

Science 7–8

Contents

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Aboriginal and Torres Strait Islander content has been excluded as accuracy cannot be guaranteed, and it is better to be respectful than cover the entire curriculum inaccurately.

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Contents

This book is the **Science 7–8** student workbook. It is written for the **Levels 7 and 8** band of the Victorian Curriculum F–10 Version 2.0 (VC2), Science. **The band is one scope.** All twenty-nine content descriptions in this book are tagged “Levels 7 and 8” — not one is tagged Level 7 alone or Level 8 alone — so the book does not split them into a Year 7 part and a Year 8 part. Schools choose their own two-year rotation, and the book works with any rotation.

The book is twenty booklets:

- **Chapter 1 — Nature and development of science** — Science78_Chapter01 — subtopics 1A, How scientific knowledge changes, and 1B, Who does science (*34 pp*)
- **Chapter 2 — Questioning and predicting** — Science78_Chapter02 — subtopics 2A, Investigable questions, and 2B, Hypotheses and reasoned predictions, and Topic test 1 — How science works, and asking a good question, with its answers and fully-worked solutions (*48 pp*)
- **Chapter 3 — Planning and conducting** — Science78_Chapter03 — subtopics 3A, Planning a reproducible investigation, 3B, Risk, ethics and protocols, and 3C, Equipment and precision (*56 pp*)
- **Chapter 4 — Processing, modelling and analysing** — Science78_Chapter04 — subtopics 4A, Organising data, 4B, Representing with keys, models and mathematical relationships, and 4C, Reading processed and secondary data, and Topic test 2 — Planning, measuring and processing, with its answers and fully-worked solutions (*62 pp*)
- **Chapter 5 — Evaluating** — Science78_Chapter05 — subtopics 5A, Interrogating a method and a conclusion, and 5B, Building an evidence-based argument (*36 pp*)
- **Chapter 6 — Communicating** — Science78_Chapter06 — subtopics 6A, The scientific report, and 6B, Choosing the format for the purpose and the audience, and Topic test 3 — Evaluating and communicating, with its answers and fully-worked solutions (*45 pp*)
- **Chapter 7 — Biological sciences A: the diversity of life** — Science78_Chapter07 — subtopics 7A, Similarities and differences within and between groups of organisms, and 7B, Classification tools (*35 pp*)
- **Chapter 8 — Biological sciences B: cells, tissues, organs and systems** — Science78_Chapter08 — subtopics 8A, Cell theory and the microscope, 8B, Organelles and what they do, 8C, From cells to tissues to organs, and 8D, Organ systems and survival (*70 pp*)
- **Chapter 9 — Biological sciences C: ecosystems** — Science78_Chapter09 — subtopics 9A, Matter and energy through an ecosystem, and 9B, Populations under pressure, and Topic test 4 — Biological sciences, with its answers and fully-worked solutions (*53 pp*)
- **Chapter 10 — Chemical sciences A: particles, properties and mixtures** — Science78_Chapter10 — subtopics 10A, The particle and kinetic theories, 10B, Explaining a substance with its particles, 10C, Pure substances and mixtures, and 10D, Separating a mixture (*69 pp*)
- **Chapter 11 — Chemical sciences B: atoms and chemical change** — Science78_Chapter11 — subtopics 11A, The atomic theory of matter, 11B, Physical change against chemical change, and 11C, The indicators of chemical change, and Topic test 5 — Chemical sciences, with its answers and fully-worked solutions (*62 pp*)
- **Chapter 12 — Earth and space sciences A: the dynamic earth** — Science78_Chapter12 — subtopics 12A, Plate boundaries and what they build, and 12B, The evidence for plate tectonics (*35 pp*)
- **Chapter 13 — Earth and space sciences B: rocks, minerals and Earth’s resources** — Science78_Chapter13 — subtopics 13A, The rock cycle, 13B, Rock properties in use, 13C, Renewable and non-renewable resources, and 13D, Extraction and energy production (*76 pp*)
- **Chapter 14 — Earth and space sciences C: the Earth–Sun–Moon system** — Science78_Chapter14 — subtopics 14A, Earth and the Sun, and 14B, Earth, Moon and Sun, and Topic test 6 — Earth and space sciences, with its answers and fully-worked solutions (*42 pp*)
- **Chapter 15 — Physical sciences A: forces and simple machines** — Science78_Chapter15 — subtopics 15A, Forces investigated and represented, 15B, Changing an object’s motion, and 15C, Simple machines (*49 pp*)
- **Chapter 16 — Physical sciences B: energy, transfer and efficiency** — Science78_Chapter16 — subtopics 16A, Forms of energy, 16B, Energy on the move, and 16C, The household energy audit (*56 pp*)

- **Chapter 17 — Physical sciences C: electric circuits** — Science78_Chapter17 — subtopics 17A, Building a circuit for a purpose, and 17B, Voltage and current, and Topic test 7 — Physical sciences, with its answers and fully-worked solutions (42 pp)
- **Chapter 18 — Use and influence of science** — Science78_Chapter18 — subtopics 18A, Socio-scientific issues, and 18B, Science communication and its consequences, and Topic test 8 — Science in society, with its answers and fully-worked solutions (44 pp)
- **Chapter 19 — SITs, end-of-band review and solutions** — Science78_Chapter19_Review — Scientific Investigation Tasks 1 and 2, the end-of-band review, and the review's worked solutions (42 pp)
- **Chapter 0 — Contents** — Science78_Chapter00_Contents — this booklet: how to use the book, what it covers, teacher notes, safety notes and the band word list (0 pp)

Series total: twenty booklets ≈ 956 pages. The built booklets — Science78_Chapter01 to Science78_Chapter18, Science78_Chapter19_Review and Science78_Chapter00_Contents — are in S:\Files\VC2Science\Textbook7_8\.

How to use this book

The chapters are in a teaching order. Chapter 1 frames the band: what scientific knowledge is, how it changes, and who makes it. Chapters 2 to 6 are the five Science inquiry sub-strands — questioning and predicting, planning and conducting, processing, modelling and analysing, evaluating, and communicating — one chapter each, taught as a front block **and then revisited**: every investigation in every knowledge chapter cites the numbered Chapter 2–6 subtopic it draws on, because a student cannot plan a fair test in Chapter 8 with the variables, precision and error material still ahead. Chapters 7 to 17 carry the four Science understanding sub-strands — biological, chemical, Earth and space, and physical sciences — each split across two to four chapters. Chapter 18, use and influence of science, is the capstone: socio-scientific issues and science communication ask students to reason *about* science, and that reasoning is strongest once the science is in, immediately before the end-of-band review. **This is a teaching order, not a VCAA sequence.** The curriculum states no order within the band, and a school that runs the chapters in another order is not out of compliance — but keep Chapter 1 first, and Chapter 18 after the knowledge chapters it draws on. The teaching order implies no year-level allocation.

One band, two years. The band is not split by year level: there are no Year 7 chapters and no Year 8 chapters, because the curriculum itself makes no Year 7 / Year 8 split. No chapter, subtopic, test or contents line in this book is tagged with a year level. Whichever way a school rotates the chapters across Year 7 and Year 8, every subtopic in this book is taught as written.

A subtopic is not one lesson. Each of the 47 subtopics is several lessons of work, and the book is sized for the two-year band as a whole, with room left to go back over things.

Inside each subtopic. Every subtopic opens with a header block that names its content description code, quotes the content description verbatim, gives the achievement-standard extract the subtopic serves, lists the elaboration ids it draws on, and — where the mathematics matters — names the enabling Levels 7–8 Mathematics code. Then come the words — a **Words to know** table or a **Word watch** — and the theory: short paragraphs, with every new science word named and explained the first time it is used. That is followed by four worked examples — two worked with support and two worked without — then fourteen questions, six with support and eight without, spanning the major variations of the subtopic, each with answers and fully-worked solutions. Investigations in the knowledge chapters plan and analyse practical work, and each one says which Chapter 2–6 subtopic it is drawing on.

The assessment travels with the chapters. Each block's topic test is appended to the booklet of the block's last chapter; the two Scientific Investigation Tasks and the end-of-band review fill the Chapter 19 booklet. See the teacher notes below.

The numbers stay inside what VC2 Mathematics Levels 7 and 8 delivers. Every quantitative demand in the book cites the enabling Levels 7–8 Mathematics code at the point of use. In particular: there is **no scientific notation** — very small and very large quantities are written in words or in smaller units — and the book's graphs are read for shape, trend and anomaly, **never for gradient, and no line of best fit is drawn**; both belong to Levels 9 and 10 mathematics.

Everything real is really real. Every data set, record and named case in the book is real, Victorian or Australian where the curriculum asks for it, and carries a source line with a retrieval date, so students can see where the numbers come from. Seasons are southern-hemisphere, tide and seismicity data are Victorian, and Victoria's mains supply — 230 V, 50 Hz AC — is cited correctly wherever it appears.

Every science word is gathered twice. Each subtopic's words are listed in its Words to know table or its Word watch, and they are all gathered again, chapter by chapter, in the band word list at the back of this booklet.

The tests and the review are untimed. There is no time to beat on any instrument in this book, and if a student needs it, the teacher will read any question out. See the teacher notes below.

What this book covers

The table below lists all 29 content descriptions of the Levels 7 and 8 band, in the coverage register the series checks itself against. Every one of the 29 codes appears here exactly once, with exactly one owner subtopic; there are no gaps and no deferrals — no content description is left to another book, and no code from another band appears anywhere in this one. A **Partner** is the second subtopic of a split delivery, marked † in the chapter plan, and is **not** an owner.

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
1	VC2S8H01	Nature and development of science	1A	—	E01–E07	95	whole CD
2	VC2S8H02	Nature and development of science	1B	—	E01–E07	82	whole CD
3	VC2S8H03	Use and influence of science	18A	—	E01–E06	68	whole CD
4	VC2S8H04	Use and influence of science	18B	—	E01–E07	77	whole CD
5	VC2S8U01	Biological sciences	7A	7B	7A: E01 E02 E05 E06 E07 / 7B: E03 E04	93	7A: similarities and differences within and between groups of organisms · 7B: development and use of classification tools, including dichotomous keys
6	VC2S8U02	Biological sciences	8A	8B	8A: E01 E02 E03 E07 / 8B: E04 E05	96	8A: cell theory, cells as basic units of life, unicellular

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
					E06		and multicellular · 8B: specialised structures and organelles and their specific functions
7	VC2S8U03	Biological sciences	8C	8D	8C: E01 E02 E03 / 8D: E04 E05 E06 E07	92	8C: structure of cells, tissues and organs related to function in a plant and an animal organ system · 8D: organ systems enable survival, and the effect of a disorder
8	VC2S8U04	Biological sciences	9A	9B	9A: E01 E02 / 9B: E03 E04 E05 E06	92	9A: matter and energy flow, food webs and food pyramids · 9B: populations affected by changing biotic and abiotic factors
9	VC2S8U05	Chemical sciences	10A	10B	10A: E01 E02 E03 / 10B: E04 E05 E06	90	10A: particle and kinetic theories — arrangement, motion and attraction of particles · 10B:

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
10	VC2S8U06	Chemical sciences	10C	10D	10C: E01 E02 / 10D: E03 E04 E05 E06 E07	94	explaining the properties and behaviour of substances 10C: pure and impure substances, homogeneous and heterogeneous, modelled with particles · 10D: separation on the properties of the components
11	VC2S8U07	Chemical sciences	11A	—	E01–E05	77	whole CD
12	VC2S8U08	Chemical sciences	11B	11C	11B: E02 E03 / 11C: E01 E04 E05	85	11B: distinguishing physical from chemical change · 11C: the indicators of chemical change, including gas preparation and testing
13	VC2S8U09	Earth and space sciences	13C	13D	13C: E01 E02 / 13D: E03 E04 E05 E06	84	13C: renewable and non-renewable resources and sustainable use · 13D: benefits and risks of resource extraction

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
14	VC2S8U10	Earth and space sciences	12A	12B	12A: E02 E03 / 12B: E01 E03 E04 E05 E06	68	and energy production 12A: tectonic activity and the features formed at divergent, convergent and transform boundaries · 12B: the scientific evidence supporting the theory
15	VC2S8U11	Earth and space sciences	13A	13B	13A: E02 E03 E04 / 13B: E01 E05 E06	94	13A: rock-cycle processes and their timescales · 13B: properties reflecting formation, determining usefulness and mining method
16	VC2S8U12	Earth and space sciences	14A	14B	14A: E01 E05 / 14B: E02 E03 E04 E06	79	14A: Earth–Sun positions modelled to explain seasons · 14B: Earth–Moon–Sun positions modelled to explain lunar phases, eclipses and tides
17	VC2S8U13	Physical sciences	15C	—	E01–E06	88	whole CD
18	VC2S8U14	Physical sciences	15A	15B	15A: E03 E04 E05 E06 / 15B: E01 E02	92	15A: balanced and unbalanced

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
							forces including gravitational force, investigated and represented on force diagrams · 15B: change in motion related to mass and to the magnitude and direction of the forces
19	VC2S8U15	Physical sciences	16A	16B	16A: E01 E04 E05 E06 / 16B: E02 E03	91	16A: forms of energy classified as kinetic or potential, and transformations · 16B: transfers by conduction, convection and radiation, analysed for efficiency
20	VC2S8U16	Physical sciences	16C	—	E01–E06	67	whole CD
21	VC2S8U17	Physical sciences	17A	17B	17A: E01 E02 E03 E04 / 17B: E01 E03 (shared)	63	17A: circuits transfer energy when current flows, and are designed for diverse purposes with different components · 17B:

#	CD code	Strand	Owner	Partner (†, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
22	VC2S8I01	Questioning and predicting	2A	2B	2A: E01 E02 / 2B: E03 E04	85	explaining circuit operation with voltage and current 2A: investigable questions to identify patterns and test relationship s · 2B: reasoned predictions and hypotheses, including analysing and evaluating scientific models
23	VC2S8I02	Planning and conducting	3A	3B	3A: E01 E02 E04 / 3B: E03 E05 E06	78	3A: reproducibl e planning, variables, assumptions · 3B: risks, ethical issues, and protocols for cultural sites and artefacts on Country and Place
24	VC2S8I03	Planning and conducting	3C	—	E01–E06	78	whole CD
25	VC2S8I04	Processing, modelling and analysing	4A	4B	4A: E06 / 4B: E01 E02 E03 E04 E05	87	4A: tables and graphs · 4B: keys, models and mathematic al relationship s
26	VC2S8I05	Processing, modelling	4C	—	E01–E04	91	whole CD

#	CD code	Strand	Owner	Partner (+, not an owner)	Elaboration ids (owner / partner)	MCQs	Clause split
		and analysing					
27	VC2S8I06	Evaluating	5A	—	E01–E07	70	whole CD
28	VC2S8I07	Evaluating	5B	—	E01–E05	73	whole CD
29	VC2S8I08	Communica ting	6A	6B	6A: E01 E03 E06 / 6B: E02 E04 E05 E07	86	6A: report structure, conventions , scientific vocabulary and referencing · 6B: selecting presentation formats, models, other representati ons and digital tools for purpose and audience

Notes on this table:

- Elaboration ids are shown short inside a row whose CD code is already given — row 5's E03 is VC2S8U01.E03. The elaborations are VCAA's illustrations of what a content description might look like: they are contexts and examples, not the requirement. The content description is the expectation, and an elaboration that is not used is not a gap. The ids are recorded here because they are what joins each subtopic to the banked question set.
- The MCQs column is the count of questions already keyed to that code in the question bank, read from the curriculum authority file on 7 August 2026. It is not a target, and it is not a claim about how many the book will print.
- **The counts close.** 29 codes · 29 owners · 18 partners · 11 whole-CD subtopics → 47 subtopics. All 174 elaboration ids are allocated, three of them deliberately listed against both limbs of a split (VC2S8U10.E03, VC2S8U17.E01 and VC2S8U17.E03) → 177 entries in the column above. 2,415 banked multiple-choice questions are keyed to these codes, and every banked question for this band reaches a subtopic. There are no gaps: no content description is handed to another book, deferred, or delivered at reduced weight.
- **Aboriginal and Torres Strait Islander elaborations held back.** The notice on the first page of every booklet in this series states the estate's position on Aboriginal and Torres Strait Islander content. This book applies it at elaboration level: **ten elaborations are held back entirely** — VC2S8H01.E02, VC2S8H01.E04, VC2S8H03.E02, VC2S8H03.E03, VC2S8I07.E04, VC2S8I07.E05, VC2S8U01.E06, VC2S8U06.E05, VC2S8U13.E04 and VC2S8U15.E05 — and **three more are held back in part**: VC2S8I07.E03 (its cultural-protocols limb; 5B teaches its acknowledging-sources limb), and VC2S8U04.E05 and VC2S8U04.E06 (their First Nations limbs; 9B teaches the wider introduced-species and fire science). Where a First Nations elaboration *is* taught — in 1B, 3B, 6B, 12B, 13B, 14A, 14B, 15A and 18B — it is taught only from named, published sources that carry the permission of the Traditional Owners whose knowledge they record, it is attributed to the People the source names, and it never reproduces or redraws the cultural material itself. **The mandated protocols limb is taught either way.** VC2S8I02's own

content description requires following protocols when accessing cultural sites and artefacts on Country and Place, and its achievement standard requires students to identify intercultural considerations when planning fieldwork. That is content description text, not an elaboration, and it is not optional: subtopic 3B teaches it as process and law, against real, named Victorian instruments — the *Aboriginal Heritage Act 2006* (Vic), the *National Parks Act 1975* (Vic) and the *Wildlife Act 1975* (Vic). No content description is left without a teaching context by any holding-back here.

What this book does not cover. This book covers Levels 7 and 8 only. The other Science bands — Foundation to Level 2, Levels 3 and 4, Levels 5 and 6, and Levels 9 and 10 — live in their own books. The years before Foundation (Birth–Foundation) are not covered by this series at all. Towards Foundation Levels A–D are a separate product for students with disability, and are not in this book. VCE content, vocabulary and unit references do not appear on any student-facing page of this book.

This book also does not pre-teach Levels 9–10 or VCE. It teaches each content description, names the destination in the chapter’s forward note, and stops there. In particular, there is no subatomic structure, electron shells or ions, no chemical equations or balancing, no Ohm’s law or resistance calculation, no $F = ma$ or named Newton’s laws, no waves or electromagnetic spectrum, no radioactivity, no genetics or inheritance, no natural selection or evolution, no photosynthesis or respiration as equations, no greenhouse effect as a taught radiative mechanism, and no universe beyond the Earth–Sun–Moon system. Each of those belongs to a content description in the Levels 9 and 10 book or to VCE.

Teacher notes

There is **no VCAA examination at Levels 7 and 8, no external assessment, no study score and no mark VCAA receives**. Victorian schools report achievement against the Victorian Curriculum F–10 achievement standard on teacher judgement. Every instrument below is a **school instrument**, and the mark totals are a school convenience for consistency across classes. Every test carries this standing notice:

This is a school-designed paper. It is not a VCAA instrument. Achievement at Levels 7 and 8 is reported against the Victorian Curriculum achievement standard on teacher judgement; the marks here are one source of evidence towards that judgement.

The instruments. Eight topic tests — one per block — are folded into the booklet of the block’s last chapter at build time, each with its answers and fully-worked solutions. The two Scientific Investigation Tasks, the end-of-band review and the review’s worked solutions fill the Chapter 19 booklet.

Instrument	Covers	Marks	Planned for	Inquiry marks (min)	Host
Topic test 1 — How science works, and asking a good question	Chapters 1–2 (1A, 1B, 2A, 2B)	30	about 35 minutes	5	Chapter 2 booklet
Topic test 2 — Planning, measuring and processing	Chapters 3–4 (3A, 3B, 3C, 4A, 4B, 4C)	40	about 45 minutes	5	Chapter 4 booklet
Topic test 3 — Evaluating and communicating	Chapters 5–6 (5A, 5B, 6A, 6B)	30	about 35 minutes	5	Chapter 6 booklet
Topic test 4 — Biological sciences	Chapters 7–9 (7A, 7B, 8A–8D, 9A, 9B)	40	about 45 minutes	5	Chapter 9 booklet
Topic test 5 — Chemical	Chapters 10–11 (10A–10D, 11A,	40	about 45 minutes	5	Chapter 11 booklet

Instrument	Covers	Marks	Planned for	Inquiry marks (min)	Host
sciences	11B, 11C)				
Topic test 6 — Earth and space sciences	Chapters 12–14 (12A, 12B, 13A– 13D, 14A, 14B)	40	about 45 minutes	5	Chapter 14 booklet
Topic test 7 — Physical sciences	Chapters 15–17 (15A, 15B, 15C, 16A, 16B, 16C, 17A, 17B)	40	about 45 minutes	5	Chapter 17 booklet
Topic test 8 — Science in society	Chapter 18 (18A, 18B)	25	about 35 minutes	5	Chapter 18 booklet
SIT-1 — Reading someone else’s investigation	the inquiry strands (I01, I02, I04, I05, I06, I07)	25	untimed	whole task	Chapter 19 booklet
SIT-2 — Running your own	the inquiry strands (I02, I03, I04, I05, I06, I07, I08)	35	untimed	whole task	Chapter 19 booklet
End-of-band review	the whole book	80	90 minutes	20	Chapter 19 booklet
Total		425			

Each topic test has a multiple-choice section A drawn from the banked items keyed to its codes, and a short and structured-response section B: T2 carries one supplied data set to table and graph, T3 one flawed method to critique, T4 one dichotomous-key item and one food-web item, T5 one separation-design item and one density calculation, T6 one sourced Victorian tide or seismicity data interpretation, T7 one force diagram, one Sankey/efficiency item and one circuit item, and T8 one 8-mark issue analysis.

Administration — untimed, with reading support. These rules apply to every instrument in the book, and each instrument states them on its first page:

- Completion is **untimed**. The times in the table above are planning guidance for a Years 7–8 timetable and attention span; there is no time to beat, and a student may take as long as they need.
- **Reading support** is permitted. The teacher may read any question aloud to a student who needs it. Reading is not what is being looked at, and the teacher does not help with the answer.
- A **scientific calculator** is permitted for T2, T3, T5, T6, T7 and the end-of-band review, and is not required for T1 or T8.
- Item types: 1-mark multiple choice (four options, A–D), short response and structured response, with at least one extended item per paper built on a supplied stimulus — a data table, a graph, a labelled diagram or a short scenario.
- **Science inquiry is examinable in its own right, so it is examined in every paper.** At least 5 marks of every topic test are inquiry-strand marks — in T4 to T7 those marks attach to that chapter block’s own practical work — both SITs are inquiry tasks through their whole length, and 20 of the review’s 80 marks are inquiry. A student cannot pass this book on recall.
- **Marking guides ship with every instrument.** Each guide gives the acceptable responses and the mark allocation per response; the SITs carry a point-based marking guide plus a full model response — no holistic-only rubrics anywhere in the book.
- **A mark is a record that evidence was seen.** The records are for reporting against the Levels 7 and 8 achievement standard. They are not used to rank students.

The Scientific Investigation Tasks. SIT-1 sits after Chapter 6, when the inquiry spine is complete: on a supplied method and data set, students identify the variables and the unstated assumptions, process and represent the data, describe trends and anomalies, find the sources of error and say how the method could be improved, and justify a conclusion from the evidence. SIT-2 sits after Chapter 14: a student-planned, student-conducted investigation from one of four approved contexts drawn from Chapters 7 to 14, with a written risk assessment and ethics statement, a logbook, processed data, analysis, evaluation and a report written for a stated audience. The approved contexts are specified in the task, so a school does not have to invent one, and each is achievable with standard Victorian secondary laboratory equipment. SIT-2's risk assessment and ethics statement is where VC2S8I02's protocols limb is assessed: a student planning fieldwork must show the cultural-heritage and permissions check, because the achievement standard asks for exactly that.

The end-of-band review. Run once, after Chapter 18: one cumulative paper of 90 minutes with a scientific calculator permitted. Section A is 25 one-mark multiple-choice questions spread across all strands; section B is 45 marks of short and structured response across the four knowledge strands and the inquiry strands; section C is one 10-mark extended-response socio-scientific question carrying an inquiry limb. The strand weighting — Science as a human endeavour 8, Science inquiry 20, Biological 13, Chemical 13, Earth and space 13, Physical 13 — is printed in the paper's front matter, so a teacher can see the balance without counting. The inquiry weighting is deliberately the largest single block, one quarter of the paper. The review is a teaching instrument for reporting against the Levels 7–8 achievement standard, **not a mock examination**, and it must not be retitled or reformatted as one.

The question bank. The bank holds 2,415 multiple-choice items keyed to the 29 codes in the table above. They are a practice and diagnostic resource for the subtopics that own and partner each code — **they are not the assessment instrument, and there are no multiple-choice-only papers in this book.** The band's achievement standard is written in verbs — plan, construct, compare, explain, evaluate, communicate — that a pick-one item cannot evidence. The thinnest draws are VC2S8U17 (63 banked) and VC2S8U10 (68 banked); where the bank cannot supply an item at the right difficulty, a new one is authored against that code — never substituted from a neighbouring code, because that silently breaks the coverage join.

Safety notes

Safety in this book is stated **at the point of use**: every practical activity carries a risk assessment on the same page as the activity, written to **Science ASSIST (ASTA)** guidance, cited with a retrieval date, and naming the personal protective equipment required. This is not a formality — it is also how 3B is modelled for the student, and 3B teaches the pattern: name the hazard, name the risk, name the control, and agree it all before the work starts. Standing rules, in every part of the book:

1. **The subtopics that carry real hazards say so.** 11C (preparation and testing of oxygen, carbon dioxide and hydrogen), 10D (distillation), 10A and 10B (heating), and 17A and 17B (circuits) each carry their risk assessment at the point of use, and the teacher's risk sign-off precedes the work.
2. **No mains electricity in any student circuit.** The circuits of 17A and 17B use cells and low-voltage DC packs only, and the book says so wherever a circuit is built. Mains electricity — supplied at 230 V, 50 Hz AC in Victoria — is taught as content in 17A's household-wiring comparison, cited correctly, and never as an activity.
3. **The risk assessment names the personal protective equipment** — eye protection wherever there is heating, splashing or a projectile — and teacher supervision is stated where required.
4. **The investigation pages plan and analyse practical work — they do not replace it.** No page implies that a written exercise satisfies a practical requirement. The activity, the site, the equipment, the supervision, the teacher's risk sign-off and the school's fieldwork permission process are all beyond what a printed page can supply.
5. **Fieldwork gets its permissions before it starts.** Subtopic 3B teaches it and SIT-2 assesses it: where an investigation leaves the classroom, permission is obtained before work starts, under real, named Victorian instruments — the *Aboriginal Heritage Act 2006* (Vic), the *National Parks Act 1975* (Vic) and the *Wildlife Act 1975* (Vic) — and access may be restricted or refused. Visiting a cultural site is a matter of permission and respect; 13B's Wil-im-ee Mooring case says so plainly.

6. No photographs of identifiable children appear in this book, and no claims are made about living private individuals.
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Word list

Every science word in this book is named and explained the first time it appears, and every subtopic opens with its Words to know or its Word watch. This list gathers those words, chapter by chapter, as the book teaches them. A word that the book teaches again in a later subtopic is listed again where the book teaches it again.

Chapter 1 words

1A — *How scientific knowledge changes*

- **model** — a stand-in for something hard to see or test directly; it shows some features and leaves others out
- **theory** — (scientific sense) an explanation of a wide range of observations, built from many lines of evidence, that can be tested and revised
- **accepted** — currently used by scientists because it accounts for the evidence best — not “proven forever”
- **evidence** — observations or measurements that support or challenge an explanation
- **classification** — placing living things into groups based on their features and relationships
- **fungi** — the group containing mushrooms, moulds and yeasts; they take in ready-made food and are not plants
- **lift, weight, thrust, drag** — the four forces on an aircraft in steady flight: up, down, forward, backwards
- **vortex** — a swirling tube of air; at a plain wing tip it makes extra drag
- **winglet** — the upturned tip on a modern wing that weakens the vortex and cuts drag
- **continental drift** — Wegener’s 1912 proposal that the continents had once been joined and had moved apart
- **plate tectonics** — the accepted theory that the Earth’s outer shell is divided into moving plates
- **Gondwana** — the southern supercontinent in the reconstructions — the joined lands that now make up South America, Africa, Madagascar, India, Antarctica and Australia
- **sound-wave survey** — imaging the underground by sending sound waves down and reading the reflections — one form of deep Earth imaging
- **periodic table** — the arranged table of the elements; its forms have changed as knowledge grew

1B — *Who does science*

- **multidisciplinary** — mixing several fields of knowledge and work, not just one
- **perspective** — the angle a person sees a question from, shaped by who they are and what they need
- **worldview** — a person’s whole picture of how the world works and what matters in it

Chapter 2 words

2A — *Investigable questions*

- **causal relationship** — a relationship where a change in one thing *brings about* the change in the other — do this, and that happens
- **correlation** — a *togetherness*: two things that change together, rising and falling in step, without any claim about which (if either) is doing the causing; correlation is counted and seen, causes have to be argued for and tested
- **variable** — anything in an investigation that can take different values — temperature, height, tide level, the number of swoops

2B — *Hypotheses and reasoned predictions*

- **hypothesis** — a *proposed explanation* for something observed — stated so that you can say what would be seen if it were true, and so that some possible observation could show it to be wrong
- **prediction** — a statement of what you expect to observe in one particular test *if* the hypothesis is true

- **reasoned prediction** — a prediction backed by knowledge or past observations, not by luck
- **theory (from 1A)** — not a big hypothesis: what a well-tested explanation becomes after many passed tests; guess, hypothesis and theory sit at three different places on the road from wondering to knowing

Chapter 3 words

3A — Planning a reproducible investigation

- **independent variable** — the variable you change on purpose
- **dependent variable** — the variable you measure as the outcome
- **controlled variable** — a variable you keep the same so it cannot affect the outcome
- **hypothesis (from 2B)** — a testable idea about the answer to a question — a claim a plan can support or knock down
- **reproducible** — an investigation is reproducible when another group can follow your written plan and compare their results with yours
- **assumption** — something the plan takes as given without checking
- **analogous model** — a stand-in you can handle and watch, used because the real thing is too small, too fast or too hard to test directly — it is *analogous* because it behaves like the real thing in the one way you are testing

3B — Risk, ethics and protocols

- **hazard** — anything with the potential to cause harm — a flame, a wet floor, a corrosive chemical
- **risk** — the chance that a hazard actually harms someone, together with how bad that harm would be; the same hazard can carry a low risk or a high risk depending on who and what is exposed to it
- **control** — anything done to lower a risk
- **hierarchy of controls** — the ranking of controls from the one that removes the hazard itself down to the one that only protects the person
- **PPE (personal protective equipment)** — what you wear (safety glasses, a lab coat); it sits last in the hierarchy of controls
- **ethical** — acting in a way you could defend as right and fair to everyone and everything the work affects
- **ethical issue** — a point in the work where that question has to be answered
- **protocol** — a set of rules for how to behave in a particular situation
- **cultural protocols** — in the curriculum's own words, ethical principles that guide behaviour in particular situations when interacting with Aboriginal and/or Torres Strait Islander Peoples, designed to protect Aboriginal and Torres Strait Islander cultural and intellectual property rights about sharing of particular information
- **artefact** — an object made or changed by people in the past — here, usually one of Aboriginal cultural heritage, such as a worked stone flake
- **permission** — agreement from the right person or body before the work starts

3C — Equipment and precision

- **precision** — how closely readings of the same thing agree with each other; an instrument's precision is set by its finest graduation
- **accuracy** — how close a reading is to the true value
- **graduation** — one of the marked lines on a scale; the **finest graduation** is the smallest step the scale marks
- **meniscus** — the curve on the surface of a liquid in a narrow container — water climbs the glass a little, so the surface dips in the middle
- **abiotic factor** — a non-living part of a habitat, such as temperature, light, humidity or pH
- **exponent notation** — a short way to write repeated multiplying by 10: $10^3 = 10 \times 10 \times 10 = 1\,000$
- **tare** — to set an instrument's display back to zero before measuring, so the reading that follows is the sample alone

Chapter 4 words

4A — Organising data

- **data** — the measurements and facts you collect — the numbers written down during a practical, before anything has been done to them
- **information** — data that has been organised so it tells you something — data with a shape and a message
- **representation** — a way of showing data: a table, a graph, a diagram
- **category** — a named group — a surface, a colour, a brand — as opposed to a measured number
- **outlier** — a value that sits a long way from the others in a data set; the point that makes you look twice before you trust it

4B — Representing with keys, models and mathematical relationships

- **representation (from 4A)** — a way of organising data or an idea so it can be used — a table, a graph, a key, a model, a formula, a diagram
- **key** — a set of yes–no questions that leads you to the name of an item by its observable features
- **dichotomous** — splitting into two at every step; every question in a dichotomous key offers exactly two answers
- **model (from 1A)** — a stand-in for a real thing — a globe, a drawing of particles, a simulation on screen — that keeps some features of the real thing and drops others
- **scale** — how a model’s sizes compare with the real thing’s: 1:100 reads as “one unit on the model stands for one hundred of the same units in real life”
- **variable** — in a formula, a letter standing for a number that can change
- **substitute** — to replace each letter in a formula with its number so the formula can be calculated
- **algorithm** — a sequence of steps and decisions, written so exactly that a person or a computer can follow it without guessing — a key is one, and so is a recipe written as “if this, do that”

4C — Reading processed and secondary data

- **pattern** — a shape that repeats often enough that you could say what comes next
- **trend** — the long direction data travels across a stretch of time, even when individual points wobble up and down
- **relationship** — a link between two quantities — as one changes, the other changes in a regular way you can describe
- **anomaly** — a data point that sits away from the pattern the rest of the data makes
- **primary data** — data you or your class collected yourselves in your own investigation
- **secondary data** — data somebody else collected, and you are reading their record

Chapter 5 words

5A — Interrogating a method and a conclusion

- **assumption (from 3A)** — anything a method takes for granted without checking; every method has them, and the habit science builds is naming them and asking how reasonable each one is
- **error** — any gap between a measurement and the true value; not a slip or a mistake
- **random error** — chance in the measurement — readings scatter on both sides of the true value, a little high here, a little low there
- **systematic error** — a built-in shift — every reading moves the same way, by roughly the same amount, because something in the setup or the instrument is off
- **claim** — a conclusion or statement someone asks you to believe
- **evidence (from 1A)** — the observations and measurements standing behind a claim; evaluation is what happens when claims and evidence are made to face each other

5B — Building an evidence-based argument

- **argument** — not a fight: a claim with its evidence and reasoning attached
- **claim (from 5A)** — a statement someone asks you to believe
- **evidence (from 5A)** — the observations and measurements standing behind it
- **reasoning** — the link — the sentence that says *why* that evidence supports that claim
- **credibility** — how much a source deserves to be believed when it makes a claim
- **citation** — a written note that tells the reader exactly where a piece of information came from; to **cite** is to write one
- **protocol (from 3B)** — an agreed set of rules about how something is to be done correctly

Chapter 6 words

6A — *The scientific report*

- **scientific report** — a written account of an investigation that lets another person check it
- **convention** — an agreed habit of presentation — where a caption goes, how a unit is written — that every report in science follows, so every reader knows where to look
- **aim** — the question the investigation answers
- **hypothesis (from 2B)** — the testable prediction you state before the test
- **results** — what you found, as numbers and plain statements
- **discussion** — what the results mean, including assumptions and sources of error
- **conclusion** — the one- or two-sentence answer to the aim
- **active voice** — the doer comes first: “*we measured the mass*”
- **passive voice** — the thing it happened to comes first and the doer is usually left out: “*the mass was measured*”
- **tense** — whether a sentence sits in the past or the present
- **citation marker** — a small tag in the text, like [S1], that points at one line in the reference list
- **reference list** — the list at the end of a report that gives every source in full
- **plagiarism** — using someone else’s words, ideas or images without credit, so they read as yours
- **justify** — to give reasons for a position that someone on the other side has to answer
- **socio-scientific issue** — a real-world question where science meets people — where the evidence is part of the argument but not all of it

6B — *Choosing the format for the purpose and the audience*

- **format** — the shape a message travels in — a table, a graph, a poster, a talk, a model, an animation
- **audience** — who the message is for
- **purpose** — what the message is meant to do: report, explain, spark interest, persuade
- **model (from 4B)** — a stand-in for the real thing, used when the real thing is too big, too small, too slow or too hidden to show directly
- **representation (from 4B)** — the wider family: any way of putting an idea somewhere it can be seen or heard, including models, graphs, tables and labelled drawings
- **analogy** — *this is like that*: it carries an unfamiliar idea on the back of a familiar one, and it always has two halves — what it carries well, and where it breaks
- **digital tool** — any device or software that takes part in collecting, holding, graphing or presenting the message

Chapter 7 words

7A — *Similarities and differences within and between groups of organisms*

- **organism** — any living thing — an animal, plant, fungus or microorganism
- **diversity of life** — the variety of organisms living on Earth
- **classification** — sorting organisms into groups by the features they share

- **requirements for life** — the seven jobs every living thing does — movement, respiration, sensitivity, growth, reproduction, excretion, nutrition (MRS GREN)
- **respiration** — the process that releases energy from food inside living cells
- **sensitivity** — noticing changes around the organism and responding to them
- **excretion** — getting rid of wastes the body cannot use
- **nutrition** — taking in food, or making it
- **species** — a group of organisms whose members can breed with each other and produce young that can themselves breed
- **genus** — a group of closely matched species; the first word of a scientific name
- **scientific name** — the two-part Latin-or-Greek name every species gets, used worldwide
- **Linnaean hierarchy** — the ordered system of groups within groups: kingdom, phylum, class, order, family, genus, species
- **kingdom** — the largest rank of the Linnaean hierarchy taught here
- **phylum** — the rank inside a kingdom; members share a body plan
- **class** — the rank inside a phylum
- **order** — the rank inside a class
- **family** — the rank inside an order
- **vertebrate** — an animal with a backbone
- **evidence (from 1A)** — observations that support or change a scientific idea

7B — Classification tools

- **classification tool** — a tool — a key, a guide or a chart — that keeps the diversity of life in order
- **dichotomous key** — a key that sorts organisms by offering exactly two choices at every step
- **couplet** — a numbered pair of statements in a key, offering exactly two choices
- **specimen** — the organism you are trying to name
- **go-to** — an instruction such as “go to 3” that sends you on to the next couplet
- **path** — the chain of choices taken through a key, written as 1b → 3a
- **feature** — a part or quality of an organism that you can observe, used by a couplet
- **leaflet** — one of the small blades a divided leaf is split into
- **toothed edge** — a leaf edge with small teeth along it, like a saw
- **strap-like** — long and narrow, like a strap or a grass blade
- **survey** — an organised look at what lives in a place, with what is found written down
- **mollusc** — a soft-bodied animal, most with a shell or its remnant — the snail and slug group
- **arachnid** — an eight-legged animal — the spider group
- **reptile** — a scaly-skinned animal with backbones — the lizard group here
- **amphibian** — the frog group: young live in water, adults usually on land
- **life stage** — one of the different looks an organism has as it grows, like tadpole and frog
- **look-alike** — one of two species so similar that a key cannot split them

Chapter 8 words

8A — Cell theory and the microscope

- **cell** — the basic unit of life — the smallest piece of living matter that is still alive
- **cell theory** — the theory in three claims: all living things are made of one or more cells; the cell is the basic unit of life; all cells come from cells that already exist
- **organism** — any living thing
- **unicellular** — made of a single cell that does every job of life
- **multicellular** — built from many cells working together

- **micrometre (µm)** — one thousandth of a millimetre; the unit used for the sizes of cells
- **light microscope** — an instrument that shines light through a thin sample and uses lenses to magnify it
- **eyepiece lens** — the lens of a microscope that you look through
- **objective lens** — a lens of a microscope close to the sample
- **stage** — the flat part of a microscope that the slide sits on
- **magnification** — how many times bigger an image is than the real thing; $\text{image size} \div \text{actual size}$
- **photomicrograph** — a photo taken through a microscope
- **scale bar** — a line on an image, labelled with the true length it stands for
- **wet mount** — a sample mounted in a thin film of liquid on a slide, under a cover slip
- **cover slip** — the very thin glass square lowered over a wet mount
- **stain** — a coloured liquid, such as iodine, used to make cell parts easier to see
- **bacterium (bacteria)** — a unicellular organism, much smaller than a plant or animal cell, with no nucleus

8B — *Organelles and what they do*

- **organelle** — a structure inside a cell that has a specific job
- **cell membrane** — the thin outer layer of a cell that lets some substances through and not others
- **selectively permeable** — letting some substances through and keeping others out
- **cytoplasm** — the jelly-like material inside the cell membrane, in which the organelles sit
- **nucleus** — the control centre of the cell, which holds the DNA
- **DNA** — the material that carries the instructions for building and running the cell
- **mitochondrion (mitochondria)** — an organelle that releases energy from food, using oxygen
- **respiration (from 7A)** — the process that releases energy from food inside living cells
- **ribosomes** — tiny structures in the cytoplasm that join building blocks into proteins
- **protein** — a building and working material of the cell, made as a chain of building blocks
- **chloroplast** — an organelle in plant cells that captures light energy to make food
- **chlorophyll** — the green pigment in chloroplasts that captures light energy
- **pigment** — a coloured substance
- **simple sugar** — the food a chloroplast makes; the cell uses it as fuel
- **photosynthesis** — the food-making process in chloroplasts, using light energy, carbon dioxide and water
- **vacuole** — a storage sac in a cell; plant cells have one large central vacuole
- **cell wall** — the firm outer layer of a plant cell, built mostly from cellulose
- **cellulose** — the strong material that plant cell walls are mostly built from
- **diffusion** — the spreading of a substance from where there is a lot of it to where there is little

8C — *From cells to tissues to organs*

- **tissue** — a group of similar cells working together at one job
- **organ** — a structure made of different tissues working together
- **organ system** — organs working together
- **specialised cell** — a cell whose shape and parts suit one particular job
- **surface area** — the area of the outside of something; more of it lets more pass in or out at once
- **root hair cell** — a root surface cell with one long thin hair, built for taking in water and minerals
- **xylem** — the plant tissue that carries water and minerals one way, up from the roots
- **phloem** — the plant tissue that carries food from the leaves both ways
- **vascular bundle** — a group of xylem and phloem travelling together in a stem or leaf
- **sieve plate** — the hole-filled end wall between two phloem cells
- **companion cell** — a living cell alongside a phloem tube that keeps it working
- **haemoglobin** — the red material in a red blood cell that binds oxygen and carries it

- **biconcave** — shaped like a disc with a dip in the middle on both sides
- **heart** — the organ, made mostly of muscle tissue, that pumps the blood
- **atrium (atria)** — an upper chamber of the heart that receives blood coming in
- **ventricle** — a lower chamber of the heart that pumps blood out
- **valve** — a flap that closes to keep blood moving one way
- **artery** — a vessel carrying blood away from the heart, with a thick muscle wall
- **vein** — a vessel carrying blood back to the heart, with a thinner wall, a wider space and valves
- **capillary** — the narrowest vessel, with a wall one cell thick, where delivery to the cells happens
- **plasma** — the liquid part of the blood, carrying dissolved food and wastes
- **pulse** — the push of blood through an artery each time the heart contracts

8D — Organ systems and survival

- **organ system** — a group of organs working together at one big job
- **disorder** — a condition in which part of an organism stops working as it should
- **vital organ** — an organ the organism cannot live without
- **non-vital organ** — an organ the organism can live without, because the rest of the body manages
- **lumen** — the open channel inside a blood vessel
- **plaque** — a build-up of fatty substances inside an artery wall
- **villi (villus)** — tiny finger-like projections lining the small intestine, through which food substances pass into the blood
- **absorption** — the passing of food substances (or other substances) into the blood
- **phloem (from 8C)** — the transport tissue in a plant that carries sugar from the leaves to the rest of the plant
- **ringbarking** — the removal of a band of bark all the way around a trunk or stem
- **dieback** — the dying back of a plant from its tips, here caused by root rot
- **dialysis** — the cleaning of the blood by a machine that does part of the kidneys' filtering job
- **artificial organ** — a man-made device that does part or all of the job of a real organ
- **transplant** — an operation replacing a failing organ with a healthy organ from a donor
- **donor** — the person an organ for a transplant comes from

Chapter 9 words

9A — Matter and energy through an ecosystem

- **ecosystem** — all the living things in a place, together with the non-living things around them, linked by flows of matter and energy
- **food chain** — one feeding path, drawn with arrows from each food to its feeder
- **food web** — many food chains joined together, showing the feeding relationships in an ecosystem
- **producer** — a living thing (such as a green plant) that captures light energy and stores it in the food it makes
- **consumer** — a living thing that eats other living things
- **primary consumer** — a consumer that eats producers (second trophic level)
- **secondary consumer** — a consumer that eats primary consumers (third trophic level)
- **tertiary consumer** — a consumer that eats secondary consumers (fourth trophic level)
- **top consumer** — a consumer that nothing else in the chain or web eats
- **trophic level** — a feeding step counted up from the producers
- **decomposer** — a living thing, such as a fungus or bacterium, that breaks down dead matter and waste and returns nutrients to the soil
- **microorganism** — a living thing too small to see with the eye alone, such as a bacterium
- **pyramid of energy** — a model with one bar per trophic level showing the energy stored at that level; producers form the base

- **pyramid of numbers** — a model with one bar per trophic level showing the number of organisms at that level
- **nutrient** — a substance that living things need to take in to grow and stay healthy
- **matter** — the material living things are made of; it cycles through an ecosystem and is never used up

9B — Populations under pressure

- **population** — all the individuals of one species living in a place at a time
- **biotic factor** — a living part of an ecosystem that affects a population — its food, its predators, its diseases
- **abiotic factor (from 3C)** — a non-living part of an ecosystem — water, temperature, light, soil, fire

Chapter 10 words

10A — The particle and kinetic theories

- **particle** — an unbelievably tiny piece of matter; what every substance is made of
- **particle theory** — the theory that matter is made of tiny particles with space between them
- **kinetic theory** — the theory that the particles of matter are always moving, and move faster the hotter it is
- **matter** — anything that takes up space — all substances are matter
- **state** — one of the three forms of matter: solid, liquid or gas
- **attraction** — the pull between particles that holds them together
- **vibrate** — to move a little way from side to side about a fixed position
- **melting** — the change of state from solid to liquid
- **freezing** — the change of state from liquid to solid
- **boiling** — the change of state from liquid to gas throughout the liquid, at the boiling point
- **evaporating** — the change of state from liquid to gas at the surface only, at any temperature
- **condensation** — the change of state from gas to liquid
- **sublimation** — the change of state from solid straight to gas (explained fully in 10B)
- **change of state** — a substance moving between solid, liquid and gas
- **heat** — energy on the move from something warmer to something cooler
- **temperature** — how hot something is, in °C; tracks how fast the particles move
- **model (from 1A)** — a simplified picture or object that stands in for the real thing, with strengths and limits

10B — Explaining a substance with its particles

- **melting point** — the temperature where a solid on its own becomes a liquid
- **boiling point** — the temperature where a liquid becomes a gas throughout
- **density** — the mass of a substance per unit volume (here in g/cm³)
- **mass** — how much matter something has, in grams (g) or kilograms (kg)
- **volume** — the space something takes up, in cubic centimetres (cm³) or millilitres (mL)
- **compressibility** — how easily a sample can be squeezed into a smaller space
- **gas pressure** — the push of gas particles colliding with a surface, added together
- **viscosity** — how strongly a liquid resists flowing
- **diffusion (from 8B)** — the spreading of a substance from where there is a lot of it to where there is little
- **sublimation (from 10A)** — a solid turning straight into a gas, with no liquid stage
- **expansion** — getting bigger when heated
- **contraction** — getting smaller when cooled

10C — Pure substances and mixtures

- **pure substance** — matter made of one substance only — an element or a compound
- **element** — a pure substance that cannot be broken into simpler substances; one kind of particle
- **compound** — a pure substance whose particles hold two or more kinds of parts joined in a fixed proportion

- **mixture (impure substance)** — two or more substances together without chemical joining; amounts can vary
- **composition** — what a sample is made of, and in what amounts
- **homogeneous** — (of a mixture) uniform composition — the same mix in every part
- **heterogeneous** — (of a mixture) non-uniform composition — different parts, different mix
- **solution** — a homogeneous mixture formed when a solute dissolves in a solvent
- **solute** — the substance that dissolves
- **solvent** — the substance the solute dissolves in
- **dissolve** — (of a solute) to spread, particle by particle, evenly through a solvent
- **dilute** — a small amount of solute in this amount of solvent
- **concentrated** — a large amount of solute in the same amount of solvent
- **saturated** — holding as much solute as can dissolve at this temperature
- **supersaturated** — holding more solute than a saturated solution could at this temperature; unstable

10D — *Separating a mixture*

- **filtration** — separating an insoluble solid from a liquid by passing the mixture through filter paper
- **residue** — the solid caught on the filter paper
- **filtrate** — the liquid that passes through the filter paper
- **decantation** — letting a solid settle, then pouring the liquid off
- **evaporation** — heating a solution so the liquid boils off and the dissolved solid is left behind
- **crystallisation** — getting a dissolved solid back slowly, as crystals, by slow cooling or slow evaporation
- **magnetic separation** — using a magnet to lift a magnetic part out of a mixture
- **distillation** — boiling a liquid off and then cooling the vapour back to a liquid so it can be collected
- **volatile** — (of a liquid) evaporating and boiling easily
- **chromatography** — separating dissolved substances by letting a solvent carry them along a paper at different rates
- **solvent front** — the furthest point the solvent reached on the paper

Chapter 11 words

11A — *The atomic theory of matter*

- **atom** — the smallest particle of an element that is still that element
- **element** — a substance made of one kind of atom only (gold, oxygen, helium)
- **compound** — a substance in which two or more kinds of atom are joined in a fixed recipe (water, salt)
- **mixture** — two or more substances in the same place, not joined; the recipe can vary (air, brass, seawater)
- **molecule** — a joined group of atoms; the formulas of molecules such as O_2 and H_2O show how many atoms of each kind are joined
- **pure substance** — one kind of stuff with a fixed make-up — the elements and the compounds
- **solution** — a mixture in which the dissolved particles are spread evenly and never settle (salt water)
- **suspension** — a mixture whose large particles settle if left (muddy water)
- **colloid** — a mixture whose tiny particles stay floating throughout and do not settle (milk)
- **symbol** — the one- or two-letter name of an element, first letter capitalised (Cu, O, Na)
- **chemical formula** — symbols and subscript numbers naming the elements in a substance and counting the atoms of each (H_2O , $CaCO_3$)
- **subscript** — the small number written low after a symbol in a formula, counting atoms of that element
- **periodic table (from 1A)** — the chart of all the elements, each with its own square and number, arranged so the pattern shows
- **percentage** — a share out of every 100 parts; the way a mixture's varying recipe is written down

11B — *Physical change against chemical change*

- **physical change** — a change in which no new substance is made — the same substances are present afterwards, perhaps in a different shape, size or state
- **chemical change** — a change in which one or more new substances are made, with different properties
- **property** — anything about a substance that can be measured or observed — colour, density, melting point, hardness, whether it conducts, how it behaves with other substances
- **physical property** — a property you can observe or measure without changing the substance into something new — colour, density, melting point, how it bends or flows
- **chemical property** — a property about how a substance behaves when it *could* become something new — whether it rusts, burns, or resists acids
- **reversibility** — whether a change can be turned back into the original substances; a clue, not the deciding test
- **dissolving** — one substance spreading out among the particles of another to form a solution; a physical change
- **rusting** — the slow chemical change in which iron in damp air becomes rust, a crumbly orange-brown substance
- **indicator (of chemical change)** — an observable sign — such as a new colour or a gas appearing — that suggests new substances are being made; the four named indicators are taught in 11C

11C — *The indicators of chemical change*

- **indicator (of chemical change)** — an observable sign — a colour change, a temperature change, a gas being made, or a precipitate — that suggests new substances are forming
- **precipitate** — an insoluble solid that appears when two clear solutions are mixed
- **insoluble** — does not dissolve; stays as a solid in the liquid
- **catalyst** — a substance that speeds up a chemical change without being used up (such as MnO₂ in the preparation of oxygen)
- **limewater** — a clear liquid that turns milky (cloudy white) when carbon dioxide is bubbled through it
- **splint** — a thin wooden stick, like a match without the head, used in gas tests
- **glowing-splint test** — the test for oxygen: a glowing splint relights in the gas
- **limewater test** — the test for carbon dioxide: the gas turns limewater milky
- **pop test** — the test for hydrogen: a burning splint at the mouth of the tube gives a squeaky pop

Chapter 12 words

12A — *Plate boundaries and what they build*

- **theory (from 1A)** — not a guess: an explanation backed by a great body of evidence that ties together many observations; how theories grow and change is the subject of 1A

12B — *The evidence for plate tectonics*

- **proof** — in science, evidence never proves a theory once and for all — it *supports* it; where everyday talk might reach for *proof*, this book uses *evidence* and *support*
- **accepted (from 1A)** — the best explanation on offer: it ties together many observations, it supplies a working mechanism, and it keeps passing new tests; acceptance is a status, not a finish line

Chapter 13 words

13A — *The rock cycle*

- **mineral** — a substance found in nature; the ingredients that rocks are made of
- **sediment** — loose material — sand, mud, pebbles, shells — that can be pressed and cemented into rock
- **weathering** — the breaking down of rock where it sits, with no movement
- **erosion** — the carrying away of broken rock by water, wind, ice or waves
- **deposition** — the dropping of sediment when its carrier slows down
- **compaction** — the squeezing of sediment layers together by the weight of layers above

- **cementation** — dissolved minerals left between grains, gluing sediment into solid rock
- **crystallisation** — crystals forming and growing as a melt cools and becomes solid
- **magma** — melted rock underground
- **lava** — magma that has reached the surface
- **uplift** — forces inside the Earth pushing rock back up toward the surface
- **metamorphic rock** — rock changed by heat and pressure underground, without melting
- **metamorphism** — the changing of rock into metamorphic rock by heat and pressure, without melting
- **fossil** — the preserved remains or traces of a living thing from long ago
- **rock cycle** — the model in which rocks are continually made, changed, broken down and made again

13B — Rock properties in use

- **properties** — a rock's observable features: what you can see, feel and test without breaking it apart — colour, texture, layering, hardness, reaction to acid, and fossils
- **hardness** — how well a material resists being scratched; the Mohs scale ranks minerals from 1 (talc) to 10 (diamond), and the numbers are ranks, not measurements
- **acid test** — one drop of dilute acid on a fresh surface; fizzing shows the rock contains the mineral calcite
- **calcite** — the mineral that fizzes with dilute acid; limestone is the common rock built mostly of it
- **dichotomous key (from 7B)** — here, a provided key that identifies a rock by offering exactly two choices at each step
- **granite** — an igneous rock of large, visible interlocking crystals; very hard and durable
- **basalt** — an igneous rock whose crystals are too small to see; the most common rock of its kind; in Victoria called **bluestone**
- **bluestone** — the Victorian name for the local basalt, quarried since the 1850s for warehouses, kerbs, cobblestones and foundations
- **blue metal** — crushed bluestone, sold as railway ballast, road base and for concrete
- **limestone** — a sedimentary rock made of calcite; fizzes with dilute acid and often holds shell fossils
- **marble** — metamorphic rock: limestone changed by heat and pressure into interlocking calcite crystals; takes a high polish
- **sandstone** — a sedimentary rock of cemented grains; gritty, porous, and soft enough to cut and carve
- **slate** — metamorphic rock: changed mudstone that splits into thin, flat, weatherproof sheets
- **greenstone** — a dark, very tough, fine-grained rock that flakes to a sharp edge — the rock quarried by the Wurundjeri at Wil-im-ee Mooring for hatchet heads
- **quarry** — a place where rock and earth materials are dug out at the surface
- **mine** — an extraction that may go underground
- **ore** — a rock that contains metals or valuable minerals that can be mined for profit
- **rehabilitation** — restoring mined land so it can be used again — back-filling, reshaping, treating water, spreading saved topsoil and replanting, or flooding a pit on purpose as a lake or wetland
- **back-fill** — tipping waste rock back into a worked-out pit as part of rehabilitation

13C — Renewable and non-renewable resources

- **resource** — anything people can use that comes from the Earth or from the energy that reaches it
- **renewable resource** — a resource replaced by natural processes at least as fast as people use it
- **non-renewable resource** — a resource formed so slowly that it does not come back on any human timescale once used
- **regeneration** — the natural replacement or re-forming of a resource — regrowth, breeding, refilling
- **regeneration timescale** — how long regeneration takes — from daily (sunlight) to millions of years (coal)
- **fossil fuel** — coal, oil or natural gas — fuel formed from long-dead organisms over millions of years
- **peat** — soft, wet plant material formed when dead plants only half break down; the first stage on the way to coal

- **ore** — rock mined because it holds enough of a useful mineral to be worth extracting
- **finite** — present in a fixed amount that runs down as it is used
- **stock** — the amount of a resource in store at a given time
- **flow (of a resource)** — a supply that keeps arriving whether used or not — sunlight, wind
- **aquifer** — a layer of rock or sand underground that holds groundwater
- **groundwater** — water stored underground in aquifers, reached by bores
- **recharge** — the refilling of an aquifer, mostly by rain soaking in
- **bore** — a deep hole drilled or dug to reach groundwater
- **overfishing** — taking fish faster than the population can breed them back
- **rotation cycle** — the plantation pattern of planting, growing, harvesting and replanting patches in turn
- **sustainable use** — use of a resource in the 1987 sense: meeting the needs of the present without compromising the ability of future generations to meet their own needs

13D — *Extraction and energy production*

- **no emissions while generating** — the fair statement for wind and solar: they produce no carbon dioxide while they make electricity, but their towers, panels and batteries had to be made, transported and installed, which used energy; the same care applies the other way — a coal station's risks include mining and ash, not only the smoke from its chimneys
- **variable, not unreliable** — wind and solar output changes with the weather; that is a real problem for a grid, but it is not the same as being unreliable by accident, and the responses — storing energy, connecting the grid over wider areas, keeping quick-start back-up — are engineering questions with engineering answers

Chapter 14 words

14A — *Earth and the Sun*

- **intensity** — how much light energy arrives on a given patch of a surface; the same sunlight spread over a wide patch has a lower intensity than the same sunlight packed onto a small one — a low Sun does not send *weak* light to Earth, it sends the same light spread wider
- **direct (of sunlight)** — arriving straight onto a surface, at a steep angle — not glancing across it at a low angle

14B — *Earth, Moon and Sun*

- **spring tide** — a tide with the biggest range — the highest high tides and the lowest low tides; nothing to do with the season — here *spring* means to jump up
- **neap tide** — a tide with the smallest range
- **phase** — one of the shapes the lit part of the Moon makes as seen from Earth
- **waxing** — growing: from new moon to full moon, the lit part we see gets bigger each night
- **waning** — shrinking: from full moon back to new moon, the lit part gets smaller
- **gibbous** — more than half lit but not full
- **crescent** — a curved sliver, less than half lit
- **gravity** — the pull that every object with mass has on every other object; Earth's gravity pulls everything toward the ground, and the Moon's gravity reaches all the way across space and tugs on Earth's oceans

Chapter 15 words

15A — *Forces investigated and represented*

- **magnitude** — the size of a force — how many newtons of push or pull there are — shown on a force diagram by the length of the arrow
- **mass** — the amount of matter in an object, in kilograms; the same everywhere — people say “weight” when they mean this, but kilograms measure mass
- **weight** — the pull that gravity exerts on that mass — a force, measured in newtons, which is different on the Moon and on Earth; the mass of this book is the same on the Moon, its weight is not

15B — Changing an object's motion

- **force** — a push or a pull on an object, measured in newtons (N)
- **mass** — how much matter an object has, in grams (g) or kilograms (kg)
- **weight** — the pull of gravity on an object's mass — a force, in newtons (N)
- **net force** — the overall push or pull when all the forces on an object are combined, taking their directions into account
- **balanced forces** — forces that balance out, leaving a net force of zero — no change of motion
- **unbalanced forces** — forces that do not balance out, leaving a net force — the motion changes
- **magnitude** — the size of a force — a bigger force has a bigger magnitude
- **friction** — a force between surfaces that acts against the motion of an object sliding or rolling over another surface
- **change of motion** — starting, stopping, speeding up, slowing down, or changing direction
- **force diagram** — a picture that represents each force on an object as an arrow: the arrow points the way the force acts, and a longer arrow means a bigger force (built in 15A)
- **newton (N)** — the unit of force
- **fair test** — an investigation that changes only one thing at a time, keeping everything else the same

15C — Simple machines

- **simple machine** — one of the six basic force-changers: lever, inclined plane, wedge, pulley, screw, wheel and axle
- **load** — the force the machine must overcome
- **effort** — the force you apply to the machine
- **fulcrum** — the fixed pivot a lever turns about
- **effort arm / load arm** — the distances from the fulcrum to the effort and to the load
- **mechanical advantage (MA)** — load force $\div$ effort force; how many times the machine multiplies your force
- **inclined plane** — a ramp that raises a load with a smaller push over a longer way
- **wedge** — a moving double inclined plane that turns one push into two sideways forces
- **pulley** — a wheel on an axle with a rope running over it; fixed (MA = 1) or movable (MA = 2)
- **block and tackle** — pulleys combined so several rope segments share the load
- **screw** — an inclined plane wrapped around a rod
- **pitch** — how far a screw advances in one full turn
- **wheel and axle** — a big wheel fixed to a small axle, turning together

Chapter 16 words

16A — Forms of energy

- **energy** — not a feeling and not a substance you can hold, pour or see: a property of things — **the ability to make change happen**; measured in joules (J)
- **joule (J)** — the unit energy is measured in
- **potential** — stored, waiting to be used; potential energy is energy that is not doing anything yet — a raised book, a stretched band, a tank of fuel — but is ready to become something the moment conditions allow
- **transformation** — the form of the energy changes — stored chemical energy becomes kinetic energy in a speeding car
- **transfer** — the form stays the same but the energy moves place — thermal energy moves from a hot cup into your cold hands

16B — Energy on the move

- **thermal energy** — the energy stored in a warm object; in everyday talk this is what people treat as a thing a hot object “holds”

- **heating** — the *moving* of that energy from a hotter place to a colder one; conduction, convection and radiation are the three ways heating happens
- **waste** — does not mean *destroyed*: energy can never be destroyed, so a “waste” output is the share of the input that ends up somewhere it is not useful — almost always as thermal energy warming the surroundings; “lost” means lost *to usefulness*, not lost from the universe

16C — The household energy audit

- **energy audit** — a careful list of where a household’s energy goes, used to find savings
- **kilowatt-hour (kWh)** — the unit energy bills use: the energy a 1 000 W device uses in one hour
- **power (W, kW)** — how fast an appliance uses energy right now
- **star rating** — a label score comparing how much energy an appliance (or house) uses for the same job
- **passive solar design** — designing a building to heat and cool itself using the Sun’s path, with no machines
- **eave** — the edge of a roof that overhangs the wall, shading windows from high summer Sun
- **thermal mass** — heavy material (concrete, brick, mudbrick) that stores heat and releases it later
- **insulation** — material that slows heat flow by trapping still air (batts, polystyrene, foil)
- **standby power** — energy used by appliances that are left on instead of switched off at the wall
- **glazing** — the glass in a building’s windows

Chapter 17 words

17A — Building a circuit for a purpose

- **current** — a flow of charge around a loop, and the flow that carries energy from the source to every component; not something a wire “has” — something that flows, or does not
- **circuit** — a complete loop of components joined by conducting wire; the current goes right around the loop and back to where it started, and break the loop at any point and the current stops; the circuit is the loop itself, not the diagram drawn of it

17B — Voltage and current

- **charge** — the stuff that moves around the loop — carried by the wires, and never used up
- **current (from 17A)** — how much charge is flowing past a point in the circuit — a big current means a lot of charge flowing; measured in amperes (A)
- **voltage** — the push a supply gives to the charge — it tells you how much energy each bit of charge carries as it moves; measured in volts (V); a circuit can have a big voltage and a small current, or a small voltage and a big current — they are two different questions about the same loop; say *the current through* a component and *the voltage across* it

Chapter 18 words

18A — Socio-scientific issues

- **socio-scientific issue (from 6A)** — a question that science can *inform* but cannot, on its own, *answer*: the science in it is real and testable, and the decision in it reaches into people’s lives, jobs, values and rights
- **stakeholder** — one of the people, groups, places and living things an issue touches — the ones with a *stake* in how it is decided; naming the stakeholders first is the habit that stops a weighing from missing someone
- **the four lenses** — the four kinds of consideration the content description names: the ethical lens asks what is right and wrong; the environmental lens asks what happens to living things and their surroundings; the social lens asks what happens to people and communities; the economic lens asks what it costs and who pays
- **dual use** — knowledge that serves or harms depending on what people decide to do with it — one chemistry, two choices
- **hazard (from 3B)** — here: a natural event with the potential to cause harm, like an earthquake; a **disaster** is what happens when the hazard meets people in the way — the hazard is natural, the size of the disaster is not

- **cultured meat** — the descriptive name this book uses for meat grown from animal cells in a culture medium; the other names in circulation — *clean meat*, *fake meat*, *lab meat* — each signal a stance before anything is weighed
- **bioreactor** — a warm, controlled tank in which cells are fed nutrients and multiply into tissue

18B — *Science communication and its consequences*

- **biodegradable (from 18A)** — a set-meaning term: a material is biodegradable only if micro-organisms break it down into natural substances **under named conditions** — warmth, moisture, air and time; the test is not “does it break down somewhere, someday?” but “does it break down under the conditions in the standard?”