

Internal Assessment Criteria

Design

Level/marks	Aspect 1	Aspect 2	Aspect 3
	Defining the problem and selecting variables	Controlling variables	Developing a method for the collection of data
Complete / 2	Formulates a focused problem/research question and identifies the relevant variables.	Designs a method for the effective control of variables.	Develops a method that allows for the collection of sufficient relevant data.
Partial / 1	Formulates a problem/research question that is incomplete or identifies only some relevant variables.	Designs a method that makes some attempt to control the variables.	Develops a method that allows for the collection of insufficient relevant data.
Not at all / 0	Does not identify a problem/research question and does not identify any relevant variables.	Designs a method that does not control the variables.	Develops a method that does not allow for any relevant data to be collected.

Aspect 1: defining the problem and selecting variables

- Students must identify a focused research question and not merely repeat the aim provided by the teacher.
- Variables are factors that can be measured and/or controlled. Independent variables are those that are manipulated. A controlled variable is one that should be held constant so as to not obscure the effects of the independent variable on the dependent variable.
- Variables should be identified explicitly as the dependent (measured), independent (manipulated) and controlled variables (constants).

Aspect 2: controlling variables

- “Control of variables” refers to the manipulation of the independent variable and the attempt to maintain the controlled variables at a constant value.
- The method should include explicit reference to how the control of variables is achieved. If the control of variables is not practically possible, some effort should be made to monitor the variable(s).

Aspect 3: developing a method for the collection of data

- The planned investigation should anticipate the collection of sufficient data so that the research question can be suitably addressed and an evaluation of the reliability of the data can be made.
- If an error analysis of standard deviation is to be carried out, then a sample of at least five is needed. This is also true for graphing purposes.

Data Collection and Processing

Level/marks	Aspect 1	Aspect 2	Aspect 3
	Recording raw data	Processing raw data	Presenting processed data
Complete / 2	Records appropriate quantitative and associated qualitative raw data, including units and uncertainties where relevant.	Processes the quantitative raw data correctly.	Presents processed data appropriately and, where relevant, includes errors and uncertainties.
Partial / 1	Records appropriate quantitative and associated qualitative raw data, but with some mistakes or omissions.	Processes quantitative raw data, but with some mistakes and/or omissions.	Presents processed data appropriately, but with some mistakes and/or omissions.
Not at all / 0	Does not record any appropriate quantitative raw data or raw data is incomprehensible.	No processing of quantitative raw data is carried out or major mistakes are made in processing.	Presents processed data inappropriately or incomprehensibly.

- Ideally, students should work on their own when collecting data. If data is collected in groups, the actual recording and processing of data should be independent.
- If pooled data is used, students must clearly indicate which data is their own.

Aspect 1: recording raw data

- Raw data is the actual data measured. This may include associated qualitative data.
- Uncertainties are associated with all raw data. Uncertainties in measurements must be indicated. It is usually +/- whatever the smallest gradation of the instrument is.
- In tables of quantitative data, columns should be clearly annotated with a heading, units, and the uncertainty of measurement.
- Significant digits in the data and the uncertainty in the data must be consistent. The number of significant digits should reflect the precision of the instrument.
- There should be no variation in the precision of raw data. For example, the same number of decimal places should be used.
- For data derived from processing (eg – means), the level of precision should be consistent with that of the raw data.

Aspect 2: processing raw data

- Data processing involves combining and manipulating raw data to determine the value of a physical quantity (eg – adding, subtracting, dividing), and taking the average of several measurements and transforming data into a form suitable for graphical representation.
- If the raw data is already in a suitable form, then a best-fit line graph should be drawn. Plotting raw data without a best-fit line does not constitute processing data.
- The raw and processed data may be shown in one table providing they are clearly distinguishable.
- Statistical analysis carried out using calculators or spreadsheets are acceptable.

Aspect 3: presenting processed data

- Students are expected to decide upon suitable presentation format themselves (eg – spreadsheet, table, graph, chart, flow diagram, etc...)
- There should be clear, unambiguous headings for calculations, tables or graphs.
- Graphs should have appropriate scales, labeled axes with units, and accurately plotted data points with a suitable best-fit line or curve. Use of software for graph drawing is acceptable.
- Students should present the data so that all stages to the final result can be followed. For repetitive calculations, one a sample is necessary.
- Metric/SI units should be used at all times and expressed to the correct number of significant digits.
- The uncertainties associated with raw data should be taken into account. Error bars on data points in graphs may also be used to express the degree of uncertainty in the data.

Conclusion and Evaluation

Level/marks	Aspect 1	Aspect 2	Aspect 3
	Concluding	Evaluating procedures(s)	Improving the investigation
Complete / 2	States a conclusion, with justification, based on a reasonable interpretation of the data.	Evaluates weaknesses and limitations.	Suggests realistic improvements in respect of identified weaknesses and limitations.
Partial / 1	States a conclusion based on a reasonable interpretation of the data.	Identifies some weaknesses and limitations, but the evaluation is weak or missing.	Suggests only superficial improvements.
Not at all / 0	States no conclusion or the conclusion is based on an unreasonable interpretation of the data.	Identifies irrelevant weaknesses and limitations.	Suggests unrealistic improvements.

Aspect 1: concluding

- Analysis may include comparisons of different graphs or descriptions of trends shown in graphs.
- The explanation should include observations, trends, or patterns revealed by the data.
- When measuring an already known and accepted value students should compare the experimental value with a textbook or literature value. This should be fully referenced.

Aspect 2: evaluating procedure(s)

- The design and method, as well as the quality of the data must be commented on.
- The students must show appreciation for how significant identified weaknesses are.
- The precision and accuracy of the measurements are relevant here.
- When evaluating procedure, the processes, use of equipment and management of time should be specifically looked at.

Aspect 3: improving the investigation

- Suggestions for improvement should be based on the weaknesses and limitations identified.
- Modifications to the experimental techniques and the data range can be addressed here.
- The modifications proposed should be realistic and clearly specified.

Manipulative Skills (assessed summatively)

Level/marks	Aspect 1	Aspect 2	Aspect 3
	Following Instructions*	Carrying out techniques	Working safely
Complete / 2	Follows instructions accurately, adapting to new circumstances (seeking assistance when required).	Competent and methodical in the use of a range of techniques and equipment.	Pays attention to safety issues.
Partial / 1	Follows instructions but requires assistance.	Usually competent and methodical in the use of a range of techniques and equipment.	Usually pays attention to safety issues.
Not at all / 0	Rarely follows instructions or requires constant supervision.	Rarely competent and methodical in the use of a range of techniques and equipment.	Rarely pays attention to safety issues.

* Instructions may be in a variety of forms: oral, written worksheets, diagrams, photographs, videos, flow charts, audio tapes, models, computer programs, and so on, and need not originate from the teacher.

Personal Skills (for group 4 project assessment only)

Level/marks	Aspect 1	Aspect 2	Aspect 3
	Self-motivation and perseverance	Working within a team	Self-reflection
Complete / 2	Approaches the project with self-motivation and follows through to completion.	Collaborates and communicates in a group situation and integrates the views of others.	Shows a thorough awareness of their own strengths and weaknesses and gives thoughtful consideration to their learning experience.
Partial / 1	Completes the project but sometimes lacks self-motivation.	Exchanges some views but requires guidance to collaborate with others.	Shows limited awareness of their own strengths and weaknesses and gives some consideration to their learning experience.
Not at all / 0	Lacks perseverance and motivation.	Makes little or no attempt to collaborate in a group situation.	Shows no awareness of their own strengths and weaknesses and gives no consideration to their learning experience.