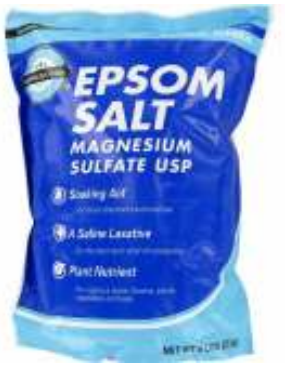
AS PRACTICAL 1

Water of crystallisation (Instructions)

Aim

Epsom salt have many uses, including use as bath salts (to relax muscles), as a laxative and as a plant nutrient. Epsom salt contains hydrated magnesium sulfate which has the formula $MgSO_4.xH_2O$.



The aim of this experiment is to find the value of x in hydrated magnesium sulfate.

Principle

You are going to heat a sample of $MgSO_4.xH_2O$ which will cause the compound to lose the water of crystallisation. By knowing the mass of the original sample and the mass of water lost, you will be able to work out n.

The experiment uses the principle of "**heating to constant mass**". Once the reaction finishes, the mass will stop decreasing as no more water is lost. The sample is heated and weighed from time to time until the mass stays the same.

$$MgSO_4.xH_2O \rightarrow MgSO_4 + x\,H_2O$$

Safety

Magnesium sulfate is a low hazard.

The major danger here is carrying very hot glassware.

Use test tube holders at all times to handle the boiling tube.

Method

When using the balance:

- use the same balance each time;
- place the boiling tube in the beaker on the balance;
- carry the tube with a test tube holder;
- take great care when carrying the hot tube.

1) Find the mass of an empty boiling tube. Record this and all other masses in a suitable table.
2) Place about 2 cm depth of hydrated magnesium sulphate in the boiling tube and find the mass.
3) Heat the tube to constant mass (use test tube holders to hold the tube). Clearly, if steam is still being given off from the tube, there is still water of crystallisation to be lost.

Analysis

4) Calculate the moles of $MgSO_4$ at the end.
5) Use your answer to (4) to calculate the moles of $MgSO_4.xH_2O$ at the start.
6) Use your answer to (5) and the mass of $MgSO_4.xH_2O$ at the star to find its relative formula mass.
7) Find the value of x.

Evaluation

8) The balance used could accurately record mass to the nearest 0.01 g (uncertainty in each reading is 0.005 g). Using the lowest mass measured with the balance, find the maximum apparatus uncertainty for this experiment.
9) Give that the relative formula mass in 246.4, calculate your percentage experimental error using your value from question (6).
10) Explain whether your result for the relative formula mass of hydrated magnesium sulfate is accurate.

Questions

11) Explain the principle of heating to constant mass.
12) Why would it not be appropriate to use a balance with a resolution of 0.1 g for this experiment to find the value of x g (uncertainty in each reading is 0.05 g)?
13) Why is it not necessary to use a balance with a resolution of $\pm$ 0.001 g for this experiment to find the value g (uncertainty in each reading is 0.0005 g) of x?