

Preparation of calcium nitrate

Student worksheet

Making calcium nitrate

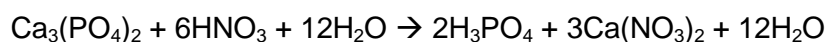
Calcium nitrate is a complex fertiliser. This simple salt is a source of two nutrients – calcium and nitrogen.

Calcium nitrate is manufactured by one of these processes:

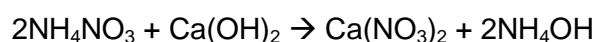
- the reaction of calcium carbonate (usually as limestone) with nitric acid:



- as a by-product of the extraction of calcium phosphate:



- the reaction of ammonium nitrate solution and calcium hydroxide:



You can make calcium nitrate-4-water in the laboratory by reacting calcium carbonate with dilute nitric acid.

Equipment and materials

- Weighing bottle (or small beaker)
- Evaporating basin
- 250 cm³ beaker
- Bunsen burner, tripod and gauze
- 25 cm³ measuring cylinder
- Filter funnel and filter paper
- Hot water bath
- Watch glass
- Thermometer (10 – 110 °C)
- Stirring rod
- Sample bottle
- Spatula
- 1 mol dm⁻³ nitric acid, 25 cm³
- Calcium carbonate, 2.5 g

Method

Care: Wear eye goggles. 1 mol dm⁻³ nitric acid is corrosive.

- Weigh out about 2.5 g of calcium carbonate.
- Using a measuring cylinder, measure 25 cm³ of 1 mol dm⁻³ nitric acid into a 250 cm³ beaker.
- Warm the acid to about 60 °C. While stirring the acid, use a spatula to add powdered calcium carbonate a little at a time, allowing the effervescence to die away between additions. Continue adding portions until there is no effervescence and some solid calcium carbonate can be seen in the beaker.
- Filter the warm mixture into an evaporating basin. Evaporate the filtrate slowly over a hot water bath at about 60 °C until crystals form.
- Allow the concentrated solution to cool.

6. Filter off the crystals and put the filter paper and crystals on a watch glass and dab dry with another piece of filter paper. Cover them with a piece of clean filter paper and leave them to dry at room temperature.
7. Label a sample tube with the name of the product, your name and the date. Weigh the labelled sample tube and record its mass.
8. Tip your dry product into the sample tube. Weigh the tube again. Record its mass.

Calculations

You used an excess of calcium carbonate and so the theoretical yield depends on the volume of 1 mol dm^{-3} nitric acid used.

Calculate

1. the theoretical yield of calcium nitrate-4-water, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$;
2. the percentage yield of calcium nitrate-4-water, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$.