<table>
<thead>
<tr>
<th>Band</th>
<th>The topic of the investigation is identified and research question is:</th>
<th>Background information provided for the investigation is:</th>
<th>Appropriateness of the methodology of the investigation.</th>
<th>Consideration of factors that may influence the relevance, reliability &amp; sufficiency of collected data.</th>
<th>Evidence of awareness of the significant safety, ethical or environmental issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Relevant and fully focused.</td>
<td>Entirely appropriate and relevant and enhances the understanding of the context of the investigation.</td>
<td>Highly</td>
<td>Nearly all factors considered.</td>
<td>Full - all potential hazards identified and dealt with appropriately</td>
</tr>
<tr>
<td>4</td>
<td>Relevant but not fully focused.</td>
<td>Mainly appropriate and relevant and aids the understanding of the context of the investigation.</td>
<td>Mainly</td>
<td>Some factors considered.</td>
<td>Limited</td>
</tr>
<tr>
<td>2</td>
<td>Some relevance but not focused.</td>
<td>Superficial or of limited relevance and does not aid the understanding of the context of the investigation</td>
<td>Limited</td>
<td>Few factors considered.</td>
<td>Some</td>
</tr>
<tr>
<td>0</td>
<td>Standard not reached</td>
<td>Standard not reached</td>
<td>Standard not reached</td>
<td>Standard not reached</td>
<td>Standard not reached</td>
</tr>
</tbody>
</table>

### Student Checklist

**Identification of the topic of investigation**

- □ Research Question or Aim clearly stated
  
  *If a hypothesis is required:*
  
  □ It is quantitative
  
  □ It may be in the form of Null and Alternative Hypothesis (if statistical test involved)
  
  □ Prediction is explained using **scientific theory**.
  
  □ Sources are cited appropriately.

**Background information**

- □ Background information provided is **relevant**.
  
  □ Background information **explains the context** of the investigation clearly.
  
  □ Sources are cited appropriately (in-text references and reference list provided).

**Appropriateness of the methodology of the investigation.**

- □ Does plan to collect data **address RQ?**
  
  □ Annotated photo of equipment or experimental set-up
  
  □ Method for recording results, including units and uncertainty of tools (± _ )
  
  □ **Min. 5 increments** over a suitable range for the IV (unless comparing populations)
  
  □ Method clearly presented in step-wise format and can be repeated by others.
  
  □ What statistical test(s) will be used? Why?
  
  □ Results table designed **before** investigation is planned, to guide procedure.
  
  □ Full citation of published protocol, if used.

**Consideration of factors that may influence the relevance, reliability and sufficiency of collected data.**

- □ IV correctly identified with **units/ range**
  
  □ Method to manipulate IV, including specific details of **range and increments**
  
  □ Explain how range of IV was selected
  
  □ DV correctly identified with **units and precision**
  
  □ Sufficient **repeats** at each increment to ensure **reliability** and allow for stats.
  
  □ List all variables to be controlled and present them as a table, for each variable:
    
    - How could it **impact** the results?
    
    - Exactly **how** will it be **controlled**? (Value, with method for achieving that value)

**Evidence of awareness of the significant safety, ethical or environmental issues**

- □ Safety/ ethics/environmental concerns addressed, including **animal experimentation policy**.
### ANALYSIS

<table>
<thead>
<tr>
<th>Band</th>
<th>Raw data is:</th>
<th>Data processing</th>
<th>Impact of uncertainties</th>
<th>Interpretation of processed data</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Sufficient. Could support a detailed and valid conclusion.</td>
<td>Appropriate and sufficient accuracy enables a conclusion to the RQ to be drawn that is fully consistent with data.</td>
<td>Full and appropriate consideration.</td>
<td>Correct valid and detailed interpretation.</td>
</tr>
<tr>
<td>4</td>
<td>Relevant but incomplete. Could support a simple or partially valid conclusion.</td>
<td>Appropriate and sufficient. Could lead to a broadly valid conclusion but significant inaccuracies and inconsistencies in the processing.</td>
<td>Some consideration.</td>
<td>Broadly valid limited interpretation.</td>
</tr>
<tr>
<td>2</td>
<td>Insufficient to support a valid conclusion.</td>
<td>Basic, inaccurate or too insufficient to lead to a valid conclusion</td>
<td>Little consideration.</td>
<td>Incorrect or insufficient invalid or very incomplete</td>
</tr>
</tbody>
</table>

### Student Checklist

#### Recording Raw Data

- Raw data clearly distinguished from processed data (possibly separate table)
- Table title is specific and clear, including IV and DV.
- Raw data collected is **sufficient** to support a **detailed** and **valid** conclusion.
- Units of IV and DV present and correct

#### Processing Raw Data

- Uncertainties correct (± ___)
- All data are recorded correctly and honestly
- Decimal points consistent throughout
- Decimal points consistent with precision of the measuring equipment
- Associated qualitative data (observations) MUST be recorded.

- Calculations to determine DV carried out, if necessary
- Table title is specific and clear, including IV and DV.
- Calculations or statistical tests appropriate to investigation and address RQ.
- Mathematics correctly applied
- Worked example calculations given
- Standard deviations included where appropriate, with appropriate DP.

#### Impact of Uncertainties

- Processed data (and decimal places) consistent with precision of recorded data
- Titles self-explanatory and complete
- Appropriate choice of graph
- Axes labeled clearly, including metric/ SI units and uncertainties of values
- Axes scaled appropriately
- Error bars included, unless insignificant
- Error bar source (e.g. standard deviation) stated and data are correct
- Line or curve of best fit included (if appropriate).

#### Interpretation of Processed Data

- Uncertainties adjusted to reflect any calculations carried out.
- Uncertainties/ errors included in tables and graphs.
- Uncertainties/ errors justified.

- **Patterns and trends** in data stated, with specific numerical reference to the graph/ tables.
- Comparisons, if appropriate, are made.
### Conclusion (data)
- Data related to RQ and hypothesis – to what extent to they agree/ disagree?
- Specific numerical reference to data
- Appropriate language used “Supports my hypothesis” (not ‘proves’ or ‘is correct’)
- Associated qualitative data add value to explanations.

### Conclusion (theory)-comparison to the scientific context
- Scientific explanation for results
- Comparison with published data and theoretical texts.
- Sources cited appropriately
- Reference list provided in the appropriate format.

### Discussion of the strengths and weaknesses of the investigation
- Reference to error bars (or STDEV) with regard to variability of results
- Evaluate random biological variation, measurement/ instrument errors, systematic error
- Analysis of reliability of results:
  - Possible effect on data
  - Significance of the weakness or limitation in terms of the data set
- Are data sufficient to address the RQ?
- Was the range of the IV appropriate?
- Identify & Explain anomalous data points
- This can be clearly presented in a table
- Refer to quantitative data

Time management or human error may be mentioned, though these are not scientific errors – they should be eliminated with good practical skills. The focus here should be on the investigation/method.

### Suggestions for the improvement and extension of the investigation
For each weakness or limitation mentioned above, how could improved experimental design remove or reduce the impact of the error in terms of:
- Techniques used to collect and record data, including precision of equipment
- Design of the investigation, including range of values chosen and repeats of each IV data point
- Realistic, specific (not: “more time” or “more careful work”) and achievable improvements.
- Suggestions for further investigation stated.
### COMMUNICATION

<table>
<thead>
<tr>
<th>Presentation of the investigation</th>
<th>Structure</th>
<th>Relevance</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear. Any errors do not hamper understanding of the focus, process and outcomes.</td>
<td>Well-structured and clear: the necessary information on focus, process and outcomes is present and presented in a coherent way.</td>
<td>Relevant and concise thereby facilitating a ready understanding of the focus, process and outcomes of the investigation.</td>
<td>The use of subject specific terminology and conventions is appropriate and correct. Any errors do not hamper understanding.</td>
</tr>
<tr>
<td>Unclear, making it difficult to understand the focus, process and outcomes</td>
<td>Not well structured and is unclear: the necessary information on focus, process and outcomes is missing or is presented in an incoherent or disorganized way.</td>
<td>The understanding of the focus, process and outcomes of the investigation is obscured by the presence of inappropriate or irrelevant information.</td>
<td>There are many errors in the use of subject specific terminology and conventions*.</td>
</tr>
</tbody>
</table>

Important aspects to take into account:
- □ Tables & graphs do not break across pages
- □ Graphs clear, colouring appropriate
- □ Effective use of space

### PERSONAL ENGAGEMENT

<table>
<thead>
<tr>
<th>Evidence of personal engagement with exploration.</th>
<th>The justification given for choosing the research question and/or the topic under investigation.</th>
<th>Evidence of personal input and initiative in the designing, implementation or presentation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear with significant independent thinking, initiative or creativity.</td>
<td>Demonstrates personal significance, interest or curiosity.</td>
<td>A lot</td>
</tr>
<tr>
<td>Limited with little independent thinking, initiative or insight.</td>
<td>Does not demonstrate personal significance, interest or curiosity.</td>
<td>Little</td>
</tr>
</tbody>
</table>