

Net ionic equations, titration and redox

AP Chemistry · Lab

Name: _____ Date: _____ Class: _____

When two solutions react to form a solid, the amount of solid depends on whichever reactant runs out first. In this lab you add increasing volumes of sodium carbonate to a fixed volume of calcium chloride, collect the calcium carbonate and see how the mass changes. The graph reveals the limiting reagent and checks the mole ratio in the equation.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 4

Aim

To find how the mass of calcium carbonate formed depends on the volume of sodium carbonate added, and to locate the limiting reagent.

Equipment

- 0.400 mol/L calcium chloride solution, 25.0 mL for each trial
- 0.300 mol/L sodium carbonate solution (10, 20, 30, 40 and 50 mL)
- five 250 mL beakers, two measuring cylinders
- funnels, filter papers, balance (0.01 g)
- drying oven or warm shelf, distilled water in a wash bottle

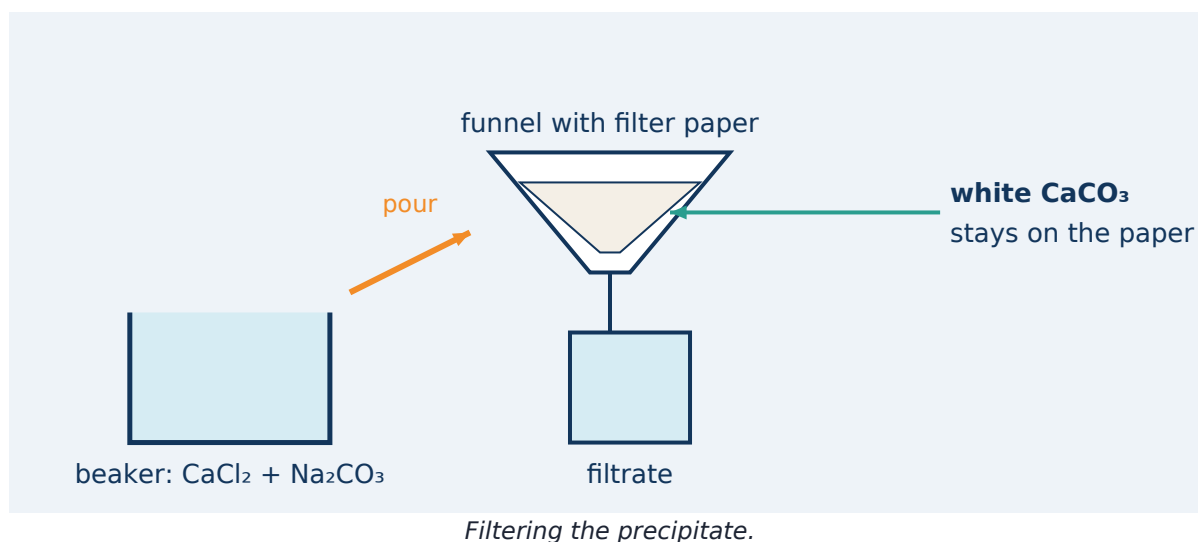
Safety

Safety

Wear goggles. Sodium carbonate solution is mildly alkaline and can irritate skin and eyes; rinse splashes with plenty of water. Handle hot filter papers with tongs.

Method

1. Weigh five dry filter papers and label them in pencil.
2. Add 25.0 mL of calcium chloride to each beaker.
3. Add 10, 20, 30, 40 and 50 mL of sodium carbonate to the beakers and stir for one minute.
4. Filter each mixture through its paper and wash the precipitate with a little distilled water.
5. Dry the papers overnight at about 80 °C or on a warm shelf, then weigh each paper with its precipitate.
6. Subtract the paper mass to get the mass of CaCO_3 .



Results

Sample data for the mass of dry CaCO_3 :

Volume Na_2CO_3 (mL)	Mass CaCO_3 (g)
10.0	0.29
20.0	0.58
30.0	0.87
40.0	0.97
50.0	0.97

Analysis questions

Question 1 Equations

Write the balanced molecular equation and the net ionic equation.

Question 2 Amounts

Calculate the amount of Ca^{2+} in 25.0 mL of 0.400 M CaCl_2 and the amount of CO_3^{2-} in 10.0 mL and 40.0 mL of 0.300 M Na_2CO_3 .

Question 3 Limiting reagent

State the limiting reagent for the 10.0 mL and the 40.0 mL trials.

Question 4 Theoretical mass

Calculate the theoretical mass of CaCO_3 (100.09 g/mol) for the 20.0 mL and 50.0 mL trials.

Question 5 Percent yield

Calculate the percent yield for the 20.0 mL trial and comment on the five yields.

Question 6 Graph

Describe the shape of the graph of mass against volume and find the volume at which the lines meet.

Question 7 Explain the plateau

Explain why the mass stops rising after 33.3 mL.

Question 8 Improve the method

State two errors and how to reduce each.