Co-worked examples: Calculations

The example exam questions in the shaded sections are followed by working out and hints on answering the questions.

Empirical formulae

**1** Sulfamic acid is a white solid used by plumbers as a limescale remover.

**a** Sulfamic acid contains 14.42% by mass of nitrogen, 3.09% hydrogen and 33.06% sulfur. The remainder is oxygen.

**i** Calculate the empirical formula of sulfamic acid. **(3)**

**Interpreting the question**

* *‘*The remainder is oxygen.’So you need to calculate the percentage of oxygen.
* ‘Calculate the empirical formula of sulfamic acid.’ This is the main question.

**Answering the question - You put the numbers into the boxes.**

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| --- | --- | --- | --- | --- | --- |
| What you do | Calculation | | | | Common mistakes |
| Write the symbols of the elements. |  |  |  |  | Remember you can check the symbols in the Periodic Table. |
| Note the % underneath. |  |  |  |  | Check sum of % = 100%.  Make sure you transfer the correct % for the correct element. |
| Write the A*r* for each element. |  |  |  |  | Remember to use the Periodic Table correctly! |
| Divide % by A*r* for ratio. |  |  |  |  | Do not round up at this stage. |
| Divide by smallest number for simplest ratio. |  |  |  |  | These numbers give you the number of each atom in the empirical formula. |
| Write the empirical formula. |  | | | | Make sure you actually write this formula out – don’t leave the answer at the ratio stage. |

**ii** The molar mass of sulfamic acid is 97.1 g mol–1. Use this information to deduce the molecular formula of sulfamic acid.

**Answering the question**

Work out empirical formula mass first, then use this to work out the molecular formula. Add up all the Ar for the empirical formula. SHOW YOUR ADDITIONS and final TOTAL answer.

1. Empirical formula mass =
2. Divide molar mass by empirical formula mass =
3. Multiply empirical formula mass by the number in 2 above to get molecular formula
4. Molecular formula =