Science Skills That Appear Everywhere

Working scientifically: the skills that turn up in Biology, Chemistry and Physics

Learn these once. They earn marks in every part of the paper.

This belongs to **Henry**.

Skills | Biology | Chemistry | Physics

Why this part comes first

Examiners test these skills inside science questions. A graph question can appear in any topic. Get these right and you pick up marks across the whole paper.

SKILL 1

Variables and fair tests

> **Big idea:** A fair test changes one thing, measures one thing, and keeps everything else the same.

The three kinds of variable

Independent variable · the one thing you **change** on purpose.

Dependent variable · the thing you **measure** to see what happened.

Control variables · everything you **keep the same**, so the test is fair.

Example

Testing how the height you drop a ball changes its bounce. Change: drop height (independent). Measure: bounce height (dependent). Keep the same: same ball, same floor, same way of measuring (controls).

MUST KNOW

What you change, measure, keep the same.

SHOULD KNOW

Why controls make a test fair.

NICE TO KNOW

The word "variable" means "something that can change".

Common mistakes

- Changing more than one thing at once. Then you cannot tell what caused the result.
- Mixing up independent (changed) and dependent (measured).

SKILL 2

Tables of results

> **Big idea:** A good table is neat, has headings with units, and is easy to read.

How to set one out

- The thing you **changed** goes in the left column.
- The thing you **measured** goes in the columns to the right.
- Put the **unit** in the heading, not next to every number.
- Repeat each reading, then work out the **mean** (average).

Drop height (cm)	Bounce 1 (cm)	Bounce 2 (cm)	Mean (cm)
20	11	13	12
40	23	25	24
60	34	36	35

Mean = add the readings, then divide by how many there are. (11 + 13) ÷ 2 = 12.

MUST KNOW

Headings with units. Work out a mean.

SHOULD KNOW

Changed thing on the left.

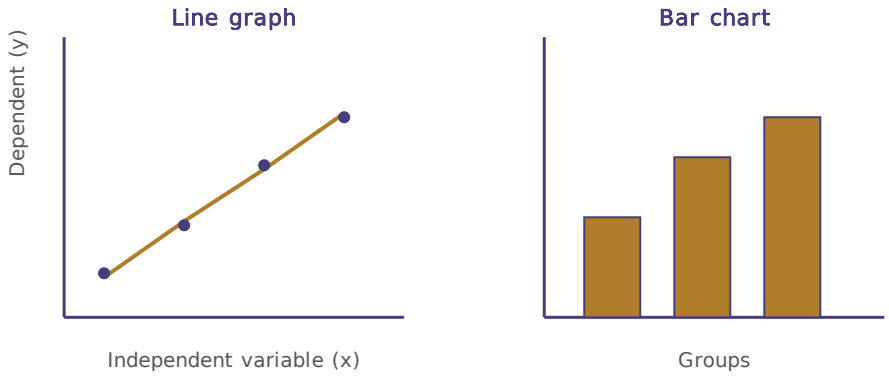
NICE TO KNOW

Repeating readings makes results more reliable.

SKILL 3

Drawing and reading graphs

> **Big idea:** Use a bar chart for groups, and a line graph for numbers that change smoothly.



The changed thing goes along the bottom (x). The measured thing goes up the side (y).

Reading a graph

- Find a value: go up from the bottom, then across to the side.
- Describe the trend: "as the x value goes up, the y value goes up too."

Common mistakes

- Forgetting to label both axes, with units.
- Using a bar chart when the numbers change smoothly (use a line graph).

SKILL 4

Analysing results and spotting errors

> **Big idea:** A conclusion answers the question. An anomaly is a result that does not fit the pattern.

A conclusion

Say what the pattern is, and link it back to the question.

> EXAMPLE
>
> "As the drop height increased, the bounce height increased. So the higher the ball is dropped, the higher it bounces."

Errors

- An **anomalous result** is an odd one that does not fit. Spot it, and leave it out of the mean.
- To make results more reliable: repeat readings, measure carefully, and use the same equipment.

MUST KNOW

Write a conclusion. Spot an anomaly.

SHOULD KNOW

Repeating makes results more reliable.

NICE TO KNOW

Errors can be random (one off) or the same each time.

SKILL 5

Calculations and the scientific method

Calculations

- Always write the **unit** after a number.
- Mean = add the values, divide by how many.
- Read scales carefully. Check what each small mark is worth.

The scientific method

- **Question** → what do you want to find out?
- **Prediction** → what you think will happen, and why.
- **Method** → the steps, kept as a fair test.
- **Results** → a neat table, then a graph.
- **Conclusion** → what the results show.
- **Evaluation** → what went well, and how to improve it.

MUST KNOW

The method in order. Work out a mean.

SHOULD KNOW

A prediction gives a reason.

NICE TO KNOW

An evaluation suggests improvements.

YOUR TURN

Skills: questions

QUICK CHECK

1. Which variable do you change on purpose?

2. Which variable do you measure?

3. What do you call a result that does not fit the pattern?

EXPLAIN WHY

4. Why should you only change one variable in a fair test?

WORKED EXAMPLE ANSWER

You should change only one variable so that you know it caused the result. If you changed two things at once, you could not tell which one made the difference, so the test would not be fair.

INDEPENDENT PRACTICE

5. A pupil tests how the amount of light changes how tall a plant grows. Name the independent variable, the dependent variable, and one control variable.

EXAM STYLE

6. The readings for one drop height are 30 cm, 32 cm and 58 cm. (a) Which is the anomaly? (b) Work out the mean of the two sensible readings. **[3 marks]**

ANSWERS

Skills: answers

1. The independent variable.
2. The dependent variable.
3. An anomalous result (an anomaly).
4. So you know that one variable caused the result. Changing two at once means you cannot tell which made the difference.
5. Independent: the amount of light. Dependent: how tall the plant grows. Control (any one): same type of plant, same amount of water, same pot or soil.
6. (a) 58 cm is the anomaly. (b) (30 + 32) ÷ 2 = 31 cm.

Carry these into every topic

Whenever a Biology, Chemistry or Physics question shows a table or a graph, or asks about a fair test, these are the marks. Use them.