*Delete all guidelines under each heading once you have completed your Project Report*

**PROJECT TITLE: …**

**SUBTITLE** *(if applicable)* …

First Name(s):

Surname:

Category:

Sub-category:

Province and Region:

School:

Grade:

(Cover page: All project reports must have a cover page with the above details)

This is guide and template on how to write an mathematics/theoretical type project report to bring to the Eskom Expo for Young Scientists’ fair. It gives detailed instructions, that you need to read and follow. Ask your teacher/Regional Science Fair Director if you do not understand any part of this section of the report guide.

Pages should have 2.5-cm margins. It is preferable to use 12-point Sans-serif fonts that are easy on the eyes, i.e. Gill Sans MT, Times New Roman. Use 1.5-line spacing. Include page numbers on the bottom centre or right corner of each page. Spelling, grammar usage and punctuation should conform to the Oxford English Dictionary for UK English (not US English).

Paragraphs are useful tools for separating and organising your ideas. Different ideas should be split into separate paragraphs and common ideas should be grouped in the same paragraph. Your paragraph should have a topic sentence which gives the reader an indication of what to expect in that paragraph. If you present two hypotheses/engineering goals in the Introduction, then you should deal with those hypotheses/goals in the same order in the Methods, Results, and Discussion sections.

*Abbreviations*

Use abbreviations sparingly and only if they will save substantial redundancy throughout your project report. Adding abbreviations (particularly abbreviations that are common in your choice of category) can make your writing more concise, but overuse simply adds confusion. Be sure to define abbreviations in full at first use by writing out the term in full, and then placing the abbreviation in parentheses; e.g., arithmetic progression (A.P.). Do not begin a sentence with an abbreviation.

*Notations and Numbers*

Use standard scientific notation. Think about which subscripts and superscripts would be best to use in the report. Numbers should be written in scientific notation.

Numbers whose absolute value is greater than or equal to 0.1 and less than 100 may be written without exponent. e.g.

0.5268 10.31

Numbers whose absolute value falls outside the range less than 0.1 and greater than 100 should be written with an exponent e.g.

-1.97x105 1.97x10-11

Most numbers in the theory are associated with units. It is important that the units are shown next to the number written in the correct notation. For example, the average magnitude of the acceleration due to gravity at the surface of the earth is m/s2 or 9.80 m.s-2. Do not begin a sentence with a number.

*Variables and Equations*

Variables in text and in equations are often represented by symbols. The symbols must be italicised, however, units and numbers are in normal font. Vectors are in bold font or with arrows above them, and matrices are in bold. Clearly define all variables when they are first used.

Equations should be treated as part of the text. If you use equations taken from a source, reference the source. If the equation is not to be numbered and is small, it can be included in a sentence, it may be placed in the text just like a word (e.g. the energy of a photon is given by *E = hv*, where *E* is the photon energy, *h* is Planck’s constant and ν is the frequency of the light).

It is required to number equations that are going to be used continuously. Grammatically, the equation is treated as if it is part of the text. Which is why there are punctuations such as a comma or full stop at the end of a displayed equation. Use of an equation editor is strongly encouraged e.g.:

$\left(x+a\right)^{n}=\sum\_{k=0}^{n}\left(\genfrac{}{}{0pt}{}{n}{k}\right)x^{k}a^{n-k}$ Eq 1

Refer to all numbered equations in the report and refer to them in text, if you will not be referring to an equation, do not number it.

*Theorems or Corollaries*

Number theorems and corollaries by section. Subdividing the report into title sections enables readers to more easily locate them in the report. For example, “In Theorem 8.1, it was proved…,” – it’ll be easy to for the reader/judge to locate the theorem under that section.

*Tables and Figures*

Tables and figures form part of what you say in the paragraph(s). They are accessories to the text. You cannot just put a table or figure, always refer to them in text e.g. “Viscosity decreases with increasing temperature as shown in Figure 1…” Whenever you refer to tables and figures in the paragraph(s), you need to be clear about what you are determining from them and why. Both should be able to stand alone and make sense to the reader. Tables and figures should have appropriate title/captions and labels with correct units.

Tables have a title at the top and figures have captions at the bottom which describes the purpose for which it has been presented (e.g. “Table 1: Measurements of the width of the cylinder” and “Figure 1: The viscosity of oil in mm2/s at different temperatures”). Table and figures are usually referenced by a number and should be numbered in sequence, e.g. Table 1, Table 2… Figure 1, Figure 2, etc.

Label your axes so that the reader knows what scale points are plotted on the graph and specify units for quantities.

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# Introduction

In the introduction, present a brief overview sufficient enough to establish the need for your research project. It sets the project in its broader context and narrows it down by identifying and explaining the motivation for the project. It ranges between two to four pages. Never put your results or conclusion in the Introduction.

## Literature Review

Briefly review relevant literature (e.g. journal articles, books, technical reports, etc.) to orientate the reader. You present an overview of what is known about the research project. In doing so, you will read previous and recent research done around your project report and write what is most relevant to it.

As you near the end of the literature review (*i.e*., at the beginning of the last paragraph), identify the important gap that you are trying to fill. You need to build up to why you are doing this research project.

### Problem Statement or Phenomena

Based on the gaps/ knowledge you found in the literature review, you lead up to the need*.* Based on the need you identified, state the problem statement/ phenomena, as clearly as possible.

### Aim

State your aim and it should always be concise.

### Hypothesis or Research question

Clearly state the hypothesis or the research question you want to answer.

# Method

The method section must explicitly explain how you went about solving the problem or understanding the phenomena. It describes the mathematical/ theoretical techniques you used and thus must be written in the past tense.

## Variables

State the variables of your research project.

## Procedure

Explain which procedure you followed, why you chose it and gives a clear step- by-step description of how the procedure was carried out. Give enough detail in this section so that someone else could be able to replicate what you did, in order to verify or refute what you found. For theoretical work describe the theory with basic equations and indicate how such equations are solved. Details of long derivations should be put in the appendix. You need to mention the type of programming software you used e.g. MATLAB, R, Statistica, Wolfram Mathematica, etc. and the variables that will be influencing your data.

# Results

The overall purpose of this section is to describe patterns, not to explain or interpret them. Think of the Results section as telling a story about what you found when conducting your experiments or theoretical calculations. You need to set the context within which the data were collected. That will help the reader to understand more fully the data and analyses specific to your hypothesis/ research question.

Results should be presented in a way that it aligns with the hypothesis/ research question. Begin by thinking about what information the reader will need to assess whether you achieved your aim or not. It should be presented in a form that is easy to read, which usually means putting it in a graph or a table.

# Discussion

The discussion interprets patterns you found. Explain why you found what you found, backing it up with relevant literature. This is done by reviewing and comparing literature. Literature used must be cited and referenced. How are they similar or different? Why might there be differences between your project and others? It explains what the patterns mean (i.e., why you found the results you did). What assumptions did you make?

# Limitations and errors

Briefly discuss all the things that affect your measurement but which you cannot do anything about, given certain constraints. This includes sources of errors in your assumptions/ calculations that bias your results.

# Recommendations for Future Research

Make concrete suggestions about how this project could be extended.

# Conclusion

Clearly state your conclusion and importantly, be sure to address the importance of your work. Write your conclusions to address one all-important question: - So what? What is the overall importance of your results? Why should anyone care? You must refer to the hypothesis/ question and to the most important results and you must state whether your hypothesis is supported or rejected.

# Acknowledgments

Any person who made a direct contribution to the project should be acknowledged. If applicable, funding sources should be mentioned.

# References

Referencing is a way to validate that you have done further reading, learning and comprehension by using relevant sources. Eskom Expo for Young Scientists uses the Harvard format for referencing. Formatting has to be consistent throughout the report.

# Appendix

An appendix is placed at the end of your report, the full version is either inappropriate or too detailed for the body of the report. There may be more than one appendix, in which case the series is called the appendices. Examples of material suitable for an appendix are a new computer program specifically designed for the research, or an unpublished test and its validation.