# Determining the empirical formula of magnesium oxide
# Transcript

The empirical formula of a substance gives the simplest whole number ratio of the atoms or ions of all the elements in that substance.

For example, Na-Cl is the empirical formula of sodium chloride. The formula tells us that for every one sodium ion, there is one chloride ion.

Similarly Mg-Cl-two is the empirical formula of magnesium chloride. This formula tells us that for every one magnesium ion, there are two chloride ions.
We can work out the empirical formula of a substance if we know the mass of each element present in a sample of the substance.

For example, if we determined that there were 3.45 grams of sodium and 5.33 grams of chlorine in a sample of sodium chloride. We would calculate the amount of each element in moles by dividing mass by molar mass and then find the whole number ratio and then the formula.

Alternatively, we can compare experimental data to theoretical data of different possible empirical formulae.

This graph shows the expected mass of magnesium oxide to be formed, based on three possible empirical formulae: Mg-two-O, Mg-O and Mg-O-two.

In this experiment, a known mass of magnesium is fully combusted. The mass of the magnesium oxide is then measured.

The empirical formula of magnesium oxide can then be determined by either the calculating route, or by comparing to theoretical data.

Here are the materials and apparatus you will need to collect the data.
Draw a results table to record your experimental data.
Take the ten-centimetre piece of magnesium ribbon,and wrap it around the pencil into a coil.

Check that the coil fits inside one of the bottle tops.
Turn on and tare the balance. Make sure the reading is stable at zero-point-zero-zero grams.

Place the two bottle tops and the piece of nichrome wire on the balance. Note down the mass in your results table – this is mass M-one.

Now place the magnesium coil inside of the bottle tops. Place the second bottle top on top so that the magnesium is contained inside.

Finally, secure the two bottle tops together by wrapping and twisting the nichrome wire around the tops. Use the pliers to make sure the wire is tightly twisted.

We call this arrangement the parcel.

Weigh the whole parcel on the balance. Note down the mass in your results table – this is mass M-two.
Place the heat resistant mat on your bench.

Secure the Bunsen burner to your gas tap, and place the burner at the edge of the mat.

Place the tripod in the centre of the mat, and place the clay triangle on top of the tripod.

Finally, place the parcel on top of the clay triangle. Make sure parcel cannot fall from the triangle.
Close the air hole of the Bunsen burner, turn on the gas tap, and light the Bunsen burner.

Open the air hole half way and push the Bunsen burner underneath the parcel.

Heat the parcel for about one minute.

Now, pull the Bunsen burner back to the edge of the mat. Fully open their air hole, and return the Bunsen burner back under the parcel.

Heat the parcel for about nine minutes.
Turn off the Bunsen burner at the gas tap.

Use the tongs to move the parcel onto the heat resistant mat.

Allow the parcel to cool for five minutes
Turn on and tare the balance. Make sure the reading is stable at zero-point-zero-zero grams.

Use the tongs to move the parcel onto the balance. Weigh the mass of the parcel, and note the value in your results table – this is mass M-three.
Calculate the mass of magnesium used by subtracting M-one from M-two.

Calculate the mass of magnesium oxide produced by subtracting M-one from M-three.
Now compare your mass data against the calibration graph. Find the point on the graph where your two masses intersect. Which line does your intersection lie on? If you have collected accurate data, it should lie on the orange MgO line.
Calculate the mass of oxygen in the magnesium oxide by subtracting M-two from M-three

Divide the masses by the molar mass and find the whole number ratio and hence the empirical formula
The magnesium oxide can be disposed of in normal refuse. The bottle tops and nichrome wire can be cleaned and reused.