

**GCSE Environmental Science - Specimen Material**  
**Unit 2 Investigations in Environmental Science - ISA**

*Solar Cells – Marking Guidelines*

**Valid for submission in xxxx**

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.

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 the 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.

In some questions candidates are assessed on using good English, organising information clearly and using specialist terms where appropriate.

Instructions for assessing QWC are given against the appropriate questions in the mark scheme

<b>Section 1</b>			
<b>Question</b>	<b>Answer</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>1(a)</b>	range correctly stated	must state minimum and maximum values, and must match candidate's own data  ignore units	1 mark
<b>1(b)</b>	either yes or no with reason, eg Yes: because it gave a large difference between the two extremes  <b>or</b> No: because there was very little difference between the two extremes	no mark for simply choosing yes or no	1 mark
<b>2</b>	dependent variable correctly named	eg voltage output of solar cell	1 mark

3	<p>either yes or no with reason eg</p> <p>Yes: because some of the readings did not fit the pattern / there were some anomalous results/ to improve reliability</p> <p><b>or</b></p> <p>No: because all the results formed a clear pattern/ all the points lay very close to a best fit line on the graph</p>	no mark for simply choosing yes or no	1 mark
4(a)	statement made consistent with candidate's results eg 0.01	you may ignore units	1 mark
4(b)	<b>precision</b>		1 mark
5	to determine a suitable range (of the independent variable) or choice of measuring instrument	do <b>not</b> accept 'to see if it works'	1 mark
6(a)	<p>amplified statement gains <b>2</b> marks</p> <p>simple correct statement gains <b>1</b> mark only</p> <p>eg for <b>1</b> mark</p> <p>the area of the solar cell affects the output voltage</p> <p><b>or</b></p> <p>eg for <b>2</b> marks</p> <p>the larger the area the larger the output voltage</p>	answer must relate to candidate's own data	2 marks
6(b)	<p>amplified quantitative statement gains <b>2</b> marks</p> <p>simple qualitative statement gains <b>1</b> mark only</p> <p>eg for <b>1</b> mark</p> <p>the graph shows an upward sloping line</p> <p>eg for <b>2</b> marks</p> <p>for every extra cm<sup>2</sup> exposed, there was an increase in the output voltage of 10 mV</p>	answer must relate to candidate's own data	2 marks

7	<p>sensible suggestion that would improve <b>accuracy</b> eg</p> <p>more repeats <b>and</b> calculate new mean/ repeat using a different technique or equipment</p>	<p>do <b>not</b> allow generalisations such as 'take more care'</p>	1 mark
8	<p><b>Table:</b> Correct headings and units all correct for all measured variables</p> <p>Table with incomplete headings or units for the measured variables = <b>1</b> mark</p> <p><b>Graph:</b></p> <ul style="list-style-type: none"> <li>• x axis: suitable scales chosen and labelled with quantity and units</li> <li>• y axis: suitable scales chosen and labelled with quantity and units</li> <li>• points or bars plotted correctly to within <math>\pm 1</math> mm</li> </ul> <p>Suitable line drawn on graph or bars correctly labelled on bar chart</p>	<p>eg all headings present = <b>1</b> mark eg all units present = <b>1</b> mark</p> <p>as a 'rule of thumb', add up the total number of headings and units that should be present, then:</p> <ul style="list-style-type: none"> <li>• all present and correct = <b>2</b> marks</li> <li>• some missing, but at least half present and correct = <b>1</b> mark</li> <li>• fewer than half present and correct = <b>0</b> marks</li> </ul> <p>accept axes reversed it may not always be necessary to show the origin</p> <p>scale should be such that the plots occupy at least one third of each axis</p> <p>allow one plotting error out of each 5 points plotted</p> <p>allow error carried forward from incorrect points</p> <p>if wrong type of graph/chart, maximum <b>3</b> marks</p> <p>if the independent variable is:</p> <ul style="list-style-type: none"> <li>• <i>continuous</i>: should draw a best fit line graph N.B. if no line possible because there is no correlation, candidates should state this on the graph to gain the mark</li> <li>• <i>categoric</i>: should draw a bar chart</li> <li>• <i>discrete</i>: you may allow either a bar chart or a line graph</li> </ul>	<p>2 marks</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p>
<b>Max for Section 1</b>			<b>18</b>

<b>Section 2</b>			
<b>9</b>	Marks awarded for this answer will be determined by the quality of written communication.		
	The answer is coherent and in a logical sequence. It contains a range of appropriate or relevant specialist terms used accurately. The answer shows very few errors in spelling, punctuation and grammar. There is a clear and detailed scientific description of how to carry out an investigation into how the area of solar cells affects the voltage produced so that the method gives valid results.	<b>4</b>	
	The answer has some structure and the use of specialist terms has been attempted, but not always accurately. There may be some errors in spelling, punctuation and grammar. There is a scientific description of how to carry out an investigation into how the area of solar cells affects the voltage produced so that the method gives valid results, but there is a lack of clarity and detail.	<b>2-3</b>	
	The answer is poorly constructed with an absence of specialist terms or their use demonstrates a lack of understanding of their meaning. The spelling, punctuation and grammar are weak. There is a brief description of how to carry out an investigation into solar cells using a method that gives results, which has little clarity and detail.	<b>1</b>	
	No relevant content.		<b>0</b>
	Examples of scientific points that may contribute to a candidate's response:		
	<ul style="list-style-type: none"> <li>• connect voltmeter to solar panel</li> <li>• measure area of exposed panel</li> <li>• exclude any extraneous light/ place equipment in light-proof box</li> <li>• turn on light source</li> <li>• record output voltage</li> <li>• change area exposed</li> <li>• repeat measurement for new area</li> <li>• repeats made for the same area</li> </ul>		

<b>10(a)</b>	there is a voltage when no area is exposed		1 mark
<b>10(b)</b>	deducted the zero error (10) from all readings		1 mark
<b>11</b>	any suitable control variable, eg light intensity/ distance of lamp from solar cell/ background lighting/ colour of light/ temperature		1 mark
<b>12</b>	<b>continuous</b>		1 mark
<b>13(a)</b>	idea of identifying anomalies/ being able to see spread of results		1 mark
<b>13(b)</b>	add the repeat values together and divided by the number added together		1 mark
<b>14(a)</b>	there appears to be an anomalous result in that region (so needs to replace that result)		1 mark
<b>14(b)</b>	smooth curve missing at the anomalous point		1 mark
<b>14(c)</b>	similarity noted	eg they both show an increase in voltage with area	1 mark
	difference noted	eg my graph continued rising and didn't flatten out	1 mark
<b>15(a)</b>	correct statement eg hardly any increase in voltage between 250 cm <sup>2</sup> and 500 cm <sup>2</sup> / double the area would double the cost for very little gain		1 mark
<b>15(b)</b>	idea of being influenced by non-scientific factors, eg commercialism/ increase profits		1 mark
<b>Max for Section 2</b>			<b>16</b>
<b>Total for ISA</b>			<b>34</b>