

# Commentary on candidate evidence

## Candidate 8 – Viscosity

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available		Mark awarded	Comments
	a	b		
4 Results (including uncertainties)	a	1	1	The candidate has included sufficient data relevant to the aim, with adequate range and (with the exception of the density measurements) number of repeats.
	b	4	3	<p>The candidate has included graphical analyses.</p> <p>The graphs have correct scales and labels and the data points are accurately plotted.</p> <p>Sample calculations are shown.</p> <p>On the graph (page 13), not all of the data points have been plotted.</p> <p>In addition, some of the candidate's graphs are too small for ease of checking the accuracy of plotting.</p> <p>In spite of these points, this was judged a competent analysis with few slips.</p>
	c	3	2	<p>The LINEST analysis on page 2 is good, although there are significant figures slips on pages 2 and 3.</p> <p>The inclusion of the 'box data' is good practice.</p> <p>Calibration uncertainty, together with percentage, power and combination calculations are included on page 4.</p> <p>The origin of <math>\Delta l</math> and <math>\Delta r</math> (page 8) is unclear, although they are combined correctly.</p>

Section	Mark available		Mark awarded	Comments
				<p>The candidate has not however included either scale reading or random uncertainties in the report. This is a fundamental oversight.</p> <p>This is a difficult uncertainties analysis to mark, but, with the inclusion of the LINES'T 'box data', it was felt to be worth two marks.</p>
5 Discussion (conclusion(s) and evaluation)	b	3	2	<p>The candidate has compared individual results.</p> <p>The candidate shows an awareness of percentage uncertainties in their final results and their significance. In addition, the candidate also shows an understanding of precision and accuracy, rogue data and systematic uncertainty. There are also comments on possible sources of uncertainty and on the reliability of equipment. Those regarding the stopwatch however are trivial.</p> <p>Despite the absence of scale reading and random uncertainties, and the absence of comment on the range of the dependent variables and the number of repeats, the candidate's evaluation of procedures was judged to be of a reasonable standard.</p>
	c	3	3	<p>The candidate has included comments related to their planning of the project, including the reasons for their selection of procedures, problems encountered during planning and modifications to their planned procedures.</p> <p>The candidate has compared their results to accepted values and stated which method gave the closest value to the accepted value.</p> <p>In addition, modifications to procedures are discussed (time</p>

Section	Mark available		Mark awarded	Comments
				<p>measurement by stopwatch to the use of video analysis).</p> <p>The candidate is also aware of the terminal velocity issue.</p> <p>The candidate has also suggested some further work.</p>
<b>Total</b>	<b>14</b>		<b>11</b>	

## Candidate 9 – Young’s Modulus

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available		Mark awarded	Comments
	a	b		
4 Results (including uncertainties)	a	1	1	The candidate’s data is sufficient and relevant to the aims of the project.
	b	4	3	<p>The candidate has used an appropriate graphical analysis for both procedures, with the gradient of the graphs used to determine a value for Young’s Modulus.</p> <p>The symbols used for the data points on the graphs however are too large for the accuracy of plotting to be checked.</p> <p>The rounding of the values of the gradients of the lines of best fit at an early stage in the analysis, has had a significant effect on the final values for Young’s modulus obtained.</p> <p>In addition, the values of the gradient of the lines of best fit used are to one significant figure in the calculation of Young’s modulus, but to six significant figures in the calculation of uncertainties. This inconsistency is not ideal.</p>
	c	3	2	<p>The candidate has shown an awareness of reading random and calibration uncertainties. In addition, almost all combinations of uncertainties are calculated correctly. LINEST ‘box data’ is used to determine the final uncertainty in the calculated value of Young’s Modulus.</p> <p>However, the source of the stated reading uncertainty for length extensions is not clear. In addition, the uncertainty in the final values of</p>

Section	Mark available		Mark awarded	Comments
				Young's modulus takes account only of the uncertainty in the gradient of the line of best fit, and does not take account of uncertainty in the area and in the length of the wire.
5 Discussion (conclusion(s) and evaluation)	b	3	2	<p>The candidate has identified some areas where uncertainties may have arisen, including the temperature of room and the radius of the wires. They have identified that the wires had exceeded their elastic limits (but had done nothing to address this). In addition, comments on the slipping of the knots are included.</p> <p>The candidate has however made similar points in the evaluations of both procedures, and has not attempted to identify the source of the largest uncertainty in the values of Young's modulus determined.</p>
	c	3	1	<p>The candidate has compared the experimental results with the quoted values of Young's Modulus for the metals used.</p> <p>There is a suggestion for improvement to the second procedure - the use of a travelling microscope instead of a metre stick.</p> <p>Time issues that may have prevented repeating the procedure with a smaller maximum mass were ignored by the candidate.</p> <p>In addition, there are few comments on the planning of the project, the selection of procedures, problems encountered during planning or any required modifications to planned procedures.</p>
<b>Total</b>	<b>14</b>		<b>9</b>	

## Candidate 10 – ‘g’

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available		Mark awarded	Comments
	a	b		
4 Results (including uncertainties)	a	1	1	<p>For two of the procedures, the candidate has given sufficient data with an acceptable number of repeats.</p> <p>There is no range in the independent variable for the second procedure.</p>
	b	4	1	<p>For two of the procedures, the candidate has attempted appropriate graphical analysis. There are however a significant number of issues.</p> <p>The graph on page 54 is too small for the accuracy of plotting to be checked, and the curve shown does not follow the data points plotted. The Equivalent Pendulum Length (EPL) values are stated but the candidate has not shown how they were obtained.</p> <p>An incorrect relationship is used on page 55, and the corresponding graph has the axes transposed, which gave a reasonable final value for <math>g</math>.</p> <p>There are incorrect units on the <math>T^2</math> axis on the graphs on pages 55 and 61.</p> <p>Procedure 2 has a sample calculation on page 58, but the simple pendulum relationship is not appropriate for this procedure.</p> <p>The graph for procedure 3 (page 61) is too small for the accuracy of plotting to be checked. The line of best fit looks appropriate and the calculation of <math>g</math> for this procedure has been correctly carried out.</p>

Section	Mark available		Mark awarded	Comments
				In all graphs, the data points are plotted with large dots which are too large for the accuracy of plotting to be checked.
	c	3	0	<p>Overall, the candidate has not shown even a basic awareness of uncertainties.</p> <p>The use of 'average random uncertainty' on page 56 is inappropriate.</p> <p>In addition, there is no indication as to how this value was obtained.</p> <p>There is no consistency in the use of random uncertainty.</p> <p>The candidate has attempted a treatment of uncertainties on page 59, but there are significant mistakes.</p> <p>The candidate has given scale reading uncertainties for procedure 3 on page 61, but the scale reading uncertainties in length is likely to be incorrect.</p>
5 Discussion (conclusion(s) and evaluation)	b	3	0	<p>The candidate has given a brief evaluation for each procedure, but nothing of quality.</p> <p>The candidate is aware of the need to have a sufficient data range and repeats. The statement about 20 swings is felt to be trivial and having it swing from a larger angle would invalidate the small angle approximation in the theory for the simple pendulum.</p> <p>The statement about volume on page 59 would have made little difference to the radius and was felt to be trivial for the analysis used by the candidate.</p> <p>The candidate is aware of the need to have a range of masses but there</p>

Section	Mark available		Mark awarded	Comments
				are no other valid statements for procedure 3.
	c	3	1	<p>There are no comments on the planning of the project, neither the selection of procedures, problems encountered during planning or any required modifications to planned procedures.</p> <p>There is little of quality, but the candidate has compared their results with the accepted value for <math>g</math>.</p>
<b>Total</b>	<b>14</b>		<b>3</b>	