GCSE Science – Controlled Assessment ISA – Marking Guidelines

Science ISA – PU1.1 Solar Cells

For submission in May 2012 or January 2013

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 and fasten them together with the results table(s) and the graphical work and the candidate's research work from Section 1 of the ISA.

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.

These Marking Guidelines are necessarily generic. Additional guidance on how to relate these generic mark schemes to particular investigations are given below the generic section.

Read through the whole of the candidate's answer and use the Marking Guidelines below to arrive at a 'best-fit' mark.

The layout on the ISA has been designed to help the candidate to structure an answer, but it does not matter if the candidate has written part of the answer in what you consider to be the wrong section of a question.

SECTION 1

	0 marks	1 mark	2 marks	3 marks
Q. No. 1	No creditworthy response	Two relevant sources are identified **or** The usefulness of one of the sources is commented on	Two relevant sources are clearly identified. The usefulness of the sources is commented on.	Two relevant sources are clearly identified. The usefulness of both sources is explained and a comparison made.
Additional Guidance	*A clearly identified source is referred to by title and author or for websites at least the name of the web site should be quoted.* *A clear comment on only one of the sources may be sufficient to gain 2 marks if the answer implies a comment on the other source.* *If candidates have taken part in peer discussion as part of their research, simply stating this is not sufficient to qualify for quoting a source.* *Similarly reference to their own notes or exercise book alone is insufficient.*			

PU1.1 Solar Cells ISA - Marking Guidelines

SECTION 1				
	0 marks	**1 mark**	**2 marks**	**3 marks**
Q. No. 2	No creditworthy response.	A method for determining the interval is attempted but is incomplete. Only one value to be investigated in the preliminary experiment is suggested. Little or no mention is made of measurement of the dependent variable.	There is a clear statement of what is meant by the term 'interval'. A method for determining the interval is stated, but incomplete. Values to be investigated in the preliminary experiment are suggested but may not all be appropriate. The dependent variable is stated, but details concerning its measurement are incomplete. A statement concerning how the results could be used has been made, but is unclear.	There is a clear statement of what is meant by the term 'interval'. A suitable method for determining the interval is stated. Appropriate values to be investigated in the preliminary experiment are suggested. Measurement of the dependent variable is correctly described. A clear statement concerning how the results could be used to determine the best value for the interval has been made.
Additional Guidance	*A suitable method is likely to involve measuring the output voltage for two different areas of solar cell exposed, and then comparing the values.* *The way in which the results could be used is likely to refer to deciding whether or not there is sufficient (or too much) difference between the output voltages for the two areas used.* *Do **not** give full credit to a candidate who describes how to do the entire investigation at this stage*			

PU1.1 Solar Cells ISA - Marking Guidelines

<table>
<tr><th colspan="5">SECTION 1</th></tr>
<tr><td rowspan="8">Q. No. 3</td><td colspan="4">In this question candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to use good English, organise information clearly and use specialist vocabulary where appropriate.

Read through the whole of the candidate's answer and use the marking guidelines below to arrive at a best fit mark, as candidates may meet some criteria but not others in a level.</td></tr>
<tr><td>0 marks</td><td>1, 2 or 3 marks</td><td>4, 5 or 6 marks</td><td>7, 8 or 9 marks</td></tr>
<tr><td>No creditworthy response.</td><td>Most of the necessary equipment is stated</td><td>All of the major items of equipment are stated.</td><td>All of the major items of equipment are stated.</td></tr>
<tr><td></td><td>The method described is weak but shows some understanding of the sequence of an investigation.</td><td>The method described will enable valid results to be collected.</td><td>The method described will enable valid results to be collected.</td></tr>
<tr><td></td><td>The measurements to be made are stated</td><td>The measurements to be made are stated, at least one control variable is identified.</td><td>The measurements to be made are stated, and control variables are clearly identified with details of how they will be monitored or controlled.</td></tr>
<tr><td></td><td>An appropriate hazard is identified, but the corresponding risk assessment and control measure is weak or absent.</td><td>Any significant hazards are identified, together with a corresponding control measure but the risk assessment is weak or absent.</td><td>Any significant hazards are identified, together with an assessment of the associated risks and corresponding control measures.</td></tr>
<tr><td></td><td>The answer is poorly organised, with almost no specialist terms and little or no detail.</td><td>The answer has some structure and organisation, use of specialist terms has been attempted but not always correctly, some detail is given.</td><td>The answer is coherent and written in an organised, logical sequence, containing a range of a relevant specialist terms used correctly.</td></tr>
<tr><td></td><td>The spelling, punctuation and grammar are very weak.</td><td>There is reasonable spelling, punctuation and grammar, although there may still be some errors.</td><td>The answer shows almost faultless spelling, punctuation and grammar.</td></tr>
<tr><td>Additional Guidance</td><td colspan="4">Typical hazards with associated risk reduction might include: the bench lamp could get very hot, low risk of burning if touched with hand, do not place bench lamp too close to the solar cell.

It may be possible to credit a clearly labelled diagram for some of the marks.</td></tr>
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PU1.1 Solar Cells ISA - Marking Guidelines

SECTION 1				
	0 marks	**1 mark**	**2 marks**	**3 marks**
Q. No. 4	No creditworthy response.	There is an indication that ambient lighting might affect the results. There is little understanding that this could lead to an uncertainty in the measurements.	There is a statement that ambient lighting might affect the results. There is an understanding that this could lead to an uncertainty in the measurements. There is a suggestion that if the ambient lighting is constant, the results will still be valid.	There is a statement that ambient lighting would affect the output voltage. There is an understanding that this could lead to a systematic uncertainty or error. There is a statement that either a constant value will be deducted from all reading or a proposal to control the ambient lighting.
Additional Guidance	*Suggestions for controlling the ambient light levels might include conducting the experiment inside a light-proof box.*			

	0 marks	**1 mark**	**2 marks**
Q. No. 5	No table or a table with incomplete headings or units for the measured variables. Fewer than half of the required elements are present.	A table with incomplete headings or units for the measured variables. At least half of the required elements are present.	Correct headings and units present for all measured variables.
Additional Guidance	*The table should be able to accommodate all the* variables *that the candidate is going to record during the investigation. There is no need for the candidate to include columns for repeats, means or derived values.*		

PU1.1 Solar Cells ISA - Marking Guidelines

SECTION 2				
Q. No. 1 (a)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Any **one** variable correctly identified.	Any **two** variables correctly identified.	All **three** variables correctly identified.
Additional Guidance	*The independent variable is the area of solar cell exposed* *The dependent variable is the output voltage (from the solar cell)* *Examples of control variables include the distance from the bench lamp to the solar cell, or the background lighting level.*			
Q. No. 1 (b)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	A correct value for the resolution is given. **or** A sensible but incorrect value is given for the resolution, with a correct statement appropriate to the resolution they have given.	A correct value for the resolution is given. A correct statement as to whether or not the resolution was appropriate is given, but the explanation is not clear.	A correct value for the resolution is given. A correct statement as to whether or not the resolution was appropriate is given with a clear explanation.
Additional Guidance	*Look at the candidate's table of results in order to confirm the resolution. A clear explanation will convey that the candidate understands the term resolution.*			

SECTION 2				
Q. No. 1 (c)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	There is a correct statement regarding whether or not any results were repeated and there is reference to the possibility or otherwise of anomalous results	There is a correct statement regarding whether or not any results were repeated and there is reference to the possibility or otherwise of anomalous results There is an attempt to suggest a reasonable cause of possible errors	There is a correct statement regarding whether or not any results were repeated and there is reference to the possibility or otherwise of anomalous results There is an attempt to suggest a reasonable cause of possible errors There is an explanation as to the cause of possible errors **with** reference to numerical data from their own results
Additional Guidance	*If the candidate answers yes, they may refer to a clearly anomalous result that needs repeating, or to the fact that not all the points lie comfortably on a line of best fit (random errors) or to a systematic error.* *If the candidate answers no, they may refer to, eg all points on the graph lying close to the best fit line.* *Reference to lack of time may be allowed for 1 mark at the teacher's discretion, but should be annotated.*			
Q. No. 1 (d)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	At least one end of the candidate's range is correctly stated. Another value of the independent variable is suggested, although it may not be appropriate.	The range is correctly stated, according to the candidate's own results. Another appropriate value of the independent variable is suggested.	The range is correctly stated, according to the candidate's own results. Another appropriate value of the independent variable is suggested. The reason given for the choice of the additional reading is appropriate.
Additional Guidance	*An appropriate extra reading will usually be one of the following:* • *an intermediate reading to fill in a gap, perhaps where the trend line becomes unclear* • *a reading outside the range already investigated, perhaps to see if the trend continues.*			

PU1.1 Solar Cells ISA - Marking Guidelines

SECTION 2				
	0 marks	**1 mark**	**2 marks**	**3 marks**
Q. No. 1 (e)	No creditworthy response.	A simple correct statement is made as to whether or not the results support the hypothesis, with an attempt at an explanation	A simple correct statement is made as to whether or not the results support the hypothesis and an explanation that includes a **simple** description of a correctly identified pattern or lack of pattern:	A simple correct statement is made as to whether or not the results support the hypothesis and an explanation that includes a **detailed** description of a correctly identified pattern or lack of pattern
Additional Guidance	*Answers must be consistent with candidate's data*			

	0 marks	**1 mark**	**2 marks**
Q. No. 2 (a)	No creditworthy response.	Both axes are labelled with the variables (ignore any units)	Both axes are labelled with the variables (ignore any units) **and** an appropriate line drawn.
Additional Guidance	*Accept axes drawn either way round (ie it doesn't matter which axis the area is on).* *The line should be a straight line, sloping from bottom left to top right.* *No values need to be shown on either axis and the line may intercept either axis.*		

PU1.1 Solar Cells ISA - Marking Guidelines

SECTION 2				
Q. No. 2 (b)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	A clear statement is made that Case Study **1** supports the hypothesis A simple correct statement is made about one of the other Case studies	A clear statement is made that Case Study **1** supports the hypothesis Correct statements are made about both Case studies **2** and **3** supported by a more detailed explanation of **one** of them	A clear statement is made that Case Study **1** supports the hypothesis Correct statements are made about both Case studies **2** and **3** supported by a more detailed explanation of **both** of them
Additional Guidance	*An example of a clear statement for Case Study **1** is "the greater area of the solar cell, the greater the voltage".* *Further explanation for Case Study **3** could include reference to the variables in results between the two tests.* *Further explanation for Case Study **2** will be that the results are based on wavelength / colour of light rather than light intensity.*			
Q. No. 2 (c)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Any **one** of the following statements is made: • neither axis has any units • the grid has no vertical lines • there are only 3 points plotted • poor use of space	All of the following statements are made: • neither axis has any units • the grid has no vertical lines • there are only 3 points plotted	All of the following statements are made: • neither axis shows any units • the grid has no vertical lines • there are only 3 points plotted • the graph does not show the origin
Additional Guidance	*There are no marks simply for saying whether or not the candidate agrees with the conclusion. The marks are for the explanation which should imply whether or not there is agreement.* *For 3 marks, the candidate should show understanding that in order to confirm direct proportionality, the graph should show a straight line passing through the origin. In this case it is unclear from the graph shown whether the line – if extrapolated – would have passed through the origin so it is not possible to agree with the statement.*			

SECTION 2				
Q. No. 3	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	An idea from the research has been related to the context.	An idea from the research has been related to the context. There is a simple explanation of how this idea can be useful in the given context.	An idea from the research has been related to the context. There is a detailed explanation of how this idea can be useful in the given context.
Additional Guidance	*The candidate should attempt to explain, for example, how manufacturers of calculators could work out the optimum area of solar cell needed for a particular calculator.*			

	Answer	**Additional Guidance**	**Mark**
Q. No. 4	X axis: suitable scales chosen and labelled with quantity and units.	Scale should be such that the plots occupy at least one-third of each axis. Accept axes reversed. It may not always be necessary to show the origin.	**1**
	Y axis: suitable scales chosen and labelled with quantity and units.		**1**
	Points or bars plotted correctly to within ± 1 mm.	Allow one plotting error out of each 5 points/bars plotted.	**1**
	Suitable line drawn on graph or bars correctly labelled on bar chart.	Allow error carried forward from incorrect points. If wrong type of graph / chart, maximum **3** marks. If the independent variable is: • categoric; a bar chart should be drawn • continuous; a best fit line should be drawn **NB** If no line is possible because there is no correlation, candidates should state this on the graph to gain the mark	**1**