

GAC013 Scientific Investigation: Planning and Reporting

GAC Science

From readings to an investigation report

A paper holds more water in one comparison. What should its report actually claim? A strong report lets the reader trace the conclusion back to the method and readings. These extra notes develop the reporting outcome alongside the original GAC013 hand-out. Your teacher's actual brief sets the required structure and assessment criteria.

Plan, conduct and record

A **research question** 研究问题 identifies what you want to find out. For example: which of two paper types retains more water under the stated procedure? A **hypothesis** 假设 gives a testable prediction or explanation. Predict a difference between paper types, then identify which readings could challenge that prediction.

Specify the **independent variable** 自变量, measured response and relevant controlled conditions before starting. Here, paper type is the independent variable. Retained-water mass, measured as wet mass minus dry mass, is the **dependent variable** 因变量. Use fresh squares with the same area, the same immersion and draining times, and the same checked balance. Do not squeeze only one paper type. State how the order of trials will be chosen. A change in procedure must be recorded; it cannot be repaired by hiding a reading.

Obtain teacher agreement on a safe, permitted method before conducting any practical activity. Keep a dated record of materials, instructions, units, readings and changes to the plan. Record what happened, including unexpected observations and missing readings. Do not invent completed trials.

Show the evidence and the calculation

The following table repeats the original handout's **fictional data**. It is written practice, not a new completed investigation.

Trial	A retained-water mass / g	B retained-water mass / g
1	3.0	4.2
2	3.2	4.0
3	2.8	4.4
Mean 平均值	3.0	4.2

A mean summarises the readings. Show enough calculation for a reader to check it:

$$\bar{m}_A = \frac{3.0 + 3.2 + 2.8}{3} = 3.0 \text{ g}$$

$$\bar{m}_B = \frac{4.2 + 4.0 + 4.4}{3} = 4.2 \text{ g}$$

The difference between these means is $4.2 - 3.0 = 1.2$ g. Each paper's readings span 0.4 grams. This spread is not automatically the full **measurement uncertainty** 测量不确定度. The balance, timing and draining procedure may also contribute to uncertainty. No **statistical test** 统计检验 or **confidence level** 置信水平 has been supplied; do not invent one.

Write a conclusion that fits the test

A **conclusion** 结论 answers the research question using the recorded evidence. For these fictional readings, B retained more water on average under the supplied conditions. The observed difference is 1.2 grams. Both types show variation between trials.

Do not write "B is best for every task". Strength, price and performance in other uses were not tested. Do not claim that repeats repaired an unequal procedure. Repeats help examine variation, not remove **systematic bias** 系统性偏差. A limitation should identify a specific problem and explain its effect on the interpretation. An improvement should address that problem, not promise perfect results.

Worked evaluation. One trial used a longer draining time for A. Its reading may be lower because of the changed draining procedure, rather than paper type alone. Keep the original record and flag the departure from the plan. A later permitted trial using the agreed timing can add evidence; it does not make the earlier event disappear.

Organise and reference the report

Report part	What the reader needs
Question and background	The question, prediction and relevant scientific ideas
Method	Materials, variables, procedure, safety and reasons for key choices
Results	Actual observations, units, tables and checked calculations
Discussion and conclusion	The answer, alternative explanations, limits and justified improvements
References and supporting material	Sources of background claims and the records needed to check the work

A **reference** 参考文献 identifies where a borrowed fact, idea or image came from. Use the reference style required by your brief. Keep enough information to locate each source. Mark supplied case data as supplied data. Distinguish research you propose from work actually completed. Copying a claim from a website is not independent confirmation of it. Check who produced the source, which evidence it provides and whether it addresses your question.

Practice and explained answers

1. Identify the changed variable and measured response.
2. Why do three repeats not repair squeezing only A?
3. Calculate the mean difference and each set's range.
4. Write a conclusion without a universal product claim.
5. How should a report describe a test that is only planned?

Answers.

1. Change paper type; measure wet mass minus dry mass, in grams.
2. Squeezing changes another condition. Repeats do not isolate paper type.
3. Mean difference: 1.2 g. Each range: 0.4 g, not the whole uncertainty.
4. B retained more water under these conditions; other properties were not tested.
5. Label it as planned; it adds no observations or confirmation until performed.