SCH4U1

Laboratory Reports

Lab reports will be completed in pen in a bound notebook. The right side of each page will be used for the lab reports. The left side can be used for rough work or calculations. Underline headings in each lab report.

Cover Page: Include the title and code of the course, the student's name, the teacher's name and the period, semester and year of the course.

Table of Contents: Include the title, date and page number of each lab.

Title: Provide a <u>descriptive</u> title for each lab.

Purpose: State what you intend to investigate. (To study ..., To determine.... To measure..., etc.)

Background: Answer prelab questions or summarize any information which is relevant to the experiment. (Only required when specifically requested.)

Procedure: You may usually state: "*Refer to handout*." Be sure to attach the handout in your lab notebook .

If writing the procedure write in past tense without the use of person pronouns (I, we etc.). For example, "A test tube was filled with water" is preferred to "I filled a test tube with water."

Diagrams: Any diagrams should be at least 1/2 a page and drawn in pencil on blank paper. The diagram should have a title and the apparatus should be labeled. A ruler should be used at all times. (Only required when specifically requested.)

Observations: Observations should be organized in the form of a table. Tables must include a descriptive title. It is good practice to have any tables for observations completed prior to the lab.

Graphs: The following guidelines should be followed when creating any graphs:

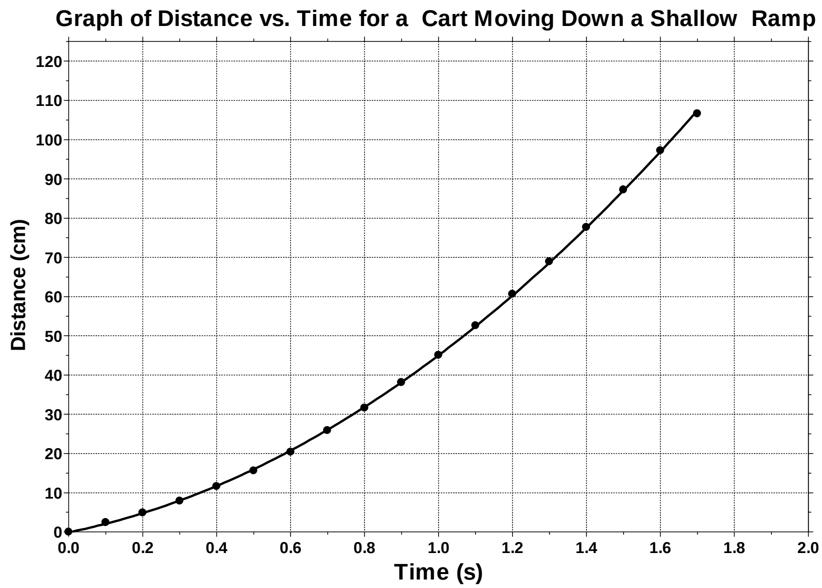
- Graph should be done on proper graph paper.
- The title should be at the top of the graph and describe what is being plotted (Graph of <u>y</u> vs. <u>x</u> for ...". Titles are to be in ink.
- The graph should cover most of the page so spread out the scale on the axis as much as possible.
- Axes should be darkened and include ticks, labels and units in ink.
- Put the points on the graph in <u>pencil</u> and draw a line or smooth curve through them in pencil too. Remember data from an experiment does not necessarily line up perfectly, so draw the line or curve of best fit through the points.

Discussion: Answer the discussion questions at the end of each investigation.

Conclusion: The conclusion should restate the purpose and state the results of the experiment. Compare the experimental result to the accepted or theoretical results and discuss possible systematic sources of experimental error.

References: Include any outside sources used in preparing the lab report in a list at the end of the lab. References should be organized in an appropriate format. Refer to p. 11-14 of the IRHS Student Planner for details.

Sample Graph:



Sample Table:

Table 1: Mass of an Unknown Metal

Metal Sample	Initial Mass (g)	Final Mass (g)	Total Mass (s)
A	15.64	12.24	3.40
B	27.21	27.00	0.21

WHAT IS EXPERIMENTAL ERROR?

In conducting an experiment a person encounters one or more of three general types of errors: **human error**, **systematic error**, and **random error**.

Human error (a mistake) occurs when you, the experimenter, make a mistake. Examples would be when you set up your experiment incorrectly, when you misread an instrument, or when you make a mistake in a calculation. Human errors are not a source of experimental error; rather, they are "experimenter's" error. <u>Do not quote human error as a source of experimental error.</u>

Systematic error is an error inherent in the experimental set up which causes the results to be skewed in the same direction every time (i.e., always too large or always too small). One example of systematic error would be the loss of energy to the surroundings while carrying out a calorimetry experiment. Some systematic errors can be easily corrected. For example, if a balance reads 0.25 g when there is no mass on it, this would introduce a systematic error to each mass measurement—they would all be too large by 0.25 g. This can be corrected by zeroing the balance. Other systematic errors can only be eliminated by using a different experimental setup. Most of the simple experiments you do will have some systematic error.

All experiments have **random error**, which occurs because no measurement can be made with infinite precision. Random errors will cause a series of measurements to be sometimes too large and sometimes too small. An example of random error could be when making timings with a stopwatch. Sometimes you may stop the watch too soon, sometimes too late. Either case introduces random error in your measurements. (Note that when a human is involved in the actual measurement process, he/she can introduce valid experimental error that is not within the definition of human error. Your finite reaction time is not a mistake; it is a limitation of one part of the experimental process, the human making the measurement.) Random error can be reduced by averaging several measurements.

ERROR ANALYSIS

One way to analyze experimental error is with a % error calculation. The % error is useful when you have a single experimental result that you wish to compare with a standard value, or when you have two experimental values obtained by different means that you wish to compare. (In the latter case it is often called % difference since there is no standard to compare to.)

The % error is calculated according to the following formula.

$$Error = Experimental\ Value - Theoretical\ Value$$

$$Percentage\ Error = \frac{Error}{Theoretical\ Value} \times 100\%$$