Student Name:	Student Code:

IA Title:

	Criteria				
	Research Design	Data Analysis	Conclusion	Evaluation	Total
Marks Awarded					
Marks Available	6	6	6	6	**24**

The report should be a maximum of 3,000 words. The word count does not include data tables, sketches, graphs, headings, references or bibliographies

Research Design

This criterion assesses the extent to which the student effectively communicates the methodology (purpose and practice) used to address the research question.

Mark	Aspect		
	Research Question	Methodological considerations	Methodology
0	The report does not reach the standard described by the descriptors below		
1 2	The research question is **stated** without context	Methodolical considerations associated with collecting data relevant to the research question are **stated**	The description of the methodology for collecting or selecting data lacks the detail to allow for the investigation to be reproduced
3 4	The research question is **outlined** within a broad context	Methodological considerations associated with collecting relevant and sufficient data to answer the research question are **described**.	The description of the methodology for collecting or selecting data allows for the investigation to be reproduced with few ambiguities or omissions.
5 6	The research question is **described** within a specific and appropriate context.	Methodological considerations associated with collecting relevant and sufficient data to answer the research question are **explained**.	The description of the methodology for collecting or selecting data allows for the investigation to be reproduced.

Checklist

Research Question components:		Independent variable(s) explained/justified:			specific materials used (with quantities)
	independent variable with range (and unit if applicable)		selection of the method for measuring the IV		specific apparatus used (with uncertainties)
	dependent variable(s) with unit and time frame (if applicable)		justification regarding the scope of measurements (IV range + increments)		precise, logical procedural steps
	Study species		the quantity of measurement (trials/repeats and time frame)		diagrams/images of procedural setup/steps
Background:		Dependent variable(s) explained/justified:			avoiding uncessary or repetitive information
	description of the system in which RQ is embedded (context)		selection of the method for measuring the DV		methodology is easy to understand and follow and is in principle repeatable
	background theory of direct relevance and justifies/sets up choice of RQ		regarding the quality of measurements (precision of measurements)		
	study species described and justified	Control variables explained/justified:			
	background used to formulate a hypothesis		impact on DV		
			method of their control		
			how uncontrolled variables will be monitored/taken into account		
		Considerations explained/justified:			
			Safety considerations relating to hazards/safe handling (impact and mitigation)		
			Environmental considerations relating to disposal/disturbance (impact and mitigation)		
			Ethical considerations (if animals/personal data/databases used)		

Data Analysis

This criterion assesses the extent to which the student's report provides evidence that the student has recorded, processed and presented the data in ways that are relevant to the research question.

Mark	Aspect		
	Communication of Data	Consideration of Uncertainties	Data Processing
0	The report does not reach the standard described by the descriptors below		
1 2	The recording and processing of the data is communicated but is <u>neither</u> **clear nor precise**.	The recording and processing of data shows **limited evidence** of the consideration of uncertainties.	Some processing of data relevant to addressing the research question is carried out but with **major omissions, inaccuracies or inconsistencies.**
3 4	The communication of the recording and processing of the data is <u>either</u> **clear or precise**.	The recording and processing of data shows **evidence** of a consideration of uncertainties but with **some significant omissions or inaccuracies**.	The processing of data relevant to addressing the research question is carried out but with **some significant omissions, inaccuracies or inconsistencies.**
5 6	The communication of the recording and processing of the data is <u>both</u> **clear and precise.**	The recording and processing of data shows **evidence** of an **appropriate consideration** of uncertainties.	The processing of data relevant to addressing the research question is carried out **appropriately and accurately.**

Checklist						
	☐	sufficient and relevant data collected	☐	uncertainty of measurement provided	Appropriate and accurate processing, including:	
	☐	qualitative data colelcted and described	☐	precision of measurement in tables/graphs	☐	mean and standard deviation
	☐	clear communication: method of processing can be understood easily (descriptions, sample calculation, screenshots, etc.)	☐	uncertainty is consistently reported	☐	statisitical tests
	☐	H_0 and H_A for statistical tests presented	☐	significance testing (ex: ANOVA) with displayed *p* values	☐	choice and presentation of graph (scale, title, axes labels)
	precise communication - following conventions:		☐	outliers identified/discussed	☐	valid conclusion is able to be drawn from data that addresses RQ
	☐	annotations of graphs and tables	☐	graph displays and reports uncertainty (error bars and R^2 value, if scatter plot)		
	☐	use of SI units, decimal places, sig figs				

Conclusion

This criterion assesses the extent to which the student successfully answers their research question with regard to their analysis and the accepted scientific context.

Mark	Aspect	
	Interpretation of Data	Scientific Context
0	The report does not reach the standard described by the descriptors below	
1 2	A conclusion is **stated** that is relevant to the research question but is <u>not supported by the analysis</u> presented.	The conclusion makes <u>superficial comparison</u> to the accepted scientific context.
3 4	A conclusion is **described** that is relevant to the research question but is <u>not fully consistent with the analysis</u> presented.	A conclusion is described that makes <u>some relevant comparison</u> to the accepted scientific context
5 6	A conclusion is **justified** that is relevant to the research question and <u>fully consistent with the analysis</u> presented	A conclusion is justified through <u>relevant comparison</u> to the accepted scientific context.

Checklist		patterns and trends in data described with reference to the graph/tables	scientific explanation for results include:	
				comparison made with published material, values, course notes, textbooks or outside sources. Discrepencies discussed
		variation within the data (st dev, stats) discussed		explantion justified with explicit reference to the data
		anomolies identified and discussed		citation of published materials detailed and appropriate
		measurement uncertainty/experimental error discussed		
		conclusion based on and refers to the interpretation of processed and raw data		
		hypothesis readdressed		
		research question restated and addressed		

Evaluation

This criterion assesses the extent to which the student's report provides evidence of evaluation of the investigation methodology and has suggested improvements.

Mark	Aspect	
	Methodological Weaknesses/Limitations	Improvements
0	The report does not reach the standard described by the descriptors below	
1 2	The report **states** <u>generic</u> methodological weaknesses or limitations	Realistic improvements to the investigation are **stated**
3 4	The report **describes** <u>specific</u> methodological weaknesses or limitations	Realistic improvements to the investigation, that are <u>relevant to the identified weakenesses or limitations</u> are **described**
5 6	The report **explains** the relative impact of <u>specific</u> methodological weaknesses or limitations	Realistic improvements to the investigation, that are <u>relevant to the identified weakenesses or limitations</u> are **explained**

Checklist				
	Methodological and procedural weaknesses/limitations are specific and relevant to investigation (not generic) including:			improvements are realistic (in a highschool setting)
				improvements related to identified weaknesses/limitations
		Issues relating to control variables		
		Issues relating to the precision of measurement		
		Issues relating the variation in the data		
		limited range in data collected		
		confines of the system (availability of materials/time, etc.)		
		applicability of assumptions made		