

GCSE



CCEA GCSE TEACHER GUIDANCE

Chemistry Practical Manual

Unit 3: Practical Skills

C1: Determine the mass of water
present in hydrated crystals

Determine the mass of water present in hydrated crystals

A solid which is hydrated contains 'water of crystallisation'. This is water which is 'chemically combined' in the crystal structure. If we heat a hydrated solid gently, the water will be released and the solid will lose mass. In this experiment you will heat hydrated iron(II) sulfate crystals. By carefully heating the crystals and recording mass measurements, we can calculate the mass of water in the supplied crystals.

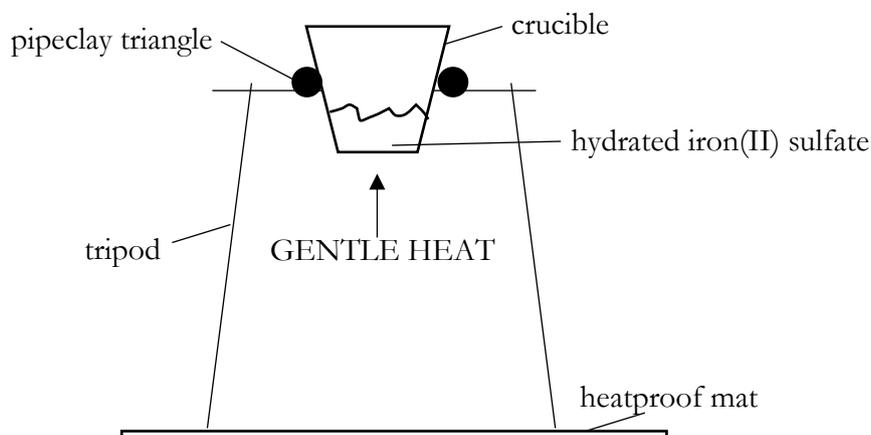
To carry out this practical, each group will need:-

- Hydrated iron(II) sulfate, $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$ (1.30 g – 1.50 g)
- Spatula
- Weighing bottle
- Bunsen, tripod and pipe clay triangle
- Heat-proof mat
- Crucible and lid
- Tongs
- Electronic balance

Safety considerations

- Gentle heating should be carried out to reduce risk of FeSO_4 decomposing, use a well-ventilated lab
- Iron(II) sulfate is harmful
- Wear safety goggles
- Take care when heating, all apparatus will become very hot

Apparatus



Method

1. Weigh a crucible, record this mass value in your results table
2. Add between 1.30 g and 1.50 g of hydrated iron(II) sulfate crystals, $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$. Reweigh the crucible, and record the new mass in the results table
3. Place the crucible containing the hydrated iron(II) sulfate crystals on the pipe clay triangle and gently heat for two minutes. You should avoid the formation of brown iron(III) oxide if possible.
4. Allow to cool and weigh the crucible, lid and its contents, record the mass
5. Reheat the crucible and its contents and reweigh, record the new mass
6. Continue reheating and reweighing until constant mass is observed. This process is known as 'heating to constant mass' and ensures that all the water of crystallisation has been removed from the hydrated crystals.

Results table

| Reading | Mass (g) |
|--------------------------------------|----------|
| Mass of empty crucible | |
| Mass of empty crucible, and crystals | |
| Mass after 1 st heating | |
| Mass after 2 nd heating | |
| Mass after 3 rd heating | |
| Mass after 4 th heating | |

Analysis of data

Mass of hydrated crystals _____ g

Mass of anhydrous crystals _____ g

Mass of water of crystallisation _____ g

Extension work:

Calculating the formula of the hydrated crystals

Moles of anhydrous crystals

_____ moles

Moles of water

_____ moles

Ratio of FeSO₄: H₂O = _____ : _____

Formula FeSO₄. _____ H₂O

Analysis of the results

The actual value should be: 7
Suggest why your value may be:

a) Lower than expected:

b) Higher than expected:

c) How would you improve the accuracy of this experiment?

d) How would you improve the reliability of this experiment?
