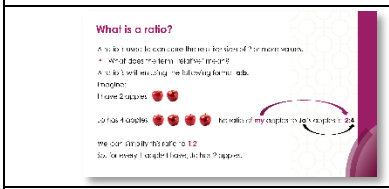
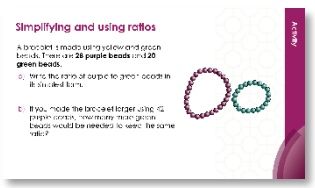
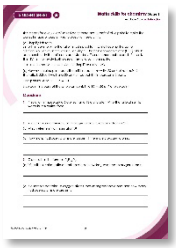
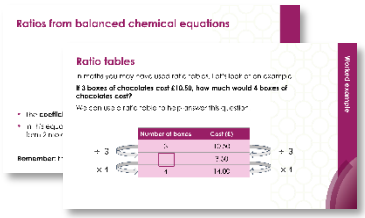
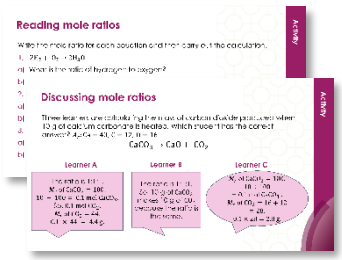
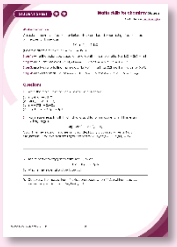
Ratio and proportion

This learner worksheet forms part of the Maths skills for chemistry resources series which can be viewed at: rsc.li/4A41ezG. The series offers flexible, targeted support for maths skills which are fundamental to chemistry teaching:

- Graphs and data, divided into:
    - Creating graphs
    - Interpreting graphs
- **Ratio and proportion**
- Understanding number, divided into:
    - Unit conversion
    - Significant figures and rounding
- Algebra and equations

Resource series components

The resource series is divided into two stages. Stage 1 (✪) is most suitable for ages 11–14 and stage 2 (✪✪) for ages 14–16. However, older learners with gaps in their fundamental knowledge can use stage 1 as a stepping stone.

Stage 1 ✪		
		
Teacher-led presentation (✪)	**Short activities (✪)**	**Learner worksheet (✪)**
Stage 2 ✪✪		
		
Teacher-led presentation (✪✪): a full lesson including learning objectives, learner-facing instructions and activities.	**Short activities (✪✪):** learner-facing activities, designed as lesson starters or quick activities to engage prior knowledge.	**Learner worksheet (✪✪):** activities for learners to independently practice their maths skills. Suitable as classroom activity following the teacher presentation or as a home-learning task.

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Key terms support

Key vocabulary for each skill area is defined in the key terms support: rsc.li/4wypuqq. You will find the key terms listed by area and an accessible glossary slide for each term.

Using the learner worksheet

The focus of this learner worksheet is mastering maths skills in a chemistry context. The aim is for learners to develop and apply maths skills independently.

Learning objectives

1 Use ratios from balanced symbol equations to determine quantities of reactants and products.

2 Calculate and use mole ratios from chemical equations.

The learner worksheets complement the teacher-led presentations but can function independently, for example as a classroom activity or homework assignment.

Answers are provided at the end of this document. When relevant, common mathematical misconceptions are highlighted.

When to use

Use the learner worksheet for:

- **Reviewing learning** – if learners are confident with the mathematical skill, use the worksheet as a tool to review learning and assess learners' skill level.
- **Independent practice** – provide learners with the worksheet to use as independent practice.
- **Scaffolded practice** – break the worksheet into sections and complete over a longer period, such as multiple lessons.
- **Mathematical modelling** – for those requiring additional support, talk through the initial questions pulling out the mathematical skills used to answer the question, highlighting and defining any key terms. If learners are still finding the task difficult, consider fading the initial questions and asking learners to complete the later questions independently.

Scaffolding

The worksheet presents a clear progression in skill development. It starts with a recap of key knowledge and a worked example. The first question engages prior knowledge of the chosen maths skill in a chemistry context. Following this, learners will complete activities in a chemistry context.

Have the key terms list or accessible glossary available for learners who require additional support with mathematical vocabulary.

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Metacognition

The learner worksheet supports learners to develop their metacognitive skills in three key areas.

- **Planning** – prompt learners to draw on their existing mathematical knowledge by asking themselves: 'Have I seen a similar question before? Have I come across this mathematical skill before? Have I learned a different method for solving a similar problem?'
- **Monitoring** – prompt learners to ask themselves: 'How confident am I feeling with these mathematical skills? Which questions am I finding difficult? Which type of questions do I feel I have mastered?'
- **Evaluation** – prompt learners to ask themselves: 'What have I learned about myself when doing these questions? Which of the mathematical skills did I use to answer these questions?'

Mole ratios

In the teacher-led presentation and short activities, learners have learned the following method for calculating mass from moles:

Step 1: **write** the balanced equation and identify the mole ratio.

Step 2: **calculate** the moles of the substance you know using: $\text{moles} = \frac{\text{mass}}{M_r}$

Step 3: **use** the mole ratio to **find** the moles of the substance you need.

Step 4: **convert** back to mass using: $\text{mass} = \text{moles} \times M_r$

This is included as guidance on the first page of the learner worksheet.

Common misconceptions

Some of the common errors and misconceptions related to mole ratios include:

- treating the coefficients in equations as masses rather than mole ratios
- applying the mole ratio directly to masses (e.g. multiplying grams by the ratio number)
- confusing the ratio of atoms in a formula (subscripts) with the ratio of moles in an equation (coefficients)
- calculating M_r incorrectly by missing atoms (e.g. using 28 for CO_2 instead of 44)
- assuming 1:1 ratio without checking the equation.

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Answers

1.

(a) 2:1:2
(b) 1:1:1
(c) 2:3:2
(d) 1:2:1:2

2. $Mg : MgCl_2 = 1 : 1$
Moles of $Mg = 2.4 \div 24 = 0.1$ mol
Moles of $MgCl_2 = 0.1$ mol
Mass of $MgCl_2 = 0.1 \times 95 = 9.5$ g

3.

(a) 4:2 = 2:1
(b) Moles of $Fe = 11.2 \div 56 = 0.2$ mol
Mole ratio = 2:1, so, moles of $Fe_2O_3 = 0.2 \div 2 = 0.1$ mol
Mass of $Fe_2O_3 = 0.1 \times 160 = 16.0$ g

4. $N_2 : H_2 : NH_3 = 1 : 3 : 2$
Moles of $NH_3 = 68 \div 17 = 4$ mol

(a) Mole ratio = 1:2, so, moles of $N_2 = 4 \div 2 = 2$ mol
Mass of $N_2 = 2 \times 28 = 56$ g
(b) Mole ratio = 3:2, so, moles of $H_2 = (4 \div 2) \times 3 = 6$ mol
Mass of $H_2 = 6 \times 2 = 12$ g

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