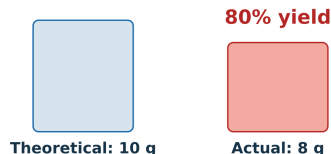


C3 Yield and atom economy

AQA Separate Chemistry 8462 | Paper 1 extras | Foundation + Higher

1 Actual and theoretical yield

Product collected from the same reaction



Actual yield: product obtained.

Theoretical yield: maximum possible amount.

The theoretical amount is supplied in introductory questions. Calculating it from reactant mass and an equation is Higher Tier.

2 Percentage yield

Percentage yield

$$\frac{6 \text{ g collected}}{8 \text{ g possible}} \times 100 = 75\%$$

Yield (%) = actual mass ÷ theoretical mass × 100.

Use the same mass units.

6 g collected / 8 g possible:

$$6 \div 8 \times 100 = 75\%.$$

Do not turn the fraction upside down.

3 Why yield can be lower

Separation

Product lost in transfer or on equipment

Reversible

Some product changes back to reactants

Side reactions

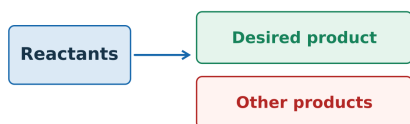
Reactants make unwanted products

Product may be lost during transfer or separation. A reversible reaction may not finish. Side reactions may make unwanted products.

An apparent yield above 100% can indicate wet/impure product or measurement error.

4 Atom economy

Track all the reactant atoms



High atom economy → less unwanted material

Atom economy (%) = desired product formula-mass total ÷ reactant formula-mass total × 100.

Use the balanced equation and include all coefficients (large numbers before formulae).

5 A worked example

Desired product: calcium oxide



$$\text{Atom economy} = 56 \div 100 \times 100 = 56\%$$



CaO is wanted. M_r values: 100, 56, 44.

Atom economy = $56/100 \times 100 = 56\%$.

CO₂ is the by-product here.

A one-product reaction has 100% atom economy.

6 Do not mix the measures

Percentage yield

How much possible product did we actually collect?

Atom economy

How much reactant mass becomes the desired product?

Yield: how much possible product was collected?

Atom economy: how much reactant mass goes into desired product?

High atom economy reduces waste but does not guarantee high yield.

AQA section 4.3.3.