	Chemistry and Physics - Independent Experiment (IA) Form	

Candidate's Name (Family Name, Given Name)	**Student ID Number**	
Instructors Name	**Subject and Level**	**Date Performed**
Title and brief description of the investigation:		

LEVELS AWARDED

Personal Engagement	**Exploration**	**Analysis**	**Evaluation**	**Communication**	**TOTAL**
/2	/6	/6	/6	/4	/

NOTE: A score of ZERO (0) in any category indicates that that category of the report does not reach the minimal level as described in the category

Personal Engagement			
Limited (1)		*Significant (2)*	*Mark*
The evidence of personal engagement with the exploration is limited with little independent thinking, initiative or creativity.		**The evidence of personal engagement with the exploration is clear with significant independent thinking, initiative or creativity.**	
The justification given for choosing the research question and/or the topic under investigation does not demonstrate personal significance, interest or curiosity.		The justification given for choosing the research question and/or the topic under investigation demonstrates personal significance, interest or curiosity.	
There is little evidence of personal input and initiative in the designing, implementation or presentation of the investigation.		There is evidence of personal input and initiative in the designing, implementation or presentation of the investigation.	

Exploration			
Not Focused/Superficial – Mark (1-2)	*Not Focused but Relevant – Mark (3-4)*	*Focused/Major Factors Addressed – Mark (5-6)*	*Mark*
The topic of the investigation is identified and a research question of some relevance is **stated but it is not focused**.	The topic of the investigation is identified and a relevant but not fully focused research question is described.	The topic of the investigation is identified and a relevant and fully focused research question is clearly described.	
The background information provided for the investigation is **superficial** or of limited relevance and does not aid the understanding of the context of the investigation.	The background information provided for the investigation is mainly appropriate and relevant and aids the understanding of the context of the investigation.	The background information provided for the investigation is entirely appropriate and relevant and enhances the understanding of the context of the investigation.	
The methodology of the investigation is only appropriate to address the research question to a very limited extent since it takes into consideration few of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.	The methodology of the investigation is mainly appropriate to address the research question but has limitations since it takes into consideration only some of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.	The methodology of the investigation is highly appropriate to address the research question because it takes into consideration all, or nearly all, of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.	
The report shows evidence of limited awareness of the significant safety, ethical or environmental issues that are **relevant to the methodology of the investigation***.	The report shows evidence of some awareness of the significant safety, ethical or environmental issues that are **relevant to the methodology of the investigation***.	The report shows evidence of full awareness of the significant safety, ethical or environmental issues that are **relevant to the methodology of the investigation***.	

* This indicator should only be applied when appropriate to the investigation.

Academic honesty statement

I declare that the work attached herewith is my own and contains my own words and ideas. ***Any work other than my own is only used as reference and is cited appropriately – failure to do so is plagiarism resulting in an automatic zero. In the event plagiarism occurs, an academic honesty report will be filed with the guidance office.***

Candidates Signature:

Analysis			
Insufficient/Incomplete – Mark (1-2)	*Relevant/Incomplete – Mark (3-4)*	*Focused/Major Factors Addressed – Mark (5-6)*	*Mark*
The report includes **insufficient relevant** raw data to support a valid conclusion to the research question.	The report includes relevant but incomplete quantitative and qualitative raw data that could support a simple or partially valid conclusion to the research question.	The report includes sufficient relevant quantitative and qualitative raw data that could support a detailed and valid conclusion to the research question.	
Some **basic** data processing is carried out but is either too **inaccurate or too insufficient to lead to a valid** conclusion.	Appropriate and sufficient data processing is carried out that could lead to a broadly valid conclusion but there are significant inaccuracies and inconsistencies in the processing.	Appropriate and sufficient data processing is carried out with **the accuracy** required to enable a conclusion to the research question to be drawn that is fully **consistent** with the experimental data.	
The report shows evidence of little consideration of the impact of measurement uncertainty on the analysis.	The report shows evidence of some consideration of the impact of measurement uncertainty on the analysis.	The report shows evidence of full and appropriate consideration of the impact of measurement uncertainty on the analysis.	
The processed data is incorrectly or insufficiently interpreted so that the conclusion is invalid or very incomplete.	The processed data is interpreted so that a broadly valid but incomplete or limited conclusion to the research question can be deduced.	The processed data is correctly interpreted so that a completely valid and detailed conclusion to the research question can be deduced.	

Evaluation			
Not Relevant/Superficial – Mark (1-2)	*Some Relevance/Descriptions – Mark (3-4)*	*Fully Justified/ Described/Relevant– Mark (5-6)*	*Mark*
A conclusion is **outlined** which is not relevant to the research question or is not supported by the data presented.	A conclusion is **described** which is relevant to the research question and supported by the data presented.	A detailed conclusion is **described and justified** which is entirely relevant to the research question and fully supported by the data presented.	
The conclusion makes superficial comparison to the accepted scientific context.	A conclusion is described which makes some relevant comparison to the accepted scientific context.	A conclusion is correctly **described and justified** through relevant comparison to the accepted scientific context.	
Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **outlined** but are restricted to an **account** of the **practical** or **procedural issues** faced.	Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **described** and provide evidence of some awareness of the **methodological issues** involved in establishing the conclusion.	Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **discussed** and provide evidence of a clear understanding of the **methodological issues** involved in establishing the conclusion.	
The student has **outlined** very few realistic and relevant suggestions for the improvement and extension of the investigation.	The student has **described** some realistic and relevant suggestions for the improvement and extension of the investigation.	The student has **discussed** realistic and relevant suggestions for the improvement and extension of the investigation.	

Communication		
Unclear with Errors – Mark (1-2)	*Clear and Errors do not hamper Understanding – Mark (3-4)*	*Mark*
The presentation of the investigation is unclear, making it difficult to understand the focus, process and outcomes.	**The presentation of the investigation is clear. Any errors do not hamper understanding of the focus, process and outcomes.**	
The report is 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.	The report is well structured and clear: the necessary information on focus, process and outcomes is present and presented in a coherent way.	
The understanding of the focus, process and outcomes of the investigation is obscured by the presence of inappropriate or irrelevant information.	The report is relevant and concise thereby facilitating a ready understanding of the focus, process and outcomes of the investigation.	
There are many errors in the use of subject specific terminology and conventions*.	The use of subject-specific terminology and conventions is appropriate and correct. Any errors do not hamper understanding.	

Comments: (see also any comments written within the investigation)

Exploration Details to consider:

- ☐ Research Question clearly stated and includes IV and DV
- ☐ Background to investigation included with citations
- ☐ **Explain** how range of IV was selected
- ☐ IV correctly identified with units/ reasonable range of 5 variations
- ☐ DV correctly identified with units and precision
- ☐ **List all variables** to be controlled. This can be presented in a table . ***For each variable:***
- ☐ How could it impact the results?
- ☐ Exactly how will it be controlled? (Value, with method for achieving that value.)
- ☐ Materials are listed with quantity & size
- ☐ Method clearly presented in step-wise format and can be repeated by others.
- ☐ Method for recording results, including units and uncertainty of tools (± _____)
- ☐ Annotated photo of equipment or experimental set-up
- ☐ **Full citation** of published protocol, if used
- ☐ Sufficient repeats at each increment to ensure reliability and allow for stats. (Usually at least 5 trials)
- ☐ **Safety/ ethics/ environmental concerns addressed**, including *animal experimentation policy*.
- ☐ Consent form for using human subjects

Analysis Details to consider:

- ☐ Results table designed before investigation was planned, to guide Design
- ☐ How will results be presented? Reason.
- ☐ What statistical test(s) will be used? Why?
- ☐ Does plan to collect data address RQ?
- ☐ Raw data clearly distinguished from processed data (possibly separate table)
- ☐ Units of IV and DV present and correct
- ☐ Uncertainties correct (± __)
- ☐ Units & Uncertainty included in the column headings of raw and processed data tables
- ☐ Decimal points consistent throughout a column
- ☐ Decimal points consistent with precision of the measuring equipment
- ☐ Sentence below data table stating how uncertainty was determined
- ☐ **Associated qualitative data** (observations) recorded
- ☐ Calculations to determine DV carried out or other calculations to address the RQ
- ☐ Formulas & Sample calculations with units written below table.
- ☐ Standard deviations included where appropriate.
- ☐ Uncertainties adjusted to reflect any calculations carried out.
- ☐ Processed data (and decimal places) consistent with precision of recorded data
- ☐ Tables & graphs do not break across pages
- ☐ Titles self-explanatory and complete on all tables & graphs
- ☐ Appropriate graph choice
- ☐ Graph is approx. ½ a page or larger
- ☐ Axes labeled clearly with unit and uncertainty
- ☐ Axes scale appropriate
- ☐ Best fit line
- ☐ Error bar's identified with the type of variability it represents (ie. standard deviation)
- ☐ Summary trend sentence given for graph

Evaluation Details to consider:

- ☐ Patterns and trends in data stated, with reference to the graph/ tables.
- ☐ Comparisons, if appropriate, are made
- ☐ Data related to hypothesis or RQ – to what extent to they agree/ disagree?
- ☐ **Scientific explanation** for results
- ☐ Comparison with published data and theoretical texts, if possible.
- ☐ Reference to error bars (or STDEV) with regard to variability of results
- ☐ **Analysis** of reliability of results: Are data sufficient to address the RQ? Or Was the range of the IV appropriate?
- ☐ Identify & Explain anomalous data points
- ☐ Strengths of the investigation identified

Evaluate *measurement/ instrument errors*, *systematic error* (problems with the method) in terms of:

- ☐ Possible effect on data
- ☐ Significance of the weakness or limitation in terms of the data set

For each limitation 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 and achievable improvements
- ☐ Suggestions for further investigation stated