# GCSE Science – Investigative Skills Assignment – Marking Guidelines

## Physics 1.3 – Efficiency of Light Bulbs

## 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** | Which power of light bulb is the most efficient<br>**or**<br>Which power of light bulb produces the most heat | Allow to find out if the power of the light bulb affects its efficiency | 1 mark |
| **2**(a) | Correct independent variable<br>eg power of the light bulb | Allow voltage applied to bulb if this is what was done | 1 mark |
| (b) | Correct reason given<br>eg **Yes** – because I was able to see a pattern in the results<br>**or**<br>**No** – because I don't know what happens at powers above or below this range | No mark for stating the number<br>No mark for **Yes** or **No** mark is for the reason | 1 mark |
| (c) | Sensible value chosen<br>Suitable reason given<br>eg because there is a gap in the pattern at this value or to extend the range | Value chosen will depend on candidate's results | 1 mark<br>1 mark |

| | Answer | Additional Guidance | |
|---|---|---|---|
| **3** | A continuous variable | | 1 mark |
| **4** | Amplified statement for **2** marks<br>eg the power of the bulb affected the temperature rise for **1** mark<br>**plus**<br>eg the more powerful the bulb, the hotter the water became / the more powerful the bulb, the less efficient it was for **2** marks<br>**or**<br>eg the temperature rise was the same for all bulbs for **1** mark<br>**plus**<br>eg therefore the most powerful bulb was the most efficient for **2** marks<br>**or**<br>eg there is no relationship between the power of the bulb and the temperature rise for **1** mark<br>**plus**<br>eg as there is no trend / the results are random for **2** marks | **NB** statement **must** relate to the candidate's own results<br>Simple correct statement for **one** mark only<br>**NB** the quality of the candidate's results is irrelevant, the important point is that the conclusion should match the results | 2 marks |
| **5**(a) | Confidence can be placed in them / they are reproducible | Allow they are accurate | 1 mark |
| (b) | Correct reason given<br>eg **Yes** – because they all lie close to a best-fit line<br>**or**<br>eg **No** – because I had several anomalous results | No mark for **Yes** or **No.**<br>Mark is for the reason | 1 mark |
| **6** | Cause<br>eg different equipment / different lamps / faulty technique / may not have measured water volumes accurately<br>Explanation<br>eg different power supplies may not provide same p.d. / lamps may vary slightly in manufacture / larger volume of water would show smaller temperature rise for same input | **NB** Explanation must relate to appropriate cause | 1 mark<br>1 mark |

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

**SECTION 2**

| | Answer | Additional Guidance | |
|---|---|---|---|
| **8**(a) | 13W fluorescent tube | | 1 mark |
| (b)(i) | Because of variation in the results / not all bulbs may be the same | | 1 mark |
| (ii) | Highest efficiency = 2.1 % | | 1 mark |
| (c) | 40 W tungsten filament | | 1 mark |
| (d)(i) | Any **two** from eg:<br>• idea of natural variation between different individual bulbs<br>• idea of reducing the effect of random errors<br>• idea of being able to spot any anomalous results<br>• idea of checking reliability / reproducibility of results | | 2 marks |

| | Answer | Additional Guidance | |
|---|---|---|---|
| (ii) | calculated the mean /average | allow description of how to calculate the mean | 1 mark |
| (iii) | eg because it shows raw data / we can see how variable the results are | | 1 mark |
| | eg because there would be too much data / couldn't see the general pattern | | 1 mark |
| | **Quality of written communication** | | 1 mark |
| | Candidates should use at least **two** technical terms from: eg<br>• data<br>• pattern<br>• variable<br>• variation | The mark is to be awarded for the **correct** use of technical terms<br><br>The marker should circle these terms<br>Annotate below candidate answer with *Q✓ for mark given or Q× for mark not given* | |
| (e) | Correct reason given<br>Any two from: eg<br>• we don't know the power input of the quartz halogen<br>• depends on what you want to use the lamp for<br>• depends on how much light intensity you require<br>• depends on what colour of light you require<br>• depends on type of fitting<br>• depends on space available | No mark for **Yes** or **No**<br>Mark is for the reason<br><br>Candidate should choose **'No'** | 2 marks |
| **9** | Intensity depends on colour / frequency / wavelength (or vice versa) | | 1 mark |
| | Graph peaks in the middle of the spectrum | Allow 'peaks at green' | 1 mark |
| **10** | Any **two** from eg:<br>• idea of conserving energy<br>• idea of protecting the environment<br>• saving money | Allow conserving fuel reserves<br><br>Allow explanation eg:<br>Reducing $CO_2$ emissions<br>Reducing effect on global warming<br>Reducing carbon footprint | 2 marks |
| | | | **Max 16 marks** |

**ISA Total 34 Marks**