

Planning fair tests and reading data

Grade 6 science (Year 7 · Class 6) · Lesson

Quick answer: The scientific method is a series of steps for testing ideas: ask a question, make a hypothesis, plan a fair test, collect data, analyse it and draw a conclusion. In a fair test you change one variable, measure one result and keep all other variables the same. Repeating readings and finding a mean makes the data more reliable.

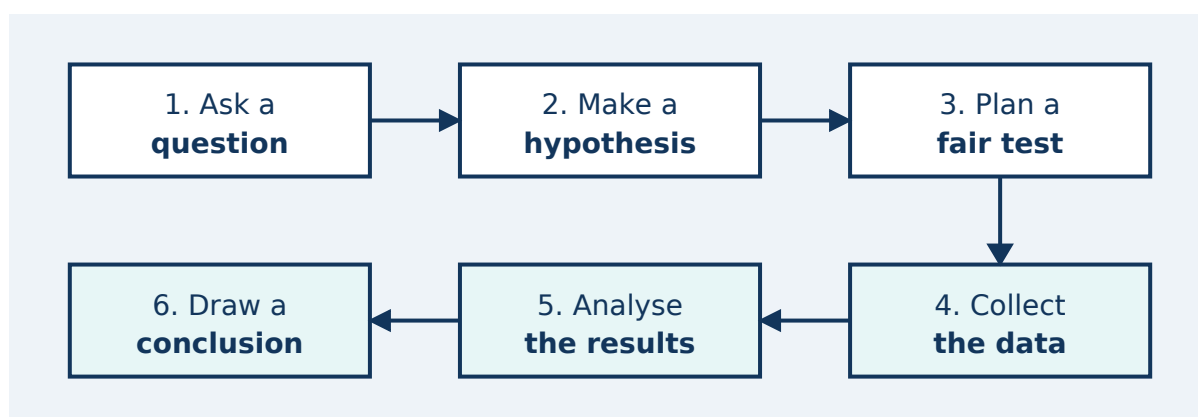
Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** SEP 3-4

What is the scientific method?

Scientists do not just guess. They follow a method that lets other people repeat their work and check it. You ask a question, make a prediction, test it fairly, collect data and then decide whether the evidence supports the prediction.

Definition

A **hypothesis** is a testable prediction that explains what you expect to happen and why. A good one is written as: "If I change X, then Y will change, because ..."

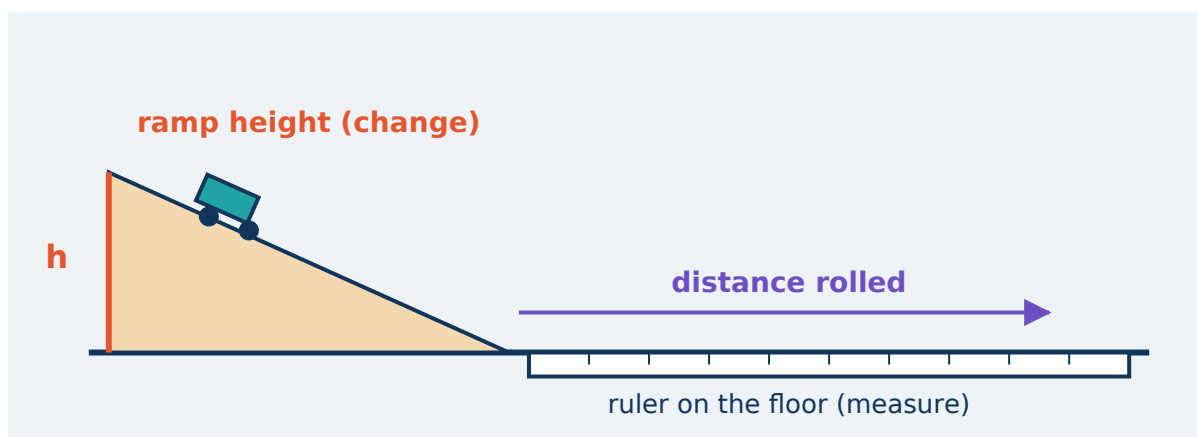


The steps of an investigation. Real scientists often go back and repeat them.

What are variables and what is a fair test?

A **variable** is anything that can change in an investigation. In a **fair test** you change only one variable, measure one result and keep everything else the same. If two things change at once, you cannot tell which one caused the result.

Type of variable	What you do with it	Example: car on a ramp
Independent	Change it on purpose	Height of the ramp
Dependent	Measure it	Distance the car rolls
Controlled	Keep it the same	Same car, same floor, same start point



A fair test: change the ramp height, measure the distance, keep the rest equal.

Key rule

One investigation, one changed variable. Everything else is a controlled variable.

How do you record and use data?

Put results in a table with headings that include units, such as "Distance (cm)". Repeat each test at least three times, because one reading can be wrong. Then calculate the **mean**: add the readings and divide by how many there are. A reading that is far from the others is an **anomaly**. Check it, and leave it out of the mean if it was clearly a mistake.

Worked example 1

Diego releases a car from a ramp 20 cm high and measures 82 cm, 85 cm and 79 cm. Find the mean.

Sum: $82 + 85 + 79 = 246$ cm. Divide by 3: $246 \div 3 = 82$. **Mean distance = 82 cm.**

Worked example 2

Wanjiru times how long a sugar cube takes to dissolve: 12.1 s, 11.9 s, 12.3 s and 18.0 s. Find the best mean.

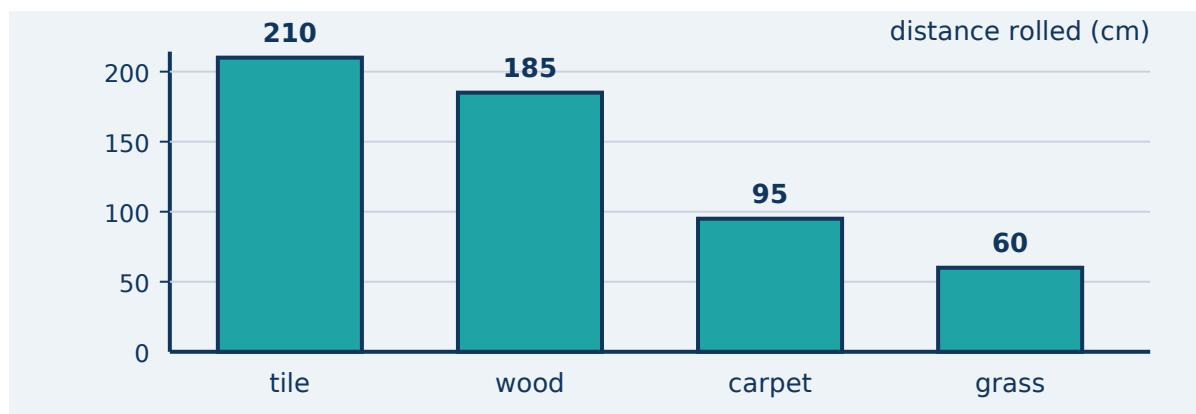
18.0 s is far from the others, so it is an anomaly (perhaps she forgot to stir). Mean of the rest: $(12.1 + 11.9 + 12.3) \div 3 = 36.3 \div 3 = 12.1$. **Mean time = 12.1 s.**

How do you write a conclusion?

A conclusion answers your original question using the data. State whether the results support the hypothesis, quote a number from your table, and mention anything that makes the results less reliable, such as an anomaly or too few repeats. Never say that a hypothesis is proved by one test: say that the evidence supports it or does not support it. For the ramp test you could write: raising the ramp from 10 cm to 20 cm increased the mean distance, so the evidence supports the hypothesis, although three trials is a small sample.

When do you draw a bar chart?

Use a bar chart when the variable you change is in categories, such as types of floor. Give the chart a title, label both axes with units, start the scale at zero and make the steps even. Draw each bar the same width. When the changed variable is a number, like time or temperature, a line graph is usually better.



Distance rolled (cm) on four floor types.

Common mistake

Students often change two things at once, for example a bigger ramp and a heavier car. Then a longer distance can have either cause, so the test is not fair.

Lina's tip

Write down your changed variable, your measured variable and your controls before you start. If you cannot name them, your plan is not ready.

Key points to remember

- A hypothesis is a testable prediction with a reason.
- In a fair test, change only the independent variable and keep controlled variables the same.
- Measure the dependent variable and repeat to find the mean.
- Mean = sum of readings divided by the number of readings.
- Use a bar chart for categories and a line graph for numbers.

Planning fair tests and reading data: frequently asked questions

What is a fair test?

A fair test changes only one variable, measures one result and keeps every other factor the same. This means any difference in the results must come from the variable you changed.

What is a hypothesis?

A hypothesis is a testable prediction with a reason, for example: if the ramp is higher, then the

car will roll farther, because it gains more speed. It can be supported or not supported by data, but never simply proved.

What are independent, dependent and controlled variables?

The independent variable is the one you change. The dependent variable is the one you measure. Controlled variables are everything else you keep the same so the test stays fair.

Why should you repeat measurements?

Repeating shows whether your results are reliable and lets you spot anomalies. You then find the mean of the readings, which is a better estimate than a single value.

When should you use a bar chart instead of a line graph?

Use a bar chart when the changed variable is a category, such as floor type or colour. Use a line graph when it is a number that changes steadily, such as time or temperature.