Advice on Planning

Consider using the following headings for your plan.

- Topic Area / Title of investigation
- Background knowledge - What do I know about this topic?
- Input / Independent variable - which variable is going to be changed?
- Output / Dependent variable - which variable is going to be measured?
- Prediction
- Graph of prediction
- Justification for prediction - using Scientific Knowledge and Understanding from the specification
- Sources of information - books, notes, web sites, articles etc.

Remember that your plan is about you communicating your thought processes to the examiner. Don't just copy huge chunks of information from a source as it will not be worth any marks. Try to use the information to inform the reader about how you decided to use the method that you did.

You may also find using copies of the following tables will enable you to complete or consolidate your ideas for the plan.

Apparatus list

Item	Quantity	Concentration and volume

Table to show reasons for choice of apparatus

Item	What it is used for	Reason for choice

Safety

Hazard	Precaution

Table to show how concentrations of working solutions will be made

End concentration	Volume of ……	Volume of …….

Table to show the variables that must be controlled

Variable	Why it must be controlled	How it will be controlled

Class practicals and individual preliminary work can help you to:

- identify key variables and design 'fair test'
- plan a procedure which includes appropriate controls
- select equipment
- work out a suitable number of measurements / observations to include in plan
- work out a suitable range of measurements to take.

Reasons for choice of equipment can be based on the preliminary study once you have used the apparatus and seen its advantages / disadvant ages.
The justification of your choice can follow more easily after a thorough preliminary study.

Advice on Implementation

Some common errors when recording your data -

1. Not recording all the raw data
2. Constructing tables that do not include all the rel evant information
3. Using two or three small tables when one table (often 'landscape') is required
4. Using a separate table for mean results when these should be in the last column of a results table
5. Not giving units at the head of the columns / beginning of t he rows
6. Putting units in the body of the table
7. Not following IoB guidelines on construction of tables.

Institute of Biology Guidelines:

- Axis labelled
- Informative title
- Line through the points (and line of best fit)
- Points marked with 'X'

Advice on Analysis

It is important that you engage with the data that you have collected. All aspects of data processing need to be assessed:

1. How much data has been collected?
2. Is it possible to carry out a statistical analysis on the data?
3. How has the data been proce ssed?
4. Have anomalous results been identified?
5. Is it possible to draw a line of best fit with confidence?
6. Does the data support the prediction?
7. Is it possible to write a description of what the data shows making use of the figures / datum points to illustra te trends?

You should use the science underpinning the investigation to explain the results that you have collected and the trend(s) that you have identified.

In other words…

- What trend(s) can you see in the data?
- Describe the trend in words.
- Include figures from tables and graphs in your description.
- Give a simple explanation of the trend in terms of your knowledge.
- Carry out some mathematical processing of the data.
- Make sure that the processing is appropriate.

Advice on Evaluation

Many of you forget that you are evaluating the data that has been collected as well as your procedure. In the evaluation you should

- identify sources of error
- quantify sources of error
- identify major sources of error
- describe the effect of these errors on the results
- suggest improvements

Try using a table like this to clarify your ideas;

Error / limitation	Cause of error	How the error can be corrected / improvement	How the improvement will reduce the error(s)

Data

There are various ways in which this can be approached

- identifying anomalous results in **raw data** by circling, underlining or highlighting in tables
- identifying anomalous results in proc essed data by circling means in tables or on graphs – these are anomalous results that do not fit the overall trend
- showing the range of results about the mean
- calculating the standard deviation for the replicate results
- calculating the 95% confidence int erval, which is better for comparing different sets of data than standard deviation.

We hope that this goes some way in helping you with your write -up. There is one final golden rule

Quality is better than quantity!