



The scientific method

As scientists, we want to explain how and why things happen—such as what happens when a current flows through a wire or when stars or planets form. We do this by thinking logically in a step-by-step process. The steps on this page are used in all fields of science.

1. Ask a scientific question

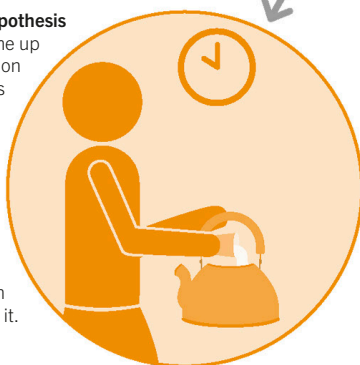
Scientists are curious and often ask questions about how things work. For instance, why does a tea kettle sometimes take longer to boil? A scientific question is one that can be answered by collecting data (information). A question such as “Which kind of hot drink is nicest?” is not a scientific question.



2. Make a hypothesis

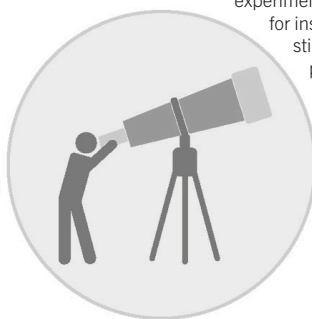
The next step is to come up with a possible explanation that can be tested. This is called a hypothesis. We can often write a hypothesis using the words “depends on.”

For instance, our hypothesis might be: the length of time the tea kettle takes to boil depends on how much water is in it.



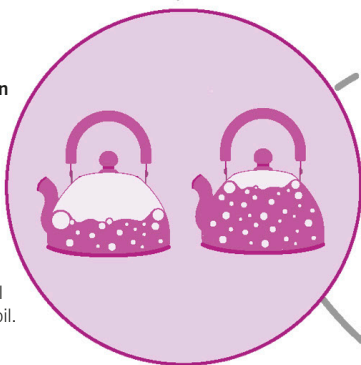
Collect data

Some scientific questions can't be tested by experiments. Astronomers can't experiment with planets and stars, for instance. However, they can still make hypotheses and predictions and then test the predictions by making observations to collect data.



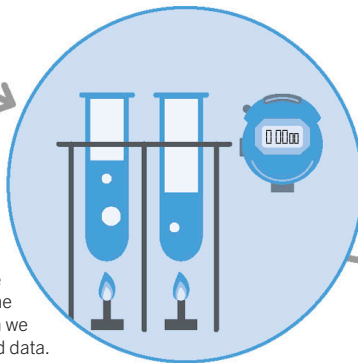
3. Make a prediction

To test a hypothesis, we use it to make a prediction. A prediction can often be written as “If ... then ...” For example: I predict that if I double the amount of water, it will take twice as long to boil.



4. Collect data

Hypotheses are usually tested by experiments. In this case, we might heat measured volumes of water and time how long each volume takes to boil. An experiment must be a fair test, which means the only variable we change is the one we're investigating (the volume of water, in this case). The information we collect in an experiment is called data.





Key facts

- ✓ A hypothesis is a scientific idea that can be tested.
- ✓ A hypothesis is used to predict what may happen in an experiment.
- ✓ If a hypothesis is supported by an experiment, it may become part of a theory.
- ✓ Scientists present their discoveries to be checked by other scientists.

7. Theory

If the hypothesis is tested many times and never fails, it might eventually become accepted as a scientific theory.



Refine hypothesis or experiment

If the prediction was wrong, the hypothesis might be wrong, too, or the experiment might not have worked properly. Failed experiments are not a waste of time—they sometimes lead to new discoveries.



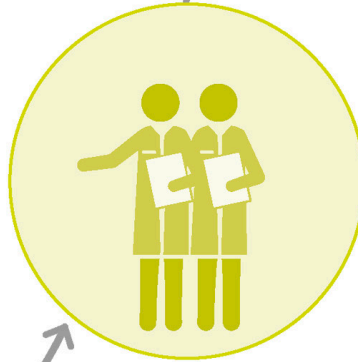
Many scientists repeat the experiment.

The conclusion does not support the hypothesis.

The conclusion supports the hypothesis.

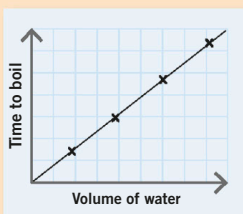
6. Peer review

After a successful experiment, a scientist may write a report (called a paper) so that other scientists can find out about the experiment and check the details. The paper may be published in a scientific journal for all scientists to read.



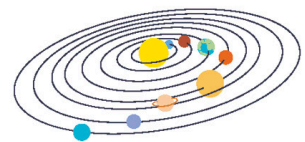
5. Analysis and conclusion

After collecting data, we analyze it carefully to check for errors and look for patterns. We use the analysis to decide whether the experiment supports the hypothesis. This forms our conclusion.



Scientific theories

People sometimes say “it’s just a theory” when they don’t believe something. However, in science, a scientific theory is an explanation that has been tested many times and become widely accepted as true. For example, the idea that Earth and other planets of the solar system orbit the Sun is a scientific theory based on many careful observations and predictions. If it weren’t for science, we’d probably believe that the movement of the Sun across the sky meant that it was orbiting Earth rather than vice versa.



Solar system