

# GCSE Science – Investigative Skills Assignment – Marking Guidelines

## Physics 2.2 – Average Velocity of an Object Falling through Air

For use until May 2009

**Last date for submission for moderation May 2010**

Please mark in red ink, and use one tick for one mark. Each part of each question must show some red ink to indicate that it has been seen.

Subtotals for each part of each question should be written in the right hand margin.

Please add annotations where necessary to explain why marks have or have not been awarded.

Enter the marks for **Section 1** and **Section 2** and the **total mark** on the front cover of the answer booklet.

The teacher must sign and date the front cover of the ISA.

The papers must be kept in a secure place and must **not** be returned to candidates.

The marking guidelines show examples of typical responses that candidates may make. However, teachers should use their professional judgement in deciding whether or not to award marks. If, in the judgement of the teacher, the candidate has provided a response which correctly answers the question, then a mark should be awarded even if this response is not shown in the mark guidance. If necessary, the teacher should annotate the script and/or mark guidance to justify the decision.

In the mark guidance:

- the use of a solidus (/) indicates an alternative answer
- the use of brackets ( ) indicates wording that is not essential in the candidate's answer, but makes the guidance clearer.

### SECTION 1

	Answer	Additional Guidance	
1	Statement referring to change in the dependent variable eg time of fall / average velocity	Dependent variable must be identified	1 mark
	Independent variable correctly identified and linked to dependent variable eg when I changed the height of drop / object released / shape of object / area of canopy / number of sails		1 mark
2(a)	Independent variable correctly identified eg the height of drop / object released / shape of object / area of canopy / number of sails		1 mark
(b)(i)	Correct number of different values stated		1 mark

	<b>Answer</b>	<b>Additional Guidance</b>	
(ii)	<p>Correct reason given</p> <p><b>Yes</b> – because eg it gave enough results to see a pattern</p> <p><b>or</b></p> <p><b>No</b> – because eg I don't know what happened at the start / end</p>	<p>No mark for <b>Yes</b> or <b>No</b>.</p> <p>Mark is for the reason</p>	1 mark
3	<p>No mark for <b>Yes</b> or <b>No</b></p> <p><b>Yes</b> – because eg some results did not fit the pattern</p> <p><b>or</b></p> <p><b>No</b> – because eg. all results fell very close to best fit line</p>	<p>Mark is for the reason</p> <p>At least one anomalous result must be identified</p>	1 mark
4(a)	<p>Cause of biggest error correctly identified</p> <p>eg timing the fall of the object</p> <p>Reason correctly given</p> <p>eg because of human reaction time</p>	<p>This will depend on the nature of the investigation, but if timing was done with a stopwatch, this will probably be the cause of the biggest error</p>	1 mark
(b)	<p>Suitable suggestion</p> <p>eg. more repeats / different equipment (eg light gates) / different technique</p>		1 mark
5	<p>Amplified statement for <b>2</b> marks</p> <p>eg the height of the drop affects the drop time for <b>1</b> mark</p> <p><b>plus</b></p> <p>eg the higher the drop the greater the drop time for <b>2</b> marks</p> <p><b>or</b></p> <p>eg there was no effect on the drop time for one mark</p> <p><b>plus</b></p> <p>eg because there was no pattern/ the results were random for 2 marks</p>	<p>Simple correct statement, stating whether or not there is a relationship between the two variables, for <b>1</b> mark only</p> <p><b>NB</b> statement <b>must</b> relate to the candidate's own results</p>	2 marks
6	<p>More repeats / repeat using different equipment or technique / compare or check results with others</p>		1 mark

	Answer	Additional Guidance	
7	<p><b>Table:</b></p> <p>Correct headings AND units all correct for all measured variables</p> <p><b>Graph/chart:</b></p> <p>X axis: suitable scales chosen and labelled with quantity and units</p> <p>Y axis: suitable scales chosen and labelled with quantity and units</p> <p>Points or bars plotted correctly to within <math>\pm 1\text{mm}</math></p> <p>Suitable line drawn on graph or bars correctly labelled on bar chart</p> <p>If wrong type of graph / chart, maximum <b>3</b> marks</p> <p>If the independent variable is: <i>continuous</i> should draw a <i>best fit line graph</i>  <i>categoric</i> should draw a <i>bar chart</i>  <i>discrete</i> may draw either a <i>best fit line graph</i> or a <i>bar chart</i> (but allow dot-to-dot joining of points in this case)</p>	<p>Table with incomplete headings or units for the measured variables gains <b>1</b> mark  eg all headings present = 1  eg all units present = 1</p> <p>Accept axes reversed</p> <p>Allow <b>one</b> plotting error out of every 5 points plotted.  Allow error carried forward from incorrect plots</p>	<p>2 marks</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p>
			<b>Max 18 marks</b>

## SECTION 2

	Answer	Additional Guidance	
8(a)(i)	Control variables		1 mark
(ii)	<p>Any <b>two</b> from: eg</p> <ul style="list-style-type: none"> <li>• type of material for canopy</li> <li>• number of strings</li> <li>• length of strings</li> <li>• mass or weight</li> <li>• height of drop</li> <li>• wind conditions</li> <li>• temperature</li> </ul>	<p><b>NB</b> this will depend on the nature of the investigation</p> <p>eg candidate might have chosen height of drop as the independent variable</p>	2 marks
(b)(i)	To see whether the selected values will give sensible results		1 mark

	Answer	Additional Guidance	
<b>8</b> (b)(ii)	<p>Any <b>four</b> from: eg</p> <ul style="list-style-type: none"> <li>• drop height too short</li> <li>• time taken to reach ground too short</li> <li>• human reaction time important</li> <li>• human reaction time forms a large percentage of drop time</li> <li>• therefore large errors likely</li> </ul> <p><b>Quality of written communication</b></p> <p>Candidates should use at least <b>two</b> technical terms: eg</p> <ul style="list-style-type: none"> <li>• average / mean velocity / speed</li> <li>• terminal velocity</li> <li>• error</li> <li>• (human) reaction time</li> <li>• precision</li> <li>• accuracy</li> <li>• percentage</li> </ul>	<p>The mark is to be awarded for the <b>correct</b> use of technical terms</p> <p>The marker should circle these terms</p> <p>Annotate below candidate answer with <i>Q✓</i> for mark given or <i>Q×</i> for mark not given</p>	<p>4 marks</p> <p>1 mark</p>
(c)(i)	2.53	Allow 2.5	1 mark
(ii)	Because this implies a greater precision than was actually achieved		1 mark
<b>9(a)</b>	Smooth, best-fit curve drawn in	Line need not pass through origin	1 mark
(b)	As the mass of the module increases, so does the canopy size required		1 mark
	Up to just over 4 kg		1 mark
	When further mass increase makes no difference		1 mark
(c)	Science can tell us what the planets are made of, but not whether they ought to be explored		1 mark
			<b>Max 16 marks</b>
<b>ISA Total 34 Marks</b>			