# Lesson Element

# Student Activity – Formula Determination

# Determination of the formula of hydrated magnesium sulfate

***Safety:*** Safety spectacles and lab coats must be worn.

## Introduction

Hydrated magnesium sulfate has the formula MgSO4•***x***H2O. The purpose of the experiment is to find ***x*** in the formula.

When the **hydrated** magnesium sulfate is heated, it loses its **water of crystallisation** to form **anhydrous** magnesium sulfate, MgSO4:

MgSO4•***x***H2O ⎯→ MgSO4 + ***x***H2O

## Apparatus

Crucible, pipe-clay triangle, tongs, balance, hydrated magnesium sulfate crystals, balance weighing to two decimal places.

Hydrated magnesium sulfate has no hazard.

## Procedure

* Recorded all masses to the accuracy of the balance: **two** decimal places.
* Weigh an empty crucible. Record the mass.
* Weigh accurately in a crucible between 1.50 and 3.50g of hydrated magnesium sulfate. Each person in the class will be using a different mass of hydrated magnesium sulfate. You will be told how much you should weigh out.
* Record the mass.
* Heat the crucible to **constant mass** as shown in the diagram below.

pipe-clay triangle

crucible

hydrated magnesium sulfate

**HEAT**

### Treatment of results

From the results, you will need to find

* the mass of the **hydrated** salt, MgSO4•***x***H2O containing water of crystallisation
* the mass of the **anhydrous** salt, MgSO4 without the water
* the mass of water that was in the hydrated salt.

## Results

mass of crucible = …………… g

mass of crucible + **hydrated** magnesium sulfate = …………… g

mass of crucible + **anhydrous** magnesium sulfate after heating = …………… g

mass of water that was removed = …………… g

mass of **anhydrous** magnesium sulfate formed after heating = …………… g

### Group results

1. Collect the other results from the group and plot a graph of the mass of the anhydrous magnesium sulfate on the *y*-axis against the mass of water on the *x*-axis.  
   You will need to record all masses to **two** decimal places.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Group |  |  |  |  |  |  |  |  |  |  |
| mass MgSO4•***x***H2O (before heat) / g | 1.5\_ | 1.7\_ | 1.9\_ | 2.1\_ | 2.3\_ | 2.5\_ | 2.7\_ | 2.9\_ | 3.1\_ | 3.3\_ |
| mass H2O  removed /g |  |  |  |  |  |  |  |  |  |  |
| mass MgSO4  (after heat) / g |  |  |  |  |  |  |  |  |  |  |

1. Draw a ‘best’ straight line on your graph.
2. Using your graph, find out what mass of the water is lost when 1.20g of anhydrous magnesium sulfate, MgSO4, is formed.
3. What mass of water would be lost to form 120 g of anhydrous magnesium sulfate?
4. Look at the atomic masses in the Periodic Table.  
   Why are we interested in **120 g** MgSO4?
5. Use the atomic masses in the Periodic Table and your answer above to find out the value of ***x*** in the formula MgSO4•***x***H2O.   
   (Round the atomic masses to the nearest whole number)
6. What is meant by "**heating to constant mass**"?

