REPORT TEMPLATE

1. DESIGN

1.1 RESEARCH QUESTION

Include a statement that is fully focused (references both independent and dependent variable) and includes a concise description of the system in which the investigation is embedded (i.e. includes key conditions such as volumes, concentrations, timings and temperatures as appropriate).

1.2 INTRODUCTION

Provide a summary of relevant background information – this should include references to scientific literature (via footnotes or in-text citations) and an explanation of the relevant application for the study (demonstrating an appropriate real-world context for the investigation).

1.3 HYPOTHESIS

Make a prediction of the outcome with a suitable justification (supported by theory from introduction).

1.4 VARIABLES

INDEPENDENT VARIABLE

Identify the variable and outline the range of intervals selected (including a justification for the range).

DEPENDENT VARIABLE

Identify the variable and describe how it will be quantitatively measured within the experiment.

CONTROL VARIABLES

Table 1.4.1: Control variables and the reason for their control

Control Variable	**Reason for Control**
Identify each variable and how it is controlled	Explanation for the level of control chosen

UNCONTROLLED VARIABLES

Table 1.4.2: Uncontrolled variables and their potential effect on results

Uncontrolled Variable	**Potential Impact**
Identify each uncontrolled variable	Description of the potential impact on data

NOTE:
If the method has been adapted from an existing experiment or if a pilot study has been conducted, design changes (i.e. control variables) can instead be outlined in a **procedural development** section.

1.5 MATERIALS AND METHOD

MATERIALS

The materials list should include the quantities required for all trials. All measurement devices should identify the uncertainty (± minimum value). The list may be separated into equipment and reagents.

METHODOLOGY

The method should be written as numbered steps in third person and past tense. It should describe the procedure for a single condition of the independent variable and then should be repeated for the other conditions and for multiple trials. It can be divided into sections for ease of communication:

- *Set up* – Outline the preparation of any reaction mixtures and the construction of any equipment
- *Conducting the experiment* – Outline all steps involved in manipulating the experimental variables
- *Collecting data* – Describe how the dependent variable is quantitated (including any calculations)

The inclusion of labelled diagrams or photographs can help to support methodological explanations.

RISK ASSESSMENT

List any hazards and the associated safety precautions that were employed. This should include the use of protective equipment and the disposal of chemicals. This section can be structured as a table:

Table 1.5.1: Safety concerns and associated precautions

Hazard	**Safety Precaution**
Identification of a potential safety hazard	Description of the preventative measure

2. RESULTS

2.1 QUALITATIVE DATA

Provide a descriptive summary of each data set. Identify any anomalous trials. Pictures are beneficial.

2.2 QUANTITATIVE DATA

RAW DATA

Table 2.2.1: Insert appropriate title

Independent Variable (units ± uncertainty)	**Dependent Variable** (units ± uncertainty)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6

NOTE:
A row in the table should be highlighted and the corresponding values used for sample calculations. Outliers should be accentuated in **bold** and a statement included outlining removal from processing.

SAMPLE CALCULATIONS

Table 2.2.2: Calculations used for data processing

Formula	Sample Calculation
The **mean (X)** was calculated using the AVERAGE function on Microsoft Excel	= AVERAGE (n_1, n_2, n_3, n_4, n_5) = sample mean
The **standard deviation (σ)** was calculated using STDEV function on Microsoft Excel	= STDEV (n_1, n_2, n_3, n_4, n_5) = sample standard deviation
The **skewness** was calculated using the SKEW function on Microsoft Excel	= SKEW (n_1, n_2, n_3, n_4, n_5) = sample skewness
Outliers were identified as data values more than 3 standard deviations beyond the mean	Upper limit = $X + (3 \times \sigma)$ = value Lower limit = $X - (3 \times \sigma)$ = value
The **percentage uncertainty** was calculated for the following measuring instruments: • 50 ml measuring cylinder (ml) = ± 0.05 • Electronic balance (g) = ± 0.01 • Plastic dropper (ml) = ± 0.2	Total % Uncertainty $= \sum \left(\frac{\text{instrument uncertainty}}{\text{quantity measured}} \right)$ $= \left(\frac{0.05}{10} + \frac{0.01}{2.4} + \frac{0.2}{3} \right) \times 100 = 11.3\%$
Correlation coefficient **(r value)** calculated using CORREL function on Microsoft Excel	= CORREL (IV values, DV values) = CORREL ({n_1, n_2, n_3, n_4, n_5} , {n_6, n_7, n_8, n_9, n_{10}})
Coefficient of determination **(r^2 value)** was calculated using the trendline in Excel	Check the box "Display R-squared value on chart" in Microsoft Excel (under 'More trendline options')
The **student's t-test** was performed using the Analysis Toolpak in Microsoft Excel	*Type of t-test:* One-tailed, unpaired, equal variance Degree of freedom = 8 Critical value = 1.864
A **one-way ANOVA** and post-hoc **Tukey HSD** test were performed using the Real Statistics add-on to the Analysis Toolpak in Excel	*Analysis of variance:* One-way ANOVA, single factor *Post-hoc:* Tukey HSD (honest significant difference) Degree of freedom = 30 Critical value = 2.53

PROCESSED DATA

Table 2.2.1: Insert appropriate title

Independent Variable	Sample Mean	Standard Deviation

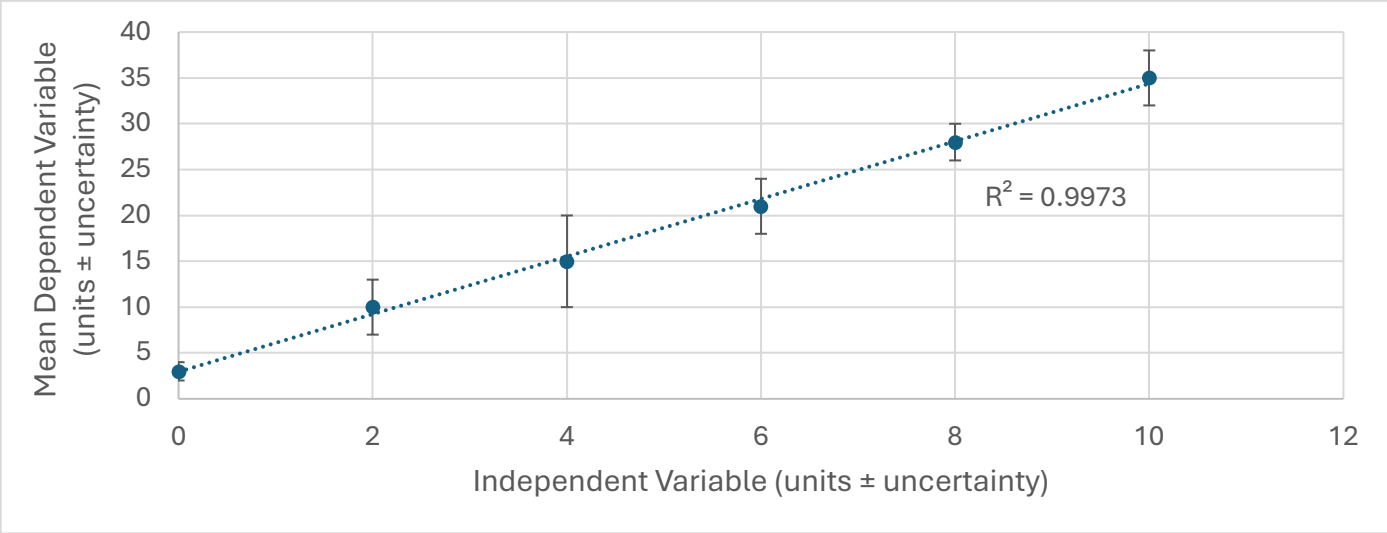
Skewness (–2 to +2)	Percentage Uncertainty	Outliers	
		Lower limit	Upper limit

NOTE:
A skewness value between –2 and +2 is acceptable for parametric statistics (i.e. normal distribution). A skewness value outside of this range suggests non-normality (requiring use of the median and IQR).

Ref: Hair, J. *et al.* (2022). A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM), 3rd ed. Thousand Oaks, CA: Sage.

2.3 GRAPH

Figure 2.3.1: Effect of independent variable on dependent variable *(error bars represent ± 1 S.D)*



2.4 STATISTICAL PROCESSING

Include a brief overview of the type of test selected (e.g. t-test, ANOVA), the reason for selection and any relevant conditions – such as the degrees of freedom (df) and the critical value (for $p<0.05$).

Next, establish the null (H_0) and alternative hypotheses (H_A) for the statistical test being performed:

- *Null Hypothesis (H_0)* – There is no difference between the independent and dependent variables
- *Alternative Hypothesis (H_A)* – There is a difference between independent and dependent variables

Following this, the results of the statistical test should be summarised in an easy-to-follow table. If a post-hoc test has been conducted (e.g. Tukey's HSD), this should also be included for future analysis.

Table 2.4.1: Sample format for a one-tailed, unpaired t-test

Independent Variable	Calculated t value	Associated p value	H_A or H_0 accepted

3. ANALYSIS

3.1 DISCUSSION

In this section, the experimental results should be analysed and interpreted according to the research question and hypothesis. Different aspects of the discussion may be covered in separate paragraphs:

- *Summarise the trend* – Describe any trends referencing both the qualitative and quantitative data
- *Explain any patterns* – Relate the results to scientific concepts and discuss anomalous outcomes
- *Assess accuracy and precision* – Analyse skewness, percentage uncertainty, standard deviation
- *Determine statistical significance* – Interpret findings of all statistical tests to deduce significance

NOTE:
A conclusion of the validity can be included with the discussion or can be placed after the evaluation.

3.2 EVALUATION

In this section, the experimental methodology should be assessed in terms of both weaknesses and limitations. Weaknesses are procedural flaws that could potentially impact the data collected, while limitations are methodological restrictions that reduce the applicability of the findings. Data should be referenced to provide specific examples of the impact of each weakness or limitation, and realistic improvements must be suggested for each identified issue. The evaluation can be arranged in a table:

Table 3.2.1: Methodological constraints and potential remedies

Constraint	Impact on Results	Suggested Improvement
Weaknesses		
Weakness must **not** be *generic* (applicable to all methods and not specific to the experiment)	Specific reference to an aspect of the data should be made (e.g. precision of error bars)	Improvement must be *realistic* (able to be performed within a high-school environment)
Limitations		
Identify conditions that do not reflect a real-world context	Outline how the limitation will impact validity of conclusions	Identify avenues of potential further experimentation

3.3 CONCLUSION

The conclusion should briefly summarise the outcome of the experiment and address the hypothesis. If methodological flaws render the findings invalid, this should be identified in this part of the report.

4. REFERENCES

4.1 BIBLIOGRAPHY

All information incorporated from an external source that is not considered to be common knowledge must be appropriately cited and included within a bibliography. There is no specific referencing format that must be used, however the format chosen must be consistent with the presentation of material within the report (e.g. Harvard referencing uses in-text citations instead of footnotes). References can be automatically generated using online resources such as MyBib website (https://www.mybib.com).

Example: Sample citation using the Harvard referencing system

- Cornell, B. (2016). *Home Page | BioNinja*. Available at: https://ib.bioninja.com.au. *(Accessed: 10 July 2025)*

4.2 APPENDICES

Appendices contain additional information that is not included in the body of the report (and does not contribute to the word count). Appendices are not assessed and hence must not include any material required for the comprehension of the investigation. If a pilot study was conducted, a synopsis of the method and findings could be included as an appendix to rationalise the design decisions undertaken within the procedural development section. Distribution tables for statistical tests could be included in an appendix if required. Most scientific reports should not require the inclusion of an appendix.