

Science in Action!!

GOAL: To answer a scientific question by using the scientific method. The results will be compiled in a report and presented at the ***Vancouver Island Regional Science Fair***.

STATEMENT OF INQUIRY: A scientific question can be answered by designing an experiment that investigates the change in variables, by collecting evidence and evaluating the consequences of those changes and drawing conclusions.

STEPS TO COMPLETE:

1. **PROJECT APPROVAL:** Choose a basic topic that you would like to investigate. Make sure it is something you're interested in and that can be studied easily. Start simple, but make sure there is a problem to be solved or studied. The website, sciencebuddies.org has some great ideas to get you started (but do NOT simply copy their experiments!).

Fill out the form on the next page and **submit to your teacher for approval**. You may not continue until your topic is approved.

ADD IN SOCIAL APPLICATION (why you want to do your project – who does it impact? You? Society? Environment?)

DUE: _____

2. **RESEARCH:** Find out everything you can about your topic, take rough notes, consult every source possible. Use online databases for science journals, websites, textbooks, and consult with experts. Make sure you make notes of all the information from your sources so you can **reference** them properly.

DUE: _____

3. **METHOD:** Create an **experimental design** (procedure) that will test your hypothesis. Hand in for approval **BEFORE** your start experimenting!

DUE: _____

4. **FORMAL LAB REPORT:** Perform the experiment procedure, noting all observations for future analysis of results. Complete a **formal lab report**.

DUE: _____

5. **EXHIBIT (POSTER BOARD)** Prepare an exhibit to display your work. You will present your project to student and specialist judges.

DUE: _____

STEP 1: PROJECT APPROVAL

Subject Area: (circle one)

Biology – Human Health and Psychology

Chemistry and Materials

Environmental

Biology – Life Sciences

Engineering and Computer Sciences

Physics

Innovation (invention)

Basic question I want to answer:

Hypothesis:

Scientific information supporting my hypothesis (include citation):

Check the box after you read the paragraph below:

I understand that if I am going to test people (including a survey or skill assessment) that I **MUST** have each participant sign a form giving their permission. If the person is under 18 years old, then their parent must sign the form. You will need to have this form approved by your teacher before you proceed.

Teacher Approval: _____

Tips for choosing a science research project:

Scientific advances often fall into the category of an “experiment” or an “innovation”. These are the descriptions used by judges at the Vancouver Island Regional Science Fair to determine the level of scientific thought that projects display.

Experiment:

Definition: *An investigation undertaken to test a specific hypothesis using experiments. Experimental variables, if identified, are controlled to some extent.*

- **Level 1:** Duplicating a known experiment to confirm the hypothesis. Hypothesis is totally predictable.
- **Level 2:** Extend a known experiment through modification of procedures, data gathering and application.
- **Level 3:** Devise and carry out an original experiment with controls. Variables are identified. Some significant variables are controlled. Data analysis includes graphic presentation with simple statistics.
- **Level 4:** Devise and carry out original experimental research which attempts to control or investigate most significant variables. Data analysis includes statistical analysis.

Innovation:

Definition: *Involving the development and evaluation of innovative devices, models or techniques or approaches in fields such as technology, engineering, or computers (both hardware and software).*

- **Level 1:** Building models (devices) to duplicate existing technology.
- **Level 2:** Make improvements to, or demonstrate new applications for existing technological systems or equipment and be able to justify them.
- **Level 3:** Design and build innovative technology or provide adaptations to existing technology that will have economic applications and/or human benefit.
- **Level 4:** Integrate several technologies, inventions or designs and construct an innovative technological system that will have commercial and/or human benefit.

Your goal is to come up with a project that is at a Level 3 or Level 4. This means designing a unique project or innovation, not repeating one you find elsewhere. Projects at this level stand a better chance of ranking high at the Vancouver Island Regional Science Fair and perhaps qualifying for the Canada Wide Science Fair.

STEP 2: RESEARCH

Collect **background research** on your topic. This research will form the basis of your formal report.

What have you found out in detail? Make sure you reference it properly. At the end discuss the specific problem you wish to experiment or study further, and restate the hypothesis. This will be assessed using Criteria B in your formal report.

1. **Explain** the problem or question that you will be testing in your scientific investigation.
 - **WHY** is this important to test? Strong science research projects have a good reason for the study or experiment.
 - **WHAT** other experiments have scientists done in the past that helps you to understand your project (i.e. background research)? Include any relevant background information that will help the reader understand what you are doing.
 - **HOW** is science going to be applied to answer your research question? For instance, what laboratory techniques will you use? What fundamental science concepts or laws apply to your experiment?
 - **EVALUATE** the use of science to answer the question you have posed. For instance, perhaps really advanced equipment could be better used to answer your question. Since this is not reasonable, how is the science you have chosen valid for answering your research question?
2. **Document your sources** using in-text citation.

STEP 3: METHOD

Write out how you are going to perform your experiment in enough detail that someone could follow your plan (like a recipe).

Materials: (include a list of materials below, or attach to this page)

Method: (Write out the steps that you will follow. Make sure you number them!)

Safety: (What safety concerns must you be aware of to successfully and safely complete your experiment?)

Teacher Approval: _____

STEP 4: FORMAL LAB REPORT

Your final lab report must have the following parts to it:

1. Introduction (stating the aims and objectives of the work)

- Your research completed in Step 2 (with changes as necessary)

PLUS

- Your variables (independent, dependent). The key controlled variables can be formatted in a table for clarity, showing the variable and how you controlled it with your procedure. Explain how your procedure will allow you to collect sufficient and valid data.
- Your hypothesis (explain it in one paragraph using scientific reasoning)

2. Method

a. Materials list

- ### b. Experimental procedure
- (Note that it is normal for your procedure to change as you go through the experiment. Submit your FINAL procedure.) This will consist of many steps, each numbered.

3. Results

a. Data

- Report your measurements as tables and graphs
- Report your observations in words or in pictures and drawings

b. Data Analysis and Discussion

- This section is a summary of what you found out in your experiment, describing your observations, data table, and graphs in words
- Explain trends or patterns in your results
- Show the results of all calculations (slope, statistics, etc.)

4. Conclusion

- Re-state your hypothesis and state whether or not you achieved your hypothesis using scientific reasoning.
- Support your statements by giving the evidence from your experiment (such as “When the amount of coconut fiber in the soil increased, all plants grew more quickly. Weekly growth rates for the first four weeks, for beans, potatoes, and geraniums were 1.5, 0.8, and 2.1 cm/gram of coconut fiber”)
- Comment on the validity of your data and the method (Is your data right? How do you know? Did your method allow you to collect valid data?) and reliability of your data (could you/did you repeat the results you got?)

5. Evaluation

- Discuss errors and what you would do differently if you repeated this experiment.
- What additional research would you do based on what you learned?

6. Acknowledgements (This is your opportunity to thank anyone who helped you with your science fair project, from a single individual to a company or government agency)

7. References

For citation examples see the OSLIS (Oregon State Library Information System – www.oslis.org) or format as below:

APA Website

Contributors' names (Last edited date). *Title of resource*. Retrieved from <http://Web> address for OWL resource

Example:

Angeli, E., Wagner, J., Lawrick, E., Moore, K., Anderson, M., Soderlund, L., & Brizee, A. (2010, May 5). *General format*. Retrieved from <http://owl.english.purdue.edu/owl/resource/560/01/>

Book

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Example:

Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.

STEP 5: EXHIBIT/POSTER BOARD

You will need to re-use or purchase a standard tri-fold poster board from Staples or another stationary store. Use this board to present your project.

Tips:

- Make your poster board eye-catching with lots of colour and images.
- The headings should be a large enough font that someone can read it from about 2 metres away.
- When people come to look at your poster board, they will probably not read the whole thing, so DO NOT simply attach your final report to the board. Instead, turn your report into point form statements that allows the reader to learn about your project efficiently.
- Be creative! You want to draw people into your project.
- Bring a demo of your experiment if it is safe (check with your teacher if you are unsure)

Example of poster board set-up:

<i>LEFT PANEL</i>	<i>CENTER PANEL</i>	<i>RIGHT PANEL</i>
	TITLE Your name	
INTRODUCTION:	DATA AND RESULTS: - put lots of graphs and pictures in the center	CONCLUSION:
PROCEDURE:		ACKNOWLEDGEMENTS:
		REFERENCES: