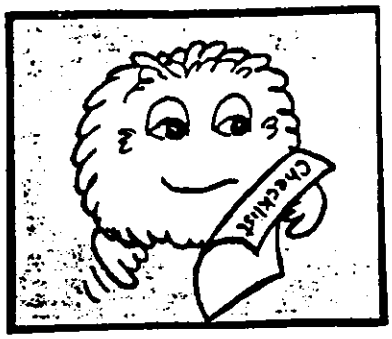
THE EXPERIMENT

An experiment is a test to find out something new or to check on something you already know. You test to see if or how one thing can cause another thing to change. Scientists call the thing that causes something to change the "independent variable" (IV) and the thing that you are watching or measuring is the "dependent variable" (DV). Everything else is what we call "constant conditions" (CC). A "control" is the thing in the test that you do not try anything on.

When you do an experiment you should only try to test one thing at a time. An example is "Do lima beans need soil to grow?" Your cause is the soil (IV). The thing you are watching is the growth of the lima bean (DV). Everything else must stay the same - place, size of bean, containers, amount of water given, etc. (CC). Be sure to have one bean that you didn't do the test on; this is your control.



SCIENCE PROJECT

CHECKLIST

- ☐ Ask a QUESTION that you can investigate yourself.
- ☐ Begin a JOURNAL to write down everything you do, observe, and think during your investigation.
- ☐ Do RESEARCH on the TOPIC of your question.
- ☐ Form a HYPOTHESIS about what you *think* the answer to your question will be.
- ☐ Plan a PROCEDURE to TEST your hypothesis. Decide what MATERIALS you will need and write STEP-BY-STEP DIRECTIONS for what you will do and how you will do it. Make sure your follow the rules for SCIENCE SAFETY and WORKING WITH ANIMALS.
- ☐ Construct a CHART to help you COLLECT and ORGANIZE your DATA.
- ☐ Fill out your SCIENCE PROJECT PROPOSAL and sign it. Then, have your teacher and your parents sign it too! Do this *before* you actually do the steps of your procedure.
- ☐ Follow the step-by-step directions of your procedure and RECORD your data onto your chart.
- ☐ Summarize the RESULTS of your testing in a WRITTEN SUMMARY.
- ☐ Make a GRAPH of the results, so others can *see at a glance* what you've learned.
- ☐ Write a CONCLUSION statement which either restates your hypothesis (if it is supported) or revise it (if it is not supported).
- ☐ Write a SCIENCE PROJECT REPORT that summarizes your investigation.
- ☐ Be prepared to give an ORAL PRESENTATION.
- ☐ Construct your SCIENCE PROJECT DISPLAY.
- ☐ Complete your SCIENCE PROJECT EVALUATION.

EXPERIMENT WORKSHEET

1. My hypothesis is (If I . . . then I think . . .)

2. The thing I plan to change is

3. The happening I plan to watch and record is

4. I plan to keep these things the same

5. What I predict will happen is

6. The conclusion I reached from this experiment

7. I think it would have been better if I had

WHAT THE JUDGES ARE LOOKING FOR
EXPERIMENT

LOG BOOK AND REPORT

Record all dates, observations, tasks, reflections in this book.
Report on and explain why you were interested in this topic.
Explain the theory behind your project.
Give information you needed before the actual experimentation.
Provide results and conclusions which other experimenters found.

PROBLEM

A question that includes the independent or dependent variables.

HYPOTHESIS

A statement of what you think the answer to the question will be.
It is based on your background information and observations.

DETAILED PROCEDURE

In your log, detail what materials you used and what procedure you followed to carry out this experiment (number of samples, number of trials, identify the sequence).
Include what things you held constant; identify the control; identify what things you changed or varied (independent variable - IV); and what happened as a result of this variable (dependent variable - DV).

ACCURATE MEASUREMENTS

Collect data using tables.
Transfer and arrange data into graph form so the results are easily viewed.
Use metric measurement whenever you can.
Do the experiment an appropriate number of times to see if the same results occur.

CONCLUSION

When your experiment is completed, you should be able to reach some conclusions.
Most of the time your data in graph form can be put into simple sentences to complete your conclusions.
What did the results mean to you or your readers?
What other things of importance did you discover?

The Log Book

The log is the most important part of experimenting in science. It also is the most important part of your science fair project. A log is like a diary. You write, or type, the date of each entry and what you did, observed, or read; whom you have talked to; the drawings you made; any facts or data; and/or your thoughts about your project.

Adults or friends can answer your questions or ask questions, but you are the decision maker and the doer. Be sure to consider safety for yourself and others while doing your study or making an exhibit. Start your LOG BOOK the day you begin to think about choosing your topic. All information is kept in the log book as it replaces the report. A bound composition book is preferred for your LOG BOOK.

Specific things that might be included in the log book:

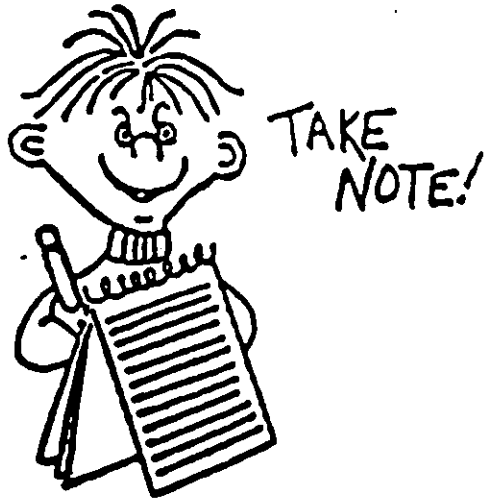
A list of books that were read and notes taken from reading those books.

The statement of the problem being explored. Any questions you may have about any aspect of the project.

Your hypothesis, procedure, materials used and reflections.

Include where you found items for collection or got the materials for your model.

Acknowledgment of those who helped you. Remember not to list actual names.



Report

All exhibits need a report. The report is the formal presentation of the project. Different teachers have different ideas of exactly how they should be organized. Don't let that fluster or confuse you. Remember that the main parts are the same, just arranged in different orders.

You may need help to organize the various parts of the report. It is a good idea to write the rough draft on every other line. This leaves room for editing and correcting grammar and spelling. Also, it seems to help to write each heading on a separate page. This helps to organize each part and make it more clear. A spiral notebook helps keep all the pages together. A folder may be used, but it should be just for Science Fair papers.

Depending on your hand-writing ability, you may decide that the report should be typed. If a parent types the report, it should be acknowledged at the end of the report.

It is important to remember that the report must be clear and concise; that is, if a stranger read the report, he would know exactly what the experiment was, and he would be able to do the exact same experiment. The length of the report may vary considerably, depending on the project.

Plot Your Path

List the variables you identified and decide which resource materials you will use to research each variable.

Here is an example:

	Sources
Independent Variable: fertilizers "x" and "y"	garden center, nursery worker, plant or fertilizer books
Dependent Variable: growth of petunias	garden center, nursery worker, encyclopedia, library

	Sources
Independent Variable:	
Dependent Variable:	

Identify the Variables

Before you can begin your research, you need to identify the variables in your question. Both variables, the independent and the dependent, need to be researched.

Remember, the cause is the independent variable and the effect is the dependent variable.

Here are some samples:

> Will fertilizer "x" or "y" cause petunias to grow taller?
> independent variable: fertilizers "x" and "y"
> dependent variable: growth of petunias

> Can insulation cause an ice cube to melt at a slower rate?
> independent variable: insulation
> dependent variable: rate at which an ice cube melts

> Can surface texture cause a change in skateboard speed?
> independent variable: surface texture
> dependent variable: skateboard speed

Restate your question and identify the variables.

_____

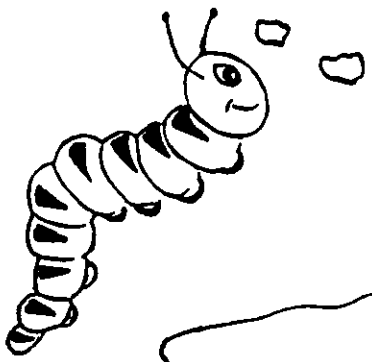
_____

independent variable:_____

dependent variable:_____

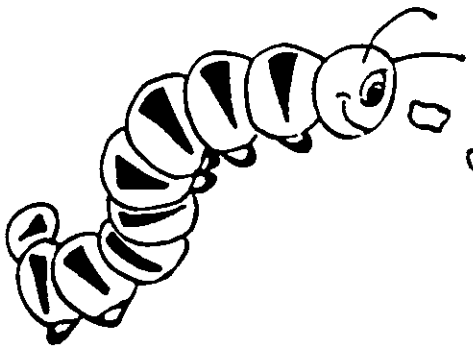
Write Your Hypothesis

You've already done the hard part - deciding on a topic, narrowing it, and researching it. Now, decide how you think your question should be answered. Change the question to an "if/then" statement. This statement is called the hypothesis.



I determined from my research that fertilizer "x" will cause greater growth in petunias than fertilizer "y." So, my hypothesis is, I F fertilizer "x" is used, then petunias will grow taller.

I determined from my research that proper insulation will cause an ice cube to melt slower than it would without being insulated. So, my hypothesis is, I F proper insulation is used, then ice will melt slower.



I determined from my research that rough surface textures cause a decrease in my skateboard speed. So, my hypothesis is, I F the surface texture is rough, then my skateboard will roll slower.

Review your question and determine your answer based on your research. Write your hypothesis.

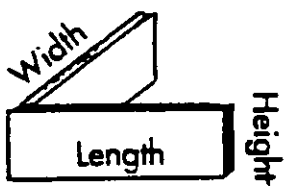
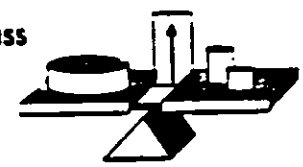
If_____

then_____

EXPERIMENT

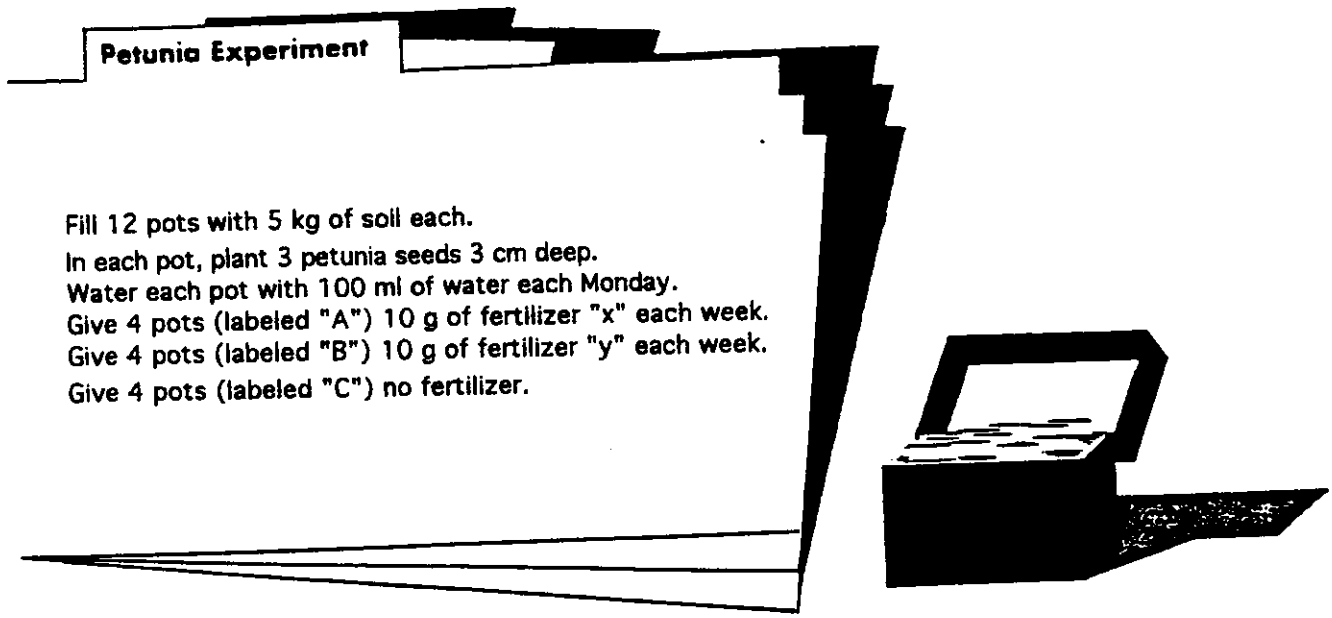
To determine if your hypothesis is correct, you need to conduct a simple experiment. The step-by-step directions for this experiment are called the procedure. The procedure is like a recipe. You need to tell times, sizes, amounts, and in what order each step is to be done.

Use metric measurements in your procedure.

To Measure:	Use:
	millimeters (mm) centimeters (cm) meters (m) kilometers (km)
Mass 	grams (g) kilograms (kg)
Volume 	milliliters (ml) liters (l) kiloliters (kl)

Plan the Procedure

The procedure for your experiment is like a recipe. Be precise and write each direction on a new line. Don't worry about the exact order now, but be specific.



Notice in the sample that 12 pots of petunia plants were used. Be sure you use enough test items in your experiment or repeat the experiment three times.

The Variables

Before setting up your experiment, you must be aware of all the variables. You have already identified two of the four variables - independent and dependent. Now you must consider the remaining two variables.

The constant variables

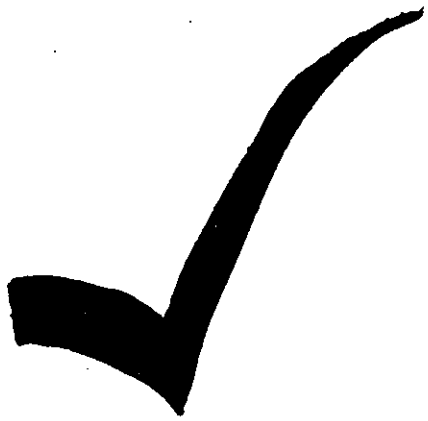
are those things that you must keep the same, so the experiment will be a fair test. If an experiment were set up to test if fertilizer "x" really did cause petunias to grow taller, then the variables such as pot size, amounts of sunlight, and amounts of water must remain constant. If only the independent variable, which in this case is the fertilizer, is changing, then it will be a fair test of that variable's effects.

The control

is the absence of the independent variable. In the case of the petunias, a plant would have to be grown without fertilizer to compare it to the growth of a plant that had been fertilized. In the case of the insulation, an ice cube would have to be tested to see how fast it melts without insulation to compare the results with the melting speed of an insulated ice cube.

Keep these two variables in mind as you write the procedure for your experiment.

Procedure Check



Before going any further, check over your procedure. Identify the following four variables to be sure your "recipe" will be a fair test of your hypothesis.

1. What is the independent variable (IV)?

2. What is the dependent variable (DV)?

3. What are the constant variables (CV)?

4. What is the control?

Did you use metric measurements?

Materials List

Make a complete list of all of the items you will need to conduct your experiment.

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____
12._____

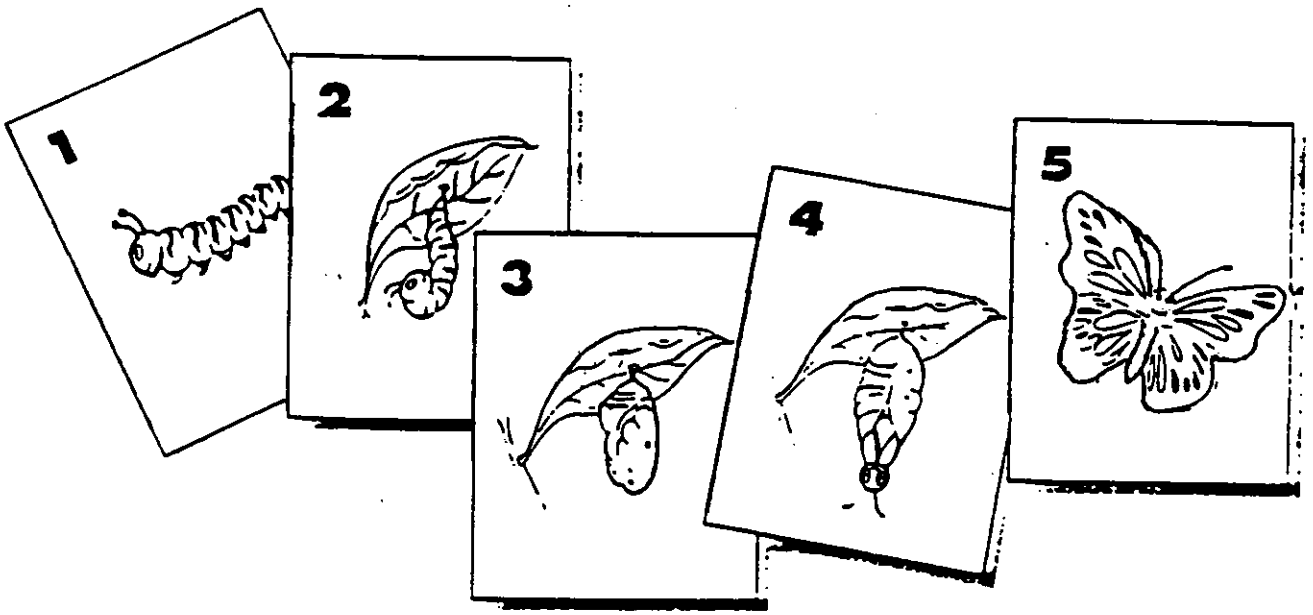
Ready. . . Gather the materials in your list.

Set. . . Read the procedure.

Go! Begin your experiment!

Record Results

It is important for you to keep accurate and organized data while conducting your observation. Using logs and drawings, write down all observations and results during the entire time you are conducting your observations (3 days - 2 weeks). Use the 2 days set aside on your time line for "recording results" to organize your information into tables, charts, and graphs.



Data Table

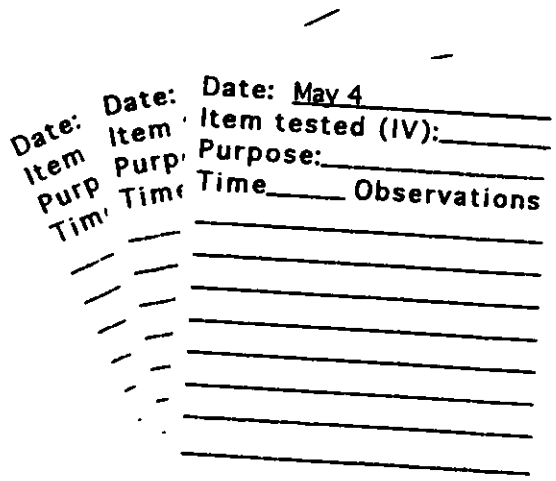
A data table is a good way to show your experiment results in an organized way. Here is a data table that has been used to record the results of the plant growth in the petunia experiment. (The height of the tallest sprout was recorded for each group each week.)

PLANT GROWTH

	A (fertilizer "x")	B (fertilizer "y")	C (no fertilizer)
Week 1	3 cm	2 cm	2 cm
Week 2	6 cm	5 cm	5 cm
Week 3	10 cm	9 cm	7 cm
Week 4	13 cm	12 cm	10 cm
Totals	32 cm	28 cm	24 cm
Average	8 cm	7 cm	6 cm

Log

Use a log if your results and observations are in words. Record your results, using one page for each day.

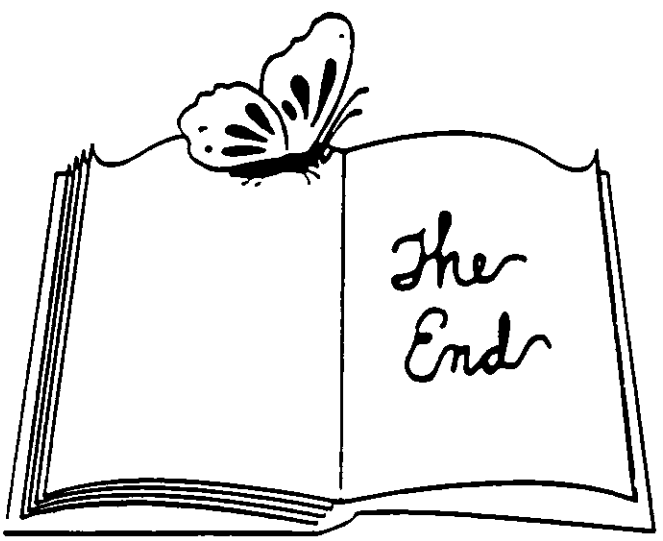


DRAW CONCLUSIONS

Conclusions are the ending to your story. Without conclusions your experiment is incomplete.

Your conclusions should:

- tell in words exactly what happened during the experiment.
- tell whether your results supported your hypothesis.
- answer all questions that came up during the experiment.
- state any other information that was discovered in the process.



EXPERIMENT STUDY (The purpose is a cause-effect relationship)

CODE _____

TOTAL POINTS

CRITERION	POINTS	SCORE	EXPLANATION
Log Book	0-15		A time-task diary. Reading & interview notes. Recorded data.
Background	0-10		History, significance, facts, & procedural information on cause-effect.
Problem	0-5		Question giving IV-DV relationship.
Hypothesis	0-5		Expected, directional relationship between IV and DV.
Procedure	0-20		Identifies the alterations of the selected IV, the what DV and how it will be measured, and the where, when and how of the CV's. Uses metric units.
Trials & Samples	0-10		Identifies the alterations of the selected IV, the what DV and how it will be measured, and the where, when and how of the CV's. Uses metric units.
Results	0-10		Appropriate number of samples and trials, use of control.
Conclusions	0-5		Reaction to hypothesis consistent with results. Includes link to background information-facts, procedures, and significance.
Scientific worth	0-5		Thoroughness of plan, uses dry run, checks for valid and reliable data, gives possible future study.
Easily viewed	0-2		Display faces forward, material easily read.
Labels	0-2		Sections of study design are labeled.
Attractive	0-2		Uses color for emphasis, good arrangement, graphic.
Text on display	0-4		Correct spelling and grammar, clear and concise writing.
Creative approach	0-5		Evidence of researcher's original input into the design.

EXHIBITOR INFORMATION

DISPLAY CONSIDERATIONS

Label the sections and arrange them logically. Helpful sections include: background information, problem, hypothesis, procedure, results and conclusions.

Use photographs to show the procedure. Use large, bold printing of typing. Color code the study's variables. Reference your log book or report to critical information or data.

Acknowledge those who advised or assisted you. Do this in general terms such as; "teacher", "parent", etc.

Computer generated materials are fine. If it was not keyboarded by the exhibitor, state this on the first page of the log.

DISPLAY RULES

SAFETY: Examples are breakables, liquids, powders, animals, body fluids, plants, microbes, inflammables, soils, batteries, or electrical hazards **cannot** be displayed. Use photos or drawings to represent the real thing.

VALUABLES: Items which are valuable or valued by the exhibitor **are not** to be displayed. If the Fair removes an item, they will attempt to return it to the owner.

EQUITY: The name or an identifiable photo of the exhibitor or the exhibitor's school is not to be displayed or recorded on any written material. Identity is by the number which will be written, at school, on the exhibit.

EXHIBIT SUGGESTED LAYOUT

The assessment criteria indicate which sections are most valued by the points given for each of them. The arrangement suggested below takes those values into consideration.