

## **IB Biology Internal Assessment Lab Format**

Do not “cram” sections together leaving me no room to make comments.  
Do not complete sections out of order (like attaching graphs at the end)

The following titles and subtitles should be used for your lab report.

### **Design**

**Question** – must be focused and not ambiguous in any way

**Hypothesis** – state first & then give a logical rationale

**Variables** – chart identifying Independent, Dependent, & Controlled Variables

**Protocol Diagram** – draw & label a diagram which best shows the protocol you used

**Photograph of Lab Setup (optional)** – annotate this to show how **variables** were instituted, especially the controls. Do not just label equipment.

**Procedure** – Numbered steps that give enough detail that the experiment can be repeated! Be sure to emphasize how many times each data set is being repeated (5 is minimum).

### **Checklist for design**

Aspect 1: defining the problem and selecting variables

- I have identified a focused problem or a specific research question. I have done this by, for example, stating a clear aim, a clear hypothesis, and clearly defining the variables.
- I have identified and stated the independent variable and the dependent variable, and I have listed the controlled variables

Aspect 2: controlling variables

- I describe a method for the effective control of the variables. In particular, I describe how the independent variable is manipulated and how the controlled variables are maintained at constant values
- I list all the apparatus and materials used, including the volumes of tubes and cylinders, the concentrations of solutions, the model and manufacturer of any complex apparatus, etc.
- I state the level of precision of the values for the independent variable
- Any standard methods that I use are fully referenced in a footnote

### Aspect 3: developing a method for the collection of data

- I describe a method that allows for the collection of sufficient relevant data
- The data gathered enables the aim, the research question or the hypotheses to be adequately addressed
- The data gathered enables an evaluation of the reliability of the data
- The sample size should be adequate to allow a reasonable statistical analysis of the data (for calculating the standard deviation, at least five items per treatment)
- An adequately broad data range is considered
- An adequate number of data values within this range are considered

### Checklist for manipulative skills

#### Aspect 1: following instructions

- I follow instructions accurately, adapting to new circumstances. I mostly work independently, reading the instructions carefully, but seek assistance when required

#### Aspect 2: carrying out techniques

- I am competent and methodical in the use of a range of techniques and equipment

#### Aspect 3: working safely

- I pay attention to safety issues

## **Data Collection and Processing**

### ***Data Collection***

**Raw Data Table** – make sure this is raw data only. Data table design & clarity is important. A title should be given (Raw Data Table is not a data table title, it is a lab report section title) Make sure that all columns, etc. are properly headed & units are given. Forgetting one unit or misidentifying one unit is enough to drop your score in this section. Do not “split” a data table (putting part of a table on one page and finishing it on another). If you absolutely have to split a table (due to quantity of data), make sure that you re-do the title and all column headings. Uncertainties can be given within column headings for equipment precision and as footnotes beneath data tables for other types of uncertainties.

### ***Data Processing & Presentation***

**Overview** – this is a short paragraph section that gives an overview of how and why you decided to process and present the data in the form that shows up later in this section.

**Sample Calculation** – neatly lay out and explain one example only of any one type of manipulation that was done to the raw data to help make it more useful for interpretation.

**Presentation** – this is typically one or more data tables (of your now processed data) and one or more graphs of this processed data. Once again, the design & clarity of data table(s) is important and the quality of graphs is also very important. Give careful consideration to the choice of graph style(s) that you choose to do. Think about doing a scatter plot or perhaps a box/whisker plot or any number of other creative graphing styles rather than just a simple line graph. Make sure that you

follow good standard rules for doing graphs (valid title, axis' labeled including units, etc.) Weak experimental design can sometimes limit you to pie graphs and/or bar graphs; avoid this by good experimental design in which you have a quantitative independent variable (with well chosen values) as well as a quantitative dependent variable.

### Checklist for data collection and processing

#### Aspect 1: recording raw data

- I have recorded my data independently
- I have data which is quantitative (numerical)
- I have chosen a suitable format in which to record the raw data
- The variable that is measured or recorded is clearly stated (e.g. in the column heading in a table)
- The units are given for every variable (e.g. in any column headings)
- An indication is given of the uncertainty of measurements (e.g. in any column headings)
- A complete and descriptive title is given to any table that is used
- The same level of precision (number of decimal places) is used for all the items of a variable

#### Aspect 2: processing raw data

- I have decided on a suitable manner in which to process the raw data, so that I may fully test the hypotheses or fulfil the aim (this may involve a mathematical processing, statistical analysis, or transforming the data into a suitable graphical representation)
- All of the raw data has been processed to a suitable extent
- The raw data has been processed correctly
- Any raw data plotted onto a graph includes a line of best-fit

#### Aspect 3: presenting processed data

- I have decided upon a suitable format in which to present the processed data.
- There are clear, unambiguous headings for calculations, tables or graphs
- Any graphs have appropriate scales, labelled axes with units and accurately plotted data points with a suitable best-fit line or curve
- The data has been presented so that all the stages to the final result can be followed
- Metric/SI units are included for the final results
- The final results are shown expressed to the correct number of significant figures
- The uncertainties and errors associated with the raw data have been taken into account and this is shown in some manner (e.g. error bars may be used, as appropriate)

## **Conclusion and Evaluation**

**Conclusion** - this is a paragraph section in which you get a chance to discuss the results of your experiment. Start by addressing whether your data seems to support or refute your hypothesis. This should be discussed and not just stated. Specifically refer to your graphs to give support to this discussion. Avoid the use of the word “proof” or “proves” within your conclusion, as your data will not prove anything.

**Limitations of Experimental Design** – this paragraph section discusses how well your experimental design helped answer your experimental question. What worked well (and why) and what did not work well (and why)

**Suggestions for Improvement** - this section should be used for two purposes.

- 1) what minor improvements could be made to the design features that you just mentioned in the previous section that would perhaps lead to better results next time
- 2) what suggestions do you have for other possible experimental designs that may work better for answering this question

### **Checklist for conclusion and evaluation**

#### Aspect 1: concluding

- I state a conclusion which is based on a reasonable interpretation of the data
- If any hypotheses are being tested, I have stated whether the data supports these hypotheses
- I give a justification for my conclusion
- As appropriate, I compare different graphs, or describe the trends shown in my graphs
- If I am measuring an already known and accepted value, I have compared my value with that in a textbook, in order to assess the validity of the result.
- I fully reference any literature that is quoted.

#### Aspect 2: evaluating procedures

- I have commented on the design and method of the investigation
- I have commented on the quality of the data
- I have listed the weaknesses of the study
- I have assessed the importance of each of these weaknesses
- I have commented on the precision and accuracy of the measurements
- In evaluating the procedure, I have specifically looked at the processes, the use of equipment and the management of time

#### Aspect 3: improving the investigation

- My suggestions for improvements are based on the weaknesses and limitations identified in aspect 2
- As appropriate, I address modifications to the experimental technique and the data range
- The modifications that I propose are realistic and clearly specified