Science Success: Student Workbook

Supporting Student Science Fair Projects

Bay Area Science and Engineering Fair (BASEF)

BASEF

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Purpose of This Workbook

This workbook is designed to help you prepare for your science fair project. In it you will find a step-by-step process to guide you, along with some helpful hints. By using this guide, you will be able to create a successful science fair project that will be a rewarding experience! Your teacher or adult mentor will be able to assist you with the activities that appear throughout the book. These 22 activities are designed to walk you through the process of preparing a science fair project.

What Makes a Good Science Fair Project?

A good science fair project begins with a question or problem about a topic that is of interest to you. Your enthusiasm for your topic will be clear at every stage of your work and final presentation, so think of doing a project on something that interests **you**.

What a Good Science Fair Project is:

- A good project could be a report of an experiment or data collection that addresses a particular question.
- A good project could be a model that is designed to answer a specific problem.
- A good project could be a presentation of a new perspective on an overview of other people's work.

Before going further, it may help to think about what a good science fair project is **not**. A good project is not a report with no experiment or data collection. It is not a model that addresses no problem. It is not a collection of things, and it is not a summary of what has been written in books or on websites.

Types of Projects

There are 3 types of project you might choose. The process of completing each is similar, but there are some differences you will need to understand. On the next page the three types are outlined, and examples of each are given.

1) An **experiment** is a science project that uses a process of scientific inquiry to investigate the question. You would think of a question about a topic, make a hypothesis (educated guess based on your existing knowledge or by reading) regarding the answer, and then design and conduct an experiment to test that hypothesis. You will make, record, and

analyze observations to accept or reject your hypothesis. The key to a good experiment is identification and control of the variables.

Example: You might be interested in plants and have a question about what would happen if you tried different conditions for plant growth, or you might want to know whether using certain study strategies could improve test scores.

2) An **innovation** is a project in which you design a product that solves a particular problem. You would identify a problem, and experiment with materials to design a solution. You would conduct trials to test the product, and improvements in design are made to better meet the needs of the original problem.

Example: You might like building models, and might want to choose to design something that solves a particular problem, such as how to lift a heavy fridge up into a tree fort, or a device that transfers heat energy to turn on a light bulb.

3) A **study** is a project in which observations are made about an existing phenomenon and results are recorded. Instead of controlling and changing the variables, you would choose existing or naturally occurring variables for observation. Your focus is on finding a (new) explanation for the recorded observations. This type of project can also be a purely literature-researched based project in which you compare work of several others in a field and look for relationships that they may have missed. This is a less common type of project, but if done well, is certainly as strong as the experiment or innovation.

Example: You might be interested in how animals behave in certain circumstances, and may want to observe some aspect of their behaviour, such as their attentiveness to their young. You might want to do a library search to see if there are geographical patterns of disease that correspond to pesticide use.

Project Resource Page

Activity #1

Check out and browse some of the resources and websites on the Project Resource page at www.basef.ca. Each of the project types consists of several stages of planning and doing. The rest of this workbook will guide you through those stages. Use this chart for an overview of the stages for the different project types.

Experiment	Innovation	Study
Ask a question	Identify a problem	Ask a question
Form a hypothesis	Select the best alternative	Form a hypothesis
Plan the experiment	Plan the prototype	Plan the study
Perform the experiment	Build the prototype	Carry out the study
Observe and record data	Test & evaluate the prototype	Observe and record data
Organize and analyze results	Organize and analyze results	Organize and analyze results
Present results	Present results	Present results

Topics listed in the resources are good topics, and usually involve manageable experiments. However, if you are interested in creating a winning project, one which might win a trip to a regional fair, think about finding a question that is a little different, or puts your own unique spin on a common idea.

Choosing a Topic

Activity #2

Choosing a topic for your science project doesn't need to be difficult! The key is to begin with something that is interesting to you.

- One of the ideas from your browsing session may spark your interest.
- Titles of books in the non-fiction section of your school library may suggest ideas.
- Projects that others have done that you see online might give you ideas.

The source of the idea is not as important as whether it really interests you!

Student Name: ___________________________

Date: ___________________________________

What am I really interested in?

Was there a particular area we studied this year (or last) that I really enjoyed?

What have I read about or seen lately that made me wonder how it worked?

Can I think of a problem to which there is not an obvious solution?

It's ok to have more than one idea at this point. As you start to read a little about your topics, you may find that one is more interesting to you than the others for a project. Rule out any that may be too difficult to research, such as, "Is there life on Mars?" Keep all your ideas! You never know which one you may come back to in the end.

Asking the Right Question

There are many resources on how to ask a suitable question for a science fair project. The key is to make it complex enough to be interesting, and yet not too difficult to research or invent. Think about thick versus thin questions. You want to strive for a question that cannot be easily answered by a quick search on the computer. The best place to start is still with what really interests **you.**

The standard format for science fair projects that are experiments is:
"How does ______ affect ______?"

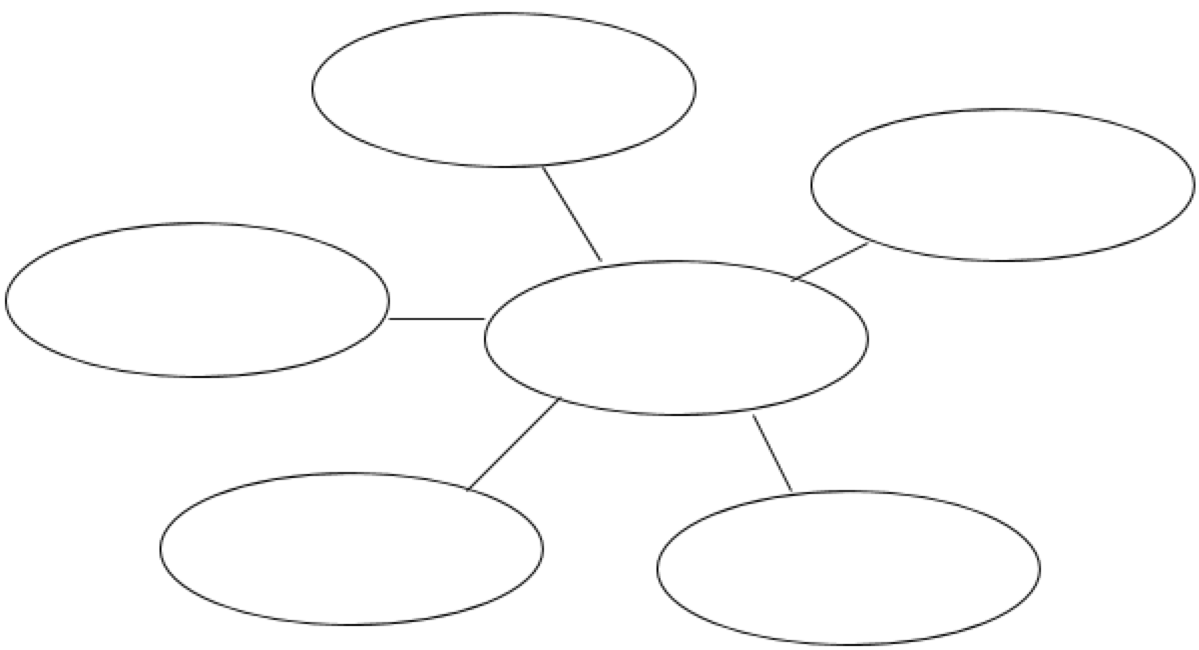
A common format for innovations (technology projects) is:
"In what way could ______ improve the performance of ______?"

Study questions often appear as:
"What type of relationship exists between ______ and ______?"

Activity #3

Student Name: ___________________________
Date: __________________________________

Write down questions about your topic that interest you. Think about what you don't know that you'd like to know, or would be helpful for other people to know.

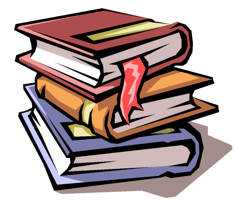


"The important thing is not to stop questioning." Albert Einstein

Keeping Track of Resources

The more resources you have used, the better your project will be. The judges will be impressed by your background research, and you will be more likely to find out interesting things about your topic that will help you write a really good question for investigation.

A suggestion is to include at least as many resources as your grade level, and make sure they are from a variety of different sources. As an example, if you are in grade 8, you might have 4 book sources, 2 websites, 1 magazine article, and one newspaper article.



People are also excellent resources. Experts in your topic area can provide valuable advice. If you don't know anyone who is an expert about your topic, maybe your teacher can suggest someone. Perhaps a parent of one of your classmates works in the very area you want to investigate. Keep track of people resources; although they are not listed in your resource list, they should be given credit in the acknowledgements section of your report. In addition, you will also want to write a brief note thanking them for their time.

Remember to record every book, magazine, website, expert as you find each one. It's much easier than having to go back and find them later!

Your original work! You will be reading a number of books as well as searching for information on the web. Remember to at all times give credit where it is due. Keep track of where information came from, and remember that even if you write something in your own words, if the idea came from another source, make sure you show the reference in the form of a references page at the back of your report in proper format. There are many different websites that you can use to automatically format your references sheet appropriately. This strengthens your project and impresses judges!

Use the tracking form on to keep track of all your resources as you use them.

Activity #4

Student Name: ___________________________

Date: __________________________________

Title			
Author			
Type of source			
Publisher			
City of Publication			
Pages			
Date			
Notes			

Refining the Question

Activity #5

Go back to your brainstorming map on page 8. How many questions can be easily answered by reading about the topic? Label these R for resource research. How many would need an experiment, innovation, or study to solve them (P)? Label these P for project idea.

Is your question something that can be easily answered through research? If yes, you need to ask a question that will better allow you to experiment or design an innovation. The key is to find something that is manageable, and at the same time, just a little different from what everyone else is doing.

Example: If there is a great deal of information on growing bean plants under different types of light, you might ask whether different types of bean seeds will show the same growth patterns under different types of light.

1) Is my question straightforward enough that I can design a project to answer it?
2) Can I complete the project in the time I have?
3) Have I allowed enough time to get all the necessary approvals and still finish before the fair? Do I know people who can help me with them?
4) Can I complete the project with the resources available to me?
5) Do I have, or can I afford the equipment and materials I will need? If not, do I know people who can help me gain access to them?
6) Where will I do my project? Will it be done at home? At school? (Be sure to get permission!) Is it dependent on materials or resources at another site?

Now is also the time to talk to someone else about your questions – scientists and engineers often talk with each other as a way of arriving at better solutions.

You may decide to stay with the topic and question you have researched, or you may choose to switch to another topic. Now is the time to do that, before you have invested a lot of time in developing your project.

Stating the Hypothesis

A hypothesis is your educated best guess of what will happen in your project.

- Scientists usually begin planning their experiments and studies around what they think will happen.
- Engineers generally begin by designing innovations they believe will solve the problem.

Example: Perhaps your project is going to investigate whether newspapers can be used as garden mulch without contaminating the soil. Your hypothesis might be, "Newspapers can be used as garden mulch without releasing chemicals into the soil that will harm plants."

The purpose of the hypothesis is to clarify for yourself and others what your experiment/study/innovation will prove or disprove. It acts as a signpost pointing to where you think your results will lead.

Sometimes results agree with the hypothesis. Some of the most interesting (and successful!) projects are those with results that do not agree with the hypothesis. That makes for exciting science! Your hypothesis is not always the answer to your question. Think of the hypothesis as a tool that helps you:

1) Focus your thinking
2) Design your experiment
3) Apply statistical analysis tools (if you wish) to the results
4) Include an independent and dependent variable.

Write your hypothesis in the space provided in the form on page 14.

Extending your thinking: Science doesn't prove the hypothesis: the results either <u>suggest</u> accepting or rejecting hypothesis. The reason? The unforeseen variable – even if you have controlled everything you can think of, there still may be a hidden factor that affected your experiment. Remember: In your write-up when you discuss your results, write, "The results support the hypothesis", not, "The results proved the hypothesis was correct".

Safety and Ethics Guidelines

There are a number of safety guidelines governing what can be displayed at a fair. You will want to check these guidelines before beginning your project. You will also want to know if there are particular safety issues regarding materials you wish to use in your project. Now is the time to find out!

Example: No vertebrates may be used in science fair projects except in studies in natural settings. The project must cause no stress to the animal, and respect for the animal must be demonstrated at all times.

If you are doing a project that involves human or animal subjects, you will need to get ethics committee approval before you begin any experiments or studies.You will find information on the BASEF website regarding the forms needed for ethics approval. Visit the BASEF website at www.basef.ca

Read the sections on safety and/or use the Rules Wizard. If your project will include human or animal subjects, read the section on ethics. Note on the project summary sheet on the next page any safety and ethics regulations that will apply to your project.

Starting a Logbook (Journal)

Experienced scientists and engineers know the importance of keeping a logbook of everything to do with their work. Sometimes things don't go as planned, and you may need to go back in your notes and figure out where the error was. Sometimes you will get a different result than you expected, and it's helpful to review where you started. Sometimes you will be writing down surprises about your research.

Begin a logbook. You will use your logbook for notes about your work as well as for most of the remaining activities in this workbook.

Remember that some of the most useful discoveries have been made by mistake – you will want notes of everything you have done. Remember that Post-it notes are an example of glue that didn't work!

Project Summary Sheet

Activity #9

Student Name: ___________________________

Date: __________________________________

Record the decisions you have made so far on this page.

My science fair topic is:

My question is:

My project will be a ________________________ (experiment, innovation, study)

Books I have read:
1.
2.
3.

Websites I have visited:
1.
2.
3.

Experts I have spoken to:
1.
2.
3.

My hypothesis is:

Interesting things I found in my resource research:

Safety regulations for my project are:

Ethics guidelines for my project are:

Project Management: Timelines

Set timelines to allow enough time to make revisions and corrections. The unexpected can happen, so plan for more time than you think you'll need for each stage. For example, always plan to finish your final display at least one week before the fair. You will be glad of the time to practice answering questions as you explain it to family and friends!

Your teacher will help you with this by assigning due dates for the different stages in your project. For example, you may be expected to have your library research done by a certain date, and all your experiments or design innovations completed by another date that will still allow you time to prepare your final presentation.

Activity #10

Student Name: ___________________________
Date: ___________________________________

Write any due dates beside the headings in the chart below.

Project Stage	Approximate Time	Due Date
Topic choice	Allow 1 week	
Question or problem statement	Allow 1 week	
Background research	Allow 2 week	
Hypothesis	Allow .5 week	
Procedure (includes materials list)	Allow 1 week	
Experiment/innovation/study complete	Variable	
Observations organized and analyzed	Allow 1-2 weeks	
Written report 1st draft complete	Allow 2-3 weeks	
Good copy of graphs, drawings, photos	Allow 1-2 weeks	
Written report final copy complete	Allow 2-3 weeks	
Science fair display complete	Allow 2-3 weeks	

*Note: many projects can be completed in less time; some will take more. It's always better to allow extra time! Timeline assumes you will have other work to do!


Be sure to note and plan for steps that will require extra time, such as ethics approval, construction of materials, ordering materials, etc.

Glossary of Terms

Subject(s) – what/who is being observed. In human studies, the participants are referred to as 'human subjects' (and you will need special ethics approval before starting your work if using human or animal subjects).

Independent Variable(s) – will be what you change in order to measure the results; can be thought of as the 'cause'. Your ability to control the independent variable(s) will be what makes a great project. Consider difficult to control variables: humidity, temperature, amount of sunlight, etc., and only change one independent variable at a time – otherwise you won't know what caused any changes!

Dependent Variable(s) – changes as a result of changes in the independent variable; can be thought of as the 'result'. Changes in the dependent variable provide data upon which you make conclusions.

Controls – conditions that do not change. Perhaps all your experiments will be performed at the same temperature. Temperature is then referred to as a control. The idea is to 'control' all variables you are not studying.

Control group – the experimental group that has not been changed. In medical research, you might hear of one group being given a drug and another a 'placebo', or pretend drug. This is done to make sure that any improvement is because of the drug itself, not because subjects think they will get better in response to the drug.

Sample (size) – the number of subjects (see above) in your experiment or research. Good research uses a large sample size to make sure the results are correct. This is important to rule out the possibility of experimental error.

Activity #11

You have 3 friends who each buy a lottery ticket on the same day, at the same store, and each of the 3 wins $5.00. Does this prove that everyone who bought a ticket at that store that day will win $5.00? Why not? How would you design an investigation to answer this question? Will your investigation be a study or an experiment? Why?

Planning the Procedure or Prototype

Your procedure will be a detailed step-by-step description of what you intend to do. It should be so clear that another person could use it and exactly repeat your work, even down to getting the same results!

➔If you are doing an **experiment**, you will want to think carefully about the dependent variables you are testing, what controls there will be, how you will alter the independent variable, how you will define the control group, what sample size you will use, and how many trials you will run.

➔If you are conducting a **study,** you will want to think carefully about the independent variable you wish to study, the dependent variables you are observing, how you will define the control group, what sample size you will use (bigger is better!), and how many trials you will run.

➔If you are designing an **innovation**, you will want to think carefully about making improvements to the design in small increments so you can run trials to determine the success of each.

Extending your thinking: Reliability and Validity

Example: Your teacher gives a test on topics that have not been covered in class, and everyone fails. The results are **reliable**, but is the test a **valid** measurement?

Reliability: Reliable results mean that however many times the experiment is repeated, the results will tend to be the same. If you only perform your experiment once, you can't prove your results aren't accidental.

Validity: Validity refers to the accuracy of the results in measuring what you intend.

Careful control of all variables, collecting data from a large sample, and running several trials, will go a long way towards establishing reliability and validity.

Writing the Materials List & Detailed Plan

Your materials list is an important part of your procedure 'recipe': it is the specific list of ingredients. Giving clear and specific detail in materials is important for identifying variables and controls. You don't want to change the amount or type of materials part way through your investigation! The detail can also be critical when applying for ethics approval if you are using human or animal subjects.

Activity #12

Best Brownies

Which recipe is more precise?

Brownies – Recipe A	Brownies – Recipe B
Mix the following: Butter - 70 ml Chocolate - 3 squares Sugar – 250 ml Eggs -2 Flour – 320 ml Baking powder – 5 ml Vanilla – 10 ml Nuts – 125 ml Bake until done in a 300° oven.	Preheat oven to 300°F Melt together: 70 ml unsalted butter 3 squares unsweetened Baker's chocolate Mix in well: 250 ml white sugar Beat in one at a time: 2 medium eggs Mix in: 320 ml all-purpose flour 5 ml baking powder 10 ml vanilla extract 125 ml chopped walnuts Smooth mixture into 20 cm square glass pan. Bake at 300° for 30 minutes.

- ✓ Be accurate about amounts of materials: quantity, size, amount.
- ✓ Specify how they will be measured.
- ✓ Specify brand names you will use.
- ✓ State what temperature materials will be.
- ✓ Include drawings/photos of any material that cannot be described in words.
- ✓ Include detailed instructions for equipment you construct.
- ✓ For human or animal subjects, detail any characteristics of your subjects: age, grade level, height, gender, and any other variables that you are trying to control.
- ✓ It's better to have too much detail about your materials than not enough!

Remember that your materials list goes hand in hand with your procedure. Someone else should be able to use your procedure and your materials list and get the same results. Be specific!

The same level of detail should apply to each step in your procedure. State clearly how things will be constructed, experimental methods you will use, and conditions (variables) you will control for each step, such as temperature, light, etc.

Think of your written procedure as a recipe for your work.

In your logbook, write a detailed plan for your experiment/innovation/study, including a detailed materials list.

Activity #13

As you begin planning your procedure, you may find it helpful to refer to the judging rubric (Appendix I). Keeping it clearly in mind through the remaining stages of your project work will help you to complete a successful project!

Conducting the Experiment or Study, or Building the Prototype

Follow your procedure exactly as you have written it. If, for any reason, you make any changes, make a careful note of exactly what you changed and why. It might be that you had to substitute materials, or replace a broken part. It's okay to change the procedure, as long as you tell why.

Be as careful and accurate as possible when you are recording your observations. Detailed notes will really help you when you prepare your written report. Keep track of data on a prepared project worksheet, being sure to include the date. If your observations show no change, record that – it's still important information!

If you can, take photographs of each step of your procedure – they will be an important part of your final report. Photographs add clarity to your explanation of your procedures.

Project Tracking Form

Below is a sample tracking form for an experiment. Your draft form is part of your research logbook. Later, you will think of the best way to present your results for your finished project.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Notes
Sample 1								
Sample 2								
Sample 3								
Control group								

Below is a tracking sheet for a design innovation project. You would note the observations of each trial of the designed innovation as you do the trial.

	Trial #1 (date)	Trial #2 (date)	Trial #3 (date)	Notes
Design 1				
Design 1 + modifications				
Design 2				
Design 2 + modifications				

These are examples only: you will design a tracking sheet to best help you manage your data. Do allow a place for notes! The value in using charts to collect 'raw' data is that it makes it easier to see patterns as they develop. You will find it easier to see whether your experiment or innovation is doing what you thought it would!

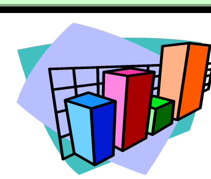
If you use questionnaires as part of your work, be sure to keep the originals in a binder. While they are never displayed, the judges may ask to see them. Use a project tracking form to summarize the data.

Activity #14

In your research logbook, and using the above as examples, design your sample tracking form for data collection.

You may wish to use a spreadsheet. An advantage of this is that it will be easy to make graphs for your final presentation. Also keep a paper copy of all your work!

If you have other assignments in computer applications or written work, ask your teacher if you can use your science project work.



Organizing the Data

Sometimes it will be easy to see a trend in your results from the tables you are using to collect your data. Sometimes graphing the data will make the trend more obvious as you compare the graphs between the study group and the control group. Check with your teacher to check what type of graph to use for your data.

Extending your thinking: There are a number of data management resources available, and many of them will help you in doing a statistical analysis on your results. Sreadsheets allow you to create graphs and charts from data you enter, and SPSS (Statistical Package for the Social Sciences) will allow you to run statistical analyzes on your data.

Analyzing the Results

Now you are ready to analyze your data. What patterns do you see in your observations? Do you need to repeat the experiment, trial, or study because the results don't indicate any change or pattern? Consider how this can be explained, and what you need to change before repeating your work.

Activity #15

Look carefully at all your data. Pretend you're looking at someone else's project (it may be helpful to do this with a friend) and ask critical questions:

? What do the results mean?
? Do they really show that?
? Did they support my hypothesis, or is further work needed?
? Are there other explanations for what happened?
? What experiment/design change should come next?
? How do my results compare to what I've read about this topic?
? What would happen if I changed…?
? What could have been better about my method?

Write down the answers to these and any other questions you can think of in your research logbook.

This is the most important part of your project! The questions you ask about the your data and your written report of your answers makes all the difference between an 'ok' project, and one that might win prizes!

Conclusions

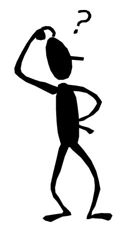
Did your results support the hypothesis or not? Be careful about claims you make – it's better to write that you have to reject your hypothesis than to try to pretend you were correct! Summarize your work clearly, and tie your conclusions directly back to your original question and hypothesis.

Activity #16

Record your conclusions in your logbook.

Extending your thinking: Correlation refers to a relationship between two variables: if the independent variable is changed, the dependent variable changes. Correlation does not equal causation! That is to say, evidence of a relationship between the variables does not mean that one has caused the other. Further experiments would be needed to test the 'causation'.

My project didn't work!



Good! You have found out what it feels like to be a researcher. Now you will have something interesting to write about in your report.

1) What might have gone wrong?
2) Was there an error in your work that you could fix for next time?
3) If your hypothesis is not supported, what did you learn instead?
4) How does your new learning fit with your background reading?

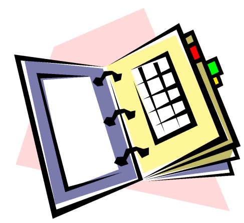
Many projects that go on to national and international fairs didn't work out the way they were originally intended. In real science and technology things often don't go according to plan. Reporting on your interpretation of research surprises makes for good science! Your write-up may say, "The results are inconclusive. Further experimentation will be needed in the following areas…"

Discussion: Relevance and Applications

An important part of your conclusions will be to write about the real-world applications of your work. Does your innovation address a highway engineering problem that will result in less asphalt wear and tear? Will your experiment allow plants to be grown with less water? Have you discovered something about how students respond to different stimuli that might affect the way advertisers send their messages? This part of your report demonstrates the value of your work and tells the judges you are still thinking!

The Written Report

The report you write is your way of communicating your work with your teacher, classmates, judges, and others who may come to the show. A sign of an excellent report is one that someone else could use to repeat your work. Your report needs to be clearly written, in a logical sequence, with all steps in your work clearly explained. Your written work should tell a story about your observations, and should include the following:



___ A title page with your project name and your name
___ An abstract of your work (see next page)
___ A table of contents
___ Introduction
___ Your question/problem statement, purpose, and hypothesis
___ Background information, written in your own words
___ Your procedure, including the materials list
___ Summaries of all experiments/tests you made
___ A summary of all data you collected*
___ Your conclusions about the results
___ Your discussion of the possible applications of your work
___ A reference list
___ Acknowledgements

In addition, you may have an appendix section, which could include:
___ Any required forms, for example, ethics committee approval forms
___ Copies of blank questionnaires used in your project

Your original logbook (journal) should also be submitted as a separate book

*Rather than copying in all observations, you might refer to tables or graphs that illustrate your story.

Use the checklist above to keep track of what you have completed for your written report.

Preparing an Abstract

An abstract, or summary of your work, is usually about 250 words long. A shorter summary of 50 words may be required as part of your registration for regional or national fairs. An abstract should include:

- ✓ Title
- ✓ Problem
- ✓ Purpose of Project
- ✓ Hypothesis
- ✓ Procedure
- ✓ Conclusions

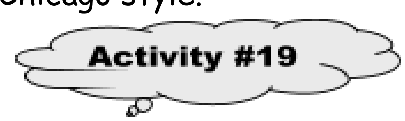
Judges may use your abstract to form an initial opinion about your project. Think of it as the 'ad' for your work!

On a page in your research logbook, prepare a draft abstract for your work.

Preparing a Reference List

Your reference list will be an alphabetical list of all the resources you used to complete your project. Only resources you quote or take ideas from, go in this list. You will be able to easily create this list from your notes on page 8. If you wish, list other sources that you read for 'Background Reading' separately.

There are different reference list formats – often, the easiest way to format your list is to look at the way it has been done in a reference book you use. The references for this booklet are in APA (American Psychological Association) format, which is used for most social science work. If your project involves human subjects, this is an appropriate format for you to use. Other common reference style formats are MLA (Modern Language Association) or Chicago style.



Use a page in your research logbook to prepare your project reference list.

The Display Board

The purpose of your display is to communicate the summary of your work and results in an eye-catching manner. Your display information should not be the same as what is in your written report. Rather, it should be the highlights.

Think of the display as a website homepage, and the written report as the links from that homepage.

Items you must include:

- Your question/problem statement
- Your hypothesis
- Graphs or charts summarizing your results
- A summary of your results
- The booklet of your written report (to go on the table)
- Your original logbook (to go on the table)

Items you may include:

- Models, drawings, photographs
- Materials to demonstrate your project (if allowed under safety guidelines)

Don't include:

- Other references such as books, website pages. You may include a summary of these in your own words.
- Any substances on the prohibited list. Consider photographs instead.
- Anything irreplaceable. Think carefully about security and possible damage before putting expensive equipment at your display.

Questions to ask yourself about your display:

? How will I neatly attach materials to your backboard?
? What kind of glue or tape will I use?
? How will the finished product look?
? How will my backboard be constructed?
? How will I make it both freestanding and solid?
? Will I purchase a ready-made board or print one professionally off?
? What colours will I use? (avoid neon – it's hard on judges' eyes!)

Look at Appendix II in this book for a drawing of a project display.

You will want the material to fit comfortably on the backboard you select in a font large enough to be easily read. Set this page up and stand about 1.5metres away. What will be easy for judges (maybe with ageing eyesight!) to read?

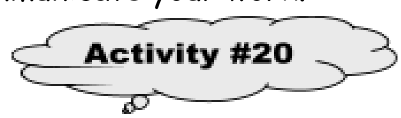
I planned my experiment to investigate…

This line is 24pt, and while it may seem large, is a minimum size for the descriptions on your backboard. 36pt, as shown below, is better. Titles should be larger still.

I planned my experiment to investigate…

Think about where you will place graphs, drawings, photographs, and any props you may have to help explain your project. Think about colour and design as well. An attractive project that is neatly presented is more likely to get the judges' attention and interest! Avoid colour combinations that may be so bright they distract from the main purpose of the display: to communicate your work.

Planning the Display

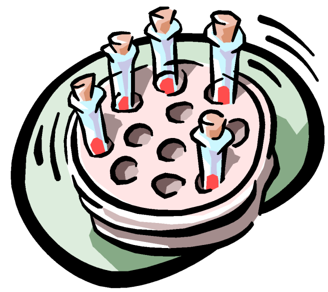


Your teacher will provide you with a large piece of paper you can use to plan your display. Think carefully about the information that is necessary to communicate your work, and what layout and colours will look best.

Display Safety

Safety guidelines are designed to protect others who may visit your project, and are in place for preventing injury, illness through various microbes, as well as possible allergic reactions. Visit the BASEF site at http://www.basef.ca/project-display-information/ for clarification on what you may display and safety requirements

Some items that will <u>not</u> be allowed at your display will be:



- ✓ Live animals
- ✓ Tissue or blood
- ✓ Soil
- ✓ Fungi, moulds
- ✓ Bacteria
- ✓ Nut products
- ✓ Certain electrical components
- ✓ Lasers
- ✓ Explosives

Visit the BASEF website again at www.basef.ca/ and re-check the safety guidelines that will apply to your display. Record them in your logbook.

Don't worry if you wanted to be able to show something and it's on the prohibited list. You can take photographs or make drawings to illustrate your ideas.

Discussing Your Work

The nature of scientific and technology research is that it is shared with and critiqued by peers, and eventually the public. This aspect of your project allows you to develop an important set of skills.

Practice is the best way to prepare to verbally present your work and answer judges' questions! Take every possible opportunity to explain your project to family, neighbours, the family dog: in fact, anyone who will listen! Invite your audience to ask you tricky questions – if you can't answer them, you'll be able to look up the answer, and you'll be ready when the judge asks the same question! Judges will often start by asking you to tell them a little about your project. This is your chance to showcase the main points of your project. Begin with a brief explanation of your problem, where you got the idea, and move quickly on to talking about the interesting things you discovered. Say less rather than more; the judges will ask questions about what they want to know.

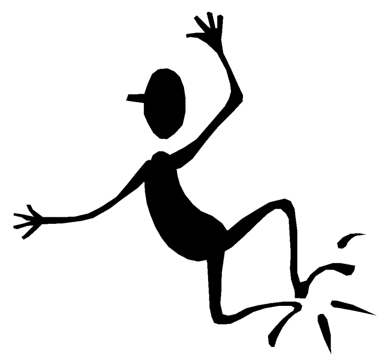
When the judges ask 'trick' questions, they aren't really trying to trip you up. Rather, they are looking at whether your project is that little bit better than others. Have you explored deeper than other students? Have you come up with a surprising result and thought about how to study it further? Here are some judges' favourite questions:

Activity #22

Practice answering these questions with a partner:
- ? What was the biggest surprise in your work?
- ? What did you find out that you didn't expect?
- ? What do you think would happen if you changed (a variable)?
- ? What further work would you have done if you'd had more time?
- ? If you were to do this project again, what would you do differently?
- ? Tell me something that's not obvious from your backboard.

In Conclusion

Take time to write thank you notes to all who helped you with your work!



Congratulations on your hard work! You have come successfully through the process of completing a science fair project. We hope that like most students, you found it both challenging and rewarding. Well done on your hard work, and good luck at the fair.

Don't forget to register for the BASEF regional fair – you can find out how by going to www.basef.ca/

APPENDIX I – Sample Judging Rubric

Bay Area Science and Engineering Fair - Judging Form	
Project ID:	(Do not write in this space)
Write Project Mark here, and enter it in the Mark Sense Boxes to the right:	Fill box completely, one box per row. Make no other marks in this space. 10 9 8 7 6 5 4 3 2 1 0 10's 1's

A. Scientific Thought (maximum 45 marks)

1. Select whether the project is either an experiment, study, or innovation.
2. Determine the level of the project by matching the description with the project. Circle the deserving mark out of a maximum of 45.

Definition	Level 1 (acceptable)	Level 2 (fair)	Level 3 (good)	Level 4 (excellent)
Experiment Investigation undertaken to test one or more hypotheses.	Duplication and reporting of an experiment to test a previously confirmed hypothesis.	Extension of a known experiment through modification of its procedure, data collection, analysis or application.	A new approach to the design, modification or application of an existing experiment with control of some variables.	A new experimental approach to a research problem in which most of the significant variables are controlled.
Study A collection and analysis of data showing evidence of a correlation, or pattern of scientific interest. Variables are identified and controlled.	Study and presentation of printed material related to the basic issue.	Study of material collected through compilation of or expansion of existing data and through observation. The study attempts to address a specific issue.	Study based on new observations and research of a previously studied topic. Appropriate analysis of data and correlations made.	A new approach to the study of a problem which correlates information from a number of sources. The report also offers new insights or solutions to the problem.
Innovation The development and evaluation of models or innovative devices, using approaches from the field of technology or engineering.	Building models or other devices that duplicate existing technology; minimal reporting.	Make improvement to an existing technology or use an existing technology for new applications.	Design and build an innovative adaptation of an existing technology for a new application.	Build a novel technology or integrate technologies to form an innovative system that has commercial or human benefit.
Score out of a possible 45 marks.	15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35	25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45

NOTE: This form will be machine scanned; please DO NOT FOLD. Use this form ONLY for the Project # printed in the ID Section.	**A**	Score:

<table>
<tr><td colspan="3">

B. Display (maximum 10 marks)

- Is workmanship neat and carefully done?
- Is lettering clear?
- Are colours strong and suitable?
- Is the layout complete, logical and self-explanatory?
- Is the content clearly and logically presented?
- Is the display simple and visually balanced?
- Does it capture attention?
- Does it have impact?
- Is there good balance and use of contrasts?
- Do the backboards, table and all displays meld together?

Circle: 1 2 3 4 5 6 7 8 9 10
</td><td>B</td><td>Score:</td></tr>
<tr><td colspan="3">

C. Notebook / Work Journal (maximum 20 marks)

- Is the notebook clear, concise and neat?
- Is it different from the backboard display?
- Is it well organized?
- Is there a journal summarizing actual work noting both successes and failures?
- Is there a bibliography?
- Are there acknowledgements?

Circle: 1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
</td><td>C</td><td>Score:</td></tr>
<tr><td colspan="3">

D. Abstract (maximum 5 marks)

- Is the abstract present?
- Does the abstract contain all aspects of the project?
- Is the information concise, complete, and accurate?
- Is the abstract well written? (grammar, syntax and spelling)

Circle: 1 2 3 4 5
</td><td>D</td><td>Score:</td></tr>
<tr><td colspan="5">

E. Interview (maximum 20 marks)
</td></tr>
<tr><td>Student is unsure of the material or the process of the project and has difficulty answering questions about the project.</td><td>Student can summarize the project adequately and can answer the majority of questions about the project.</td><td>Student explains the project well and can answer all questions about the project clearly and logically.</td><td rowspan="2">E</td><td rowspan="2">Score:</td></tr>
<tr><td>Circle:
6 7 8 9 10</td><td>Circle:
11 12 13 14 15</td><td>Circle:
16 17 18 19 20</td></tr>
<tr><td colspan="5">

NOTE: Judges marks are not to be disclosed to anyone outside of the Judges Group.
</td></tr>
<tr><td colspan="5">Please note some constructive comments for students.</td></tr>
</table>

APPENDIX II – Sample Project Display Layout

Project Title		
Purpose Hypothesis Background	Procedure Observations Results	Conclusions Discussions Acknowledgments

The key to success in project layout is to play with what makes sense to tell the story of your work. You may need extra space in certain areas. You may wish to include a description of your materials because of their relevance to your work.

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