Science 5–6

Chapter 11 — Use and influence of science

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Contents

Using science to identify problems and make decisions

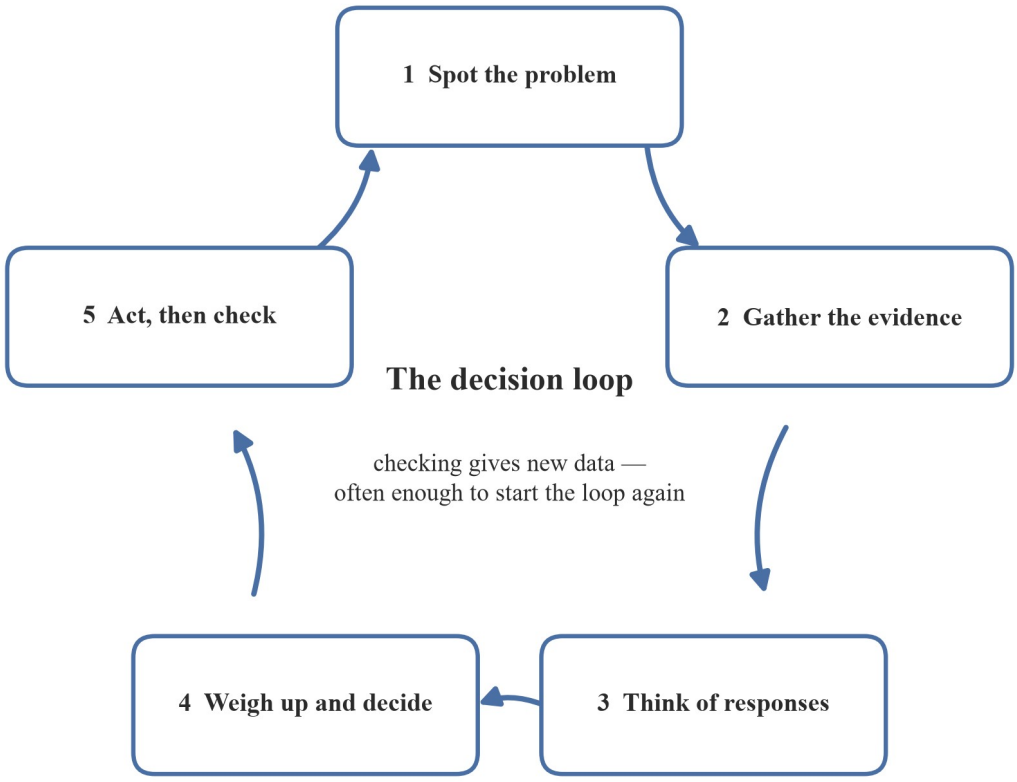
Words to know problem · data · evidence · response · decision · community · cost · rule · guideline · claim · audience

Science is not only about knowing things. Individuals and **communities** (groups of people who live, work or meet together) use knowledge from science, science skills and data to notice when something is wrong, think about what to do, and make a **decision** (a choice about what to do). In this section we follow real kinds of cases — a worn park path, street lights near a penguin beach, mouldy bread, storm-brought power lines, recycling bins — and we learn a method for moving from a **problem** to a well-argued decision.

Theory

From a problem to a decision

When something needs fixing, people who use science tend to move through the same five steps. The steps form a loop, because checking a decision gives you new **data** (the facts, numbers and observations we collect), and new data can start the loop again.



Five numbered boxes joined by arrows in a closed loop: spot the problem, gather the evidence, think of responses, weigh up and decide, act then check. The centre reads "the decision loop — checking gives new data".

1. **Spot the problem.** A problem is a gap between what is happening and what we want to be happening. It is worth naming the problem in one clear sentence before doing anything else.
2. **Gather the evidence.** Collect data by measuring, observing, reading records or asking questions. **Evidence** is data that we use to back up a claim — the same numbers become evidence when they support an answer to a question.
3. **Think of responses.** A **response** is a possible way to deal with the problem — a **rule** (something people agree to follow), a **guideline** (advice about the best thing to do), a design, or a decision to leave things as they are.

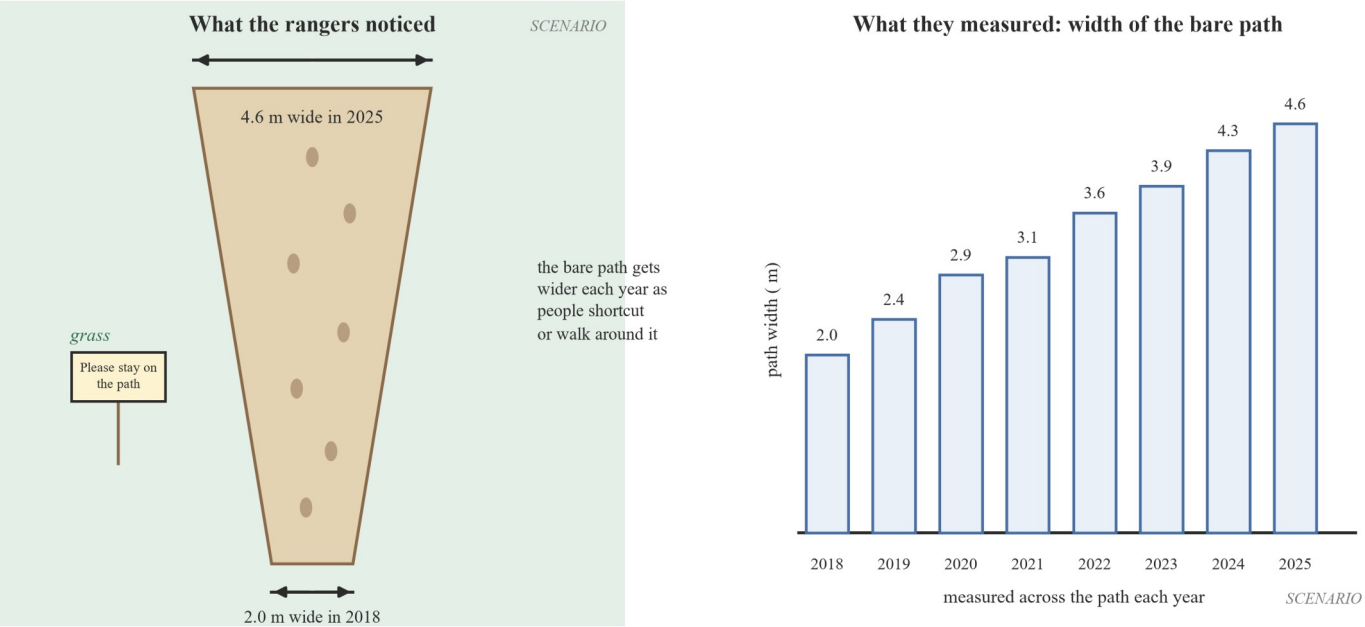
4. **Weigh up and decide.** Check each response against the evidence, then against the **cost** (what must be given up — usually money, time or something else people want), what different people want, and what the community values.
5. **Act, then check.** Put the decision into action and collect new data to see whether it worked.

The method is the point: it survives every example in this section, and it is the method the questions will ask you to use.

Case 1 — A park path that keeps getting wider

SCENARIO — *Point Banksia Park*, a coastal park in Victoria, built on real park-management practice.

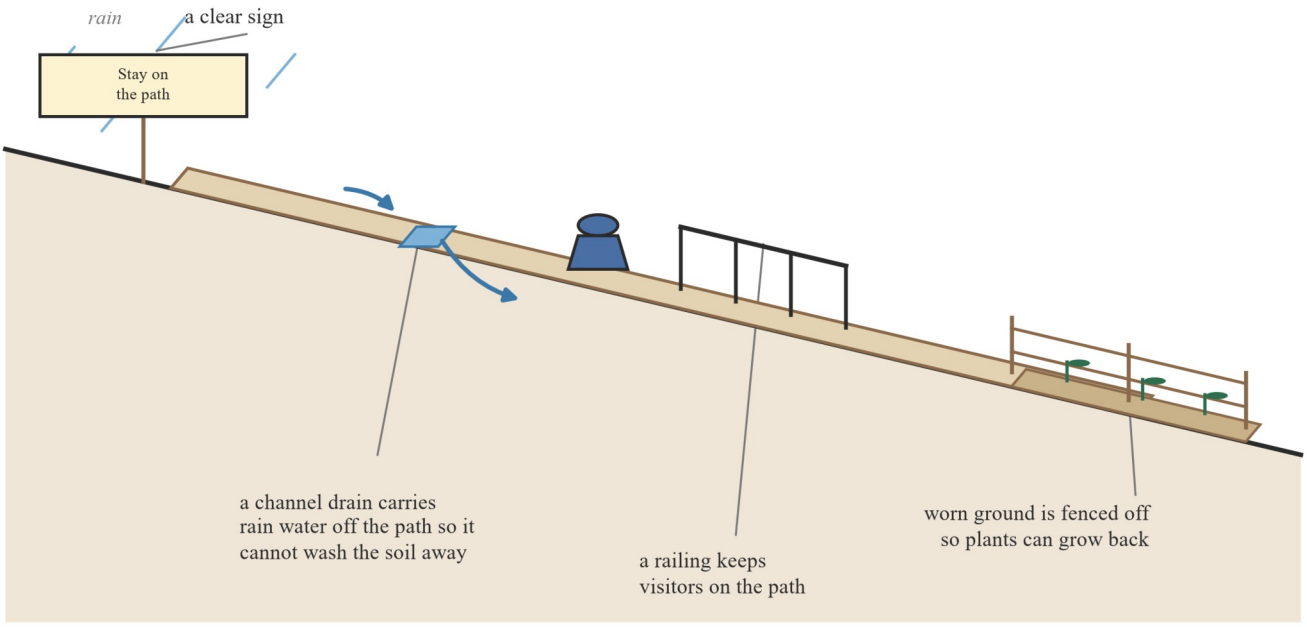
The rangers at Point Banksia Park noticed a problem: the bare path through the grass was getting wider every year, as visitors cut corners or walked around muddy parts. Feet wear the plants away, and when the plants go, rain washes the soil downhill. Knowledge from science — that moving water carries soil, and that plants hold soil in place — helped the rangers name the problem as erosion caused by foot traffic.



Left panel: a view from above of a bare path through grass, 2.0 metres wide in 2018 and 4.6 metres wide in 2025, with footprints and a "please stay on the path" sign. Right panel: a column graph of the path width measured each year from 2018 to 2025, rising every year from 2.0 to 4.6 metres.

The data gave the rangers evidence: the width grew every single year, so the problem was real and growing. Their responses mix rules and built things:

How the rangers responded — Point Banksia Park (SCENARIO)



Side view of a path on a slope with four labelled responses: a stay-on-the-path sign, a channel drain that carries rain water off the path, a railing that keeps visitors on the path, and worn ground fenced off so plants can grow back.

- a **rule** — stay on the path — backed up by signs and a railing;
- a **design** — a channel drain to carry rain water off the path before it can wash soil away;
- a decision to fence off the most worn ground so plants can grow back.

There is one more part of this case that is about law, not only science. Some places in Victoria are important to Aboriginal people and are protected by law even when they look like ordinary ground. One Victorian law that protects Aboriginal cultural places is the *Aboriginal Heritage Act 2006* (Vic).

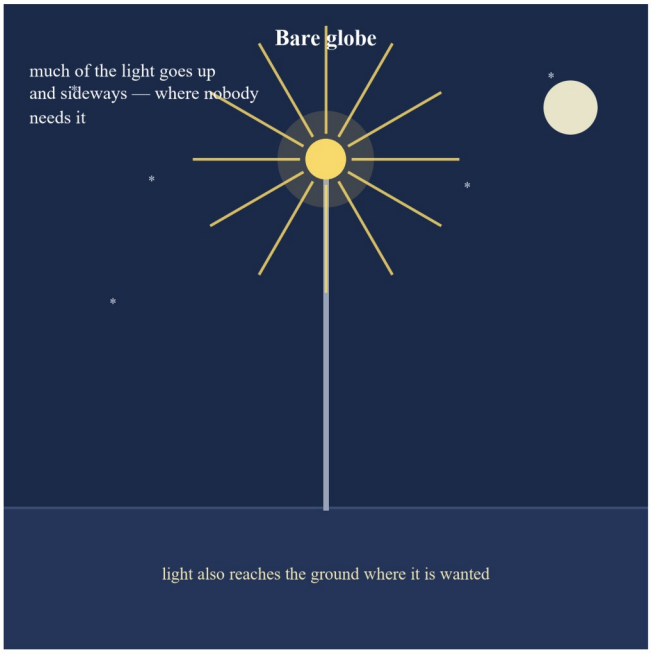
Source: Aboriginal Heritage Act 2006 (Vic), legislation.vic.gov.au — retrieved 2026-08-21.

This is why park work follows a careful process: before rangers or a council dig, build or move earth in such a place, the right people and bodies must be asked, and approvals must come first. The science tells the rangers *how* to protect the park; the law and the Traditional Owners tell them *what must be asked* before they act. The cultural knowledge itself belongs to Aboriginal communities — it is not something a science textbook can hand out.

Case 2 — Street lights and little penguins at Sandbay

SCENARIO — *Sandbay*, a Victorian seaside suburb with a little-penguin colony, built on real light-pollution practice.

Little penguins come ashore in the dark and walk from the water to their burrows. At Sandbay the street lights along the beach stay on all night, and on bright nights the penguins wait at the water's edge for longer before they move. The science behind the problem comes from what we know about light: it travels in straight lines from a source, so a bare globe throws light sideways and upward as well as down.



Two night panels. A bare globe sends light rays in all directions, including up and sideways. A covered globe sends a cone of light only downward, onto the path.

Two night panels. With the lights on, penguins wait at the water's edge and hold back from the bright sand. With the lights off, the penguins walk up from the water to their burrows in the dune.

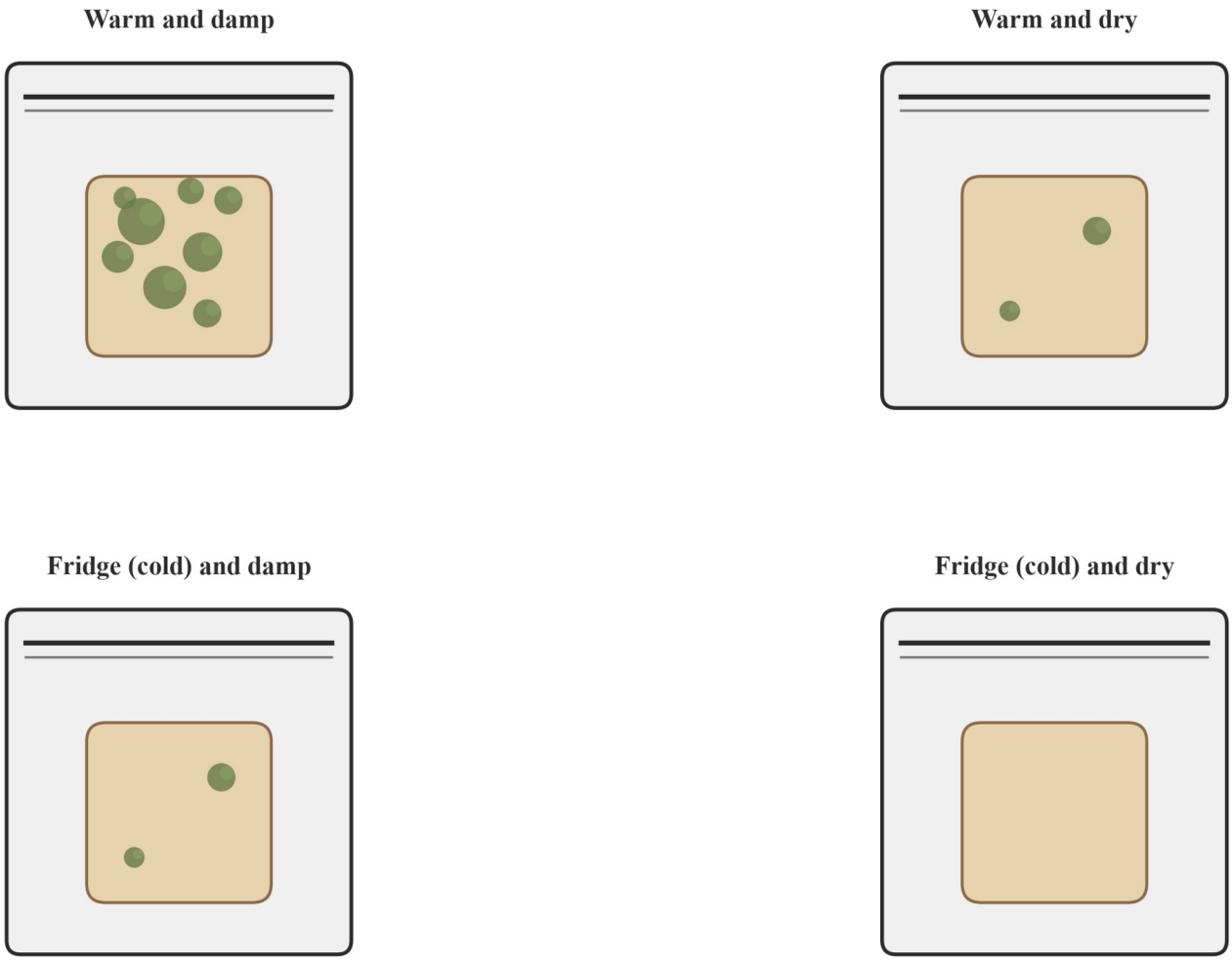
The community's responses come straight from that knowledge:

- **covered globes** that point their light downward, so no light goes up or sideways;
- **timers and motion sensors**, so lights are on only when people need them;
- switching some lights **off after midnight**, when the beach is empty.

Each response has a cost and a benefit, and different people weigh them in different ways — shopkeepers want people to feel safe walking home, and penguin carers want darker nights. The council's decision has to weigh the evidence *and* those wants.

Case 3 — Keeping food safe

Mould and bacteria grow fastest where conditions are warm and damp. That single fact is the science behind most food storage, for individuals and for whole communities.



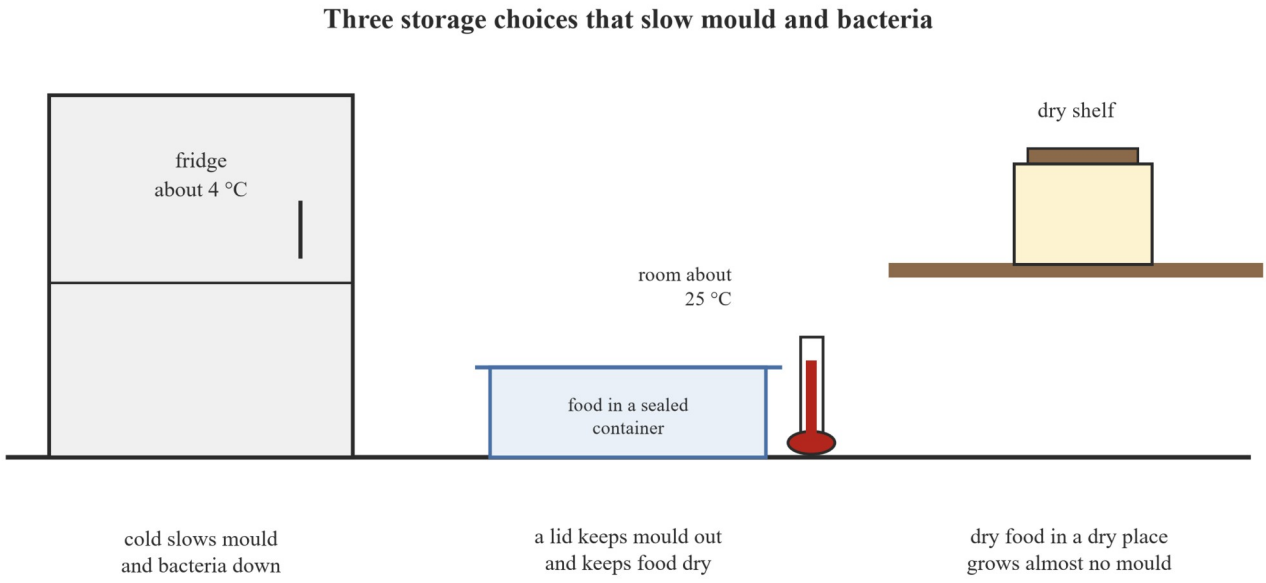
Mould grows fastest where it is warm and damp — SCENARIO, class data at day 5 (bags stayed sealed)

Four sealed bags of bread after five days: heavy mould in the warm damp bag, a little mould in the warm dry and fridge damp bags, no mould in the fridge dry bag. The caption reads "mould grows fastest where it is warm and damp".

Reading the bags two ways gives two pieces of evidence:

- compare the damp bags: the warm one grew far more mould than the fridge one, so **cold slows mould down**;
- compare the warm bags: the damp one grew far more mould than the dry one, so **dry slows mould down**.

Those two pieces of evidence are the reasons behind everyday decisions:

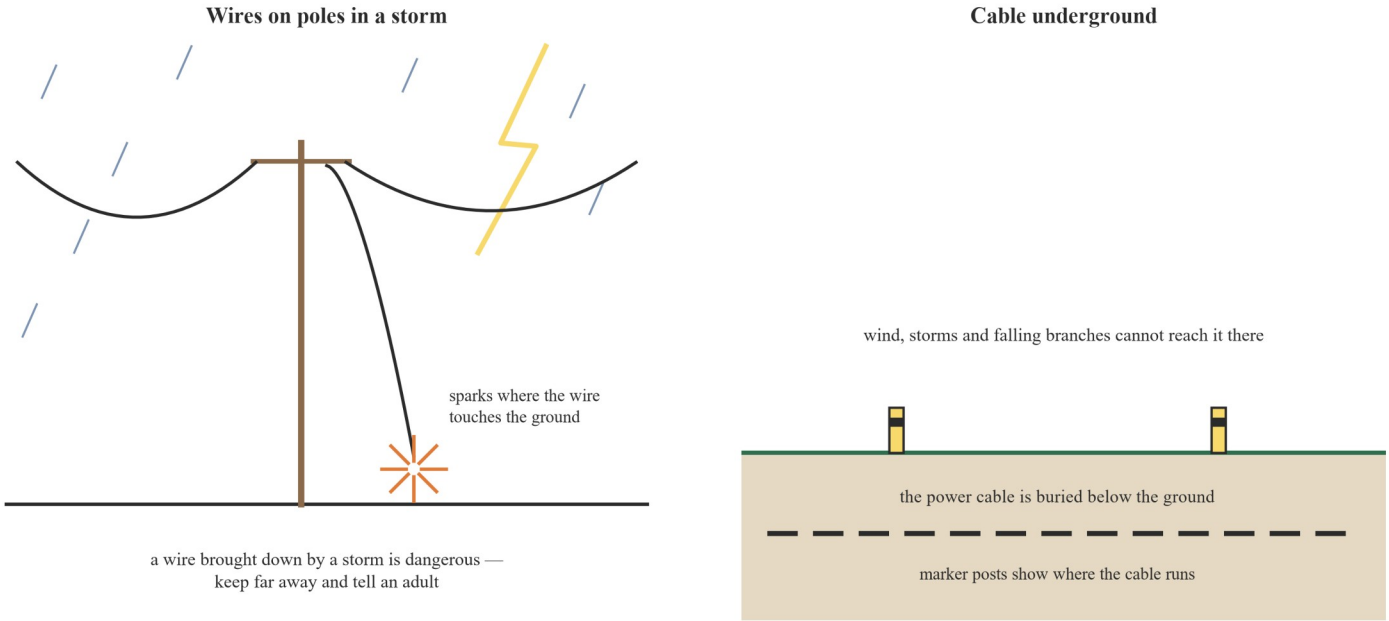


A kitchen bench with three labelled choices: a fridge at about 4 °C, food in a sealed container, and a dry shelf — each slows mould and bacteria.

Individuals decide to put food in the fridge, keep food dry, and seal it in containers so mould and bacteria cannot reach it. Communities make the same science into guidelines: packaging that keeps food dry and sealed, labels such as *refrigerate after opening*, and storage advice printed on packets. The decision is small, but it is the same loop: problem (food spoils), evidence (warm and damp speed spoilage), response (cold, dry, sealed), check (food keeps longer).

Case 4 — Power lines and storms

Power wires carried on poles do the job cheaply, but storms bring wires down, and a wire on the ground is dangerous. Knowledge from science about electricity — that it can flow through a brought-down wire into the ground, and that people must keep far away — is part of every decision about power lines (and part of the safety teaching in earlier chapters).

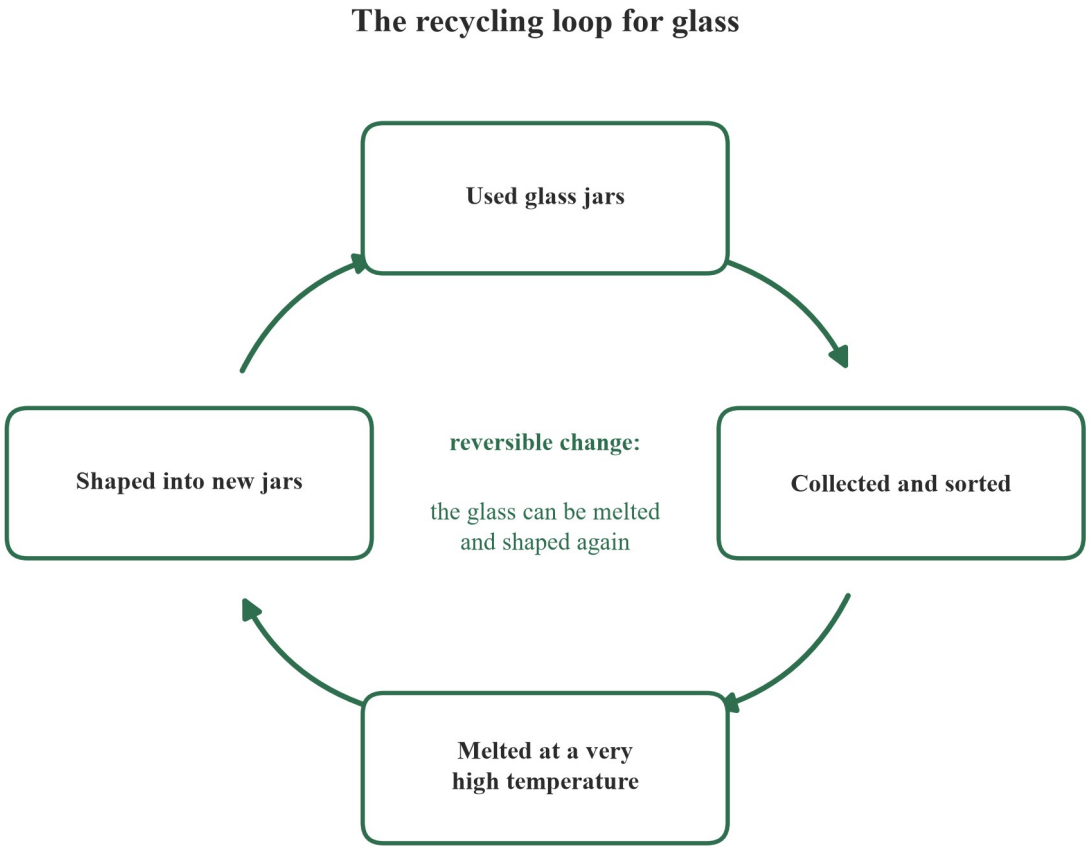


Left panel: a storm brings a wire on poles down onto the ground, sparking where it touches. Right panel: the same street with the power cable buried underground, marked by small posts, where wind and falling branches cannot reach it.

One response is to lay power cables **underground**, where wind, storms and falling branches cannot reach them. The catch is cost: underground cables cost many times what wires on poles cost. So different places make different decisions — busy suburbs and storm-prone coasts may choose underground cables, while long country lines stay up on poles. Same science, different costs, different decisions. The science sets the choices; it does not make the choice for anyone.

Case 5 — Recycling and reversible change

Some changes can be undone: melt glass and you can shape it into a new jar. That is a **reversible change**, and it is the knowledge behind recycling guidelines for glass and metals.



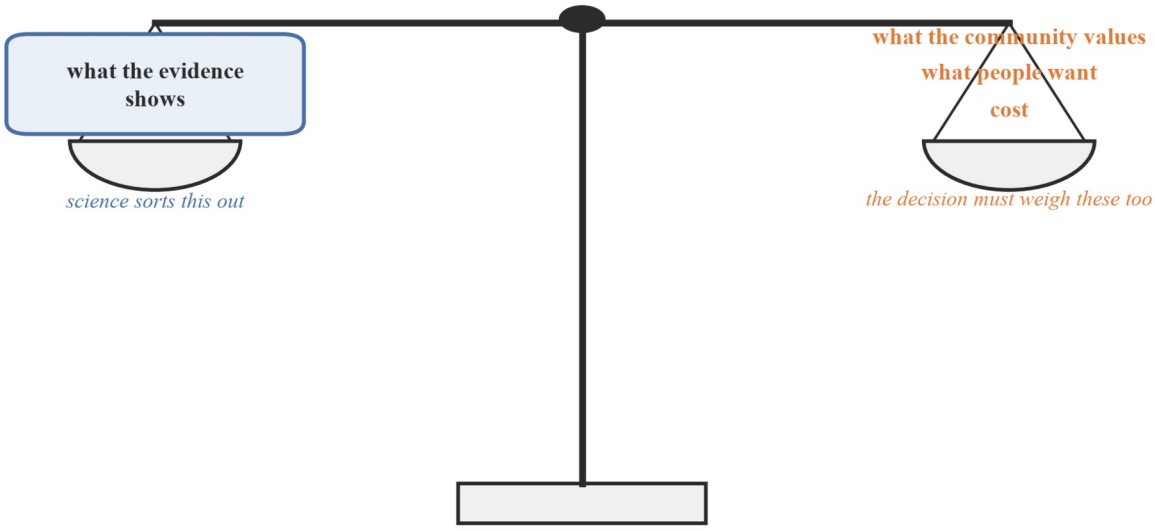
A closed loop of four boxes: used glass jars, collected and sorted, melted at a very high temperature, shaped into new jars. The centre notes that this works because melting and re-shaping glass is a reversible change.

Communities turn that knowledge into guidelines — what goes in the recycling bin, what goes in the rubbish bin — because a material that *cannot* be melted and re-shaped in a useful way cannot be recycled the same route. When a council writes a recycling guideline, the evidence is the science of the material, and the decision also weighs cost (collecting and sorting is expensive) and what people will actually do at home.

A decision weighs more than the evidence

Every case above ends the same way: the evidence narrows the choices, then cost, competing interests and values make the final call.

A decision weighs more than the evidence



Two people can read the same evidence well and still make different decisions — they weigh cost, interests and values in different ways.

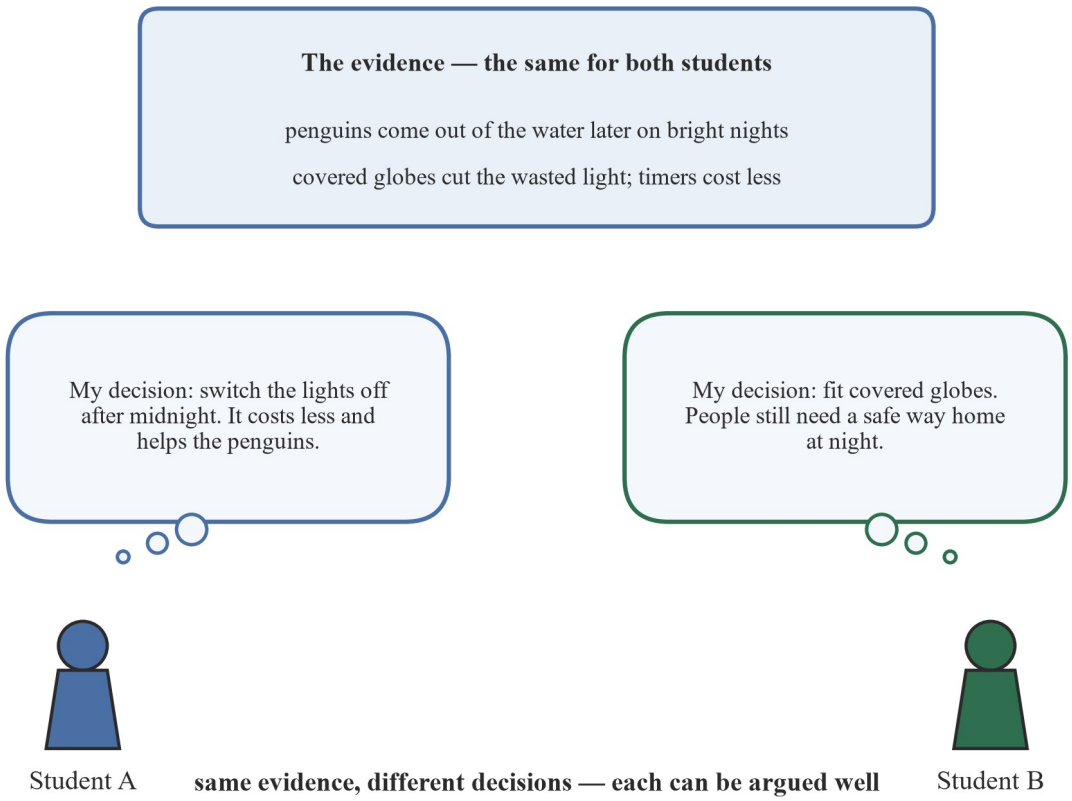
A balance. On one pan sits a card reading "what the evidence shows". On the other pan sit three items: cost, what people want, and what the community values. The caption reads: two people can read the same evidence well and still make different decisions, because they weigh cost, interests and values in different ways.

This is not a weakness in science — it is how decisions work. Two people can both read the evidence correctly and still reach different decisions, because one weighs cost more heavily and the other weighs what the community values more heavily. Saying "the evidence shows this, *and* the cost matters" is not sitting on the fence; it is the complete answer.

Arguing a position from evidence

Because people can differ, a good decision-maker must be able to argue a position so an **audience** (the people you are trying to persuade — a council, a principal, a class, a family) can follow it. A well-built position has three parts:

- a **claim** — the decision or answer you are arguing for;
- the **evidence** — the data you are using, and what it shows;
- your **reasoning** — why the evidence supports the claim, including how you weighed cost and what people want.



Two students beneath a shared evidence box. Student A decides to switch the lights off after midnight because it costs less and helps the penguins. Student B decides to fit covered globes because people still need a safe way home at night. The caption: same evidence, different decisions — each can be argued well.

Both students above use the same evidence and both argue well. In this kind of question, two different claims can each earn full marks — what earns the marks is the evidence and the reasoning, not which side you pick.

Worked examples

Example 1 — with support

Use the decision loop on the Point Banksia Park case. The rangers measured the bare path each year: 2.0 m wide in 2018 and 4.6 m wide in 2025, growing every year in between.

Working	Comment
1. Name the problem: the bare path is getting wider each year, so plants and soil are being lost.	Step 1 — a problem is a gap between what is happening and what we want.
2. The data: width 2.0 m (2018) rising to 4.6 m (2025), up every single year.	Step 2 — data is what was collected.
3. The evidence: the steady growth year after year shows the problem is real and growing, not a one-off wet winter.	Step 2–3 — data becomes evidence when it backs up a claim.
4. A matching response: a stay-on-the-path rule with signs and a railing, plus fencing off the most worn ground.	Step 3–4 — the response must attack the cause (feet off the path).
5. Check: measure the path width again next year and compare.	Step 5 — new data closes the loop.

Example 2 — with support

Sandbay council has three options for its beach lights. **A** — fit covered, downward globes: $4,000, light stays on all night but no light goes up or sideways. **B** — a timer switching the lights off after midnight: $800. **C** — do nothing: $0.

The evidence: penguins wait longer at the water's edge on bright nights; covered globes stop light going up and sideways; people want a safe way home after dark. Weigh the options and make a decision with reasons.

Working	Comment
1. What the evidence shows: all-night bright light is the problem for the penguins; covered globes fix the wasted light; a timer fixes the late-night light only.	The science narrows the choices.
2. Costs: A $4,000, B $800, C $0.	Cost is part of the weighing, not an afterthought.
3. What people want: safe paths home (A or B keep them, C does not), darker nights for the penguins (A or B help, C does not), spending less (B or C keep costs down).	Competing interests — name them, do not hide them.
4. Decision, e.g. choose **A**: it cuts the wasted light every hour of the night *and* keeps paths lit for people; the cost is high but the fix is complete.	A claim with reasons.
5. (Equally good: choose **B** — most of the benefit for far less money, accepting bright light before midnight.)	Two different claims can both be well argued — the marks are in the reasoning.

Example 3 — by yourself

A shop near your school throws out many loaves of bread each week. The owner asks you for **two** storage rules to make bread keep longer, each with the evidence for it. Use the four-bag investigation from Case 3. (3 marks)

Practice questions

With support

Q1 (3 marks). In your own words, explain the difference between: (a) data and evidence; (b) a rule and a guideline; (c) a problem and a response.

Q2 (3 marks). These steps of the decision loop are out of order. Rewrite them in the right order. A weigh up and decide · B act, then check · C gather the evidence · D think of responses · E spot the problem

Q3 (3 marks). Point Banksia Park. (a) State the problem the rangers identified. (b) Give one piece of data they collected. (c) Name one response and explain how it attacks the cause of the problem.

Q4 (2 marks) Sandbay. Name two responses that stop light going where it is not needed, and say which part of the night each one fixes.

Q5 (2 marks) Bread and mould. (a) Name the two conditions in which mould grows fastest. (b) Use your answer to explain why sealed packets and fridges both keep food longer.

Q6 (2 marks). "A decision is never made from the science alone." Show what this means using the Sandbay options A, B and C.

By yourself

Q7 (3 marks). A class repeats the four-bag investigation and scores the mould from 0 (no mould) to 4 (most of the slice):

Bag	Day 1	Day 2	Day 3	Day 4	Day 5
warm and damp	0	1	2	3	4
warm and dry	0	0	0	1	1
fridge and damp	0	0	0	1	1
fridge and	0	0	0	0	0

Bag	Day 1	Day 2	Day 3	Day 4	Day 5
dry					

(a) Describe the pattern in the table. (b) State the evidence it gives about one condition that speeds mould growth. (c) Give one decision a family could make using this evidence.

Q8 (3 marks) Power lines. (a) One benefit of putting power cables underground. (b) One cost. (c) A long country power line stays up on poles. Give one reason this can still be a good decision.

Q9 (3 marks) Recycling. (a) Explain why glass jars can be recycled into new jars, using the idea of reversible change. (b) A material that burns and cannot be melted back into shape is hard to recycle this way. Explain why.

Q10 (3 marks) Data or evidence? The Sandbay penguin carers record: *"On the six dark nights we watched, penguins started walking up within about 10 minutes of coming ashore. On the six bright nights, most waited over an hour."* (a) Is this record data or evidence? Explain. (b) The claim is: *bright light holds the penguins back*. Explain how the record works as evidence for this claim.

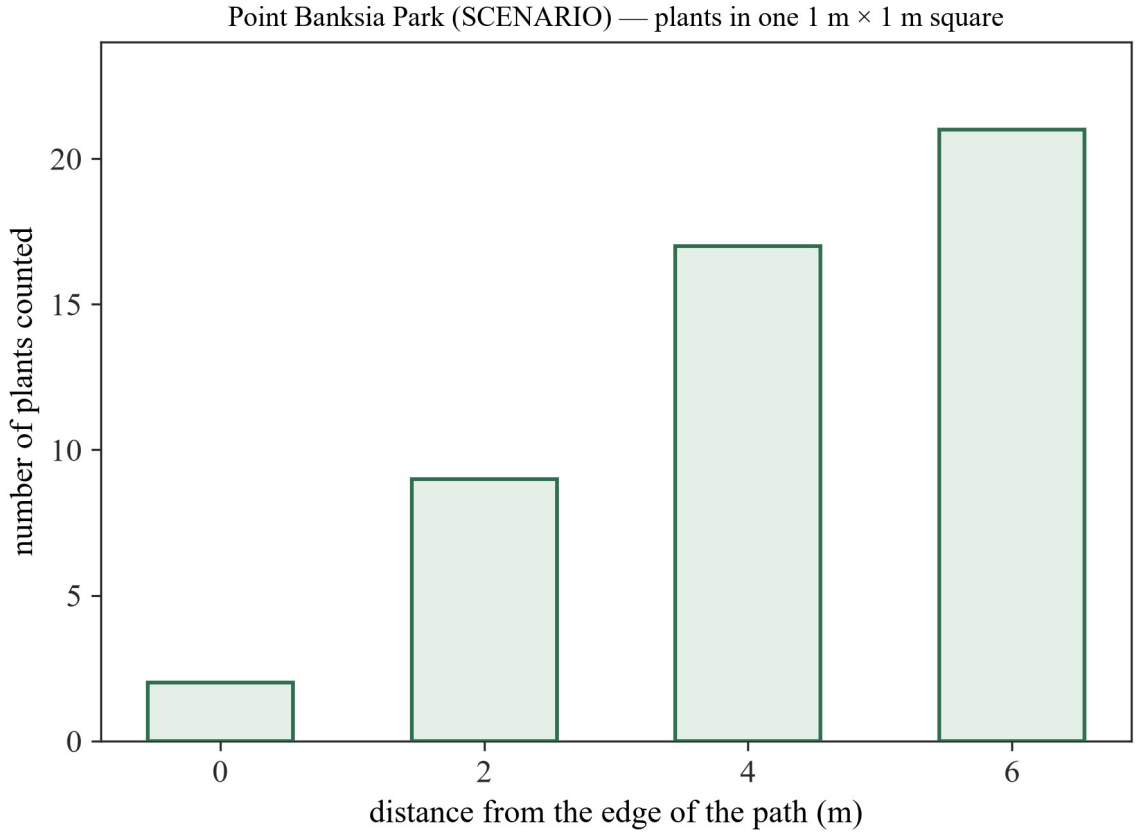
Q11 (2 marks). A councillor says: "The path at Point Banksia Park looks fine to me. No decision is needed." Use the decision loop to say what is missing from this approach.

Q12 (3 marks) Your school wants to start a vegetable garden, but the last two gardens died in the summer holidays. (a) Name the problem in one sentence. (b) Give two pieces of data you would collect before deciding anything. (c) Suggest one response and say how it attacks the cause.

Q13 (3 marks) A council plans a new boardwalk through a coastal reserve. A survey says part of the reserve may be an Aboriginal cultural place protected under laws such as the *Aboriginal Heritage Act 2006* (Vic). (a) Why can the council not simply start building? (b) What must happen before work begins? (c) Whose knowledge and authority are involved, besides the council's?

Q14 (5 marks) Your school yard has bright floodlights that stay on all evening, and your class has counted few birds and insects near them at night. Write the **claim, evidence and reasoning** for a position you would argue to the principal (your audience). Your position must name one response, use at least two pieces of evidence, and mention one cost or one thing people want.

Q15 (3 marks) Use the graph below, from the Point Banksia Park survey. Counting squares were placed on the ground at 0 m (at the path edge), 2 m, 4 m and 6 m from the path, and the plants in each square were counted.



A column graph titled "Point Banksia Park (SCENARIO)". The number of plants counted in a one-metre square rises from 2 at the path edge to 9 at 2 metres, 17 at 4 metres and 21 at 6 metres from the path.

(a) Describe the pattern in the graph. (b) Explain how this evidence supports the stay-on-the-path rule.

Q16 (6 marks) Run the whole decision loop on this case. *Litter piles up under the school canteen at the end of lunch, and birds scatter it across the yard.* In your answer: (1) name the problem; (2) give two pieces of data you would collect; (3) turn one of them into evidence; (4) suggest two responses; (5) make a decision, weighing the evidence, one cost and one thing people want; (6) say how you would check the decision worked.

Practical — What makes bread go mouldy fastest?

PRACTICAL — this page plans or analyses work done in the classroom, laboratory or field. It is not a substitute for doing it.

Question. Which conditions make mould grow fastest on bread — warmth, dampness, or both?

Equipment. Four clear sealable bags with seals · four same-size slices from one loaf · water spray · labels and marker · tongs · a fridge · this page's results table. The whole set-up is done twice (your set plus a partner group's set) so conditions can be compared twice.

Safety.

Risk	How we manage it
Mould growing in the bags	Bags stay **sealed** for the whole investigation. Never open a bag, never smell or eat the bread.
Spreading mould or bacteria by handling	Use tongs to put slices in bags; wash hands after handling bags; wipe the bench afterwards.
A student with a mould allergy	They record results from a distance and never handle the bags.
Bags left for days	The teacher checks the seals each day; at the end, sealed bags go straight into the bin.

Variables.

What we change	warmth (warm bench vs fridge) and dampness (sprayed vs dry slice)
What we measure	mould score, 0 (no mould) to 4 (most of the slice), each day for 5 days
What we keep the same	same loaf, same slice size, same bags, same light, same scoring scale

Method.

1. Label the bags 1–4: *warm damp, warm dry, fridge damp, fridge dry*.
2. With tongs, put one slice in each bag. Spray the two "damp" slices until damp but not dripping.
3. Seal all four bags. Check the seals with the teacher.
4. Put bags 1–2 in a warm spot in the room and bags 3–4 in the fridge.
5. Each day for 5 days, score the mould on each slice from 0 to 4 **without opening the bag**, and record it.
6. At the end, compare your set with the partner group's set: do the two sets show the same pattern? Hand the sealed bags to the teacher for disposal.

Results. Record your scores, then the sample results below show one class's set.

Bag	Day 1	Day 2	Day 3	Day 4	Day 5
1 warm and damp	0	1	2	3	4
2 warm and dry	0	0	0	1	1
3 fridge and damp	0	0	0	1	1
4 fridge and dry	0	0	0	0	0

Thinking about the results.

1. Which bag went mouldy fastest? Which grew no mould at all?
2. Compare bags 1 and 3. What does the difference show?
3. Compare bags 1 and 2. What does the difference show?
4. Did your set and the partner set show the same pattern? Why does checking a second set matter?
5. Was the test fair? Name two things the method kept the same.

Claim and reasons. Finish this frame in your book, then end with a decision:

- **Claim** — mould grows fastest on bread that is …
- **Evidence** — bag … scored … while bag … scored …
- **Reasons** — so the two conditions that slow mould are …
- **Decision** — using this evidence, I would keep bread …

Answers

Q1. (a) Data is what we collect; evidence is data used to back up a claim. (b) A rule is agreed and followed; a guideline is advice about the best thing to do. (c) A problem is the gap between what is happening and what we want; a response is a way to close that gap. **Q2.** E, C, D, A, B. **Q3.** (a) The bare path widens each year, losing plants and soil. (b) e.g. width 2.0 m (2018) → 4.6 m (2025). (c) e.g. stay-on-the-path rule — feet cause the wear, so keeping feet on the path attacks the cause. **Q4.** Covered downward globes (fix wasted light all night); timers/motion sensors or switching off after midnight (fix light when nobody needs it). **Q5.** (a) Warmth and dampness. (b) A fridge removes the warmth; a sealed packet removes the dampness and keeps mould out — each removes one condition mould needs. **Q6.** The evidence supports A and B over C for the penguins — but A costs $4,000 and B $800, and people want safe paths home; the final choice depends on what the council weighs most, not on the penguin evidence alone. **Q7.** (a) Only the warm damp bag scores high; dry or cold bags stay near 0. (b) e.g. damp speeds growth — the warm damp bag reached 4 while the warm dry bag reached only 1. (c) e.g. keep bread sealed and dry, or in the fridge. **Q8.** (a) Storms and falling branches cannot bring the cable down — safer and more reliable. (b) It costs many times more than wires on poles. (c) Over such a long line the underground cost is too high for the benefit; wires on poles plus the keep-away rule manage the danger. **Q9.** (a) Melting and re-shaping glass is reversible, so old jars become new jars. (b) Recycling that route needs the change to be reversible; a material that cannot be melted back into shape cannot be re-made this way. **Q10.** (a) As written it is data — records of what was observed. (b) It becomes evidence for the claim because the dark/bright comparison shows penguins move sooner when the light is off, which is exactly what the claim says. **Q11.** Step 2 is skipped: no data gathered, so no evidence, so the "no problem" view is an opinion, not a checked claim. Checking the records (width each year) is what the loop demands. **Q12.** e.g. (a) the garden dies each summer when no one waters it. (b) rainfall over the holidays; who is at school in January; how the last gardens were watered. (c) e.g. a timer drip-waterer — it supplies water when no one is there, attacking the cause (no water in hot weeks). **Q13.** (a) The place may be protected by law; building without asking could damage something the law (and its Traditional Owners) protect. (b) The right people and bodies are asked and approvals come first, before any work. (c) Aboriginal Traditional Owners and the bodies set up under the law — their knowledge and authority, not the council's alone. **Q14.** e.g. claim: put the floodlights on a timer to switch off at 9 pm. Evidence 1: counts show few birds/insects near the lights at night. Evidence 2: lights on after 9 pm light an empty yard. Reasoning: the timer cuts wasted light when no one needs it; cost — teams training later would need the lights on some nights, so a switch can turn them back on for late training. **Q15.** (a) Plant count rises from 2 at the path edge to 21 at 6 m — fewer plants closer to the path. (b) Fewer plants near the path is evidence that feet damage the ground beside the path, which is what the stay-on-the-path rule is for. **Q16.** See full solutions.

Full solutions

Q1 (3). One mark per pair, key difference as in Answers. **Q2 (3).** Correct order E–C–D–A–B. **Q3 (3).** One each: (a) widening path losing plants/soil; (b) any width/year figure from the data; (c) any named rule or built thing + how it removes the cause. **Q4 (2).** One mark each response with its part of the night. **Q5 (2).** (a) warm + damp (1); (b) fridge removes warmth / sealed packet removes dampness and mould (1). **Q6 (2).** Evidence points one way (1) + a cost or a want that also counts (1). **Q7 (3).** (a) pattern (1); (b) one condition with the right bag comparison (1); (c) a decision that uses it (1). **Q8 (3).** One each: safer/more reliable (1); high cost (1); cost outweighs benefit over a long line, danger managed by rules (1). **Q9 (3).** (a) reversible change named and used (2 — idea + application); (b) irreversible change cannot use the melt-and-reshape route (1). **Q10 (3).** (a) data, with "records/observations" (1); (b) comparison supports the claim: sooner movement on dark nights (2). **Q11 (2).** No data/evidence gathered (1); opinion not checked against the loop (1). **Q12 (3).** One each for problem, two data items, response matched to cause. **Q13 (3).** (a) law protects the place / damage risk (1); (b) ask the right bodies, approvals before work (1); (c) Traditional Owners and the bodies under the Act (1). **Q14 (5).** Claim names a response (1); evidence ×2 (2); reasoning links evidence to claim (1); one cost or want weighed (1). **Q15 (3).** (a) rising pattern with figures (2 — pattern + numbers); (b) feet damage ground beside path, so the rule protects it (1). **Q16 (6).** One mark per numbered part: problem (1); two data items (1); evidence from one (1); two responses (1); decision weighing evidence + cost + want (1); check with new data (1).

Practical notes. 1 fastest = bag 1 (warm damp); no mould = bag 4. 2 cold slows mould (bag 1 vs 3). 3 damp speeds mould (bag 1 vs 2). 4 agreement between sets shows the pattern is real, not a one-off; disagreement says check the method. 5 e.g. same loaf/slice size, same bags, same scale — any two. **Frame:** claim — warm and damp; evidence — bag 1 reached 4 by day 5 while bag 4 stayed at 0; reasons — cold and dry each slow mould; decision — keep bread sealed and dry, and in the fridge to keep it longest.

Test

Topic 6 test — Science in society Science 5–6 · Victorian Curriculum 2.0 · Levels 5 and 6

> This is a school-designed paper. It is not a VCAA instrument. Achievement at Levels 5 and 6 is reported against the Victorian Curriculum achievement standard on teacher judgement; the marks here are one source of evidence towards that judgement.

About this test

- **Total: 25 marks** across three sections. Answer all questions.
- **Suggested time: 30 minutes.** This test is untimed: students may take as long as they need to finish it.
- **No calculator. No formula sheet. No reading time.**
- **Reading support is available.** A teacher may read any question aloud to a student who asks. Reading is not being tested.
- The paper covers Topic 6 — Science in society: Chapters 10–11, subtopics 10A (How scientific knowledge changes) and 11A (Using science to identify problems and make decisions).
- Science inquiry is assessed in this paper as well as science as a human endeavour. Inquiry items are worth **9 of the 25 marks**.

What this paper assesses

> *scientific knowledge changes over time, often resulting from collaboration or by building on the work of others, and leads to advances in science* — VC2S6H01
>
> *scientific knowledge, skills and data can be used by individuals and communities to identify problems, consider responses and make decisions* — VC2S6H02

Section A — Multiple choice (8 marks)

Answer all eight questions. Choose A, B, C or D. Each question is worth 1 mark.

Q1. In 1799, scientists in England first saw a platypus skin sent from Australia. Many of them thought it was: *(1 mark)*

A. A young otter that had not yet grown B. The fossil of an animal that no longer lives C. A fake sewn together from parts of different animals D. A new kind of water bird

Q2. When new evidence about the solar system was gathered with telescopes, earlier models were: *(1 mark)*

A. Kept exactly as they were B. Thrown away and never referred to again C. Replaced by models that could never be tested D. Changed or improved to fit the new evidence

Q3. Contour banks are low banks of soil built across a slope to slow water down. To place them well, you need to know about: *(1 mark)*

A. Only the farmer's knowledge of the paddock B. Soil and rock properties, how water flows, and how the paddock is farmed C. Only the yearly rainfall total for the district D. Only the cost of the machines used to build them

Q4. Fire extinguishers, glasshouse crops and paintball markers all use compressed carbon dioxide. What does this best show? *(1 mark)*

A. All three products were invented by the same person B. Compressed gas is only useful in safety equipment C. One piece of scientific knowledge can be applied in many different fields D. Gases are the only substances that can be compressed

Q5. A coastal park asks visitors to stay on the marked path. The main scientific reason for this rule is: *(1 mark)*

A. To stop visitors getting lost B. Walking off the path damages plants and speeds up erosion C. To make the park look tidier in photos D. Walking off the path is against the law everywhere

Q6. Little penguins come ashore in the dark to walk to their burrows. A bare globe sends light up and sideways as well as down. Which change to the street lights best uses this knowledge? *(1 mark)*

A. Use brighter globes so people can see better B. Leave the lights on all night so the beach stays bright C. Put up more street lights along the beach D. Fit covered globes that send their light only downward

Q7. Mould grows fastest on food kept where it is: *(1 mark)*

A. Warm and damp B. Warm and dry C. Cold and damp D. Cold and dry

Q8. A council is deciding whether to put its power cables underground. One good reason to choose underground cables is: *(1 mark)*

A. They cost far less than wires on poles B. Storms and falling branches cannot bring them down C. They never need any checking or repair D. Electricity flows faster through buried cables

Section B — Short response (11 marks)

Answer all questions. Write your answers in full sentences where a question asks you to explain.

Q9. Use the platypus story from Chapter 10. *(3 marks)*

(a) In 1799, George Shaw checked the platypus skin for stitches. Why was that a fair thing to check at the time? *(1 mark)*
(b) Give one piece of evidence that changed what scientists claimed about the platypus. *(1 mark)*
(c) "Scientists changed their minds about the platypus, so science failed." Do you agree? Explain your answer. *(1 mark)*

Q10. Chapter 11 teaches a decision loop with its own words. *(2 marks)*

(a) What is the difference between **data** and **evidence**? *(1 mark)*
(b) What is the difference between a **rule** and a **guideline**? *(1 mark)*

Q11. SCENARIO — Point Banksia Park, a coastal park in Victoria (as in Chapter 11). The rangers want to know whether feet damage the ground beside the path. They place a 1-metre counting square on the ground at four distances from the path edge and count the plants inside each square. *(4 marks)*

Distance from the path edge (m)	Plants counted in a 1 m square
0	2
2	9
4	17
6	21

(a) What does the table show about the plants near the path? Quote the figures in your answer. *(1 mark)*
(b) The rangers claim: *feet damage the ground beside the path*. Explain how the table works as evidence for this claim. *(1 mark)*
(c) Give one thing that could make these counts unreliable. *(1 mark)*
(d) Write one question the rangers could investigate next. *(1 mark)*

Q12. Some communities recycle glass jars. *(2 marks)*

(a) Used glass jars are collected, melted and shaped into new jars. Explain why recycling glass works this way, using the idea of a **reversible change**. *(1 mark)*
(b) A material that cannot be melted and re-shaped is hard to recycle this way. Explain why. *(1 mark)*

Section C — Extended response (6 marks)

Q13. SCENARIO — Sandbay, a Victorian seaside suburb with a little-penguin colony (as in Chapter 11). The street lights along the beach stay on all night. The council has three options. *(6 marks)*

Option	What happens	Cost
A	Fit covered globes that point their light downward; the lights stay on all night	$4,000
B	A timer switches the lights off after midnight	$800
C	Do nothing	$0

The penguin carers keep this record: *On the six dark nights we watched, penguins started walking up the beach within about 10 minutes of coming ashore. On the six bright nights, most waited over an hour.*

(a)

(i) What do the penguin carers' records show? *(1 mark)*

(ii) The claim is: *bright light holds the penguins back*. Explain how the record works as evidence for this claim. *(1 mark)*

(b) Write the **claim, evidence and reasoning** for the position you would argue to the council (your audience).

(c) Make a claim that names the option you choose. *(1 mark)*

(ii) Give the evidence you are using. *(1 mark)*

(iii) Give your reasoning, weighing one cost or one thing people want. *(1 mark)*

(iv) After the council acts, how would it check whether its decision worked? *(1 mark)*

Marking guide

For the classroom teacher. This paper is a school instrument: the marks are one source of evidence towards the on-balance judgement against the Levels 5 and 6 achievement standard. Mark every part as set out below. Accept any response that carries the same idea in different words; spelling and handwriting do not lose marks. There are no half-marks: each mark point is either earned or not earned.

Where the multiple-choice items come from. The band's question bank (`mcq-system/data/output/questions/L5-6_Science.csv`) holds 54 items keyed to `VC2S6H01` and six keyed to `VC2S6H02`. Section A uses five bank items (Q1, Q2, Q3, Q4 and Q5; the option order has been changed from the bank order, and the answer letters below are the letters as printed on the paper). In Q1, Q3, Q4 and Q5 one or more bank sentences carried a word or a turn of phrase outside this book's words; those sentences are rewritten in the book's own words without changing what they test. The bank's six `VC2S6H02` items all sit on elaborations E01 and E02 and carry `auto_fixed` audit tags recording placeholder distractors; the three E01 items test recall of erosion itself — content owned by Chapter 8's `VC2S6U05` — rather than knowledge being used to make a decision, and are passed over. The bank has no item on the light-pollution, food-storage or power-cable elaborations at any difficulty, so Q6, Q7 and Q8 are new items written against the same code — `VC2S6H02` (drawing on `VC2S6H02.E03`, `VC2S6H02.E04` and `VC2S6H02.E05`). No item draws on `VC2S6H01.E04`, which this book does not take up (D8), and no item draws on a code from any other band or topic; the only codes used are the two above and the inquiry codes mapped at the end of this guide.

Section A — answers (8 marks)

Q	Answer	As printed	Source
1	**C**	A fake sewn together from parts of different animals	Bank item `VC2S6H01.E02.S01.D1.V01` (options reordered; stem and options in the book's words)
2	**D**	Changed or improved to fit the new evidence	Bank item `VC2S6H01.E07.S02.D1.V01` (options reordered)
3	**B**	Soil and rock properties, how water flows, and how the paddock is farmed	Bank item `VC2S6H01.E03.S01.D2.V01` (options reordered; stem in the book's words)
4	**C**	One piece of scientific knowledge can be applied in many different fields	Bank item `VC2S6H01.E05.S01.D2.V01` (options reordered; stem in the book's words)
5	**B**	Walking off the path damages plants and speeds up erosion	Bank item `VC2S6H02.E02.S01.D1.V01` (options reordered; stem and options in the book's words)
6	**D**	Fit covered globes that send their light only downward	New item — `VC2S6H02`, draws on `VC2S6H02.E03`
7	**A**	Warm and damp	New item — `VC2S6H02`, draws on `VC2S6H02.E04`
8	**B**	Storms and falling branches cannot bring	New item — `VC2S6H02`, draws on

Q	Answer	As printed	Source
		them down	VC2S6H02.E05

Each correct answer earns 1 mark. There is no working required for Section A and no part-credit.

Section B — marking (11 marks)

Q9 (3 marks · 10A · VC2S6H01)

(a) *(1 mark)* Accept any response that says the animal was unknown in Europe and mixed features no one had seen together — a warm furry body with a duck-like bill — so a fake was a fair claim to check. For example: "No one in Europe had seen such an animal, so it might have been sewn together."

(b) *(1 mark)* Either: more bodies arrived from Australia and were checked carefully, and no stitches were ever found; or: in 1884 scientists showed that the platypus lays eggs. One piece of evidence is enough.

(c) *(1 mark)* Disagree, with the reason that the claim changed because better evidence arrived — a claim that follows the evidence is science working, not failing. Do not award the mark for a bare "disagree" with no reason.

Q10 (2 marks · 11A · VC2S6H02)

(a) *(1 mark)* Data are the facts, numbers and observations we collect; evidence is data used to back up a claim. Both halves are needed for the mark.

(b) *(1 mark)* A rule is something people agree to follow; a guideline is advice about the best thing to do. Both halves are needed for the mark.

Q11 (4 marks · Science inquiry · VC2S6I05, anchored at 11A)

(a) *(1 mark)* Accept any description that says there are fewer plants close to the path and more plants further away, quoting at least two figures — for example "the count rises from 2 plants at 0 m to 21 plants at 6 m". Do not award the mark for a statement with no figures, such as "there are fewer plants near the path".

(b) *(1 mark)* Accept any response that links the low counts beside the path to foot traffic — for example "where people walk, the plants are nearly gone; where feet do not reach, the plants grow back". The answer must connect the pattern to feet, not just repeat the pattern.

(c) *(1 mark)* Any one specific weakness, for example: only one square was counted at each distance; the counts were made on one day only; the squares were placed at only one spot along the path; one person did all the counting. Do not accept "human error" or "they might have counted wrong" with no detail.

(d) *(1 mark)* Any investigable question that follows from the counts, for example: "Do the plants grow back if the worn ground is fenced off?" or "Is the path still getting wider each year?" Do not accept a question the table has already answered, such as "How many plants are there at 2 m?".

Q12 (2 marks · 11A · VC2S6H02)

(a) *(1 mark)* Accept any response that says melting and re-shaping glass is a reversible change, so used jars can become new jars — the glass can be recovered and used again.

(b) *(1 mark)* Accept any response that says this recycling route only works when the change can be undone: a material that cannot be melted and re-shaped cannot be re-made into new things this way.

Section C — marking (6 marks)

Q13 (6 marks · 11A content with Science inquiry · VC2S6H02, VC2S6I05, VC2S6I06)

(a)(i) *(1 mark)* Accept both sides of the comparison: on the six dark nights the penguins started walking within about 10 minutes of coming ashore; on the six bright nights most waited over an hour. One side alone is not enough. (a)(ii) *(1 mark)* Accept any response that says the record compares dark nights with bright nights, and the penguins move sooner when the light is off — which is exactly what the claim says. The answer must point at the comparison, not just restate the claim. (b)(i) *(1 mark)* A claim that names one option as the decision — for example "The council should choose Option A" or "The council should put the lights on a timer (Option B)". The claim must be a decision, not a restatement of the problem. Options A and B are the straightforward cases; accept Option C only if parts (ii) and (iii)

genuinely engage with the record. (b)(ii) *(1 mark)* The penguin carers' record used to support the claim in (b)(i) — for example "on bright nights most penguins waited over an hour". The knowledge of light from Chapter 11 (a bare globe sends light up and sideways as well as down) may stand as a second piece of evidence but not as the only one. Repeating the record from part (a) is creditworthy here if it is used to support the claim. (b)(iii) *(1 mark)* Any one named cost or want, weighed — for example: Option A costs $4,000 but fixes the wasted light all night and still lights the path home; Option B costs $800 and gives most of the benefit, but the beach stays bright before midnight; shopkeepers want people to feel safe walking home; penguin carers want darker nights. The cost or want must be weighed against the evidence, not just named. Two different claims can each earn full marks here — the marks are in the evidence and the reasoning, not in which option the student picks. (c) *(1 mark)* Collect new data after the change and compare it with the old record — for example, time how long the penguins wait at the water's edge on nights after the globes are changed or the timer is fitted. Do not accept "ask people if they think it worked" with no new data.

Mark summary and curriculum map

Section	Marks	Inquiry-strand marks
A — Multiple choice	8	0
B — Short response	11	4 (Q11: 4)
C — Extended response	6	5 (Q13(a): 2, Q13(b): 3)
Total	**25**	**9** (required minimum: 8)

The inquiry items rehearse the codes the topic's chapters practise per §4.3 of the plan of record — `VC2S6I06` at 10A, and `VC2S6I05` and `VC2S6I06` at 11A.

Evidence towards the achievement-standard extracts (§4.1 of the plan of record):

Items	Code	Achievement-standard extract
Q1, Q2, Q3, Q4, Q9	`VC2S6H01`	"students describe examples of advances in science achieved by scientists who work individually and in teams, building on the work of others."
Q5, Q6, Q7, Q8, Q10, Q12, Q13(c)	`VC2S6H02`	"They discuss examples that illustrate how individuals and communities use scientific knowledge, skills and data to inform their actions and make decisions."
Q11, Q13(a)	`VC2S6I05`	"They compare their methods and findings with those of others including identification of possible sources of error, suggest improvements to their own and others' investigations, pose questions for further investigation and select evidence to develop reasoned conclusions." (evidenced here by reading supplied records as evidence, finding what makes the records unreliable, and posing the next question)
Q13(b)	`VC2S6I06`	"They communicate ideas, findings, patterns, trends and relationships for a specific purpose and audience, including using various presentation formats, scientific vocabulary and digital tools where appropriate."

Items	Code	Achievement-standard extract
		(evidenced here by the claim–evidence–reasoning position argued to the council)