

North Toronto Collegiate Science Department

Progression for Scientific Lab Reports

Grade 9-10 Components:

For each individual assignment, teachers may be requiring any or all of the components. At each level, students should be progressing towards the next level by the end of the year.

- Purpose:** This should be a simple statement involving an action (i.e. "To determine...").
 - Grade 9:** At this level, the purpose will generally be related to a task.
For example: To measure the current flow through series and parallel circuits.
 - Grade 10:** At this level, the purpose should be related to the procedures, methods or tests being used to complete the task.
For example: To use solubility patterns to test for the presence of specific ions.
- Hypothesis:** This should be a simple (1-sentence) statement that attempts to *predict* and *explain* the results.
- Materials and Apparatus:** One of the following three options will be assigned by the teacher. The use of labelled diagrams is strongly encouraged with all options.
List: provide a complete list of materials and apparatus used
Refer: make references to a specific page or document where the materials list can be found.
Note Changes: note any changes to a prescribed list in conjunction with a reference.
- Procedure:** One of the following options will be assigned by the teacher. Procedures should NOT be written in the 1st tense.
Copy out: Students provide a complete, written procedure based on one that they have been given. They should be sure to note any changes and include diagrams where appropriate.
Progression: Towards the end of the unit or year, students will be required to design or write a modification to a given procedure to either make an improvement, examine a different concept or complete a different task.

Alternative: Occasionally, students may be required to write a **Design Summary**, a paragraph of no more than five sentences summarising the procedure with appropriate reference to the materials used.
- Results (and Observations):** This section includes three possible components: *Qualitative Observations*, *Measured Data* and *Calculated Data* depending on the inquiry. These components can be presented separately or in a combined format. All tables and figures must be appropriately titled and labelled.
In all cases, **theoretical interpretations** of the data are **not** to be made.
 - Qualitative Observations:** This is a necessary component for all lab reports. It should make reference to initial and final physical properties of the materials being studied using appropriate, consistent language. Observations during physical or chemical changes can also be recorded. Students are encouraged to present their observations in an organised and concise manner (labelled and titled tables are usually best).
 - Measured Data:** If quantitative measurements are made, they should be presented in an organised manner with appropriate units.
 - Calculated Data:** The results of calculations can be presented with measured data *as long as* the complete calculations are included and presented as well.
Alternative: In some cases, students may be asked to write a *Results Summary*, in paragraph form, referring to significant qualitative and quantitative data.
- Discussion/Analysis:** This section is where interpretation of results in relation to the purpose is to be completed. The format of this is dependent on course level and lab content.
Grade 9-10: Most lab reports will involve the completion of a variety of questions assigned by the teacher. The questions should guide students through an analysis of the observations, calculations, significance of the observations and also evaluation of possible errors. It may also include evaluation of the procedure with suggestions for improvement.

Error Analysis: A separate section of the discussion should make note of significant *uncontrollable* sources of error and their relative effect on the results. This should also include a recommendation towards an improvement or remedy for the error.
- Conclusion:** This section should be a summary related to the original purpose. It should address the relationship between the outcome and the question. It may also include steps for further examination.

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Grade 11 Components:

For each individual assignment, teachers may be requiring any or all of the components. At each level, students should be progressing towards the next level by the end of the year.

- Purpose:** This should be a simple statement involving an action (i.e. "To determine...").
Grade 11: At this level, the purpose should be related to the procedures or tests being used to complete the task.
For example: To use solubility patterns to test for the presence of specific ions.
- Hypothesis:** This should be a simple (1-sentence) statement that attempts to *predict* and *explain* the results. Research may be necessary for completion.
- Materials and Apparatus:** One of the following three options will be assigned by the teacher. The use of labelled diagrams is strongly encouraged with all options.
List: provide a complete list of materials and apparatus used
Refer: make references to a specific page or document where the materials list can be found.
Note Changes: note any changes to a prescribed list in conjunction with a reference.
- Procedure:** One of the following options will be assigned by the teacher. Procedures should NOT be written in the 1st tense unless accommodating changes. In all cases, use of labelled diagrams is encouraged.
Refer: Students make a reference to a specific page or document where the procedure is found. They should be sure to note any changes and include diagrams as appropriate. **Complete:** Students provide a complete, written procedure describing the physical steps taken. This procedure may be an original design or a modification to a given procedure to make an improvement, examine a different concept or complete a different task.

Alternative: If the materials and procedure are referred to, students may be required to write a **Design Summary**, a paragraph of no more than five sentences summarising the procedure with appropriate reference to the materials used.

- Results (and Observations):** This section includes three possible components: *Qualitative Observations*, *Measured Data* and *Calculated Data* depending on the inquiry. These components can be presented separately or in a combined format. All tables and figures must be appropriately titled and labelled.
In all cases, **theoretical interpretations** of the data are **not** to be made.
 - Qualitative Observations:** This is a necessary component for all lab reports. It should make reference to initial and final physical properties of the materials being studied using appropriate, consistent language. Observations during physical or chemical changes can also be recorded. Students are encouraged to present their observations in an organised and concise manner (labelled and titled tables are usually best).
 - Measured Data:** If quantitative measurements are made, they should be presented in an organised manner with appropriate units.
 - Calculated Data:** The results of calculations can be presented with measured data *as long as* the complete calculations are included and presented as well.Alternative: In some cases, students may be asked to write a *Results Summary*, in paragraph form, referring to significant qualitative and quantitative data.

- Discussion/Analysis:** This section is where interpretation of results in relation to the purpose is to be completed. The format of this is dependent on course level and lab content.

Questions: Some lab reports will involve the completion of a variety of questions from the lab document or textbook as assigned by the teacher. The questions should guide students through an analysis of the observations, calculations, significance of the observations and also evaluation of possible errors. It may also include evaluation of the procedure with suggestions for improvement.

Paragraph: Students will be given several opportunities to work towards a paragraph form discussion. Students can use suggested questions as a guide for their discussion. The discussion should make direct links between the physical task and the concepts being studied. Students are encouraged to include appropriately titled, labelled and captioned figures and tables and to make reference to them in their discussion.

Error Analysis: A separate section of the discussion should make note of significant *uncontrollable* sources of error and their relative effect on the results. This should also include a recommendation towards an improvement or remedy for the error. Quantitative labs should include a calculation of % error, which may need to be discussed further.

- Conclusion:** This section should be a summary related to the original purpose. It should address the relationship between the outcome and the question. It may also include steps for further examination.

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Grade 12 Components:

For each individual assignment, teachers may be requiring any or all of the components. At each level, students should be progressing towards the next level by the end of the year.

1. **Purpose:** This should be a simple statement involving an action (i.e. "To determine...").

Grade 12: The purpose at this level should relate to the concept being studied and make a connection to the task or procedure as well.

For example: To use calorimetry to measure the enthalpy change of a system when ionic crystals are dissolved.

2. **Hypothesis:** This should be a simple (1-sentence) statement that attempts to *predict* and *explain* the results. Occasionally, some research will be required to complete the hypothesis.

3. **Materials and Apparatus:** One of the following three options will be assigned by the teacher. The use of labelled diagrams is strongly encouraged with all options.

List: provide a complete list of materials and apparatus used

Refer: make references to a specific page or document where the materials list can be found.

Note Changes: note any changes to a prescribed list in conjunction with a reference.

4. **Procedure:** One of the following options will be assigned by the teacher. Procedures should NOT be written in the 1st tense unless accommodating changes. In all cases, use of labelled diagrams is encouraged.

Refer: Students make a reference to a specific page or document where the procedure is found. They should be sure to note any changes and include diagrams as appropriate.

Complete: Students provide a complete, written procedure describing the physical steps taken. This procedure may be an original design or a modification to a given procedure to make an improvement, examine a different concept or complete a different task.

Alternative: If the materials and procedure are referred to, students may be required to write a **Design Summary**, a paragraph of no more than five sentences summarising the procedure with appropriate reference to the materials used.

5. **Results (and Observations):** This section includes three possible components: *Qualitative Observations*, *Measured Data* and *Calculated Data* depending on the inquiry. These components can be presented separately or in a combined format. All tables and figures must be appropriately titled and labelled.

In all cases, **theoretical interpretations** of the data are **not** to be made.

a) **Qualitative Observations:** This is a necessary component for all lab reports. It should make reference to initial and final physical properties of the materials being studied using appropriate, consistent language. Observations during physical or chemical changes can also be recorded. Students should be encouraged to present their observations in an organised and concise manner (labelled and titled tables are usually best).

b) **Measured Data:** If quantitative measurements are made, they should be presented in an organised manner with appropriate units.

c) **Calculated Data:** The results of calculations can be presented with measured data *as long as* the complete calculations are included and presented as well.

Alternative: In some cases, students may be asked to write a *Results Summary*, in paragraph form, referring to significant qualitative and quantitative data.

6. **Discussion/Analysis:** This section is where interpretation of results in relation to the purpose is to be completed. The format of this is dependent on course level and lab content.

Questions: Some lab reports will involve the completion of a variety of questions from the lab document or textbook as assigned by the teacher. The questions should guide students through an analysis of the observations, calculations, significance of the observations and also evaluation of possible errors. It may also include evaluation of the procedure with suggestions for improvement.

Paragraph: Students will be given several opportunities to work towards a paragraph form discussion. Students can use suggested questions as a guide for their discussion. The discussion should make direct links between the physical task and the concepts being studied. Students are encouraged to include appropriately titled, labelled and captioned figures and tables and to make reference to them in their discussion.

Error Analysis: A separate section of the discussion should make note of significant *uncontrollable* sources of error and their relative effect on the results. This should also include a recommendation towards an improvement or remedy for the error. Quantitative labs should include a calculation of % error, which may need to be discussed further.

7. **Conclusion:** This section should be a summary related to the original purpose. It should address the relationship between the outcome and the question. It may also include steps for further examination.