

GAC013 Science II: Scientific Principles

GAC Science

What this module is, and how it is marked

GAC013 is not a science content module. It is a module about **how science works** — its history, its method, its language, how the discipline is organised, and the issues it raises.

Assessment is a **practical investigation** 探究实验 you plan and run, an **investigation report** 实验报告 written to scientific conventions, a test, and coursework. The investigation carries substantial weight.

- $\triangle$ The report is marked on **method and reasoning**, not on getting the expected result. An experiment that failed, reported honestly with an explanation, scores above one that quietly reports the textbook answer.

The history of science

- Science is a **method**, not a body of facts, and the method was assembled over centuries.
- A **paradigm** 范式 is the framework a field works inside; a **paradigm shift** 范式转换 is when it changes, as with heliocentrism or plate tectonics.
- Ideas are **provisional** 暂定的: they stand until better evidence arrives. That is a strength of science, not a weakness, and questions test whether you can say why.

The scientific method

- A **hypothesis** 假设 is a testable statement, not a guess. If no result could contradict it, it is not a hypothesis.
- The **independent variable** 自变量 is what you change; the **dependent variable** 因变量 is what you measure; the **control variables** 控制变量 are what you hold constant.
- A **control group** 对照组 shows what happens without the treatment.
- **Repeat** 重复 measurements to see the spread. One reading is an anecdote.

Worked example. Does fertiliser increase plant growth?

Independent: fertiliser amount. Dependent: height after four weeks. Controls: same species, soil, water, light, pot size. Control group: no fertiliser. Repeats: five plants per condition.

Writing those five lines before touching a plant is the planning mark, and it is the part most students skip.

The language of science

- **Units** 单位 follow the SI system, and a number without one means nothing.
- **Significant figures** report precision. Copying eight digits off a calculator claims a precision the instrument did not have.
- **Accuracy** 准确度 is closeness to the true value; **precision** 精密度 is how tightly repeats cluster. A measurement can be precise and wrong.
- **Uncertainty** 不确定度 is the range a value might lie in, and stating it is part of a scientific claim.

The organization of science

- **Peer review** 同行评审 is other specialists checking a paper before publication. It filters; it does not guarantee.
- **Replication** 可重复性 is how a result becomes trusted: someone else does it and gets the same thing.
- Science is done in **institutions** 机构 with funders, and asking who paid is a normal part of reading a result, not cynicism.

Scientific issues

- Science supplies evidence; it does not settle values. Whether a technology *should* be used is not a question a measurement answers.
- **Risk** 风险 combines how likely harm is with how bad it would be, and public argument routinely confuses the two.
- **Communicating uncertainty** 传达不确定性 is a skill: a range with a confidence level says more than a single number, and it is what an honest scientist gives a journalist.
- $\triangle$ In this unit, choose neutral and well documented issues — vaccination programmes, water quality, energy sources, food safety — and argue from evidence rather than position.