



Narrative – Reaction time (ruler drop test)

Year group and curriculum area	Year 9 or 10. Science/physics/mathematics.
Activity	Establishing a method to estimate the reaction time of learners in a class from a picture and a formula of distance and time.
Topic	Biology (senses); physics (motion); how science works; planning an experiment/displaying results; calibration/relationships/graphs.
Possible strategy/solution	<p>Teachers can take the activity as a whole, using the 'Ruler drop plan' (more able and talented learners) and present each block as a task.</p> <p>OR</p> <p>Teachers can use the 'Reaction times activity sheet' which has both an introduction and a strategy to arrive at a solution. Learners could be given the equation and the sheet could include the value of the acceleration give as $g = 10 \text{ ms}^{-2}$.</p> <p>To make it even more accessible to less able learners, the subject of the equation could be changed to read $t = \sqrt{2\text{Distance}/\text{acceleration}}$, or an Excel spreadsheet could be used with an appropriate equation in a cell, etc.</p> <p>OR</p> <p>A table to convert the distance to time could be provided for low ability groups (see next page).</p>

Line where partner pinched ruler (cm)	Reaction time (seconds milliseconds)	
	seconds	milliseconds
5cm	0.1 seconds	100 milliseconds
10cm	0.14 seconds	140 milliseconds
15cm	0.17 seconds	170 milliseconds
20cm	0.2 seconds	200 milliseconds
25.5cm	0.23 seconds	230 milliseconds
30.5cm	0.25 seconds	250 milliseconds
43 cm	0.3 seconds	300 milliseconds
61 cm	0.35 seconds	350 milliseconds
79 cm	0.4 seconds	400 milliseconds

Example of procedure

- Hold the ruler vertically so that the zero end hangs down.
- Ask your partner to stand next to you and place his or her hand below the ruler's zero line, ready to catch the ruler when it falls by pinching it between his or her thumb and index finger. Your partner's fingers should be just below the ruler, but as close as possible to the bottom edge without touching or overlapping.
- Tell your partner that you will count from one to five and drop the ruler at some point during the count. Your partner will need to catch the ruler as quickly as he or she can, pinching the ruler between his or her fingers.
- Count from one to five and drop the ruler at some point.
- Your partner should catch and pinch the ruler. How fast did your partner appear to act? Did your partner's fingers pinch near the zero line?
- Write down the centimetre or inch line where your partner's fingers pinched the ruler.
- Calculate how long it took your partner to respond using the chart provided. Was your partner as fast as you thought?
- Repeat the drop four more times for your partner, and record the measurement each time. Does your partner's reaction time change? Are the five reaction times different? Vary when you drop the ruler. For example, you could drop on the count of five first, then drop on two.
- Switch tasks and try catching when your partner drops the ruler, then compare your results with the others. Do most people have a similar reaction time? Are older people faster than younger people? Are girls faster than boys?

	<ul style="list-style-type: none"> • You can also try a few variations. What happens when you tell your partner when you will drop the ruler? Does reaction time improve with practice? • Extra: Ambidextrous, anyone? Repeat this activity and compare your results when you use your dominant hand – the hand you write with – and when you use your other hand. Is there any difference between hands? • Extra: Consider adding other distracting sounds and sights – such as turning on a TV set or flicking a flashlight on and off – during the activity. Do your responses slow with so many sensory signals? <p>Graphs</p> <p>The data can be represented on a graph to aid locating points between those in the table.</p> <p>This can also be used to illustrate the relationship between the variables.</p>
<p>Links with the LNF</p>	<p>Skills</p> <ul style="list-style-type: none"> • Generating and using a strategy to solve problems. • Working collaboratively to solve a problem. <p>Numeracy component</p> <p>Strand: Developing numerical reasoning (Year 9/10)</p> <p>Element: Identify processes and connections (Year 9/10)</p> <p>Learners are able to:</p> <ul style="list-style-type: none"> • 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 • use a scientific calculator to carry out calculations effectively and efficiently using the available range of function keys • identify, measure or obtain required information to complete the task • identify what further information might be required and select what information is most appropriate • select appropriate mathematics and techniques to use • estimate and visualise size when measuring and use the correct units.

Element: Represent and communicate (Year 9/10)

Learners are able to:

- explain results and procedures precisely using appropriate mathematical language
- refine methods of recording calculations
- use appropriate notation, symbols and units of measurement, including compound measures
- select and construct appropriate charts, diagrams and graphs with suitable scales.

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: Use number facts and relationships (Year 9)**

Learners are able to:

- use powers and understand the importance of powers of 10
- show awareness of the need for standard form and its representation on a calculator.

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
- use the order of operations including brackets and powers.

Element: Estimate and check (Year 9)

Learners are able to:

- make and justify estimates and approximations of calculations
- choose the appropriate degree of accuracy to present answers.

	<p>Literacy component</p> <p>Strand: Writing across the curriculum (Year 10)</p> <p>Element: Organising ideas and information (Year 10)</p> <p>Aspect: Meaning, purposes, readers (Year 10) Learners are able to:</p> <ul style="list-style-type: none"> • 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. <p>Aspect: Structure and organisation (Year 10) Learners are able to:</p> <ul style="list-style-type: none"> • write independently in an appropriate form with increasing confidence, ensuring content is organised, detailed and relevant, <i>e.g. how best to present opinions, information and explanations</i> • show clear awareness of different readers by selecting from a range of styles and structures, and adapting their use of language • organise writing in an appropriate form, ensuring content is detailed within and between paragraphs or sections. <p>Element: Writing accurately (Year 10)</p> <p>Aspect: Grammar, Punctuation, Spelling, Handwriting (Year 10) Learners are able to:</p> <ul style="list-style-type: none"> • 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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