# Scaffolding titration calculations

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**Titration calculations are difficult. You can reduce the cognitive load by careful scaffolding using the table method.**

## Table method example

A student titrated a 25.0 cm3 sample of sulfuric acid, H2SO4, with a 0.102 mol/dm3 solution of potassium hydroxide, KOH. 23.1 cm3 was the mean volume of potassium hydroxide required.

The equation for the reaction is H2SO4 + 2KOH → K2SO4 + 2H2O.

1. Construct a table with the row titles shown below and the reagents used in the column headers.

|  |  |  |
| --- | --- | --- |
|  | KOH | H2SO4 |
| **C**oncentration (mol/dm3) |  |  |
| **V**olume (cm3) |  |  |
| **M**oles |  |  |
| Mole **r**atio |  |  |

2. Find the numbers in the question and put them in the right place in the table. The gaps make it easy to know what needs calculating.

|  |  |  |
| --- | --- | --- |
|  | KOH | H2SO4 |
| **C**oncentration (mol/dm3) | 0.102 |  |
| **V**olume (cm3) | 23.1 | 25.0 |
| **M**oles |  |  |
| Mole **r**atio | 2 | 1 |

3. The calculation begins with the reagent for which we have both concentration and volume, allowing us to calculate the moles.

|  |  |  |
| --- | --- | --- |
|  | KOH | H2SO4 |
| **C**oncentration (mol/dm3) | 0.102\* |  |
| **V**olume (cm3) | 23.1\* | 25.0 |
| **M**oles | 2.36 x 10-3 |  |
| Mole **r**atio | 2 | 1 |

**n(KOH)**

$m=\frac{cv}{1000}$ 🡪$ \frac{0.102}{1000}x 23.1=2.36 x 10^{-3}mol$

4. Now the column for KOH has been filled, we use the mole ratio to find the moles of H2SO4.

|  |  |  |
| --- | --- | --- |
|  | KOH | H2SO4 |
| **C**oncentration (mol/dm3) | 0.102 |  |
| **V**olume (cm3) | 23.1 | 25.0 |
| **M**oles | 2.36 x 10-3 ÷2 🡪 | 1.18 x 10-3 |
| Mole **r**atio | 2÷2 🡪 | 1 |

**n(H2SO4)**

$\frac{2.36 x 10^{-3}}{2}=1.18 x 10^{-3}mol$

5. The final step is to use the moles and volume to find the concentration.

|  |  |  |
| --- | --- | --- |
|  | KOH | H2SO4 |
| **C**oncentration (mol/dm3) | 0.102 | 0.047 |
| **V**olume (cm3) | 23.1 | 25.0\* |
| **M**oles | 2.36 x 10-3 | 1.18 x 10-3\* |
| Mole **r**atio | 2*÷2―›* | 1 |

**C(H2SO4)**

$n=\frac{cv}{1000}$ 🡪 $c=\frac{n}{v}$ $x 1000 $🡪 $\frac{1.18 x 10^{-3}}{25} x 1000=0.047 mol/dm^{3}$