Chemistry Lab Format

COVER PAGE

Experiment:#?
Date: [this is the date of the experiment, not write-up]
Unit:

Student Name [Underlined]
Lab Partner's Name (s) follow
Duration of Experiment

EXPERIMENT TITLE
(centered and underlined)

Pre-Lab Theory: used in more formal labs where applicable.

Pre - Lab Assignment
Usually will help to explain and understand the purpose and theory of the lab to be undertaken.

Purpose: (Research Question)
Stated in a list if more than one objective exists; (1)
(2)
(3)

Hypothesis: used where applicable, based upon the nature of the lab, and clearly justified as to why this is your chosen hypothesis!

Apparatus and Materials: these are reported as separate columns

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_ _ _ _ _	_ _ _ _ _

When more complex equipment configurations are required, a diagram of the apparatus set up is included at this point.

Procedures: usually this reads as "refer to resource lab sheet please"
If the students design their own labs (as is the case several times in the year) the procedures are then stated by the student here. These may be concept maps or flow charts of simple apparatus diagrams which are numbered to indicate order or sequence. Creativity is encouraged, without loss of clarity to convey information to the reader for purposes of "lab reproducibility".

Observations: these follow in a specific order :

(**a**) quantitative observations
- (i) data tables of measurements (numbered- if more than one), suitably presented in table format, with headers and units labelled.
- (ii) uncertainty in measurements
- (iii) raw data clearly labelled

(**b**) qualitative observations
-illustrations and use of color are encouraged for some labs, full observations must be given to attain full marks.

Data Processing and Presentation

Calculation of results, do one sample calculation, identical calculations do not need to be repeated. Show all steps clearly, using significant figures appropriately. For repeated trials, calculate a final result for each trial. Any assumptions made should be clearly stated, and where appropriate balanced equations should be employed. Calculation of percentage error and uncertainty should be estimated if only one measurement is done.

The presentation of results should be easy to follow and understand, preferably in a summary table.

Graphs may be useful, especially for several values of continuous variables: show title and axes, using standard notation, using an appropriate size (larger, rather than smaller), using an appropriate scale (the origin may not need to be included, indicating points clearly, and showing relationship by fitting points to line(s) or a smooth curve.

Data Evaluation and Conclusion

Draw conclusions from your results, do not just restate the results. Conclusions should be clearly related to the research question, i.e. to the purpose of the experiment. Explain how your conclusions follow from the results. Compare with literature or accepted value or reasonable value where possible. Calculate percent error where possible.

Limitations to conclusions should be clearly stated, i.e. are tests conclusive, are interpretations possible?

Limitations of procedures should be considered, i.e. are there flaws in the procedures which could affect the results, are measurements and observations reliable, is precision unknown because of lack of replication? Analyse all sources of error.

For identified weaknesses, suggest improvements: suggestions should be realistic, not involving unavailable equipment or materials, suggestions should be specific, not vague (e.g. "More careful work"). Purposed changes should try to eliminate or reduce errors, improve control of variables, provide other procedures for better measurements.

Discussion:

These are assigned problems, usually 2 to 4 questions, with a variety of qualitative and quantitative problems to answer (in complete sentence form).

Extension:

Some labs have an extra component that requires students to extrapolate the lab skill to a new situation in a critical thinking question. This may require them to consider a technology or use in society that uses the same application or skill learned of in the lab.

ASSESSMENT DETAILS

Criteria:

Planning (a) Defined problem (s)/research question (s); formulated hypothesis (es); selected any relevant variables.

Planning (b) Designed realistic procedures to include appropriate apparatus, materials, methods for both the control of variables and collection of data.

Data Collection Observed and recorded raw data with precision and presented them in an organized way (*using a range of appropriate scientific methods/techniques)*

Data Processing and Presentation Transformed, manipulated and presented data *(in a variety of appropriate ways)* to provide effective communication.

Evaluation and Conclusion Evaluated the result(s)of experiment (s) and evaluated the procedure(s); suggested modifications to the procedure (s), where appropriate.

Manipulative skills [summative only] Carried out to arrange of techniques proficiently with due attention to safety; followed instructions

Personal skills (a) [summative only] Worked within a team; recognized the contributions of others; encouraged the contributions of others.

Personal skills (b) [summative only] Approached experiments/investigations/projects and problem-solving exercises with self-motivation and perseverance, and in an ethical manner; paid due attention to the environmental impact.

Achievement Level Descriptors

(The same set of descriptors are provided for our level and standard level.)

For each assessment criterion, four achievements levels, describing achievement levels 0-3 are defined. The lowest level of achievement is represented by 0, while 3 represents the highest level of achievement.

The descriptors concentrate on positive achievement, although for the lower levels failure to achieve may be included in the description.

The aim is to find, for each criterion, the descriptor which conveys most adequately the achievement levels attained by the candidate's work.

ASSESSMENT DETAILS

Achievement Level

0 the candidate has not reached a standard described by any of the descriptors given below.

1 the candidate meets **all** of aspects of the criterion partially **or** a **few** aspects of the criterion completely.
2 the candidate meets **all** aspects of the criterion partially in **and most** aspects of the criterion completely.
3 the candidate meets **all** aspects of the criterion completely.

Using the assessment criteria
When assessing a candidate's work, teachers should read descriptors, starting with level 0, until they reach a descriptor which describes a level of achievement that the work being assessed has **not** attained. The work is therefore best described by the preceding descriptor.

Only whole numbers should be recorded; partial marks, fractions and decimals are not acceptable.

Teachers should not consider the descriptors as marks or percentages. Although the descriptor levels are ultimately added together to obtain a score out of 24, teachers should not assume that there are other arithmetic relationships (e.g., a level two performance is not necessarily twice as good as a level one performance and so on).

Similarly, teachers should not think in terms of a pass/fail boundary or make comparisons with the IBO 1-7 grade scale, but should concentrate on identifying the appropriate descriptor for each assessment criterion.

Candidate's scores

The highest descriptors do not imply faultless performance, but should be achievable. Teachers should therefore not hesitate to use the extremes (level 0 and level 3) if they are appropriate descriptions of the work being assessed.

A candidate who attains a high level of achievement for one criterion will not necessarily reach high levels of achievement for the other criteria. Conversely, a candidate who attains a low level of achievement for one criterion will not necessarily attain low levels of achievement for the other criteria. Teachers should not assume that the scores of a group of candidates being assessed will follow any particular distribution pattern.

Suggestions for Planning

Research question

Give a clear and specific statement of your aim for the experiment.
If general question already has been suggested, make it more specific and relevant to your individual experiment.

Hypothesis

Formulate an hypothesis only if a meaningful statement is possible.
Avoid an hypothesis if you already know the expected result or if you have no idea what result you might obtain.
Explain the basis of a meaningful hypothesis; be quantitative where possible.

Variables

State variables explicitly, and explain why each is relevant (and appropriate planning experiment should have more than two relevant variables).
Indicate which variables are independent and which dependent (manipulated and responding).
Indicate which variables need to be controlled.

Apparatus and materials

Be as specific as possible (e.g. 50 cm^3 beaker rather than "beaker")

Control of variables

Refer to variables that need to be controlled.
Give an explicit procedure for how each variable will be controlled.
Indicate how the procedure will control the variable.

Method/procedure

Provide enough detail that another person could repeat your work.
Standard procedures (e.g., titrations, melting points) need little detail.
The procedure should be appropriate to the level of uncertainty needed (e.g., don't use a measuring cylinder to dispense the analyte for a titration, or an analytical balance where only an approximate mass is needed).
The procedure should allow collection of sufficient relevant data (e.g., repeated trials where appropriate).

Suggestions for Drawing Graphs

1. Identify your graph with a heading that clearly indicates the content of the graph.

2. Choose axes; the independent variable is usually plotted on the horizontal axis.

3. Label axes using the appropriate convention: quantity/unit

4. Decide on the range of values to cover all points
   (a) Decide whether 0,0 or some other point not determined experimentally is a valid point to be included.
   (b) If 0,0 does not need to be on the graph, the points should be spread out to cover the entire graph.

5. Decide on the scale
   (a) The graph should fill at least half a page in your notebook; if it does not, it may be difficult to interpret or to use to read values.
   (b) use a linear scale for most applications.
   (c) Choose a convenient scale for entering points, so that each square represents 1,2,5 or a multiple of 10 times the numbers to be plotted; 3 squares to one unit, for example, makes it difficult to plot or evaluate a point.
   (d) Label equal intervals, but not every square.

6. Locate points by X or small dot with a circle around it.

7. Draw a smooth curve, a straight line, or more than one curve or line to represent the relationship indicated by the data points. Depending on the nature and purpose of the experiment, you have to decide whether or not it is appropriate to make an assumption about the relationship before you draw a curve or line. It is rarely appropriate to just "connect the dots".