



SCIENTIFIC METHOD

Prescribed Focus Area: 5.2

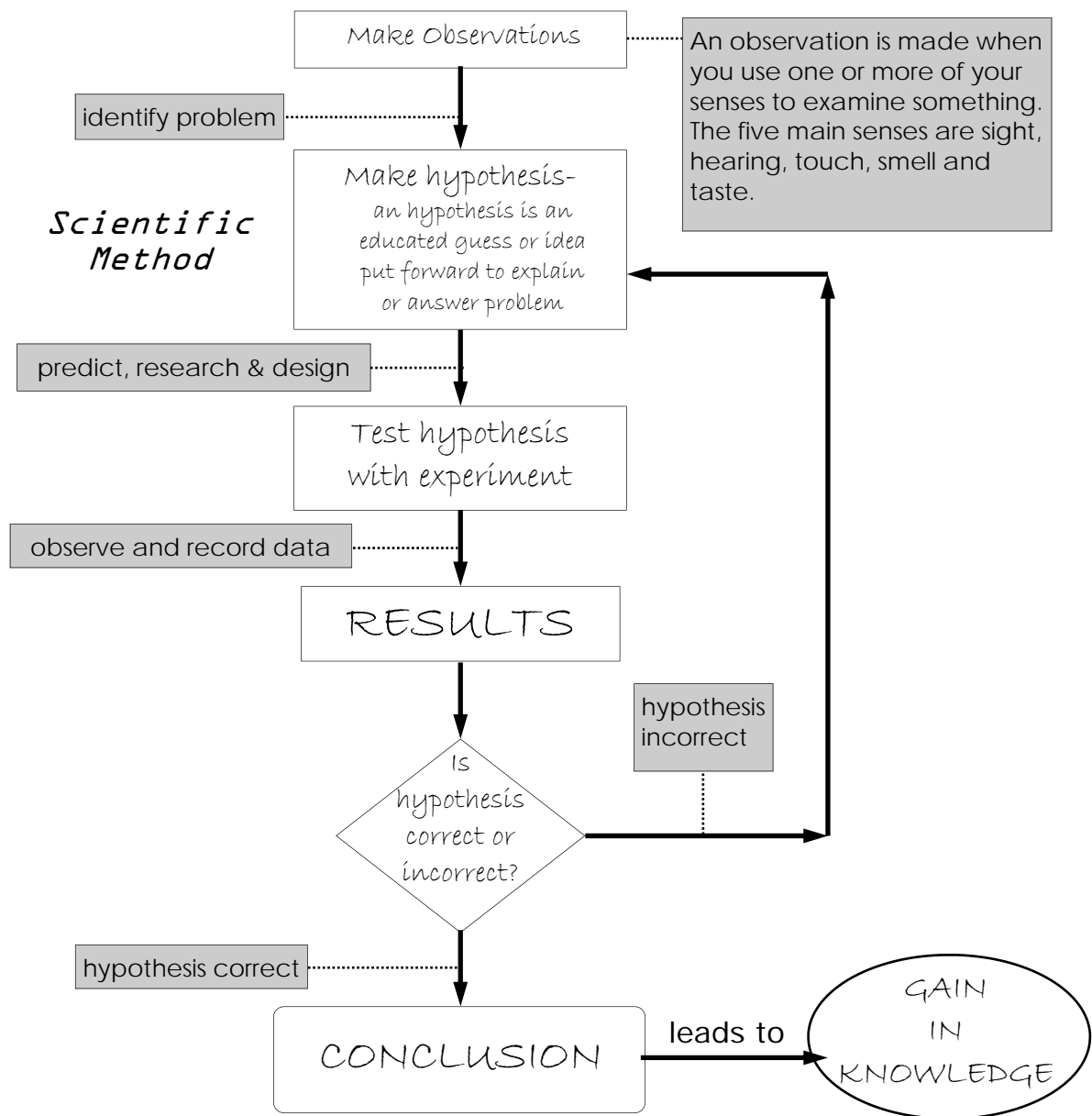
a student describes the processes that are applied to test and validate models, theories and laws

What is Science?

Science is often described as “knowledge gained by study and practice”. The study of science is different from all other forms of study because of the way in which scientific knowledge is **gathered, tested** and **used to predict** future events.

Science can be considered as a subject which “*collects and organises information about natural events with the aim of generating new information*”.

The method by which scientists investigate a problem is called **scientific method**. The process of scientific method is summarised below:





Important Terms Related to Scientific Method

Term	Meaning
observation	An observation is made when we use one or more of our senses (seeing, hearing, smelling, tasting and touching).
hypothesis	An hypothesis is an educated guess, based on observations, put forward to explain something. An hypothesis is tested in science using a controlled experiment.
inference	An inference is a statement which explains an observation or observations - it might or might not be correct. Inferences are used in conjunction with previous knowledge, to put forward a hypothesis from the observations made.
prediction	Predictions are used to design an experiment from the hypothesis. A prediction should be simple, specific and able to be tested.
variable	Any factor which can change in an experiment.
controlled variable	Controlled variables are variables which must be kept constant. If these variables aren't controlled it may affect the experimental variable.
replication	Replication occurs when an experiment is repeated. Replication minimises human error and other inaccuracies, thus improving the reliability of results. Replication allows you to identify any invalid results and possibly explain these results.



More on Variables

- Any factor which can change in an experiment is a **variable**.
- The **independent variable** is changed throughout the experiment. This is the variable you are examining the effect of and the variable over which you have control– its values are generally evenly spaced.
- The **dependent variable** is the variable that changes in response to changes made to the independent variable.
- **Controlled variables** are variables which must be kept constant. If these variables aren't controlled it may affect the experimental variable and it will not be a **fair test**.

When you are investigating the effect of the presence of some factor on a variable, a **control** is needed for comparison. The variables needed for a 'controlled' experiment are listed below:

Type of variable	Experiment	Control	Test
Controlled variables		constant	constant
Independent variables		absent	present

Example:

Hypothesis: Copper is a better heat conductor than iron.

Experiment:

An iron rod and copper rod are set up on tripods as shown. A piece of wax is fastened at the end of each rod. A Bunsen burner heats the other end of the rods. The wax will melt when sufficient heat is conducted along the rod. The rod on which the wax melts first is the better heat conductor.

Independent variable:

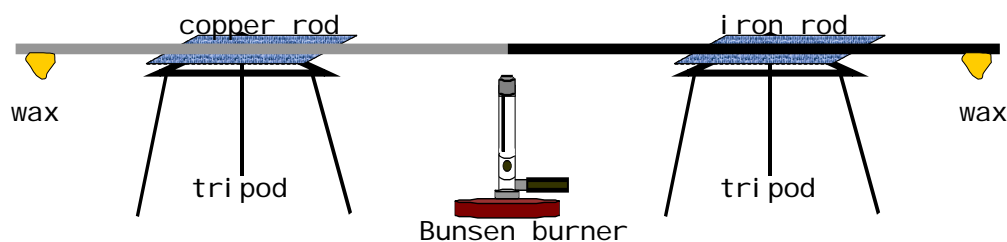
- ✦ The type of metal.

Dependent variable:

- ✦ Time it takes before wax melts.

Controlled variables: (examples)

- ✦ Amount of Bunsen burner flame reaching each rod.
- ✦ The distance of the wax from the heated end and amount of wax.
- ✦ Distance of tripods from the Bunsen.





Example:

Hypothesis: A black can will heat up faster than a white can.

Experiment:

One aluminium can is painted black. Another is painted white. They are placed out in sunlight. A thermometer is placed in each can. The temperature is recorded every minute for ten minutes.

Independent variable:

- ✦ The colour of the can.

Dependent variable:

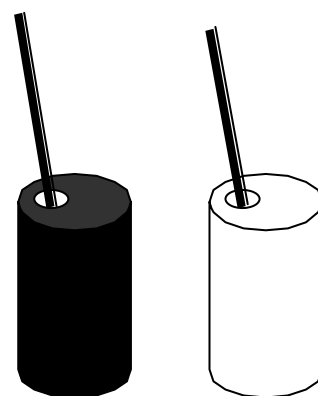
- ✦ Temperature of each can.

Controlled variables: (examples)

- ✦ Type of can (e.g. aluminium).
- ✦ The size of the can.
- ✦ The position of the cans in sunlight.



thermometers



black can

white can

Questions:

Imagine you are asked to investigate whether plants will grow more rapidly in green light than in normal white light.

1. Propose an hypothesis.
2. Design an experiment to test your hypothesis.
3. Explain how you would set up a control for the experiment.
4. (a) Identify the independent variable.
(b) Identify the dependent variable.
5. Describe four variables which would have to be controlled.
6. Construct a table to record the results.