LAB REPORT FORMAT (GRADE 12)

Laboratory activities in science are an excellent learning device. Besides providing enjoyable opportunities for group dynamics, and skill development, they also amplify the theory by concrete example. Often, lab activities can illustrate exceptions, enhance problem solving, provide the opportunity for in-depth or lateral thinking or allow for the development of critical analysis and error analysis. However, the lab report remains an important form of evaluation of the lab activity. In the junior sciences you were exposed to a fixed report format. This format was structured to allow you to report your findings in a universal manner. You were challenged to hypothesize, evaluate your results and present your findings in the most appropriate manner possible.

In Grade 12, you will be expected to continue and refine this process. As such, evaluation of these reports will include both content and your abilities to express yourself in the report form. Expectations will include your ability to:

- follow the required format
- record, present and manipulate data in the most appropriate manner
- evaluate your results with respect to experimental errors
- comprehend the theoretical principles and apply them to "Discussion" questions
- use proper sentence structure, grammar and spelling

The following describes the format to be followed when writing up lab report for Grade 12.

At the senior level labs are varied. Although it is possible that all aspects of this format may not apply in every case, you are to use this format for all lab reports leaving out only those parts which have been specifically deleted by your teacher.

GENERAL

1. Avoid the use of personal pronouns. Use the third person passive tense.
2. Indent all text away from key headings.
3. Include a meaningful title and ensure that the title, student's name, teacher's name, date and course code appear at the top of the first page or on a separate title page (Cover Page).

TITLE

The title of the lab should be written to reflect the reason for the lab.

THEORY

You may be expected to research the theoretical aspects of the lab or present a brief synopsis of the lab results or expectations. You should express what you intend to determine and how you expect to determine it.

APPARATUS & METHOD

This section lists the materials you will use and how you will set up the equipment. Your information may be set-up as one of the following (as indicated by your teacher):

a labelled/annotated diagram (always required in Physics)
numbered steps
a flow chart with diagrams

OBSERVATIONS
In this section, you will present your findings. Depending on the lab, they may be visual descriptions, numerical data or a chart or table of values. You must choose the best possible method of presentation for the data you collect. This requires an understanding of the lab procedure and purpose, and to know beforehand what you will be looking for and what you might be expected to do with the data.

CALCULATIONS & MANIPULATIONS
Depending on the lab, you may need to perform calculations, manipulate your data, draw tables, charts, or graphs. You will be expected to make proper use of significant figures. Calculations must show all relevant steps. Multiple and repetitive calculations need only show one full example. Graphs should be large and properly labelled. You are responsible for choosing the best method of presentation of your calculated results.

DISCUSSION QUESTIONS
In this section, you will answer all questions on the lab sheet or in the text that are directly related to the lab. Answers should be presented as fully calculated problems, or full sentences for explanations.

EXPERIMENTAL UNCERTAINTIES
Experimental errors are those that arise because of experimental design or equipment. They do NOT include human errors - errors in reading or measuring. Your errors must be appropriate to your result i.e. an error which accounts for a high result cannot be used to explain your LOW one.
Error analysis should be in numbered sentences in decreasing order of effect. IN PHYSICS, AT LEAST THREE EXPERIMENTAL UNCERTAINTIES ARE REQUIRED. THE INSTRUMENTAL UNCERTAINTIES OF ALL THE EQUIPMENT USED TOGETHER COMPRISE ONE OF YOUR UNCERTAINTIES.

CONCLUSION
The "conclusion" is a brief expression about the outcome of your lab. The conclusion should address the purpose of the lab.

EXTENSION QUESTIONS
Answer all extension questions from the lab sheet or text. Answers should be complete, as expected in the "Discussion" section. For self-designed methods, include real life applications and interesting facts to your process.

Labs may be hand written as long as they are legible.

Source: MIDDLEFIELD C.I – SCIENCE DEPARTMENT

Comparing values:
Values may be compared using the % error formula:
% error = ((measured – predicted) / predicted) x 100%

OR
%difference formula:
%diff = (|measure 1 – measure 2| / average of 2 measures) x 100%

Experimental Uncertainties:
Instrumental Uncertainties – one of your uncertainties is always instrumental. You should describe for each instrument the limitation in its precision. For example, a metre stick marked in mm markings can only measure to the nearest mm (or .5 mm if you are careful). THIS IS NOT A MANUFACTURING ERROR NOR DOES IT MEAN THAT THE INSTRUMENT IS BROKEN OR NOT WORKING.

Procedural Uncertainties – describe what aspects of your procedure lead to imprecise or inaccurate data. MAKING A MISTAKE IS NOT AN UNCERTAINTY. IF YOU MAKE A MISTAKE, YOU REDO THE MEASUREMENT. Do not include uncertainties that never occurred. Address the anomalies in your lab!

Use proper English. If your grammar, sentence structure or spelling interferes with the clarity of what you are trying to say, you will lose format marks. USE THE CORRECT WORD TO DESCRIBE YOUR SITUATION. WORDS LIKE "LEVEL, HORIZONTAL, PARALLEL, STRAIGHT" HAVE SPECIFIC MEANINGS AND SHOULD NOT BE CONFUSED.

GRAPHING RULES
GRAPHS ARE MEASURING INSTRUMENTS – THEY NEED TO BE MADE AS PRECISE AS POSSIBLE. THIS IS THE GUIDING PRINCIPLE FOR EVERYTHING THAT FOLLOWS BELOW.
1. All graphs need fully labelled axes including the variable being plotted and the unit used.
2. Graphs should have a meaningful title. A title that just repeats the axis labels is not sufficient.
3. The graph axes should be chosen so that the data points are widely spread across the entire graph in both the horizontal and vertical directions.

Hand-Drawn Graphs

1. Hand drawn graphs must be done on graph paper. Graphs not done on graph paper are automatically worth 0 marks.
2. Graphs must be done in pencil.
3. The entire sheet of graph paper should be used so that the data spreads out over most of the sheet.
4. The data points must be plotted clearly and visibly (make them dark enough).
5. Best fit straight lines are drawn with a ruler so that the line comes as close as possible to every data point. The points not on the line should be roughly evenly spread on either side of the line. In the case where the data is obviously curved and intended to be curved, draw the best fitting curve freehand.
6. Slope and intercept calculations may be done right on the graph. The rest of the analysis should be done in the appropriate section of the lab report.

USING THE EQUIPMENT

The Stopwatch

The typical class stopwatch has a smallest increment of 0.01 s. However, its major source of error is in the judging of when to start and stop it. The error can be minimized when measuring a periodic motion by measuring the single time interval over multiple periods and dividing the time by the number of periods. When the motion is not periodic, but can be repeated, multiple trials under the same conditions can be averaged to produce a better time.

The Metre Stick

The typical class metre stick has smallest increments of 1 mm or 0.1 cm. Typical other sources of error usually involve trying to ensure the metre stick is not tilted in any way with respect to the length being measured. It needs to be parallel to the particular dimension in question.

The Spring Scale

Each spring scale has a different smallest increment. It is up to the student to study the scale and determine its value. The student should also always confirm the calibration. Hold the scale vertical with nothing hanging from it and adjust the plastic nut until the scale reads zero newtons. Internal friction inside the scale tube will affect the readings.