

Water of crystallisation barium chloride



Background

Many ionic compounds which crystallise out of an aqueous solution are fixed in regular positions throughout the crystal lattice. These compounds are said to be hydrated, and the number of water molecules per formula unit of the compound is shown as part of the formula. For example $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ have respectively five and ten water molecules of crystallisation per formula unit of compound.

These water molecules of crystallisation can be driven off by heating the hydrated compound. If the remaining compound has no water molecules of crystallisation it is said to be anhydrous.

The purpose of this experiment is to determine the number of water molecules of crystallisation of hydrated barium chloride, $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$. To do this a known mass of the hydrated compound will be heated so that the mass of water driven off can be determined. From this the empirical formula of the hydrate will be calculated.

Equipment required

Balance

Crucible and lid

Bunsen

Hydrated barium chloride (2-3 g) Pipe clay

triangle

Tripod

Desiccator

Crucible tongs

Barium chloride is poisonous. Do not allow into come into contact with your skin.

- **Do not touch the hot crucible with your hands. Always use crucible tongs.**

#1 Obtain a clean, dry crucible and lid and heat them strongly for 5 minutes over a bunsen flame. Allow them to cool in a desiccator.

#2 Weigh the crucible and lid on an accurate balance. Add 2-3 g barium chloride crystals and immediately reweigh.

#3 Place the lid on the crucible, leaving a small gap, and heat for 5 minutes with a low flame. Then heat strongly for 20 minutes. Allow the crucible to cool in the desiccator and reweigh when cool.

#4 Repeat the strong heating for a further 5 minutes, cool in the desiccator and again reweigh. Repeat until constant weight has been obtained, that is, to within 1 or 2 milligrams.

Processing of results, and questions

1 Determine the mass of anhydrous BaCl_2 and the mass of water driven off in the heating process.

2 Calculate the number of moles of anhydrous BaCl_2 and the number of moles of water lost during the heating process.

3 Calculate the ratio $n(\text{BaCl}_2) : n(\text{H}_2\text{O})$. What is the empirical formula of the compound?

4 Write the formula

