

Scientific Method I

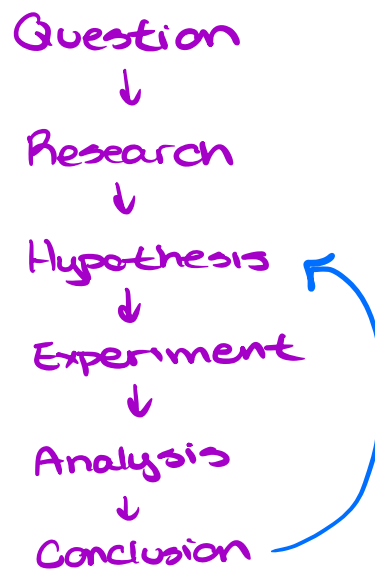
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What is science?

Science is a way of studying the natural world through a structure of questioning and experimenting. It is not static, meaning that as new facts and studies arise, our understanding of the world begins to change.

The Scientific Method

The steps to the scientific method are as follows:



What is a **hypothesis**?

A hypothesis is an educated guess about how things work. It makes a prediction about an outcome and attempts to answer a question. It always follows the format, "If...then...because..."

E.g.: If the witch weighs as much as a duck, then she will float because wood and ducks float and witches are made of wood.

What is a **conclusion**?

A conclusion is a summary of the results. It will *either* support or contradict the hypothesis.

Types of Data

Qualitative:

Qualitative data is used to describe quality.

E.g.: texture, colour, smell, change in appearance, etc. (5 senses)

Quantitative:

Quantitative data is used to describe the quantity (the amount) of something.

E.g.: weight, mass, length, age, reaction time, etc. (a number)

Types of Variables

E.g.: Two brands of paper towels are compared to see which one holds the most liquid. 50 mL of water is placed into two beakers. One paper towel from the brand, Cleans-a-Lot, is placed into Beaker 1 while one paper towel from another brand, Good-at-Cleaning, is placed into Beaker 2. When the paper towels are removed from the two beakers, it was discovered that Beaker 1 contained 15 mL of water while Beaker 2 contained 5 mL of water.

Independent:

An independent variable is purposefully changed by the experimenter.

E.g.: Brand of paper towel

Dependent:

A dependent variable changes with response to the independent variable.

E.g.: Amount of water absorbed

Controlled:

A controlled variable does not change within the experiment.
These variables are quantities that the experimenter wants to remain constant.

E.g.:
Amount of water we started with
Size of paper towel pieces
How long the paper towels were in the beaker
Type of liquid

Practice:

1. Rebecca notices that some of the plants in her garden are growing very quickly, whereas the same plants in other parts of her garden are not. After doing some research, she discovers that the plant that she has in her garden need a certain amount of sunlight everyday to grow well. She decides to conduct an experiment. She grew five of the same plants and exposed them to sunlight for a specified period of time. After 6 weeks, she measures out the height of her plants. Here are her results:

Plant #	Amount of time exposed to light	Final height
1	20 min	3.0 cm
2	40 min	6.0 cm
3	60 min	14.0 cm
4	80 min	18.0 cm
5	100 min	29.0 cm

Based on Rebecca's experiment and results, answer the following questions:

- a. What was the **independent** variable?

Amount of exposed light

- b. What was the **dependent** variable?

Final height of the plant

- c. List 3 **controlled** variables in Rebecca's experiment.

- Type of soil
- Location of the plant
- Type of plant
- Amount of water

- d. Write a hypothesis that would fit into Rebecca's experimental setup.

If I place my plant outside in the sun for longer, then the plant will grow taller because plants need sunlight to grow

- e. Write a proposed conclusion Rebecca could make for her experiment.

The longer periods of light that the plant receives, the taller the plants grew. Through my findings, my hypothesis is supported. I can conclude that the more sunlight plants receive, the taller they will grow

2. Outline how you would plan an experiment using the Scientific Method to test out how much water an individual should be drinking every day in order for a person to feel more awake during the day.

1) Question : How much water should a person drink everyday?

2) Research : Drinking water helps people feel more awake.

3) Hypothesis : If a person drinks 8 cups of water everyday, then they will feel more awake because water helps with a person's energy levels.

4) Experiment : 1) Find 10 people

2) Each person will be given a certain amount of water everyday for 2 weeks.

3) At the end of each day, participants will do a survey about their energy levels.

5) Analysis & Data

6) Conclusion

3. Chelsey wants to know why different types of water will freeze at different temperatures. She goes to the library and conducts some research about the properties and composition of fresh water and seawater. She decides to set up an experiment to see whether seawater or fresh water will freeze at a lower temperature. Chelsey then goes to her lab and does the following:

a. Fills 2 beakers with water.

b. Dissolves 20g of salt into one beaker.

c. Places both beakers into the freezer at -1.5°C for 2.0 hours.

Chelsey takes out both the beakers at the same time and notes that the beaker containing salt water is a liquid and the beaker that has no salt in it has frozen.

- a. Write a hypothesis that would fit with Chelsey's experiment set-up. Be sure to use an **if...then...because** statement.

If water has salt in it, then it will freeze at a lower temperature than regular fresh water because salt lowers the freezing point of water

- b. What conclusion could Chelsey make based on her observations?

The more salt in the water, the lower the temperature must be in the end to make it freeze. My hypothesis was supported.

- c. What is the **independent** variable in this experiment?

Type of water (salt vs. fresh)

- d. What is the **dependent** variable in this experiment?

State of water at the end (solid vs. liquid)

- e. What are 2 **controls** in this experiment?

- Amount of water

- Time spent in the freezer

- Temp. of the freezer