Narrative – Rates of reaction (What do experiments tell us?)

Llywodraeth Cymru
Welsh Government

Year group and curriculum area	Year 9 or 10. Science/chemistry.
Activity	Supports a revision or an experimental planning strategy and is designed to engage learners in looking at evidence found in graphs and write about it. Learners ask the question 'What is this experiment designed to find out and how does it achieve that?'.
Topic	This particular resource relates to rates of reaction in science/chemistry. The activity is designed to encourage learners to study information provided carefully and systematically, to help learners develop good writing skills, and to provide more quantitative data from graphs to support conclusions.
Possible strategy/solution	This is a standard rate of reaction experiment. **Requirement** • Activity sheet 'Rates of reaction – What do experiments tell us?'. Learners are introduced to the question 'What is this experiment designed to find out and how does it achieve that?'. This is done by presenting groups of learners with the activity sheet and working through the sheet, or by the teacher introducing the topic and using a demonstration experiment set up. Learners write notes as the teacher explains the procedure. The experiment could be linked to a word or balanced equation. Hydrochloric acid + Magnesium = Magnesium chloride + hydrogen, etc. Balanced symbol equations could be used for the more able and talented learners.

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	The idea of a fair test is explored and the variable (concentration) identified. Learners then explore the graph in detail. They are required to do the following. • Identify that curve A is steeper than curve B and that this identifies that reaction A is faster than B because . . . • The gradient of the graph could be calculated in the short interval that the graph is a straight line (using say 26 seconds this gives a gradient of A twice that of B). • In A the reaction lasts for 60 seconds compared to B which lasts for 120 seconds, i.e. twice as long. Learners could also work out the average rate of hydrogen produced per second. In A this is $1cm^3$ per second; in B it is half that. They arrive at a final reasoned statement with evidence which concludes the following. The rate doubles when the concentration of acid is doubled leading to a general statement . . . Further experiments would need to be carried out before the general conclusion could be made, e.g. does this always happen no matter what the reaction when concentrations are doubled?
Links with the LNF	**Skills** • Generating and using a strategy to solveproblems. • Working collaboratively to solve a problem. **Numeracy component** **Strand: Developing numerical reasoning (Year 9/10)** **Element: Identify processes and connections (Year 9/10)** Learners are able to: • transfer mathematical skills across the curriculum in a variety of contexts and everyday situations • select, trial and evaluate a variety of possible approaches and break complex problems into a series of tasks • prioritise and organise the relevant steps needed to complete the task or reach a solution • choose an appropriate mental or written strategy and know when it is appropriate to use a calculator • identify what further information might be required and select what information is most appropriate • select appropriate mathematics and techniques to use.

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Element: Represent and communicate (Year 9/10)
Learners are able to:

- explain results and procedures precisely using appropriate mathematical language
- use appropriate notation, symbols and units of measurement, including compound measures
- interpret graphs that describe real-life situations, including those used in the media, recognising that some graphs may be misleading.

Element: Review (Year 9/10)
Learners are able to:

- select and apply appropriate checking strategies
- interpret answers within the context of the problem and consider whether answers, including calculator, analogue and digital displays, are sensible
- verify and justify results or solutions, including discussion on risk and chance where relevant
- interpret mathematical information; draw inferences from graphs, diagrams and data, including discussion on limitations of data
- draw conclusions from data and recognise that some conclusions may be misleading or uncertain.

Strand: Using number skills (Year 9)

Element: Fractions, decimals, percentages and ratio (Year 9)
Learners are able to:

- use equivalence of fractions, decimals and percentages to select the most appropriate for a calculation
- use and interpret different representations of fractions, *e.g. mixed numbers and improper fractions*
- express one quantity as a percentage of another
- calculate a percentage increase or decrease
- use ratio and proportion to calculate quantities.

Element: Calculate using mental and written methods (Year 9)
Learners are able to:

- use efficient written methods to add and subtract numbers and decimals of any size, including a mixture of large and small numbers with differing numbers of decimal places
- multiply and divide whole numbers and decimals.

Element: Estimate and check (Year 9)
Learners are able to:

- make and justify estimates and approximations of calculations

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	• choose the appropriate degree of accuracy to present answers. **Literacy component** **Strand: Oracy across the curriculum (Year 10)** **Element: Developing and presenting information and ideas (Year 10)** **Aspect: Listening (Year 10)** Learners are able to: • respond to the ideas of others in thoughtful and considerate ways, seeking clarification through appropriate questioning • listen to a range of information and ideas from different viewpoints, identifying how different speakers present specific points of view. **Aspect**: **Collaboration and discussion (Year 10)** Learners are able to: • use a range of options and strategies to enable the group to progress and reach agreement. **Strand: Reading across the curriculum (Year 10)** **Element: Responding to what has been read (Year 10)** **Aspect: Response and analysis (Year 10)** Learners are able to: • synthesise and analyse information to gain in-depth understanding from sources which may have conflicting views • understand and distinguish between facts/evidence and bias/argument commenting on both obvious points and inferences. **Strand: Writing across the curriculum (Year 10)** **Element: Organising ideas and information (Year 10)** **Aspect: Meaning, purposes, readers (Year 10)** Learners are able to: • write both extended pieces, which include detailed evidence and information, and shorter pieces which summarise concisely, showing clear awareness of the reader or intended audience • construct responses that connect and develop ideas to fully cover the topic.

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	Aspect: Structure and organisation (Year 10) Learners are able to: • improve the content, structure and accuracy of their writing through independent review and editing • write independently in an appropriate form with increasing confidence, ensuring content is organised, detailed and relevant, *e.g. how best to present opinions, information and explanations* • organise writing in an appropriate form, ensuring content is detailed within and between paragraphs or sections. **Element: Writing accurately (Year 10)** **Aspect: Language (Year 10)** Learners are able to: • use a wide range of technical terms, appropriate vocabulary, and expression for different purposes and to create different effects, *e.g. to persuade, inform, entertain*. **Aspect: Grammar, Punctuation, Spelling, Handwriting (Year 10)** Learners are able to: • vary sentence structures to engage and sustain the reader's interest and write with grammatical accuracy • use the full range of punctuation in order to vary pace, clarify meaning, avoid ambiguity and create deliberate effects • use a variety of strategies and resources to accurately spell an increasing range of familiar, unfamiliar and subject-specific words • present their handwritten or on-screen work effectively, choosing form, images and graphics to enhance meaning • Welsh-medium statement: write grammatically accurate sentences ensuring that the verb tense and person is correct in context • Welsh-medium statement: use a range of mutations correctly (soft, nasal and aspirate mutations) in context.

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