

The Research Paper Must Contain These Parts In Order:

(Examples of student papers are on the West Michigan Science Challenge website.)

- a.) **Cover Sheet** – Your cover sheet should contain, in this order – Your project title, your testable question, your name. This should be written and centered on the page.
- b.) **Table of Contents** - Include a page number for the beginning of each section.
- c.) **Introduction** - The introduction should be written separated into four parts:
 - (1) Reasons for research - Why is this project important to you or others?
 - (2) Problem statement - Is the problem a testable question? Explain why.
 - (3) Background information - All information found from research. This is the main body of the introduction.
 - (4) Hypothesis.
- d.) **Materials List** - Include everything used in the experiment, the number used, and use.
- e.) **Procedures** - Describe in detail the methods used to collect data or make observations. This is where to define variable(s) and controls (See below for clarification). The procedures should be detailed enough that someone would be able to repeat the experiment from the information in your paper. Include photographs or drawings of self-designed equipment.
- f.) **Results** - Results should be divided into three areas:
 - (1) **Data Table(s)** - should include all trial results.
 - (2) **Graph(s)** - illustrate the important **averages** of data.
 - (3) **Written results** - Discuss your data table(s) and graph(s). This section is a written account of the results*.
- g.) **Discussion/Conclusion** - This is the most important part of the paper. Be thorough. Was the hypothesis supported or not supported by the results? Discuss how the conclusion was made and refer to tables and graphs. Compare the results with published data, commonly held beliefs, and/or expected results. Discuss problems encountered. Make suggestions for solutions or changes that need to be made. Who would benefit from these results and why? Also, discuss ways to expand on this project or other related research, which could be done.
- h.) **Bibliography (references)** - Using the correct style, include any documentation that is not your own. Credit all those who assisted in any way: printed references, interviews, films, Internet, use of loaned equipment, etc.

Examples of cited material:

Asimov, Isaac. *Life and Energy*. New York: Avon Books, 1972. (book)

Kirshner, Robert P. "Supernova: Death of a Star." *National Geographic*, April 29, 1998, 618-647. (magazine)

Sydney Shoemaker. "Memory". Vol. 5-6 of the *Encyclopedia of Psychology*. New York: Macmillan Co., 1972. (encyclopedia)

Newell, Sally J. Interview with research scientist. Muskegon, MI, 15 January 1999. (interview)

Angier, Natalie. "Chemists Learn why Vegetables Are Good for You." *New York Times* 13 Apr. 1993, late ed.: Cl. *New York Times Online*. (website)

Walker, Janice R. "MLA-Style Citations of Electronic Sources." *The Columbia Guide to Online Style*. January 1999. <<http://www.cas.usf.edu/english/walker/mla.html>> (11 February 2000). (website)

Clarification of Independent Variable, Dependent Variable, Control, and Constants

An Independent Variable is the part of an experiment that the investigator changes on purpose. In a simple experiment, there is only one independent variable. Sometimes this variable is called the manipulated variable.

A Dependent Variable is the variable that responds in an experiment. This is the part that you measure or observe. The dependent variable is the reaction or response to the independent variable or change made in the experiment. The dependent variable is the measured response. It may be a measurement using quantitative data-length, mass, time, volume, height etc., or qualitative data-color, appearance, behavior, or observations.

Constants are variables that *might* affect an experiment but are kept from doing so. Constants are all the factors that are kept the same so they are prevented from affecting the outcome of the experiment.

A Control is used as a standard of comparison. A control is important because it is used to detect "hidden" variables that are varying when they should not. In some experiments the control is called a "no treatment" control. The experimenter does nothing to one of the samples. In some experiments, all trials receive a treatment. The experimenter must select one of the levels of the independent variable being tested as the control.