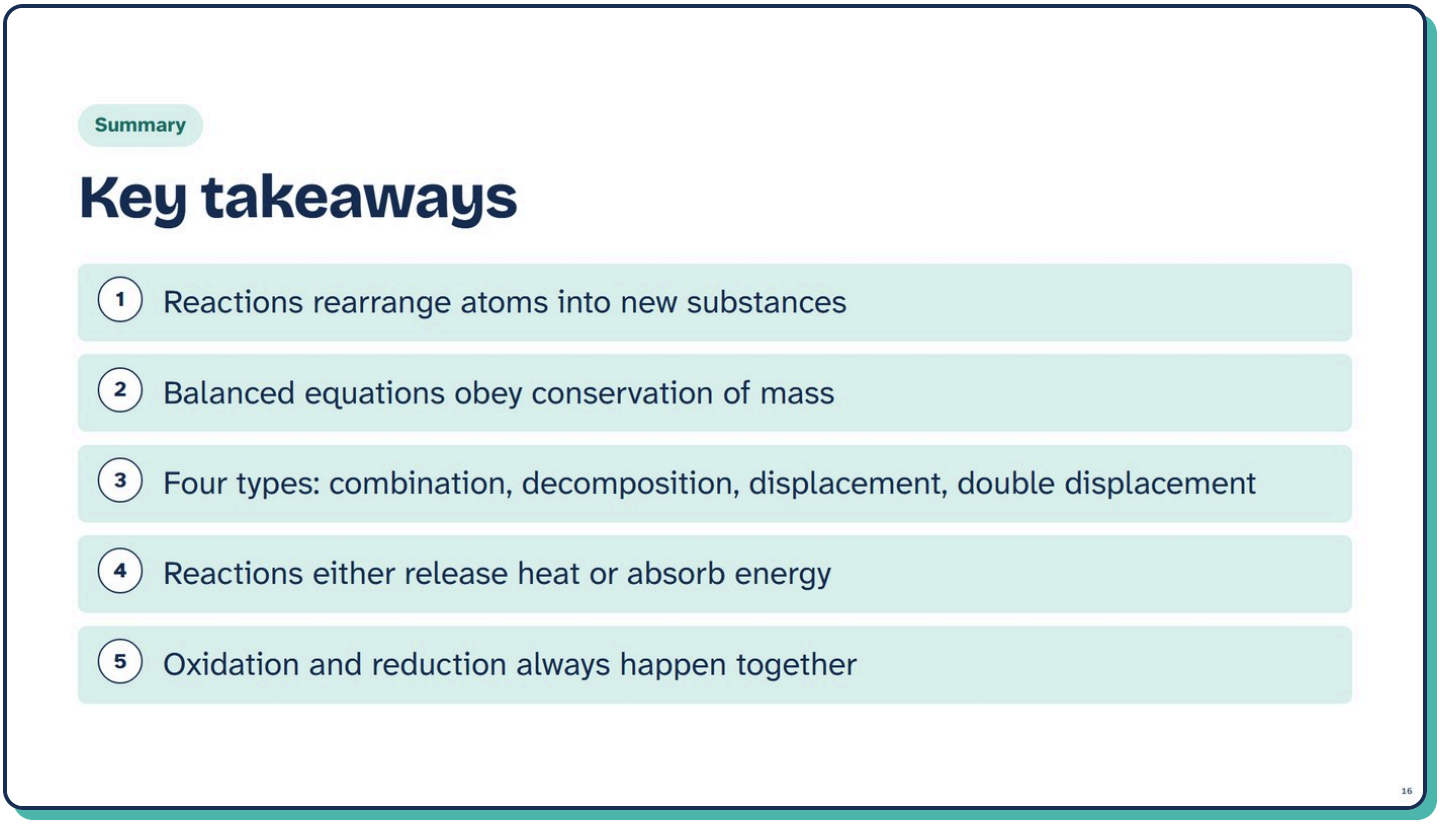
Corrosion is the slow damage of a metal by air, moisture or chemicals around it; rusting of iron is the most costly example. Rancidity is the oxidation of fats and oils in food. Ask students how their families prevent these: painting and oiling gates, storing food in airtight containers, and adding antioxidants.



Quick check

Teacher notes

Answer: B, hydrogen, because it gains oxygen to become water. Copper oxide loses oxygen, so it is reduced. Let students vote before revealing the answer, then ask them to explain their choice.



Key takeaways

Teacher notes

Ask each student to write one balanced equation and label its reaction type as an exit ticket. Then move to the five-question quiz. Homework: find two examples of corrosion or rancidity at home and suggest how to prevent each.