How Much Product Can a Chemical Reaction Make

KS4 CHEMISTRY Ages 11-15 ⏰ 3 min read

What Is a Limiting Reactant?

When you mix chemicals together, they combine in specific amounts to create new substances. But here's the thing: one ingredient often runs out first. That ingredient is called the **limiting reactant**, and it decides how much product you can actually make.

Think of it like making sandwiches. If you have **10 slices of bread** but only **3 slices of cheese**, you can only make **3 cheese sandwiches**. The cheese runs out first, so it limits how many sandwiches you can make — even though you have plenty of bread left over.

The Recipe Must Be Followed

Every chemical reaction has a **chemical equation** that shows the exact ratio of chemicals needed. For example, hydrogen and oxygen combine in a **2:1 ratio** to make water. If you only have half as much oxygen as you need, you can't make as much water. The oxygen becomes the limiting reactant.

Scientists call the amounts we expect to make the **theoretical yield** — that's what you'd get if the reaction went perfectly and nothing was wasted.

Real Life Is Messy

In reality, chemical reactions are rarely perfect. Some product gets stuck to containers, some escapes as gas, and some reactions don't go to completion. That's why we measure something called **actual yield** — the amount of product you actually collect.

Think of it like baking a cake. The recipe says you should get a **20cm** cake. But the actual cake might be smaller because some mixture stuck to the bowl, and the edges burned a bit.

We measure how good a reaction was using something called **percentage yield**. This shows what percentage of the theoretical yield we actually got. A yield of **100%** would be perfect, but most reactions give **70–90%** — sometimes much less.

Why Does This Matter?

Factories making medicines, plastics, and fuels need to know exactly how much product they'll get. If they don't account for limiting reactants and efficiency losses, they'll waste money buying too many chemicals or produce less than they promised.

Understanding yield helps scientists design better reactions, waste less, and make medicines and materials more cheaply. It's all about being clever with what we have.