Percentage Yield

amount of product actually produced in a chemical reaction (mol or g)
↳ this is often less than theoretical due to inefficiencies in recovering products or side reactions which reduce product
↳ calculated by determining mass or volume of product

ratio of actual and theoretical yields.
larger values = more efficient

$$\text{Percentage Yield (\%)} = \frac{\text{experimental yield}}{\text{theoretical yield}} \times 100\,\%$$

amount of product produced in a chemical reaction assuming the limiting reactant is completely used up. (mol or g)
↳ calculated stoichiometrically using the limiting reactant

Example problems

(i) 36 g of tin (IV) phosphate, $Sn_3(PO_4)_4$, reacts with 36g of sodium carbonate, Na_2CO_3 to make tin (IV) carbonate and sodium phosphate. If 29.8g of tin (IV) carbonate are actually formed, what is the percent yield?

(ii) 15g of sodium sulfate, Na_2SO_4, reacts with excess iron (III) phosphate, $FePO_4$, producing a 65.0 % yield. How many grams of sodium phosphate will actually be made?

(iii) What mass of silver could be formed if a large zinc wire is placed in a beaker containing 145.0 mL of 0.095 mol dm^{-3} silver nitrate, $AgNO_3$, and allowed to react overnight? Reaction has 97% yield.

Percentage Purity

Some samples of compounds are composed of a mixture of different substances.

Percentage of a sample which is a specific product

$$\text{Percentage Purity (\%)} = \frac{\text{mass of pure compound in sample (mass of the compound of interest (g))}}{\text{total mass of sample (mass of the mixture in total (g))}} \times 100\ \%$$

Example problems

(i) A 12.00g sample of a crystallised pharmeceutical product was found to contain 11.57g of the active drug. Calculate the percentage purity of the sample of the drug.

(ii) 15.0g of 92.5% magnesium hydroxide, $Mg(OH)_2$, is reacted with excess H_3PO_4 to produce water and magnesium phosphate. Calculate the mass of $Mg_3(PO_4)_2$ that will be formed (assuming a 100% yield).

(iii) Automotive air bags inflate when solid sodium azide, NaN_3, decomposes explosively into sodium and nitrogen gas. What volume of nitrogen gas is formed if 120g of 85% pure sodium azide decomposes. Assume STP conditions.