

# Hypothesis, Experiment procedure, Results and Conclusions

# How to write a hypothesis

A hypothesis is an answer to a scientific question. When we already have our scientific question, we can look for information about the topic and discuss with our group partners. Finally, with the information and ideas that we know, we have to write a tentative answer (or educated guess) to our question.

**ATTENTION!** Check your hypothesis!

Is your hypothesis testable with the experiment?	YES	NO
Is it based on your ideas and information?	YES	NO
Were you discussing your ideas in group?	YES	NO
Does it include an independent variable (the one we change) and a dependent variable (the one is fixed)?	YES	NO

# Example of questions and hypothesis

Question	Hypothesis	Prediction
How does the size of a dog affect how much food it eats?	Larger animals of the same species expend more energy than smaller animals of the same type. To get the energy their bodies need, the larger animals eat more food.	If I let a 70-pound dog and a 30-pound dog eat as much food as they want, then the 70-pound dog will eat more than the 30-pound dog.
Does fertilizer make a plant grow bigger?	Plants need many types of nutrients to grow. Fertilizer adds those nutrients to the soil, thus allowing plants to grow more.	If I add fertilizer to the soil of some tomato seedlings, but not others, then the seedlings that got fertilizer will grow taller and have more leaves than the non-fertilized ones.
Does an electric motor turn faster if you increase the current?	Electric motors work because they have electromagnets inside them, which push/pull on permanent magnets and make the motor spin. As more current flows through the motor's electromagnet, the strength of the magnetic field increases, thus turning the motor faster.	If I increase the current supplied to an electric motor, then the RPMs (revolutions per minute) of the motor will increase.
Is a classroom noisier when the teacher leaves the room?	Teachers have rules about when to talk in the classroom. If they leave the classroom, the students feel free to break the rules and talk more, making the room noisier.	If I measure the noise level in a classroom when a teacher is in it and when she leaves the room, then I will see that the noise level is higher when my teacher is not in my classroom.

# How to write the material and procedure of an experiment

When you have already written your hypothesis, you have to write the material and procedure of the experiment. First, you should include a list of all the material that you will need. For the procedure, it is very important that you write it step by step, like a recipe of your science experiment, so that someone else could duplicate your experiment exactly!

It is also important to include how many times the experiment should be repeated. Repeating the experiment is necessary to verify that your results are consistent and not just an accident.

## ATTENTION! Check your procedure!

Is it numbered?	YES	NO
Is it written in infinitive (cut, stick, fill, check, write...)?	YES	NO
Is it so detailed that anyone could repeat this experiment?	YES	NO
Is the number of repetitions included?	YES	NO
Is there an explanation about how to measure the results in the dependent variable?	YES	NO

# Example of experiment materials and procedure

## Materials List

- CD player & a CD (low drain device)
- Three identical flashlights (medium drain device)
- Camera flash (high drain device)
- AA size Duracell and Energizer batteries
- AA size of a "heavy-duty" (non-alkaline) battery (I used Panasonic)
- Voltmeter & a AA battery holder
- Kitchen timer

## Experimental Procedure

1. Number each battery so you can tell them apart.
2. Measure each battery's voltage by using the voltmeter.
3. Put the same battery into one of the devices and turn it on.
4. Let the device run for thirty minutes before measuring its voltage again. (Record the voltage in a table every time it is measured.)
5. Repeat step 4 until the battery is at 0.9 volts or until the device stops.
6. Do steps 1–5 again, three trials for each brand of battery in each experimental group.
7. For the camera flash push the flash button every 30 seconds and measure the voltage every 5 minutes.
8. For the flashlights rotate each battery brand so each one has a turn in each flashlight.
9. For the CD player repeat the same song at the same volume throughout the tests.

# Dependent and Independent variables

The 2 main variables in an experiment are the:

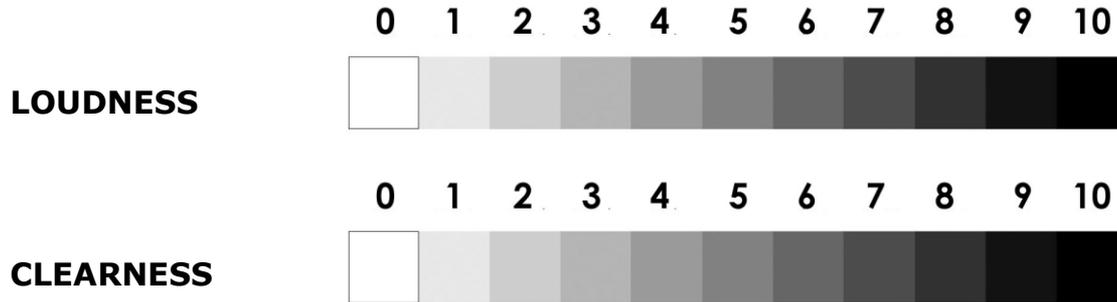
- **Independent variable**: it's the variable that we change.
- **Dependent variable**: it's the variable that we are testing and measuring.

We change the independent variable to see the effects on the dependent variable.

Question	Independent Variable (What I change)	Dependent Variables (What I observe)
Is a classroom noisier when the teacher leaves the room?	Teacher location: The teacher is either in the room or not in the room.  "The teacher's location is an either/or situation"	Loudness, measured in decibels

# How to record data and write results

**COLLECTING DATA:** Write down information that you get from the experiment. It is very useful to add graphic information such as:

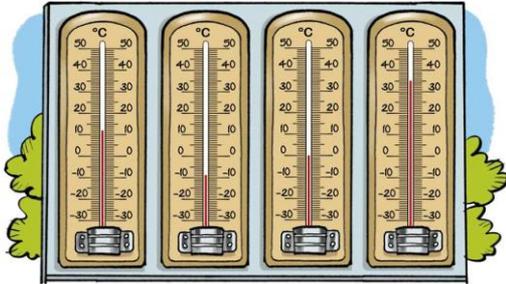


**RESULTS:** You simply say in words what your data is telling you.

Ex: Under water, loudness is 5 out of 10 while outside water, loudness is 7 out of 10. Clearness is 4 under water and a 1 outside water.

# Examples of How to collect Data

0 1 2 3 4 5 6 7 8 9 10



Salty water: 4 of 5.

Mineral water: 2 of 5.

Tap water: 2 of 5.

## RATING STARS



# How to write conclusions

The conclusion is a summary of the research and the results of the experiment. This is where you answer your research question. You make a statement of whether your data supported your hypothesis or not.

What Makes for Good Conclusions?	For Good Conclusions, You Should Answer "Yes" to Every Question
Do you summarize your results and use it to support the findings?	Yes / No
Do your conclusions state that you proved or disproved your hypothesis? (Engineering & programming projects should state whether they met their design criteria.)	Yes / No
If appropriate, do you state the relationship between the independent and dependent variable?	Yes / No
Do you summarize and evaluate your experimental procedure, making comments about its success and effectiveness?	Yes / No
Do you suggest changes in the experimental procedure and/or possibilities for further study?	Yes / No