

Day 1 Data

Mass of Na ₂ CO ₃	2.431 g
Mass of CaCl ₂	2.013 g
Mass filter paper + watch glass	6.178 g
Mass precipitate + filter paper + watch glass	7.818 g
Observations from reaction	various

Sample Calculations

Determine moles of sodium carbonate

Molar mass Na₂CO₃ = 105.99 g/mol

$$\frac{2.431 \text{ g Na}_2\text{CO}_3}{1} \times \frac{1 \text{ mol Na}_2\text{CO}_3}{105.99 \text{ g Na}_2\text{CO}_3} = \mathbf{0.0229 \text{ mol Na}_2\text{CO}_3}$$

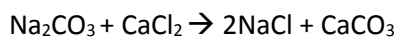
Determine moles of calcium chloride

Molar mass of CaCl₂ = 110.98 g/mol

$$\frac{2.013 \text{ g CaCl}_2}{1} \times \frac{1 \text{ mol CaCl}_2}{110.98 \text{ g CaCl}_2} = \mathbf{0.0181 \text{ mol CaCl}_2}$$

Determine limiting reactant

Write the precipitation reaction out and balance it:



Since the balanced coefficients of sodium carbonate and calcium chloride are both 1, this means that an equal number of moles of each is required for a stoichiometric mixture. CaCl₂ will run out first and is the limiting reactant.

OR

$$\frac{0.0229 \text{ mol Na}_2\text{CO}_3}{1} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol Na}_2\text{CO}_3} = 0.0229 \text{ mol CaCO}_3$$

$$\frac{0.0181 \text{ mol CaCl}_2}{1} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCl}_2} = 0.0181 \text{ mol CaCO}_3$$

The second equation shows a smaller, limited amount of product, therefore CaCl₂ is the limiting reactant.

Determine the theoretical yield of calcium carbonate

Use the amount of limiting reactant to start this calculation.

$$\frac{0.0181 \text{ mol CaCl}_2}{1} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCl}_2} \times \frac{100.09 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} = \mathbf{1.81 \text{ g CaCO}_3}$$

Determine the actual yield of calcium carbonate

Use the dried weight of the precipitate and subtract the filter paper and watch glass masses.

$$7.818 \text{ g} - 6.178 \text{ g} = \mathbf{1.640 \text{ g CaCO}_3}$$

Determine the percent yield of calcium carbonate

$$\frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{1.640 \text{ g}}{1.81 \text{ g}} \times 100 = \mathbf{90.6\%}$$