**Helpful Tips for Coursework Writing:**

**Affect** is a VERB

Example: How do you think rain will **a**ffect Tina’s hair.

**Effect** is a NOUN

Example: The **e**ffect of the rain was that Tina’s got Frizzy.

**Hypothesis:**

The prediction that could be tested in an experiment.

The hypothesis is stated as an “If…then….” statement.

**Independent Variable** (or manipulating variable) is the variable (factor) you changed in the experiment. The independent variable is chosen before you conduct the experiment

**Dependent variable** (or responding variable) is the variable that may change as a result of the independent variable. The dependent variable is the data that is observed and measured in an experiment.

**Controlled variable** (or constants) are factors that are kept the same in the experiment, so that the experiment is a fair test.

**For Data Tables**

|  |  |
| --- | --- |
| Column 1: Independent Variable | Column 2: Dependent Variable |
| **X** | **Y** |
|  |  |

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| --- | --- | --- |
| Name Columns Appropriately | Include Appropriate units | Example: Temperature (°C) |
|  |  |  |

**For Graphs:**

* Write a title for you graph
* Label the horizontal and vertical axes. Include appropriate measurements units.
* Write “Independent Variable” on the correct axis and write “Dependent Variable” on the correct axis.
* Mark an appropriate scale on each axis
* Plot your data on the graph and connect the dots

This table summarizes the graphs and the relationships that you are most likely to see

|  |  |  |  |
| --- | --- | --- | --- |
| Graph Shape | **Written relationship** | **Modification required to linearize the graph** | **Algebraic representation** |
| **linear**  **y**  **x** | **y is independent of x** **y is a constant value no matter the value of x** | **None** | **y = b** |
| **linear**  **y**  **x**  **y**  **x**  **y**  **x** | **y is proportional to x.** | **None** | **y = mx + b** |
| **hyperbola** | **y is inversely proportional to x.**  **y is inversely proportional to the square of x.** | **Graph y vs , or possibly y vs )** | **y = m+ b**  **or**  **y = + b** |
| top opening parabola | **y is proportional to the square of x.** | **Graph y vs x2** | **y = mx2 + b** |
| side opening parabola **y**  **x** | **The square of y is proportional to x.** | **Graph y2 vs x** | **y2 = mx + b** |

**Note:** On a few occasions you may get data that requires two steps to linearize. Such as starting with a hyperbola (so you inverse the **x** data) and that produces a top opening parabola. Just continue on with by squaring of the values in the inverse column you just made. This is a y is inversely proportional to the square of x relationship.

Another starts with a hyperbola (so you inverse the **x** data) and that produces a side opening parabola. Continue on by squaring the **y** data values. This is a y squared is inversely proportional to x relationship.

**TIPS FOR GRAPHING IN SCIENCE**

**Steps for making a graph with Logger Pro**

1. Double click on the X in the Data Set. Enter the name and the unit of what is being plotted on the X-axis. Click on the Sig. Figs and set them to the correct number.

2. Double click on the Y in the Data Set. Enter the name and the unit of what is being plotted on the Y-axis. Click on the Sig. Figs and set them to the correct number.

3. In the first box, enter your value for the X-axis, press enter on the keyboard, enter your value for the Y-axis and press enter. Repeat until you are done.

4. If the graph is linear, hold the left mouse key down and drag a box around all the points. Click on Analyze in the top row and choose Regression.

**Steps for linearizing a non-linear graph in Logger Pro.**

The shape of the graph should be your clue on what to do with your data. (See chart)

1. Click on Data in the top row, choose New Column, and choose Calculated.

2. In the New Column Name box, type the label for the modified data.

3. In the New Column Units box, type the modified unit.

4. In the New Column Formula box enter the formula of the calculation for the modified data. In the formula, the variable is inserted by clicking on the Columns button and choosing the heading for the column of the original data you want to modify.

5. When done with the new column, you will need to click on the label for the x or y-axis and choose the new column you want graphed on that axis.

6. If the points are linear, box them in and choose regression line. If they are not linear, the data may be bad, the wrong modification may have been chosen, or further modification may need to be done.

# Common errors in writing equations from graphs

1. Not putting units on the slope and intercept. (The slope is the y-unit divided by the x-unit!!)
2. Putting units on the variables. (Only a letter representing the variable is to be there.)
3. Not modifying the variable in the equation to the one in the linearized graph.
4. Putting a letter from the unit in for the variable instead of a letter from what was measured.

**Reports should have the following sections:**

1. Introduction and Purpose
   1. Briefly describe the **purpose** of the investigation.
   2. Briefly describe the **materials** and **procedures** used in the investigation.
      1. For Investigations that you have planned, the **materials** and **procedures** should be described in detail.
2. Observations and Data
   1. Record **observations** (made with the five senses) in a table or chart, neatly drawn with a ruler.
      1. Include column headings and, where appropriate, row headings.
      2. Some possible column or row headings are:
         1. Before, During, After
         2. Time, Observation
   2. Record **data** (measurements and calculations) in a table or chart, neatly drawn with a ruler.
      1. Include column headings and row headings.
      2. State units in the column or row heading, not the body of the table.
3. Results and Analysis
   1. Submit any **graphs** produced in the analysis of the data.
      1. Graphs can be hand-drawn or computer-produced.
   2. Include any **mathematical formulas** used to analyze the data, including a **sample calculation**.
   3. Analyze the quantitative data (graphs and/or calculations).
   4. Analyze the qualitative data (observations).
4. Conclusion
   1. Make a claim or draw a conclusion.
   2. Support your claim or conclusion with:
      1. Qualitative data
      2. Quantitative data
   3. Discuss any anomalous or unexpected results.
   4. Address possible sources of experimental error.
   5. For Investigations that you have planned, evaluate your plan.
      1. Evaluate the procedures.
      2. Suggest changes and/or discuss changes that you made.
      3. Address unexpected results.

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| **Score** | **Skill C2: Observing, Measuring and Recording** |
| 0 | No evidence of positive achievement for this skill. |
| 1 | Some evidence of positive achievement, but the criteria for a score of 2 are not met. |
| 2 | **Makes observations or readings given detailed instructions.**  **Records results in an appropriate manner given a detailed format.** |
| 3 | Is beyond the level defined for 2, but does not meet fully the criteria for 4. |
| 4 | **Makes relevant observations, measurements, or estimates given an outline format or brief guidelines.**  **Records results in an appropriate manner given an outline format.** |
| 5 | Is beyond the level defined for 4, but does not meet fully the criteria for 6. |
| 6 | **Makes relevant observations, measurements, or estimates to a degree of accuracy appropriate to the instruments or techniques used.**  **Records results in an appropriate manner given no format.** |

**Coursework Rubric**

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| **Score** | **Skill C1: Using and Organizing Techniques, Apparatus, and Materials** |
| 0 | No evidence of positive achievement for this skill. |
| 1 | Some evidence of positive achievement, but the criteria for a score of 2 are not met. |
| 2 | **Follows written, diagrammatic, or oral instructions to perform a single practical operation.**  **Uses familiar apparatus and materials adequately, needing reminders on points of safety.** |
| 3 | Is beyond the level defined for 2, but does not meet fully the criteria for 4. |
| 4 | **Follows written, diagrammatic, or oral instructions to perform an experiment involving a series of step-by-step practical operations.**  **Uses familiar apparatus, materials, and techniques adequately and safely.** |
| 5 | Is beyond the level defined for 4, but does not meet fully the criteria for 6. |
| 6 | **Follows written, diagrammatic, or oral instructions to perform an experiment involving a series of practical operations where there may be a need to modify or adjust one step in the light of the effect of a previous step.**  **Uses familiar apparatus, materials, and techniques safely, correctly, and methodically.** |

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| **Score** | **Skill C4: Planning, Carrying Out and Evaluating Investigations** |
| 0 | No evidence of positive achievement for this skill. |
| 1 | Some evidence of positive achievement, but the criteria for a score of 2 are not met. |
| 2 | **Suggests a simple experimental strategy to investigate a given practical problem.**  **Attempts “trial and error” modification in the light of the experimental work carried out.** |
| 3 | Is beyond the level defined for 2, but does not meet fully the criteria for 4. |
| 4 | **Specifies a sequence of activities to investigate a given practical problem.**  **In a situation where there are two variables, recognizes the need to keep one of them**  **constant while the other is being changed.**  **Comments critically on the original plan and implements appropriate changes in the light**  **of the experimental work carried out.** |
| 5 | Is beyond the level defined for 4, but does not meet fully the criteria for 6. |
| 6 | **Analyzes a practical problem systematically and produces a logical plan for an**  **investigation.**  **In a given situation, recognizes that there are a number of variables and attempts to**  **control them.**  **Evaluates chosen procedures, suggests/implements modifications where appropriate, and shows a systematic approach in dealing with unexpected results.** |

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| **Score** | **Skill C3: Handling Experimental Observations and Data** |
| 0 | No evidence of positive achievement for this skill. |
| 1 | Some evidence of positive achievement, but the criteria for a score of 2 are not met. |
| 2 | **Processes results in an appropriate manner given a detailed format.**  **Draws an obvious qualitative conclusion from the results of an experiment**. |
| 3 | Is beyond the level defined for 2, but does not meet fully the criteria for 4. |
| 4 | **Processes results in an appropriate manner given an outline format.**  **Recognizes and comments on anomalous results.**  **Draws qualitative conclusions that are consistent with obtained results and deduces patterns in data.** |
| 5 | Is beyond the level defined for 4, but does not meet fully the criteria for 6. |
| 6 | **Processes results in an appropriate manner given no format.**  **Deals appropriately with anomalous or inconsistent results.**  **Recognizes and comments on possible sources of experimental error.**  **Expresses conclusions as generalizations or patterns where appropriate.** |