Science 3–4

Chapter 4 — Chemical sciences

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Solids, liquids, gases and changes of state

What we teach here — `VC2S4U04` (Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4): “solids, liquids and gases have observable properties; adding or removing heat energy leads to a change of state between solids, liquids and gases”. **In our words:** everything around you is a solid, a liquid or a gas; each behaves in its own way, and heating or cooling can turn a thing from one state into another.

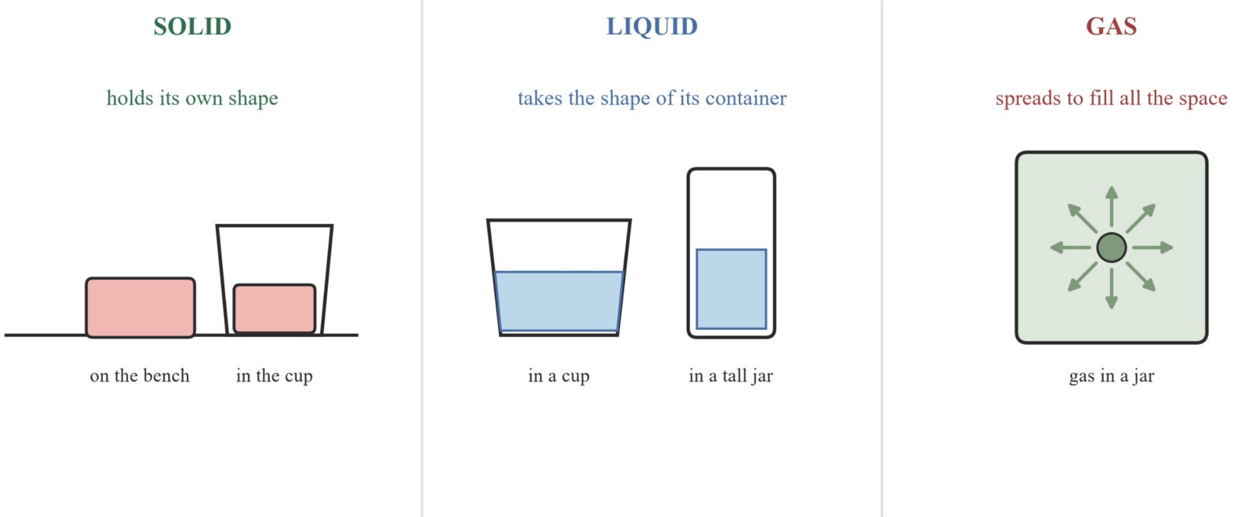
Theory

The three states

Everything you can touch, pour or smell is made of stuff, and that stuff comes in three **states**: solid, liquid and gas. A **state** is the way a kind of stuff behaves — the things it does that you can see and test.

An ice cube, a rock and a chocolate block are **solids**. Water, milk and orange juice are **liquids**. The air in a balloon, and the bubbles that make a fizzy drink fizzy, are **gases**. How do we sort any new thing into the right group? We run three tests.

Three tests for the three states



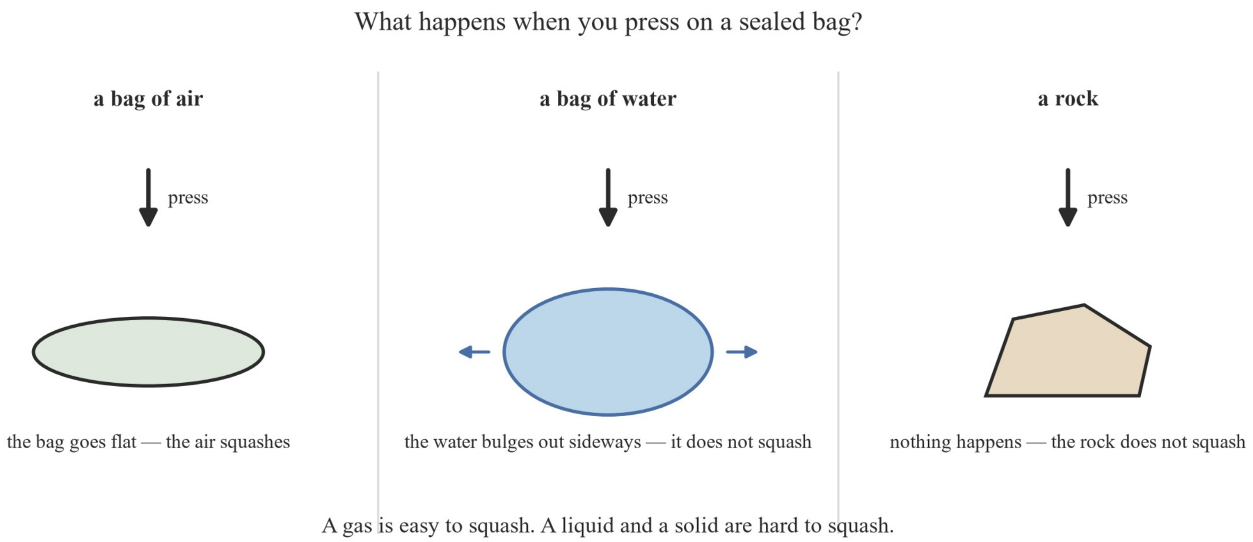
Three panels show the three tests: an eraser keeps the same shape on the bench and in a cup (solid); water takes the shape of a cup and of a tall jar (liquid); arrows show a gas spreading to fill a whole jar (gas).

Test 1 — does it hold its own shape? A **solid** holds its own shape. Put an eraser in a cup and it is still eraser-shaped. Solids keep their shape on their own.

Test 2 — does it take the shape of its container? A **liquid** takes the shape of its **container** — the thing holding it. Pour the same water from a cup into a tall jar: in the cup it is short and wide, and in the jar it is tall and thin. The water did not change. Only its shape changed, because the container changed.

Test 3 — does it fill all the space? A **gas** spreads out to fill all the space it can. Let a gas into a jar and it does not sit in a pile at the bottom like a solid, or pool like a liquid — it fills the whole jar, every corner.

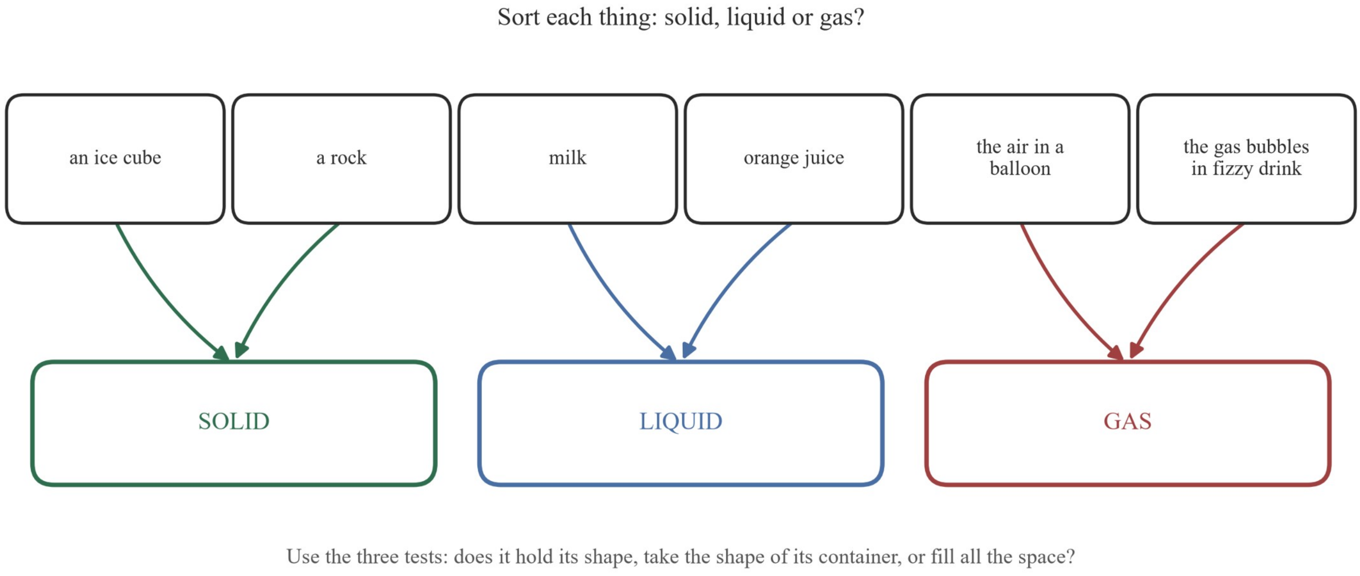
A fourth check — the squash test



Three things are pressed from above: a sealed bag of air goes flat, a sealed bag of water bulges out sideways, and a rock does not squash.

Press gently on a sealed bag of air and it goes flat — a gas is easy to squash. Press on a sealed bag of water and it does not squash; it bulges out sideways instead. Press on a rock and nothing happens at all. So a gas is easy to squash, and a liquid and a solid are hard to squash. That is one more property you can observe. A **property** is something about a thing that you can notice or test — like its shape, or whether it squashes.

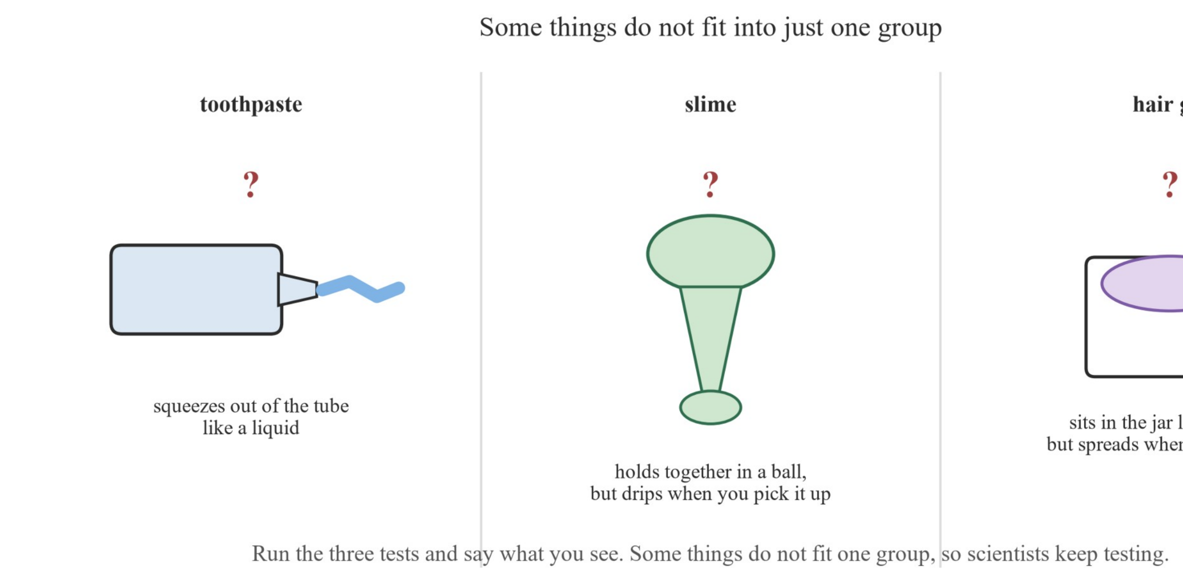
Sorting things into the three states



A sorting diagram with six cards (an ice cube, a rock, milk, orange juice, the air in a balloon, and the gas bubbles in fizzy drink) above three boxes labelled solid, liquid and gas, with arrows sorting each card into its group.

Run the tests on each thing. An ice cube holds its own shape, so it is a **solid** — even though it is made of water! Milk and orange juice take the shape of whatever holds them, so they are **liquids**. The air in a balloon, and the bubbles in a fizzy drink, spread to fill the space they are in, so they are **gases**.

When the sort is tricky

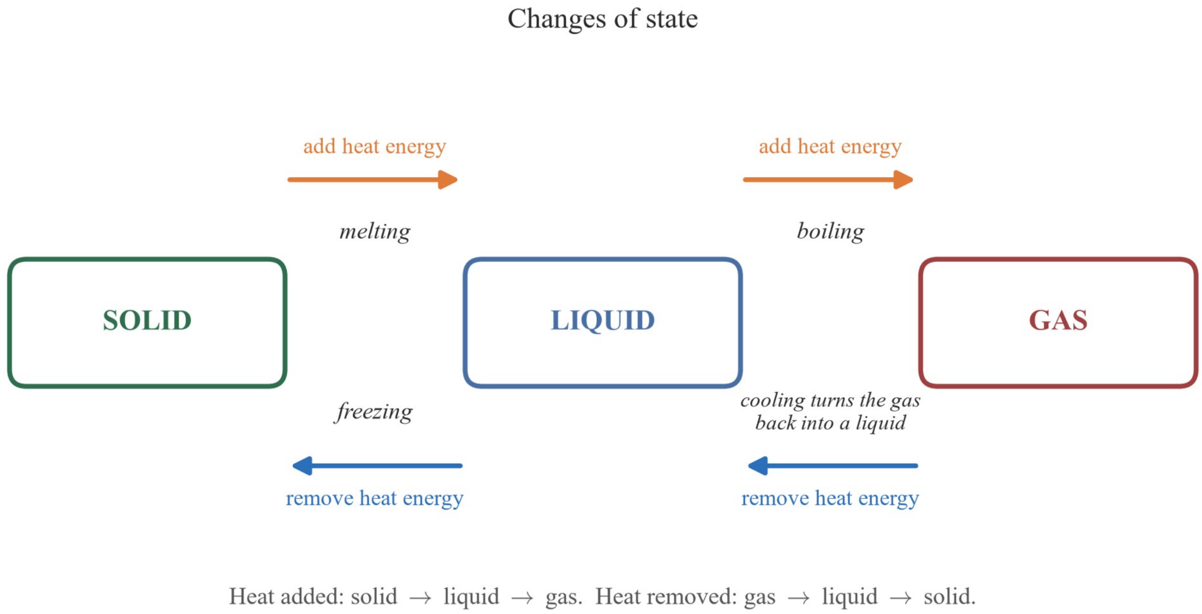


Toothpaste squeezing out of its tube, slime stretching and dripping, and hair gel sitting in a jar: three tricky things that do not fit into just one group.

Some things fight the sort. Toothpaste squeezes out of the tube like a liquid, but it sits on your brush and holds its shape like a solid. Slime holds together in a ball in your hand, then drips when you pick it up. Hair gel sits in the jar like a solid, but spreads when you scoop it. These things do not fit one group, and that is all right — scientists meet tricky things too. The rule is the same as always: run the tests, say what you see, and sort by what the thing **does**, not by what it looks like.

Changes of state

A **change of state** is when a thing turns from one state into another. Every change of state in this subtopic comes from **heat energy**: adding heat energy, or removing it.



A map of changes of state. Adding heat energy turns a solid into a liquid (melting) and a liquid into a gas (boiling). Removing heat energy turns a gas back into a liquid, and a liquid into a solid (freezing).

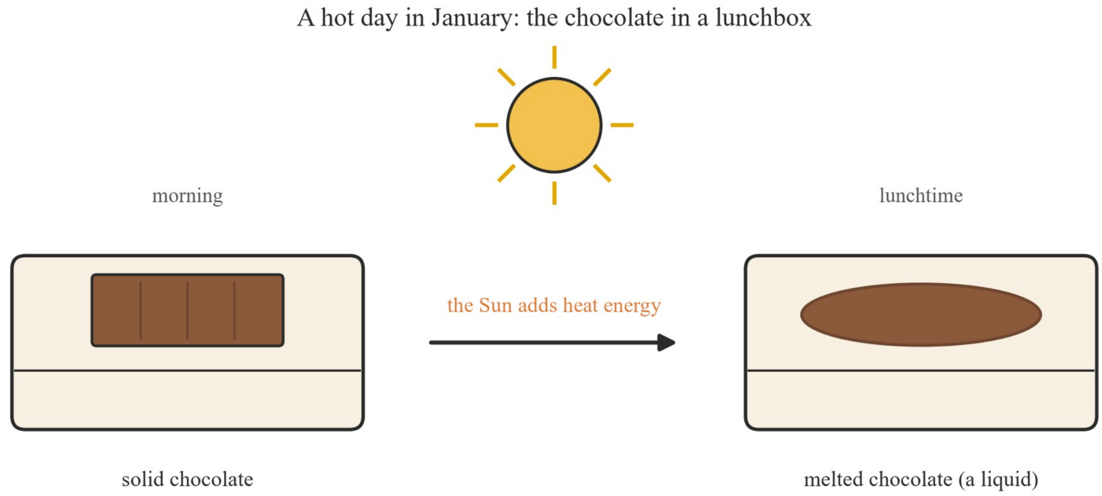
Melting is the change from solid to liquid. Add heat energy to ice and it melts into liquid water. **Freezing** is the change from liquid to solid. Remove heat energy from liquid water — put it somewhere very cold — and it freezes into solid ice. **Boiling** is the change from liquid to gas: add enough heat energy and liquid water boils and becomes water as a gas. And when water as a gas is cooled, it turns back into liquid water.

Read the map both ways:

- **Heat added:** solid → liquid → gas.
- **Heat removed:** gas → liquid → solid.

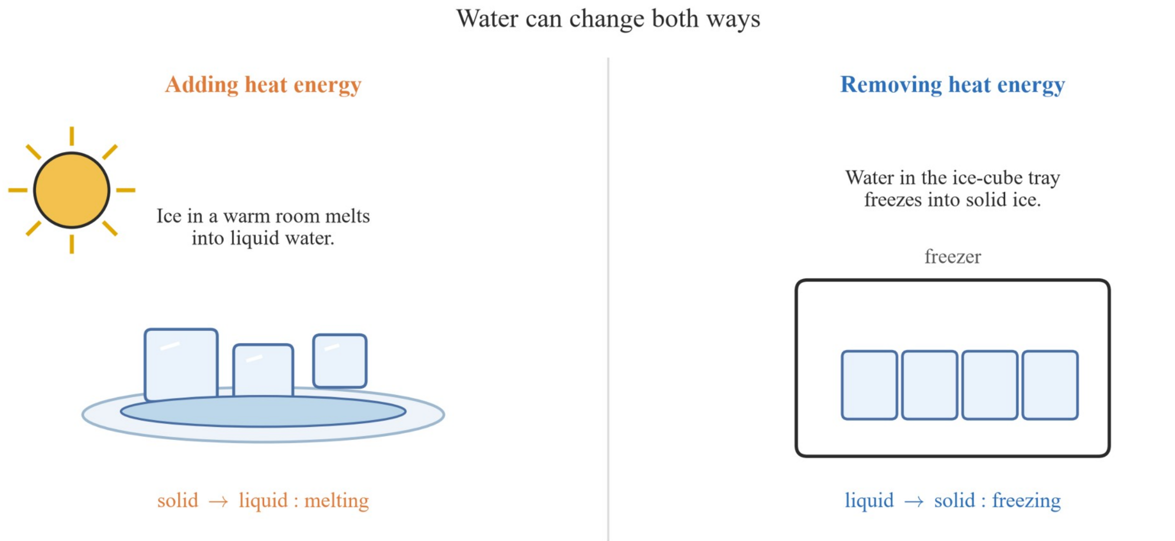
The same thing can change state and change back again. Water does this all the time, in every kitchen in Victoria.

Melting and freezing around you



A lunchbox in the morning holds a solid chocolate block; by lunchtime on a hot day the Sun has added heat energy and the chocolate has melted into a liquid pool.

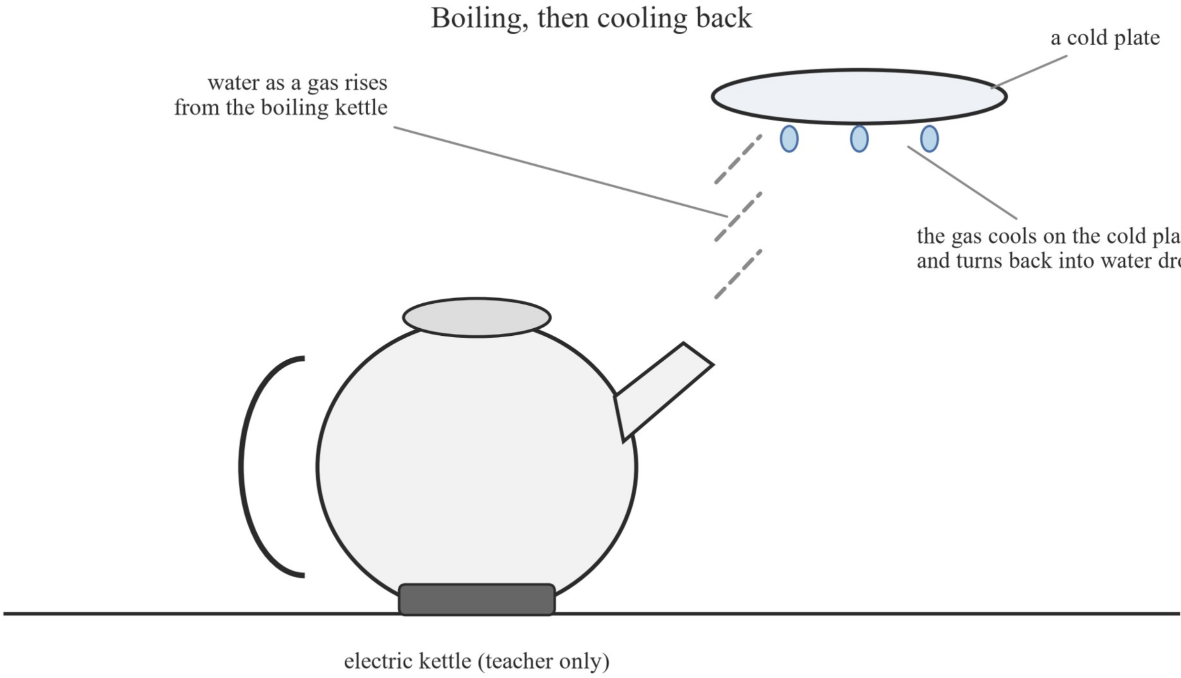
A hot day in January. In the morning, the chocolate in a lunchbox is a solid block with straight edges. By lunchtime, the Sun has added heat energy all morning, and the chocolate is a liquid pool in the wrapper. That is **melting**: solid → liquid, driven by heat energy going in. (Ask anyone who has opened that lunchbox. It is a sad day for the chocolate, and a very good day for learning science.)



Two panels. Left: ice cubes on a plate in a warm room melt into a pool of liquid water — adding heat energy. Right: liquid water in an ice-cube tray inside a freezer turns into solid ice — removing heat energy.

Water changes state both ways. Ice in a warm room melts: heat energy goes in, solid becomes liquid. Water in an ice-cube tray in the freezer freezes: heat energy comes out, liquid becomes solid. The two changes are each other's opposite, and the same heat-energy story explains both.

Boiling, and cooling back



Liquid water boils and becomes a gas. When the gas is cooled, it turns back into liquid water.

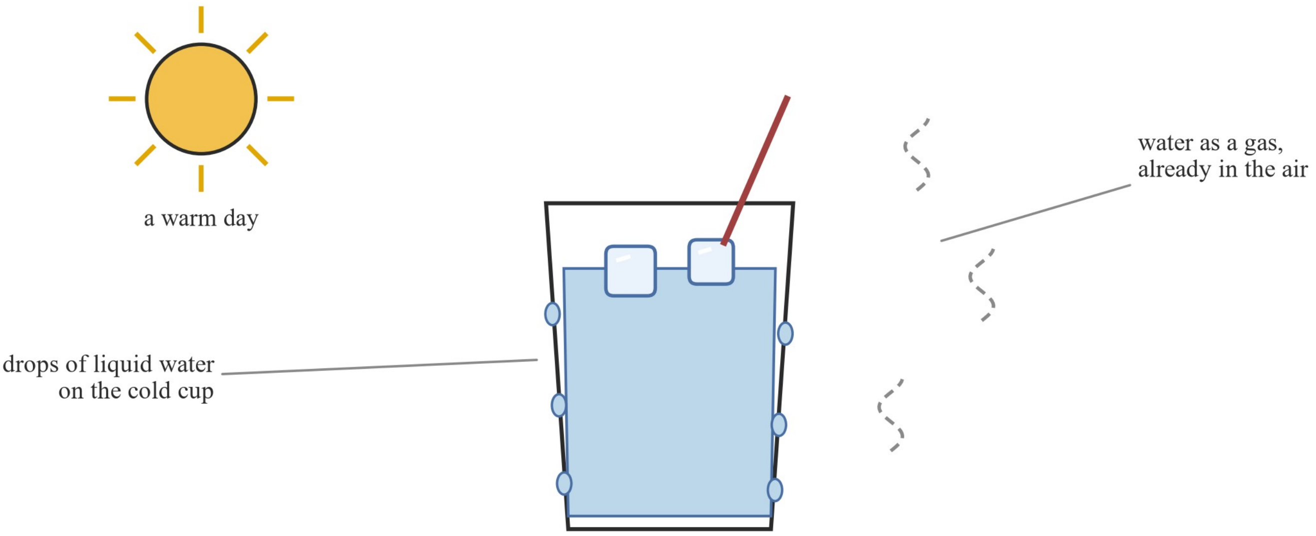
An electric kettle boils water on a bench. Water as a gas rises from the spout, and when it reaches a cold plate held above, the gas cools and turns back into drops of liquid water under the plate.

Your teacher can show you boiling with an electric kettle. As the water gets hotter and hotter, it boils: liquid water becomes water as a gas, and the gas rises from the spout. Hold a cold plate above the rising gas (teacher only) and the gas cools on the plate and turns back into drops of liquid water. Heat in, liquid to gas. Heat out, gas back to liquid.

Safety: the kettle and the plate are for the teacher to handle. Boiling water and the gas from it can burn. You watch from a safe spot — observing is a full science job.

Where do the drops on a cold cup come from?

Where do the drops on a cold cup come from?



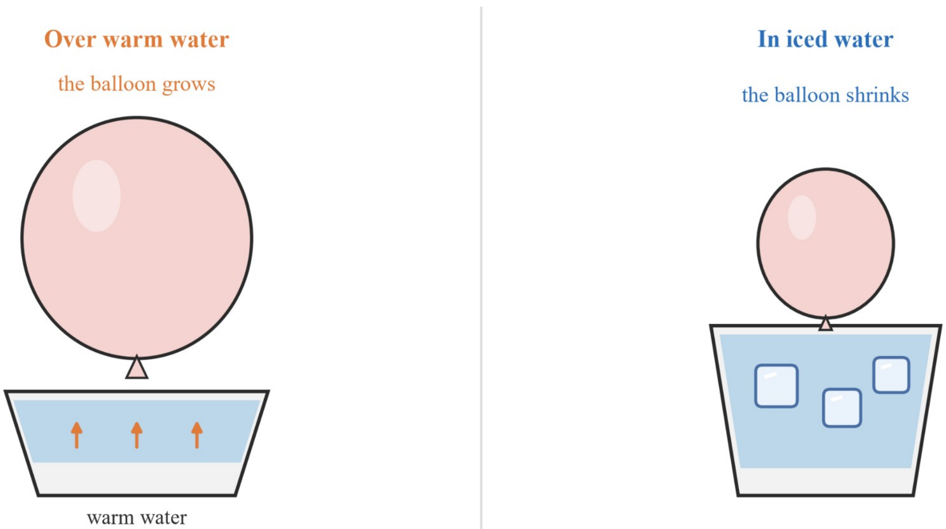
The cold cup cools the gas in the air, and it turns back into liquid water on the outside of the cup.

A cold drink cup on a warm day. Drops of liquid water form on the outside of the cup, made from water as a gas that was already in the air and cooled on the cold cup.

On a warm day, a cold drink cup gets wet on the **outside**. The drink did not leak through the cup — the water was already in the air, as a gas. The cold cup cooled the gas, and the gas turned back into liquid water on the cup. Gas → liquid, driven by heat energy going out. It is the same change as the drops under the cold plate at the kettle.

Gases fill the space

The same balloon, warm and cold

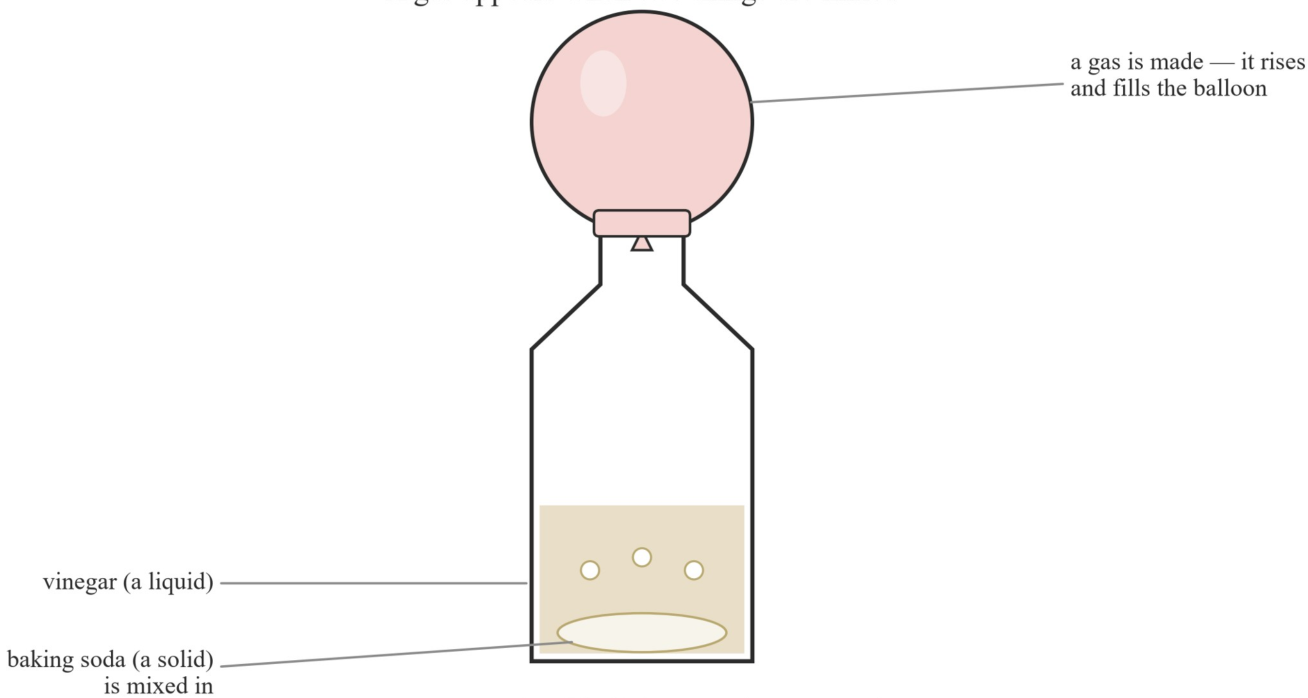


The air inside is a gas. It fills more space when it is warm, and less space when it is cold.

The same balloon held over a bowl of warm water grows, and held in a bucket of iced water shrinks, because the air inside the balloon is a gas.

Blow up a balloon and tie it off. The air inside is a gas. Hold the balloon over a bowl of warm water (an adult pours the water from a kettle) and the balloon grows: the warm air inside fills more space. Now sit the balloon in a bucket of iced water and it shrinks: the cooled air fills less space. The amount of air inside never changed — a gas just fills the space it has, more when warm and less when cold. That is what gases do.

A gas appears when two things are mixed



Gases spread to fill all the space they can reach.

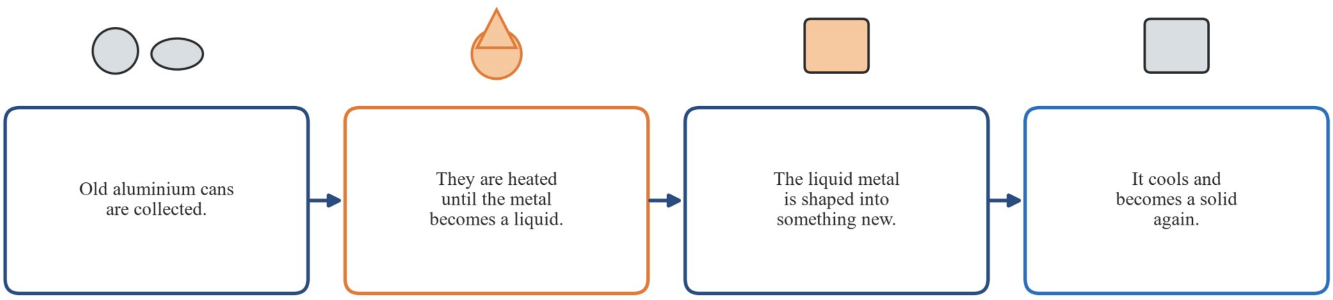
A bottle holds vinegar, a liquid, with baking soda, a white solid powder, mixed in. Bubbles rise and a gas is made; the gas fills the balloon fitted over the mouth of the bottle.

Here is one more gas fact your teacher can show. Baking soda is a solid (a fine white powder) and vinegar is a liquid. Mix them in a bottle with a balloon fitted over the mouth, and a gas appears: the bubbles rise, and the gas spreads to fill the balloon and blows it up. The gas is carbon dioxide — the same gas that makes fizzy drinks fizzy. Notice the gas fact doing the work: the gas was made in the bottom of the bottle, but it did not stay there. It rose and filled all the space it could reach. Gases fill the space.

Safety: this one is a teacher demo. Fit the balloon on so the gas can get through, and never seal the bottle shut — the gas needs somewhere to go.

Changes of state help us

Changes of state help recycle aluminium



solid → liquid → solid: the same changes of state you have met in this subtopic.

Four steps in recycling aluminium: old cans are collected; they are heated until the metal becomes a liquid; the liquid metal is shaped into something new; it cools and becomes a solid again.

Changes of state are not just kitchen science — they help us look after things. Think about an aluminium can, like a soft-drink can. Old cans are collected and heated until the metal melts into a liquid. The liquid metal is shaped into something new, then cooled until it is solid again. Solid → liquid → solid: the same changes of state you met in the kettle and the lunchbox, doing a big job. Glass and some plastics are recycled the same way. Melting and freezing are why one can become another can, again and again.

Words to know in 4A

Word	What it means here
state	the way a kind of stuff behaves: solid, liquid or gas
solid	holds its own shape; hard to squash
liquid	takes the shape of its container; hard to squash
gas	spreads to fill all the space it can; easy to squash
container	the thing holding a liquid or a gas
property	something about a thing you can notice or test
heat energy	what we add or remove to change a thing's state
melting	the change from solid to liquid (heat added)
freezing	the change from liquid to solid (heat removed)
boiling	the change from liquid to gas (enough heat added)
change of state	when a thing turns from one state into another

Worked examples

Example 1 — with steps

Sort these three into solid, liquid and gas: an ice cube, orange juice, and the air inside a balloon. Say the test you used for each.

Working	Comment
Ice cube: put it on a plate and it keeps its own shape — a cube. It does not pool or spread.	Test 1: it holds its own shape, so it is a **solid**. Being made of water does not matter; ice behaves like a solid.
Orange juice: in the glass it is glass-shaped; in the bottle it is bottle-shaped.	Test 2: it takes the shape of its container, so it is a **liquid**.
Air in a balloon: it spreads into every part of the balloon and fills it.	Test 3: it fills all the space it can, so it is a **gas**. The squash test agrees — a balloon is easy to squash.

∴ ice cube = solid, orange juice = liquid, air = gas — sorted by what each thing does, using the three tests.

Example 2 — with steps

A saucer of butter sits in a hot kitchen in the middle of summer. In the morning it is a hard block. By afternoon it is a soft pool. Name the change of state, and say what caused it.

Working	Comment
Morning: the butter holds its own shape — a block.	A block that holds its shape is behaving as a **solid**.
Afternoon: the butter is a pool; it has taken the shape of the saucer.	A pool that takes the shape of what holds it is behaving as a **liquid**.

Working	Comment
The change: solid → liquid. That change has a name.	Solid to liquid is **melting**.
What caused it: the kitchen was hot all day — heat energy went into the butter.	Every change of state here comes from adding or removing **heat energy**. This one added it.

∴ the butter **melted** — heat energy went in, and the solid butter changed state into liquid butter.

Example 3 — on your own

On a warm day, Zali's cold water bottle gets wet on the outside. "The lid must be leaking," she says. Is she right? Use a change of state to explain where the water on the outside comes from.

∴ Zali is not right — the water did not leak through the bottle. The air around the bottle holds water as a gas. The cold bottle cooled that gas, and the gas changed state back into liquid water on the outside of the bottle: gas → liquid, because heat energy came out. The water came from the air, not the lid.

Example 4 — on your own

A class hangs one balloon over a bowl of warm water and sits a second, blown up the same size, in a bucket of iced water. After ten minutes the first balloon has grown and the second has shrunk. Explain both changes, using what gases do.

∴ the air inside each balloon is a gas, and a gas fills the space it has. Over the warm water, the air inside warmed and filled more space, so the balloon grew. In the iced water, the air inside cooled and filled less space, so the balloon shrank. No air went in or out — the same gas filled more space when warm and less space when cold.

Practice questions

With steps

Q1. Name the state of each thing, and say the test that tells you: (a) a rock (b) milk (c) the air in a balloon

Q2. For each change, name it (melting, freezing or boiling) and say whether heat energy was added or removed: (a) a puddle of water in a very cold night turns to ice (b) ice-cream left on the bench turns to a pool (c) water in a kettle on until it bubbles turns to a gas

Q3. Copy the map of changes of state and fill in the gaps: (a) solid + heat added → ______ (b) liquid + heat removed → ______ (c) liquid + enough heat added → ______ (d) gas + heat removed → ______

Q4. Look at the squash diagram in the Theory. What happens when you press gently on: (a) a sealed bag of air? (b) a sealed bag of water? (c) a rock? (d) Which state is easy to squash?

Q5. Sort these into solids, liquids and gases: honey, an iron nail, the bubbles in lemonade, rain water, a wooden block, the wind.

Q6. Butter goes solid in the fridge and liquid on the bench on a hot day. (a) Name the change from fridge butter to bench butter. (b) Name the change from bench butter back to fridge butter. (c) What was added or removed each time?

On your own

Q7. Toothpaste comes out of the tube like a liquid but holds its shape on your brush like a solid. Run the three tests on toothpaste and say why it is tricky to sort.

Q8. Hari says the chocolate story in the Theory shows freezing, because the chocolate ended up in a different shape. Is Hari right? Explain, using the words *solid*, *liquid* and *heat energy*.

Q9. Your teacher boils water in a kettle and holds a cold plate above the spout. Drops of water appear under the plate. Explain where the drops come from, naming both changes of state you saw.

Q10. A sealed bag of air goes flat when you press it, but a sealed bag of water only bulges. What does this tell you about how a gas behaves compared with a liquid?

Q11. Old aluminium cans can become new cans. Use changes of state to explain how, naming each change and what caused it.

Q12. It is a cold morning in the Victorian Alps and the puddles on the walking track are solid. By the afternoon they are liquid again. (a) Name the change that happened in the night, before the walk. (b) Name the change that happened through the afternoon. (c) What was added or removed in each change?

Answers

Q1. (a) solid — it holds its own shape; (b) liquid — it takes the shape of its container; (c) gas — it spreads to fill all the space it can. **Q2.** (a) freezing, heat removed; (b) melting, heat added; (c) boiling, heat added. **Q3.** (a) liquid; (b) solid; (c) gas; (d) liquid. **Q4.** (a) the bag goes flat — the air squashes; (b) the bag bulges out sideways, it does not squash; (c) nothing happens; (d) a gas is easy to squash (a liquid and a solid are hard to squash). **Q5.** Solids: an iron nail, a wooden block. Liquids: honey, rain water. Gases: the bubbles in lemonade, the wind (moving air). **Q6.** (a) melting; (b) freezing; (c) melting added heat energy; freezing removed it. **Q7.** e.g. test 1: on the brush it holds a shape for a while, like a solid; test 2: squeezed from the tube it flows and takes a new shape, like a liquid. It does both, so it does not fit one group — a tricky sort. **Q8.** No — the chocolate started as a solid block and ended as a liquid pool, so the change was solid → liquid, which is melting. Heat energy from the hot day went **in**. Freezing would be liquid → solid, with heat coming out. **Q9.** e.g. the kettle boiled the water: liquid → gas (boiling, heat added). The gas rose and cooled on the cold plate: gas → liquid (heat removed), and that is the drops under the plate. **Q10.** e.g. a gas is easy to squash — it fills less space when pressed. A liquid is hard to squash — it keeps its space and moves sideways instead. That is one way to tell a gas from a liquid. **Q11.** e.g. the cans are heated until the aluminium melts (solid → liquid, heat added); the liquid metal is shaped; then it cools and freezes back into a solid (heat removed). Melting and freezing are what let one can become the next. **Q12.** (a) freezing (liquid → solid, heat removed in the night); (b) melting (solid → liquid, heat added through the afternoon); (c) freezing removed heat energy; melting added it.

Answers with every step

Q1. Run the tests. (a) A rock keeps its own shape no matter where you put it — bench, cup, pocket — so it passes test 1: a **solid**. (b) Milk is bottle-shaped in the bottle and glass-shaped in the glass: it takes the shape of its container, test 2, so a **liquid**. (c) The air in a balloon spreads through the whole balloon and fills it — test 3 — so a **gas**.

Q2. Match each story to a direction on the map. (a) Water turning to ice is liquid → solid: **freezing**, and heat energy was **removed** (the cold night took heat out). (b) Ice-cream turning to a pool is solid → liquid: **melting**, heat **added** from the warm room. (c) Bubbling kettle water turning to a gas is liquid → gas: **boiling**, heat **added** by the kettle.

Q3. Read the map each way. Adding heat energy: solid → **liquid** (a), and liquid → **gas** (c). Removing heat energy: liquid → **solid** (b), and gas → **liquid** (d). If you can read the map both ways, you can read every story in this subtopic.

Q4. The squash diagram shows all three. (a) The bag of air goes flat: the gas squashes. (b) The bag of water bulges out sideways: the liquid does not squash, it moves. (c) The rock does nothing at all: the solid does not squash. (d) So the **gas** is the state that is easy to squash — and that is also why a gas always fills its container, spreading into whatever space the squash leaves it.

Q5. Test each thing. Honey and rain water take the shape of what holds them: **liquids** (honey is a slow, thick liquid, but it still pools). An iron nail and a wooden block hold their own shapes: **solids**. The bubbles in lemonade are pockets of gas spreading out, and the wind is moving air — air fills all the space around you: **gases**.

Q6. (a) Fridge butter to bench butter is solid → liquid: **melting**. (b) Bench butter back in the fridge is liquid → solid: **freezing**. (c) On the bench, heat energy was **added** (the hot day warmed the butter); in the fridge, heat energy was **removed** (the fridge cooled it). Same butter, both directions of the map.

Q7. Test 1: squeezed onto the brush, toothpaste holds its shape for a while — solid-like. Test 2: squeezed from the tube, it flows and takes a new shape — liquid-like. Test 3: it never spreads to fill a room, so it is no gas. Because it passes test 1 sometimes and test 2 other times, toothpaste does not fit one group. That is what makes it a tricky sort, and the way through is the same as for slime and hair gel: say what the thing does, and when.

Q8. Hari has the story the wrong way round. In the morning the chocolate held its own shape (a solid block); by lunchtime it took the shape of the wrapper (a liquid pool). Solid → liquid is **melting**, not freezing — and it happened because heat energy from the hot day went **in**. Freezing is the other arrow: liquid → solid, heat out. The different shape at the end is exactly what a liquid does: it takes the shape of its container.

Q9. Two changes of state, one story. First, the kettle added heat energy until the water **boiled**: liquid → gas, and the gas rose from the spout. Second, the cold plate removed heat energy from the gas, so it turned back into liquid water: gas → liquid, and that is the drops under the plate. Heat in made the gas; heat out brought it back.

Q10. Pressing shows the difference between the two states. The bag of air went flat because a gas is easy to squash — it simply fills less space. The bag of water bulged because a liquid is hard to squash — it keeps the same space and moves out of the way instead. So one good way to tell a gas from a liquid is the squash test: gases are easy to squash, and liquids are not.

Q11. Follow the aluminium around. The old cans are **heated** until the metal **melts** — solid → liquid, heat added. Now liquid, the metal can be poured and shaped into something new. Then it is **cooled** until it **freezes** back into a solid — heat removed. The pair of changes of state you met with butter and ice-cream is the same pair that lets one can become the next, so the metal is used again instead of thrown away.

Q12. (a) In the night the puddles went liquid → solid: **freezing**, because the cold night **removed** heat energy from the water. (b) Through the afternoon the Sun **added** heat energy and the ice went solid → liquid: **melting**. (c) So freezing removed heat energy and melting added it — the same two arrows of the map, drawn on a walking track in the Alps.

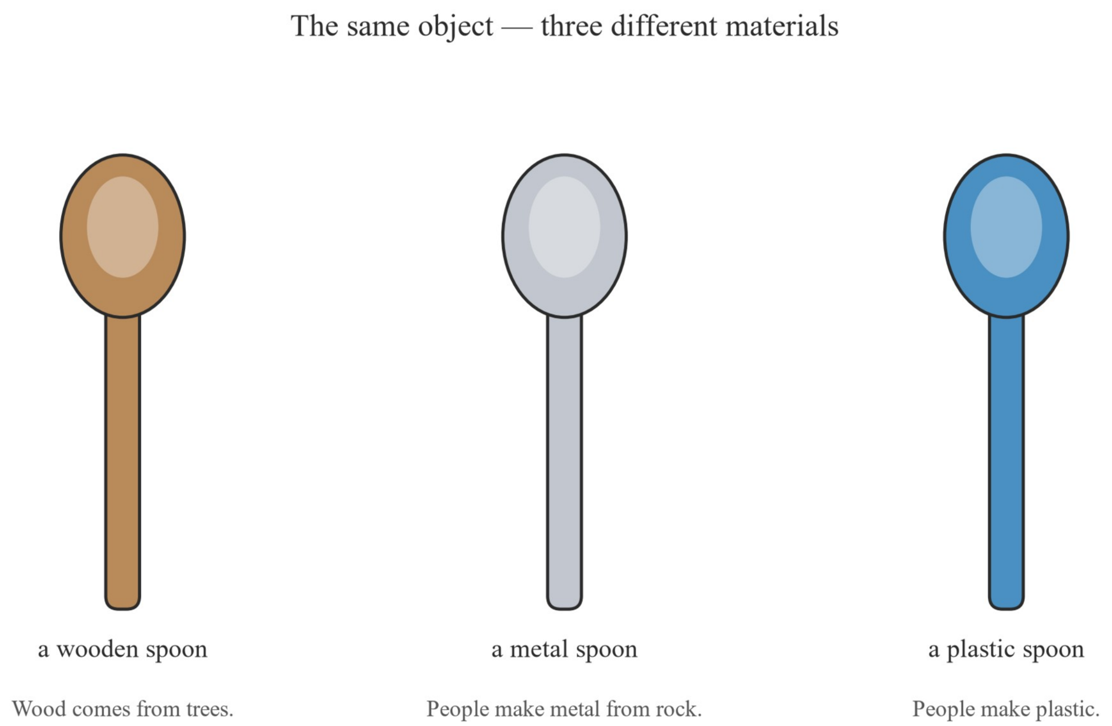
Choosing, using and re-using materials

> **What we teach here** — `VC2S4U05` (Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4): “the properties of natural and made materials, including fibres, metals, glass and plastics, influence their use and re-use”. **In our words:** everything you can pick up is made of one or more materials, and what a material is like — its properties — decides the jobs it is given, and whether it can be used again or made into something new. The teaching contexts come from the elaborations of `VC2S4U05` (`.E01`, `.E02`, `.E05` and `.E06`). `VC2S4U05.E03` and `.E04` are reserved under the ICIP decision and are not taught here.

Theory

Objects and materials

A **material** is what a thing is made of. An **object** is the thing itself. Take a spoon. The object is “spoon”, but the material might be wood, or metal, or plastic.



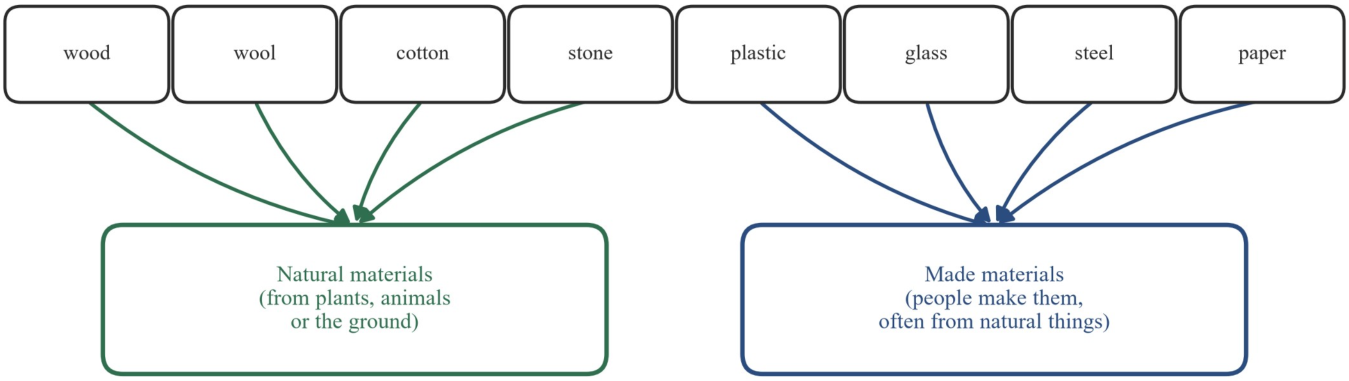
Three spoons of the same shape side by side: a wooden spoon, a metal spoon and a plastic spoon. Labels say wood comes from trees, people make metal from rock, and people make plastic.

The same object can be made from different materials. That is why science always says both: the object, and the material it is made of.

Natural and made materials

Materials come from two places. **Natural** materials come from plants, animals or the ground: wood from trees, wool from sheep, cotton from cotton plants, stone from the ground. **Made** materials are made by people, very often from natural things: people make paper from wood, glass from sand, steel from metal rock, and plastic from things taken from the ground.

Where do materials come from?



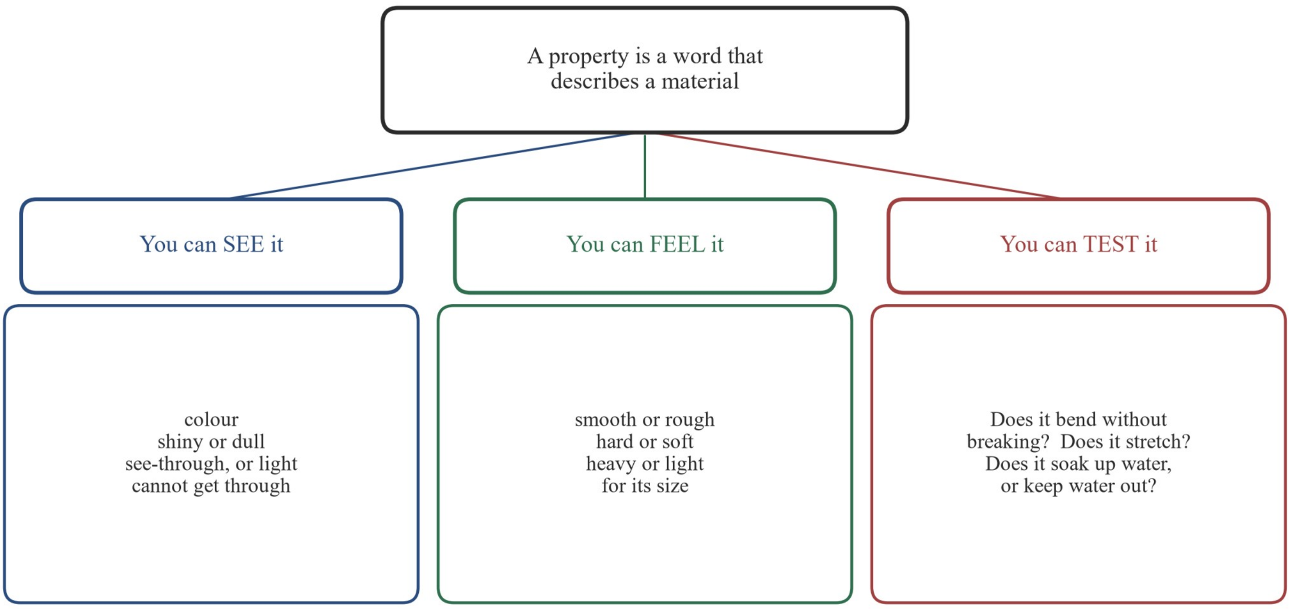
A sorting diagram. Eight cards — wood, wool, cotton, stone, plastic, glass, steel and paper — are sorted into two boxes. Natural materials, from plants, animals or the ground, take wood, wool, cotton and stone. Made materials, made by people, often from natural things, take plastic, glass, steel and paper.

Paper is a tricky one. It starts life as a tree, but a tree is not paper. Paper is a made material, because people make it.

Property words

A **property** is a word that describes a material — something about it you can see, feel or test.

Property words — how do you find them out?

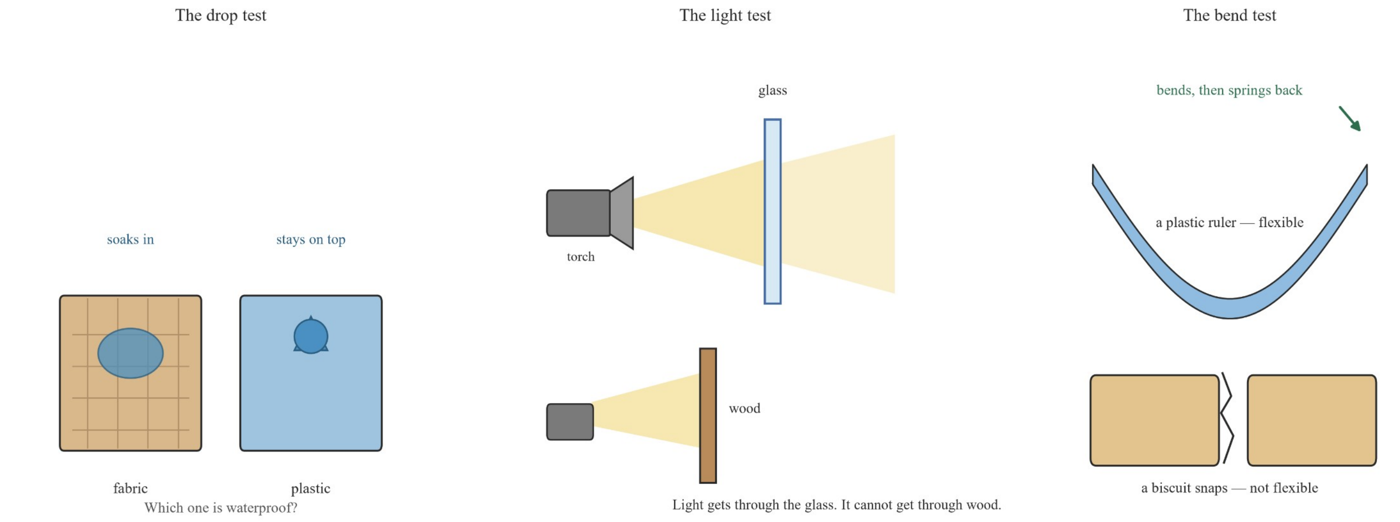


A word map. At the top, one box: a property is a word that describes a material. Three branches. Words you can see: colour, shiny or dull, see-through or light cannot get through. Words you can feel: smooth or rough, hard or soft, heavy or light for its size. Words you can test: does it bend without breaking, does it stretch, does it soak up water or keep water out.

Property words let us say exactly why a material is right for a job. “It is strong” says more than “I like it”.

Three quick tests

Properties are not just said — they are tested. Here are three tests you can run in class.



Three panels of simple material tests. The drop test: a drop of water on fabric soaks in, and a drop on plastic stays on top, so the plastic keeps water out. The light test: a torch beam gets through a piece of glass but not through a piece of wood. The bend test: a plastic ruler bends and springs back, and a biscuit snaps instead of bending.

- **The drop test** — put a drop of water on the material. If the water soaks in, the material soaks up water. If the drop sits on top, the material keeps water out. A material that keeps water out is **waterproof**.
- **The light test** — shine a torch at the material. If light gets through, the material is **see-through**. If not, light cannot get through it.
- **The bend test** — bend the material gently. If it bends and springs back, it is **flexible**. If it snaps, it is not.

Safety: water stays over a tray so the bench stays dry, and the torch is passed, not thrown.

The four families

Most of the materials around you belong to one of four big families: **fibres**, **metals**, **glass** and **plastics**.

Four panels, one for each material family. Fibres: a cotton T-shirt and a wool sock — soft, easy to bend, most soak up water. Metals: an aluminium drink can and a steel saucepan — strong, hard, shiny, keep water out. Glass: a glass jar — see-through, hard, keeps its shape, breaks if dropped. Plastics: a drink bottle and a lunch box — light for their size, keep water out, can be made into many shapes.

Fibres are thin threads made into cloth. Cotton comes from a plant and wool comes from a sheep, so those are natural fibres. Fibres are soft and easy to bend, and most soak up water — just right for clothes and towels.

Metals are strong and hard, and shiny when clean. They keep water out. Aluminium, a light metal, and steel, a strong metal, are the two you meet most often.

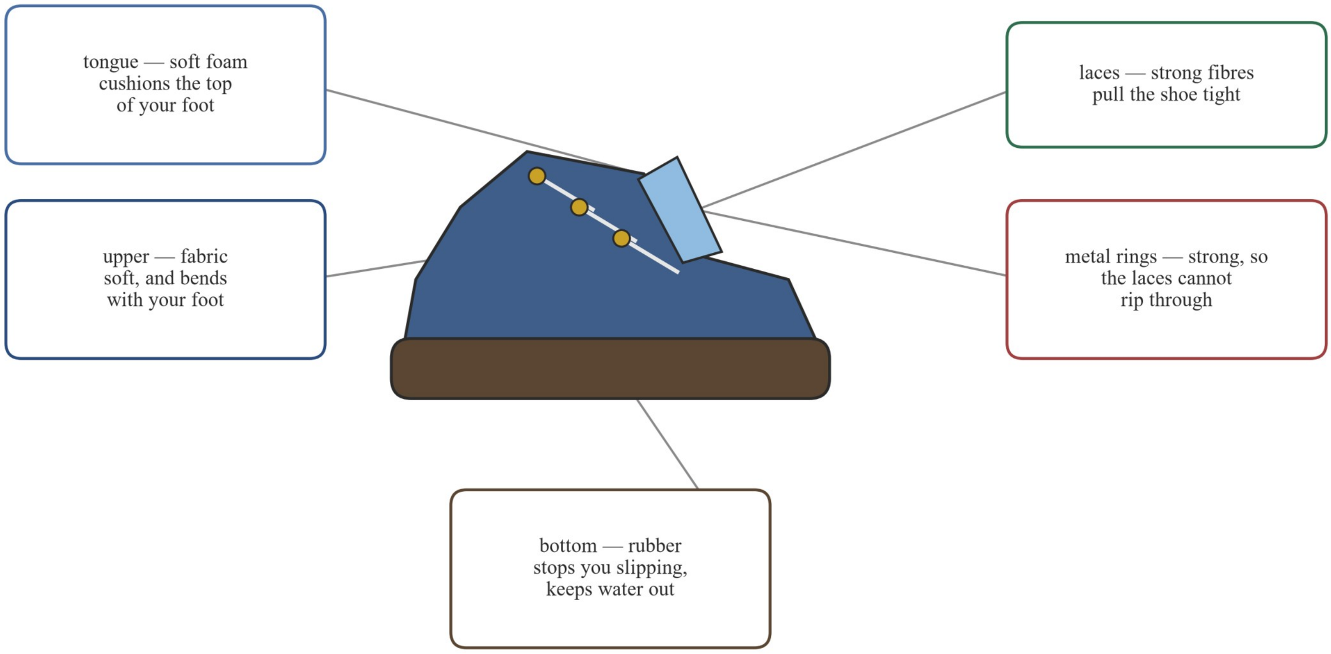
Glass is see-through and hard, and it keeps its shape. Its weak spot is that it breaks if you drop it.

Plastics are light for their size, keep water out, and can be made into almost any shape. That is why plastic is used for so many things — and why choosing the right plastic matters, as we will see when we get to recycling.

One object, many materials

An object is usually made of several materials at once, because an object has several jobs and no one material does all of them well.

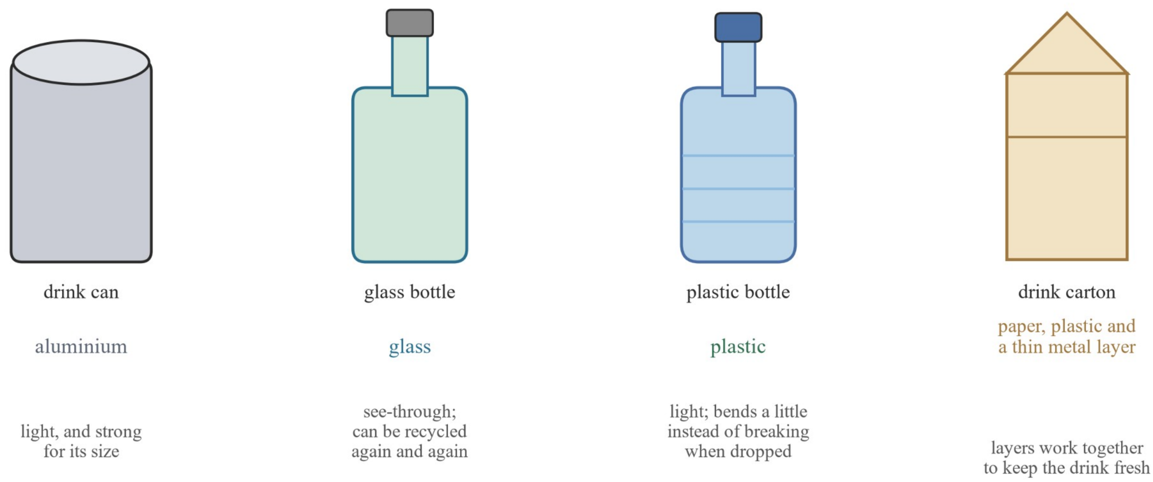
One object, many materials: a school shoe



A labelled school shoe. The laces are strong fibres that hold the shoe on your foot. Small metal rings stop the laces ripping through. The tongue is soft foam that makes the top of the foot comfortable. The upper is fabric, soft and able to bend with the foot. The bottom is rubber, which stops you slipping and keeps water out.

Every part of the shoe is a material chosen for a property. The bottom has to stop you slipping and keep water out, so it is rubber. The upper has to bend with your foot, so it is fabric. The little rings sit where the laces pull hard, so they are metal. Ask of any object: *what job does this part do, and which property does its material bring?*

Drink containers — which material, and why?

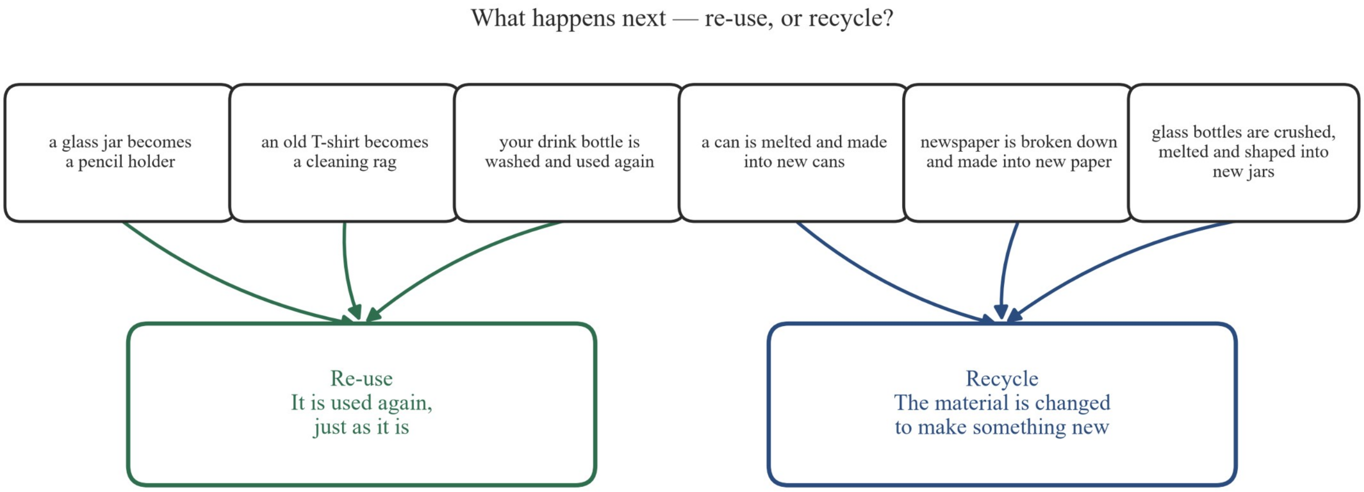


Four drink containers with labels. An aluminium drink can is light, and strong for its size. A glass bottle is see-through, and can be recycled again and again. A plastic drink bottle is light, and bends a little instead of breaking when dropped. A drink carton is paper, plastic and a thin metal layer, working together to keep the drink fresh.

Drink containers show the same idea. A can has to be light to carry and strong in your bag: aluminium. A bottle for sport has to be light and must not break if it is dropped: plastic. A carton keeps light and air out with its layers: paper, a little plastic and a thin metal layer, all stuck together.

Re-use and recycle

When we finish with a thing, two good things can happen instead of the bin. **Re-use** means the thing is used again, just as it is. **Recycle** means the material is changed to make something new.

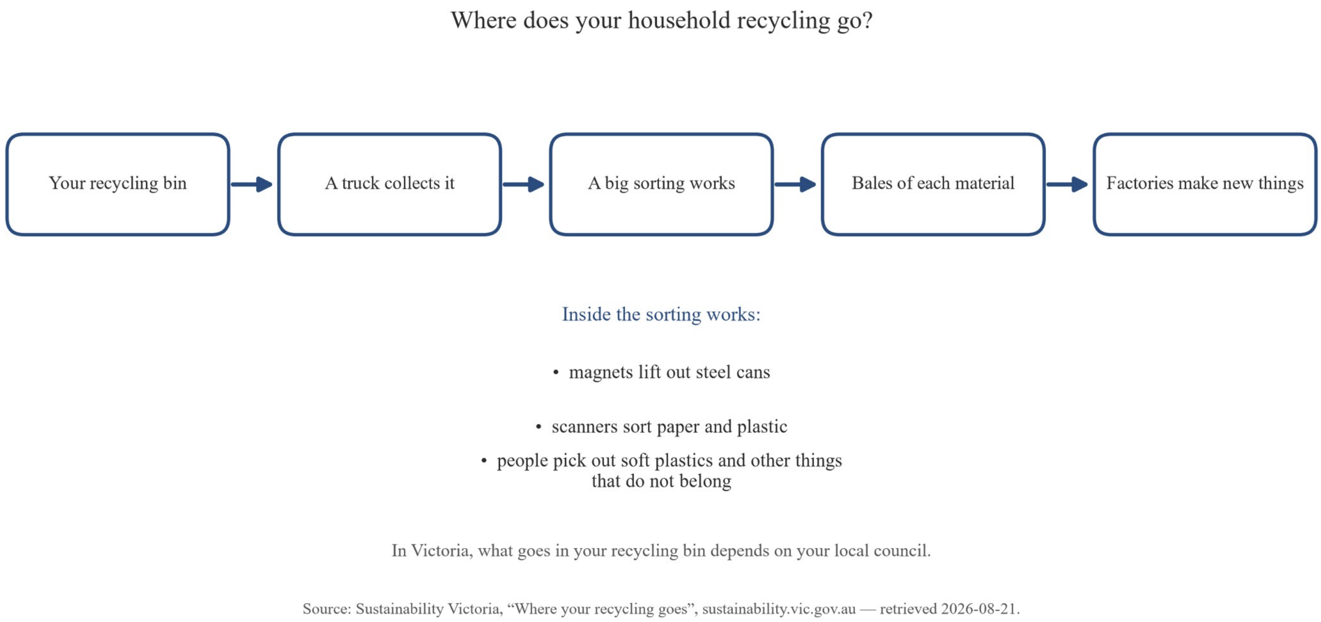


A sorting diagram with two boxes. Re-use, used again just as it is: a glass jar becomes a pencil holder, an old T-shirt becomes a cleaning rag, a drink bottle is washed and used again. Recycle, the material is changed to make something new: a can is melted and made into new cans, newspaper is broken down and made into new paper, glass bottles are crushed, melted and shaped into new jars.

You may already know that re-using and recycling are good ways to look after things. This subtopic asks the science question behind that: *why* can this material be recycled and that one not? The answer is always about properties.

Recycling also uses science you met in 4A. Recycling metal and glass is melting and freezing done on purpose: the old metal is heated until it melts, shaped, and cooled until it is solid again.

Why can some materials be recycled and others not?

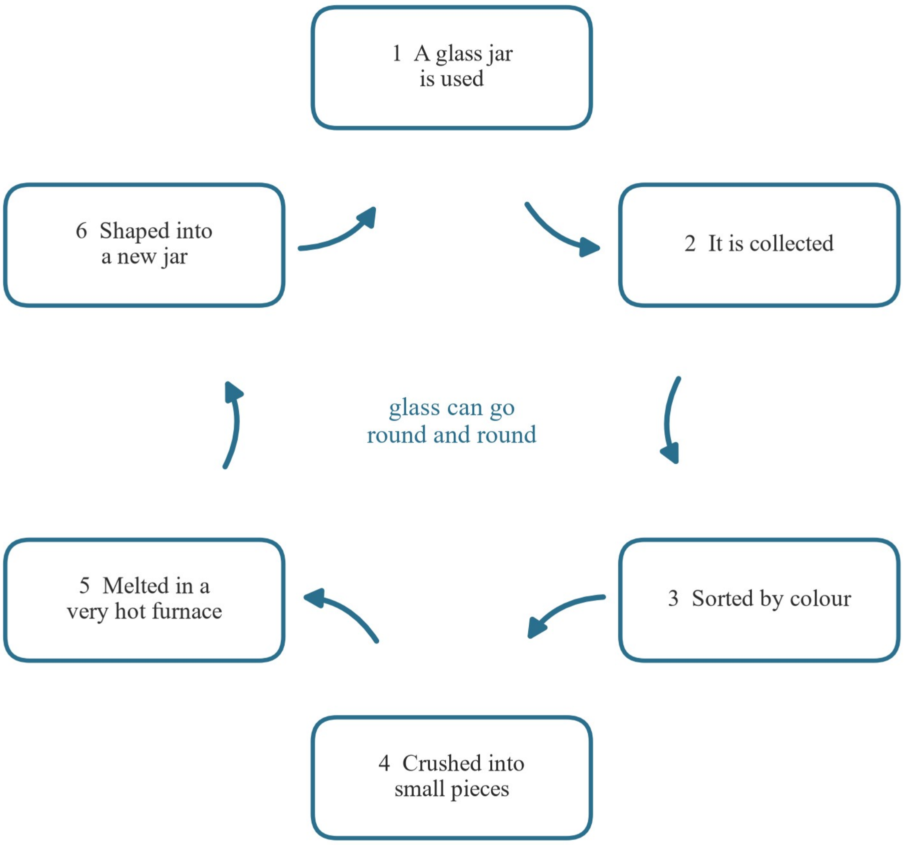


A flow chart of the recycling journey in Victoria: your recycling bin, a truck collects it, a big sorting works, big bundles of each material, factories make new things. Inside the sorting works: magnets lift out steel cans, scanners sort paper and plastic, and people pick out soft plastics and other things that do not belong.

In Victoria, your recycling bin goes to a big sorting works. Machines and people sort it into piles of one material each — magnets lift out the steel, scanners sort paper and plastic — and each pile is made into something new. Notice what that needs: the material must be **easy to sort** and **easy to change**. That is a property argument.

- **Glass** is one material, and melting does not wear it out, so glass can be recycled again and again.
- **Metals** also melt and can be shaped again and again, like glass.
- **Paper** can be broken down and made into new paper, but its fibres get a little shorter each time, so paper is recycled only a few times.
- **Plastics** are the tricky family. There are many kinds of plastic, and they must be sorted kind by kind. Soft plastics like bags and wrappers do not belong in your recycling bin at all — at the sorting works they have to be picked out by hand.
- **Mixed materials** are the hardest of all. A drink carton is paper, plastic and metal stuck together. A crisp packet is shiny plastic stuck to thin metal. The more materials are stuck together, the harder they are to separate, and the harder they are to recycle.

The glass loop



Recycling does not wear glass out — it can be recycled again and again.

Source: Sustainability Victoria, "Where your recycling goes", sustainability.vic.gov.au — retrieved 2026-08-21.

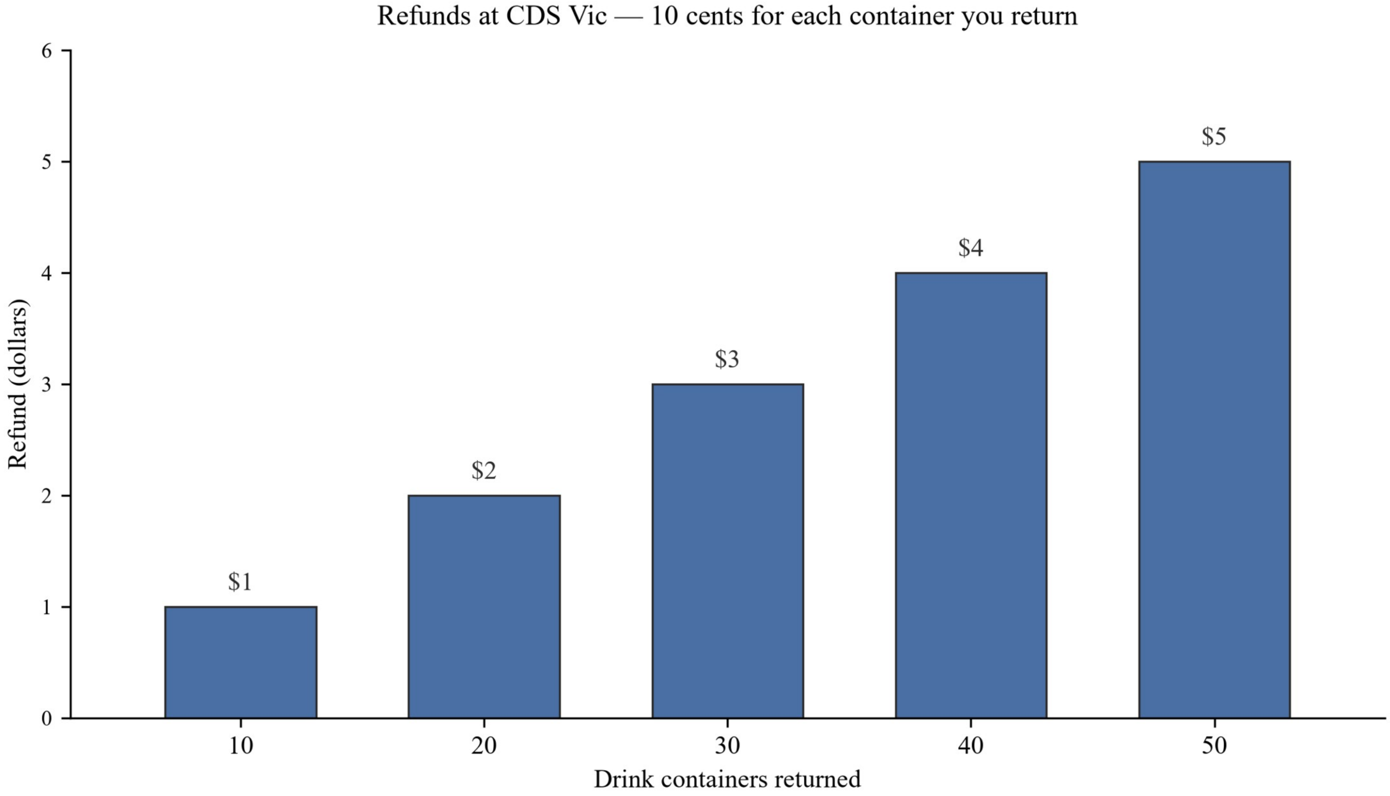
A loop of six steps a glass jar goes through: the jar is used; it is collected; it is sorted by colour; it is crushed into small pieces; it is melted until it is liquid; it is shaped into a new jar. The middle of the loop says glass can go round and round.

So the answer to "why can this be recycled and that one cannot?" is: look at the properties. One material, easy to sort, easy to melt or break down — recycled. Many materials stuck together — hard to separate, hard to recycle.

Source: Sustainability Victoria, "Where your recycling goes", sustainability.vic.gov.au — retrieved 2026-08-21.

A real Victorian story: CDS Vic

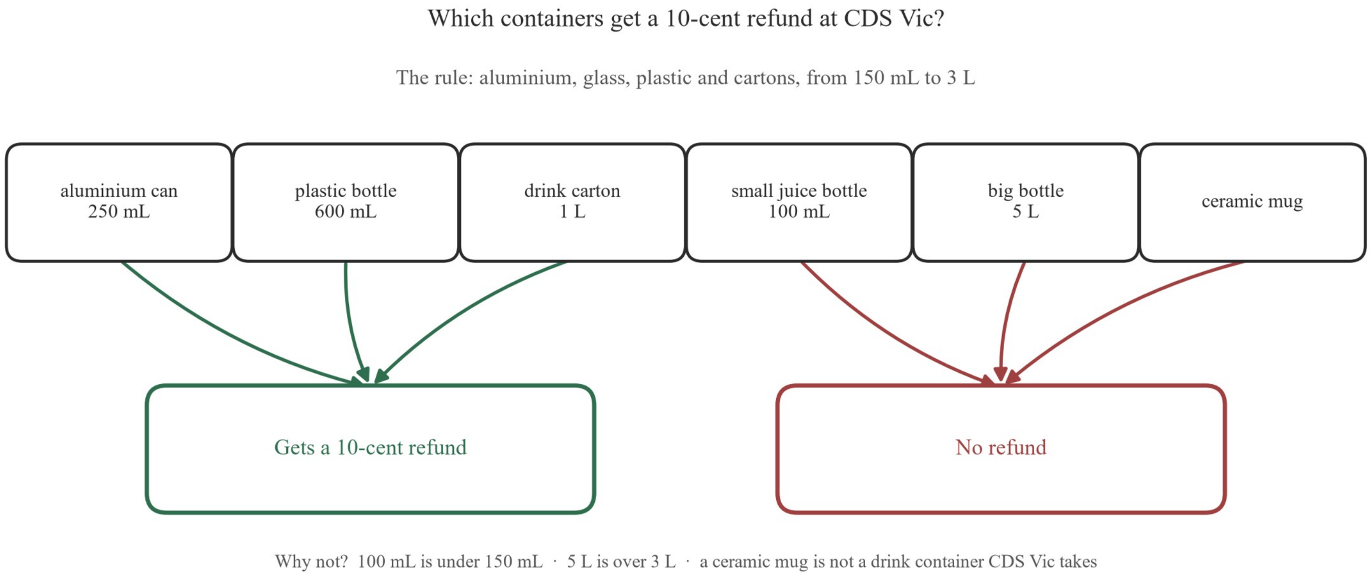
Victoria pays you back for returning drink containers. CDS Vic gives a 10-cent refund for each drink container it takes — most containers between 150 mL and 3 L, made of aluminium, glass, plastic or carton. There are more than 600 places across Victoria to return them.



Source: CDS Vic (Victoria's Container Deposit Scheme), refund and container rules, cdsvic.org.au — retrieved 2026-08-21.

A column graph titled "Refunds at CDS Vic — 10 cents for each container you return". Along the bottom are the drink containers returned, at 10, 20, 30, 40 and 50. Up the side is the refund in dollars, and the columns show $1, $2, $3, $4 and $5.

The graph is just the 10-cent rule counted up: 10 containers is $1, and every 10 more adds another dollar. Returned containers are recycled into new ones — the property argument again: a can is one material (aluminium), easy to sort and easy to melt.



A sorting diagram of the CDS Vic rule. An aluminium can of 250 mL, a plastic bottle of 600 mL and a drink carton of 1 L get a 10-cent refund. A small juice bottle of 100 mL, a big bottle of 5 L and a ceramic mug get no refund: 100 mL is under 150 mL, 5 L is over 3 L, and a mug is not a drink container CDS Vic takes.

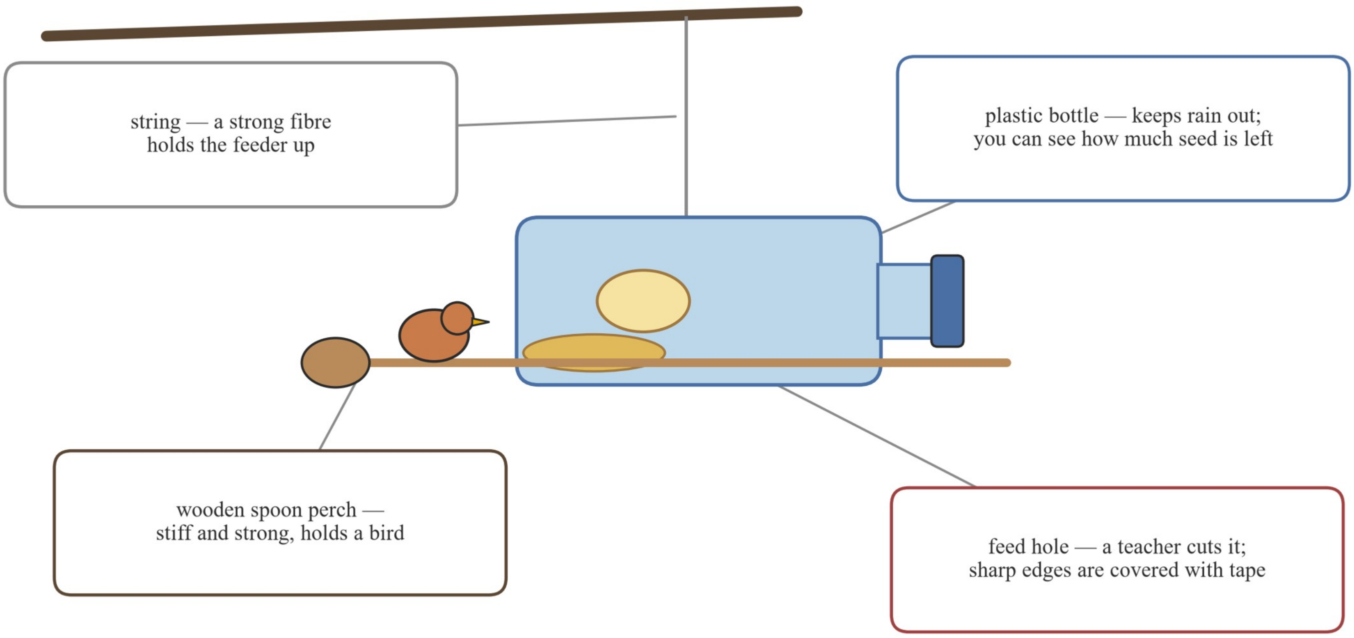
The size rule matters too. A container under 150 mL is too small and a container over 3 L is too big, so they do not get the refund. And a mug is not a drink container at all, so it does not count.

Source: CDS Vic (Victoria's Container Deposit Scheme), refund and container rules, cdsvic.org.au — retrieved 2026-08-21.

Design and build: a bird feeder

Knowing properties lets you *choose* materials for a job. That is what designing is.

Design and build: a bird feeder



Each part has a job. Each material was chosen for its properties.

A labelled bird feeder made from a plastic bottle on its side, hung from a branch with string. The string is a strong fibre that holds the feeder up. The plastic bottle keeps rain out and lets you see how much seed is left. A wooden spoon pushed through the bottle is a perch, stiff and strong enough to hold a bird. A feed hole is cut by a teacher, and its sharp edges are covered with tape.

Every part of the feeder was chosen for a property: the bottle is waterproof so the seed stays dry, and see-through so you can see when the seed is running out; the spoon perch is stiff and strong; the string is a strong fibre.

Your turn (in small groups, with an adult): design, build and test an object for a purpose — a bird feeder like this one, a lunch box, or a little tent for a toy. Write down each part, its material, and the property you chose it for. Then test it: for the feeder, tip a little water over the roof and check the seed stays dry.

Safety: an adult does all cutting, and sharp edges are covered with tape. Wash your hands after handling bird seed.

Words to know in 4B

Word	What it means here
material	what a thing is made of
object	the thing itself
natural	from plants, animals or the ground
made	made by people, often from natural things
property	a word that describes a material
waterproof	keeps water out

Word	What it means here
see-through	light can get through it
flexible	bends without breaking, and springs back
fibre	a thin thread made into cloth; one of the four families
metal	strong, hard, shiny family; keeps water out
glass	see-through, hard family; breaks if dropped
plastic	light, waterproof family; can be made into many shapes
re-use	use a thing again, just as it is
recycle	change the material to make something new

Worked examples

Example 1 — with steps

A class is going on a walk on a wet day. Each student needs something to keep the rain off. Choose from: a paper bag, a plastic raincoat, a wool jumper. Say the property you use each time.

Working	Comment
Paper bag: the drop test — water soaks into paper.	Paper soaks up water, so it is not waterproof. Wrong material for rain.
Wool jumper: wool soaks up water too, and it is made to keep you warm, not dry.	Not waterproof either. Right job, wrong material.
Plastic raincoat: the drop test — water sits on top of plastic and runs off.	Plastic keeps water out: it is **waterproof**. Right material for the job.

∴ the plastic raincoat, because keeping rain out needs a waterproof material, and plastic is waterproof while paper and wool soak up water.

Example 2 — with steps

Use the CDS Vic graph. A class collects 40 drink containers and returns them. (a) Read the refund off the graph. (b) Check it without the graph. (c) The class spends the money on a bird-feeder kit that costs $3. How much is left?

Working	Comment
(a) Find 40 on the bottom of the graph; the column above 40 reaches $4.	Reading a column graph: up from the number, across to the dollars.
(b) 40 containers at 10 cents each is 40 tens of cents: 10 give $1, so 40 give $4.	The graph and the count agree — a good habit from 1C.
(c) $4 − $3 = $1.	Whole dollars only.

∴ the refund is $4, and $1 is left after buying the kit.

Example 3 — on your own

Sort these into re-use and recycle: (a) an old jar becomes a home for pencils; (b) old newspaper is broken down and made into new paper; (c) a drink bottle is washed and filled again; (d) steel cans are melted and made into new cans. Say the rule you sorted by.

∴ re-use: (a) and (c) — the thing is used again just as it is. Recycle: (b) and (d) — the material is changed to make something new. The rule: re-use keeps the thing; recycle changes the material.

Example 4 — on your own

A glass jar and a crisp packet both go in the bin after lunch. The jar can be recycled again and again in Victoria. The crisp packet cannot go in the recycling bin at all. Explain both, using properties.

∴ the jar is one material (glass), so it is easy to sort, and melting does not wear glass out — it can go round the loop again and again. The crisp packet is shiny plastic stuck to thin metal: two materials stuck together are hard to separate, and materials that cannot be separated cannot be recycled. Properties decide.

Practice questions

With steps

Q1. Look at the three spoons in the Theory. Name the object, then the three materials, and say which materials are natural and which are made.

Q2. Sort these into natural and made: wool, glass, cotton, steel, wood, plastic, paper, stone.

Q3. Name the property: (a) light can get through it (b) it keeps water out (c) it bends without breaking and springs back (d) water soaks into it

Q4. For each object, name the family (fibre, metal, glass or plastic) and one property that makes it right for the job: (a) a saucepan (b) a T-shirt (c) a see-through drink bottle that does not break in a sports bag (d) a jar you can see into

Q5. Name three parts of the school shoe, the material of each, and the property that material brings.

Q6. Sort into re-use or recycle: (a) an ice-cream tub becomes a pot for a plant (b) aluminium cans are melted and made into new cans (c) your water bottle is washed and used all term (d) glass bottles are crushed, melted and shaped into new jars

On your own

Q7. Look at the drink containers in the Theory. Why is a sports-day drink bottle plastic and not glass? Use two properties.

Q8. Use the CDS Vic rule and graph. (a) What refund do 30 containers get? (b) Which of these get the 10-cent refund: a 250 mL can, a 600 mL bottle, a 5 L bottle? Say why each does or does not.

Q9. Glass can be recycled again and again, but paper can only be recycled a few times. Explain the difference, using what happens to each material.

Q10. The bird feeder uses a plastic bottle, a wooden spoon and string. Choose two of those parts and say the job, the material, and the property that makes it right.

Q11. A crisp packet is shiny plastic stuck to thin metal. Explain why it cannot go in the recycling bin, even though metal and plastic can each be recycled.

Q12. A drink carton is paper, a little plastic and a thin metal layer stuck together. Use the property argument to explain why cartons are harder to recycle than a glass bottle.

Answers

Q1. The object is a spoon. Materials: wood (natural), metal (made), plastic (made). **Q2.** Natural: wool, cotton, wood, stone. Made: glass, steel, plastic, paper. **Q3.** (a) see-through; (b) waterproof; (c) flexible; (d) soaks up water. **Q4.** (a) metal — strong and hard for cooking; (b) fibre — soft and easy to bend; (c) plastic — light and does not break if dropped; (d) glass — see-through. **Q5.** Any three, e.g. bottom — rubber — stops slipping and keeps water out; upper — fabric — soft and bends with the foot; laces — strong fibres — hold the shoe on your foot; rings — metal — strong where the laces pull. **Q6.** Re-use: (a), (c). Recycle: (b), (d). **Q7.** e.g. plastic is light to carry, and it bends a little instead of breaking when dropped; glass is heavy for its size and breaks if dropped. **Q8.** (a) $3. (b) The 250 mL can and the 600 mL bottle get it — they are between 150 mL and 3 L. The 5 L bottle does not — it is over 3 L. **Q9.** e.g. melting does not wear glass out, so it can go round the loop again and again; paper's fibres get shorter each time it is broken down, so after a few times the fibres are too short to make new paper. **Q10.** e.g. bottle — plastic — waterproof, so the seed stays dry, and see-through, so you can see when the seed is running out; spoon — wood — stiff and strong, so it holds a bird; string — strong fibre — holds the feeder up. **Q11.** e.g. the packet is two materials stuck together; at the sorting works they cannot be separated, and materials that cannot be separated cannot be recycled. **Q12.** e.g. the bottle is one material, easy to sort and easy to melt; the carton is three materials stuck together, and stuck-together materials are hard to separate, so the carton is harder to recycle.

Answers with every step

Q1. The object is the thing you hold — a spoon. The materials are what each spoon is made of: wood, metal and plastic. Wood comes from a tree, so it is natural. Metal is made by people from metal rock, and plastic is made by people, so both are made materials.

Q2. Run the where-from test. Wool comes from sheep, cotton from a plant, wood from a tree and stone from the ground: **natural**. Glass is made from sand, steel from metal rock, plastic from things taken from the ground, and paper from wood — all made by people: **made**. Paper is the trap: it starts as a tree, but people make it, so it is made.

Q3. Match each line to a test. (a) Light getting through is the light test: **see-through**. (b) Water kept out is the drop test: **waterproof**. (c) Bending without breaking and springing back is the bend test: **flexible**. (d) Water going in is also the drop test: the material **soaks up water**.

Q4. Name the family, then the property that does the job. (a) A saucepan is **metal** — strong and hard, so it can sit over heat and hold food. (b) A T-shirt is **fibre** (cotton) — soft and easy to bend, so it is comfortable to wear. (c) A sports-bag bottle is **plastic** — light to carry, and it bends a little instead of breaking when dropped. (d) A jar you can see into is **glass** — see-through, so you can find what is inside.

Q5. Any three parts with the right property. The **bottom** is rubber: it stops you slipping and keeps water out (waterproof). The **upper** is fabric: soft, and it bends with your foot (flexible). The **laces** are strong fibres: they hold the shoe on your foot without ripping (strong). The little **rings** are metal: strong where the laces pull. The **tongue** is soft foam: it makes the top of your foot comfortable (soft).

Q6. Apply the rule: re-use keeps the thing as it is; recycle changes the material. (a) The tub stays a tub and holds a plant: **re-use**. (b) Cans are melted and become new cans — the material is changed: **recycle**. (c) The bottle is washed and used again as a bottle: **re-use**. (d) Bottles are crushed and melted into new jars — the material is changed: **recycle**.

Q7. Two properties, two reasons. Glass is see-through and hard, but it breaks if dropped and is heavy for its size — wrong for a bag that gets thrown around. Plastic is light to carry, and in the bend test it bends a little instead of breaking — right for sport. So the sports-day bottle is plastic: light, and it does not break when dropped.

Q8. (a) Up from 30 on the graph, the column reaches **$3** — and the count agrees: 30 containers at 10 cents each is three lots of $1. (b) The rule is 150 mL–3 L. The 250 mL can is inside the window: refund. The 600 mL bottle is inside the window: refund. The 5 L bottle is over 3 L: **no refund**. Size is part of the rule as well as material.

Q9. Follow each material round its loop. Glass is crushed and melted, and the melted glass is as good as new glass — melting does not wear it out — so the loop can go round and round. Paper is broken down and its fibres are made into new paper, but the fibres get a little shorter each time; after a few times round, they are too short to hold together, so paper's loop stops. Same idea, different properties.

Q10. Two parts, each as job–material–property. The **bottle** is plastic: its job is to hold seed and keep rain out, and plastic is waterproof — and see-through, so you can see when the seed is running out. The **spoon** is wood: its job is a perch, and wood is stiff and strong, so it holds a bird. The **string** is fibre: its job is holding the feeder up, and the fibre is strong.

Q11. The packet looks like two recyclable materials, but they are stuck together in one thin sheet. At the sorting works, recycling needs piles of one material each, and there is no machine that can pull the metal off the plastic. Materials that cannot be separated cannot be recycled — so the packet does not belong in the recycling bin, even though metal and plastic, on their own, can be.

Q12. Compare the two, material by material. The glass bottle is one material: easy to sort (it is glass, and nothing else) and easy to change (it melts without wearing out). The carton is three materials stuck together — paper for strength, plastic to keep liquid out, metal to keep light out — and that is exactly what makes it good at its job and hard to recycle: stuck-together materials must be separated before they can be recycled, and separating paper, plastic and metal from one carton is hard. Properties choose the use, and the same properties decide the re-use.

Chapter 4 check-up — Chemical sciences

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 4 check-up · Codes `VC2S4U04` (4A), `VC2S4U05` (4B)**
>
> **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 4 teaches. The extracts, word for word:

> *They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state.* — `VC2S4U04` (4A)
>
> *They relate the use and re-use of materials to the materials' properties.* — `VC2S4U05` (4B)

The words in this check-up are the words you learned in Chapter 4. If you need them, the word lists are at the end of 4A and 4B.

In this check-up you will:

- sort three things into solid, liquid and gas (A1)
- say which state is easy to squash (A2)
- name and label changes of state (A3, A4)
- sort materials into natural and made (A5)
- name the four material families (A6)
- match property words to what they mean (A7)
- say whether a thing is re-used or recycled (A8)
- explain a melted lunchbox with heat energy (B1)
- compare a glass jar with a crisp packet (B2)
- make a re-use and recycle sort table (B3)

Part A — 8 marks

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

A1. *(1 mark · `VC2S4U04`)* Sort these three into **solid**, **liquid** and **gas**:

1. the air inside a balloon
2. orange juice
3. an iron nail

A2. *(1 mark · `VC2S4U04`)* Press gently on a sealed bag of air and it goes flat. Press on a sealed bag of water and it bulges out sideways instead. Identify the state that is easy to squash.

A3. *(1 mark · `VC2S4U04`)* Name the change of state when a liquid becomes a gas.

A4. *(1 mark · `VC2S4U04`)* On a cold night in the Victorian Alps, heat energy leaves the puddles on the walking track, and the water turns to solid ice. Label this change of state.

A5. *(1 mark · `VC2S4U05`)* Classify each material as **natural** or **made**:

(a) wool
(b) steel

A6. *(1 mark · `VC2S4U05`)* Name the four material families.

A7. *(1 mark · `VC2S4U05`)* Match each property word to what it means. Draw a line from each word to the right meaning.

Words: **1.** waterproof **2.** flexible **3.** see-through

Meanings: **A.** light can get through it **B.** it keeps water out **C.** it bends without breaking, and springs back

A8. *(1 mark · `VC2S4U05`)* An old glass jar is washed out and becomes a home for pencils. It is used again, just as it is. Identify whether this is **re-use** or **recycle**.

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 · `VC2S4U04`)* On a hot January day, the chocolate in Zali's lunchbox starts the morning as a solid block with straight edges. By lunchtime it is a liquid pool in the wrapper.

(a) Name the change of state that happened to the chocolate. (1 mark)
(b) Explain what caused this change. Use the words *heat energy*, *solid* and *liquid* in your answer. (2 marks)

B2. *(2 marks · `VC2S4U05`)* In Victoria, a glass jar can be recycled again and again. A crisp packet is shiny plastic stuck to thin metal, and it cannot go in the recycling bin at all — even though plastic and metal can each be recycled on their own. Compare the glass jar and the crisp packet, and say why each one can or cannot be recycled.

B3. *(2 marks · `VC2S4U05`)* Construct a table with two columns. Label one column **Re-use** and the other column **Recycle**. Sort these four into your table:

- an old glass jar becomes a home for pencils
- aluminium cans are melted and made into new cans
- a drink bottle is washed and used again all term
- glass bottles are crushed, melted and shaped into new jars

Then write one sentence that says the rule you sorted by.

Mark record

Question	Code	Worth	Given
A1 — sort solid, liquid and gas	`VC2S4U04`	1	
A2 — the state that squashes	`VC2S4U04`	1	
A3 — name the change, liquid to gas	`VC2S4U04`	1	
A4 — label the change, liquid to solid	`VC2S4U04`	1	
A5 — natural or made	`VC2S4U05`	1	
A6 — the four material families	`VC2S4U05`	1	
A7 — match the property words	`VC2S4U05`	1	
A8 — re-use or	`VC2S4U05`	1	

Question	Code	Worth	Given
recycle			
B1 — the melted lunchbox, and why	VC2S4U04	3	
B2 — glass jar against crisp packet	VC2S4U05	2	
B3 — make the sort table	VC2S4U05	2	
Total		**15**	

Marking guide

Teacher guidance — Chapter 4 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:

- `VC2S4U04` (4A): "They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state."
- `VC2S4U05` (4B): "They relate the use and re-use of materials to the materials' properties."

Marks at a glance

Part	Questions	Code	Marks
Part A	A1–A4	`VC2S4U04`	4
Part A	A5–A8	`VC2S4U05`	4
Part B	B1	`VC2S4U04`	3
Part B	B2–B3	`VC2S4U05`	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 · `VC2S4U04` · 1 mark

- **Accept:** the air inside a balloon — **gas**; orange juice — **liquid**; an iron nail — **solid**.
- **Marks:** 1 for all three sorted correctly; 0 otherwise.
- **Evidences:** "classify solids, liquids and gases based on observable properties" — the three tests taught in 4A: a gas fills the space, a liquid takes the shape of its container, and a solid holds its own shape.

A2 · `VC2S4U04` · 1 mark

- **Accept: gas** (a gas is easy to squash). Accept any wording that says the air squashed and the water did not.

- **Marks:** 1 for gas; 0 for liquid or solid.
- **Evidences:** "classify solids, liquids and gases based on observable properties" — the squash test is the fourth check taught in 4A: a gas is easy to squash, and a liquid and a solid are hard to squash.

A3 · `VC2S4U04` · 1 mark

- **Accept: boiling**. Also accept *it boils* or *the liquid boils*.
- **Marks:** 1 for boiling; 0 for melting or freezing.
- **Evidences:** "describe how heating and cooling can cause a change of state" — liquid to gas, with heat added, is the change 4A names boiling.

A4 · `VC2S4U04` · 1 mark

- **Accept: freezing**. Also accept *it freezes* or *the water froze*.
- **Marks:** 1 for freezing; 0 for melting or boiling.
- **Evidences:** "describe how heating and cooling can cause a change of state" — liquid to solid, with heat removed, is the change 4A names freezing.

A5 · `VC2S4U05` · 1 mark

- **Accept:** (a) wool — **natural** (it comes from a sheep); (b) steel — **made** (people make it from metal rock).
- **Marks:** 1 for both classified correctly; 0 otherwise.
- **Evidences:** "relate the use and re-use of materials to the materials' properties" — the natural-and-made sort taught in 4B is the first step in talking about materials by what they are like and where they come from.

A6 · `VC2S4U05` · 1 mark

- **Accept: fibres**, **metals**, **glass** and **plastics** — all four families, in any order.
- **Marks:** 1 for all four named; 0 otherwise.
- **Evidences:** "relate the use and re-use of materials to the materials' properties" — the four families are how 4B groups materials by the properties they share.

A7 · `VC2S4U05` · 1 mark

- **Accept:** 1–B (waterproof → it keeps water out), 2–C (flexible → it bends without breaking, and springs back), 3–A (see-through → light can get through it).
- **Marks:** 1 for all three matched; 0 otherwise.
- **Evidences:** "relate the use and re-use of materials to the materials' properties" — the property words matched here are the vocabulary 4B uses to say why a material is right for a job.

A8 · `VC2S4U05` · 1 mark

- **Accept: re-use** — the jar is used again, just as it is.
- **Marks:** 1 for re-use; 0 for recycle (recycling would change the material to make something new, and the jar was not changed).
- **Evidences:** "the use and re-use of materials" — the re-use/recycle rule taught in 4B: re-use keeps the thing as it is; recycle changes the material.

Part B — answers

B1 · `VC2S4U04` · 3 marks

- **(a) — 1 mark.** Accept: **melting**. Also accept *it melted*.
- **(b) — 2 marks.** Award 1 mark for saying that heat energy was **added** — accept *heat energy went into the chocolate*, *the hot day added heat energy*, or *the Sun added heat energy all morning*. Award 1 mark for linking the heat to the change — accept *the added heat energy changed the chocolate from a solid to a liquid*,

or *the heat melted it: solid to liquid*. The response must use, in some form, the ideas of heat going in and of solid becoming liquid.

- **Do not award** the second idea if the response says heat was removed, or that the chocolate got colder.
- **Evidences:** “describe how heating and cooling can cause a change of state” — the lunchbox chocolate is the 4A melting story: solid → liquid, driven by heat energy going in.

B2 · `VC2S4U05` · 2 marks

- **The glass jar — 1 mark.** Accept any wording that says the jar is **one material** (glass), so it is easy to sort, and melting does not wear glass out, so it can be shaped into new jars again and again. Example: *the jar is just glass, so the sorting works can sort it easily, and it melts and becomes new glass every time*.
- **The crisp packet — 1 mark.** Accept any wording that says the packet is **two materials stuck together** (plastic and metal), and stuck-together materials are hard to separate, and materials that cannot be separated cannot be recycled. Example: *the plastic and the metal are stuck together, and nobody can pull them apart, so it cannot be recycled*.
- **Evidences:** “relate the use and re-use of materials to the materials’ properties” — this is the property argument 4B teaches for recycling: one material, easy to sort and easy to change, is recycled; many materials stuck together are not.

B3 · `VC2S4U05` · 2 marks

- **The table — 1 mark.** Accept any table with two columns labelled **Re-use** and **Recycle** (accept the student’s own column words that mean the same, such as *used again* and *made into something new*), with all four sorted correctly: **Re-use** — the old glass jar becomes a home for pencils; the drink bottle is washed and used again all term. **Recycle** — the aluminium cans are melted and made into new cans; the glass bottles are crushed, melted and shaped into new jars. The four may run down the rows or across the top; either way is right.
- **The rule — 1 mark.** Accept any sentence carrying both ideas: re-use means the thing is used again just as it is; recycle means the material is changed to make something new. Example: *re-use keeps the thing the same, and recycle changes the material*. One sentence with both ideas gets the mark; a sentence with only one idea gets 0.
- **Evidences:** “the use and re-use of materials” — the sort and the rule are the re-use/recycle distinction 4B teaches and argues from properties.

Where each question traces in the curriculum

Every question traces to the achievement-standard extract of one of the two Chapter 4 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	4A	`VC2S4U04`	“They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state.”
A2	1	4A	`VC2S4U04`	“They classify solids, liquids and gases based on observable properties, and describe how heating

Question	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
				and cooling can cause a change of state.”
A3	1	4A	VC2S4U04	“They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state.”
A4	1	4A	VC2S4U04	“They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state.”
B1	3	4A	VC2S4U04	“They classify solids, liquids and gases based on observable properties, and describe how heating and cooling can cause a change of state.”
A5	1	4B	VC2S4U05	“They relate the use and re-use of materials to the materials’ properties.”
A6	1	4B	VC2S4U05	“They relate the use and re-use of materials to the materials’ properties.”
A7	1	4B	VC2S4U05	“They relate the use and re-use of materials to the materials’ properties.”
A8	1	4B	VC2S4U05	“They relate the use and re-use of materials to the materials’ properties.”

Question	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
B2	2	4B	`VC2S4U05`	“They relate the use and re-use of materials to the materials’ properties.”
B3	2	4B	`VC2S4U05`	“They relate the use and re-use of materials to the materials’ properties.”
Total	**15**			

Total

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

Chapter 4 investigation task — Chemical sciences

This investigation task 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 4 investigation task · Codes `VC2S4I01`, `VC2S4I02`, `VC2S4I03`, `VC2S4I04`, `VC2S4I05`, `VC2S4I06`, in the content of Chapter 4 (`VC2S4U04`, `VC2S4U05`)

Total: 20 marks · Part A — Question and prediction · 3 marks · Part B — Planning scaffold · 5 marks · Part C — Measure and record · 4 marks · Part D — Represent and read the pattern · 4 marks · Part E — Compare and judge · 2 marks · Part F — Communicate · 2 marks

The marks for each part are written with the part. You will work in a small group, but you will write your own scaffold, your own table, your own graph and your own answers.

Every part of this task points to a part of the Levels 3 and 4 achievement standard that Chapters 1 and 2 teach. The science you need is from Chapter 4. The extracts, word for word:

Students pose questions to identify patterns and relationships, and make predictions based on observations. — `VC2S4I01` (1A)

They plan investigations using planning scaffolds, identify key components of fair tests and describe how they conduct investigations safely. — `VC2S4I02` (1B)

They use familiar classroom instruments and simple procedures to record observations and results, including formal measurements. — `VC2S4I03` (1C)

They construct representations to organise data and information, and identify patterns and simple relationships. — `VC2S4I04` (2A)

They compare their findings with those of others, assess the fairness of their investigations, propose further questions for investigation and draw conclusions. — `VC2S4I05` (2B)

They communicate observations, findings and ideas for an identified purpose and audience, using scientific vocabulary and digital tools where appropriate. — `VC2S4I06` (2C)

The words in this task are the words you learned in Chapters 1, 2 and 4. If you need them, the word lists are at the end of 1A, 1B, 1C, 2A, 2B, 2C, 4A and 4B.

In this task you will:

- read a short observation about ice on a hot day
- write the question your class will investigate, a prediction, and what your prediction is based on (Part A)
- complete a planning scaffold: what to change, what to keep the same, the hazard and the control (Part B)
- estimate first, then measure how long each ice cube takes to melt, and record the times in your own table (Part C)
- construct a column graph of your times, and write the pattern you read off it (Part D)
- compare your findings with another group's, and say whether your test was fair (Part E)
- write a short note to the school canteen team, using Chapter 4 words (Part F)

Read this first.

It is a hot January sports day. A cup of water with ice in it sits in the sun. By lunchtime, all the ice has gone — it has **melted**. But the ice blocks in the cooler bag still have some solid ice left.

In this task, your class will run one real investigation — a fair test of a change of state — to find out what makes ice melt faster or slower.

The equipment

Your teacher will set this out for each group:

- 3 ice cubes from the same ice-cube tray — the same size, from the same freezer
- 3 plates that are the same
- 3 small trays to catch drips and spills
- a clock with a second hand, or a stopwatch
- a small cooler bag with a lid that closes
- paper and pencil (and grid paper, if your teacher has some)

The cooler bag is an **insulator**. An insulator is a material that does not let heat energy through easily.

Safety first

A **hazard** is anything that could hurt someone. A **control** is what you do so nobody gets hurt. For this test:

- **Hazard:** melted water can spill and make the floor slippery. **Control:** every plate sits on a tray. Wipe any spill at once, and tell your teacher about a big one.
- **Hazard:** ice is very cold, and holding it too long can hurt your skin. **Control:** do not hold the ice cubes in your hands for a long time, and do not eat or drink anything from this test. Wash your hands when the test is over.
- **Supervision:** your teacher supervises the whole task. Your teacher sets up the three spots and hands out the ice.

Part A — Question and prediction · 3 marks

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

A1. *(1 mark · `VC2S4I01`)* Write the question your class will investigate. It must be a question your test can answer.

A2. *(1 mark · `VC2S4I01`)* Write your prediction. Say what you think will happen to the three ice cubes.

A3. *(1 mark · `VC2S4I01`)* Write what your prediction is based on. A prediction is based on something you have observed. A guess is not.

Part B — Planning scaffold · 5 marks

One question, worth 5 marks. The marks for each row are written in the table.

A **fair test** is a test that changes only one thing, and keeps everything else the same. A planning scaffold is a table that holds your plan. This one is provided for you — your job is to complete it.

B1. *(5 marks · `VC2S4I02`)* Complete the planning scaffold for your class test.

Our plan	Write it here	Worth
What we change		1 mark
What we keep the same (write two things)	1. ______ 2. ______	2 marks
The hazard		1 mark
The control — what we do about the hazard		1 mark

The method

Your class runs the test together. Follow these steps.

1. Put one ice cube on each plate. Put each plate on a tray.
2. Put the plates in the three spots your teacher has set: a sunny spot by the window, a shady spot on the bench, and inside the cooler bag. Close the cooler bag.
3. Start the clock. Write down the start time.
4. Check the ice cubes every five minutes. Open the cooler bag quickly, look, and close it straight away.

5. When an ice cube has melted all the way — when there is no solid ice left — write down the time. Write the time to the nearest minute.
6. Keep checking until all the ice has melted, or until your teacher calls the stop time.

Part C — Measure and record · 4 marks

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

C1. *(1 mark · `VC2S4I03`)* Design your own results table before the data arrives. It should show the three spots, a place for your estimate, and a place for the time you measure. Write the unit in each heading.

C2. *(1 mark · `VC2S4I03`)* An **estimate** is your best answer before you measure. Before the clock starts, write an estimate in your table: how many minutes will each ice cube take to melt?

C3. *(1 mark · `VC2S4I03`)* Run the test. Record the time each ice cube takes to melt all the way. Write all three times in your table.

C4. *(1 mark · `VC2S4I03`)* Write the unit you used for your times. Why does that unit suit this measurement?

Part D — Represent and read the pattern · 4 marks

D1 is worth 2 marks. D2 is worth 1 mark. D3 is worth 1 mark.

D1. *(2 marks · `VC2S4I04`)* Construct a column graph of the times you measured.

(a) Draw the two axes and label them. Put the three spots along the bottom, and the time to melt — in minutes — up the side, with a number scale. (1 mark)

(b) Draw one column for each spot. Each column must be the right height for your table. (1 mark)

D2. *(1 mark · `VC2S4I04`)* Write the pattern you read off your graph. Which spot melted its ice cube fastest? Which spot melted its ice cube slowest?

D3. *(1 mark · `VC2S4I04`)* Explain the pattern. Use the words *heat energy*, *solid*, *liquid* and *melting* in your answer.

Part E — Compare and judge · 2 marks

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

E1. *(1 mark · `VC2S4I05`)* Get another group's three times. Write one thing that is the same as your findings, and one thing that is different. If the times are different, write one thing that could have caused the difference.

E2. *(1 mark · `VC2S4I05`)* Judge your test, then ask the next question. Was your test fair? Write one thing you kept the same, or one thing you would change to make the test fairer. Then write one more question your findings make you want to investigate.

Part F — Communicate · 2 marks

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

F1. *(1 mark · `VC2S4I06`)* Here is your purpose and your audience. The team at the school canteen — the place that sells food at school — wants ice blocks to stay solid on hot sports days. Write two or three sentences for the canteen team. Tell them where to keep the ice blocks, and why. Base your advice on what your group found.

F2. *(1 mark · `VC2S4I06`)* Use at least three of these Chapter 4 words the right way in your note: *solid*, *liquid*, *melting*, *heat energy*, *change of state*, *insulator*.

Mark record

Part	Code	Worth	Given
A — question and prediction	`VC2S4I01`	3	

Part	Code	Worth	Given
B — planning scaffold	`VC2S4I02`	5	
C — measure and record	`VC2S4I03`	4	
D — represent and read the pattern	`VC2S4I04`	4	
E — compare and judge	`VC2S4I05`	2	
F — communicate	`VC2S4I06`	2	
Total		**20**	

Marking guide

Teacher guidance — Chapter 4 investigation task · 20 marks. This guide is written so a teacher without a science background can mark the task. Every acceptable answer is written out below, and every mark is allocated per response.

About this instrument

- The investigation task 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. The investigation itself runs over whatever class time you give it; the marking is on each student's own records, not on speed.
- **Reading support** is permitted: the teacher may read any question aloud on request. Reading is not being assessed.
- Students work in small groups, but each student is marked on their own work: their own scaffold, their own table, their own graph, and their own comparison and note.
- This is the Chapter 4 host context set by the assessment plan: **a fair test of a change of state** — melting — with an insulator (the cooler bag) as one of the conditions. The marks are for the inquiry skills taught in Chapters 1 and 2, performed in the content of Chapter 4. Chapter 4 content knowledge itself is assessed in the Chapter 4 check-up, not here.
- 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 part is tagged with the code it traces to. The six extracts from the Levels 3 and 4 achievement standard, quoted at the head of the task:

- `VC2S4I01` (1A): "Students pose questions to identify patterns and relationships, and make predictions based on observations."
- `VC2S4I02` (1B): "They plan investigations using planning scaffolds, identify key components of fair tests and describe how they conduct investigations safely."
- `VC2S4I03` (1C): "They use familiar classroom instruments and simple procedures to record observations and results, including formal measurements."
- `VC2S4I04` (2A): "They construct representations to organise data and information, and identify patterns and simple relationships."
- `VC2S4I05` (2B): "They compare their findings with those of others, assess the fairness of their investigations, propose further questions for investigation and draw conclusions."
- `VC2S4I06` (2C): "They communicate observations, findings and ideas for an identified purpose and audience, using scientific vocabulary and digital tools where appropriate."

Marks at a glance

Part	Assesses	Marks
Part A — question and prediction	`VC2S4I01`	3
Part B — planning scaffold	`VC2S4I02`	5
Part C — measure and record	`VC2S4I03`	4
Part D — represent and read the pattern	`VC2S4I04`	4
Part E — compare and judge	`VC2S4I05`	2
Part F — communicate	`VC2S4I06`	2

Part	Assesses	Marks
	Total	**20**

Setting up the task

- Make the ice cubes ahead of time, all in the one tray, so they are the same size. Keep a few spare in the freezer.
- Work in groups of three or four. Set up three spots: a sunny spot by a window, a shady spot on a bench, and a small cooler bag with a lid. On a cold or cloudy day, swap the sunny spot for the warmest safe spot in the room — not on a heater and not on any hot surface.
- Give each group a clock or stopwatch, three plates on trays, and a clean, dry cooler bag.
- For Part E, pair each group with another group to share times. If your class has only one group, give the students the times an earlier class recorded.
- Decide the stop time before the test starts — for example, one hour, or until lunchtime.

General marking rules

- Accept answers in the student's own words. The acceptable answers below are wide by design — if the response shows the skill, give the mark.
- Spelling does not lose marks.
- The marks are for the inquiry skills, not for getting the "right" result. A group whose sunny-spot ice cube melted slowly still earns full marks for recording faithfully, graphing their own data correctly, and reading the pattern their own graph shows.
- If an answer is right but the reason is unclear, ask the student to say more — once. If the follow-up shows the skill, give the mark. If it shows a guess with nothing behind it, record 0 and move on without comment.
- Where an item is marked all-or-nothing, it gets its mark, or 0.

Part A — answers

A1 · `VC2S4I01` · 1 mark

- **Accept:** any question the test can answer about how fast ice melts in different conditions. Examples: *Where does an ice cube melt fastest?*, *Which spot melts the ice first?*, *Does ice melt faster in the sun than in the shade?*, *What makes ice melt faster or slower?*
- **Marks:** 1 for a question the test can answer; 0 for a statement, or a question the test cannot answer (for example, a question about something nobody could observe in the test).
- **Evidences:** "pose questions to identify patterns and relationships" — the question looks for a relationship between the spot and how fast the ice melts.

A2 · `VC2S4I01` · 1 mark

- **Accept:** any clear statement of what the student thinks will happen to the three ice cubes. Examples: *The ice cube in the sunny spot will melt first*, *The ice cube in the cooler bag will melt last*, *The sun will melt its ice fastest and the bag slowest*.
- **Marks:** 1 for a clear prediction; 0 for a restatement of the question with no answer offered. The prediction does not have to turn out right.
- **Evidences:** "make predictions based on observations" — the prediction is the student's answer before the test runs.

A3 · `VC2S4I01` · 1 mark

- **Accept:** something the student has observed or experienced. Examples: *On a hot day the ice in my drink disappears quickly*, *At sports day the ice blocks in the cooler bag stayed frozen the longest*, *The puddle on the hot asphalt went first*.
- **Marks:** 1 for a basis in an observation or an experience; 0 for a bare *I think so* or *I just guess* with nothing behind it.

- **Evidences:** "make predictions based on observations" — the distinction 1A teaches: a prediction is grounded in a prior observation; a guess is not.

Part B — answers

B1 · `VC2S4I02` · 5 marks

- **What we change — 1 mark.** Accept: *the spot*, *where each ice cube sits*, or naming the three conditions — sunny spot, shady spot, cooler bag.
- **What we keep the same — 2 marks, one for each of any two.** Accept any two that genuinely keep the test fair: *the size of the ice cubes (the same tray)*, *the same plates*, *starting at the same time*, *checking at the same times*, *all three in the same room*. Reject answers that do not affect the test (for example, *the same colour pencil*).
- **The hazard — 1 mark.** Accept any real hazard in this test: *spilled water makes the floor slippery*, *the ice is very cold and can hurt your skin*, *wet floors and wet hands*. Reject *the ice melts* — that is the result being measured, not a hazard.
- **The control — 1 mark.** Accept a control that matches the hazard named: for spills, *the plates sit on trays and we wipe spills at once*; for the cold, *we do not hold the ice for long, and we wash our hands after*. The control must answer the hazard in the row above it; a control for a different hazard gets 0.
- **Evidences:** "plan investigations using planning scaffolds, identify key components of fair tests and describe how they conduct investigations safely" — the scaffold is provided (the CD says "provided scaffolds"); the student supplies the one thing changed, the things kept the same, and the hazard with its control.

Part C — answers

C1 · `VC2S4I03` · 1 mark

- **Accept:** any table that shows the three spots, a place for the estimate and a place for the measured time, with the unit — minutes, or *min* — in the headings. The table may be hand-drawn; it does not need a ruler.
- **Marks:** 1 for a usable table with the unit in the headings; 0 if the headings carry no unit or the table has nowhere for the estimate and the measured time.
- **Evidences:** "record observations and results, including formal measurements" — 1C teaches designing the table before the data arrives.

C2 · `VC2S4I03` · 1 mark

- **Accept:** an estimate for all three spots, written before the clock starts, in plausible minutes — roughly 5 to 120 minutes is a sensible range. The estimates do not have to turn out close.
- **Marks:** 1 for three plausible estimates recorded before measuring; 0 for estimates that cannot be right for ice melting in a classroom (a few seconds, several days), or estimates evidently written after the test.
- **Evidences:** "observations, including formal measurements, can be made and recorded" — estimating before measuring is the practice 1C founds on VC2M3M01: knowing roughly what to expect so an absurd reading is noticed.

C3 · `VC2S4I03` · 1 mark

- **Accept:** all three measured times in the table. Times recorded to the nearest check (for example, the nearest five minutes) are fine. If the cooler-bag ice cube had not melted by the stop time, accept *still melting at … minutes* as that group's longest time.
- **Marks:** 1 for three measurements recorded (or two measurements plus a *still melting* record); 0 if fewer than three rows carry anything.
- **Evidences:** "use familiar classroom instruments and simple procedures to record observations and results, including formal measurements" — the clock is the instrument; the procedure is the five-minute check.

C4 · `VC2S4I03` · 1 mark

- **Accept:** the unit is **minutes**, with a reason that suits. Examples: *seconds are too small — the numbers would be huge*, *hours are too big — the melting takes less than an hour*, *it takes more than a minute but less than an hour*.
- **Marks:** 1 for the right unit and a reason that fits; 0 for the wrong unit, or for a reason that does not.
- **Evidences:** "including formal measurements" — choosing the unit that suits the measurement is part of measuring properly; 1C asks *which unit suits this object* before it asks for the number.

Part D — answers

D1 · `VC2S4I04` · 2 marks

- **(a) — 1 mark.** Accept a graph with both axes drawn and labelled: the bottom axis shows the three spots (words or pictures), and the side axis shows the time to melt, with the unit — minutes — and a number scale. Reject if either axis has no label, or the side axis has no unit.
- **(b) — 1 mark.** Accept three columns, one per spot, each the right height for the student's own table. Accept heights that are close against the scale the student chose; the columns may be in any order. Reject columns that do not match the student's own data.
- **Evidences:** "construct representations to organise data and information" — the representation is a column graph, the graph type this band builds (categorical spots along the bottom, whole-number minutes up the side).

D2 · `VC2S4I04` · 1 mark

- **Accept:** the pattern read off the student's own graph — which spot melted fastest, which slowest. Example: *The sunny spot melted first and the cooler bag last*. If the group's data ran another way (their "sunny" spot was in cloud), accept the pattern their graph actually shows.
- **Marks:** 1 for a pattern consistent with their own graph; 0 for a pattern copied from another group, or one their graph does not show.
- **Evidences:** "identify patterns and simple relationships" — the relationship is between the spot and the melting time.

D3 · `VC2S4I04` · 1 mark

- **Accept:** any wording that carries both ideas: heat energy going in, and solid changing to liquid. Example: *The warmer spot adds heat energy faster, so the solid ice changes to liquid faster there; the cooler bag does not let heat energy through easily, so its ice melts slowest*. If the group's data ran another way, accept an explanation that fits their data and still uses the heat-energy idea.
- **Marks:** 1 for both ideas — heat energy, and solid becoming liquid (melting); 0 if only one idea is there. Apply the ask-once rule if the ideas are implied but unclear.
- **Evidences:** "identify patterns and simple relationships" — the explanation links the pattern to the Chapter 4 content: heating causes the change of state from solid to liquid.

Part E — answers

E1 · `VC2S4I05` · 1 mark

- **Accept:** a real comparison with the other group's times. Award the mark for one thing the same and one thing different, or for a reason the times differ. Examples: *Both groups had the sunny spot fastest; their times were shorter — maybe their ice cubes were smaller*, *Our cooler-bag ice was still melting and theirs had melted — their bag was open longer when they checked*, *They got the same order as us but bigger times because the sun went behind a cloud*.
- **Marks:** 1 for a comparison that names something real about the two sets of findings; 0 for *the same* or *different* with nothing said about what.
- **Evidences:** "compare their findings with those of others" — and, where the findings differ, asking what could have caused the difference is the first form of judging measurements, before that judgment has a harder name.

E2 · `VC2S4I05` · 1 mark

- **Accept, both together:** a fairness judgement with a reason, and one further question. Fairness examples: *Yes — we kept the ice cubes the same size and started together*, *Not quite — the shady spot got sun for a while; next time we would check the spot stays shady*. Further-question examples: *Do bigger ice cubes take longer to melt?*, *Does wrapping the plate in cloth keep the ice solid longer?*, *Would the same thing happen with butter?*
- **Marks:** 1 when both are there: the fairness judgement with a reason, and one question that could be investigated. If one is missing, apply the ask-once rule; if the follow-up supplies it, give the mark.
- **Evidences:** "assess the fairness of their investigations, propose further questions for investigation" — fairness as a judgment with a reason, and the next question the results raise.

Part F — answers

F1 · `VC2S4I06` · 1 mark

- **Accept:** two or three sentences written for the canteen team, with advice that follows from the group's findings. Example: *Keep the ice blocks in the coolest place you have, out of the sun. A cooler bag with the lid closed is best, because it keeps heat energy out, so the ice blocks stay solid longer*. The advice must suit the audience (the people keeping the ice blocks) and match what the group found.
- **Marks:** 1 for a message that suits the stated purpose and audience and follows from the findings; 0 for advice that contradicts the group's own results, or writing with no audience in it.
- **Evidences:** "communicate observations, findings and ideas for an identified purpose and audience" — the purpose is keeping ice blocks solid; the audience is the canteen team.

F2 · `VC2S4I06` · 1 mark

- **Accept:** at least three of the named words used the right way in the note: *solid*, *liquid*, *melting*, *heat energy*, *change of state*, *insulator*. Example: *...the heat energy melts the ice blocks: the change of state is solid to liquid…*
- **Marks:** 1 for three or more used correctly; 0 for fewer than three, or words used the wrong way round (for example, *the cold energy* or *melting from liquid to solid*).
- **Evidences:** "using scientific vocabulary" — the vocabulary is the Chapter 4 word list, used to do a job, not listed.

Where each part traces in the curriculum

Each part assesses one inquiry content description, performed in the content context of Chapter 4. The extracts below are quoted verbatim from the Victorian Curriculum F–10 Version 2.0, Science, Levels 3 and 4 achievement standard.

Part	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
A — question and prediction	3	1A	`VC2S4I01`	"Students pose questions to identify patterns and relationships, and make predictions based on observations."
B — planning scaffold	5	1B	`VC2S4I02`	"They plan investigations using planning scaffolds, identify key components of fair tests and describe how they conduct investigations safely."

Part	Marks	Subtopic	Owns	Achievement-standard extract (verbatim)
C — measure and record	4	1C	`VC2S4I03`	“They use familiar classroom instruments and simple procedures to record observations and results, including formal measurements.”
D — represent and read the pattern	4	2A	`VC2S4I04`	“They construct representations to organise data and information, and identify patterns and simple relationships.”
E — compare and judge	2	2B	`VC2S4I05`	“They compare their findings with those of others, assess the fairness of their investigations, propose further questions for investigation and draw conclusions.”
F — communicate	2	2C	`VC2S4I06`	“They communicate observations, findings and ideas for an identified purpose and audience, using scientific vocabulary and digital tools where appropriate.”
Total	**20**			

The content context is Chapter 4 and is not marked here: `VC2S4U04` (4A) supplies the change of state — melting, driven by heat energy — and `VC2S4U05` (4B) supplies the materials reasoning behind the cooler bag, an insulator chosen by property. Chapter 4 content knowledge is assessed in the Chapter 4 check-up.

Total

Part A: 3 marks. Part B: 5 marks. Part C: 4 marks. Part D: 4 marks. Part E: 2 marks. Part F: 2 marks. **Total: 20 marks.**