Science 3–4

Chapter 7 — Science as a human endeavour

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Contents

Data that explains natural phenomena

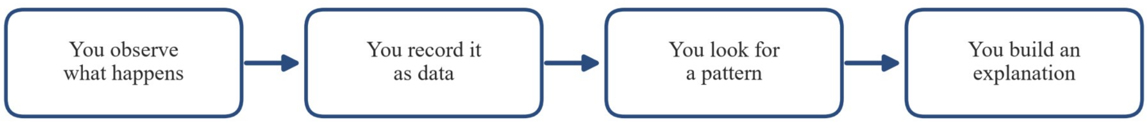
What we teach here — `VC2S4H01` (Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4): “data from observations obtained through scientific inquiry can be used to develop explanations of natural phenomena”. **In our words:** We notice things happening in the world — milk going off, a plant growing badly, a butterfly becoming hard to find. When we write down what we notice, it becomes data. And data can help us say *why* the thing happened. That “why” is called an explanation. In this subtopic we look at four real jobs where people use data to explain what they see in the natural world.

Theory

The big move: from what we notice to why it happened

A **natural phenomenon** is something that happens in the natural world. Rain falling, milk going off, a butterfly becoming hard to find — these are all phenomena. An **observation** is what you notice when you look or measure carefully. When observations are written down or recorded, they become **data**. Data can be numbers, like a thermometer reading, or it can be notes, like “the milk smelled bad”.

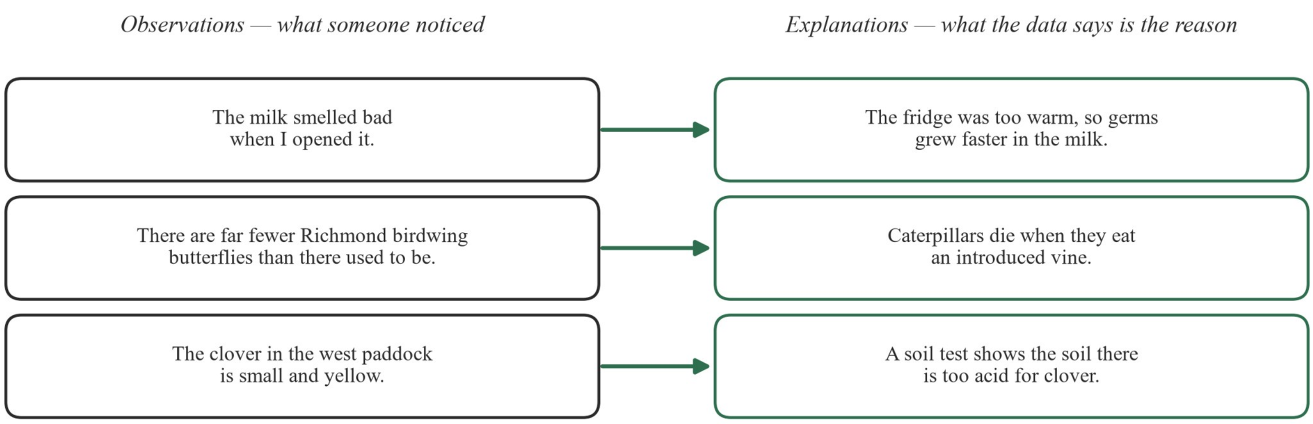
An **explanation** says *why* something happened. A good explanation fits the data — the data must back it up. That is the big move in this subtopic.



An explanation says why something happened — and the data must back it up.

Four boxes joined by arrows: you observe what happens, you record it as data, you look for a pattern, and you build an explanation

Here are three real pairs. On the left is what someone noticed. On the right is the explanation the data led to.



Each explanation answers a question the observation raised.

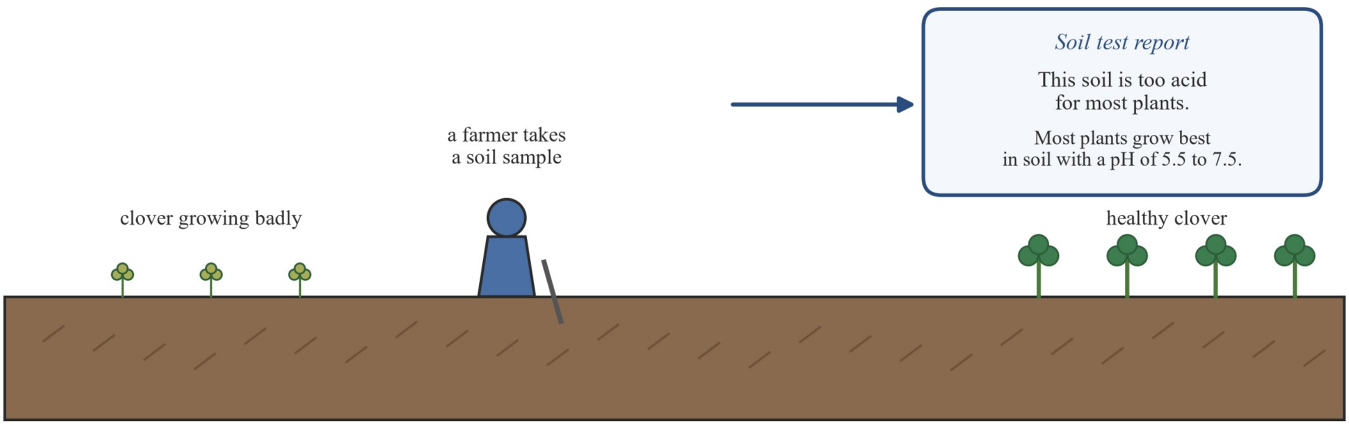
Three observation cards on the left joined by arrows to three explanation cards on the right: milk going off in a warm fridge, fewer Richmond birdwing butterflies, and clover growing badly in acid soil

Each explanation answers a question the observation raised. Now let us see four real jobs where people make this move.

Case 1 — farmers test their soil

A farmer notices that the clover in one part of a paddock is small and yellow, while clover on the rest of the paddock is green and tall. That is the observation. To find out why, the farmer takes a **soil sample** — a little bit of soil — and sends it to a lab for a **soil test**. A soil test checks what the soil is like and gives back data, as numbers.

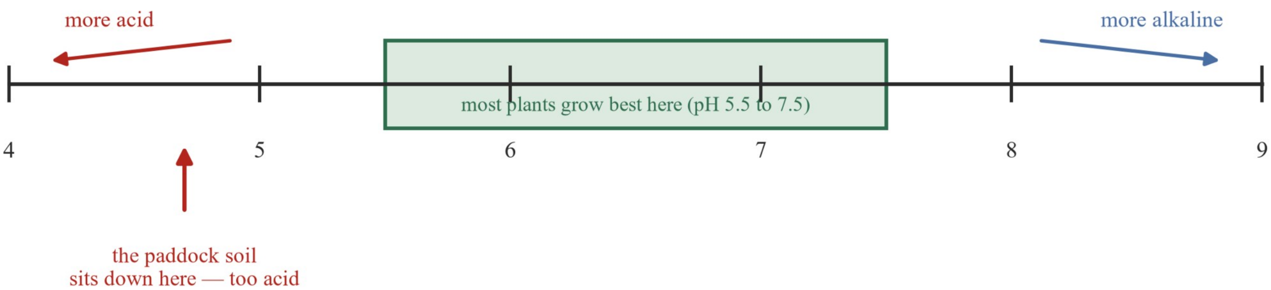
The lab's data explains why the clover is doing poorly on one side of the paddock.



A farmer taking a soil sample in a paddock where the clover is growing badly on one side and growing well on the other, with an arrow to a soil test report that says the soil is too acid

One number a soil test gives is the **pH**. The pH is a number that tells how **acid** the soil is. Most plants grow best in soil with a pH of 5.5 to 7.5. Soil with a pH below that band is too acid, and many plants grow badly in it. Soil on the other side of the band is **alkaline** — the opposite of acid.

pH is a number that tells how acid a soil is. A soil test measures it.



A pH number line from 4 to 9 with the band from 5.5 to 7.5 shaded green and labelled most plants grow best here, and a pointer showing the paddock soil sits on the acid side, below the band

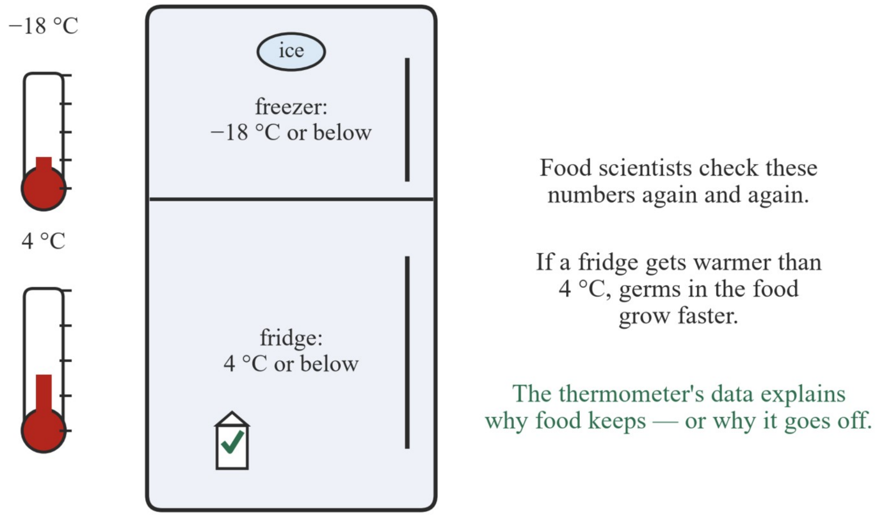
The test comes back: the soil where the clover is growing badly is too acid. That data is the explanation. The clover is small and yellow *because* the soil it grows in is too acid. The farmer can now fix that part of the paddock, and the data told the farmer what to fix.

Source: Wikipedia, “Soil pH” — most plants grow best in soil with a pH between 5.5 and 7.5 — retrieved 2026-08-21 (saved copy at _sources/wiki_soil_ph_2026-08-21.html).

Source: Wikipedia, “Soil test” — a soil test is a lab check of a soil sample that works out what the soil is like — retrieved 2026-08-21 (saved copy at _sources/wiki_soil_test_2026-08-21.html).

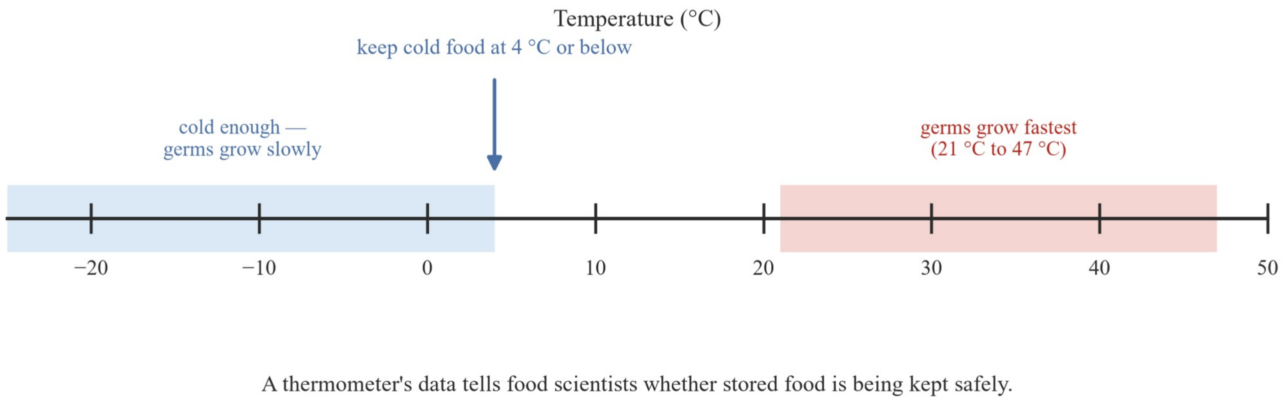
Case 2 — food scientists watch the fridge

A **food scientist** is a scientist who studies food and how to keep it good to eat. Food scientists know that cold food must be kept cold. A fridge should sit at 4 °C or below, and a freezer at −18 °C or below. The thermometer inside is the observation tool, and its readings are the data.



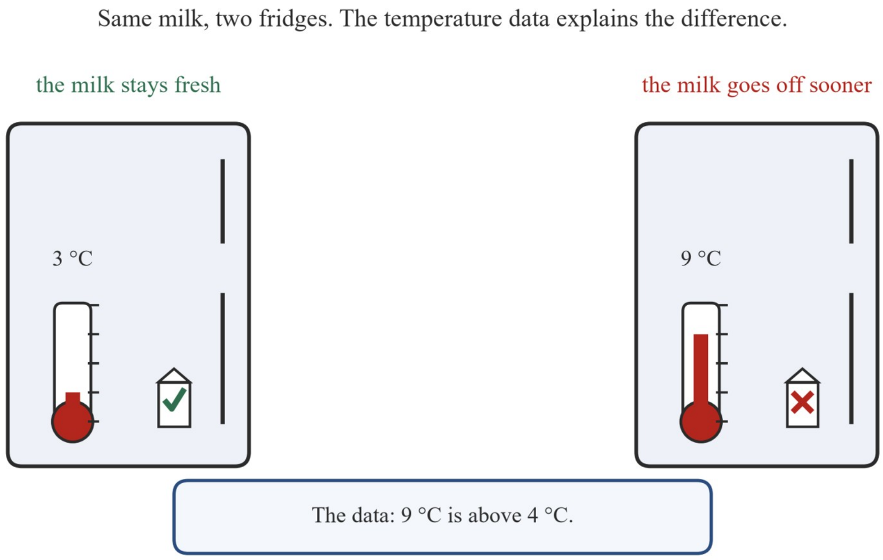
A fridge and a freezer with thermometers: the fridge is kept at 4 °C or below, and the freezer at −18 °C or below

Why does the cold matter? **Germs** — tiny living things, too small to see — are on food all the time. In the cold, they grow slowly. But between 21 °C and 47 °C they grow fastest. That band is called the danger zone.



A temperature number line from −20 °C to 50 °C: at 4 °C and below, germs grow slowly, and between 21 °C and 47 °C, germs grow fastest

So think about two fridges holding the same milk. One sits at 3 °C. The other sits at 9 °C — too warm. The milk in the warm fridge goes off sooner. The observation is “the milk went off”. The data is “9 °C is above 4 °C”. And the explanation is: the fridge was too warm, so the germs in the milk grew faster.



Two fridges with the same milk inside: in the fridge at 3 °C the milk stays fresh, and in the fridge at 9 °C the milk goes off sooner; the data box says 9 °C is above 4 °C

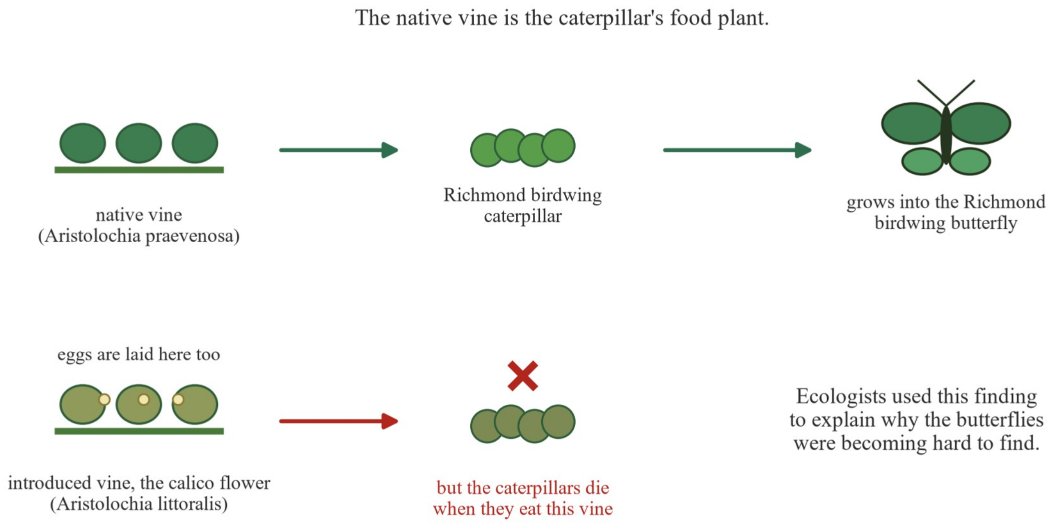
Source: Wikipedia, “Food storage” — a fridge should be kept at 4 °C or below and a freezer below −18 °C — retrieved 2026-08-21 (saved copy at _sources/wiki_food_storage_2026-08-21.html).

Source: Wikipedia, “Danger zone (food safety)” — the danger zone is the temperature band in which the germs that make food go off can grow, and they grow much faster between 21 °C and 47 °C — retrieved 2026-08-21 (saved copy at _sources/wiki_danger_zone_2026-08-21.html).

Case 3 — ecologists count the Richmond birdwing

An **ecologist** is a scientist who studies living things and how they get on with each other. The **Richmond birdwing** is a big, beautiful butterfly of east-coast rainforest. Its caterpillar has one food plant: a **native** vine, the Richmond birdwing vine. The vine is eaten by the caterpillar, and the caterpillar grows into the butterfly.

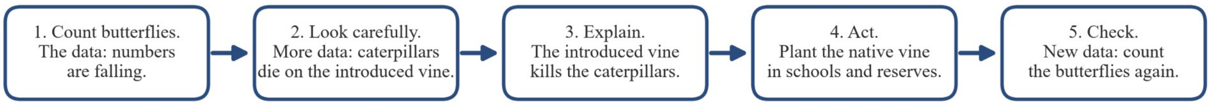
Long ago, people who collected butterflies said the Richmond birdwing was common. These days, ecologists’ counts show far fewer of them. That is the observation. Why?



The native vine is eaten by the Richmond birdwing caterpillar, and the caterpillar grows into the Richmond birdwing butterfly; below, eggs are laid on an introduced vine too, but the caterpillars die when they eat that vine

More data gave the answer. The butterfly also lays eggs on an **introduced** vine — the calico flower — that people brought to Australia as a garden plant. But caterpillars that hatch on the calico flower die when they eat it. So in places full of the introduced vine, the caterpillars die, and fewer butterflies are born. The data explains the fall in numbers.

And the explanation led to action: people plant the native vine in schools and parks, so the caterpillars have their true food plant again. Then ecologists do what scientists always do — they collect new data, and count the butterflies again.



Each step uses data. New data can make an explanation better.

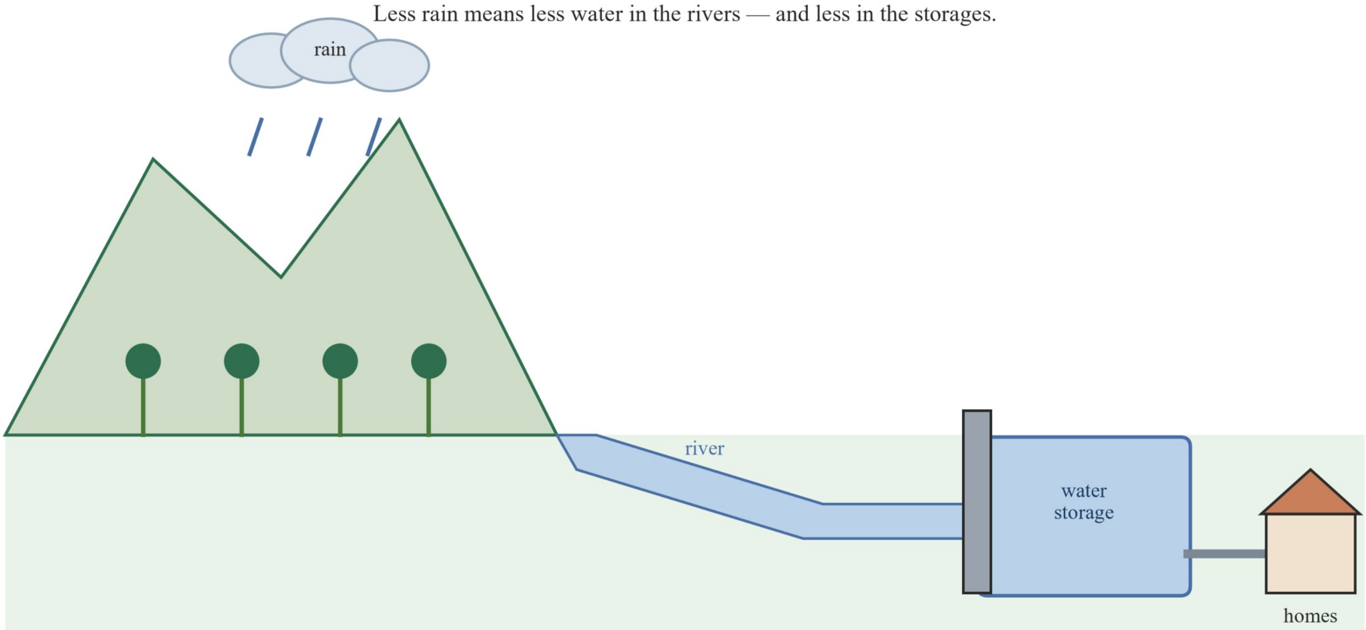
Five boxes joined by arrows: count the butterflies and the numbers are falling; look carefully and find caterpillars dying on the introduced vine; explain that the introduced vine kills the caterpillars; act by planting the native vine; and check by counting the butterflies again

Source: Wikipedia, "Ornithoptera richmondia" — the Richmond birdwing was once common but its numbers went down, and its caterpillars die when they eat the introduced calico flower — retrieved 2026-08-21 (saved copy at _sources/wiki_richmondia_2026-08-21.html).

Case 4 — hydrologists watch the rain and the rivers

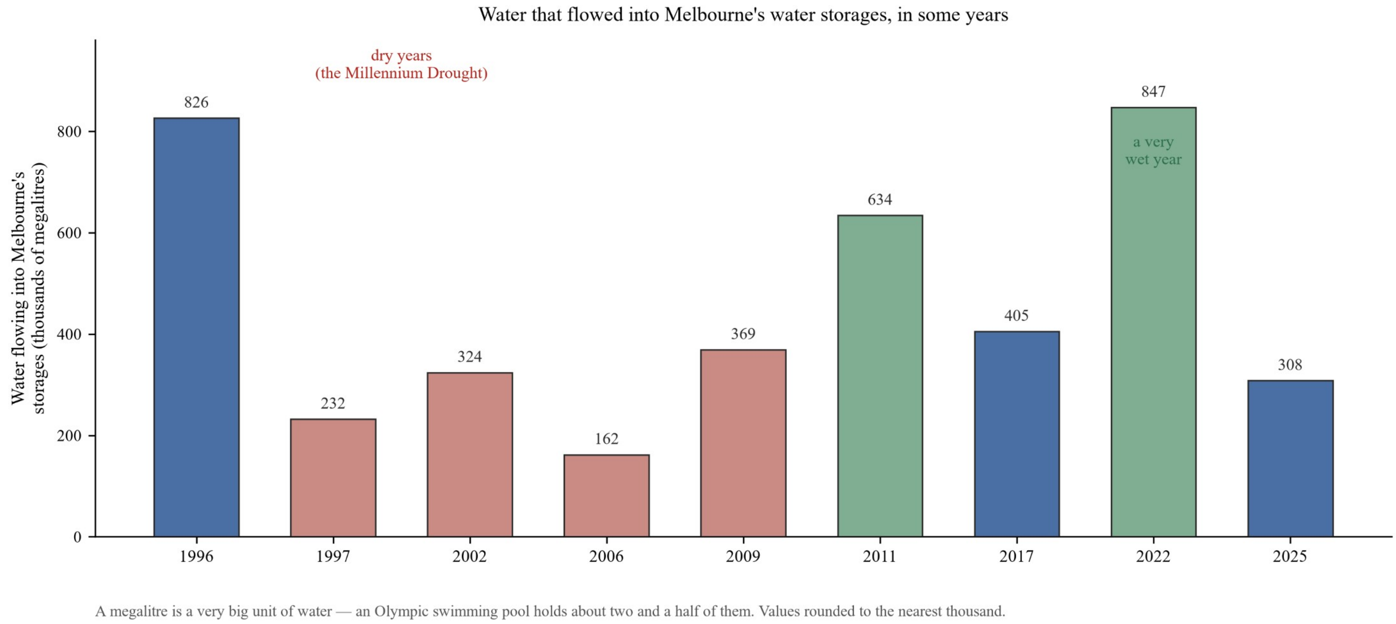
A **hydrologist** is a scientist who studies water: rain, rivers, and the big **water storages** that hold a city's water until it is needed. Here is the picture for Melbourne: rain falls on the ranges, runs down into rivers, and the rivers fill the storages. Pipes then carry the water to homes.

Less rain means less water in the rivers — and less in the storages.



Rain falling on the forested ranges, running into a river, and the river filling a water storage behind a dam wall, with a pipe carrying water on to homes

Hydrologists measure how much water flows into Melbourne's storages each year. Here is real data for some years, in thousands of **megalitres** — a megalitre is a very big unit of water, and an Olympic swimming pool holds about two and a half of them.

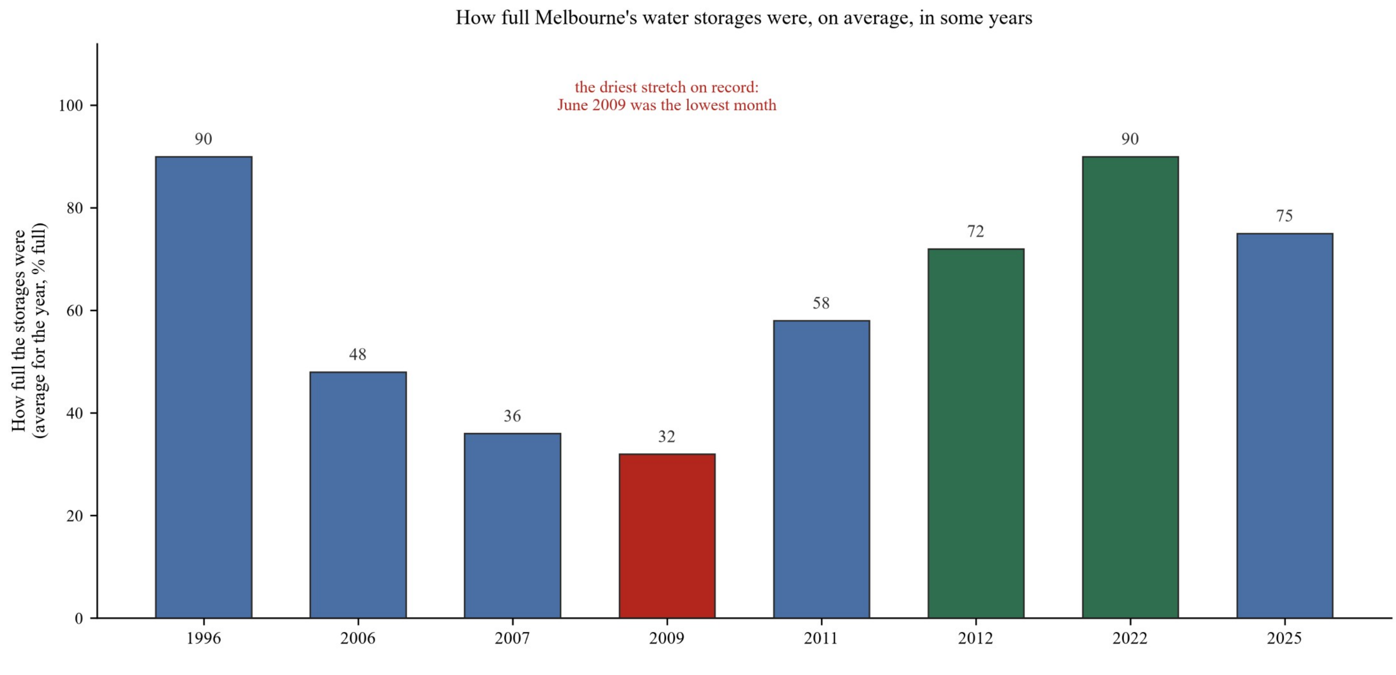


A column graph of water flowing into Melbourne's water storages in nine years from 1996 to 2025: the drought years 1997 to 2009 are low, and the wet years 2011 and 2022 are high

Source: Melbourne Water, inflows into Melbourne's water storages by year — retrieved 2026-08-20 (saved copies at _sources/mw_flows.json and _sources/mw_historical.json; the live data feed did not answer when checked again on 2026-08-21).

Look at the pattern. In 1996, a lot of water flowed in. In 1997, 2002, 2006 and 2009 — years of the Millennium Drought, a long dry spell in Victoria — much less flowed in. Then 2011 and 2022 were wet years, and the inflow jumped back up.

Hydrologists also record how full the storages are. Here is that data for some of the same years.



A column graph of how full Melbourne's water storages were, on average, in eight years from 1996 to 2025: full in 1996, falling to the lowest point in 2009, then refilling by 2012 and 2022

Now the explanation move. Observation: the storages got emptier and emptier, down to their lowest point on record in mid-2009. Data: through those same years, far less water flowed into the storages, because far less rain came down.

Explanation: the long drought meant less rain, less river flow, and so emptier storages. And when the rains came back in 2011, the storages refilled — new data that fits the same explanation. The Bureau of Meteorology and CSIRO's State of the Climate report says the same thing for much of Australia: less cool-season rain since 1994, and less water in most rivers since 1970.

Source: Bureau of Meteorology and CSIRO, State of the Climate 2024, report at a glance, bom.gov.au — retrieved 2026-08-20 (saved copy at _sources/sotc_bom_2026-08-20.html).

New data can make an explanation better

An explanation is never just a story. It has to fit the data. If new data does not fit, the explanation must change. Think of the ecologists: if the butterfly counts had *not* gone up after the native vine was planted, the explanation about the introduced vine would have been wrong, and the ecologists would have looked for a better one. That is how scientific inquiry works — observe, record data, explain, then check with new data.

Words to know in 7A

Word	What it means
natural phenomenon	something that happens in the natural world, that we can notice and ask about
observation	what you notice when you look or measure carefully
data	observations that are written down or recorded, as numbers or notes
explanation	a saying of why something happened, that fits the data
soil test	a lab check of a soil sample that gives back data about the soil, as numbers
pH	a number that tells how acid a soil is
acid	a soil with a low pH is acid; most plants grow badly in soil that is too acid
alkaline	the opposite of acid; a soil with a high pH is alkaline
germ	a tiny living thing, too small to see, that can make food go off
food scientist	a scientist who studies food and how to keep it good to eat
ecologist	a scientist who studies living things and how they get on with each other
hydrologist	a scientist who studies water: rain, rivers and storages
water storage	a big place where a city's water is kept until it is needed
megalitre	a very big unit of water; an Olympic swimming pool holds about two and a half of them

Worked examples

Example 1 — scaffolded

A class keeps two milk cartons in two fridges for a week. Fridge A reads 3 °C. Fridge B reads 9 °C. On day five, the milk from fridge B smells bad, and the milk from fridge A is still fresh. Build the explanation.

Working	Comment
Observation: the milk in fridge B went off first.	"The milk smelled bad" is what the class noticed.
Data: fridge B reads 9 °C; fridge A reads 3 °C.	The thermometer readings are the data. Cold food should sit at 4 °C or below.
Pattern: the milk that went off was the milk kept above 4 °C.	Line the data up next to the rule food scientists use.

Working	Comment
Explanation: fridge B was too warm, so germs in that milk grew faster and it went off.	The explanation fits the data.

Example 2 — scaffolded

Use the column graph of water flowing into Melbourne's storages. (a) Read off the inflow for 2006. (b) Read off the inflow for 2022. (c) How many more thousand megalitres flowed in in 2022 than in 2006?

Working	Comment
(a) The 2006 column is labelled 162.	The number above each column is the value, in thousands of megalitres.
(b) The 2022 column is labelled 847.	2022 was a very wet year.
(c) $847 - 162 = 685$.	Take 162 away from 847.

∴ About 685 more thousand megalitres flowed into the storages in 2022 than in 2006 — a wet year against a drought year.

Example 3 — unscaffolded

A farmer notices the clover in the west paddock is small and yellow. The soil test comes back, and the number for that paddock sits below 5.5 on the pH scale. Explain what is going on, and say what the pH number would need to be for the clover to grow well.

The observation is the poor clover. The data is the pH number below 5.5 — the acid side of the scale. Most plants, clover included, grow best in soil with a pH of 5.5 to 7.5, so the explanation is: the west paddock soil is too acid for the clover, which is why it is small and yellow. For the clover to grow well, the pH number for that paddock would need to sit inside the 5.5 to 7.5 band.

∴ Too-acid soil explains the poor clover; a pH inside 5.5 to 7.5 is what good clover soil reads.

Example 4 — unscaffolded

Look at the two Melbourne water graphs together. In 2009 the storages were at their lowest on record. Use the inflow graph to explain why, and say which new data in 2011–2012 backed the explanation up.

The storage graph shows the storages getting emptier down to 2009. The inflow graph shows why: through 1997–2009, the drought years, far less water flowed into the storages each year — less rain, less river flow, so the storages could not refill. The new data that backed the explanation up came when the rains returned: inflow jumped in 2011, and the storage graph shows the storages refilling by 2012. Less rain in, emptier storages; more rain in, fuller storages — the data and the explanation fit both ways.

∴ Low inflow through the drought explains the empty storages of 2009, and the 2011–2012 refill is new data that fits the same explanation.

Practice questions

Scaffolded

Q1. What is data? Start your answer with "observations that are".

Q2. Put the four steps of the big move in order: build an explanation; observe what happens; record it as data; look for a pattern.

Q3. Sort these into observations and explanations: (a) "the fridge read 9 °C"; (b) "the milk went off because the fridge was too warm"; (c) "the clover in the west paddock is small and yellow".

Q4. A soil test shows the soil in one paddock sits below the 5.5 to 7.5 band on the pH scale. Will most plants grow well in it? Say why.

Q5. Use the fridge picture. A fridge should sit at 4 °C or below. What should a freezer sit at?

Q6. Use the danger-zone number line. Between which two temperatures do germs grow fastest?

Q7. Use the inflow graph. Which year shown had (a) the most water flowing in, and (b) the least?

Q8. Use the storage graph. Was 2009 fuller or emptier than 2012?

Unscaffolded

Q9. Sam says “the milk went off because the fridge was too warm”. Name one piece of data that would back Sam’s explanation up.

Q10. Clover in one paddock is small and yellow, and clover in the next paddock is green and tall. A soil test comes back for each paddock. What would the two pH numbers most likely show?

Q11. Eggs laid on the calico flower vine hatch, but those caterpillars never become butterflies. Why not?

Q12. After planting the native vine in new places, ecologists count the butterflies again. (a) Why is that new count data? (b) If the count goes up, what does it do for the explanation?

Q13. Use the inflow graph. (a) Read off the inflow for 2006 and for 2022. (b) How many more thousand megalitres flowed in in 2022 than in 2006? (c) Use the water picture to say why less rain in the drought meant less water flowing into the storages.

Q14. Use the storage graph. (a) Which year shown was the emptiest? (b) Which two years read about 90? (c) Use the inflow graph to explain why the storages were so empty in 2009.

Q15. True or false, and fix it if false: “data is only numbers”.

Q16. Match each person to the data they would care about most. (i) food scientist; (ii) ecologist; (iii) hydrologist; (iv) farmer. Data cards: (a) butterfly counts and caterpillar deaths; (b) fridge and freezer temperatures; (c) soil pH from a soil test; (d) rain and river flow into the storages.

Answers

Q1. Data is observations that are written down or recorded.

Q2. Observe what happens; record it as data; look for a pattern; build an explanation.

Q3. Observations: (a) and (c). Explanation: (b).

Q4. No. Below the band the soil is too acid, and most plants grow badly in soil that is too acid.

Q5. −18 °C or below.

Q6. Between 21 °C and 47 °C.

Q7. (a) 2022. (b) 2006.

Q8. Emptier — 2009 is the lowest column on the graph.

Q9. A thermometer reading for the fridge that is above 4 °C — like the 9 °C reading in the story.

Q10. The poor paddock would read below the 5.5 to 7.5 band (too acid), and the good paddock would read inside the band.

Q11. The calico flower is an introduced vine, and caterpillars die when they eat it, so they never grow into butterflies.

Q12. (a) It is an observation, counted carefully and written down, so it is data. (b) If the count goes up, it is new data that fits the explanation — the explanation gets stronger.

Q13. (a) 162 and 847. (b) 847 − 162 = 685 thousand megalitres more. (c) Rain fills the rivers and the rivers fill the storages, so less rain meant less river flow and less water into the storages.

Q14. (a) 2009. (b) 1996 and 2022. (c) Through the drought years far less water flowed into the storages, so they could not refill and got emptier and emptier.

Q15. False. Data can be notes too — "the milk smelled bad" is data, not a number.

Q16. (i)–(b); (ii)–(a); (iii)–(d); (iv)–(c).

Fully-worked answers

Q1. An observation is what you notice. Once it is written down or recorded, it is data. So: data is observations that are written down or recorded.

Q2. The picture of the big move shows the order. First you observe what happens. Then you record it as data. Then you look for a pattern. Last, you build an explanation.

Q3. (a) is a thermometer reading written down — an observation, and data. (c) is what someone noticed in the paddock — an observation. (b) says *why* the milk went off, and it fits the data — an explanation.

Q4. The shaded band, 5.5 to 7.5, is where most plants grow best. Below the band the soil is too acid. So most plants will not grow well in it.

Q5. The freezer picture shows its rule: −18 °C or below.

Q6. The red band on the number line runs from 21 °C to 47 °C — germs grow fastest there.

Q7. (a) The tallest inflow column is 2022, at 847. (b) The shortest is 2006, at 162.

Q8. The 2009 column (32) is lower than the 2012 column (72), so 2009 was emptier.

Q9. Sam's explanation is about warmth, so the backing data is a warmth reading: the fridge thermometer showing a number above 4 °C, like 9 °C. With that data, "too warm, so germs grew faster" fits.

Q10. The pH band for good plant growth is 5.5 to 7.5. The clover in the poor paddock is small and yellow, so the soil test for it would most likely read below the band — too acid. The test for the good paddock would read inside the band.

Q11. The calico flower is an introduced vine. The butterfly lays eggs on it, but caterpillars that hatch and eat it die. Dead caterpillars never grow into butterflies.

Q12. (a) The new count is an observation made carefully and written down, so it is data. (b) If the count goes up after the native vine is planted, the new data fits the explanation that the introduced vine was the problem. Data that fits makes an explanation stronger.

Q13. (a) The columns are labelled: 2006 is 162, and 2022 is 847 (thousands of megalitres). (b) $847 - 162 = 685$, so 685 more thousand megalitres. (c) In the water picture, rain runs into rivers and rivers fill the storages. Less rain in the drought meant less river flow, so less water flowed into the storages.

Q14. (a) The shortest storage column is 2009. (b) The 1996 and 2022 columns both read 90 — nearly full. (c) The inflow graph shows the drought years had much less water flowing in. With little rain and little river flow, the storages could not refill, so by 2009 they were at their lowest on record.

Q15. Numbers are one kind of data, but notes are data too. “The milk smelled bad” and “caterpillars die on the calico flower” are data, and not one of those is a number. So the saying is false.

Q16. A food scientist studies how to keep food good to eat, so fridge and freezer temperatures are their data: (i)–(b). An ecologist studies living things, so butterfly counts and caterpillar deaths are theirs: (ii)–(a). A hydrologist studies rain, rivers and storages: (iii)–(d). A farmer growing clover cares about the soil test: (iv)–(c).

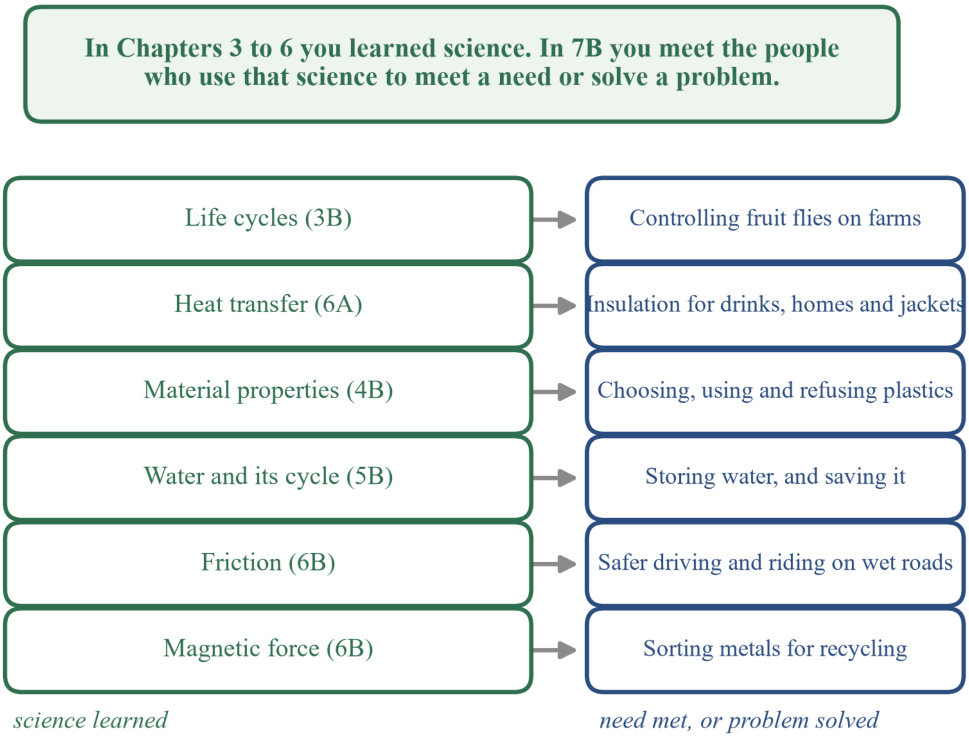
Science that meets a need or solves a problem

What we teach here — `VC2S4H02` (Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4): “scientific knowledge, skills and data can be used by people to explain how they will meet a need or solve a problem”. **In our words:** people take the science you have already learned — life cycles, heat, materials, water, friction and magnets — and put it to work on real jobs: growing food, keeping things cold or warm, choosing what to buy, storing water, driving safely and sorting rubbish.

What you learn here

Science, put to work

In Chapters 3 to 6 you learned science for its own sake: life cycles, heat, the properties of materials, water, friction and magnetic force. In 7B you meet the people who use that science to meet a need or solve a problem. The pattern is always the same: there is a need or a problem, someone brings in the right science, and the need gets met or the problem gets solved.



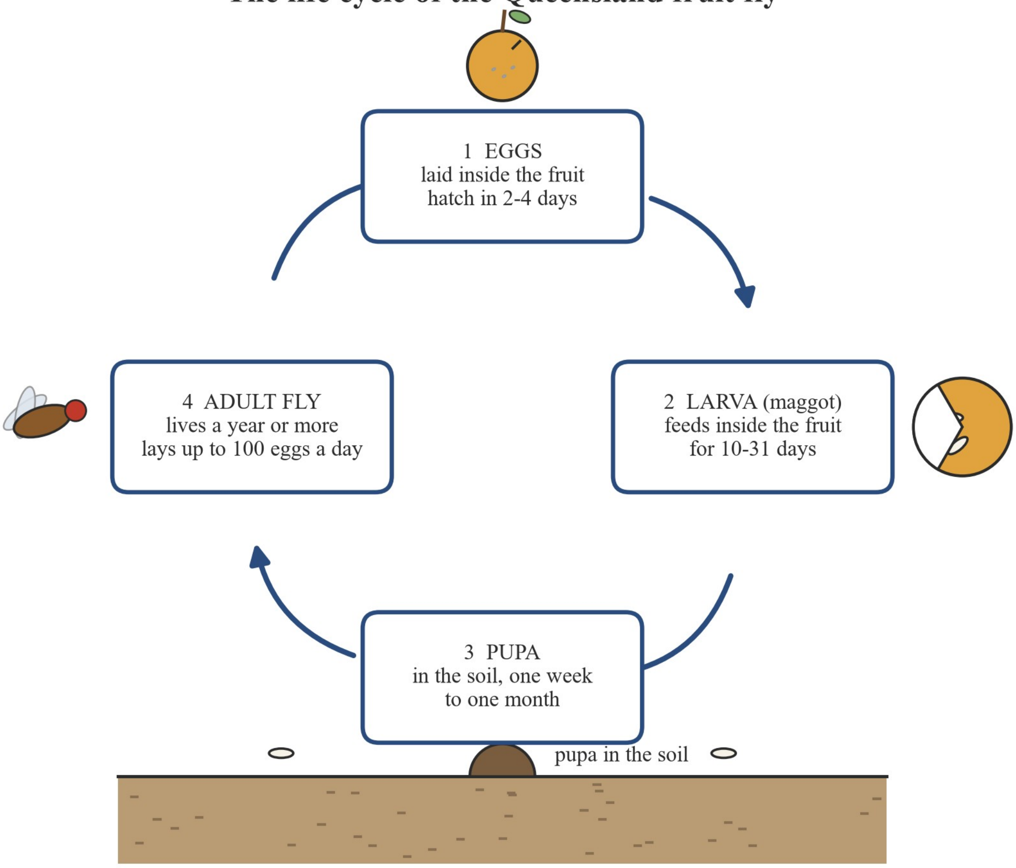
A map with six rows. Each row shows science learned in Chapters 3 to 6 on the left and the need it meets on the right: life cycles (3B) leads to controlling fruit flies on farms; heat transfer (6A) leads to insulation for drinks, homes and jackets; material properties (4B) leads to choosing, using and refusing plastics; water and its cycle (5B) leads to storing water and saving it; friction (6B) leads to safer driving and riding on wet roads; magnetic force (6B) leads to sorting metals for recycling.

Work through the six cases below. For each one, find the science it uses, the need or problem, and what people do. That is the whole skill this subtopic teaches.

Case 1 — Fruit flies, and how knowing a life cycle solves a problem

You met life cycles in 3B. Here is one that matters to every fruit grower in Victoria: the life cycle of the Queensland fruit fly, Australia’s costliest fruit pest.

The life cycle of the Queensland fruit fly



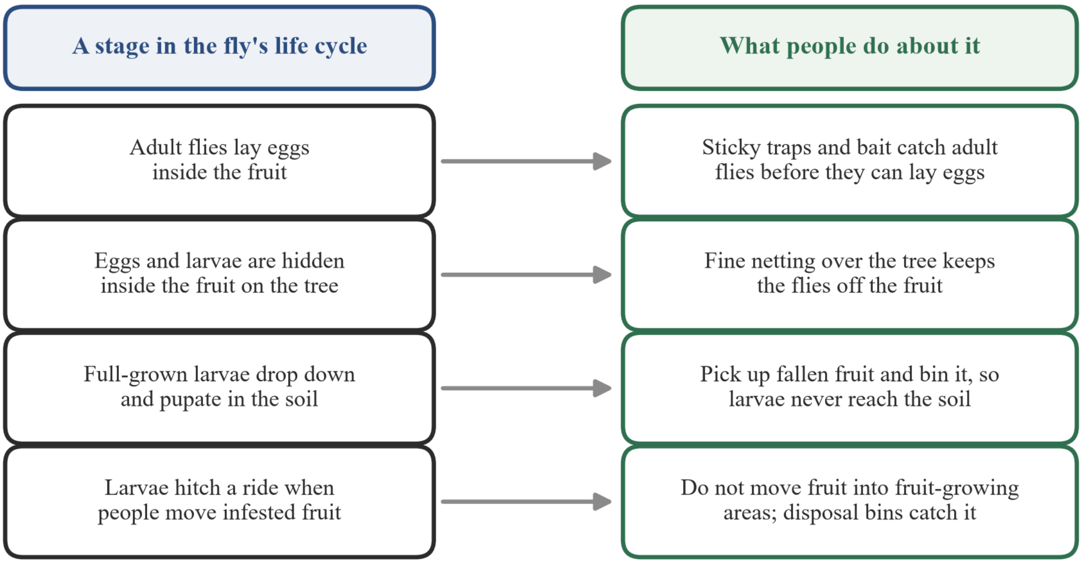
After the pupa stage, the adult fly comes out of the soil — and the cycle starts again.

A cycle diagram with four stage boxes joined by arrows going around in a circle. Stage 1, eggs, are laid inside the fruit and hatch in 2–4 days. Stage 2, the larva or maggot, feeds inside the fruit for 10–31 days. Stage 3, the pupa, rests in the soil for one week to one month. Stage 4, the adult fly, lives a year or more and lays up to 100 eggs a day. Drawings show eggs inside a fruit, maggots inside a cut-open fruit, a pupa in the soil, and an adult fly.

The female fly stings a hole in a piece of fruit and lays her eggs inside. The eggs hatch in 2–4 days, and the larvae — the maggot stage — feed inside the fruit for 10–31 days, turning it to rot. Full-grown larvae drop to the ground and become pupae in the soil, the resting stage between larva and adult. After one week to one month, adult flies come out of the soil, and the cycle starts again. An adult fly can live a year or more and lay up to 100 eggs a day.

Now the science does the solving. People who know **which stage** happens **where** can act on the right stage at the right time.

Knowing the life cycle tells people where to act



Every control works on one part of the life cycle.

A matching diagram with four rows. Left column, a stage in the fly's life cycle; right column, what people do about it. Adult flies lay eggs inside the fruit, so sticky traps and bait catch adult flies before they can lay eggs. Eggs and larvae are hidden inside the fruit on the tree, so fine netting over the tree keeps the flies off the fruit. Full-grown larvae drop down and pupate in the soil, so people pick up fallen fruit and bin it, so larvae never reach the soil. Larvae hitch a ride when people move infested fruit, so people do not move fruit into fruit-growing areas, and fruit bins catch it.

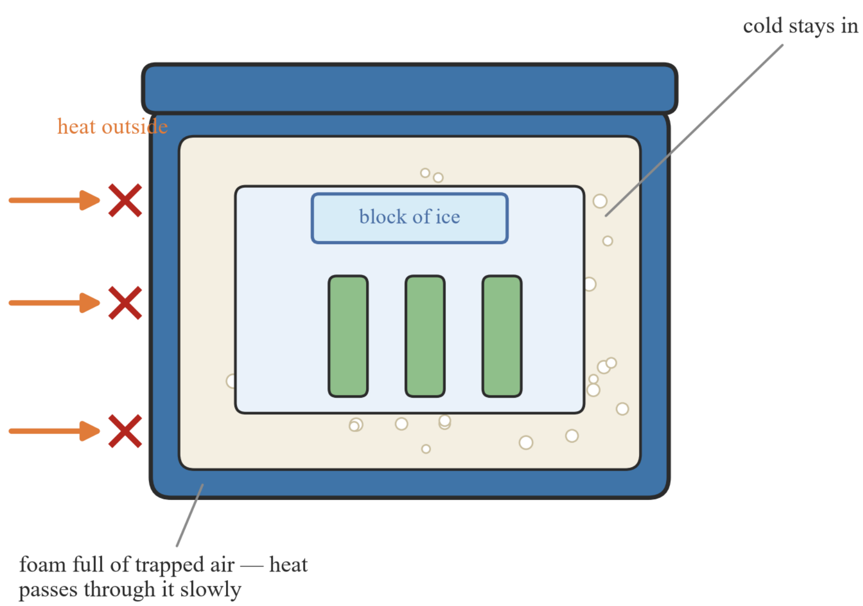
Fruit growers in north-west Victoria use all of these — traps and bait (bait is food that lures the flies in), netting, and fruit bins. The Greater Sunraysia district, around Mildura, is part of a fruit-fly-free zone — a zone is an area with special rules — set up in 2007 so that fruit grown there can be sold without extra chemical treatment. On the roads into the zone, such as the Calder Highway near Mildura, there are warning signs and bins for throwing fruit away, so that no fruit carrying hidden larvae travels in. Every one of those choices is a life cycle fact doing a job.

Source: Wikipedia, "Bactrocera tryoni", en.wikipedia.org — retrieved 2026-08-21. Source: Wikipedia, "Sunraysia", en.wikipedia.org — retrieved 2026-08-21.

Case 2 — Insulation: keeping things hot or cold

You met heat moving from hot things to cold things in 6A. Sometimes you want to slow that moving down. **Insulation** is anything that slows heat down as it passes through, and people who design things — engineers — test materials to find good insulators.

How an insulated cooler keeps drinks cold



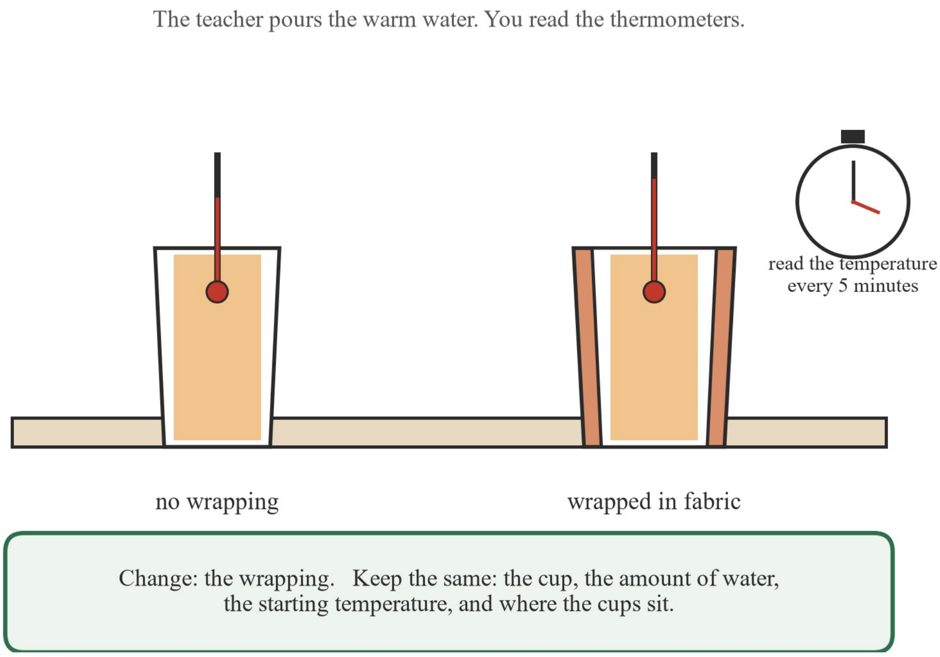
Australian coolers of this kind have been made since 1952. First cork, then foam: the trapped air does the work.

A view inside an insulated cooler box. A block of ice sits above bottles inside. The walls are a thick layer of foam full of trapped air. Heat arrows from outside are stopped at the foam, and a label says the cold stays in.

A famous Australian test case is the Esky, a portable cooler that has been made in Australia since 1952. The first Eskies were insulated with cork; later ones used foam. The foam is full of trapped air, and heat passes through trapped air very slowly, so the heat of a hot day crawls in instead of pouring in. That is why an Esky keeps drinks cold at the beach or the footy. The same idea is at work in the insulation in house walls and roofs, and in a puffer jacket: the jacket is not warm by itself — it slows the heat your body makes from escaping, so you stay warm.

Engineers test insulation the same way you can in class: warm water, two cups, one wrapped and one not, and a thermometer in each.

A fair test: which wrapping keeps water warm?



A fair test on a bench: two cups of warm water, each with a thermometer, one cup with no wrapping and one cup wrapped in fabric, and a stopwatch. A box underneath says: change the wrapping; keep the same the cup, the amount of water, the starting temperature, and where the cups sit.

Class activity — the wrapping race. In pairs, wrap one cup in a material (fabric, foil, bubble wrap, newspaper) and leave one cup unwrapped. The teacher pours the same warm water into both cups at the same time. Read and record the temperature every 5 minutes for half an hour, then make a column graph of your readings. Which wrapping kept the water warmest? Was the test fair — what did you change, and what did you keep the same?

Safety: the teacher handles the warm water. You read the thermometers and do the wrapping.

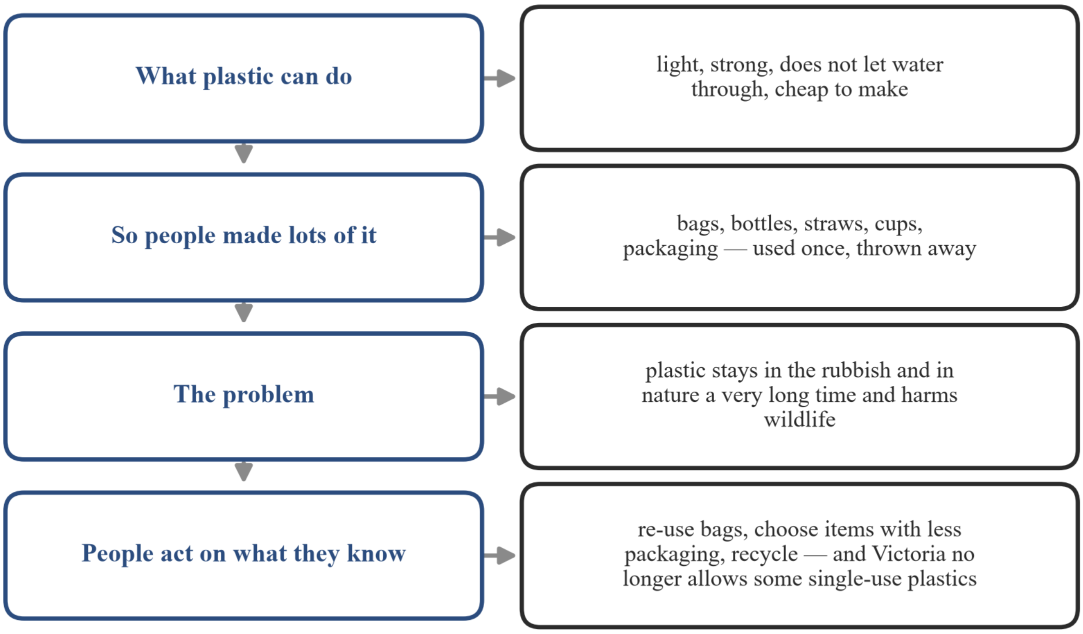
The data you collect is exactly the kind of data engineers collect when they test materials for Eskies, house walls and jackets. That is the point: your class test and their professional test are the same science.

Source: Wikipedia, “Esky”, en.wikipedia.org — retrieved 2026-08-21.

Case 3 — Plastics: knowing the properties changes the choices

You met properties of materials in 4B — the things you can notice or test about a material. Plastic is used all over the place because of its properties: it is light, strong, does not let water through, and is cheap to make. Those same properties became the problem. Plastic that is used once and thrown away does not rot away quickly; it stays in the rubbish and in nature a very long time, and it harms wildlife.

Plastic: useful, then a problem, then changed

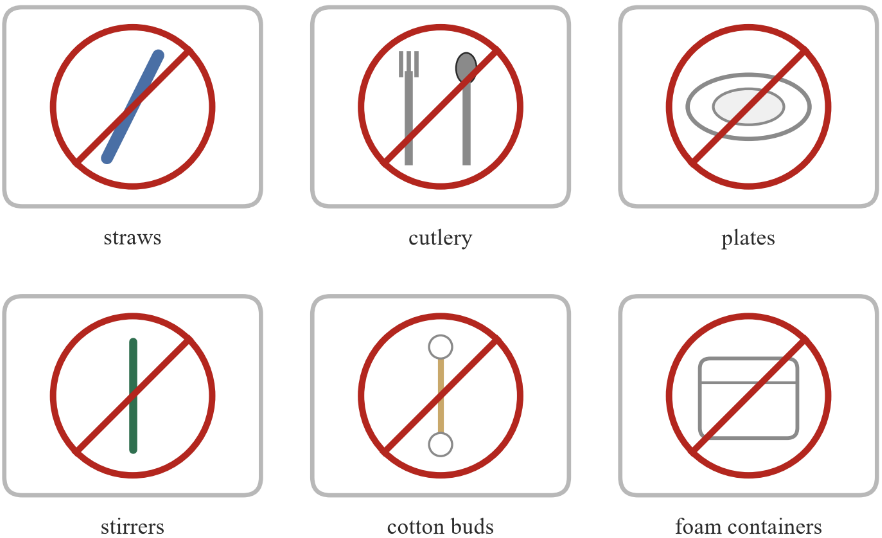


A four-step flow diagram. What plastic can do: light, strong, does not let water through, cheap to make. So people made lots of it: bags, bottles, straws, cups, packaging, used once and thrown away. The problem: plastic stays in the rubbish and in nature a very long time and harms wildlife. People act on what they know: re-use bags, choose items with less packaging, recycle, and Victoria no longer allows some single-use plastics.

Knowledge of both sides — the useful properties and the lasting rubbish — has changed how people purchase, use and dispose of plastic. Shoppers re-use bags and choose items with less packaging. Councils recycle what they can. And the Victorian Government no longer allows some **single-use** plastic items to be sold — single-use means made to be used once, then thrown away.

Single-use plastic items not allowed in Victoria

Single-use means made to be used once, then thrown away.



Six pictures with a red no-sign over each: straws, cutlery (knives, forks and spoons), plates, stirrers, cotton buds, and foam containers.

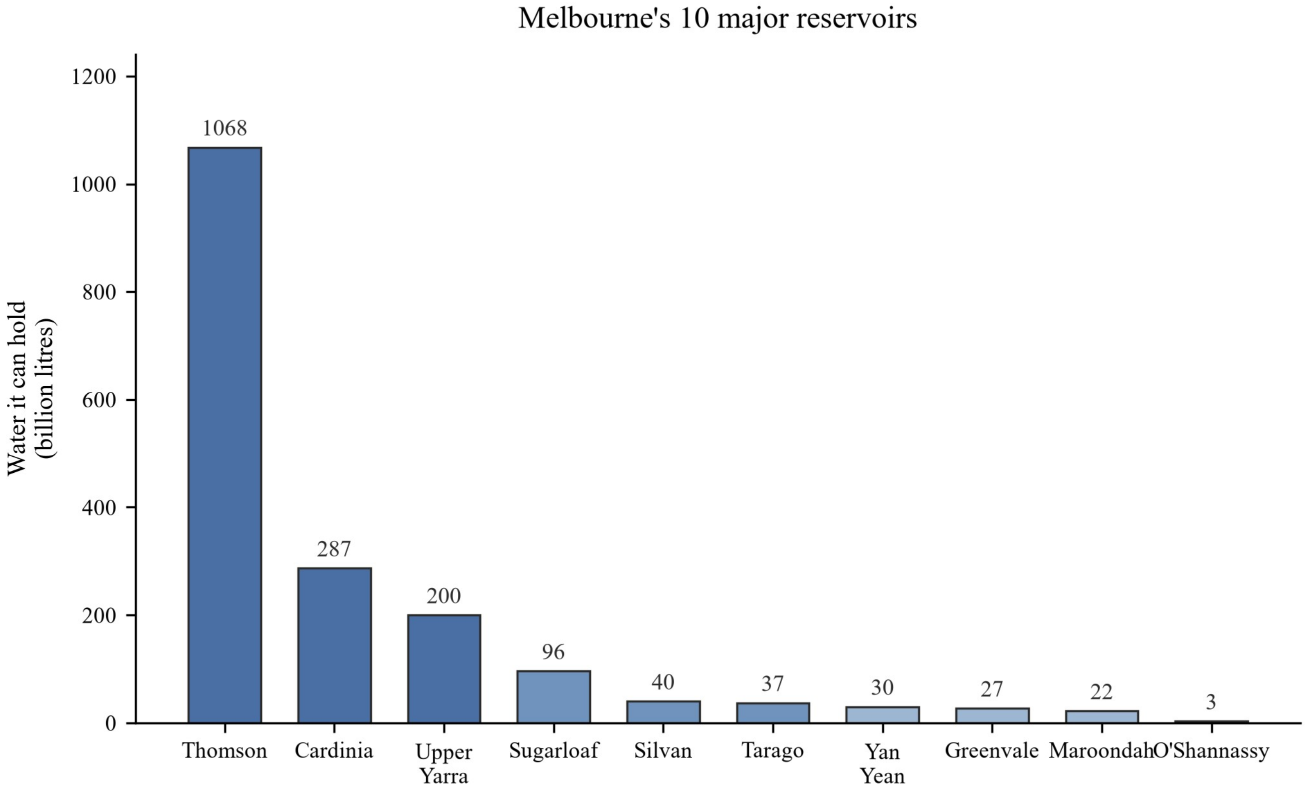
The list of items not allowed includes drinking straws, cutlery, plates, drink stirrers, cotton bud sticks, and foam food and drink containers. Notice the science doing the work: people did not stop using plastic because they disliked it.

They learned its properties, learned what it does as rubbish, and changed what they buy, how they use it, and what they throw away.

Source: Victorian Government, “Single-use plastics”, vic.gov.au — retrieved 2026-08-21.

Case 4 — Storing water, and saving it

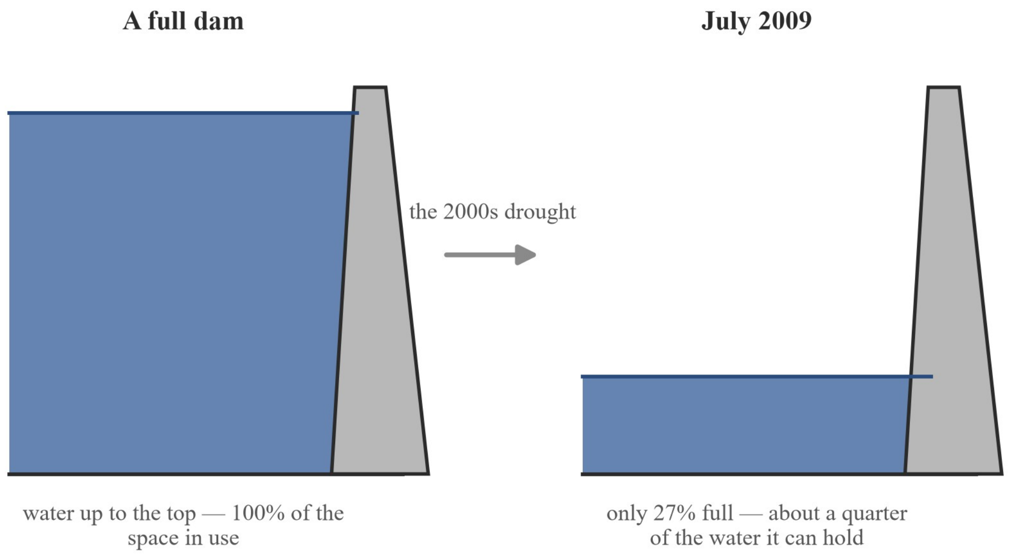
You met water and its cycle in 5B. People cannot rely on rain arriving when they need it, so they build places to store it: dams, wells, artificial lakes, canals, pipes and water towers. Melbourne’s water is stored in ten major reservoirs — a reservoir is a lake people built to hold water.



A column graph titled Melbourne’s 10 major reservoirs. Each column shows how many billion litres a reservoir can hold: Thomson 1068, Cardinia 287, Upper Yarra 200, Sugarloaf 96, Silvan 40, Tarago 37, Yan Yean 30, Greenvale 27, Maroondah 22, O’Shannassy 3. A billion is a thousand million, and a litre is the amount in a big milk bottle.

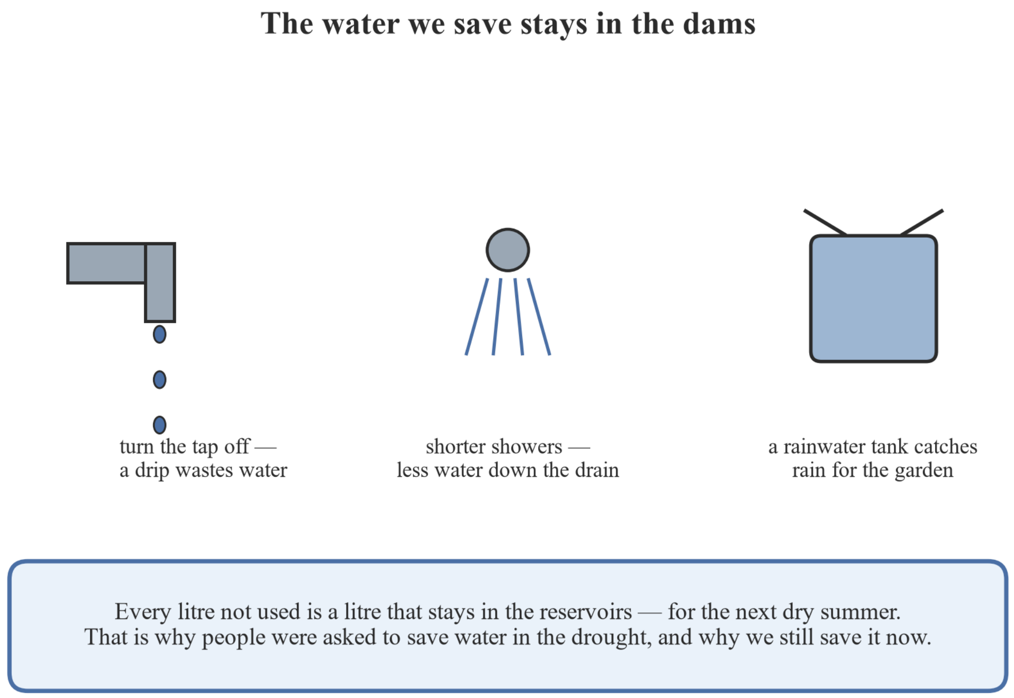
Together the ten reservoirs can hold up to 1,812 billion litres — a billion is a thousand million, and a million is a thousand thousands. The Thomson reservoir alone holds more than half of it. The reservoirs are joined by pipes, so water can be moved from one to another as needed.

Why are people encouraged to save water, even between showers and garden hoses? Because every litre not used stays in the reservoirs for later. That lesson was taught hard in the 2000s drought — a drought is a long time with much less rain than usual.



Two panels showing the same dam. Left, a full dam with water up to the top. Right, the dam in July 2009 with the water only about a quarter of the way up, labelled 27 per cent full.

By July 2009, Melbourne's reservoirs held only 27% of the water they can hold — about a quarter. Homes went on strict water rules, and the city came close to running out. When rain returned, the dams filled again — but the lesson stayed: save water in the good years, and you have it in the bad years.



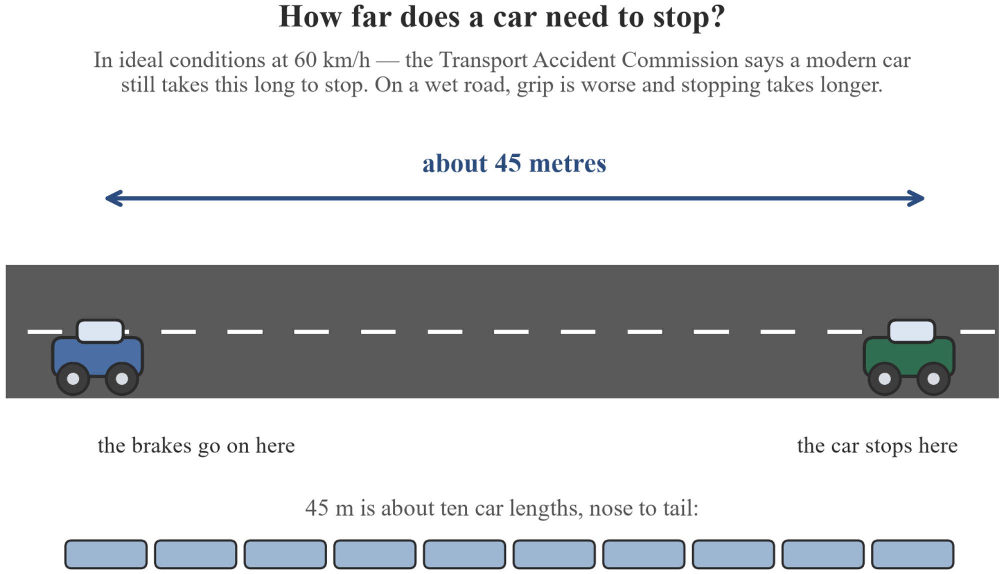
Three pictures of saving water: a tap turned off so it does not drip, a shower head with the caption shorter showers, and a rainwater tank catching rain for the garden. A box underneath says every litre not used is a litre that stays in the reservoirs for the next dry summer.

Turning the tap off while you brush, taking shorter showers, fixing drips, and catching rain in a tank for the garden are all the same action in disguise: the water you do not use stays in the dams.

Source: Melbourne Water, "Water storage reservoirs", melbournewater.com.au — retrieved 2026-08-21. Source: Wikipedia, "2000s Australian drought", en.wikipedia.org — retrieved 2026-08-21.

Case 5 — Friction and road safety

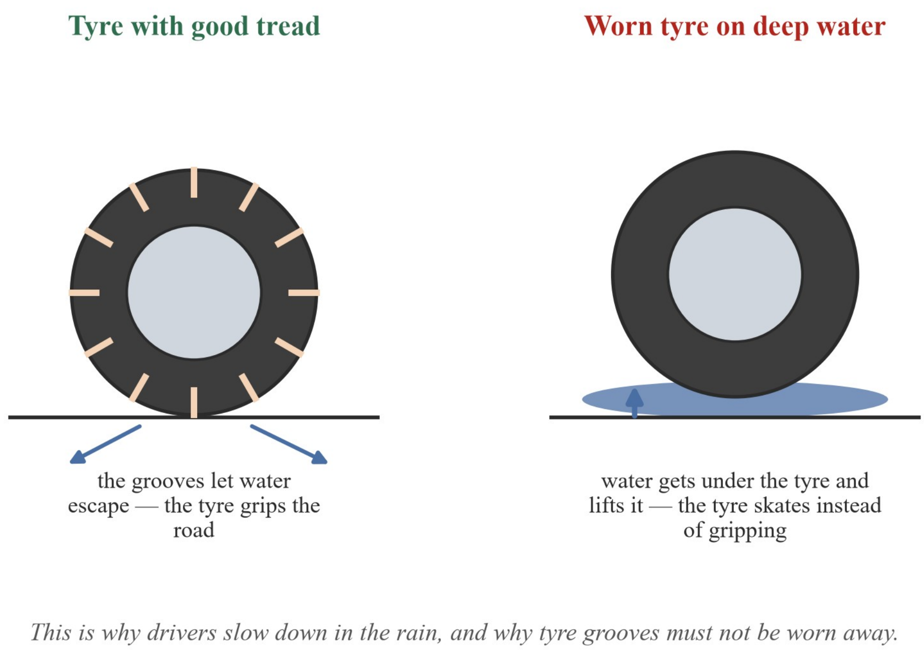
You met friction in 6B: the force that grips when two surfaces rub, and the reason things slow down and stop. Road safety is applied friction.



A road with a car at the left where the brakes go on and the same car at the right where it stops, with a double arrow between them labelled about 45 metres. Below, ten small car shapes nose to tail show that 45 metres is about ten car lengths.

The Transport Accident Commission, Victoria's road-safety authority, gives this number: in good conditions, a modern car travelling at 60 km/h takes about 45 metres to stop once the brakes go on — about ten car lengths. And a car travelling at just 65 km/h is still moving at about 30 km/h after it has travelled those same 45 metres. Speeding is a part of about one in four crashes where someone dies. Those are friction facts: stopping is friction doing work between the tyres and the road, and more speed means more road needed.

Wet roads change the friction story, because water can get between the tyre and the road.



Two panels. Left: a tyre with good tread, whose grooves let water escape so the tyre grips the road. Right: a worn tyre on deep water, lifted by a wedge of water under it, so the tyre skates instead of gripping.

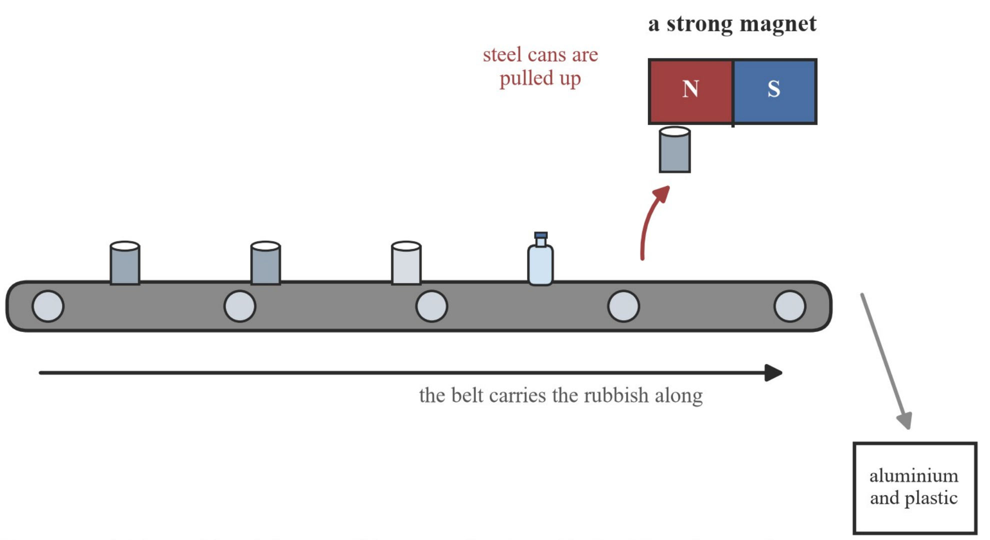
A good tyre has **tread** — a pattern of grooves. On a wet road the grooves let the water escape, so the rubber still touches the road and friction still grips. A worn tyre with shallow grooves cannot shift the water; the water gets under the tyre and lifts it, and the tyre skates on the water instead of gripping the road. That skating is called aquaplaning, and a worn tyre starts aquaplaning at a slower speed than a good tyre. So the friction knowledge tells drivers and riders exactly what to do in the wet: slow down, keep good tyres, and leave extra room — because stopping takes longer when grip is less.

Source: Transport Accident Commission, “Speeding”, tac.vic.gov.au — retrieved 2026-08-21. Source: Wikipedia, “Aquaplaning”, en.wikipedia.org — retrieved 2026-08-21.

Case 6 — Magnets that sort the rubbish

You met magnetic force in 6B: magnets pull on magnetic materials like iron and steel, and not on aluminium, plastic or glass. Recycling plants use that fact as a sorting machine.

Sorting metals at a recycling plant



The same trick is used in mining to pull iron out of rock, and in food factories to take stray metal out of food before it is packed.

A conveyor belt carrying steel cans, an aluminium can and a plastic bottle under a strong magnet. The steel cans are pulled up towards the magnet, while the aluminium can and the plastic bottle keep going and fall into a bin labelled aluminium and plastic.

The belt carries mixed rubbish along, and a strong magnet hangs over the end. Steel cans and tins are magnetic, so they are pulled off the belt; aluminium cans and plastic bottles are not magnetic, so they keep going and fall into their own bin. One magnet, two neat piles, no hands needed. The same trick sorts iron out of crushed rock in mining, and catches stray bits of metal out of food in food factories before it is packed.

Class activity — the magnet sort. Mix steel paperclips, aluminium foil balls and small plastic bits in a tray. Sweep a magnet (in a plastic bag, for easy cleaning) over the mix and watch the steel come out, leaving the rest behind. That is magnetic separation in miniature.

Safety: mind the pointy ends of the paperclips.

Source: Wikipedia, “Magnetic separation”, en.wikipedia.org — retrieved 2026-08-21.

The pattern

Six cases, one pattern. A need or a problem; the right science brought in from what you already know; people acting on it — trapping flies, wrapping cups, saying no to straws, building reservoirs, slowing down in the wet, hanging a magnet over a belt. That is what it means to use scientific knowledge, skills and data to meet a need or solve a problem.

Words to know in 7B

Word	What it means here
insulation	anything that slows heat down as it passes through
reservoir	a lake people built to hold water
billion	a thousand million
million	a thousand thousands
litre	the amount of milk in a big milk bottle
drought	a long time with much less rain than usual
larva (larvae)	the maggot stage of an insect, between egg and pupa
pupa (pupae)	the resting stage of an insect, between larva and adult
single-use	made to be used once, then thrown away
tread	the pattern of grooves on a tyre
aquaplaning	when a tyre skates on a layer of water instead of gripping the road
magnetic separation	using a magnet to pull magnetic materials out of a mix

Worked examples

Example 1 — with steps

A grower finds maggots inside her apricots, and full-grown larvae dropping from the fruit to the soil. Name the two life cycle stages she is seeing, and give the control that matches each.

Working	Comment
Maggots inside the fruit: the feeding stage after the egg hatches.	That is the **larva** stage, feeding inside the fruit for 10–31 days.
Control for larvae on the tree: the flies must be stopped before the eggs are laid inside.	Fine **netting** over the tree keeps adult flies off the fruit, so no eggs go in.
Larvae dropping to the soil: full-grown larvae on their way to pupate in the soil.	That is the larva-to-**pupa** step of the cycle.
Control for dropping larvae: stop them reaching the soil.	**Pick up fallen fruit and bin it**, so the larvae inside never pupate.

∴ she is seeing the larva stage twice — feeding inside, then dropping — and the matching controls are netting the tree (stops eggs going in) and binning fallen fruit (stops larvae pupating). Knowing the cycle says where to act.

Example 2 — with steps

Use the reservoir column graph. (a) Which reservoir can hold the most water, and which the least? (b) How many more billion litres can the Thomson hold than the Cardinia?

Working	Comment
(a) Tallest column: Thomson, 1068. Shortest column: O’Shannassy, 3.	Read the graph: the height of each column is the amount it can hold.
(b) 1068 − 287 = 781.	“How many more” means subtract: take 287 away from 1068.

∴ (a) the Thomson holds the most (1068 billion litres) and the O’Shannassy the least (3); (b) the Thomson can hold 781 billion litres more than the Cardinia.

Example 3 — on your own

At the beach, Mia's drinks stay cold in the Esky. "The Esky must make cold," she says. Is she right? Use the insulation idea to explain what the Esky really does.

∴ Mia is not right — the Esky does not make cold. Heat always moves from hot things to cold things, so on a hot day heat tries to move into the cold drinks. The Esky's foam walls are full of trapped air, and heat passes through trapped air very slowly, so the heat only crawls in. The drinks stay cold because the heat of the day is slowed down, not because cold is made. It is the same science as a puffer jacket slowing your body's heat from escaping.

Example 4 — on your own

A driver always travels at 60 km/h on a dry road and stops fine at the give-way sign. In heavy rain she keeps the same speed, and nearly misses the stop. Use friction to explain what changed, and name two things she should do in the wet.

∴ on the dry road, the tyres grip and friction stops the car in about 45 metres. In heavy rain, water sits between the tyres and the road; if the tread cannot shift it, the tyre skates on the water (aquaplaning) and grip is much less, so stopping needs more than 45 metres and the give-way sign comes too soon. In the wet she should slow down and leave extra room — and keep good tyres, because worn tread aquaplanes sooner.

Practice questions

With steps

Q1. Name the four stages of the Queensland fruit fly's life cycle, in order.

Q2. Match the control to the stage. Which control works on: (a) adult flies, before eggs are laid? (b) flies reaching fruit on the tree? (c) larvae about to pupate in the soil?

Q3. Look at the Esky diagram. (a) What material slows the heat down? (b) What is inside the foam that does the slowing? (c) Name two other things made with the same idea.

Q4. (a) Name two properties of plastic that made it useful. (b) Name two single-use plastic items Victoria no longer allows to be sold.

Q5. Use the reservoir column graph. (a) Which two reservoirs can hold more than 200 billion litres? (b) How many more billion litres can the Silvan hold than the Tarago?

Q6. (a) About how far does a modern car at 60 km/h take to stop in good conditions? (b) What does the tread on a tyre do on a wet road?

On your own

Q7. Explain why a fruit-fly-free zone puts fruit bins on the roads into the zone. Use one stage of the life cycle in your answer.

Q8. In the wrapping race activity, what is the one thing you change, and name three things you keep the same. Why does keeping things the same matter?

Q9. Plastic is light, strong and waterproof, and those properties made it popular. Explain how the same properties help make plastic a rubbish problem, and name one choice a shopper can make because of that knowledge.

Q10. Melbourne's dams were about 27% full in July 2009. Explain why people are encouraged to save water even in years when the dams are full.

Q11. Use the TAC numbers (45 metres to stop from 60 km/h; still about 30 km/h after 45 metres from 65 km/h) to explain why extra speed is dangerous, even a little extra.

Q12. A recycling plant has a mixed pile of steel cans, aluminium cans and plastic bottles. Explain how a magnet sorts the pile into two useful groups, and name one other industry that uses the same trick.

Answers

Q1. Egg, larva (maggot), pupa, adult fly. **Q2.** (a) sticky traps and bait, catching adult flies before they lay eggs; (b) fine netting over the tree; (c) picking up fallen fruit and binning it. **Q3.** (a) the foam (insulation); (b) trapped air; (c) any two of: house wall and roof insulation, a puffer jacket, an Esky. **Q4.** (a) any two of: light, strong, does not let water through, cheap to make; (b) any two of: drinking straws, cutlery, plates, drink stirrers, cotton bud sticks, foam food and drink containers. **Q5.** (a) the Thomson (1068) and the Cardinia (287); (b) 40 − 37 = 3 billion litres more. **Q6.** (a) about 45 metres; (b) the grooves let water escape, so the rubber touches the road and friction grips. **Q7.** e.g. larvae can be hidden inside fruit that people carry, and they would pupate and hatch as flies inside the zone. The bins catch that fruit at the border, so the larva stage never gets in — the zone stays fruit-fly-free. **Q8.** e.g. change: the wrapping. Keep the same: the cup, the amount of water, the starting temperature, and where the cups sit (any three). Keeping them the same makes the test fair, so any difference in the temperatures is caused by the wrapping and nothing else. **Q9.** e.g. the same properties that make plastic useful also make it last: strong and waterproof plastic does not rot away, so thrown-away plastic stays in nature and harms wildlife. A shopper who knows this can re-use a bag, or choose items with less packaging. **Q10.** e.g. the drought showed that full dams can fall to about a quarter in a few dry years. Water saved in the good years stays in the dams for the bad years, so saving water all the time is the safe habit. **Q11.** e.g. at 60 km/h the car uses the whole 45 metres to stop. At 65 km/h, after those same 45 metres the car is still travelling at about 30 km/h — so where the slower car has stopped, the faster car is still moving fast. A little extra speed means a lot of extra stopping. **Q12.** e.g. the magnet pulls the magnetic steel cans out of the mix, while the aluminium cans and plastic bottles, which are not magnetic, keep going into their own pile — two sorted groups with one magnet. Mining uses the same trick to sort iron out of crushed rock (and food factories to catch stray metal).

Answers with every step

Q1. Read the cycle diagram around once. The adult fly lays **eggs** inside the fruit; the eggs hatch into the **larva** (maggot) that feeds inside the fruit; the full-grown larva becomes a **pupa** in the soil; the pupa comes out as an **adult fly**, and the cycle repeats. Egg → larva → pupa → adult.

Q2. Match each control to the stage it blocks. (a) Traps and bait catch **adult flies** before they can lay eggs — acting on stage 4. (b) Netting stops flies reaching the fruit on the tree, so no eggs go in — acting on stage 4 at the tree, protecting stages 1 and 2. (c) Binning fallen fruit stops **larvae** reaching the soil to pupate — acting at the larva-to-pupa step.

Q3. (a) The thick wall is **foam** — the insulation. (b) The foam is full of **trapped air**, and heat passes through trapped air very slowly. (c) The same idea is built into **house wall and roof insulation** and **puffer jackets** (an Esky itself is the third example).

Q4. (a) Plastic is **light** and **strong**, does not let **water** through, and is **cheap to make** — any two. (b) Victoria's not-allowed list covers **drinking straws, cutlery, plates, drink stirrers, cotton bud sticks and foam food and drink containers** — any two.

Q5. (a) Read the graph for columns over 200: the **Thomson** at 1068 and the **Cardinia** at 287 (the Upper Yarra is exactly 200, not more). (b) Silvan 40, Tarago 37: 40 − 37 = **3 billion litres** more.

Q6. (a) The TAC figure is **about 45 metres** — about ten car lengths. (b) On a wet road the **grooves of the tread let the water escape**, so the rubber still touches the road and **friction grips**; without working tread, the water lifts the tyre and it skates.

Q7. Follow the cycle. Fruit carried into the zone can hide **larvae**; those larvae would drop, **pupate**, and hatch as flies inside the fruit-fly-free zone, undoing all the growers' work. The roadside **fruit bins** catch carried fruit at the border, so the larva stage is removed before it can finish the cycle. The bins are the life cycle used as a security gate.

Q8. A fair test changes one thing and keeps the rest the same. Change: **the wrapping**. Keep the same: **the cup, the amount of water, the starting temperature, where the cups sit** — any three. If two things differed between the cups, you could not say which one caused the difference in temperature; keeping everything else the same means the wrapping alone is on trial. That is the fairness idea from 1B, doing its usual job.

Q9. The useful properties are the same ones that make the rubbish last. **Strong** and **waterproof** plastic does not break down or rot, so a bottle or bag thrown away stays in nature a very long time and can harm wildlife; **light** plastic blows and floats far from the bin. Knowing that, a shopper can **re-use a bag** or **choose items with less packaging**, and Victoria can say no to some single-use items. Knowledge of the properties changed what people purchase, how they use it, and what they throw away.

Q10. The number 27% is the whole argument: in July 2009, after the long drought, the dams held only about a quarter of their water, and Melbourne came close to running dry. Dams fill and empty with the years, so water saved in a full-dam year is water banked for a dry year. That is why saving water is a habit for every year, not an emergency measure.

Q11. Line the two cars up at the same braking point. The 60 km/h car uses the full 45 metres to stop. The 65 km/h car has travelled the same 45 metres and is **still moving at about 30 km/h** — so at the exact spot where the slower car is safely stopped, the faster car is still travelling at more than half of 60. Friction can only do so much work per metre of road; extra speed needs extra metres, and crashes happen in the metres you do not have.

Q12. Sort by the magnetic fact. Steel is **magnetic**; aluminium and plastic are **not**. A magnet over the belt (or a magnetic drum) pulls the **steel cans** out of the moving mix, while the **aluminium cans and plastic bottles** pass under and fall into their own stream — two clean groups from one pass. **Mining** pulls iron out of crushed rock the same way, and **food factories** catch stray metal out of food before packing. One force, three industries.

Chapter 7 check-up — Science as a human endeavour

This check-up is a piece of class work from your workbook. It is a school instrument, not a VCAA exam — Science Levels 3 and 4 has no outside exam. There is no time to beat. Take as long as you need. If you want, your teacher will read any question out to you.

Chapter 7 check-up · Codes `VC2S4H01` (7A), `VC2S4H02` (7B)

Total: 15 marks · Part A — Questions A1 to A8 · 8 marks · Part B — Questions B1 to B3 · 7 marks

Part A questions are worth 1 mark each. Part B questions are worth 2 or 3 marks, and the marks for each part are written with the question.

Every question in this check-up points to a part of the Levels 3 and 4 achievement standard that Chapter 7 teaches. The extracts, word for word:

Students explain the role of data in scientific inquiry. — `VC2S4H01` (7A)

They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data. — `VC2S4H02` (7B)

The words in this check-up are the words you learned in Chapter 7. If you need them, the word lists are at the end of 7A and 7B.

In this check-up you will:

- name what observations become when they are written down (A1)
- sort statements into observations and explanations (A2)
- name the number that tells how acid a soil is (A3)
- match three scientists to the data they care about (A4)
- name the four stages of the Queensland fruit fly's life cycle (A5)
- identify the life cycle stage that sticky traps act on (A6)
- name single-use plastics Victoria no longer allows to be sold (A7)
- identify the Melbourne reservoir that holds the most water (A8)
- identify the data in the milk story, and explain what happened (B1)
- explain how roadside fruit bins keep a zone fruit-fly-free (B2)
- construct a magnetic sort table, and explain the sort (B3)

Part A — 8 marks

Eight questions, each worth 1 mark. A question gets its mark, or no mark.

A1. *(1 mark · `VC2S4H01`)* Observations that are written down or recorded become something new. Name what they become.

A2. *(1 mark · `VC2S4H01`)* Classify each statement as an **observation** or an **explanation**.

(a) "The fridge read 9 °C."
(b) "The milk went off because the fridge was too warm."

A3. *(1 mark · `VC2S4H01`)* A soil test gives back a number that tells how acid the soil is. Name that number.

A4. *(1 mark · `VC2S4H01`)* Match each scientist to the data they care about most. Draw a line from each scientist to the right data.

Scientists: **1.** food scientist **2.** ecologist **3.** hydrologist

Data: **A.** butterfly counts, and where caterpillars are dying **B.** rain, and how much water flows into the city's storages **C.** fridge and freezer temperatures, to keep food good to eat

A5. *(1 mark · `VC2S4H02`)* Name the four stages of the Queensland fruit fly's life cycle, in order.

A6. *(1 mark · `VC2S4H02`)* Growers hang sticky traps to catch Queensland fruit flies before the flies can lay eggs. Identify the life cycle stage the traps act on.

A7. *(1 mark · `VC2S4H02`)* Name two single-use plastic items that the Victorian Government no longer allows to be sold.

A8. *(1 mark · `VC2S4H02`)* Melbourne's water is stored in ten major reservoirs. Identify the reservoir that can hold the most water.

Part B — 7 marks

Three questions. B1 is worth 3 marks, B2 is worth 2 marks, and B3 is worth 2 marks. Write your answers in your own words.

B1. *(3 marks · `VC2S4H01`)* A family buys two cartons of the same milk. One carton goes into a fridge that reads 3 °C. The other goes into a fridge that reads 9 °C. Five days later, the milk in the 9 °C fridge smells bad. The milk in the 3 °C fridge is still fresh.

(a) Identify the data in this story. (1 mark)
(b) Food scientists say cold food should be kept at 4 °C or below. Explain why the milk in the 9 °C fridge went off first. (2 marks)

B2. *(2 marks · `VC2S4H02`)* The Greater Sunraysia district, around Mildura, is part of a fruit-fly-free zone. On the roads into the zone there are bins where people must throw away any fruit they are carrying.

(a) Name the stage of the Queensland fruit fly's life cycle that can be hidden inside carried fruit. (1 mark)
(b) Explain how these bins help keep the zone fruit-fly-free. (1 mark)

B3. *(2 marks · `VC2S4H02`)* A recycling plant has a mixed pile of steel cans, aluminium cans and plastic bottles.

(a) Construct a table with two columns. Label one column **Magnetic** and the other column **Not magnetic**. Sort the three items into your table. (1 mark)
(b) Explain how one strong magnet can sort the whole pile into two useful groups. (1 mark)

Mark record

Question	Code	Worth	Given
A1 — name what recorded observations become	`VC2S4H01`	1	
A2 — observations or explanations	`VC2S4H01`	1	
A3 — name the soil-acid number	`VC2S4H01`	1	
A4 — match the scientists to their data	`VC2S4H01`	1	
A5 — the four fruit fly stages, in order	`VC2S4H02`	1	
A6 — the stage sticky traps act on	`VC2S4H02`	1	
A7 — two banned single-use plastics	`VC2S4H02`	1	
A8 — the biggest reservoir	`VC2S4H02`	1	
B1 — the milk story: the data, and why it went off	`VC2S4H01`	3	
B2 — fruit bins, and the stage they stop	`VC2S4H02`	2	

Question	Code	Worth	Given
B3 — the magnet sort table, and how it works	VC2S4H02	2	
Total		**15**	

Marking guide

Teacher guidance — Chapter 7 check-up · 15 marks. This guide is written so a teacher without a science background can mark the check-up. Every acceptable answer is written out below, and every mark is allocated per response.

About this instrument

- The check-up is a **school instrument**, not a VCAA exam. Science Levels 3 and 4 has no external examination and no external assessment.
- Completion is **untimed** — a student may take as long as they need.
- **Reading support** is permitted: the teacher may read any question aloud on request. Reading is not being assessed.
- A mark is a record that the evidence was seen. Marks are for reporting against the achievement standard, not for ranking students.

The extracts evidenced

Each question is tagged with the code it traces to. The two extracts from the Levels 3 and 4 achievement standard, quoted at the head of the check-up:

- `VC2S4H01` (7A): “Students explain the role of data in scientific inquiry.”
- `VC2S4H02` (7B): “They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”

Marks at a glance

Part	Questions	Code	Marks
Part A	A1–A4	`VC2S4H01`	4
Part A	A5–A8	`VC2S4H02`	4
Part B	B1	`VC2S4H01`	3
Part B	B2–B3	`VC2S4H02`	4
		Total	**15**

General marking rules

- Accept answers in the student’s own words. The acceptable answers below are wide by design — if the response shows the understanding, give the mark.
- Spelling does not lose marks.
- Part A items are marked all-or-nothing: each gets its 1 mark, or 0.
- Part B items are part-marked exactly as shown with each question.
- If an answer is right but the reason is unclear, ask the student to say more — once. If the follow-up shows the understanding, give the mark. If it shows a guess with nothing behind it, record 0 and move on without comment.

Part A — answers

A1 · `VC2S4H01` · 1 mark

- **Accept:** data. Also accept *they become data* or *observations become data*.
- **Marks:** 1 for data; 0 otherwise.
- **Evidences:** “explain the role of data in scientific inquiry” — the first move 7A teaches: an observation is what you notice, and once it is written down or recorded it is data.

A2 · `VC2S4H01` · 1 mark

- **Accept:** (a) observation — a reading that was noticed and written down;

(b) explanation — it says *why* the milk went off.

- **Marks:** 1 for both classified correctly; 0 otherwise.
- **Evidences:** "explain the role of data in scientific inquiry" — telling what was noticed apart from the saying-why is the sort 7A is built on.

A3 · `VC2S4H01` · 1 mark

- **Accept:** pH. Also accept *the pH* or *the pH number*.
- **Marks:** 1 for pH; 0 otherwise.
- **Evidences:** "explain the role of data in scientific inquiry" — the pH is the number a soil test gives back, the data that explained the poor clover in 7A's Case 1.

A4 · `VC2S4H01` · 1 mark

- **Accept:** 1–C (food scientist → fridge and freezer temperatures), 2–A (ecologist → butterfly counts and dying caterpillars), 3–B (hydrologist → rain and water flowing into the storages).
- **Marks:** 1 for all three matched; 0 otherwise.
- **Evidences:** "explain the role of data in scientific inquiry" — the three real jobs 7A walks through, each one a person using their data to explain what they see.

A5 · `VC2S4H02` · 1 mark

- **Accept:** egg, larva (maggot), pupa, adult (fly) — all four, in that order. Accept the student's own words for the stages that mean the same, such as *egg, maggot, pupa, fly*.
- **Marks:** 1 for all four named in order; 0 otherwise.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge" — the Queensland fruit fly life cycle from 7B's Case 1, the knowledge the controls are built on.

A6 · `VC2S4H02` · 1 mark

- **Accept:** the adult stage. Accept *adult*, *adult fly* or *the fly*.
- **Marks:** 1 for the adult stage; 0 for egg, larva or pupa.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge" — knowing *which stage* a control acts on is the skill 7B's Case 1 teaches: traps catch adult flies before eggs are laid.

A7 · `VC2S4H02` · 1 mark

- **Accept:** any two of: drinking straws, cutlery (knives, forks and spoons), plates, drink stirrers, cotton bud sticks, foam food and drink containers.
- **Marks:** 1 for any two named; 0 for one or none, or for items not on the list.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge, skills and data" — 7B's Case 3: people learned plastic's properties and what it does as rubbish, and changed what is allowed to be sold.

A8 · `VC2S4H02` · 1 mark

- **Accept:** the Thomson. Also accept *Thomson reservoir*.
- **Marks:** 1 for the Thomson; 0 otherwise.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge, skills and data" — 7B's Case 4: the reservoirs are how Melbourne stores water against the dry years, and the Thomson holds more than half of it.

Part B — answers

B1 · `VC2S4H01` · 3 marks

- **(a) — 1 mark.** Accept the two temperature readings as the data: *3 °C and 9 °C*, or *the thermometer readings of the two fridges*. Also accept wider wordings that name what was written down, such as *the temperatures of the fridges, and which milk went off*. A response that names only the smell, with no measurement or record idea, gets 0.
- **(b) — 2 marks.** Award the first mark for saying the 9 °C fridge is too warm — accept *9 °C is above 4 °C*, *it was warmer than the 4 °C rule*, or *the fridge was too warm*. Award the second mark for linking the warmth to the milk going off — accept *germs in the milk grew faster in the warmer fridge, so it went off sooner*, or *in the warmth the germs grew fast and made the milk go off*. The response must carry both ideas: above the rule, and the germs growing faster.
- **Do not award** the second mark if the response says the cold fridge made the milk go off, or that germs grow faster in the cold.
- **Evidences:** "explain the role of data in scientific inquiry" — this is the observation → data → explanation move of 7A's Case 2, in a new story: the readings are the data, and the explanation must fit them.

B2 · `VC2S4H02` · 2 marks

- **(a) — 1 mark.** Accept: the larva stage. Accept *larva*, *larvae* or *maggot*.
- **(b) — 1 mark.** Accept any wording that says the bins stop hidden larvae finishing the cycle inside the zone. Examples: *any larvae inside the fruit are binned at the border, so they cannot pupate in the soil and come out as flies inside the zone*; *the bins catch the fruit before the larvae get in, so the cycle cannot finish there*. The response must carry the idea that the larva stage is removed before it can become a fly inside the zone. "So people have no fruit" with no life cycle idea gets 0.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge" — 7B's Case 1: the roadside bins are a life cycle fact doing a job, the larva stage used as a security gate for the fruit-fly-free zone.

B3 · `VC2S4H02` · 2 marks

- **(a) — 1 mark.** Accept any table with two columns labelled **Magnetic** and **Not magnetic** (accept the student's own column words that mean the same, such as *pulled by a magnet* and *not pulled by a magnet*), with all three sorted correctly: **Magnetic** — the steel cans; **Not magnetic** — the aluminium cans and the plastic bottles. The items may run down the rows or across the top; either way is right.
- **(b) — 1 mark.** Accept any wording that says the magnet pulls the magnetic steel out and leaves the rest. Examples: *steel is magnetic, so the magnet pulls the steel cans off the pile, and aluminium and plastic are not magnetic, so they stay — two groups from one magnet*; *the magnet picks up what is magnetic and cannot pick up what is not*. The response must name both halves of the sort — what the magnet takes, and what it leaves.
- **Evidences:** "needs have been met or problems have been solved through applying scientific knowledge" — 7B's Case 6: magnetic force used as a sorting machine in recycling, one magnet making two neat piles.

Where each question traces in the curriculum

Every question traces to the achievement-standard extract of one of the two Chapter 7 subtopics. The extracts below are quoted verbatim from the Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4 achievement standard.

Question	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
A1	1	7A	`VC2S4H01`	"Students explain the role of data in scientific inquiry."
A2	1	7A	`VC2S4H01`	"Students explain the role of data in scientific inquiry."
A3	1	7A	`VC2S4H01`	"Students explain the role of data in

Question	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
				scientific inquiry.”
A4	1	7A	VC2S4H01	“Students explain the role of data in scientific inquiry.”
B1	3	7A	VC2S4H01	“Students explain the role of data in scientific inquiry.”
A5	1	7B	VC2S4H02	“They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”
A6	1	7B	VC2S4H02	“They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”
A7	1	7B	VC2S4H02	“They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”
A8	1	7B	VC2S4H02	“They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”
B2	2	7B	VC2S4H02	“They provide examples to explain how needs have been met or problems have been solved through applying scientific

Question	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
				knowledge, skills and data.”
B3	2	7B	`VC2S4H02`	“They provide examples to explain how needs have been met or problems have been solved through applying scientific knowledge, skills and data.”
Total	**15**			

Total

Part A: 8 marks. Part B: 7 marks (3 + 2 + 2). **Total: 15 marks.**