



## Conducting a Science Experiment

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### Key Info

- If you haven't already, obtain a notebook to record all of your observations during your experiment.
- Before starting your experiment, prepare a **data table** so you can quickly write down your measurements as you observe them.
- Follow your experimental procedure exactly. If you need to make changes in the procedure (which often happens), write down the changes exactly as you made them.
- Be consistent, careful, and accurate when you take your measurements. Numerical measurements are best.
- Take pictures of your experiment for use on your display board if you can.

### Related Links

- [Laboratory Notebook](#)
- [Science Project Photography](#)

### Preparations

With your detailed experimental procedure in hand, you are almost ready to start your science experiment. But before you begin there are still a few more things to do:

- **Know what to do.** Read and understand your experimental procedure. Are all of the necessary steps written down? Do you have any questions about how to do any of the steps?
- **Get a laboratory notebook** for taking notes and collecting data (see Data Table below).
- **Be prepared.** Collect and organize all materials, supplies and equipment you will need to do the experiment. Do you have all of the materials you need? Are they handy and within reach of your workspace?
- **Think ahead about safety!** Are there any safety precautions you should take? Will you need adult supervision? Will you need to wear gloves or protective eye gear? Do you have long hair that needs to be pulled back out of your face? Will you need to be near a fire extinguisher?



## Data Table

Prepare a **data table** in your laboratory notebook to help you collect your data. A data table will ensure that you are consistent in recording your data and will make it easier to analyze your results once you have finished your experiment.

**Sample Data Table**

Trial	Faucet Opening (the Independent Variable)	Water Flow (the Dependent Variable)
#1	1/4 open	[Write your data in this column as you make measurements during your experiment.]
#2	1/4 open	
#3	1/4 open	
#4	1/2 open	
#5	1/2 open	
#6	1/2 open	
#7	3/4 open	
#8	3/4 open	
#9	3/4 open	
#10	Fully open	
#11	Fully open	
#12	Fully open	

Note: Some experiments will require additional columns for two or more dependent variables.

## During the Experiment

It is very important to take very detailed notes as you conduct your experiments. In addition to your data, record your **observations** as you perform the experiment. Write down any problems that occur, anything you do that is different than planned, ideas that come to mind, or interesting occurrences. Be on the lookout for the unexpected. Your observations will be useful when you analyze your data and draw conclusions.

We suggest that you keep a laboratory notebook so that all your information is kept in one place (don't use loose-leaf notebooks, you want to make sure all your information stays together). The data that you record now will be the basis for your science fair project final report and your conclusions so capture everything in your **laboratory notebook**, including successes, failures, and accidents.

If possible, take **pictures** of your experiment along the way, these will later help you explain what you did and enhance your display for the science fair.

Remember to use numerical measurements as much as possible. If your experiment also has qualitative data (not numerical), then take a photo or draw a picture of what happens.

Be as exact as possible about the way you conduct your experiment, especially in following your experimental procedure, taking your measurements, and note taking. Failures and mistakes are part of the learning process, so don't get discouraged if things do not go as planned the first time. You should have built enough time in your schedule to allow you to repeat your test a couple of times.

In fact, it's a good idea to do a quick **preliminary run** of your experiment. Show your preliminary data to your mentor or teacher, and make revisions to your experimental procedure if necessary. Often there are glitches in the procedure that are not obvious until you actually perform your experiment--this is normal. If you need to make changes in the procedure (which often happens), write down exactly the changes you made.

Stay organized and be safe! Keep your workspace clean and organized as you conduct your experiment. Keep your supplies

within reach. Use protective gear and adult supervision as needed. Keep any chemicals away from pets and younger brothers or sisters.

**Sample**

Here is a sample from a laboratory notebook.

**Checklist for Conducting a Science Experiment**

What Makes a Good Science Experiment?	For a Good Science Experiment, You Should Answer "Yes" to Every Question
Did you take detailed notes about your observations and record them in your laboratory notebook?	Yes / No
Did you collect your data using a data table?	Yes / No
Were you consistent, careful, and accurate when you made your measurements?	Yes / No
Were you careful to insure that your controlled variables remained constant so as not to affect your results?	Yes / No
If you ran into any unexpected problems, did you adjust your experimental procedure accordingly?	Yes / No
If you are doing an engineering or programming project, have you involved some of your targeted users in the testing of your prototype?	Yes / No

You can find this page online at: [http://sciencebuddies.com/science-fair-projects/project\\_experiment.shtml](http://sciencebuddies.com/science-fair-projects/project_experiment.shtml)

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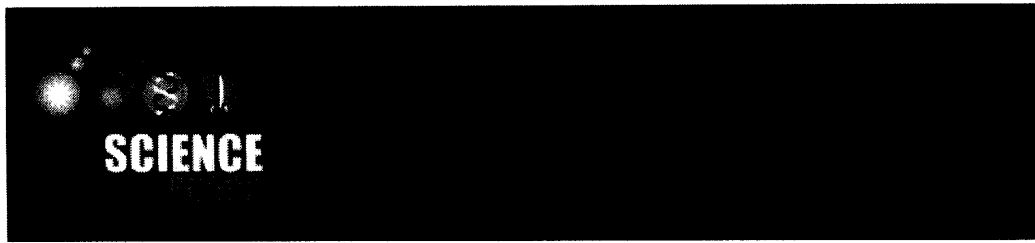
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UNDER  
LAB ORATORY  
NOTEBOOK



## What Makes A Great Science Project Logbook?

Joanne Rebbeck, Ph.D.

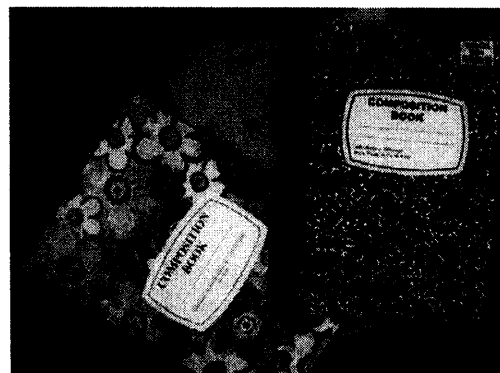
February 24, 2005

Whether you are a research scientist or a first-time science fair student, a logbook is a crucial part of any research project. It is a detailed account of every phase of your project, from the initial brainstorming to the final research report. The logbook is proof that certain activities occurred at specific times. Journals and logbooks are subject to scrutiny by the scientific community and are acceptable evidence in a court of law.



Here are a few pointers that are easy to follow. As a research scientist, I practice these suggestions everyday. They should help keep you organized, and certainly will impress any science fair judge. It's a great opportunity to show off all of your hard work!

1. **Find a durable hard-bound notebook or black and white composition book**, typically a lined journal works great. Do not attempt to use a spiral bound notebook. They won't hold up over the course of your experiment. Papers are too easily removed or torn from them, and before you realize it, important items are missing. Loose papers are a disaster waiting to happen.
2. **Label your logbook** with your name, phone number, email address, and teacher's name in a prominent location. Make logbook entries in pen not in pencil. This is a permanent record of all of your activities associated with your project.



3. Number the pages in your logbook before using it, unless already numbered for you.
4. Always date every entry, just like a journal. Entries should be brief and concise. Full sentences are not required.

3/19 FRI H<sub>2</sub>O pots  
 Green tray: WO#20-1 ✓  
 3/20 SAT  
 Green tray WO#6-1  
 3/22/99 MON: Plants have really taken off since SAT.  
 Power off ~9:30-Noon  
 Fertilized all plants w/Peters 20-20-20(?)  
 200ml/pot - seedlings  
 100ml/pot - ungerminated pots  
 Removed #88 RO-04-1 Insect feeding?  
 3/23/99 Lights still off @ 7:30 AM, forgot to reset time  
 clocks after yesterday's power outage  
 3/24/99 Removed #54 RO-04-3 Virus?  
 3/25/99 Green Tray - WO#8-1  
 3/26/99 " WO#20-1 H<sub>2</sub>O pots ~450ml  
 w/plants, ~300ml for ungerminated acorns  
 3/29/99 1 CO#6 in Green Tray  
 3/30/99 Tues H<sub>2</sub>O all pots Battery died on  
 datalogger  
 4/5/99 Some starting 2nd/leaf Started growth  
 Fertilize seedlings 200ml/pot <sup>measure</sup>  
 4/6/99 Finished growth measured (leaf # + QMI)  
 4/8/99 Thur - light watering 3 seedlings died  
 probably from 4th stress

Logbook entry of observations made while watering planted oak acorns in greenhouse

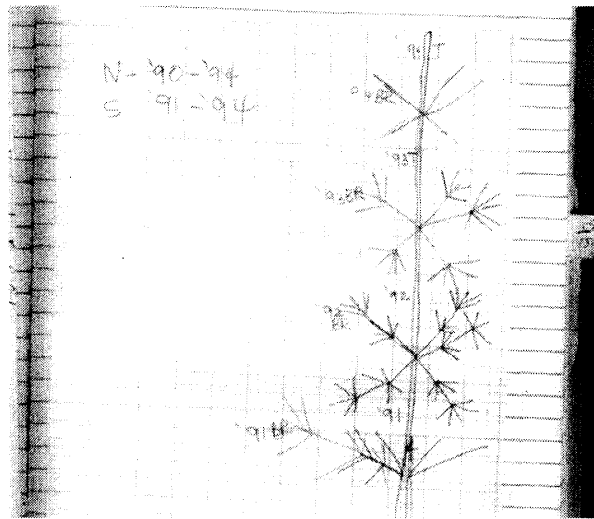
5. Don't worry about neatness. It's a personal record of your work. Do not re-do your logbook because it looks sloppy. Think of the logbook as your "Dear Diary" for science fair. It's not just for recording data during the experimental phase of your project and it's not just for your teacher.

6. **It should be used during all phases of your project,** jotting down ideas or thoughts for a project, phone numbers, contacts or sources and prices of supplies, book references, diagrams, graphs, figures, charts, sketches, or calculations.

5/20/99 2:20 pm clear, almost clear blue day  
light levels monitored

70%	③	6	5	4					
91%	②	1	2	3					
30%	②	6	5	4					
		1	2	3					
75%	①	6	5	4					
S		1	2	3					→N

Sketch of layout of sample points inside shade tents



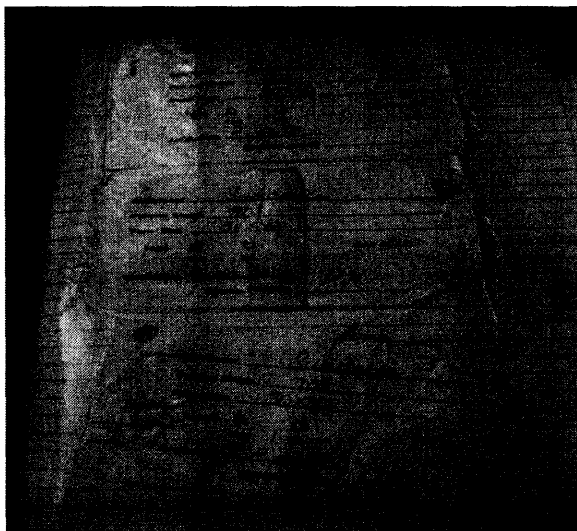
Hand drawing showing different ages of tree branches that were sampled during an experiment

Log entries should include your brainstorming, calculations, library/internet searches, phone calls, interviews, meetings with mentors or advisors, notes from tours of laboratories, research facilities and other related activities.

Remember that it's documentation of your work.

7. **Use it regularly and write down everything,** even if it seems insignificant, it could later be extremely useful. For example, it's the middle of the night and you're frantically preparing that final report but you can't find the title of that crucial reference. Make sure that you describe things completely, so that when you read your notes weeks or months later you will be able to accurately reconstruct your thoughts and your work.

8. **Glue, staple or tape any loose papers**, photocopies of important items. Loose papers or other unsecured items are prohibited as they tend to fall out and can end up missing.



9. **Organize your logbook.** Make a table of contents, index, and create tabs for different sections within your logbook. This helps keep you organized for different activities. For example, have a data collection section, a section with contacts, sources, etc. and a section of schedule deadlines.

Table of Contents	Tab color	Page #
Deadline Schedule	Red	1
Daily Notes & Reflections	White	2
Background Research Library & Internet	Blue	20
Information Contacts, Supply sources	Green	26
Experimental Setup	Yellow	35
Data collection	Purple	40
Results (pictures, graphs, summary tables)	Orange	50
Reflections	Light blue	60

10. **Include a reflections section in your logbook.** For example, what, if anything would I do differently next time? What part of the experiment could be changed to improve the experimental procedure?

11. **Always include any changes made to procedures, mishaps, failures, or mistakes.** As human beings, all of us make mistakes!

<p>1/4/05 my cat, Sheba scratched the pots of soil, and ate 4 of my 12 plants. I will have to replant everything! I need to protect plants from the silly cat. Maybe i should try putting a screen around the pots or keep cat outside!</p>	<p>2/5/05 Disaster in the lab this morning. Setup manure digester last night in incubators, temperature was set at 25 °C but came into a real mess, samples heated up too much and caps blew off. I will need to try a lower temperature to avoid this accident from happening again!!!! HUGE MESS TO CLEAN UP.....</p>
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12. **Include any and all observations made during your experiment.** In other words, record ALL data directly in your logbook. If that is not possible, then staple photocopies of data in the logbook.

9-5-01  
Wook hV curves  
DONE IN HEADHOUSE NOT GH

Plant#	Light	PAR	Page#	PS 1	PS
3070	4	1200	1, 2	10.92, 10.43	9.870
		800	3, 4	10.29, 10.20	9.652
		400	5, 6	9.010, 8.30	7.947, 7.7
		100	7, 8	2.809, 2.916	3.181
		50	9, 10	.743, .7929	.7955, .70
		0	11, 12	-1.820, -1.841	-1.562
3025	2	1200		2.226, 4.42	0.668
		<del>800</del>			
		<del>400</del>			
		<del>100</del>			
		<del>50</del>			
3272	2	1200	16, 17	7.7, 7.869	7.391, 6.9
		800	18, 19	7.096, 7.297	6.226
		400	20, 21	3.9, 7.214	6.88, 6.7
		50	24, 25	4.40, 4.117	4.065, 3
		0	26, 27	-2.437, -2.090	
3011	3	1200	28, 29	5.49, 6.2	
		800	30, 31	6.5	
		400	32, 33	6.77, 6.045	5.08
		100	35, 36	4.224, 5.963	4.103, 3.61
		50	37, 38	1.365, 1.629	1.667
		0	39, 40, 41	-4.395, -1.521	-1.113, 70

Entry of photosynthetic data from oak seedlings. Data files were also stored electronically on a computer as shown in the next example.



LI-COR File List

Filename	Date	Contents
JR941.prn	June 14	YP Pmax on detached lvs Rep1 CH 1-5 - Node 6-8
JR942.prn	June 15	" " " " " Rep2 CH 6-10
JR943.prn	June 16	" " " " " Rep3 CH 11-15
JR944.prn	June 28	WP Pmax detached 93 Needles Rep1-3
JR945.prn	July 11	YP Pmax detached lvs Rep 1 Node 11
JR946.prn	July 12	" " " " " Rep 2
JR947.prn	July 13	" " " " " Rep 3
JR948.prn	July 26	WP Pmax detached 93N (1 fascicle) Rep 1-3
JR949.prn	July 27	" " " " 94N (2 fasc.) " "
JR9410.prn	July 28	" " " " 93 N (2 fascicles) " "
JR9411.prn	Aug 8	YP " " " Rep1 Node 78-84
JR9412.prn	Aug 9	YP " " " Rep 2 - CH 6-7
JR9413.prn	Aug 10	YP " " " Rep 2
JR9414.prn	Aug 12	YP " " " Rep 3
JR9415.prn	Aug 22	WP " " " 93 needles (2 fascicles)
JR9417.prn	Sept 8	YP Pmax 3x Y20s (Node 6)
JR9416.prn	Aug 23	WP Pmax detached 94 needles (2 fascicles) 1-3 rep

A list of data files and description of contents stored on a personal computer

Remember, keeping up a great logbook throughout the entire duration of the science project really pays off later! Not only will a nicely maintained logbook impress your teacher and the judges at the fair, it will also help you stay out of trouble later when you need to look back and provide details of what you did.

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