

Science for Young Minds

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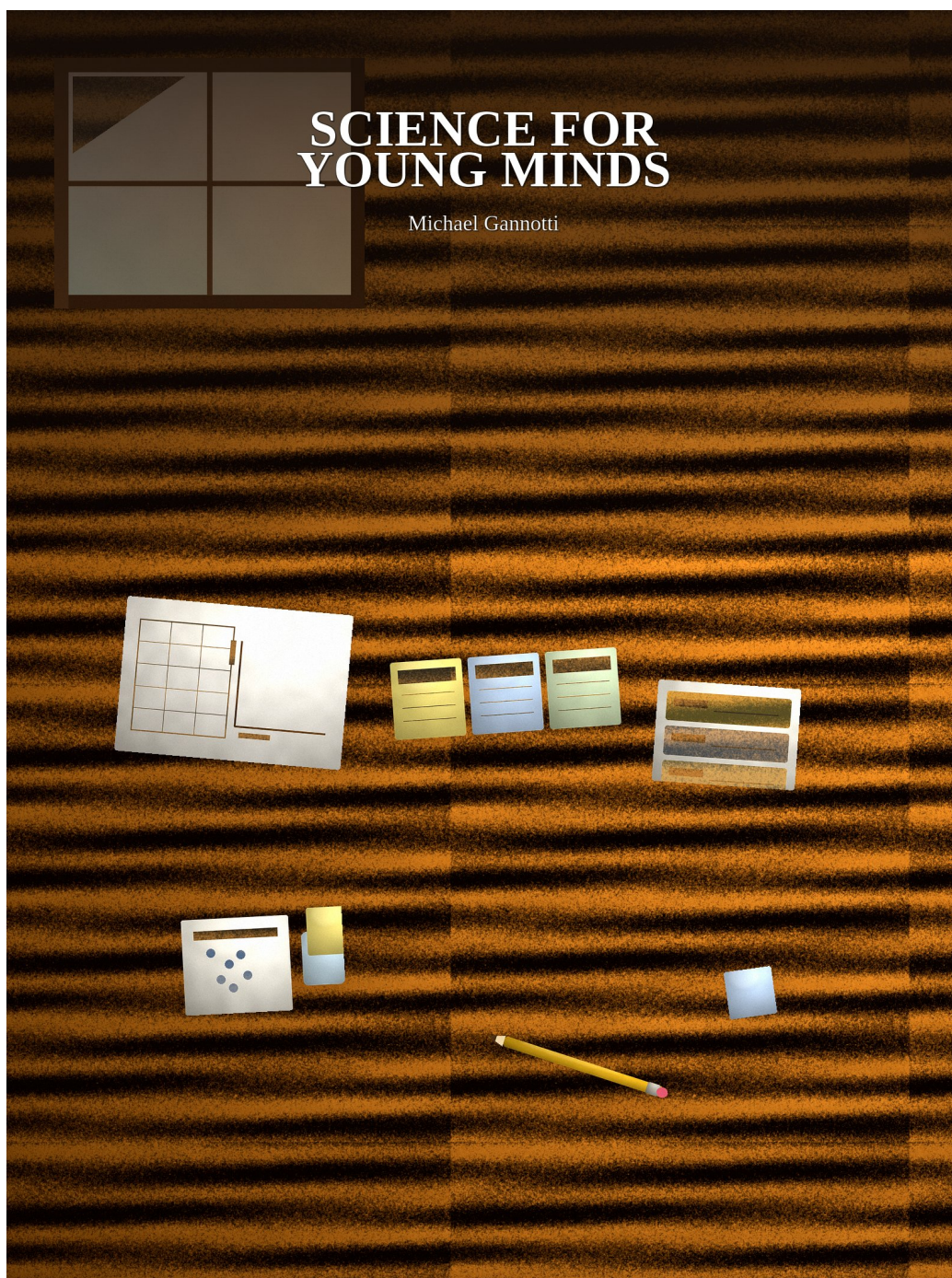


Figure 1: Cover

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This illustrated edition is the teaching-manual of 17 September 2026. Endnotes run in one series. Chapter-opening images are original still-lives, not portraits of persons or children. Documents still constrain the facts.

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Welcome

You do not need to be a scientist to teach science at home to an eleven- to fourteen-year-old.

You need a fair test on the table, a blank notebook the student fills from what they actually measured, and one good question you are willing to wait for.

That is the whole focus of this book: **fair test with a notebook record**, and **claim with evidence** — CER light, not a lab-report franchise. Looking first. Measuring next. A short claim that points at *this* trial’s numbers. Then a named idea, just in time.

Why this book exists

Many adults remember science as a vocabulary list and a laminated five-step “method” poster. That memory is ordinary. It is not a character flaw.

At ages **11–14**, science looking grows up from *Science for Little Thinkers* (ages 5–10: notice before name, draw what you saw, fair-test light at the upper end of that band). Same house, different noun. Here the student names what changed and what stayed the same, fills a blank table from measurements they took, moves table → graph → sentence, builds a model and names a limit, and says a claim that points at the notebook.

This book is for two readers at once: you, at the table as co-teacher, and the student, in short respectful pages they can actually use. Place by **skill**, not birthday. Inside chapters you will see bands **11–12** and **13–14**. Those are planning grain. An eleven-year-old who already names IV and DV for *this* trial and fills a stranger-readable table may run 13–14 moves. A thirteen-year-old who still invents neat

rows or cannot say what stayed the same stays longer on 11–12 fair-test and recording work — without shame.

A good Science Hour looks like this picture: one phenomenon or apparatus on the table; a blank page dated; a question the hour can actually answer; a try the student runs and records in their own hand; one authentic question from you; a short claim that points at the notebook; an exit crumb for tomorrow. About **25–45 minutes**. Not a museum every day. Not ten demos with no record. Not an AP free-response packet as Tuesday’s spine.

Library visits, museum halls, and night-sky logs motivate. They do not replace the fair-test-with-notebook move. Shared kitchen talk motivates. It does not replace the student’s blank table.

What you will learn to hear

By the end of a few weeks with this book, you should be fluent enough in today’s looking move to hear a name-first rush, a force-as-fuel jab, a confounded “proof,” an adult-filled data table, a generated observation filed as the student’s looking, a demo with no student’s record, a coverage lecture with no phenomenon on the table, a kitchen-as-Chemistry-credit claim, and a chatbot CER with no trial — and to ask a good question, without grabbing the answer or filling the silence with the explanation.

That fluency is teachable. It is not a personality change. It is practice with tomorrow’s apparatus for five quiet minutes before the lesson.

What this book will not do

It will not sell you a 180-day worksheet dump or promise a score.

It will not reprint *Science for Little Thinkers* with longer words, or reprint *Science for Homeschooling*’s grades 1–12 map, high-school Biology/Chemistry/Physics transcript path, NCAA lab-if-offered edges, or AP/CLEP spine. One pointer to each, then teach 11–14 Science Hour.

It is not a sequel to *Critical Thinking for Young Minds*, *English for Young Minds*, *History for Young Minds*, or *Math for Young Minds*. Those neighbors share house

craft — talk boxes, skill bands, parent warm-ups. This book teaches looking, measuring, and claiming from *this* trial. Measurement and graphs neighbor math; keep the lookable on the table. CER light is about notebook evidence, not a debate club.

It will not title the subject **Young Minds Science I**. Put the work under **Science** — or Life Science, Physical Science, or Earth Science when the year’s work truly is that band. Never a curriculum brand as the credit line.

It will not treat a kitchen density try as Chemistry credit, a vinegar-and-soda fizz as a lab franchise, or America’s Lab Report as middle-grades default credit. Adult present. No unauthorized mixing. Curiosity is not a permit.

It will not wait until high school to name a variable, run a fair test, or write a claim with notebook evidence. Middle-grades science looking is already the work. Coverage is a map. Depth is the hour.

It will not invent neat rows for a messy trial, file a generated “microscope photo” as data, or let a model summary stand in for the student’s measuring. Those honesty rules live once in *The Science Hour*; later chapters point back.

How to begin

Read **How to use this book**, the **five things** list, and **The Science Hour** once. The Hour holds the session shape, the talk-box shape, in-home and out-of-home try-it shape, safety, and the AI rules for 11–14 — said once so later chapters can point back in a sentence.

Then open Chapter 1. Put apparatus down before the vocabulary. Cover the caption. Ask what they notice. Wait. Open a blank notebook. That is science at 11–14.

You can do this. The student can look, measure, and claim. Your job is to put the fair test on the table, keep the notebook blank until they measure, ask one good question, and wait.

A note on sisters and neighbors

If you already own *Science for Little Thinkers*, keep using its observe-before-explain grain with a younger sibling on the same table — while this adolescent

fills a blank data table and names what changed. If you later need high-school lab credit language, transcript architecture, or NCAA edges, that path lives in *Science for Homeschooling*. This book stays in the middle-grades Science Hour: fair test, notebook, CER light, one phenomenon deep.

The path through middle-grades science looking is the promise. A diploma is not. A percentile is not. A culture-war win is not. Put the apparatus down. Open the blank page. Begin.

How to use this book

Use this book one week at a time. Do not try to “finish the year” from the table of contents.

This week’s honest plan

1. **Pick one chapter focus.** One looking move owns the week — notebook before explain, blank table first, fair test with a named change, model with a limit, CER light, one life/physical/earth phenomenon, talk-and-write, or a short skill check. Coverage itch is the enemy of looking.
2. **Run three to five Science Hours** of the named shape (~25–45 minutes each). Same five beats every time: observe and frame the question; plan the fair test or model; try, measure, and record; talk plus CER light; exit ticket. Details live in **The Science Hour**.
3. **Name one in-home try-it and one out-of-home try-it** from that chapter’s practice section. In-home might be a ramp, a dissolving trial, a blank table, graph axes before points, or an insulation wrap. Out-of-home might be a museum one-exhibit CER, a park tree-height soft measure, a library journal peek, a night-sky log with an adult, or a stream-edge soft look. Library, walk, museum, kitchen, and yard *are* the practice. They do not replace the fair-test-and-claim move.
4. **Friday: one diagnostic wrong plus a done-enough check.** Hear one incorrect pattern (name-first, confounded proof, invented neat rows, adult-filled blanks, claim with no notebook pointer). Repair with another look or a re-design — not a scolding lecture. Ask what they can show two ways. Place next week by skill, not birthday.

That is a full week. One deep hour beats five manic demos. There is no national table of kitchen science minutes for ages 11–14 — do not invent one.

How to read a teaching chapter

Every teaching chapter uses the same eight headings:

1. **Why this matters**
2. **For the parent: understand it yourself**
3. **How to teach it this week**
4. **Practice that actually builds learning**
5. **For the student**
6. **If it isn't clicking**
7. **Tools, including AI**
8. **What “done enough” looks like**

Read the parent warm-up before you sit down with the student. Practice naming IV/DV and “can we tell for sure?” alone with tomorrow’s apparatus for five to eight minutes. Cut CER to claim + notebook pointer + one because until the habit holds.

Inside “How to teach” and “Practice” you will find **named try-its** (time, materials, safety, the fun, the skill) and a **talk box** with a locked opening question, follow-ups, wait guidance, and what a stuck silence usually means. Use the locked opening. Do not swap it for “did you have fun?” or a vocabulary quiz word.

Age-band moves for **11–12** and **13–14** live inside those headings. Place by what they can show, not by the candle on the cake.

Activity banks are a menu

Later chapters draw from named banks (observe, record, fair test, CER, models, life/physical/earth, talk, write, outings, assessments). A chapter picks one or two try-its for the week. It does not assign all eighty cards in the research banks behind this book. Pick, run, record, claim. Stop while a look remains.

Siblings and mixed ages

Share the apparatus. Split the try. A younger sibling may still run Little Thinkers grain on the same object — notice, draw, fair-test light — while the 11–14 student fills a blank table and writes a claim that points at the notebook. Do not force one worksheet onto every age at the table. The older student’s notebook stays their own handwriting.

Multilingual homes

Looking works in the family’s talk language. The student may notice, measure, and claim aloud in the language they think in. When print load blocks (units, table headers, a short CER write), the adult reads measurement units and headers aloud. Science looking is not an English quiz first. Units still get written so a stranger can read the page.

Records without panic

Keep a dated notebook. Title the work **Science** if a stranger ever needs a name — Life, Physical, or Earth Science only when the work truly is that. Optional vendor review questions are fine. They are not the spine. Full records guidance lives in the Records chapter later. You do not need a transcript architecture to begin Chapter 1.

What not to do with the book

Do not turn the chapter list into a 180-day calendar you must finish.

Do not skip The Science Hour and invent a different session shape every day.

Do not use tools sections as permission to invent data, paste a blank table into a chatbot, or file a generated image as a result. The AI box is said once in The Science Hour; later chapters point back.

Do not title the year’s work **Young Minds Science I**. The dated notebook lives inside **Science**.

Open The Science Hour once. Then teach Chapter 1 this week.

If you only remember five things

1. **Fair test with a notebook record.** Put one try on the table. The student measures and writes what happened on a dated page a stranger could read. Messy real numbers beat invented neat ones. A demo with no student's record is a show, not this book's hour. The notebook is the evidence store.
2. **Name what changed, what you measured, and what stayed the same.** One change on purpose (the independent variable, said in ordinary language). One outcome you count, time, weigh, or carefully observe (the dependent variable). Everything else held alike on purpose. Then ask: can we tell for sure? If two things changed, you cannot blame one. Variable words are tools, not a spelling test.
3. **Ask one good question and wait.** After you ask, give a slow three. Look at the materials or the notebook, not at the adolescent, if the silence is hard. Do not fill the quiet with the vocabulary or the explanation. Struggle before rescue: ask, wait, hint, then model. Hearing a wrong reason and asking a better question is teaching.
4. **Claim with evidence from *this* notebook (CER light).** Claim answers the investigation question. Evidence points at numbers or observations they wrote down. Reasoning is one short because that links them with an idea actually met this week. Oral counts at the table. A chatbot paragraph with no trial does not. Feeling is not evidence. A generated picture is not evidence.
5. **Place by skill, not birthday.** An eleven-year-old who names IV/DV and fills a stranger-readable table may stretch into 13–14 moves. A thirteen-year-old who still invents rows or cannot say what stayed the same stays longer on recording and fair-test habits — without shame. A publisher's "grade 7 science" scope is not a legal grade and not a transcript line. A path

through middle-grades science looking is the promise. A percentile is not. A diploma is not.

Keep these five clean. Honesty about tools — parent holds the account at 11–12; co-hold with the parent still in the room at 13–14; unaided first on looking, measuring, and recording; no invented tables; a generated image is not data; Bastani's high-school math crutch caution is off-age for science hour — lives once in **The Science Hour**. Later chapters point back in a sentence.

If you forget everything else on a busy Tuesday, remember this: apparatus down, blank page open, one change named, one question asked, one wait. That hour is enough.

The Science Hour

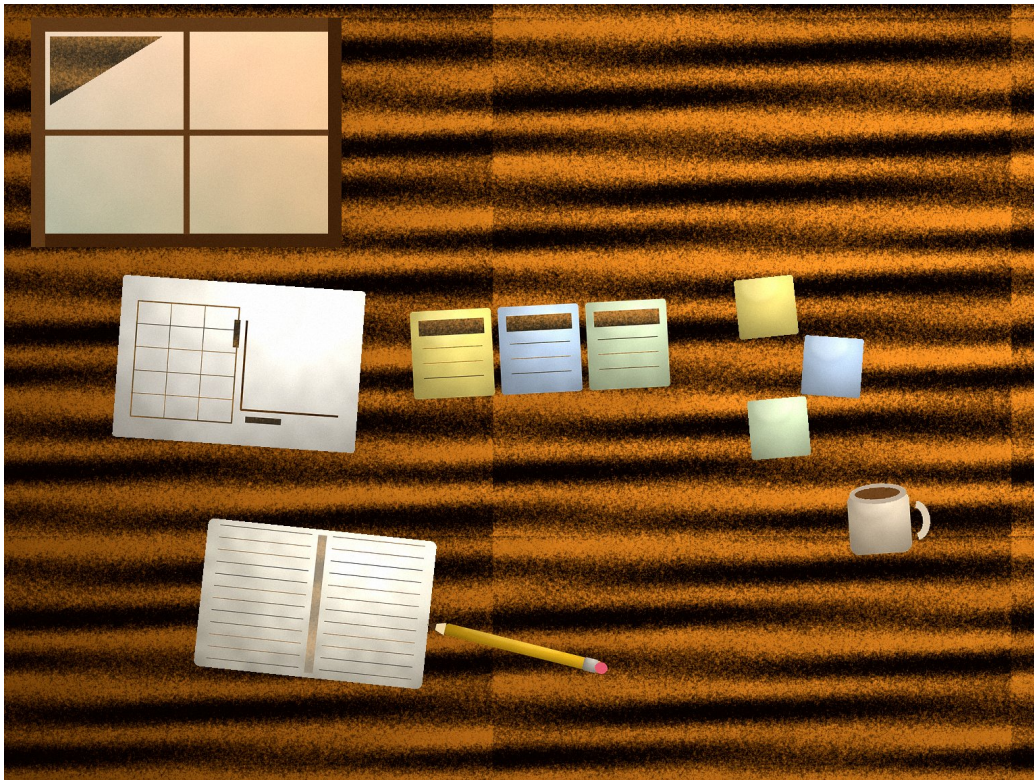


Figure 2: A kitchen table with a blank data table, IV/DV cards, and a dated notebook — still-life, no people, no logos.

This chapter says the session once for the whole book. Later chapters point back. Read it once. Then teach.

A Science Hour is **about 25–45 minutes**. Same five beats every time. Not a museum field trip every day. Not silent textbook reading as the hour. Not activity mania. Not an AP free-response packet as Tuesday’s spine.

The five beats

1. **Observe / frame the question (4–8 min)**. Phenomenon or apparatus visible. Cover the textbook caption when looking is the point. Student names what they notice and what question *this hour* can actually answer.
2. **Plan the fair test or model (4–8 min)**. Name change / measure / same — or name what the model will show and what it will leave out. Draw the blank table or sketch the model **before** running. Adult present for safety decisions.
3. **Try / measure / record (10–18 min)**. Student runs the trial or builds the model. Adult does not grab the notebook. Record: table, graph axes then points, labelled sketch, or a photo the student took — **student’s data**. Messy real numbers beat invented neat ones.
4. **Talk + CER light (6–12 min)**. Claim that answers the question. Evidence that points at the notebook. Reasoning one sentence that links them with an idea actually met this week. Wait after the authentic question. If two trials disagree, that is data, not failure.
5. **Exit ticket (2–5 min)**. CER oral crumb, “what was confounded?”, model-limit sentence, or redesign note. You note one diagnostic wrong for tomorrow — not a graded performance.

Optional sixth: a sibling soft challenge — “Do you agree? Point at the evidence.” Keep it kind.

When the hour goes sideways

What you see	Likely cause	Move
Student only repeats your words	Explain-before-look; no wait	Cover caption; ask “what do you notice?”; count three

What you see	Likely cause	Move
Neat table, no real trial	Invent-data / worksheet dump	Trash invented rows; re-run; keep messy numbers
“Wow,” then nothing remembered	Demo without record	Force blank table before cleanup
Claim ignores the trial	Confounded setup or overwritten notebook	Redesign with one change; restore student’s original words
Ten activities, no idea	Activity mania	Cut to one phenomenon; name the idea after looking
Worksheet filled, no looking	Worksheet dump	Materials first; worksheet only as blank record
AP FRQ packet as Tuesday	AP-as-weekly-spine	Return to one fair test + CER light
AI sheet already “observes”	Generated observation as student data	Trash it; blank page; student’s eyes and meter
Kitchen mess + unsafe mix	No adult control	Stop; safety card; authorized materials only

Bands inside the hour

11–12. Adult co-names the “same” list. Tables with two or three trial rows. CER oral or two-sentence write. Models physical or diagrammatic with one named limit. Wait practice. Still refuse full lab reports.

13–14. Student names IV/DV/controls in ordinary language. Redesigns a confounded try unaided. CER light paragraph. Graph axes labelled before plotting. Model limits plus “what would change the prediction.” Still refuse AP lab report as weekly default. If fair-test habits are weak, stay on 11–12 fair-test cards longer. Skill, not birthday.

Dose honesty

Three to five Science Hours in a week plus one out-of-home try-it is a full week. Twenty-five minutes of frame + one fair test + a CER crumb beats a rushed medley. There is no national table of kitchen science minutes for ages 11–14. Do not invent one.

Talk-box shape (once)

Point at the materials or the notebook. Ask one authentic question — you have not pre-scripted the student's sentence. Wait about three seconds. Uptake: "You said ; **our table shows** ." Optional sibling: "Do you agree? Point at the evidence."

Locked openings live in each teaching chapter. Follow-ups usually include: what do you *see* or *measure*?; what does the notebook show?; how do you know from *this*?; what else was different / can we tell for sure? / what does the model leave out?; you may change your mind / try another look / redesign once.

Wait. After you ask, a slow three is a useful convention from classroom science wait-time research (Rowe; Stahl's think-time — classroom origin). After they stop, wait again. If they are mid-measure or mid-claim, do not cut them off. Look at the materials, the table, or the notebook if the silence is hard. Do not invent a kitchen wait coefficient.

Stuck silence usually means: the question was vague; wait was actually zero; they are hunting a vocabulary word because you asked name-first; they are guessing what you want; the materials never landed; they offered a book-only guess; they think science means "repeat the parent's explanation"; they invent neat rows because the trial was messy. Pose, wait, point back at the notebook. Do not fill the silence with the right vocabulary, and do not turn the table into a fight.

In-home try-it shape (once)

Every named try-it lists **time, materials, safety, the fun, the skill**. In-home examples you will meet: ramp with surface-only change; dissolving with temperature-only change; blank data table before any race; graph axes before points; insulation wrap; density measure; pendulum length-only; particle picture with a limits sticky; CER triangle oral. One idea per hour. Student's record is the data.

Out-of-home try-it shape (once)

Same grain outside: stream or pond soft look; park tree-height soft measure; grocery nutrition soft compare (second-hand labels named as such); museum one-exhibit CER; night-sky log with adult; garden biodiversity soft count; library journal peek. Ordinary safety. Adult present for water and night. No cold stranger quiz. Outings motivate. They do not replace the fair-test-with-notebook move.

Safety spine (once)

Adult present for heat, electricity, outdoor water, chemicals, glassware, dissecting tools, and any “kitchen chemistry picture.”

Kitchen chemistry is a **picture**, not a Chemistry credit. A vinegar-and-soda fizz shows change. It does not mint a transcript line.

No unmarked bottles. No bleach mixes. No drain cleaners. No alcohol flames. No sealed pressurized fizz bottles. No lasers in default try-its.

Living things: no harm, return organisms, wash hands. Mold cultivation refused by default. Home vertebrate dissection refused as default — soft alternatives live later (flower parts, ethical kit, museum specimen).

In kitchen words: recognize what could spill, burn, shatter, or be tasted; assess who holds what; minimize hazard; prepare for a spill or burn before you start. If the protection an activity needs is missing, skip the activity.

Unauthorized mixing is not curiosity. Curiosity is not a permit.

Later chapters point back here in one sentence.

AI at the science hour (ages 11–14) — once

The student looks, measures, and records what happened. The tool does not write the lab report, invent a table, or paint a “result.”

Ages 11–12 (under 13 — COPPA)

Parent holds the account. Scripts and parent–student talk. **Not** live open chat as the student’s partner.

You (the parent) may, on *your* account, before or after the student tries:

1. Ask the tool to **explain this week’s idea to you** from a **named** textbook or lab page — not to the student as a live partner.
2. Ask for **extra practice** that matches today’s looking/measuring (a blank observation card, a blank data table to fill from a *new* try, a predict–measure–claim card) with answers only on a **PARENT KEY** page the student never sees.
3. Ask for a short **SCRIPT** you will say *after* they look, measure, and try a claim — questions that keep *your* voice and the student’s eyes on the trial and the table.
4. Ask for **revision questions after a claim draft** — not a rewrite of the student’s lab report.
5. Ask for a **hint** that is not the finished report and not a fake data table.
6. After they finish, show the tool **work they already did** (crop the photo to the paper or notebook) and ask what mix-up is likely — then *you* talk to the student.
7. Ask for **discussion questions** you will vet and ask yourself — the student answers you, not the tab.
8. Ask for a **labelled schematic** of this week’s idea to look at together, then put away before the try — never filed as “what I saw.”

Ages 13–14 (COPPA off; parent still in the room — not a licence)

Parent co-holds the account. Still no unsupervised chatbot as the only partner. Turning 13 is not a permission slip for a private scientist companion or for “AI writes the lab report because they’re ready for real science now.”

Same eight allows as above. The student may sit *next to* the parent while the parent uses a tool. The student may hear revision questions after they have drafted a claim. The student may type their own “I claim ____ because my table shows . **A limitation is .**” The blanks are the student’s. A model that fills the blanks is still the crutch.

Must not (both grains)

1. Paste tonight's worksheet / blank data table and take the answers (**photo-to-key**).
2. Ask the tool to **write the student's lab report or observation paragraph** or "fix this to an A."
3. Ask the tool to **invent an observation or a data table** ("fill in what I should have seen").
4. Ask the tool to **generate a gel, micrograph, sky photo, or "what I saw under the glass" and treat it as the student's result.**
5. Leave a chatbot running as the student's only partner during the attempt — not at 11, not at 14.
6. Put a **model summary** on the table as the observation instead of the student's looking/measuring.
7. Treat a **generated picture** of a cell, gel, cloud, spectrum, or "result" as data (looking at a labelled schematic together is fine; filing it as evidence is not). **Generated image $\neq$ data.**
8. Invent research or trust a fluent citation without opening the paper — parent-side or student works cited.
9. Detector-grade the student's observation paragraph and call the score honesty.

Unaided first on looking, measuring, and recording that *are* the lesson. **SCRIPT after the try.**

One crutch sentence, labelled OFF-AGE for science hour, then teach: in a **high-school math** trial (not this science band), an unguarded chatbot made practice look better and left students worse on the test with the window closed (Bastani et al., 2025). The kitchen-table rule it supports: the model may prepare the adult and the next looking page; it may not do the student's looking, measuring, or recording when those are the lesson.

Students can look, measure, and talk about evidence when a real phenomenon is on the table — a chatbot is not that phenomenon (*Ready, Set, SCIENCE!; Taking Science to School*).

COPPA: 11–12 — parent holds the account. 13–14 — co-hold / still in the room; not a licence. Not a secret friend. Keep accounts, logs, and keys where the parent can open them.

Later chapters' "Tools, including AI" headings point back here in one sentence. Do not rewrite this box in every chapter.

Life of the habit as session rhythm

Revisit yesterday's IV/DV card for two minutes. Mix last week's fair test into Friday's diagnostic. Stop while a look remains. That rhythm lives here and in later "done enough" checklists — not as a ninth teaching chapter titled "life of the habit."

Sibling and quiet-day notes

If a sibling joins, share the apparatus and split the try. The 11–14 student's notebook stays their handwriting. A younger sibling may notice and draw on a separate page.

On a thin-energy day, run beats 1, 3, and 5 only: notice, measure into a blank table, exit crumb. Skip the medley. Protect the blank table and the wait.

What "done enough" looks like for a single hour

- One phenomenon on the table.
- A dated notebook page with the student's record.
- One fair-test or model plan named in ordinary language.
- One claim that points at the notebook (oral is fine).
- One exit crumb.

Then stop. Tomorrow is another hour.

Chapter 1 — What science looks like at 11–14



Figure 3: A kitchen-table still-life from a high three-quarter view: a clear cup of ice water beside a dark plate with melting ice, a sticky note covering a textbook caption, an open dated notebook with five blank notice lines and one question line, a stopwatch and ruler at the edge. No people. No logos. No readable package branding.

Why this matters

Science at eleven to fourteen is not a waiting room for high school. It is not a kingdom slog through every living thing by Friday. It is not a laminated five-step “method” poster performed without a question on the table.

It is a fair test on the table with a notebook a stranger can read — before your full explanation of the idea — and placement by skill, not birthday.

That sentence is the spine of this book. If the blank page never opens, later chapters about graphs, models, and CER have nothing honest to point at. If the caption is read first every time, looking becomes theater. If birthday places the work, an eleven-year-old who can already name what changed gets stalled, and a thirteen-year-old who still invents neat rows gets pushed into vocabulary they cannot yet use.

Taking Science to School and *Ready, Set, SCIENCE!* describe four intertwined strands of proficiency: knowing and using explanations; generating and evaluating evidence; understanding how science knowledge is built; participating in science practices and talk. Teaching content alone does not mint proficiency. Activity without an idea does not either. The Science Hour intertwines them on one phenomenon.

A Framework for K–12 Science Education and the NGSS middle-grades practices map are useful as **moves maps**, not as a franchise to cover and not as national law for your kitchen. Middle-grades jobs include asking questions, planning investigations, naming independent and dependent variables, running multiple trials, using tables and graphs, and writing claim–evidence–reasoning lightly. This book ages those jobs into Science Hour language. It does not dump every performance expectation as Tuesday’s worksheet.

Prior ideas are the mind at rest. When a twelve-year-old says the ball stopped because it “ran out of force,” that is force-as-fuel — a known pattern named in the research, not a character flaw. Hear it. Put another look on the table. Name the idea just in time. Do not scold the adolescent for bringing a mind.

This chapter installs the house spine: notebook before explain; fair test as the shape of looking; refuse wait-until-high-school and coverage-as-hour. Chapter 2 deepens the record. Chapter 3 deepens the fair test. Keep this week’s job small and clear.

What you can learn this week: put the apparatus down before the vocabulary, and hear a name-first rush for what it is. What the student can try today: cover the caption until they can say what they notice and what question the hour can answer.

Two popular stories this chapter refuses, in kitchen language. First: wait until high school for named variables, fair tests, and claims with evidence. Middle-grades moves maps already ask for those jobs; an eleven-year-old who can name what changed on last month's plant trial should not be told to wait for Biology credit. Second: coverage as the hour — every kingdom, every chapter title, every worksheet — with no student's notebook. Coverage is a map. Depth is the hour. A path through middle-grades science looking is the promise. A percentile is not. A diploma is not.

This book ages up from *Science for Little Thinkers* (notice before name; draw what you saw; fair-test light). Same house, different noun. Do not reprint ice-plate and leaf-draw scripts with longer words. One pointer, then teach 11–14 looking with a blank table and a claim that points at the notebook. *Science for Homeschooling* owns the grades 1–12 map and high-school credit edges — one pointer, then teach Science Hour here.

For the parent: understand it yourself

Many adults feel rusty on science they were taught as a vocabulary list and a laminated method poster. That is ordinary. Five to eight minutes here, then the warm-up with tomorrow's apparatus, is enough for tomorrow. The student still does the looking and the recording.

Everyday picture. Imagine two cups of water, same size, same starting temperature. One wrapped in a towel. One bare. Thermometer ready. Blank table drawn. Question on the page: which cools slower if we change only the wrap? Before anyone says “insulation,” the adolescent looks, predicts with a finger on the cups, then measures. After two or three readings, they say what the numbers show. *Then* you name the idea in ordinary language. That order — look, measure, record, claim, then name — is science looking at 11–14.

Precise picture. A fair test with a notebook record means: one change decided on purpose; one outcome measured; everything else kept alike on purpose; a dated page that shows the question, the table, and what happened; a check question — can we tell for sure? CER light means a claim that answers the question, evidence

that points at *this* notebook, and one short because. Models come in a later chapter. Vocabulary is a tool word after looking, not the hour's spine.

The “scientific method” as a single five-step poster is a myth check from the *Framework*: science practices are plural and recursive, not a costume drama. Use practices as jobs for this week's phenomenon. Do not perform the poster without a notebook.

A fair-test shape you will teach carefully in Chapter 3 already peeks here: show a confounded try beside a clean try; ask “can we tell for sure?”; open a blank table before the race. Classroom research on teaching control-of-variables with ramps (grade 3–4 origin) supports teaching the rule with examples — label that origin when you meet the numbers later; do not paste classroom percentages onto this adolescent as a score. Age the *shape* for 11–14. This is a useful study shape, not a promise that every home will see the same result.

Wrong answers you should be able to hear

1. *Name-first rush*. Student defines “independent variable” with no apparatus on the table. Hear last year's vocabulary quiz driving the hour. Repair: name IV on *this* trial after a look.
2. *Method-poster theater*. Five laminated steps recited; no authentic question; no stranger-readable page. Hear the poster replacing the try. Repair: one fair test; one notebook; one claim.
3. *Birthday gate*. “They're only eleven — real variables wait for high school.” Hear the wait-until-high-school story. Repair: Framework middle moves already ask for named variables and fair tests; place by skill.
4. *Encyclopedia / kingdom hour*. Forty minutes of every living kingdom with no looking. Hear coverage itch. Repair: one phenomenon; depth is the hour.
5. *Model summary as observation*. A fluent paragraph about “what osmosis does” sits on the table instead of a mass table the student filled. Hear the explanation eating the looking. Repair: blank page; student's measuring; summary put away until after the claim.

A sixth you will also hear: “Just tell me the science word.” The student wants the answer key instead of the look. Point at the apparatus. Ask what they notice. Do not grab the name. Do not fill the silence with the caption.

Knowledge constraint, one plain sentence: looking needs something to look *at*,

and a short idea just in time — do not demand a multi-variable ecosystem design in week one of age eleven. Put one phenomenon on the table. Teach one move. Stop.

You do not need to be a scientist. You do need to put a fair test on the table with a blank notebook, and to ask what they measured.

Five-to-eight-minute parent warm-up

Do this alone with tomorrow’s apparatus before the lesson.

Minute 1. Put the apparatus on the table. Cover any caption with a sticky note.

Minute 2. Ask yourself out loud: What do I notice? What question can tomorrow’s hour answer? What would count as evidence?

Minute 3. Ask: What must stay the same if we change one thing? Write a blank table outline — headers only, empty cells.

Minute 4. Practice the locked opening you will ask: “What do you know from this trial’s notebook — before we explain the idea?” Count a slow three after you ask. Look at the apparatus, not at an imaginary adolescent.

Minute 5–8. Cut CER to claim + notebook pointer + one because. Decide whether tomorrow is OBS-01 (phenomenon before caption) or OBS-02 (variable notice first). If looking habits are thin, start with OBS-01. Do not lecture vocabulary to an empty kitchen.

How to teach it this week

Science Hour stays the five beats from the front of the book: observe / frame; plan the fair test or model; try / measure / record; talk + CER light crumb; exit ticket. This week the observe / frame beat owns **notebook before explain**. Total often ~25–45 minutes. Stop while a look remains.

Warm-up looking (4–8 min). Apparatus visible. Caption covered. Ask what they notice — before any vocabulary sentence. Wait a slow three (classroom-origin wait from elementary science research; use the move, not a kitchen coefficient).

Frame the question (inside the same beat). Student names what they notice and what question *this hour* can actually answer. Write the question on a dated page. If you only observe today, the page still opens.

Plan lightly (4–8 min) if a try will run. Co-build (11–12) or student-builds (13–14) a change / measure / same list — even if you only plan today and run tomorrow. Draw the blank table before materials race. Adult present for safety decisions.

Try / measure / record (10–18 min) if you run a short try. Student records. You do not grab the notebook. Messy real numbers beat invented neat ones. If today's hour is observe-only, skip the race and protect the notice list.

Talk + CER light crumb (6–12 min). Use the locked talk-box opening. Claim may be a notice-plus-question crumb this week — full CER deepens later. Point at the page, not at your face.

Exit ticket (2–5 min). One notice + one question written. You note one diagnostic wrong for tomorrow — name-first, caption-copying, blank-page avoidance — not a graded performance.

Exact words you can say

- “Before we name anything, look for two quiet minutes.”
- “What do you notice? I’ll wait.”
- “What question can *this* hour actually answer?”
- Locked opening: **“What do you know from this trial’s notebook — before we explain the idea?”**
- “Point at the page — not at my face.”
- “You may change your mind when we look again.”

First try-it for the student — OBS-01 Phenomenon Before Caption

- **Band:** both
- **Time:** 20–30 min
- **Materials:** One clear phenomenon (ice on two surfaces; plant under a lamp; circuit kit unpowered; two ramps ready but not racing yet); blank paper or notebook; sticky note to cover any textbook caption
- **Safety:** Adult present for heat or electricity; no open flame as default; no staring at sun or bright LEDs
- **The fun:** Being the first person in the room allowed to look without being told the answer
- **The skill:** Notice → question before name
- **Steps:** (1) Cover any caption. (2) Two minutes silent look. (3) “What do you notice?” Wait. (4) Student lists five notices. (5) Form one question the hour could answer. (6) Only then uncover a short name if needed.

- **Error patterns:** Adult narrates first; student copies caption; inventing features not present
- **Exit ticket:** “I noticed ____ before we named it; my question is ____.”

How to fade help. At first, you cover the caption and protect the silence. Next, the student covers the caption. Then they open the notebook without being told. Fade your narration. Do not fade the blank page.

When to stop talking. When they are mid-notice or mid-measure. When you have asked the locked opening. When you feel the urge to “just explain so we can move on.” Move on by looking again, not by lecturing.

Struggle before rescue. Ask. Wait. Hint with a question (“what does the page show?”). Then model one move if needed. Do not grab the answer. Do not fill the silence with the explanation. Do not paste a machine’s observation as theirs.

Sibling note. Share the apparatus. Split the try. A younger sibling may still run Little Thinkers grain — notice, draw, fair-test light — on a separate page while the 11–14 student writes a dated question and protects a blank table. Do not force one worksheet onto every age.

Age-band moves

11–12. Adult co-names what must stay the same if a try is planned. Oral notices are enough; short written question required. CER oral crumb only. Still refuse full lab reports.

13–14. Student proposes the hour’s question and a first “same” list. Written notices plus question. If a short try runs, they fill two rows themselves. Still refuse AP lab report as the week’s spine. If they cannot yet protect looking before naming, stay on 11–12 observe cards longer. Skill, not birthday.

Practice that actually builds learning

Named try-its below carry **time, materials, safety, the fun, the skill**. Library, walk, museum, kitchen, and yard *are* the practice — they do not replace the fair-test-with-notebook move.

Talk box

Opening (locked): “What do you know from this trial’s notebook — before we explain the idea?”

Follow-ups:

1. What do you notice on the apparatus — what do you *see*?
2. What does the notebook show so far — notices, question, blank table?
3. What question can this hour actually answer — how do you know from *this*?
4. What would count as evidence later — what else might be different / can we tell for sure?
5. You may change your mind when we look again.

How to wait. After you ask, a slow three is a convention, not a sacrament (elementary science classroom origin). After they stop, wait again. If they are mid-measure or mid-claim, do not cut them off. Look at the materials, the table, or the notebook, not at the adolescent, if the silence is hard.

Stuck silence usually means: the question was vague; wait-time was zero; they are hunting a vocabulary word because you asked name-first; they are guessing what you want; the materials never landed; they offered a book-only guess; they think science means “repeat the parent’s explanation”; they invent neat rows because the trial was messy. Pose, wait, and point back at the notebook — not fill the silence with the right vocabulary, and not turn the table into a fight.

In-home try-its (OBS bank + FAIR warm-ups)

OBS-01 Phenomenon Before Caption — see first try-it above. Run it early in the week.

OBS-02 Variable Notice First

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Apparatus with several obvious differences (two cars, two ramps, two cups); notebook
- **Safety:** Adult present if apparatus can tip or roll off the table
- **The fun:** Detective work before the race
- **The skill:** Change vs same before action

- **Steps:** List everything that *could* change. Circle one to change on purpose. Cross out two that must stay the same. Do not run yet — this hour owns noticing variables.
- **Error patterns:** Jumping to race before listing; calling every difference “the variable”
- **Exit ticket:** “Change: . **Same:** and ____.”

OBS-04 Measurement Tool Look

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Ruler, stopwatch, thermometer, kitchen scale (any two or three); notebook
- **Safety:** Adult present for glass thermometers; no oral thermometers in lab ice; scale on a stable surface
- **The fun:** Feeling precise without pretending the kitchen scale is a research balance
- **The skill:** Units and honest precision
- **Steps:** For each tool: what it measures, units, smallest division you can read, one way to misuse it. Practice one reading aloud with units.
- **Error patterns:** Ignoring units; inventing precision beyond the tool; using glass thermometer as a toy
- **Exit ticket:** “My tool reads ____ $\pm$ about ____ because ____.”

OBS-05 Pattern Across Trials Soft (stretch after OBS-01 holds)

- **Band:** both
- **Time:** 25–40 min
- **Materials:** Simple repeatable trial (bounce height, dissolve stirs); notebook with three blank rows
- **Safety:** Match the trial’s own safety (bounce: clear space)
- **The fun:** Seeing that “the same” try is never perfectly identical
- **The skill:** Pattern across real trials without inventing matching rows
- **Steps:** Run three trials keeping setup same. Record. Ask: what stayed similar? what varied? Is the pattern strong enough for a claim yet?
- **Error patterns:** Averaging away a wild outlier without noting it; stopping after one “good” trial; inventing matching rows
- **Exit ticket:** “Pattern I see: . **Still unsure about:** .”

FAIR-07 Confounded Catch (meta)

- **Band:** both
- **Time:** 20–30 min
- **Materials:** A short written or acted “experiment” that changes two things at once (steep *and* rough ramp; hot *and* stirred tea); notebook
- **Safety:** None beyond the demo’s own
- **The fun:** Catching a fake proof
- **The skill:** Confound notice before pride
- **Steps:** Student hears the “proof.” Ask: can we tell for sure? Name both changes. Redesign orally so only one changes.
- **Error patterns:** Defending the confound; treating “gotcha” as shame
- **Exit ticket:** “We cannot tell for sure because ____ also changed.”

FAIR-08 Variable Card Checklist

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Index card; today’s planned try (or yesterday’s)
- **Safety:** None
- **The fun:** A pocket checklist that feels like gear
- **The skill:** Ordinary-language IV/DV/controls
- **Steps:** Write Change / Measure / Same / Can we tell for sure? Fill for *this* trial. Keep the card in the notebook.
- **Error patterns:** Filling the card with vocabulary only; no trial attached
- **Exit ticket:** Show completed card for one real or planned trial.

Out-of-home try-its

OUT-04 Museum One Exhibit CER

- **Band:** both
- **Time:** 30–45 min on site
- **Materials:** Notebook; one exhibit
- **Safety:** Adult present; museum rules; no touching restricted objects
- **The fun:** Being allowed to look at one thing deeply instead of racing the building
- **The skill:** Notice before caption in public
- **Steps:** Observe before reading the whole plaque. Note what is model vs specimen. Write notices, then one question, then a CER light crumb about one exhibit claim — label second-hand evidence as second-hand.

- **Error patterns:** Racing whole museum; copying plaques without looking; treating diorama as live observation without noting model
- **Exit ticket:** CER oral at the exhibit, then a written crumb

OUT-07 Library Journal Peek Soft

- **Band:** both
- **Time:** 25–40 min
- **Materials:** Library science magazine, journal, or reliable kids science article; notebook
- **Safety:** None
- **The fun:** Feeling like a reader of real science pages
- **The skill:** Frame a question from named second-hand data
- **Steps:** Find one graph or table. Explain what it measures. Ask one question it does not answer. Second-hand labelled. Not a research-paper assignment. Not inventing data.
- **Error patterns:** Citing a chatbot summary of an unread article; worksheet dump; AP paper expectations
- **Exit ticket:** “Graph shows . *It does not tell* .”

Blocked practice (new move)

This week, block name-first and coverage. If they define a word with no apparatus, smile and put the apparatus down. If they want to “finish the chapter,” cut to one phenomenon. One OBS card plus the talk box is enough for an hour.

Mixed practice (when the move holds)

Once looking-before-name holds on two try-its, mix: one observe hour, one variable-notice hour, one short confound catch. Do not mix ten new toys in one sitting. Coverage itch is the enemy of looking.

OBS-03 System Boundary Soft (13–14; stretch 11–12)

- **Band:** 13–14 (stretch 11–12)
- **Time:** 25–35 min
- **Materials:** Everyday system (houseplant, fishbowl, phone on charger, weather jar); notebook
- **Safety:** Adult present for water systems; no opening sealed commercial devices

- **The fun:** Drawing a border around “what counts today”
- **The skill:** Inside vs crossing the boundary for *this* question
- **Steps:** Sketch the system. Draw a boundary. List inputs/outputs that cross. Ask what is inside vs outside for today’s question.
- **Error patterns:** Drawing everything in the room; ignoring flows; treating “system” as a vocabulary quiz only
- **Exit ticket:** “Inside: . *Crossing the boundary:* .”

OBS-06 Anomaly Spot Soft (both; after real data exists)

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Prior notebook page with real student data; highlighter
- **Safety:** None beyond original trial
- **The fun:** Being allowed to keep the weird row instead of erasing it
- **The skill:** Describe an anomaly without deleting it; plan one check
- **Steps:** Find one result that does not fit. Describe it. Hypothesize setup cause vs real effect. Plan one check. Do not erase.
- **Error patterns:** Silently deleting the anomaly; inventing a dramatic story; shaming the “wrong” trial
- **Exit ticket:** “Anomaly: . *Next check:* .”

Incorrect example to diagnose (illustration, not a reported family)

A parent opens a textbook page on density, reads the definition aloud, asks the student to copy it, then shows a video of a metal sinking. The student repeats “density is mass over volume.” No blank table. No measuring. No notebook question. The hour felt busy. Looking never started.

What went wrong: name-first; demo with no student’s record; coverage itch.

Repair: put two objects and a graduated cylinder on the table (or save density measure for a later physical-science try), cover the definition, ask what they notice, open a blank page. The definition can return after a claim that points at numbers.

Second incorrect pattern — force-as-fuel unrepaired.

A ball rolls to a stop. The student says it “ran out of push.” The parent scolds: “That’s not how force works,” then lectures Newton. The look dies. *Repair:* another roll; ask what they see when it slows; name friction or unbalanced forces just

in time after another look — not a character lecture.

Third incorrect pattern — demo with no record.

Parent pours, fizzes, and narrates. Everyone says “wow.” Nothing is written. Tomorrow nobody remembers what changed. Repair: blank table before cleanup; student’s hand; two numbers with units.

Library, walk, and museum motivate. They do not replace the fair-test-with-notebook move.

For the student

Science at your age is not “wait until high school.” It is not memorizing a poster. It is looking carefully, measuring something real, writing it down so another person could understand, and saying what you think — with the notebook as your backup.

You look. You measure. You record. You talk. Your parent asks one good question and waits. That is the deal.

Tiny worked example

Ice cube on a dark plate. Ice cube on a shiny plate. Caption covered. You write: “Dark plate has a bigger water puddle after five minutes. Question: does the surface color change how fast ice melts if we keep the room the same?” You have not yet said the word *energy* or *absorption*. That is a good start. The notebook knows something before the explanation arrives.

Try 1

Cover a caption on any science page or kit card. List five things you notice. Write one question the picture or apparatus could help answer. Only then read the caption. Did the caption match your notices — or did it skip something you saw?

Try 2

Pick two cups, two spoons, or two toy cars. List three things that are different. Circle one difference you could change on purpose in a fair test. Cross out two

things you would keep the same. Do not run the test yet unless an adult is ready with you. Fill a Change / Measure / Same card if you have one.

Explain it back

Tell someone at home, in your own words: what does “notebook before explain” mean? Point at a page you wrote. What would a stranger need to see on that page?

Challenge

Tomorrow, open your notebook before anyone talks. Date the page. Write one question. Leave a blank table outline. Protect that blank until you measure. If someone starts explaining first, you may say: “Can I look and write first?”

You are allowed to wait. You are allowed to change your mind when you look again. You are allowed to keep messy notices. You are not required to invent neat rows so the notebook looks “scientific.”

If someone asks what you “learned” and you only have notices and a question so far, that still counts. The explanation can come after the notebook has something true on it. Point at your page. That is science looking at your age.

If it isn’t clicking

Diagnostic 1 — They only repeat your words.

What you see: Notices sound like your lecture; wait was zero.

Next move: Cover the caption; ask what they notice; count three silently; look at the apparatus yourself. Run OBS-01 again with a different object.

Diagnostic 2 — They want the “right name” immediately.

What you see: “Just tell me the science word.”

Next move: Say “names later; notices now.” Collect five notices before any term. Then offer one tool word if needed. Protect OBS-01 before OBS-02.

Diagnostic 3 — The page stays blank or the adult fills it.

What you see: Demo culture; rescue handwriting; phone out during measuring.

Next move: Hand them the pen. Your job is the question and the wait. Their job is the record. If motor or print load blocks, they dictate; you write *their* words,

then they initial the page. Trash an adult-filled “right” table kindly; blank page; student’s eyes and meter.

When to slow down. They cannot yet say what they noticed without a caption. Stay on OBS-01 and OBS-02. Skip museum CER until notice-before-plaque holds at home.

When to go ahead. They spontaneously cover a caption, open a dated page, and ask a question the apparatus can answer. Variable notice (OBS-02) and tool look (OBS-04) land without panic. Move toward Chapter 2’s blank-table spine.

When to get a human tutor. Anxiety about “being wrong” freezes every look, or a learning difference makes measurement tools consistently unusable even with read-aloud supports. A local science-comfortable adult or co-op mentor who puts apparatus on the table beats a worksheet packet. No shame either way.

Correct a wrong reason without crushing the look. “Never correct the adolescent” is not this book’s rule. Hearing a name-first rush or a confounded “proof,” asking a better question, and naming a better move is teaching. Silence in the face of a confounded proof is not kindness; a scolding lecture is not teaching either.

Tools, including AI

Optional helpers for you, the adult. Keep this short. Point back to the Science Hour AI box in the front of the book.

You may, on your account, after the student has tried (or before, for your prep): ask a tool to explain *to you* from a named textbook page about today’s apparatus; get a labelled SCRIPT of questions for *you* to say after they look; get isomorphic blank observation cards with the answer key held by you; diagnose a page the student already produced (crop to the paper; no face upload); ask for a labelled schematic to look at together, then put away before the try.

You may not: invent an observation or data table and file it as theirs; paste a blank table and ask the tool to complete it; generate a “result” photo or micrograph and treat it as data; park an unsupervised chatbot as the student’s only partner during the attempt; write their observation paragraph; put a model summary on the table as the observation. At 11–12 you hold the account. At 13–14 you co-hold and stay in the room — turning 13 is not a licence. Unaided first on looking, measuring, and recording. SCRIPT after the try.

A one-line caution from a high-school math study travels as a kitchen rule only: a tool may prepare the adult and the next looking page; it may not do the student's looking, measuring, or recording when those are the lesson. Label that caution off-age for Science Hour — it is not an 11–14 science RCT.

What “done enough” looks like

Before you move on from this chapter's focus, check skill — not birthday.

11–12 done enough

- ☐ Looks at apparatus with caption covered and lists notices (oral ok)
- ☐ Writes one question *this* hour could answer
- ☐ Dated notebook page exists in the student's hand (or dictated-and-initialed)
- ☐ With help, begins a Change / Measure / Same card for a planned try
- ☐ Parent can hear name-first and repair with another look

13–14 done enough

- ☐ Proposes the hour's question without hunting your face
- ☐ Writes notices plus question; optional two recorded rows if a try runs
- ☐ Names a first “same” list for a planned try
- ☐ Catches an obvious confound on FAIR-07 with little prompt
- ☐ Still refuses model-summary-as-observation and invent-data

Place by skill. A fourteen-year-old who cannot look without the caption stays on 11–12 OBS longer — no shame. An eleven-year-old who covers captions, opens a dated page, and asks a real question is ready for Chapter 2's recording spine.

Not done enough (yet): vocabulary quiz with no apparatus; kingdom coverage as the hour; wait-until-high-school gate; demo with no student's record; generated observation as data; birthday gate (“you're thirteen so you must...”).

A “grade 7 science workbook” is a publisher's scope, not a legal grade, and not a transcript line. Showable looking is enough to move on.

Habit crumb (not a ninth chapter). Next Tuesday, reopen yesterday's notice page for two minutes before a new try. Mix last week's “caption covered” move into Friday's diagnostic. Stop while a look remains. Life of the habit lives in the Science Hour rhythm and in later checklists — not as a separate teaching chapter.

Title the work **Science** if a stranger needs a name. Never **Young Minds Science**
I. Never a curriculum brand as the credit line.

Chapter 2 — Recording: table, graph, sentence



Figure 4: A kitchen-table still-life from a high three-quarter view: a blank data table drawn in a dated notebook beside a second page with labelled graph axes (no points yet), a short claim sentence sticky, a ruler and pencil, a stopwatch. No people. No logos. No readable package branding.

Why this matters

At 11–14 the notebook is not a drawing alone. That was Little Thinkers grain — draw what you saw. Here the record grows up: **table** → **graph** → **sentence**. Blank table first. Axes before points. A sentence a stranger can believe because it points at numbers the student measured.

Without that spine, fair tests become stories. CER becomes opinion. Models decorate. A demo produces “wow” and nothing tomorrow can check. Recording is the middle-grades form of “what did you see?” — with units, headers, and honesty about mess.

The *Framework* middle-grades data practices ask for tables, bar graphs, and simple averages — as kitchen moves, not as AP statistics. A stranger-readable notebook is the house lock. This chapter installs it. Chapter 3 will put a named change through that blank table. Chapter 5 will ask a claim that points at it.

What you can learn this week: force a blank table before the race, and run a stranger-can-read check. What the student can try today: fill two rows from measurements they took, then say one sentence the table supports.

Refuse inventing neat rows after a messy trial. Refuse graphing without a table. Refuse a table with no question. Refuse adult-filled blanks while the student looked at a phone. Refuse a pretty photo with no date or units filed as the whole record. Refuse a generated “result” image as data.

This is useful practice, not a promise that every home will see the same result. Kitchen graphs are not AP stats. Do not invent ± 0.0001 on a kitchen scale and call it rigor.

If Chapter 1 was “look before you name,” this chapter is “write so a stranger can check.” The two moves belong together. A brilliant notice that never hits a dated page evaporates. A neat page that never met a real measurement is theater. Hold both.

Recording is also how honesty becomes visible. A parent who fills the “right” numbers while the student glances at a screen has not run Science Hour. A student who invents three neat rows because the trial was messy is practicing fraud, not science — say that gently, then redesign. A generated gel, sky photo, or “what I saw under the glass” filed as a result is not data. A model summary is not the observation. Keep those refusals short; the Science Hour chapter already said them

once.

Sister books neighbor this move without owning it. *Math for Young Minds* neighbors measurement and simple graphs — Science Hour is not a graphing unit with no phenomenon on the table. *English for Young Minds* neighbors clear sentences — the science sentence must still point at *this* table. One pointer each, then teach recording for 11–14 science looking.

For the parent: understand it yourself

Many adults remember science notebooks as either empty worksheets or beautiful posters they never used again. That memory is ordinary. Five to eight minutes here is enough for tomorrow.

Everyday picture. You bake two trays of cookies. You want to know whether tray time changed browning. You do not write a poem. You make a tiny table: tray, minutes, how brown (or a photo with a date). Then you say one sentence: “Tray B at 14 minutes was darker than Tray A at 11.” That is table → sentence. If you sketch minutes on one axis and “brown score” on the other before you plot, that is axes-before-points. A stranger could almost believe you.

Precise picture. At 11–14 the notebook spine is three moves:

1. **Blank table first** — headers with units before any trial runs; cells empty until measured.
2. **Axes before points** — label IV and DV axes with units and a title tied to the question before plotting.
3. **Sentence a stranger can believe** — one claim sentence that points at a row or a graph feature, not at a feeling.

Add date, question, and (at 13–14) a soft uncertainty note when readings bounce. A photo can support the table; it does not replace it. Label second-hand numbers (nutrition labels, textbook tables) as second-hand.

Wrong answers you should be able to hear

1. *Invented neat rows.* The trial was messy; the notebook looks perfect. Hear invent-data. Keep messy numbers. Redesign if needed. A fluent filled blank from a machine is performance, not looking.

2. *Graphing without a table.* Pretty curve; no source rows. Hear decoration. Build the blank table first; plot only from filled cells.
3. *Table without a question.* Columns exist; nobody knows what was asked. Hear record-as-busywork. Write the question above the table before measuring.
4. *Adult-filled blanks.* Parent writes the “right” numbers while the student looked away. Hear stolen data. Blank page; student’s eyes and meter.
5. *Photo-as-decoration.* Stock image or AI apparatus picture filed as “our trial.” Hear generated-image-as-data. Student-taken photo only, with date and caption; table still required.

A sixth: “Just average it so it looks clean.” Averaging can wait until the student can show the raw rows. At 13–14, a simple average is allowed *after* the rows exist — never instead of them.

When you hear invent-data, your face matters. Curiosity stays welcome. Honesty is the repair. “Let’s keep the messy page and run it again with empty cells” beats “You cheated.” The adolescent who learns that messy truth is allowed will keep looking. The adolescent who learns that only neat fiction is praised will invent.

Five-to-eight-minute parent warm-up

Alone with tomorrow’s apparatus and a blank notebook page.

Minute 1. Write today’s question at the top. Date the page.

Minute 2. Draw a blank table: trial #, IV with units, DV with units, notes. Leave every cell empty.

Minute 3. On a second page (or the back), label graph axes and units — no points yet. Title with the question.

Minute 4. Practice the locked opening: “What would a stranger need to see in your table or graph to believe your claim?” Count three. Look at the blank table.

Minute 5–8. Decide tomorrow’s first card: REC-01 (dated notebook open) if the notebook habit is thin; REC-02 (blank table first) if dating already holds; REC-03 (axes before points) as stretch at 11–12 or default at 13–14 after two real rows exist. Write one sentence stem: “According to my table, ____.” Do not invent sample numbers “to show how.”

If your own school memory is “copy the data table from the board,” name that memory once and put it down. This week the adolescent builds the blank table from the question and the apparatus — then fills it from measuring. You are not behind if you practice empty headers tonight. You are preparing.

Knowledge constraint in one line: a table does not teach itself. The student needs a question, a tool they can read, and units they can say. Do not demand a twelve-variable spreadsheet in week one of recording. Two columns done honestly beat a complicated grid abandoned mid-try.

How to teach it this week

Science Hour five beats stay. This week **try / measure / record** owns the spine — but the blank table is drawn in the **plan** beat, before materials race.

Observe / frame (4–8 min). Apparatus visible. Question named. Caption covered if looking is still fragile from Chapter 1.

Plan (4–8 min). Draw the blank table together. Headers and units. At 11–12, co-build headers. At 13–14, student drafts headers; you gate units and safety. Optional: sketch axes with labels before any point.

Try / measure / record (10–18 min). Student fills cells from measuring. You do not grab the pen. Messy real numbers beat invented neat ones. Two or three rows at 11–12; more rows and optional average light at 13–14 when habit holds.

Talk + CER light crumb (6–12 min). Locked talk-box opening. Claim sentence that points at a row. One because if an idea is already on the table this week — do not invent a principle to decorate.

Exit ticket (2–5 min). Stranger-can-read crumb, or “my table supports __,” or one uncertainty note at 13–14. You note invent-data, missing units, or adult hand-writing for tomorrow.

Sample minute map (illustration). 0–6 observe and write question; 6–12 draw blank table and (optional) axes; 12–28 measure and fill; 28–38 talk box + sentence that points at a row; 38–42 exit stranger crumb. Adjust. Thin-energy day: question + blank table + two rows + sentence. Skip the medley.

Exact words you can say

- “Table first — empty cells until you measure.”
- “What units belong in this header?”
- “Axes and labels before any points.”
- Locked opening: **“What would a stranger need to see in your table or graph to believe your claim?”**
- “Point at the row that supports that.”
- “Messy real beats invented neat.”

First try-it for the student — REC-02 Data Table Blank First

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Notebook; ruler; planned fair-test variables (even a tiny try: bounce height, dissolve stirs, ramp distance)
- **Safety:** As per the upcoming trial; adult present when the trial needs it
- **The fun:** Drawing the empty grid feels like setting a trap for honesty
- **The skill:** Headers and units before measuring; fill only after measuring
- **Steps:** (1) Write question and date. (2) Before any trial, draw table with headers (trial #, IV value with units, DV with units, notes). (3) Run trials. (4) Fill only from measuring. (5) Say one sentence the table supports.
- **Error patterns:** Drawing the table after inventing numbers; missing units; merging trials into one vague paragraph
- **Exit ticket:** Empty table ready + “I will record ____ in units of ____.” (before the race) or, after: two filled rows + one sentence

How to fade help. At first, you draw the header line with them. Next, they draft headers; you only check units. Then they refuse to start a trial without a blank table. Fade your handwriting. Do not fade the blank-first rule.

When to stop talking. When they are mid-measure. When you have asked the locked opening. When you want to “fix” a messy number. Keep the messy number. Ask what happened. Redesign if needed.

Struggle before rescue. Ask what the stranger needs. Wait. Hint: “Which header is missing units?” Then model one header line if needed. Do not grab the pen to “finish for them.” Do not fill empty cells with hoped-for numbers.

Sibling / mixed-age. Share the apparatus. Split the record. A younger sibling may draw what happened (Little Thinkers grain) on a separate page while the 11–14 student protects a blank table and writes a stranger-readable sentence. Do not force one grid onto every age.

Multilingual homes. Looking and measuring work in the family’s talk language. The adult may read units and headers aloud when print load blocks. Units still get written so a stranger can read the page. Science recording is not an English quiz first.

Age-band moves

11–12. Co-build headers. Two or three trial rows. Oral sentence that points at a row. Graph axes as stretch after rows exist — or skip graph this week if table habits are thin. Photo soft with adult account only. Still refuse full lab reports.

13–14. Student drafts headers and units. Multiple rows; optional simple average after raw rows. Graph axes labelled before plotting as a default move. Soft uncertainty note when readings bounce. Still refuse invent-data and AP lab-report padding as weekly default. If blank-table habit fails, stay on 11–12 REC longer. Skill, not birthday.

Practice that actually builds learning

Named try-its carry **time, materials, safety, the fun, the skill**. Library, walk, grocery, park, and yard *are* the practice — they do not replace table → graph → sentence.

Talk box

Opening (locked): “What would a stranger need to see in your table or graph to believe your claim?”

Follow-ups:

1. What are the headers — what do you *measure*, with what units?
2. Did you fill from *your* measuring — what does the notebook show?
3. What would be missing if we only had the sentence — how do you know from *this*?
4. What else might a stranger ask — date? same list? (13–14) bounce / uncertainty note?
5. You may revise the sentence when the table says so.

How to wait. Ask. Slow three (classroom-origin convention). After they stop, wait again. Mid-measure: do not cut off. Look at the table or axes, not at the

adolescent, if silence is hard.

Stuck silence usually means: question vague; wait zero; hunting vocabulary because you asked name-first; guessing what you want; materials never landed; book-only guess; thinking science means neat rows; inventing because the trial was messy. Pose, wait, point at the blank or filled table — not fill silence with the “right” sentence, and not fight.

In-home try-its (REC bank)

REC-01 Dated Notebook Open

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Bound notebook or dedicated section; pen; optional date stamp
- **Safety:** None
- **The fun:** Opening a page that will still exist next month
- **The skill:** Date, question, space for table and CER; no erasing data — strike through with reason if needed
- **Steps:** Date the page. Write question. Leave space for table and CER. Agree: no erasing data — strike through with reason if needed.
- **Error patterns:** Loose scraps lost by Friday; back-dating pages; parent handwriting the “real” notes
- **Exit ticket:** Show dated page with question + blank table outline

REC-02 Data Table Blank First — see first try-it above.

REC-03 Graph Axes Before Points

- **Band:** 13–14 (stretch 11–12)
- **Time:** 25–40 min
- **Materials:** Graph paper or notebook; completed table with 3+ rows
- **Safety:** None
- **The fun:** Drawing empty axes feels like aiming before you shoot
- **The skill:** Labels and units first; scale chosen; points from table only; no invented smooth curve
- **Steps:** Label axes and units first. Choose scale. Plot points. Title with the question. Do not smooth inventedly.
- **Error patterns:** Plotting before axes; decorative curves that ignore points; swapping IV/DV axes without noticing

- **Exit ticket:** “My graph shows ____ as ____ changes.”

REC-04 Photo as Record Soft

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Phone/camera with adult account; notebook; apparatus
- **Safety:** Adult controls account; no uploading minors’ faces; no hazardous staging for likes
- **The fun:** Capturing the setup like a field scientist — then still writing the table
- **The skill:** Photo supports; does not replace; date and caption required
- **Steps:** Student takes 2 photos (setup; result). Print or paste/reference in notebook with caption and date. Photo supports — does not replace — the table.
- **Error patterns:** Pretty photo with no caption; using stock image as “our trial”; AI-generated apparatus image as data
- **Exit ticket:** Caption: “Photo shows ____ on [date].”

REC-05 Uncertainty Note Soft

- **Band:** 13–14
- **Time:** 20–30 min
- **Materials:** Measuring tool + repeated readings
- **Safety:** Tool-appropriate
- **The fun:** Being allowed to say “the numbers bounced” without shame
- **The skill:** Range sentence with units; honesty about bounce
- **Steps:** Take the same measurement 3 times. Record range. Write one sentence: “These readings differ by about ____ because ____.”
- **Error patterns:** Fake identical readings; claiming ± 0.0001 on a kitchen scale; skipping the note when numbers bounce
- **Exit ticket:** Range sentence with units

REC-06 Stranger Can Read Check

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Today’s notebook page; sibling or parent as “stranger”
- **Safety:** None
- **The fun:** Watching someone else try to read your page like a detective

- **The skill:** Stranger restates question, what changed, and one result without oral help
- **Steps:** Stranger reads only the page (no oral help). Can they restate question, what changed, and one result? Fix gaps together.
- **Error patterns:** Secret codes; missing date; claim with no numbers; parent rewriting the page
- **Exit ticket:** One fix that made the page clearer

Out-of-home try-its

OUT-02 Park Tree Height Soft

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Meter stick; notebook; shadow method or clinometer soft with adult math help
- **Safety:** Adult present; stay on ground; sidewalk rules; no climbing
- **The fun:** Measuring something huge with a small stick
- **The skill:** Measure → table → sentence; name the method's limit
- **Steps:** Estimate height with a named method. Show work in a tiny table (measurement, calculation, estimate). Limit of method noted. One sentence a stranger could believe.
- **Error patterns:** Wild guesses with no method; climbing trees; traffic edges; inventing numbers
- **Exit ticket:** Estimate + method name + limit + one sentence

OUT-03 Grocery Nutrition Soft

- **Band:** both
- **Time:** 25–40 min
- **Materials:** Two similar food labels; notebook
- **Safety:** Adult present; courtesy in store; allergen awareness if handling food
- **The fun:** Spy work in the aisle — numbers already printed, honesty still required
- **The skill:** Table from labels; second-hand data labelled; CER light about which has more X per serving — not diet advice
- **Steps:** Compare one nutrient claim with numbers. Build a two-row table. Label second-hand. Write one sentence. Not health moralizing.
- **Error patterns:** Health sermons; photographing strangers; inventing label

numbers; forgetting “second-hand”

- **Exit ticket:** Claim + two numbers from labels + “second-hand” label

Bridge soft toward Chapter 3. Once blank-table-first holds, ask — without running a full fair-test chapter yet — “If we change only one thing next time, which column is the change? Which column is what we measure?” That is a header preview for IV/DV ordinary language. Do not turn this week into Chapter 3’s whole fair-test spine.

Blocked practice (new move)

This week, block invent-data and graph-without-table. If they want to plot first, smile and point at empty cells. If the table looks suspiciously perfect after a chaotic try, ask them to re-measure one cell aloud. Keep the messy page; add a new dated page if redesigning.

Mixed practice (when the move holds)

Once blank-table-first holds on two tries, mix: REC-02 + REC-06 same week; add REC-03 when three real rows exist; add REC-05 at 13–14 when bounce appears. Do not assign all six REC cards in one day.

Incorrect example to diagnose (illustration, not a reported family)

A student runs a messy ramp trial. Distances were roughly 40-something, then a bump, then “I forget.” That night the notebook shows 42.0, 42.0, 42.0 cm — perfect. A claim sentence says the towel always stops the car at exactly 42 cm. A parent smiles at the neatness.

What went wrong: invented neat rows; precision theater; stranger cannot trust the page.

Repair: Keep a note that rows were reconstructed — then trash them for claiming. Re-run with blank table first. Write real bounce. Sentence points at real rows. Neatness is not honesty.

Second incorrect pattern — adult-filled blanks. Parent “helps” by writing the temperatures while the student scrolls. Repair: blank page; student’s hand; par-

ent holds the thermometer only if safety requires — student still reads aloud and writes.

Third incorrect pattern — generated result picture. An image tool paints a “graph of our data.” Filed as Figure 1. Repair: generated image $\neq$ data. Student plots from their table. Labelled schematic for teaching is fine; filing as result is not.

Library, grocery, and park motivate. They do not replace table $\rightarrow$ graph $\rightarrow$ sentence from a real try.

More in-home recording drills (short)

REC-02b Two-row minimum. After any short try, gate cleanup until two rows have units. Time: +5 min bolted onto a try. Skill: refuse one-and-done recording.

REC-03b Axis sticky. Before plotting, student writes IV axis sticky and DV axis sticky and sticks them on the page. Then plot. Catches swapped axes early.

REC-06b Stranger next day. Same stranger-can-read check after one night. Does the page still make sense when the try is cold? Fixes “I knew what I meant yesterday.”

Out-of-home recording notes

On OUT-02 (tree height), the table may be tiny: method step, measurement, estimate. The sentence still points at the table. On OUT-03 (labels), write “second-hand” on the page in the student’s hand. Grocery numbers are evidence about labels, not about a kitchen trial you ran — say so. If a museum visit tempts a dozen exhibits, still record one exhibit deeply (pair with OUT-04 from Chapter 1) and bring one table or claim crumb home.

Incorrect example 2 — coverage worksheet as “record”

A packet asks for twenty fill-in definitions of “data,” “axis,” and “variable.” The student finishes. No apparatus. No blank table from a try. The packet feels like science class. It is not this book’s recording spine. Repair: one question, one blank table, two measured rows, one sentence. Definitions can wait until after the page exists.

Incorrect example 3 — chatbot CER with empty table

The table cells are blank. A chatbot writes a polished claim–evidence–reasoning paragraph about what “should” have happened. Filed as the student’s work. Repair: trash the paragraph for claiming. Measure. Fill. Then oral CER crumb that points at a row. Tools rules point back to Science Hour.

For the student

Your notebook is how science looking grows up from a drawing into a record another person can trust.

Table → **graph** → **sentence** means:

1. Draw an empty table with headers and units **before** you measure.
2. Fill cells only from what you measure.
3. If you graph, label axes and units **before** you put points on.
4. Write one sentence that points at your table or graph — not at a feeling.

Messy real numbers beat invented neat ones. A stranger should be able to read your page and say what you asked, what you changed, and one result.

Tiny worked example

Question: Does wrap change how fast hot water cools?

Blank table (before pouring):

Trial	Wrap	Temp after 5 min (°C)	Notes
1	towel		
2	towel		
3	none		

You fill the empty cells from the thermometer. Then you might say: “According to my table, the towel cup stayed warmer after five minutes than the bare cup.” If you graph, you label “wrap type” and “temperature (°C)” on the axes before any points. You do not invent 42.00 for every cell because that looks “scientific.”

Try 1

Open a dated page. Write a question for a tiny try you can do today (bounce height, dissolve time, ramp distance — adult present if needed). Draw a blank table with units. Run at least two trials. Fill from measuring. Write one sentence that points at a row.

Try 2

Hand your page to a “stranger” (sibling or parent). No talking. Can they restate your question, what changed, and one result? Fix one gap. That is REC-06.

Explain it back

In your own words: Why blank table first? Why might invented neat rows be a problem?

Challenge

At 13–14 (or stretch 11–12): take a completed three-row table and label graph axes before plotting. Or take the same measurement three times and write a range sentence (REC-05). At any band: take two photos of a setup with date captions — then still keep the table as the evidence.

You are allowed to wait. You are allowed to keep messy numbers. You are allowed to change your sentence when the table says so. You are not required to invent neat rows so the notebook looks “scientific.”

If a tool ever offers to “finish your table,” that is not help when filling the table is the lesson. Your numbers. Your hand. Your sentence. A picture a computer painted of a “result” is not your data. Ask an adult if you are unsure. Looking first still wins.

If it isn’t clicking

Diagnostic 1 — Perfect table, weak memory of measuring.

What you see: Neat rows; little recall of reading the tool; numbers match a hope.

Next move: Trash invented rows kindly. Re-run with blank table first. Say out

loud: messy real beats invented neat. If a tool offered a filled table, that is not the student's data — blank page, student's eyes and meter.

Diagnostic 2 — Graph pretty, table missing.

What you see: Curve or bars with no source rows; axes unlabeled.

Next move: REC-02 before REC-03. Axes labels only after three real rows. Cover decorative curves that ignore points.

Diagnostic 3 — Adult handwriting owns the page.

What you see: Parent filled “so we finish”; student disengaged.

Next move: Hand them the pen. Your job is the question and the wait. If motor or print load blocks, they dictate units and numbers; you write *their* words; they initial. Stranger-can-read still applies.

Diagnostic 4 — Units missing everywhere.

What you see: Numbers without cm, °C, or seconds; stranger cannot tell scale.

Next move: Rewrite headers with units before the next try. One oral practice: read every cell aloud with units. Exit ticket must include units.

Diagnostic 5 — Second-hand data treated as their trial.

What you see: Nutrition label or textbook table copied as “my experiment.”

Next move: Label second-hand clearly. Keep OUT-03 as label-compare, not as a pretend kitchen trial. Separate page for any real try.

When to slow down. Chapter 1 looking-before-name still thin → protect OBS cards before demanding graphs. Blank table fails every time → stay on REC-01 and REC-02; skip REC-03 for now.

When to go ahead. Student refuses to start without a blank table; stranger can read the page; sentence points at a row. Add REC-03; at 13–14 add REC-05; mix an OUT measure.

When to get a human tutor. Persistent freeze around measuring tools even with read-aloud; invent-data habit that does not bend after redesign practice; or a need you cannot scaffold. A tutor who puts a blank table on the table beats a worksheet packet. No shame either way.

Correct a wrong reason without crushing the look. “Never correct the adolescent” is not this book's rule. Hearing invented neat rows, asking for a re-measure, and naming honesty is teaching. Silence in the face of invent-data is not kindness; a shaming lecture is not teaching either.

Tools, including AI

Optional helpers for you, the adult. Keep this short. Point back to the Science Hour AI box.

You may, on your account, after the student has tried (or before, for your prep): ask a tool to explain *to you* how to set up a blank table for today’s apparatus; get a labelled SCRIPT of stranger-can-read questions for *you* to say after they record; get isomorphic blank tables with the answer key held by you; diagnose a page the student already produced (crop to the paper; no face upload); ask for a labelled schematic of a graph layout to look at together, then put away before they plot from *their* data.

You may not: invent an observation or data table and file it as theirs; paste a blank table and ask the tool to complete it (photo-to-key); generate a “result” graph or micrograph and treat it as data; park an unsupervised chatbot as the student’s only partner during recording; write their results paragraph. At 11–12 you hold the account. At 13–14 you co-hold and stay in the room — turning 13 is not a licence. Unaided first on measuring and recording. SCRIPT after the try. Generated image $\neq$ data.

A one-line caution from a high-school math study travels as a kitchen rule only: a tool may prepare the adult and the next recording page; it may not fill the student’s table when recording is the lesson. Label that caution off-age for Science Hour — it is not an 11–14 science RCT.

What “done enough” looks like

Before you move on from this chapter’s focus, check skill — not birthday.

11–12 done enough

- ☐ Dates a page and writes the question
- ☐ Draws a blank table with headers and units before measuring
- ☐ Fills 2–3 rows from real measurements
- ☐ Says one sentence that points at a row
- ☐ Passes a stranger-can-read check with one fix
- ☐ Parent can hear invent-data and adult-filled blanks — and repair

13–14 done enough

- ☐ Drafts headers and units without hunting your face
- ☐ Labels graph axes before plotting (from a real table)
- ☐ Writes a sentence a stranger believes; optional soft uncertainty note
- ☐ Still refuses invent-data, generated graphs-as-results, and AP padding as weekly default

Place by skill. A fourteen-year-old who invents neat rows and skips units stays on 11–12 REC longer — no shame. An eleven-year-old who protects blank-table-first and cites a row is ready for Chapter 3’s named-change fair tests (and may stretch REC-03).

Not done enough (yet): graph with no table; table with no question; adult-filled blanks; generated observation as data; birthday gate; photo with no caption filed as the whole record.

Habit crumb (not a ninth chapter). Next Tuesday, reopen last week’s table for two minutes before a new try. Mix stranger-can-read into Friday’s diagnostic. Stop while a look remains.

Title the work **Science** if a stranger needs a name. Never **Young Minds Science I**. Never a curriculum brand as the credit line.

Week sketch (illustration only — not a calendar promise). Hypothetical: Monday REC-01 + REC-02 plan; Tuesday measure into the blank table + sentence; Wednesday REC-06 stranger check; Thursday REC-03 axes before points (13–14 or stretch); Friday diagnostic invent-data card + done-enough checklist; Saturday OUT-02 or OUT-03 optional. Label hypothetical. Not 180 days. Not national minutes.

Chapter 3 — Fair tests with a named change



Figure 5: A kitchen-table still-life from a high three-quarter view: a board ramp with two surface strips (towel and foil), one toy car at the top, a short checklist card labelled Change / Measure / Same,² a blank distance table in a dated notebook, a meter stick along the landing zone. No people. No logos. No readable package branding.

Why this matters

You changed the surface. You also changed the height. You also used a heavier car. Then you announced that rough makes it stop.

That announcement is not a character flaw. It is what happens when a try feels busy and the mind grabs the first difference it likes. The hour's job is smaller and kinder: name the one thing you meant to change, name what you measured, name what you kept the same on purpose, and ask — after the try — whether you can tell for sure.

Fair test is a taught procedure with a notebook record, not a personality trait that appears after enough hands-on mess. Adolescents this age can name an independent variable and a dependent variable in ordinary language. They can fill a blank table from measurements they took. At 11–12 they catch an obvious confound with a prompt and redesign once with help. At 13–14 they design an unconfounded try and redesign a confounded one more independently. They do not become fair-minded because a parent bought a kit, and they do not invent control-of-variables by staring at a pile of ramps alone.³

What this idea unlocks is every later claim that points at a trial. A plant that got more light *and* more water cannot teach you about light alone. Insulation that also had a lid on one cup only cannot teach you about wrap alone. A vinegar-and-soda fizz is a change picture — adult present, authorized pair only — and it still is not a Chemistry credit.⁴ One deliberate change, recorded in a dated notebook a stranger could almost read, is how looking turns into a claim you can check.

Two refusals sit beside the idea, or the week becomes noise.

Discovery-only is not the program. A useful study of third- and fourth-graders

²Primary Connections Change / Measure / Same mnemonic — pedagogical tool; not cited here as a U.S. kitchen RCT result.

³Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effects of direct instruction and discovery learning. *Psychological Science*, 15(10), 661–667. Classroom study, grade 3–4, ramps, n=112 after exclusions; direct instruction on control-of-variables vs unguided discovery; masters ~77% vs ~23%; masters transferred alike on a poster task; both conditions active with apparatus. Label classroom origin; age the *shape* for 11–14; do not print 77%/23% as this adolescent's score; do not declare discovery dead.

⁴National Research Council. (2006). *America's Lab Report* — high-school lab origin; design principles may travel; do not treat kitchen fair tests as secondary Chemistry credit or as middle default lab credit.

learning to design unconfounded experiments found that children who received clear teaching of the control-of-variables rule produced far more “masters” than children left to unguided discovery on the same materials — and both groups manipulated the materials. The difference was explanation of the rule. Masters later looked alike on a transfer task that asked them to judge someone else’s experiment poster. That study was a classroom trial on ramps, not a kitchen RCT for ages 11–14, and the percentages are not this adolescent’s score. This is a useful study, not a promise that every home will see the same result. Use it as a move: show a confounded try and a clean try; open a blank table before the race; ask “can we tell for sure?”; then let the student design.

Worksheet-only is not the program either. A fair-test sheet with no apparatus on the table is vocabulary without a lookable. Activity mania — ten demos, no record, no “what changed?” — is entertainment. Coverage as the hour — every kingdom by Friday — is a map mistaken for depth. One try with a named change, a blank table filled from real trials, and one authentic question beats all three.

You do not need to be a scientist. You do need to put the materials down, ask what they will change and what they will keep the same, wait, and point back at the notebook when the claim gets ahead of the evidence.

This week you can learn to hear confound pride and to answer it with a redesign, not a scolding lecture. Today the student can name IV and DV for *this* trial — and catch one confound with help (11–12) or unaided (13–14).

For the parent: understand it yourself

Many adults feel rusty on “variables” and laminated scientific-method posters. That is ordinary. Five minutes here, then the warm-up, is enough for tomorrow. The student still does the trying and the recording.

Everyday picture. Two cookies from different batches. One was baked longer. One used a different pan. Someone asks which change made the cookie browner. You cannot tell for sure — two things changed. That kitchen moment is fair test in ordinary clothes. You do not need the word *variable* to feel the problem. At 11–14 you will also use the tool words when they help: independent variable for the one deliberate change, dependent variable for what you measure. Tool words, not a spelling test with no trial.

Precise picture. Four teen words carry the procedure:

- **Change (IV):** the one thing we decide to make different on purpose.
- **Measure (DV):** what we count, time, weigh, or carefully observe.
- **Same (controls):** everything else we keep alike on purpose.
- **Can we tell for sure?** If two things changed, we cannot blame one.

Primary Connections' Change / Measure / Same remains a useful mnemonic. At this age also name *independent variable* and *dependent variable* when it helps the stranger-readable notebook — after the materials are on the table, not before.

A second precise picture: a confounded try next to a clean try. Same question — does the surface change how far the car goes? Confounded: steep-smooth-short with a light car against shallow-rough-long with a heavy car. Clean: same height, same car, same release method, same start line; only the surface differs. Three trials each surface. Distances with units in a blank table drawn *before* the first release. Ask what a stranger would need to believe the claim. That hour is the rule with examples, then the student's redesign. It is not a sermon that discovery is dead.

Wrong answers you should be able to hear

1. *Confound pride.* “We changed the surface *and* the height *and* the car — and look, rough stops it!” Hear the pride. Do not crush the look. Ask: “Can we tell for sure it was the surface?” Point at the two other changes. Redesign so only one thing differs. Keep their original page; add a new dated page for the redesign.
2. *Variable vocabulary quiz with no trial.* “Define independent variable” while the ramp stays in the closet. Hear coverage dressed as science. Put the apparatus down. Name IV on *this* trial.
3. *Invented neat rows.* The trial was messy; the notebook looks perfect. Hear invent-data. Keep the messy numbers. Redesign if needed. A fluent filled blank from a machine is performance, not the student's looking.
4. *Vinegar-and-soda as Chemistry credit.* Fizz, foam, excitement — then “we did chemistry.” Hear the credit grab. Name it plainly: this is a change picture. Adult measures. Authorized pair only. No sealed bottle. No other mixes. It does not unlock titration or a Chemistry transcript line. Put the work under Science or Physical Science when the work is actually that.

5. *Unauthorized mixing “to see what happens.”* Curiosity reaches for bleach, drain cleaner, or unmarked bottles. Stop. Safety card. Authorized materials only. Curiosity is not a permit.

A sixth you will also hear: “Just tell me if the design is right.” The student wants the answer key instead of the redesign. Point at the materials and the blank “same” cards. Ask what they would keep the same next time. Do not grab the answer. Do not fill the silence with the explanation.

Five-to-eight-minute parent warm-up

Do this alone with tomorrow’s apparatus — a board, two surface scraps, one car — before the lesson.

Minute 1. Set a deliberately messy try: different height *and* different surface *and* different car. Say aloud: “Can we tell for sure?” Answer yourself: no.

Minute 2. Reset so only the surface changes. Touch each “same”: car, height, release, start line, floor. Say the change once. Say the measure once: distance in centimeters.

Minute 3. Draw a blank table with headers: trial #, surface, distance (cm), notes. Leave cells empty.

Minute 4. Practice the opening you will ask: “What did we change on purpose — and what did we keep the same?” Count a slow three after you ask.⁵ Look at the ramp, not at an imaginary adolescent.

Minute 5–8. Write Change / Measure / Same on three scraps. Put them face down. Tomorrow the student’s words fill them. Decide whether tomorrow is FAIR-01 (ramp) or FAIR-07 (confounded catch meta) first — both are strong. If fair-test habits from Chapters 1–2 are still thin, start with FAIR-08 Variable Card Checklist as the gate, then run the try.

How to teach it this week

Science Hour stays the five beats you already know from the front of the book: observe / frame; plan the fair test; try / measure / record; talk + CER light crumb;

⁵Rowe, M. B. (1972/1974). Wait-time in elementary science classes; Stahl, R. J. (1994). Think-time (ERIC ED370885). Classroom-origin ~3-second convention; use the move; do not invent a kitchen wait coefficient.

exit ticket. This week the plan and try beats own the named change. Total often ~25–45 minutes. Stop while a look remains.

Warm-up looking (4–8 min). Put the materials in view. Cover any worksheet title that already says “hypothesis” or “variables.” Ask what they notice about the setup — before any vocabulary sentence. Wait a slow three (classroom-origin wait; use the move, not a kitchen coefficient).

Plan the fair test (4–8 min). Name change / measure / same. Draw the blank table *before* materials move for the race. At 11–12, co-build the “same” list. At 13–14, the student names IV/DV/controls in ordinary language; you gate safety and start. Adult present for heat, electricity, outdoor water, chemicals, glassware, and any kitchen chemistry picture.

Try / measure / record (10–18 min). Student runs the trials. You do not grab the notebook. Messy real numbers beat invented neat ones. Two or three trials per condition at 11–12; more rows and a short methods sentence at 13–14 when the habit holds.

Talk + CER light crumb (6–12 min). Claim that answers the question. Evidence that points at a row. One “because” if the idea is already on the table this week — do not invent a principle to decorate. Point at “can we tell for sure?”

Exit ticket (2–5 min). Name IV/DV/same for *this* trial; or “confound was ____ / fair redesign changes only ____.” Diagnostic wrong noted by you for tomorrow — not a graded performance.

Exact wording you can say

- “What did we change on purpose — and what did we keep the same?”
- “What are we measuring — in what units?”
- “Can we tell for sure it was the change — what else was different?”
- “How would we redesign so only one thing changes?”
- “You may change your mind after the redesign.”
- “Fill the blank table from what you measured — not from what you hoped.”

Age-band moves: 11–12 / 13–14

11–12. Co-build the “same” list; 2–3 trial rows; oral “can we tell for sure?”; adult checks safety and gates start until Change / Measure / Same cards are filled; CER oral or two-sentence write; still refuse full lab reports.

13–14. Student names IV/DV/controls in ordinary language; redesigns a confounded try unaided; short methods sentence another student could almost follow; graph axes labelled before plotting when you pair with Chapter 2; still kitchen-scale; still refuse AP lab report as weekly default. If fair-test habits are weak, stay on 11–12 FAIR longer. Skill, not birthday.

Parent learns this week. Ask “can we tell for sure?” and wait. Co-build the “same” list at 11–12; fade at 13–14.

Student tries today. Name IV and DV for *this* trial; catch one confound with help (11–12) or unaided (13–14).

First try-it. FAIR-01 Ramp Surface Only, or FAIR-07 Confounded Catch if you want the meta lesson before the race. Fade help across the week: co-name same list → they name while you watch → they design → redesign once when confounded.

When to stop talking. When you are performing the scientific-method poster while their blank table is empty. One question. Stop. Look at the materials or the notebook if the silence is hard.

This-week sketch (illustration, not a script law)

Day	Focus	Card
Mon	Variable cards + ramp or meta catch	FAIR-08 then FAIR-01, or FAIR-07 first
Wed	Second fair test (temp dissolve or insulation)	FAIR-02 or FAIR-06
Fri	Confound catch + redesign + exit	FAIR-07 + sticky exit
Optional OUT	One focused outdoor comparison	OUT-01 or OUT-06 soft

Three to five Science Hours plus one OUT is a full week. One deep hour beats five manic demos.

Practice that actually builds learning

Named try-its below carry **time, materials, safety, the fun, the skill**. Library, walk, museum, kitchen, and yard *are* the practice — they do not replace the fair-

test-with-notebook move.

Talk box

Opening (locked): “What did we change on purpose — and what did we keep the same?”

Follow-ups:

1. What are we measuring — what do you *see* or *time* or *weigh*?
2. What does the notebook / table show for each condition?
3. Can we tell for sure it was the change — how do you know from *this* trial?
4. What else was different — what would we redesign?
5. You may change your mind after the redesign. Try another look.

How to wait. After you ask, a slow three is a convention, not a sacrament (elementary science classroom origin). After they stop, wait again. If they are mid-measure or mid-claim, do not cut them off. Look at the materials, the table, or the notebook, not at the adolescent, if the silence is hard.

Stuck silence usually means: the question was vague; wait-time was zero; they are hunting a vocabulary word because you asked name-first; they are guessing what you want; the materials never landed; they offered a book-only guess; they think science means “repeat the parent’s explanation”; they invent neat rows because the trial was messy. Pose, wait, and point back at the notebook — not fill the silence with the right vocabulary, and not turn the table into a fight.

In-home try-its (FAIR bank)

FAIR-01 Ramp Surface Only

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Board ramp; two surfaces (towel, foil); same car or ball; meter stick; notebook blank table
- **Safety:** Adult present; clear landing zone; eye protection if projectiles; no hard balls at faces
- **The fun:** The race feels like play; the blank table makes the race honest.
- **The skill:** Change surface only; hold height, release, vehicle same; three trials each; “can we tell?”

- **Steps:** Question first. Cards: Change / Measure / Same. Blank table before first release. Run. Record distances with units. Talk box. Exit: claim + one evidence row + same list.
- **Error patterns:** Changing height too; pushing harder on one surface; inventing distances.

FAIR-02 Dissolving Temp Only

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Sugar or salt; water at two adult-controlled temperatures; spoons; clear cups; timer; notebook
- **Safety:** Adult handles hot water; no tasting; spill plan; no glass overheat
- **The fun:** Watching crystals vanish on a clock feels like a race against time.
- **The skill:** Same solute mass, same water volume, same stir style; change temperature only.
- **Exit ticket:** “Temperature changed ; *dissolve time was* .”
- **Error patterns:** Different spooning; tasting lab solutions; boiling unsupervised; inventing times.

FAIR-03 Plant Light Hours

- **Band:** both (multi-day ok)
- **Time:** 25–35 min setup + brief daily checks
- **Materials:** Two similar plants; lamp timer or window vs closet with adult plan; water schedule identical; notebook log
- **Safety:** Adult present for lamps; cords; no mold experiment; water away from outlets
- **The fun:** A living system answers slowly — patience becomes data.
- **The skill:** Change light exposure only; midweek “can we tell yet?” labelled tentative.
- **Error patterns:** Watering one more; different plant species; skipping days then inventing logs; lamp as fire hazard.

FAIR-04 Pendulum Length Only

- **Band:** both
- **Time:** 30–45 min
- **Materials:** String, washer, tape, ruler, stopwatch; notebook
- **Safety:** Adult present; clear swing arc; no heavy masses overhead
- **The fun:** Timing ten swings feels precise without being a worksheet.

- **The skill:** Change length only; hold mass and release angle same; table of periods.
- **Error patterns:** Changing mass too; counting wrong; pushing instead of releasing; fake identical times.

FAIR-05 Paper Plane Mass Soft

- **Band:** 11–12 (stretch 13–14 for confound talk)
- **Time:** 25–40 min
- **Materials:** Same fold template; paperclips for mass; tape measure; notebook
- **Safety:** Open space; no aiming at faces; indoor preferred
- **The fun:** Flight distance is immediate feedback.
- **The skill:** Same design and throw style (adult helps standardize); change added mass only; name throw-force as a confound risk.
- **Exit ticket:** Same list + one confound still worrying you.
- **Error patterns:** Redesigning folds mid-test; harder throws for “favorite”; outdoor wind ignored.

FAIR-06 Insulation Wrap Only

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Two identical containers; hot water (adult); wrap materials (towel, foil, none); thermometers; notebook
- **Safety:** Adult pours hot water; no scalds; thermometer glass care
- **The fun:** Temperature drop becomes a visible race.
- **The skill:** Same start temp and volume; change wrap only; record every 2–3 min; graph optional (pair Chapter 2).
- **Exit ticket:** “Wrap ____ kept heat better; evidence at $t=10$ min: ____.”
- **Error patterns:** Different start temps; lid on one only; tasting; unsupervised kettle.

FAIR-07 Confounded Catch (meta)

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Written or acted confounded setup (parent scripts two variables changing); notebook
- **Safety:** None beyond talk
- **The fun:** Spotting the trick feels like detective work.

- **The skill:** Spot what changed; explain why we cannot tell for sure; redesign on paper to one IV.
- **Exit ticket:** “Confound was . ***Fair redesign changes only .***”
- **Error patterns:** Calling every design “fine”; fixing by inventing data instead of redesign.

FAIR-08 Variable Card Checklist

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Index cards; planned trial
- **Safety:** Gate for the actual trial’s hazards
- **The fun:** Cards make the plan visible before the mess.
- **The skill:** Cards Change / Measure / Same $\times 3$ filled before materials move; adult gates start.
- **Exit ticket:** Photo or copy of completed cards in notebook.
- **Error patterns:** Empty “same” cards; starting early; treating cards as busy-work after the trial.

Out-of-home try-its

OUT-01 Stream or Pond Soft

- **Band:** both
- **Time:** 30–45 min on site
- **Materials:** Notebook; optional thermometer; adult
- **Safety:** Adult present; no swimming as “lab”; footwear; local rules; wash hands; no entering fast water
- **The fun:** Edge looking is real-world science without a scavenger packet.
- **The skill:** Observe edges; record living/nonliving notices; optional one deliberate comparison (e.g., sunny vs shady edge temp) with adult water safety; one question for a later home fair test.
- **Exit ticket:** 5 notices + one later question with a named IV.
- **Error patterns:** Scavenger worksheet dump; entering water unsafely; inventing species lists.

OUT-06 Garden Biodiversity Soft

- **Band:** both
- **Time:** 25–40 min

- **Materials:** Soft quadrat (hula hoop); notebook
- **Safety:** Adult present; allergy check; wash hands; tick awareness as relevant; no harm to animals
- **The fun:** Counting life in a hoop turns a yard into a study plot.
- **The skill:** Count plant types in hoop in two spots; same hoop size; fair-ish comparison; no stomping beds.
- **Exit ticket:** Two counts + one difference notice; optional “what would we change on purpose next time?”
- **Error patterns:** Collecting protected plants; inventing counts; three variables changed at once if you redesign poorly.

Blocked for a new move / mixed for when to use it

Blocked (one new move): FAIR-08 or FAIR-07 alone until the student can name change + same + measure without hunting your face for the “right” word. Then FAIR-01 alone with talk box.

Mixed (when the move holds): Pair FAIR-02 with a stranger-can-read check from Chapter 2; or FAIR-06 with graph axes before points; or Friday FAIR-07 with a redesign and a short CER crumb. Pair one OUT in the same week when the home fair test is steady.

One incorrect example to diagnose

Illustration (composite, not a reported family): A twelve-year-old runs two plants. One gets a sunny window *and* extra water *and* a bigger pot. The other sits in a closet with less water in a small pot. The notebook announces: “Light makes plants grow — proved.” Rows look neat. One plant species differs.

What you hear: Confound pride + invent-neat risk + coverage itch (“we did biology”).

Next move: “Can we tell for sure it was the light?” Wait. Point at water and pot and species. Redesign with FAIR-03: same water, same pot size, same starting health; only light exposure differs. Keep the original page; add a new dated page. Do not paste a generated growth chart as “our” data. Do not file the hour as Chemistry or as a brand title on a transcript.

Exit crumb shapes

- “Change: . **Measure:** . Same: , , ____.”
- “Can we tell for sure? ____ because ____.”
- “Confound was . **Fair redesign changes only** .”
- Sticky claim + one evidence row number.

Sibling and mixed-band notes

If two adolescents share the hour, give them the same phenomenon and parallel jobs when bands differ: one fills Same cards while the other spots the confound on a scripted setup; then swap. Do not turn the table into a race for who “wins” science. Kindness is part of safety. A younger sibling from *Science for Little Thinkers* age may watch and draw; they do not own IV/DV vocabulary as a quiz. This book ages up — one pointer to the earlier book, then teach 11–14 fair test with a notebook.

Dose and safety (week grain)

Three to five Science Hours plus one OUT is enough. Multi-day plant logs (FAIR-03) can run beside shorter trials; they do not require a 180-day calendar. Safety spine from the Science Hour still holds: adult present for heat, electricity, outdoor water, chemicals, glassware; authorized materials only; no unmarked bottles; no bleach mixes; no drain cleaners; no alcohol flames; no sealed pressurized fizz bottles; living things — no harm, return, wash hands; mold cultivation refused by default; home vertebrate dissection refused as default. A vinegar-and-soda fizz remains a change picture, not a Chemistry credit.

What “fair” does not mean this week

Fair does not mean “the student guessed the parent’s preferred answer.” Fair does not mean “every trial matched.” Fair does not mean “we used science words.” Fair means one deliberate change, a real record, and an honest answer to “can we tell for sure?” Disagreement between two honest trials is data. Deleting the unpopular trial is not.

If Chapter 1 still needs notice-before-name, or Chapter 2 still needs blank-table-first, those moves are not leftovers — they are the floor under this chapter. Place

by skill. A path through middle-grades fair tests is the promise.⁶ A diploma is not. A percentile is not.

For the student

Fair test means you change **one** thing on purpose, you measure what happens, and you keep everything else the same on purpose. Then you ask: can we tell for sure?

The change is sometimes called the **independent variable** — the thing you decide to make different. What you measure is sometimes called the **dependent variable**. The things you keep the same are **controls**. Those are tool words. What matters is the try on the table and the numbers in your notebook.

Tiny worked example

Question: Does the ramp surface change how far the car goes?

Change (IV): surface — towel vs foil.

Measure (DV): distance from the bottom of the ramp, in centimeters.

Same: same car, same ramp height, same start line, same release (no push), same floor.

Table (drawn before the race):

Trial	Surface	Distance (cm)	Notes
1	towel		
2	towel		
3	foil		

You fill the empty cells from what you measure. Messy real numbers beat invented neat ones. If you also changed the height, you cannot blame the surface — redesign.

⁶National Research Council. (2007). *Taking Science to School*; National Research Council. (2008). *Ready, Set, SCIENCE!*; National Research Council. (2012). *A Framework for K–12 Science Education*. Middle-grades moves include identifying variables, planning investigations, recording, and explaining — as a moves map, not a PE dump as the weekly spine.

Try 1

Pick FAIR-01 or FAIR-08 + a simple try. Fill Change / Measure / Same cards before materials move. Run at least two trials per condition. Point at one row when you say what happened.

Try 2

Parent scripts a confounded setup (FAIR-07). Spot what changed. Say why you cannot tell for sure. Redesign on paper so only one thing changes. Keep your first page; add a new dated page.

Explain it back

In your own words: What is a fair test? What does “can we tell for sure?” protect you from?

Challenge

Design a fair test for insulation wrap (FAIR-06) or pendulum length (FAIR-04). Write a two-sentence methods note another student could almost follow. At 13–14, redesign once without being told where the confound is.

You are allowed to wait. You are allowed to change your mind after the redesign. You are allowed to keep messy numbers. You are not required to invent neat rows so the notebook looks “scientific.”

If it isn’t clicking**Diagnostic 1 — Confound pride every time.**

What you see: Two or three things change; the claim still sounds certain.

Next move: FAIR-07 on paper only for one hour. No race until the redesign names one IV. Co-build Same×3 cards (FAIR-08) and gate start. Keep original words; add a new page.

Diagnostic 2 — Perfect table, weak trial.

What you see: Neat rows, little memory of measuring, or numbers that match a hope.

Next move: Trash invented rows kindly. Re-run with blank table first. Say out loud: messy real beats invented neat. If a tool offered a filled table, that is not the student's data — blank page, student's eyes and meter.

Diagnostic 3 — Vocabulary without apparatus.

What you see: Can define IV/DV; cannot point at today's change.

Next move: Materials down first. Name IV on *this* trial only. Cover the worksheet title. Return to FAIR-01 with oral “can we tell?”

When to slow down. Recording habits from Chapter 2 still thin (no blank table, no units, stranger cannot read the page) → spend a Science Hour on blank table first and stranger-can-read before FAIR-01 becomes the gate. Looking habits from Chapter 1 still thin → notice before name for a few hours.

When to go ahead. Student names IV/DV/same without hunting your face; re-designs a confound once with help (11–12) or unaided (13–14); table has real units → add FAIR-06 with optional graph; try a short methods sentence; add one OUT soft comparison.

When to get a human tutor. Persistent freeze after redesign practice; safety push toward unauthorized mixes; or a need you cannot scaffold for measurement tools. A tutor who puts apparatus on the table beats a worksheet packet. No shame either way.

Correct a wrong reason without crushing the look. “Never correct the adolescent” is not this book's rule. Hearing a confounded “proof,” asking a better question, and naming a better move is teaching.

Tools, including AI

Optional helpers for you, the adult. Keep this short. Point back to the Science Hour AI box in the front of the book.

You may, on your account, after the student has tried (or before, for your prep): ask a tool to explain control-of-variables *to you* from today's apparatus (ramp, insulation, pendulum); get a labelled SCRIPT of questions for *you* to say after the try; get isomorphic blank tables with the answer key held by you; diagnose a page the student already produced (crop to the paper; no face upload).

You may not: invent an observation or data table and file it as theirs; paste a blank

table and ask the tool to complete it; generate a “result” photo of a ramp trial and treat it as data; park an unsupervised chatbot as the student’s only partner during the attempt; write their lab report. At 11–12 you hold the account. At 13–14 you co-hold and stay in the room — turning 13 is not a licence. Unaided first on looking, measuring, and recording. SCRIPT after the try.

A one-line caution from a high-school math study travels as a kitchen rule only: a tool may prepare the adult and the next looking page; it may not do the student’s looking, measuring, or recording when those are the lesson. Label that caution off-age for Science Hour — it is not an 11–14 science RCT.

What “done enough” looks like

Before you move on from this chapter’s focus, check skill — not birthday.

11–12 done enough

- ☐ Names change / measure / same for *this* trial (with help on the same list ok)
- ☐ Fills a blank table from real measurements (2–3 rows)
- ☐ Answers “can we tell for sure?” after a confounded demo
- ☐ Redesigns once with help so only one thing changes
- ☐ Dated notebook page a stranger could almost read

13–14 done enough

- ☐ Names IV/DV/controls in ordinary language without hunting your face
- ☐ Designs an unconfounded kitchen-scale try
- ☐ Redesigns a confounded try unaided
- ☐ Short methods sentence another student could almost follow
- ☐ Still refuses invent-data and AP lab-report padding as the weekly default

Place by skill. A fourteen-year-old who invents neat rows and cannot spot a confound stays on 11–12 FAIR longer — no shame. An eleven-year-old who runs clean single-IV trials and cites the table is ready for harder FAIR cards and a fuller CER crumb.

Not done enough (yet): variable quiz with no trial; vinegar volcano filed as Chemistry credit; ten demos with no notebook; generated observation as data; birthday gate (“you’re thirteen so you must...”).

Revisit next Tuesday: mix last week’s fair test with a new surface or a new wrap.

Life of the habit is the session rhythm and the file you keep — not a ninth teaching chapter.⁷

When the named change holds, Chapter 4 puts models on the table — what a model shows, and what it leaves out — without abandoning the fair-test spine you just built.

⁷Access date for URLs and planning grain in the research memos behind this manual: **17 September 2026.**

Chapter 4 — Models on the table



Figure 6: A kitchen-table still-life from a high three-quarter view: a particle-picture sketch of water on notebook paper, a yellow sticky labelled Limits, a clear cup of ice water beside the drawing, a simple cup-and-arrow water-cycle model, a dated notebook open to a blank “what it leaves out” line. No people. No logos. No readable package branding.

Why this matters

The model looks finished. Labels are neat. Someone announces that this *is* how molecules behave — or how the moon moves — or how energy flows through a desk lamp.

That announcement is not a character flaw. It is what happens when a picture feels complete and the mind treats the picture as the world. The hour's job is smaller and kinder: build or draw a model that helps explain a system, say what it shows, and name what it leaves out — then, when you have data, ask whether the model and the notebook agree.

Models are pictures, diagrams, or physical builds that explain. Middle grades put models on the table, predict from them, compare them to measurements, and — at 13–14 — revise once when data disagree. A model is not decoration. A model is not a generated “microscope photo” filed as Figure 1. A model summary from a screen is not the student's observation of a real trial.⁸

What this idea unlocks is every later explanation that can survive a second look. A particle picture that never meets ice and steam stays art. A food-chain craft that never marks which links were observed stays a worksheet biome. A scale map of the yard that never checks one length stays pretty. One model with a limits sticky, beside a notebook page, is how explanation stays honest.

Two refusals sit beside the idea, or the week becomes noise.

Model-as-decoration is not the program. Glitter, perfect lettering, and a photo for the fridge without a limit sentence teach craft, not science looking. Activity mania — five models, no talk about what they leave out — is entertainment. Coverage as the hour — every cell organelle labelled from a poster the student never matched to an image they looked at — is a map mistaken for depth.

Model-as-truth is not the program either. “The model is the real system” collapses the useful gap between representation and world. Kitchen models are not research-lab modeling programs. They are middle-grades practice: show, leave out, predict, compare, revise lightly.

You do not need to be a scientist. You do need to put a model on the table, ask

⁸Integrity grain for images and observations: generated image $\neq$ data; model summary $\neq$ observation; invent-data ban — house rules aligned with ordinary research honesty norms discussed in the book's research brief (access date **17 September 2026**).

what it shows and what it leaves out, wait, and point back at the notebook when the picture gets ahead of the evidence.

This week you can learn to put a limits sticky on every model before anyone decorates. Today the student can build or draw one model and name one limit aloud.

A third refusal belongs in the same breath as decoration and truth-collapse: coverage as model week. Ten labelled diagrams with no phenomenon on the table teach handwriting. One particle picture beside a cup the student watched, or one energy-arrow sketch beside a lamp they turned on, teaches the practice. Depth is the hour. The map of every model type can wait on the shelf.

For the parent: understand it yourself

Many adults remember models as dioramas or as textbook art to copy. That is ordinary. Five minutes here, then the warm-up, is enough for tomorrow. The student still builds and names the limit.

Everyday picture. A subway map. It shows connections. It leaves out street trees, exact walking times, and the smell of the platform. Nobody calls the map a lie because it leaves those out — unless someone treats the map as the city. That gap is the model habit in ordinary clothes.

Precise picture. In middle-grades science, a **model** is a representation — physical, diagrammatic, or mathematical-light — that helps explain or predict something about a system. The Framework and related teaching materials treat developing and using models as a practice, not as a craft elective. *Taking Science to School* and *Ready, Set, SCIENCE!* treat model-building as part of proficiency,⁹ tangled with domain knowledge — not as a separate “creativity hour” with no science object.

Three kitchen moves carry the practice:

- **Show:** What parts and relationships does this model include on purpose?
- **Leave out:** What does it simplify, hide, or refuse to claim?

⁹National Research Council. (2007). *Taking Science to School*; National Research Council. (2008). *Ready, Set, SCIENCE!*; National Research Council. (2012). *A Framework for K–12 Science Education*. Model-building and using models as intertwined strands/practices; kitchen translation is show / leave out / meet data — not a claim that home models equal research modeling programs.

- **Meet data:** What would this model predict — and what does the notebook say?

At 11–12, physical and diagrammatic models with one named limit are enough. At 13–14, add “what would change the prediction?” and revise once when data disagree. Still refuse AP-scale modeling reports as the weekly default.

A second precise picture: particle pictures for ice, water, and vapor beside a real cup the student watched. The drawing is linked to something seen (shape, flow, steam). The limit sticky says: particles are not little people; we are not seeing atoms with our eyes. That hour is model + evidence + limit. It is not a claim that the kitchen equals a research modeling lab.

Wrong answers you should be able to hear

1. *Model as art project only.* Beautiful build; no labels that explain; no limit sentence; no link to a question. Hear craft without science looking. Ask: “What does this model show — and what does it leave out?” Require the sticky before the photo.
2. *Generated cell picture filed as micrograph.* An image tool produces a “cell under the microscope.” It lands in the notebook as Figure 1. Hear generated image $\neq$ data. Label a schematic if you use one, then put it away before the look — or skip. Real prepared slide, printed micrograph from a book, or soft alternative. Never file a generated result as the student’s observation.
3. *Model that never meets data.* Particle picture on Monday; dissolving trial on Thursday; no comparison. Hear decoration split from looking. Predict from the model; run or revisit the trial; mark match / partial / miss (MOD-06 at 13–14; soft talk at 11–12).
4. *“The model is the truth.”* Student defends the drawing against the thermometer. Hear representation collapsed into world. Say: “Data can win. What would we revise once?” Keep both pages — prediction and result.
5. *Model summary as the observation.* A chatbot paragraph describes what “usually happens” when ice melts; that paragraph is filed as today’s looking. Hear model-summary-as-observation. Trash it kindly. Blank page. Eyes on the cup. Then, if useful, build a particle picture *after* the look and name a limit.

A sixth you will also hear: “Just tell me what to draw.” Point at the phenomenon.

Ask what a stranger would need to see in the model to understand *this* question. Do not grab the pencil and finish their thinking.

A seventh, quieter miss: the parent rebuilds the model after the student leaves so the fridge photo looks “right.” Hear adult-filled craft. Keep the student’s version. Add a new dated page if you rebuild together as a revision — labelled as revision, not as the original look.

Five-to-eight-minute parent warm-up

Do this alone with tomorrow’s lookable — ice water, or a simple cup-arrow cycle, or a desk-lamp energy sketch — before the lesson.

Minute 1. Sketch a quick particle picture of liquid water. Do not copy a textbook yet.

Minute 2. Write one limit on a sticky: “This leaves out ____.” Place the sticky on the sketch before you sit down with the student.

Minute 3. Practice the opening: “What does this model show — and what does it leave out?” Count a slow three. Look at the sketch, not at an imaginary adolescent.¹⁰

Minute 4. Write one prediction the model would make about today’s try (if you have a try). Leave a blank line for “notebook says ____.”

Minute 5–8. Decide MOD-03 (particle picture) or MOD-05 (limit talk on any model already built) as the first try. If Chapter 3 fair-test habits are still thin, keep one fair test in the week and let the model serve that trial — do not abandon the notebook spine for craft week.

How to teach it this week

Science Hour stays the five beats: observe / frame; plan the fair test *or* model; try / measure / record; talk + CER light crumb; exit ticket. This week the plan and try beats can own a model — or a model beside a short trial. Total often ~25–45 minutes. Stop while a look remains.

¹⁰Rowe (1972/1974) wait-time; Stahl (1994) think-time — classroom-origin; use the pause in model talk.

Warm-up looking (4–8 min). Phenomenon visible first when looking is the point — ice melting, lamp on, moon sketch from last night, room to map. Cover captions that already explain the model. Ask what they notice. Wait.

Plan the model (4–8 min). Name what the model will show and what it will leave out *before* decorating. Sketch or list parts. At 11–12, co-name one limit. At 13–14, student writes two limits and one prediction. Adult present for circuits, hot water, outdoor mapping near traffic.

Build / draw / compare (10–18 min). Student builds. You do not grab the markers to “fix” the science. If data exist from this week’s fair test, put the notebook beside the model. Mark match / partial / miss when the band is ready.

Talk + CER light crumb (6–12 min). What does the model show? What does it leave out? What in the notebook supports or challenges a prediction? One claim crumb that points at either the model limit or a data row — not a chatbot paragraph.

Exit ticket (2–5 min). Model + one limit aloud; or “match level: ____ / next model change: ____.”

Exact wording you can say

- “What does this model show — and what does it leave out?”
- “What would this model predict?”
- “What in the data matches — what does not?”
- “What would change the prediction?”
- “How should we revise once?” (13–14)
- “You may change your mind when the notebook disagrees.”

Age-band moves: 11–12 / 13–14

11–12. Physical or diagrammatic model; labels that explain; one named limit; talk box on show/leave out; soft compare to a simple trial; still refuse full lab reports and DNA-as-transcript dumps.

13–14. Model vs data match (MOD-06); revise once when data disagree; “what would change the prediction?”; two limits listed; still kitchen-scale; still refuse AP modeling portfolios as the weekly spine. If model talk is only aesthetic (“it looks cool”), stay on MOD-05 longer. Skill, not birthday.

Parent learns this week. Put a limits sticky on every model. Compare to notebook before decorating.

Student tries today. Build or draw one model; name one limit aloud.

First try-it. MOD-03 Particle Picture Soft or MOD-05 Limit of Model Talk. Fade help: co-write one limit → they write the sticky → they predict and compare → revise once at 13–14.

When to stop talking. When you are lecturing kinetic molecular theory while their cup of ice is ignored. One question. Stop. Look at the model and the phenomenon.

Fade help across the week. Day 1: you co-write the first limit sticky while they build. Day 2: they write the sticky; you only gate safety. Day 3: they predict from the model before any reveal of data. Day 4–5: at 13–14, they mark match/miss and revise once; at 11–12, they name one limit and one thing the model got right without a formal revision cycle. If they hunt your face for the “right” limit, point at the phenomenon and ask what a stranger would think the model claims too much.

Exact materials gate. Before MOD-01 circuits, read the kit voltage and resistor notes. Before MOD-03 steam, adult handles heat. Before MOD-04 yard maps, check traffic edges. The model hour inherits the Science Hour safety spine — it does not invent a craft exception.

This-week sketch (illustration, not a script law)

Day	Focus	Card
Mon	Particle picture + limit sticky	MOD-03
Wed	Energy arrows or physical system model	MOD-02 or MOD-01
Fri	Limit talk + model vs data (if trial exists)	MOD-05; MOD-06 at 13–14
Optional OUT	Night sky log vs phase model, or puddle then kitchen cycle model	OUT-05; EARTH-06 adjacent

Pair with Chapter 3: a fair test on dissolving or insulation can feed MOD-03 or MOD-06. Pair with Chapter 2: stranger-can-read applies to labelled models too.

Practice that actually builds learning

Talk box

Opening (locked): “What does this model show — and what does it leave out?”

Follow-ups:

1. What do you *see* in the model — which parts did you include on purpose?
2. What does the notebook / table show that relates to this model?
3. What would this model predict — how do you know from *this* drawing or build?
4. What does the model leave out — what would a better model need?
5. You may change your mind. Revise once when data disagree (13–14) or try another look.

How to wait. Slow three after the opening. After they stop, wait again. If they are mid-label or mid-limit, do not cut them off. Look at the model or the notebook if silence is hard.

Stuck silence usually means: the question was vague; they think you want a vocabulary word (“it’s a hypothesis”); the model was adult-built while they watched; they offered a book-only copy; they think models must be perfect; they fear naming a limit because “limits” sounds like failure. Pose, wait, and point at the sticky — limits are part of the work, not a confession.

In-home try-its (MOD bank)

MOD-01 Physical Model of System

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Cups, arrows on paper, string, blocks — or battery kit for a simple loop — whatever builds a simple system model (food-chain from observed links, water-cycle cups, circuit with kit)
- **Safety:** Adult present for circuits/water; authorized kits only; no household mains; no harm to living things if modeling ecosystems
- **The fun:** Building something that *does* a “what if” feels like engineering light.

- **The skill:** Build; label parts; run one “what if” change on the model; write one limit: “This model leaves out ____.”
- **Exit ticket:** Limit sentence.
- **Error patterns:** Pretty craft with no labels; claiming the model *is* the real system; no limit sentence.

MOD-02 Diagram Arrows Energy Soft

- **Band:** both
- **Time:** 25–35 min
- **Materials:** Notebook; simple scenario (lamp on desk, bike braking, plant in sun)
- **Safety:** None for drawing; adult present if you then test a lamp kit
- **The fun:** Arrows make invisible transfers discussable.
- **The skill:** Boxes for objects; arrows for energy transfers the student can justify; cross out one arrow that is guesswork.
- **Exit ticket:** “One arrow I am sure of: . *One I cut:* .”
- **Error patterns:** Arrow spaghetti; inventing transfers not evidenced; heat/light confusion left unexamined.

MOD-03 Particle Picture Soft

- **Band:** both
- **Time:** 25–40 min
- **Materials:** Notebook; ice/water/vapor observation or demo with adult
- **Safety:** Adult for hot water/steam; no unsupervised stove; towel; no sealed pressure experiments
- **The fun:** Drawing “what’s happening inside” after watching the cup feels like secret-seeing — then the limit sticky keeps it honest.
- **The skill:** Draw particle pictures for two states observed; link drawing to something seen; name limit: particles are not little people; we are not seeing atoms with our eyes.
- **Exit ticket:** “My drawing matches evidence ____.”
- **Error patterns:** Copying textbook art without looking; claiming to see atoms; open boiling unsupervised; generated “molecule photo” as data.

MOD-04 Scale Model Map Soft

- **Band:** both
- **Time:** 25–40 min

- **Materials:** Room or yard sketch; measuring tape; scale choice (e.g., 1 cm = 1 m)
- **Safety:** Adult outdoors; trip hazards; sidewalk rules
- **The fun:** Predicting a door length on paper and checking it is a quiet win.
- **The skill:** Measure key lengths; draw to scale; check one prediction; state the scale.
- **Exit ticket:** Scale statement + one checked length.
- **Error patterns:** Decorative map not to scale; mixing units; claiming surveyor precision.

MOD-05 Limit of Model Talk

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Any model built this week
- **Safety:** None
- **The fun:** Permission to criticize the model — kindly — feels grown-up.
- **The skill:** Talk box: get right / leave out / better model need; record two limits.
- **Exit ticket:** Two limits listed.
- **Error patterns:** “Nothing — it’s perfect”; only aesthetic critiques; refusing all models as “fake.”

MOD-06 Model vs Data Match

- **Band:** 13–14 (stretch 11–12 soft)
- **Time:** 30–45 min
- **Materials:** Model prediction + actual trial data from this week
- **Safety:** Per the trial
- **The fun:** Being allowed to revise the model when data win is a relief for perfectionists.
- **The skill:** Predict from model; run or revisit data; mark match / partial / miss; revise model or mark where data wins — do not change the data to fit.
- **Exit ticket:** “Match level: . *Next model change:* .”
- **Error patterns:** Changing data to fit model; changing memory of prediction after seeing results; inventing a match; chatbot rewrite of the prediction after the fact.

Out-of-home try-its

OUT-05 Night Sky Log Soft

- **Band:** both (multi-evening)
- **Time:** 20–35 min evenings
- **Materials:** Outdoor view; notebook; optional sky calendar *after* naked-eye look
- **Safety:** Adult present outdoors at night; sidewalk rules; never optics toward the sun; no lasers as default
- **The fun:** The sky is the original science hour.
- **The skill:** Sketch moon shape/time for several clear evenings before reading the calendar explanation; then compare log to a simple phase model; name what the model shows and leaves out (e.g., leaves out Earth's atmosphere, exact orbital mechanics).
- **Exit ticket:** 3 dated sketches + one pattern notice + one model limit.
- **Error patterns:** Copying calendar into log as if observed; inventing cloudy-night sketches; app-first; treating the calendar model as tonight's observation.

EARTH-06 Water Cycle Model Soft (outing-adjacent)

- **Band:** both
- **Time:** 30–45 min after a puddle or stream look, or as kitchen follow-up
- **Materials:** Clear jar, warm water, lid/ice with adult — or outdoor puddle evaporation watch; notebook
- **Safety:** Adult for hot water; towel; no sealed pressure experiments
- **The fun:** Condensation on a lid is a small magic that stays science when limited.
- **The skill:** Observe evaporation/condensation evidence; build cup-arrow model; limit: kitchen jar $\neq$ global climate engine. Stay out of climate-as-policy sermon as the weather hour — this card owns looking and modeling, not a culture-war pamphlet.
- **Exit ticket:** Model + limit sentence.
- **Error patterns:** Overclaiming climate from one jar; boiling unsupervised; generated cycle poster as observation.

Blocked for a new move / mixed for when to use it

Blocked: MOD-05 alone on a rough sketch until “leave out” is a normal sentence. Then MOD-03 with a real cup. Hold decorating until the sticky exists.

Mixed: Pair MOD-03 with FAIR-02 dissolving data; MOD-02 with a lamp look; MOD-06 with last week’s insulation table; OUT-05 with a paper phase model mid-week. One OUT plus two home model hours is a strong week.

One incorrect example to diagnose

Illustration (composite, not a reported family): A thirteen-year-old prints a glossy “cell under electron microscope” from an image generator, pastes it in the notebook, labels mitochondria from a website list, and writes “this is what I saw.” No slide. No book micrograph. No limit sticky.

What you hear: Generated image as data + model-summary-as-observation + coverage itch.

Next move: Remove the print from the data role kindly. If you keep it at all, label it *schematic / not our observation* and put it away before the look. Use LIFE-01 grain: look at a prepared slide or a high-quality printed micrograph from a book; sketch what you can actually point to; caption after looking; name a limit (many organelles are not visible in this image). Do not detector-grade the paste. Teach the honesty move.

Sibling and mixed-band notes

Shared phenomenon, parallel jobs: one builds the physical model while the other drafts the limits sticky; then swap talk roles. A younger child may add an arrow with help; they do not own “revise once when data disagree” as a quiz. Kindness is part of the hour.

Dose and safety

Models do not excuse unauthorized mixing, mains electricity, or sun-viewing with optics. Adult present when the card says so. Kitchen chemistry picture still ≠

Chemistry credit.¹¹ Three to five hours plus one OUT is enough. One deep model with a limit beats five craft projects with none.

Exit crumb shapes

- “This model shows . *It leaves out* .”
- “Prediction: . *Notebook*: .”
- “Match level: . *Next change*: .”
- Two limits on a sticky.

More practice notes (dose, prior ideas, and honesty)

Prior ideas will show up inside models. Force-as-fuel may appear as an arrow that “runs out” inside a rolling ball with no interaction named. Plants-eat-through-roots may appear in a food-chain craft that never marks sunlight. Hear the prior idea. Repair with another look + a named idea just-in-time — not a scolding lecture. Chapter 6 will give domain vehicles; this chapter owns the model habit that keeps those vehicles honest.

Honesty cards from the wider bank still apply: no inventing rows so a model “matches”; no generated observation as data; no worksheet dump as the hour; no AP packet as weekly spine. If Friday is busy, do not replace the model hour with a printed diagram to color. A rough student model with a limit sticky beats a perfect handout with none.

When you pair models with fair tests, keep the blank table discipline from Chapters 2–3. The model predicts; the table records; the talk compares. If two honest trials disagree with each other, that is data for the model conversation — not a reason to erase the unpopular row.

Library and museum help when labelled honestly. A museum diorama is often a model. OUT-04 (museum one-exhibit CER) in Chapter 5 will ask for claim and evidence; this week you can preview by asking at one exhibit: “What does this model show — and what does it leave out?” Second-hand and constructed displays stay labelled as such.

¹¹National Research Council. (2006). *America’s Lab Report* — high-school origin; do not treat middle-grades kitchen models as secondary lab credit.

What “model” does not mean this week

Model does not mean “craft grade.” Model does not mean “copy the textbook until it looks right.” Model does not mean “AI picture of the thing.” Model means a representation that explains something about *this* system, with a named gap, ready to meet a notebook when you have one.

If Chapter 3 still needs “can we tell for sure?”, keep fair-test cards in the week. Models do not replace the named change; they explain and predict beside it. A path through middle-grades modeling is the promise. A diploma is not. A percentile is not.

For the student

A **model** is a picture, diagram, or build that helps explain a system. It is useful because it shows some things clearly. It is honest when you also say what it leaves out.

Models are not decorations. They are not “the real thing in miniature” with no gaps. They are tools. Tools have limits.

Tiny worked example

You watch ice melt in a cup (adult handles any hot water if you also look at steam).

You draw a particle picture for solid and for liquid. You link the drawing to something you saw: the ice held a shape; the water flowed.

You write on a sticky: **Limits — particles are not little people; I am not seeing atoms with my eyes; this drawing leaves out attraction details and exact speeds.**

That sticky is part of the science, not an apology.

Try 1

Build or draw MOD-03 or MOD-01. Label parts. Write one limit before any photo. Say the locked question answer aloud: what it shows, what it leaves out.

Try 2

Take any model from this week (MOD-05). List two limits. If you have trial data, try MOD-06 soft: predict, compare, mark match / partial / miss. Do not change your data to protect the drawing. At 13–14, revise the model once.

Explain it back

Why does a good model need a “leaves out” sentence? What goes wrong if the model is treated as the whole truth?

Challenge

Make a scale map of a room or yard (MOD-04). Check one length. Or keep a three-evening moon log (OUT-05) and compare it to a simple phase model — label what the model leaves out.

You are allowed to wait. You are allowed to revise when data disagree. You are allowed to cross out a guesswork arrow. You are not required to file a generated picture as something you saw.

If it isn't clicking

Diagnostic 1 — Art without limits.

What you see: Beautiful model; no show/leave-out talk; sticky missing.

Next move: MOD-05 only for one hour. Two limits required before any new build. Photo after sticky.

Diagnostic 2 — Picture replaces looking.

What you see: Copied textbook art or generated image filed as observation.

Next move: Phenomenon first. Cover the art. Look. Then draw. Label schematics as schematics. Trash generated “results” from the data role.

Diagnostic 3 — Model never meets notebook.

What you see: Models on Monday, fair tests on Thursday, no bridge.

Next move: Same phenomenon all week. Predict from model before the trial. MOD-06 soft compare. Keep prediction line visible so it cannot be silently rewritten.

When to slow down. Fair-test and recording habits still thin → keep Chapter 3 / Chapter 2 cards in the week; let models serve a real trial rather than replace it. Force-as-fuel or other prior ideas showing up in energy arrows → another look + named idea just-in-time, not a scold (Chapter 6 will deepen domain vehicles).

When to go ahead. Student names a limit without treating it as failure; links drawing to evidence; at 13–14 marks match/miss and revises once → add MOD-02 with crossed-out guesswork; add OUT-05 multi-evening; prepare for Chapter 5 CER that can point at model limits as part of reasoning honesty.

When to get a human tutor. Persistent freeze on any representation; safety push (mains, lasers, unauthorized mixes); or need for microscope coaching beyond what you can offer. A tutor who puts a real lookable beside the model beats a packet of unlabeled diagrams.

Correct a wrong reason without crushing the build. “The model is perfect” is a reason to repair. Silence in the face of a generated micrograph filed as data is not kindness.

Tools, including AI

Point back to the Science Hour AI box.

You may, on your account: ask a tool to explain *to you* what a particle model usually leaves out; get a labelled SCRIPT of limit questions for you to ask after the build; get a labelled schematic to look at together, then put away before the student’s try; diagnose a model photo the student already made (crop to the paper; no face).

You may not: generate a gel, micrograph, sky photo, or “what I saw under the glass” and treat it as the student’s result; put a model summary on the table as the observation instead of a real trial; invent data so the model “matches”; write the student’s limit sentence as a paste-in lab report; park an unsupervised chatbot as partner during the build. Parent holds at 11–12; co-hold in the room at 13–14. Unaided first. SCRIPT after the try.

Generated image $\neq$ data. A fluent machine paragraph about molecules is performance, not the student’s looking.

What “done enough” looks like

11–12 done enough

- ☐ Builds or draws one model with labels that explain
- ☐ Names one limit aloud without treating it as failure
- ☐ Answers show / leave out in the talk box
- ☐ Links the model to something observed or measured (soft)
- ☐ Refuses generated image as personal observation

13–14 done enough

- ☐ Two limits listed for a model
- ☐ Predicts from model; compares to notebook; marks match / partial / miss
- ☐ Revises once when data disagree (or clearly marks where data win)
- ☐ Crosses out at least one guesswork feature on purpose
- ☐ Still refuses model-as-decoration week and AP portfolio padding as default

Place by skill. Birthday does not decide whether MOD-06 is required this month. A fourteen-year-old who only praises craft stays on limit talk. An eleven-year-old who already revises from data may try MOD-06 soft with help.

Not done enough (yet): glitter with no sticky; generated micrograph as Figure 1; model summary filed as today’s observation; “the model is the truth”; DNA transcript dump with no lookable.

Revisit next Tuesday: put last week’s fair-test table beside this week’s model and ask match / miss once. When models have limits, Chapter 5 teaches the after-trial voice:¹² claim, evidence from *this* notebook, and short reasoning — CER light.

¹²Access date for planning grain in the research memos behind this manual: **17 September 2026.**

Chapter 5 — Claim–Evidence–Reasoning light



Figure 7: A kitchen-table still-life from a high three-quarter view: an open dated notebook with a filled distance table, a triangular sticky labelled Claim / Evidence / Reasoning, a finger-width gap showing a highlighted evidence row, a short pencil, no laptop screen visible. No people. No logos. No readable package branding.

Why this matters

The trial is done. The notebook has numbers. Someone says, “It worked,” or “I feel like friction slowed it,” or pastes a fluent paragraph that never points at a row.

That moment is not a character flaw. It is what happens when the after-trial voice has no shape. The hour’s job is smaller and kinder: say what you claim, point at evidence from *this* notebook, and give one short because that links them with an idea you actually met this week.

Claim–Evidence–Reasoning light (CER light) is that after-trial voice. A claim answers the investigation question in one sentence. Evidence is appropriate data from this trial — numbers, observations, graph points — not a feeling, not a generated image, not neat rows invented after the mess.¹³ Reasoning is why that evidence supports the claim, usually with a scientific idea the student has actually met. Reasoning is typically the hardest piece. Scaffold it. Do not invent a principle to decorate the triangle.

This shape is the IQWST / McNeill & Krajcik grain labelled for home:¹⁴ useful in curriculum contexts as a researched instructional framework — not a franchise you must buy, not proof that a kitchen sticky raises a national science score, not AP free-response as Tuesday’s spine, and not a second *Critical Thinking* debate club.¹⁵ At 11–12, oral CER or a two-sentence write is enough. At 13–14, a light paragraph with a limitation — and a rival claim soft when the data are messy — is enough. Still refuse full lab-report padding as the weekly default.

What this idea unlocks is every later science argument that can survive a stranger. A claim with no notebook pointer is opinion with science clothing. Evidence that was adult-filled or machine-written is performance. Reasoning copied from a chat-bot summary of a trial the student did not run is theater. One claim, two pieces of evidence from this page, one because — spoken at the table or written short — is

¹³House honesty: generated observation $\neq$ data; invent-data ban; model summary $\neq$ observation — aligned with the book brief access date **17 September 2026**.

¹⁴McNeill, K. L., & Krajcik, J. / IQWST CER framework — claim, evidence, reasoning; opened in *Ready, Set, SCIENCE!* and NSTA explanation materials. Label as curriculum-family instructional framework; home dose is light; do not treat as a mandatory purchase franchise; do not promise kitchen stickies raise NAEP.

¹⁵National Research Council. (2008). *Ready, Set, SCIENCE!*; National Research Council. (2007). *Taking Science to School*; National Research Council. (2012). *A Framework for K–12 Science Education*. Explanation and argument from evidence as practices; middle grain includes CER paragraphs light — not AP as weekly spine.

how looking becomes a checkable sentence.

Two refusals sit beside the idea, or the week becomes noise.

CER worksheet with no apparatus is not the program. Columns for Claim / Evidence / Reasoning already waiting for invented words teach handwriting. Activity mania — ten demos, one vague “it worked” — is entertainment. Coverage as the hour — finish the chapter questions with no trial — is a map mistaken for depth.

Chatbot CER and AP-as-weekly-spine are not the program either. A fluent triangle from a window is not the student’s voice. An AP Biology free-response rubric as every Tuesday teaches a different course. This book’s spine is Science Hour: fair test with notebook, then CER light from *this* trial.

You do not need to be a scientist. You do need to ask what they wrote down that supports that, wait, and point back at the notebook when the claim floats free of the page.

This week you can learn to hear a claim with no pointer and to repair it with a finger on a row. Today the student can say or write claim + evidence pointer + one because.

A third picture helps parents who learned “conclusion” as a rubber stamp. The stamp says the hypothesis was right. CER light asks a narrower question: what do you claim from these rows, and why do those rows count? Sometimes the honest claim is weak. Sometimes two claims fit some of the data. That is not failure. That is looking with a notebook.

For the parent: understand it yourself

Many adults remember lab conclusions as “therefore my hypothesis was correct” or as a five-paragraph essay. That is ordinary. Five minutes here, then the warm-up, is enough for tomorrow. The student still points at their own page.

Everyday picture. Someone claims the bus is late every Monday. A friend asks, “What did you write down?” Three dated arrival times appear. Then: “Those times support the claim because they are all more than five minutes past the schedule on Mondays we checked.” That is CER in ordinary clothes — claim, evidence, because — without a worksheet franchise.

Precise picture. Three pieces (IQWST / McNeill & Krajcik grain):

1. **Claim** — answers the investigation question in one sentence.
2. **Evidence** — appropriate and sufficient data from **this** notebook (or clearly labelled second-hand data). Feeling is not evidence. A generated image is not evidence.
3. **Reasoning** — why that evidence supports the claim; usually one scientific idea actually met this week. Hardest piece — scaffold; do not invent a principle to complete the triangle.

Piece	Kitchen prompt	11–12 exit	13–14 exit
Claim	What answers the question?	One sentence	One sentence that could stand alone
Evidence	What did you write down that supports that?	Point at table/graph	Cite numbers/units; sufficiency talk
Reasoning	Why would that measurement count?	One “because that shows...” clause	Ties data to the idea on the table; limitation or rival claim soft

Light means light. Oral CER at the table counts. Written CER is often 4–8 sentences at 13–14, not a formal lab report. Second-hand data (museum label, weather archive, grocery nutrition panel) must be **labelled as second-hand** and still needs reasoning. Rival claim: “Another claim that fits some of the data is ____.” Soft stretch for 13–14.

Wrong answers you should be able to hear

1. *Claim with no notebook pointer.* “Rough surfaces slow the car.” No row cited. Hear floating claim. Ask: “What do you claim — and which numbers or observations in your notebook support it?” Wait. Require a finger on a row.
2. *Feeling-as-evidence.* “I feel like the wrap worked.” Hear opinion dressed as data. Highlight evidence (numbers/observations) in one color and feelings in another (CER-02). Rewrite so evidence stands alone as bullets.
3. *Chatbot-written CER.* Exit ticket is a fluent triangle the student did not earn from today’s page. Hear generated observation / write-my-lab-report.

Closed-window notebook from the student. Tool only after attempt, parent-hosted, for *your* SCRIPT or revision questions — not a rewrite of their paragraph.

4. *CER worksheet with no apparatus.* Triangle graphic organizers filled from memory of a video. Hear coverage. Materials first; worksheet only as blank record after the try.
5. *AP FRQ as weekly spine.* Tuesday is always a released AP Chemistry free-response. Hear the wrong object for 11–14 Science Hour. Return to one fair test + CER light. High-school paths exist later; they are not this book’s weekly map.

A sixth you will also hear: “Just tell me the because.” The student wants the principle pasted in. Offer two idea choices actually taught this week — student picks and justifies — or send them back to the lookable for one more notice. Do not invent a principle the hour never touched.

Five-to-eight-minute parent warm-up

Do this alone with yesterday’s or tomorrow’s notebook page — a real table from a ramp, insulation, or dissolving trial — before the lesson.

Minute 1. Write a *bad* CER on scrap: claim with no pointer; “I feel like...” as evidence; a because that names an idea you never taught.

Minute 2. Practice the repair questions you will ask: “Point at the row.” “What did you measure?” “Why does that number count?”

Minute 3. Write a *good-enough* light CER from the same table: one claim, two evidence bits with units, one because tied to an idea on the table (e.g., rougher surfaces often increase friction). Keep it short.

Minute 4. Practice the locked opening aloud. Count a slow three. Look at the notebook, not at an imaginary adolescent.¹⁶

Minute 5–8. Decide CER-01 + CER-06 (oral) as the first try; add CER-07 paragraph at 13–14 later in the week. Cut CER to claim + notebook pointer + one because if the student is new to the triangle. If Chapter 3 fair-test habits are still

¹⁶Rowe (1972/1974) wait-time; Stahl (1994) think-time — classroom-origin pause for evidence talk.

thin, keep one redesign hour in the week — CER cannot rescue a confounded proof.

How to teach it this week

Science Hour stays the five beats. This week beat 4 (talk + CER light) expands, but it still needs beats 1–3: something on the table, a plan, a student’s record. Total often ~25–45 minutes. Stop while a look remains.

Warm-up (4–8 min). Open *this week’s* notebook page. Cover any answer key. Ask what the question was. Wait.

Frame CER light (4–8 min). Name the three pieces in ordinary language. Show your bad scrap (optional) and ask what is missing — without shaming. At 11–12, co-build an oral triangle. At 13–14, student drafts claim and evidence before you discuss reasoning.

Try / point / write (10–18 min). Student points at rows while saying the claim (CER-01). Lists two evidence bullets (CER-02). Writes or says one reasoning sentence with an idea card from this week (CER-03). You do not grab the pencil to finish their because.

Talk box (inside the CER beat). Locked opening. Wait. Uptake: “You said ; *our table shows* .” Optional sibling: “Where is your evidence?”

Exit ticket (2–5 min). Sticky Claim / one evidence / one reasoning word (AS-01 grain); or oral triad once without rescue (CER-06).

Exact wording you can say

- “What do you claim — and which numbers or observations in your notebook support it?”
- “What is the claim in one sentence?”
- “Point at the evidence.”
- “Why does that number count?”
- “What can’t this trial tell?”
- “What rival claim fits some of the data?” (13–14)
- “You may change your mind when you find a better row.”

Age-band moves: 11–12 / 13–14

11–12. Oral CER or two-sentence write; claim + notebook pointer + one because; evidence as pointing and short bullets; adult offers two principle choices if reasoning stalls; still refuse full lab reports.

13–14. Light paragraph (about 5–8 sentences): question, claim, two evidence bits, reasoning, one limit (confound or uncertainty); rival claim soft (CER-05); sufficiency talk (CER-04); stranger can find claim and one number in 30 seconds; still refuse AP rubric obsession as the weekly default. If they cannot yet point at a row, stay on 11–12 oral longer. Skill, not birthday.

Parent learns this week. Ask “what did you write down that supports that?” and wait.

Student tries today. Say or write claim + evidence pointer + one because.

First try-it. CER-01 Claim Points at Table + CER-06 CER Triangle Oral. Mid-week CER-02 and CER-03. Friday CER-07 soft at 13–14 or oral triad again at 11–12. Optional OUT-04 museum one-exhibit CER or OUT-07 library journal peek with second-hand labelled.

When to stop talking. When you are finishing their because while their finger is not on the page. One question. Stop. Look at the notebook.

Fade help across the week. Day 1: oral triangle with co-pointing. Day 2: they underline claim words that could be checked against a row. Day 3: evidence bullets only — no feelings. Day 4: one because from an idea actually taught. Day 5: paragraph or rival claim soft at 13–14; sticky exit at either band.

This-week sketch (illustration, not a script law)

Day	Focus	Card
Mon	Claim points at table + oral triad	CER-01 + CER-06
Wed	Evidence not feeling + reasoning one sentence	CER-02 + CER-03
Fri	Insufficient evidence or paragraph / rival soft	CER-04; CER-07 or CER-05 at 13–14
Optional OUT	Museum one-exhibit or library graph peek	OUT-04; OUT-07

Pair with Chapters 2–4: stranger-can-read tables, fair-test “can we tell,” and model limits all feed CER honesty. A limit can appear in reasoning: “This supports the claim only for these two surfaces because we did not change height.”

Practice that actually builds learning

Talk box

Opening (locked): “What do you claim — and which numbers or observations in your notebook support it?”

Follow-ups:

1. What is the claim in one sentence — what do you *say* happened?
2. Point at the evidence — what does the notebook / table show?
3. Why does that number count — how do you know from *this* trial?
4. What can’t this trial tell — what else was different / is the evidence enough?
5. You may change your mind. Try another look / name a rival claim soft (13–14).

How to wait. Slow three after the opening. After they stop, wait again. If they are mid-pointing or mid-because, do not cut them off. Look at the table, not at the adolescent, if silence is hard.

Stuck silence usually means: the question was vague; wait was zero; they are hunting a vocabulary word; the notebook is not visible; they think you want the textbook line; they offered a feeling; they fear being wrong so they say nothing; a chatbot already “helped” and now they cannot find their own words. Pose, wait, and point at the page — not fill the silence with the right CER paragraph.

In-home try-its (CER bank)

CER-01 Claim Points at Table

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Completed fair-test table from this week
- **Safety:** None
- **The fun:** Pointing while claiming feels like proof you can touch.

- **The skill:** Write one claim answering the question; underline words checkable against a row; point physically at the row while saying the claim.
- **Exit ticket:** Claim sentence + row number cited.
- **Error patterns:** Vague claim (“it worked”); claim about a variable never measured; pointing at blank space.

CER-02 Evidence Not Feeling

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Notebook; two highlighters
- **Safety:** None
- **The fun:** Color-coding makes “feeling” visible without a lecture.
- **The skill:** Highlight evidence vs opinions/feelings; rewrite evidence as 2+ bullets with units.
- **Exit ticket:** Two evidence bullets with units.
- **Error patterns:** “I feel like friction...” as evidence; one lonely number; copying textbook as if measured today.

CER-03 Reasoning One Sentence Soft

- **Band:** both
- **Time:** 20–35 min
- **Materials:** Claim + evidence already drafted; idea card from this week’s content (e.g., “rougher surfaces often increase friction”; “insulation slows heat leaving the cup”)
- **Safety:** None
- **The fun:** One because is finishable — not an essay monster.
- **The skill:** “This evidence supports the claim because ____.” Use only an idea actually taught or observed. If stuck, adult offers two principle choices — student picks and justifies.
- **Exit ticket:** One reasoning sentence linked to today’s idea.
- **Error patterns:** Skipping reasoning; inventing a principle never met; chat-bot paragraph pasted.

CER-04 Insufficient Evidence Catch

- **Band:** both
- **Time:** 20–30 min
- **Materials:** Thin dataset (1 trial) vs thicker (3 trials) on same question
- **Safety:** None

- **The fun:** Permission to say “weak claim” without shame.
- **The skill:** Compare datasets; mark claim weak/medium; say what more evidence would help — without inventing extra trials.
- **Exit ticket:** “My claim is ____ strength because ____.”
- **Error patterns:** Overclaiming from one trial; refusing all claims forever; inventing extra trials.

CER-05 Rival Claim Soft

- **Band:** 13–14
- **Time:** 25–35 min
- **Materials:** Messy real dataset with more than one plausible reading
- **Safety:** None
- **The fun:** Arguing with yourself using data feels advanced without being mean.
- **The skill:** Primary claim + rival that fits *some* evidence; say what new trial would decide.
- **Exit ticket:** “Rival: . *Deciding trial:* .”
- **Error patterns:** Rival with zero evidence; both claims identical; debating personality not data.

CER-06 CER Triangle Oral

- **Band:** both
- **Time:** 15–25 min
- **Materials:** Notebook open; timer optional for wait
- **Safety:** None
- **The fun:** Speaking the triad without a script is a small performance that stays honest.
- **The skill:** Speak Claim / Evidence / Reasoning without reading a paragraph; parent waits after “what supports that?”; sibling may ask one evidence question kindly.
- **Exit ticket:** Oral triad completed once without rescue.
- **Error patterns:** Rushing; parent finishing sentences; evidence without numbers.

CER-07 Notebook CER Paragraph Soft

- **Band:** 13–14 (stretch 11–12)
- **Time:** 25–40 min
- **Materials:** Full trial record

- **Safety:** None
- **The fun:** A short paragraph that a stranger can parse in 30 seconds feels like real science writing.
- **The skill:** 5–8 sentences: question, claim, 2 evidence bits, reasoning, one limit. Not AP format — still light.
- **Exit ticket:** Paragraph present; stranger can find claim and one number in 30 seconds.
- **Error patterns:** Lab-report padding; missing evidence; invented neatness; AP rubric obsession; chatbot paste.

Out-of-home try-its

OUT-04 Museum One Exhibit CER

- **Band:** both
- **Time:** 30–45 min
- **Materials:** Notebook; one exhibit
- **Safety:** Adult present; museum rules; no touching restricted objects
- **The fun:** One exhibit deep beats a scavenger stampede.
- **The skill:** Observe; note what is model vs specimen; write CER light about one exhibit claim with evidence from labels/looks; label second-hand.
- **Exit ticket:** CER oral at exhibit then written crumb.
- **Error patterns:** Racing whole museum; copying plaques without looking; treating diorama as live observation without noting model.

OUT-07 Library Journal Peek Soft

- **Band:** both
- **Time:** 25–40 min
- **Materials:** Library science magazine/journal or reliable kids science article; notebook
- **Safety:** None
- **The fun:** Finding a real graph in the wild.
- **The skill:** Find one graph or table; explain what it measures; ask one question it does not answer; second-hand labelled; claim that points at named numbers — not a research-paper assignment.
- **Exit ticket:** “Graph shows . *It does not tell* .” Optional: one CER crumb from the graph’s numbers.
- **Error patterns:** Citing chatbot summary of unread article; worksheet

dump; AP paper expectations.

Blocked for a new move / mixed for when to use it

Blocked: CER-01 alone until pointing while claiming is automatic. Then CER-02 until feelings are not filed as evidence. Hold paragraph writing until oral triad exists.

Mixed: Pair CER-03 with last week’s fair-test idea card; CER-04 with a one-trial vs three-trial contrast from Chapter 3; CER-07 with a model limit from Chapter 4 in the limitation sentence; OUT-04 on a weekend with oral triad at the exhibit. One OUT plus three home CER hours is a strong week.

One incorrect example to diagnose

Illustration (composite, not a reported family): A fourteen-year-old submits a polished CER paragraph. It cites temperatures to one decimal place. The insulation trial notebook page is blank except for a date. A chat log on the family tablet shows “write a CER about towel vs foil cups.”

What you hear: Chatbot CER + invent-data risk + write-my-lab-report.

Next move: Do not detector-grade the paragraph as a character trial. Kindly set it aside as not today’s student voice. Re-run or restore the trial record: blank table, student’s thermometer readings, messy numbers allowed. Oral triad (CER-06) with finger on rows before any rewrite. Tool may later give *you* revision questions after *they* draft — not a paste-in report. Honesty card: no inventing rows; no generated observation as data.

Sibling and mixed-band notes

Sibling challenge soft: “Where is your evidence?” Original speaker points, does not argue personality. Adult referees kindness. Mixed bands: 11–12 oral triad while 13–14 writes a paragraph from the same table; share the talk box opening once.

Dose, safety, and what CER does not mean

CER does not require heat or chemicals — but if the evidence came from a trial that did, the Science Hour safety spine still holds. CER does not mean debate victory. CER does not mean “hypothesis was correct.” CER means claim + evidence from this notebook + short reasoning.

Three to five Science Hours plus one OUT is enough. One deep triangle from a real page beats five worksheets with no apparatus.

If fair-test or recording habits are still thin, keep Chapters 2–3 in the week. CER light sits on top of a stranger-readable notebook and a named change — it does not replace them.

Exit crumb shapes

- Sticky: Claim / one evidence / one reasoning word
- “I claim ____ because the notebook shows ____.”
- “My claim is ____ strength because ____.”
- “Rival: . **Deciding trial:** .”
- Stranger finds claim + one number in 30 seconds

More practice notes (second-hand data, talk craft, and honesty)

Second-hand data are allowed when labelled. A museum plaque, a library graph, a grocery nutrition panel, or a weather archive can supply evidence — if the student says they did not measure it themselves and still offers reasoning. Second-hand does not mean “copy the caption as if you ran the trial.” OUT-04 and OUT-07 practice that honesty in public places.

Talk craft still uses wait. After “what supports that?”, count a slow three. After they answer, wait again before stacking a new question. Rapid-fire quiz kills CER. Overwriting their sentence mid-because with the textbook line kills CER. Public shaming kills CER. Kind sibling challenge — finger on a number — builds it.

Honesty cards travel with this chapter: no inventing rows to make the claim look good; no generated observation as data; no worksheet dump as the hour; no AP packet as weekly spine. If the trial was messy, keep the messy numbers and weaken the claim (CER-04) rather than cleaning the page in secret.

CER light is not *Critical Thinking for Young Minds* transplanted onto science. One pointer to that sister book if your family uses it, then teach claiming from *this* trial’s notebook. Debate victory is the wrong object. Finger on the row is the right one.

When Chapter 7 deepens talking and writing science arguments, it will climb the same ladder: because-the-notebook; claim sentence; short paragraph with limitation. This chapter installs the triangle so that ladder has somewhere to stand.

For the student

After a fair test, science needs a voice. That voice is **claim**, **evidence**, and **reasoning** — CER light.

- **Claim:** one sentence that answers the question.
- **Evidence:** numbers or observations from *your* notebook — not a feeling, not something a screen invented.
- **Reasoning:** why that evidence supports the claim, using an idea you actually learned or saw this week.

Tiny worked example

Question: Does wrap type change how fast hot water cools?

Claim: The towel wrap kept the water warmer after 10 minutes than the bare cup.

Evidence: At $t=10$ min, towel cup read 62°C ; bare cup read 51°C (rows 4–5).

Reasoning: This evidence supports the claim because insulation slows heat leaving the cup — an idea we named after watching both cups.

Limit (13–14 soft): We only compared towel and bare; we cannot claim foil results from this page.

Try 1

Open this week’s table. Do CER-01: write a claim and point at a row while you say it. Then CER-06: speak Claim / Evidence / Reasoning without reading a long paragraph. Your parent waits after asking what supports that.

Try 2

Do CER-02: highlight evidence vs feelings. Write two evidence bullets with units. Then CER-03: one because using an idea from this week. At 13–14, try CER-07 — a short paragraph a stranger can scan in 30 seconds — or CER-05 rival claim soft if your data are messy.

Explain it back

What is the difference between a feeling and evidence? Why does a claim need a finger on the notebook?

Challenge

At a museum, pick one exhibit (OUT-04). Say a CER oral on site, then write a crumb. Or at the library (OUT-07), find one graph, label it second-hand, and write what it shows and what it does not tell.

You are allowed to wait. You are allowed to change your mind when you find a better row. You are allowed to say your claim is weak if you only ran one trial. You are not required to invent neat numbers or paste a machine’s paragraph as yours.

If it isn’t clicking

Diagnostic 1 — Floating claims.

What you see: Strong opinions; no row cited; “it worked.”

Next move: CER-01 only. Underline checkable words. Physical point required before any because. Cover the textbook conclusion.

Diagnostic 2 — Feeling or chatbot as evidence.

What you see: “I feel like...” or a fluent paragraph that does not match the blank page.

Next move: CER-02 color-code. Set aside machine text kindly. Re-point at student measurements. Oral triad before any rewrite. Parent-hosted tool only after a real draft, for your questions — not their paste.

Diagnostic 3 — Reasoning freeze or invented principle.

What you see: Claim + numbers, then silence — or a because that names an idea never taught.

Next move: CER-03 with two principle choices on cards from *this* week only. Or send them back for one more look at the apparatus. Do not invent a principle to complete the triangle. At 13–14, allow a limitation sentence instead of a fancy because if the idea is not ready.

When to slow down. Blank tables and fair-test “can we tell?” still shaky → return to Chapters 2–3 for a few hours; CER on a confounded proof teaches the wrong habit. Model limits confused with “I failed” → revisit Chapter 4 sticky language; limits can live inside CER honesty.

When to go ahead. Points while claiming; two evidence bullets with units; one because tied to a real idea; at 13–14 a stranger-readable paragraph or rival claim soft → mix CER into Chapter 6 domain try-its; prepare Chapter 7 talking/writing ladder; keep Friday sticky exits.

When to get a human tutor. Persistent freeze after oral practice; writing disability that needs a different scaffold (scribe for oral triad is allowed — invent-data is not); or safety/honesty pushes you cannot hold alone. A tutor who asks for a finger on the page beats a packet of blank CER worksheets.

Correct a wrong reason without crushing the claim attempt. Hearing feeling-as-evidence, asking for a row, and naming a better move is teaching. Silence in the face of a chatbot paragraph filed as theirs is not kindness.

Tools, including AI

Point back to the Science Hour AI box.

You may, on your account: ask a tool to explain CER *to you* from today’s apparatus and table; get a labelled SCRIPT of follow-ups for you to ask after their draft; get revision questions after they have written a claim — not a rewrite of their paragraph; diagnose work they already produced (crop to paper; no face); discussion questions you will vet and ask yourself.

You may not: write the student’s CER paragraph or lab report; invent observations or data tables; paste a blank CER sheet and ask the tool to complete it; park an unsupervised chatbot as partner during the attempt; generate a result image as evidence; grade by detector score. Parent holds account at 11–12; co-hold in the room at 13–14. Unaided first on looking, measuring, recording, and first claim

draft.¹⁷ SCRIPT after the try.

A fluent filled triangle from a machine is performance, not the student’s science voice. Keep accounts and keys where you can open them. A science tool is not a secret friend.

What “done enough” looks like

11–12 done enough

- ☐ Says or writes a claim that answers *this* question
- ☐ Points at a notebook row or graph while claiming
- ☐ Gives two evidence bits (oral or bullets) that are not feelings
- ☐ Offers one because tied to an idea met this week (with choice cards ok)
- ☐ Completes oral triad once without rescue

13–14 done enough

- ☐ Light CER paragraph with claim, two evidence bits, reasoning, one limit
- ☐ Cites numbers/units; sufficiency talk (weak/medium) when asked
- ☐ Rival claim soft on messy data, or clear “what can’t this trial tell?”
- ☐ Stranger finds claim + one number in ~30 seconds
- ☐ Still refuses chatbot paste, invent-data, and AP FRQ as weekly default

Place by skill. A fourteen-year-old who cannot point at a row stays on oral triad. An eleven-year-old who already writes a tight paragraph may try CER-07 soft with help. Birthday is not the gate.

Not done enough (yet): claim with no pointer; feeling-as-evidence; CER worksheet with no apparatus; chatbot triangle; AP packet as every Tuesday; “hypothesis correct” with empty table.

Revisit next Tuesday: mix last week’s fair-test table with a fresh oral triad. Life of the habit is the session rhythm and the dated page — not a ninth teaching chapter.¹⁸ When CER light holds, Chapter 6 uses life, physical, and earth phenomena as

¹⁷Bastani et al. (2025) — high-school math chatbot study; one crutch sentence only; **OFF-AGE for Science Hour**; supports unaided first / tool after attempt for the adult — not an 11–14 science RCT.

¹⁸Access date for planning grain in the research memos behind this manual: **17 September 2026**.

vehicles for fair test, recording, model, and claim — one phenomenon depth, not a kingdom dump.

Chapter 6 — Life, physical, and earth looking at middle grades



Figure 8: Density cylinders beside a dated moon-phase log and a cell image with a caption written after looking — still-life, no people, no logos.

Why this matters

Domain content at ages 11–14 is a vehicle, not a survey dump.

A cell image after a look, a density measure with units, a moon-phase log across several evenings, a soil-permeability try with one soil changed — those are middle-grades science looking. They are not “finish Life Science Unit 4 by Friday.” They are not every kingdom. They are not high-school Biology, Chemistry, or Physics as the weekly spine. They are not a culture-war weather sermon.

This is worth the struggle because coverage mania loves this chapter. The itch says: cells, ecosystems, traits, force, density, circuits, waves, rocks, weather, moon, plates, water cycle — all this month. The notebook stays thin. The adolescent learns that science means racing titles. Depth is the hour. One phenomenon this week. Fair test or model on it. Claim that points at the notebook. Stop.

Prior ideas are the mind at rest. Hear plants-eat-through-roots, cells-as-tiny-mouths, force-as-fuel. Repair with another look and a named idea just-in-time. Do not scold. Do not replace looking with a lecture about how wrong they were.

A useful texture from classroom standards maps: middle grades are asked to identify what changed and what was measured, run more than one trial, use tables and graphs, write claim–evidence–reasoning paragraphs, and use models. Those are moves. They are not a national law for your kitchen, and they are not a list of every performance expectation to finish by June. Borrow the moves. Leave the PE dump.

Sister chapters already built the spine: fair test with a notebook a stranger can read, table → graph → sentence, named change, models with limits, Claim–Evidence–Reasoning light. This chapter puts those moves on living systems, physical try-its, and earth and sky. *Science for Little Thinkers* taught notice-before-name and draw-what-you-saw on living needs, weather windows, light paths, and push-pull. One pointer. Then teach 11–14 looking with named variables, stranger-readable tables, and a claim that cites numbers. *Science for Homeschooling* holds high-school Biology–Chemistry–Physics and transcript architecture. One pointer. Then teach this week’s phenomenon.

You do not need to be a biologist, a physicist, or an earth scientist. You do need one phenomenon on the table, a blank notebook page, and one question you have not already filled with the explanation.

The locked question for this chapter is the whole craft:

“What is happening in this phenomenon — and what evidence from looking or measuring makes you say that?”

If they can answer that with a finger on the page, the week did its job.

For the parent: understand it yourself

Here is the everyday picture.

A binder says “Life Science — week 6.” Twenty vocabulary words. A diagram of a cell with every organelle labelled before anyone has looked at a slide or a printed micrograph. Friday’s quiz is matching. The plant on the sill was never measured. The notebook has neat titles and no numbers from *this* try.

Here is the precise picture.

You pick **one** card for the week — LIFE, PHYS, or EARTH. Materials land before the lecture. The adolescent looks or measures. They fill a blank table from what happened. They say or write a claim that points at those numbers. At 11–12 you co-name the “same” list and keep CER oral or two sentences. At 13–14 they name IV/DV in ordinary language, label graph axes before plotting when a graph fits, and write a short CER paragraph with one limitation. Framework middle families (life, physical, earth) are texture for choosing a phenomenon — not a performance-expectation dump as Tuesday’s hour.

PFI middle rows once: among homeschooled students in grades 6–8 in that survey year, earth sciences or geology showed up often, scientific inquiry or experiments showed up often, biology less often, chemistry or physics least often in that table. That is a neighbor census, not a mandate for your kitchen. You may still run density. You may still run a plant light log. You are not failing if this month is insulation and moon, not every kingdom.

Wrong answers you should be able to hear

1. Kingdom coverage mania.

“We have to finish cells, ecosystems, and evolution this month.” No notebook from one try.

What it usually means: the map replaced the hour.

What you say: “One phenomenon this week. Fair test or model. Claim from the notebook. The map waits.”

2. Force-as-fuel unrepaired.

“The push ran out” or “force is what makes it go” as the final answer after a motion try — no second look.

What it usually means: a common prior idea is doing the talking.

What you say: “Interesting. Same car, same path — what do you measure when we change only ____? What stays the same?”

3. Cells-as-tiny-mouths lecture.

A scolding talk about how cells “really” work before anyone has captioned what they can point to in an image.

What it usually means: vocabulary won before looking.

What you say: “Look first. Sketch what you can point to. Caption after. Then we match a short key.”

4. Home vertebrate dissection as the default hour.

A supermarket meat “lab” or an impulse kit becomes the week because it feels like “real science.”

What it usually means: high-school theater arrived early.

What you say: “Home vertebrate dissection is not our default. Flower parts, an ethical kit you chose, or a museum specimen. We record what we looked at.”

5. Climate-as-policy sermon as the weather hour.

The sitting becomes a culture-war talk with no map, no log, and no model limit.

What it usually means: controversy replaced looking.

What you say: “Today we read this weather map, predict, and compare tomorrow — or we watch a jar and name what the model leaves out. Safe science objects. Stop.”

Five-to-eight-minute parent warm-up

Pick **one** LIFE or PHYS or EARTH card for the week — not three. Gather materials. Walk the safety spine in kitchen words: what could spill, burn, shatter, or be tasted; what stays in adult hands; what we skip. Adult present for heat, electricity, outdoor water, chemicals, glassware, and any kitchen-chemistry picture. No unmarked bottles. No bleach mixes. No drain cleaners. No alcohol flames. No sealed pressurized fizz bottles. No lasers in the default banks. Living things: no

harm, return, wash hands. Mold cultivation refused by default. Vinegar-and-soda is a change picture, not a Chemistry credit.

Practice naming IV/DV for *tomorrow's* try in ordinary language: what we change on purpose, what we measure, what we keep the same, can we tell for sure?

Practice the locked opening to the empty chair:

“What is happening in this phenomenon — and what evidence from looking or measuring makes you say that?”

Count a slow three. Do not answer yourself. Put the every-kingdom binder away for this hour.

How to teach it this week

The Science Hour shape stays (~25–45 minutes). Domain content rides inside the five beats. It does not get a second colder hour titled Coverage.

Session shape

1. **Observe / frame the question (4–8 min).** Phenomenon visible. Locked opening soft. Predict if a try is coming.
2. **Plan fair test or model (4–8 min).** Change / Measure / Same — or “what the model shows and leaves out.”
3. **Try / measure / record (10–18 min).** One domain card. Blank table first. Axes before points when you graph.
4. **Talk + CER light (6–12 min).** Locked opening. Finger on the notebook. Oral triangle at 11–12; short paragraph with limitation at 13–14 when ready.
5. **Exit ticket (2–5 min).** One sticky: claim + one evidence bit + one because — or the card's own exit line.

Twenty-five-minute day: density of one object, table with units, locked question, sticky claim. That is a full hour.

Exact wording you can say

Opening, locked:

“What is happening in this phenomenon — and what evidence from looking or measuring makes you say that?”

Then wait. A slow three is a convention from elementary science classrooms, not a kitchen experiment you are failing if Wednesday is noisy. Look at the materials or the table, not at the adolescent, if the silence is hard.

Follow-ups you can rotate:

- “What did you measure or observe?”
- “What does the notebook / table show?”
- “How do you know from *this* try — not from the chapter title alone?”
- “What stays the same in this system? What can’t today’s look tell?”
- “You may change your mind. Try another look — or redesign once.”

If they freeze: “Point first. Which number or sketch supports you?”

If they name-first: “We can match the key after. What can you *point to*?”

If they invent neat rows: “Keep the messy numbers. We redesign if we must. Invented rows are not your data.”

Age-band moves

Ages 11–12. Adult co-names the “same” list. Two or three trial rows. CER oral or two-sentence write. Models with one named limit (water-cycle jar is not the global climate engine; rock sort is not watching a cycle happen today). Soft LIFE/PHYS/EARTH cards. Microscope only with adult coach if you have one — otherwise LIFE-01 printed micrograph after look. Still refuse full lab reports. Still refuse home vertebrate dissection as default.

Ages 13–14. Student names IV/DV/controls in ordinary language. Redesigns a confounded try once. CER light paragraph that cites numbers and names one limitation. Graph axes labelled before plotting when a graph fits. Model limits plus “what would change the prediction.” Plate-boundary map soft and microscope soft fit here when materials exist. Still refuse AP lab report as the weekly default. Still refuse America’s Lab Report language as middle credit for a kitchen density try. Place by skill, not birthday — a ready eleven-year-old may write the paragraph; a rusty fourteen-year-old may need co-built “same” lists for a week.

First try-it for the student

Physical home base: PHYS-03 Density Measure Soft. Kitchen scale, graduated cup, two or three objects that fit, water, notebook. Mass and volume. Density

= mass/volume with units. Predict sink/float *after* the calculation when you can, then check. Exit: one density with units + sink/float result.

Or life home base: LIFE-01 Cell Image Caption After Look. Prepared slide or high-quality printed micrograph. Look first. Sketch. Label only what you can point to. Caption after looking. Then a short key.

Or earth home base: EARTH-04 Moon Phase Log. Several clear evenings. Sketch shape and time *before* reading the calendar explanation. Then compare.

Pick one for the week. Not all three.

How to fade help

Week one on a new domain card: you co-build the blank table headers and the “same” list. You ask the locked opening and wait. You may point at a column once.

Week two on a related try: they draft the headers. You check fairness before materials start. You uptake: “You said ; *our table shows* .”

When they can name IV/DV without looking at your face for the answer, stop narrating the explanation into the silence. Struggle before rescue: ask, wait, hint that is a question, model one move, stop talking. Do not grab the answer. Do not paste a machine’s observation as theirs.

When to stop talking

After the locked opening. After they start measuring. After they begin a claim sentence. Your job is one authentic question and a wait — not a lecture that fills every gap with the chapter’s vocabulary list.

This week, honestly

Focus move: one phenomenon depth; fair test or model + CER on it.

- **Monday:** Gather materials. Safety walk. Plan Change / Measure / Same (or model limits). Blank table headers.
- **Tuesday:** Run the try / measure / record. Talk box with locked opening.
- **Wednesday:** Table → graph → sentence if numbers fit — or model + limit sticky.

- **Thursday:** CER light from *this* notebook. Optional redesign once.
- **Friday:** Sticky exit. One diagnostic wrong (coverage itch, force-as-fuel, invent neat rows, generated micrograph-as-data).
- **Weekend optional OUT:** stream/pond soft, night sky log, garden biodiversity soft, or museum one-exhibit CER in a life or earth hall — one focused look, not a scavenger dump.

Hypothetical week (insulation / thermal): Monday plan insulation fair test; Tuesday try/measure/record; Wednesday graph axes + CER oral; Thursday model limit on “heat leaving”; Friday sticky exit. Label **hypothetical**. Not a 180-day promise.

Practice that actually builds learning

Banks are a menu. A chapter picks one LIFE or PHYS or EARTH card, not all twenty. Coverage itch is the enemy of looking.

In-home try-its (named)

LIFE-01 — Cell Image Caption After Look

Time: 25–35 min. *Materials:* Prepared slide or high-quality cell micrograph (book/library/print); magnifier optional; notebook. *Steps:* Look first; sketch; label parts you can point to; only then match a short key; caption after looking. *Safety:* Adult present for microscopes; glass care; wash hands. *The fun:* Seeing something tiny become sketchable. *The skill:* Evidence-first caption — not an organelle dump. *Exit:* Sketch + three labels from evidence.

LIFE-02 — Photosynthesis Inputs Soft

Time: 25–40 min (plus optional multi-day log). *Materials:* Plant; light/dark plan; notebook. *Steps:* List inputs/outputs as a model; soft growth/light log — not sealed gas chemistry; CER light from the log if you run days. *Safety:* Adult present; lamp fire safety; no sealed pressurized setups. *The fun:* Owning a plant experiment that fits a sill. *The skill:* Inputs you can control; prior-idea repair on “plants eat only through roots.” *Exit:* “Inputs we can control at home: ____.”

LIFE-03 — Ecosystem Energy Soft

Time: 25–40 min. *Materials:* Local outdoor spot or a real terrarium you keep; notebook. *Steps:* Observe living things present; build a simple chain or web from what was *seen*; mark guess links vs observed links. *Safety:* Adult outdoors; no

harming organisms; leave stinging insects alone. *The fun:* Your patch, not a rain-forest worksheet. *The skill:* Observed vs guessed. *Exit:* One observed link + one guessed link labelled.

LIFE-04 — Trait Variation Soft

Time: 25–35 min. *Materials:* 10+ leaves of same species or bean seeds; ruler; notebook. *Steps:* Measure one trait; record variation; ask what might cause differences as questions, not lectures; graph optional. *Safety:* Non-toxic sources; wash hands. *The fun:* Numbers that are not identical on purpose. *The skill:* Variation as data. *Exit:* Range + “variation I saw: ____.”

LIFE-05 — Heart Rate Fair Soft

Time: 25–40 min. *Materials:* Timer; notebook; mild movement plan. *Steps:* Resting pulse; after mild exercise; same count method; fair-ish controls; CER light. *Safety:* Adult present; mild only; stop if dizzy; no medical diagnosis talk. *The fun:* Body as measurable (carefully). *The skill:* Same method across conditions. *Exit:* Table of two conditions + claim.

LIFE-06 — Microscope Soft (13–14 if available; else skip)

Time: 30–45 min. *Materials:* Microscope; prepared slides or onion skin with adult; notebook. *Steps:* Focus with adult coach; draw field of view; note magnification; no phone filters as data. *Safety:* Adult present; glass; electrical; wash hands; no blood sampling. *The fun:* Real focus skill. *The skill:* Drawing what you saw. *Exit:* Drawing + magnification noted.

LIFE-07 — Dissection Refuse / Soft Alternative

Time: 20–35 min. *Materials:* Honesty card; flower parts, ethical kit, or museum specimen look. *Steps:* Read refuse — home vertebrate dissection is not the default Science Hour; choose soft alternative; record with CER light if used. *Safety:* Adult present; sharps control; hygiene; ethical sourcing. *The fun:* Choosing a look that matches your house rules. *The skill:* Honesty about what “lab” means at 11–14. *Exit:* “We chose ____ because ____.”

PHYS-01 — Speed Distance Time Soft

Time: 30–45 min. *Materials:* Meter stick/tape; timer; toy car or walker; notebook. *Steps:* Measure distance; time travel; compute speed with units; repeat; discuss constant vs changing speed honestly. *Safety:* Clear path; adult outdoors near traffic. *The fun:* Timing something real. *The skill:* Units and repeats. *Exit:* “Speed $\approx$ ____ from distance ____ and time ____.”

PHYS-02 — Force Pair Soft

Time: 25–35 min. *Materials:* Spring scale or rubber band qualitative; objects to pull; notebook. *Steps:* Feel/measure pulls; sketch one force pair; avoid force-as-fuel language. *Safety:* Eye protection if bands; adult present. *The fun:* Feeling an interaction. *The skill:* Forces as pairs — prior-idea repair. *Exit:* Sketch + “I noticed ____.”

PHYS-03 — Density Measure Soft

Time: 30–45 min. *Materials:* Kitchen scale; graduated cup; objects; water; notebook. *Steps:* Mass and volume for 2–3 objects; density with units; predict sink/float then check after calculation when you can. *Safety:* Adult present; spill plan; no phones in water; no electrical objects in water. *The fun:* Sink/float with numbers behind it. *The skill:* Mass/volume with units. *Exit:* One density + sink/float result.

PHYS-04 — Circuit Series Soft

Time: 30–45 min. *Materials:* Kit only — battery holder, wires, bulb or LED with correct resistor per kit. *Steps:* Build a simple loop; predict then test what breaks the loop; sketch. *Safety:* Adult present; kit voltages only; **no wall power**; feel for heat and stop. *The fun:* Light that you earned. *The skill:* Open vs closed loop. *Exit:* Sketch + “open circuit means ____.”

PHYS-05 — Wave String Soft

Time: 25–40 min. *Materials:* Rope/string; partner or doorknob; notebook. *Steps:* Make pulses; change frequency vs amplitude one at a time; describe wavelength qualitatively if visible. *Safety:* Clear space; soft rope; adult present. *The fun:* Making waves you can see. *The skill:* One change at a time. *Exit:* “When I changed , **I saw** .”

PHYS-06 — Thermal Insulation Fair

Time: 30–45 min. *Materials:* Two cups; two wraps (or wrap vs bare); warm water with adult; thermometer; notebook. *Steps:* Same water start; change wrap only; record temps over time; CER light about which wrap; soft conduction picture in teen language after data. *Safety:* Adult for hot water; no scalds; no inventing temps. *The fun:* A race against cooling. *The skill:* Fair thermal test + CER. *Exit:* CER light triad.

PHYS-07 — Magnet Strength Distance

Time: 25–40 min. *Materials:* Magnet; paperclips; ruler; notebook. *Steps:* Max distance to attract; change one variable (orientation or barrier); fair checklist; table. *Safety:* Adult present; medical device caution; choke check for younger siblings.

The fun: Invisible reach made measurable. *The skill:* Distance as data. *Exit:* Table + claim.

EARTH-01 — Rock Cycle Soft Sort

Time: 25–40 min. *Materials:* 4–6 rock samples or library kit; hand lens; notebook. *Steps:* Sort by observable properties first; tentatively group with a key — mark tentative; name model limit: sorting $\neq$ watching a cycle today. *Safety:* Eye protection if any tapping; adult present; wash hands; no unprotected collecting on restricted land. *The fun:* Real rocks in hand. *The skill:* Property evidence before story. *Exit:* Sort table + one tentative label with property evidence.

EARTH-02 — Weather Front Map Soft

Time: 25–35 min. *Materials:* Printed weather map or printed app screenshot; notebook. *Steps:* Read symbols; mark fronts if shown; predict local weather 24h; next day compare; label second-hand data. *Safety:* Indoor fine; adult if outdoor check. *The fun:* Being wrong or right tomorrow. *The skill:* Prediction vs actual. *Exit:* Prediction vs actual one-liner.

EARTH-03 — Soil Permeability Soft

Time: 30–45 min. *Materials:* Two soils; clear bottles with holes; water; timer; notebook. *Steps:* Same water amount; change soil type only; time drainage; fair test + CER. *Safety:* Adult present; mess plan; no chemical additives; do not pour silt into drains carelessly. *The fun:* A muddy fair test. *The skill:* One IV soil type. *Exit:* Times + claim which drained faster.

EARTH-04 — Moon Phase Log

Time: 15–20 min evenings $\times$ several days. *Materials:* Outdoor view; notebook; sky calendar *after* looking. *Steps:* Sketch moon shape/time several clear evenings before reading the calendar; then compare. *Safety:* Adult present outdoors at night; sidewalk rules; never binoculars toward the sun. *The fun:* A sky that changes on you. *The skill:* Observe-before-calendar. *Exit:* Three dated sketches + one pattern notice.

EARTH-05 — Plate Boundary Map Soft (13–14; stretch 11–12)

Time: 25–40 min. *Materials:* Printed world map with plate boundaries; notebook. *Steps:* Trace boundaries; mark one convergent/divergent/transform from the key; link to a named hazard as map pattern — not fear talk; map is a model. *Safety:* None. *The fun:* Seeing Earth as pieces that meet. *The skill:* Map as model. *Exit:* One boundary type + map location cited.

EARTH-06 — Water Cycle Model Soft

Time: 30–45 min. *Materials:* Clear jar, warm water, lid/ice with adult — or outdoor puddle evaporation watch. *Steps:* Observe condensation/evaporation evidence; build cup-arrow model; limit sentence: kitchen jar $\neq$ global climate engine. *Safety:* Adult for hot water; towel; no sealed pressure experiments. *The fun:* Fog on a lid you made. *The skill:* Model + limit. *Exit:* Model + limit sentence.

Out-of-home try-its (named)

OUT-01 — Stream or Pond Soft

Time: 30–45 min on site. Observe edges; living/nonliving notices; optional temp; one question for a later fair test. No collecting protected life. Adult present; no swimming as “lab”; wash hands. *Exit:* five notices + one later question.

OUT-05 — Night Sky Log Soft

Time: 20–35 min. Log moon or find three named bright objects with adult app *after* naked-eye look. No lasers default. Adult present; night walking rules. *Exit:* dated sketch + two notices.

OUT-06 — Garden Biodiversity Soft

Time: 25–40 min. Hula-hoop quadrat soft; count plant types in two spots; same hoop size. No harm to animals. Allergy/tick awareness as relevant. *Exit:* two counts + one difference notice.

OUT-04 — Museum One Exhibit CER (*life or earth hall*)

Time: 30–45 min. One exhibit. Note model vs specimen. CER light about one exhibit claim with evidence from looks/labels. Label second-hand. Adult present; museum rules. *Exit:* CER oral at exhibit, then written crumb.

Library, walk, museum, kitchen, and yard *are* practice. They do not replace the fair-test-and-claim move.

Talk box

Opening (locked):

“What is happening in this phenomenon — and what evidence from looking or measuring makes you say that?”

Follow-ups (pick three to five):

1. Observe — “What do you *see* / *measure*?”
2. Record — “What does the notebook / table show?”

3. Reason — “How do you know from *this*?”
4. Check — “What else was different? Can we tell for sure? What can’t today’s look tell?”
5. Revise — “You may change your mind. Try another look. Redesign once.”

How to wait: After you ask, a slow three. After they stop, wait again. If they are mid-measure, do not cut them off. Look at the materials or notebook if the silence is hard.

Stuck silence usually means: the question was vague; wait was zero; they are hunting a vocabulary word because you asked name-first; they offered a book-only guess; the materials never landed; they think looking means “say what the screen already told me”; they invent neat rows because the trial was messy. Pose, wait, point back at the notebook. Do not fill the silence with the right vocabulary.

Blocked and mixed practice

Blocked (new move): Same phenomenon two days — Tuesday density of object A, Wednesday density of object B with the same method. The craft sticks before the topic hops.

Mixed (when the move is warm): Friday warm-up mixes last week’s insulation fair-test question with this week’s soil times. Ask: “What did we change on purpose last week — and what did we change this week?” Mixing builds the habit of looking for the named change, not the habit of racing new vocabulary.

One incorrect example to diagnose

Coverage hour with no phenomenon on the table.

Parent reads three chapters of Life Science aloud. Adolescent copies a cell diagram from the book. No slide, no micrograph look-first, no measurement, no claim from a trial. Exit quiz: match organelle names.

Miss: domain as survey dump; name-first; no student’s looking record.

Repair: Put LIFE-01 or LIFE-02 on the table Monday. Locked opening. Sketch or log before the key. Sticky CER from *this* page.

For the student

You already know how to run a fair test and write a claim that points at your notebook. This chapter is where those moves meet a real thing: a plant, a cup of water and a rock, a moon, a magnet, a weather map.

What this idea is.

Science at your age is not “memorize every living thing.” It is: pick one happening, look and measure, keep a record a stranger could read, and say what you claim *because of that record*. Life, physical, and earth ideas are the *topics*. The craft is still fair test + notebook + claim with evidence.

Tiny worked example (density).

You measure a steel washer: mass 8.2 g, volume about 1.0 cm³ by water rise. Density ≈ 8.2 g/cm³. You predict it sinks. It sinks. Your claim: “This washer is denser than water, because mass/volume was about 8.2 g/cm³ and it sank in the cup.” The claim needs those numbers. “Metal is heavy” alone is not enough.

Try 1. Pick one with your parent: density (PHYS-03), cell caption after look (LIFE-01), or three moon sketches (EARTH-04). Fill the blank table or dated sketches from what you actually did.

Try 2. Say or write: “What is happening — and what evidence makes me say that?” Point at your page when you answer.

Explain it back. Tell a sibling or parent, in your own words, what you changed (or what the model shows), what you measured or observed, and what you still cannot tell from today’s look.

Challenge. Redesign once: change only one thing, keep the same list honest, and see whether your claim still holds. Or add one limit sticky to a model: “This jar is not the whole sky.”

Two more tiny pictures.

Insulation. Two cups, same warm water start (adult pours). One wrapped, one bare. You record temperature every five minutes. Claim only from your times and degrees: which cup stayed warmer longer, and what in the notebook shows it?

Moon. Three clear evenings. You sketch the shape and write the time *before* anyone opens a sky calendar. Later you compare. If a night was cloudy, you write “cloudy — no sketch,” not a made-up crescent.

You are allowed to wait. You are allowed to change your mind when you look again. You are not required to finish a kingdom chart this week. A museum postcard or a stream-edge page counts when it holds the same craft: look, record, claim with evidence.

If it isn't clicking

Diagnostic 1 — They race titles and freeze on the blank table.

What it usually means: coverage habit; looking feels “too small.”

Next move: Shrink the week to one card. Hide the unit checklist for five days. Celebrate a filled table with units more than a finished chapter list.

Diagnostic 2 — Prior idea will not budge (force-as-fuel, plants only eat through roots, cells as tiny mouths).

What it usually means: the mind at rest is doing its job; a lecture will not replace it.

Next move: Another look with a named idea just-in-time. “Same ramp — what do you measure when we change only ___?” Or LIFE-02 inputs they can control. Do not scold. Do not pretend one speech fixed it.

Diagnostic 3 — They want “real lab” as dissection, mold jars, or unmarked mixing.

What it usually means: media picture of science arrived early.

Next move: LIFE-07 soft alternative. Safety spine aloud. Mold cultivation refused by default. Vinegar fizz is a change picture, not a Chemistry credit. Museum specimen or flower parts count.

When to slow down: Looking and recording are shaky — stay on blank table + one PHYS or EARTH fair test before LIFE vocabulary.

When to go ahead: They design an unconfounded try and cite numbers — add model limits and a CER paragraph.

When to get a human tutor: Persistent shutdown, safety recklessness you cannot hold, or a learning difference that needs a specialist — a calm tutor who will put apparatus on the table beats a packet mill.

Diagnostic 4 — Generated micrograph or “perfect” sky photo filed as their result.

What it usually means: a fluent picture replaced looking.

Next move: Refuse. Real look or printed micrograph they caption after seeing.

Generated image is not data. Point back to the Science Hour AI box.

Correct a wrong reason without crushing the look. “Never correct the adolescent” is not this book’s rule. Silence in the face of a confounded “proof” is not kindness. A scolding lecture is not teaching either.

Tools, including AI

Optional helpers for you, the adult. Keep this short. Point back to the Science Hour AI box for the full allow-and-ban list.

You may, on your account, after they have tried (or before, for your prep): ask a tool to explain *this week’s* apparatus to you; request a blank isomorphic table with a parent key; ask for a labelled SCRIPT of questions you will say after the try; ask revision questions after a claim draft — not a rewrite of their lab report.

You may not: invent an observation or data table and file it as theirs; generate a micrograph, gel, or sky photo and treat it as their result; put a model summary on the table as the observation; ask the tool to write their CER; park an unsupervised chat as their only partner; detector-grade a sentence like “drainage took 42 seconds.”

Generated image $\neq$ data. Model summary $\neq$ observation. At 11–12 you hold the account. At 13–14 you co-hold and stay in the room. Turning 13 is not a licence. Unaided first on looking, measuring, and recording.

What “done enough” looks like

Before you move to a new phenomenon:

- ☐ One LIFE **or** PHYS **or** EARTH card finished with a dated notebook page a stranger can read.
- ☐ Fair test language used (what changed / stayed the same / can we tell for sure?) **or** a model with one named limit.
- ☐ Claim that points at *this* notebook — oral triangle fine at 11–12; short paragraph with a limitation welcome at 13–14.
- ☐ Talk box happened with the locked opening and a real wait.
- ☐ Safety held: adult present where needed; no unauthorized mixing; dissection refuse honored if that temptation appeared.

- ☐ Optional OUT matched the week's looking (stream, sky, garden, museum) — or is planned for next week.

Place by skill, not birthday. A “grade 7 science workbook” is a publisher's scope, not a legal grade, and not a transcript line. The title a stranger reads is **Science** — or Life Science / Physical Science / Earth Science only when the work truly is that. Never a brand. Never Young Minds Science I.

Life of the habit (not a ninth chapter): Revisit last week's IV/DV card on Tuesday. Mix last week's fair test into Friday's warm-up. Stop while a look remains. A path through middle-grades looking is the promise. A diploma is not.

Done enough this week is one phenomenon, honestly tried, with a notebook claim. You can pick a new domain card next week. You do not owe every kingdom by December.

Chapter 7 — Talking and writing science arguments



Figure 9: A talk-box sticky and an open dated notebook with a CER light paragraph — still-life, no people, no logos.

Why this matters

An adolescent can run a fair test, fill a neat table, and still leave the hour with only your explanation in their mouth.

Talking science at 11–14 is one authentic question, a wait, and a finger on the notebook. Writing science at 11–14 is a ladder: variable labels, two-sentence methods, a results caption, then a claim sentence (11–12) or a short Claim–Evidence–Reasoning paragraph with a limitation (13–14). It is not a lab-report franchise. It is not a debate-club essay without a trial. It is not a chatbot paragraph filed as theirs.

This is worth the struggle because talk is how looking becomes theirs, and a because-the-notebook sentence is how looking lasts past Friday. A fluent summary from a grown-up — or from a machine — is performance. A sentence that could only come from *this* table is science.

Classroom research on wait-time started in elementary *science* lessons. Teachers often jumped in after about a second. When they waited longer — a few seconds — the talk changed. A later digest called the pause think-time and named kinds of silence. Use the pause at your table. This is a useful study, not a promise that every home will see the same result, and it is not a kitchen experiment you are failing if Wednesday is noisy.

Arguments in science at this age are small and local. “The wrap slowed cooling in *this* trial” is an argument. “I am right about heat forever” is not. Rival claims stay soft at 13–14: “Someone could say the cups started differently — our notebook shows the same start temperature, so that rival is weaker today.” You are not running a courtroom. You are teaching a finger on a number.

Wait is a kindness to thinking. Rescue at one second trains guessing your face. A slow three trains searching the page. You will sometimes fail the wait on a noisy Wednesday. Try again Thursday. The convention is enough; you do not need a kitchen wait coefficient.

Ready, Set, SCIENCE! and related CER materials describe a three-part shape: claim, evidence, reasoning. IQWST-family classrooms use that shape with middle-grades investigations. Label the shape. You do not need to buy a franchise. Borrow claim + evidence from *this* notebook + short reasoning. Refuse a worksheet CER with no apparatus on the table.

Materials alone rarely make discussion. A ramp on the table is not yet an argument. You still pose, wait, and point. The student answers you, not a tab.

Sister chapters put fair tests, tables, models, CER light, and one-phenomenon depth on the table. This chapter teaches the mouth and the pencil to stay honest to those looks. *English for Young Minds* cares about oral craft and clear sentences — borrow the kindness, not the literature scope. *Critical Thinking for Young Minds* cares about wait and change-your-mind — borrow the craft, not a playground debate without a notebook. One pointer each. Then teach science talk and science writing from *this* trial.

The locked question for this chapter is the whole craft in one line:

“What do you claim — and why does that evidence count?”

If they can answer that with a finger on a number, the week did its job.

For the parent: understand it yourself

Here is the everyday picture.

You explain why the wrapped cup stayed warmer. You ask, “So what do you claim?” The adolescent repeats your explanation, brightly. You feel the hour worked. You put the cups away. On Friday you ask why the evidence counts. They blink. They remember your story. They cannot point to the 12-minute row.

Here is the precise picture.

The trial is done. The table is on the table. You ask what they claim and why that evidence counts. You wait a slow three. They point at two temperatures. You uptake: “You said the wrap helped; our table shows the wrapped cup dropped three degrees less by minute twelve.” At 11–12 that may be oral or two written sentences. At 13–14 they write a short CER paragraph that cites numbers and names one limitation. The story can fade. The numbers stay.

An authentic question is one you do not already have the exact sentence for. “What is conduction?” with the definition facing you is recitation. “What do you claim — and why does that evidence count?” is closer to authentic. You may still know more than they do. You have not prespecified their sentence.

Oral comes before heavy print when print is the bottleneck. Spelling help is al-

lowed. Science looking does not wait for a perfect paragraph. Place by skill, not birthday.

Rowe's wait-time work is elementary science-class tape work. Stahl's think-time digest labels kinds of silence and a roughly three-second convention. Both are classroom-origin. Do not mash them into a kitchen-table science RCT. Do not invent a wait coefficient for your home. Do count three when your habit is to rescue at one.

Wrong answers you should be able to hear

1. Invent neat rows.

The trial was messy. The notebook looks perfect — identical times, no scratches, numbers that could not have come from the thermometer you used.

What it usually means: honesty lost to neatness or to a tool.

What you say: "Keep the messy numbers. We redesign if we must. Invented rows are not your data." Pull WRITE-06.

2. Overwriting mid-sentence.

They start a claim; you erase and write the textbook aim instead.

What it usually means: adult voice replaced student looking.

What you say: Stop. Keep their words. Add a second line for your note if you must — labelled as yours.

3. Rapid-fire quiz.

"What is the vocabulary word? What is the dependent variable called in the book?"

No wait. No finger on the page.

What it usually means: talk time became a test.

What you say: Put the notebook back. Ask the locked opening. Count three.

4. Public shaming.

A wrong prediction becomes a joke at their expense — or a sibling mockery hour.

What it usually means: wrong predictions were treated as character.

What you say: "Wrong predictions are useful. Keep the circle. Point at the page." Stop TALK-03 if it turns mean.

5. Chatbot paragraph as theirs.

A fluent CER sits under a blank or thin table as "what I concluded."

What it usually means: performance replaced looking.

What you say: Refuse it. Real claim from *this* notebook. Point back to the Science

Hour AI box. Generated observation is not data; a machine-written lab report is not their argument.

Five-to-eight-minute parent warm-up

Find yesterday's table. Cover the claim line with a sticky.

Practice waiting three after: "What in the notebook supports that?" Look at the table, not at the adolescent, if silence is hard.

Practice uptake aloud: "You said ; *our table shows* ."

Practice the locked opening to the empty chair. Count three. Do not answer.

If you like a SCRIPT for later, write four question lines for yourself now — questions, not their observation. They never chat a tool as the only partner. You hold or co-hold the account. Point back to the Science Hour AI box for the full list.

How to teach it this week

The Science Hour shape stays (~25–45 minutes). Talk and write are the try and the crumb, not a second subject named Young Minds Science Writing.

Session shape

1. **Observe / frame (4–8 min).** Yesterday's record uncovered — or today's apparatus down.
2. **Plan (4–8 min).** If a new try: Change / Measure / Same. If a talk/write day: name the writing rung (labels, methods, caption, CER).
3. **Try / measure / record or talk/write sit (10–18 min).** Run the science try or sit on yesterday's record with TALK and WRITE cards.
4. **Talk + CER light (6–12 min).** Locked opening. Finger on the notebook. Because-the-notebook sentence.
5. **Exit ticket (2–5 min).** Sticky claim + evidence + because — or a dated honesty card.

Twenty-five-minute day: uncover yesterday's insulation table, locked question, one because-the-notebook sentence, sticky exit. That is a full hour.

Exact wording you can say

Opening, locked:

“What do you claim — and why does that evidence count?”

Then wait.

Follow-ups:

- “Point at the notebook. Which number or observation?”
- “What does the table show if a stranger walked in?”
- “How do you know from *this* — not from the chapter summary alone?”
- “What would a sibling say? What would change your mind?”
- “Name one limitation in a sentence.” (especially 13–14)

If they freeze: “Start with: I claim ____ because the notebook shows ____.”

If they offer a feeling: “Feelings can start a question. What number supports the claim?”

If they paste fluent book language with no pointer: “Keep one book word if you need it. Now point at *our* row.”

Age-band moves

Ages 11–12. Claim sentence or oral CER triangle (claim / evidence pointer / one because). TALK-01 and TALK-02 as weekly muscle. WRITE-01 labels before the trial. WRITE-03 caption under the table (caption $\neq$ claim). WRITE-04 short — four to six sentences max, must cite numbers. Honesty card WRITE-06 once this week. Sibling challenge soft only if kindness holds.

Ages 13–14. Short CER paragraph with limitation (WRITE-04, five to eight sentences). WRITE-05 error analysis soft — one measurement difficulty, one possible confound, how it limits the claim. TALK-07 disagree redesign when two honest trials conflict — no erasing the unpopular trial. TALK-06 student asks a testable question with one named IV for a future hour. Still refuse AP lab-report padding. Still refuse invent-data.

Writing ladder (say it once this week)

1. **Labels before trial** (WRITE-01) — Change / Measure / Same with units.

2. **Caption under results** (WRITE-03) — what was measured, units, trials — not yet a claim.
3. **Methods two sentences** (WRITE-02) — enough for a stranger to repeat the one change.
4. **Claim sentence / CER light** (WRITE-04) — numbers required.
5. **Limitation / error soft** (WRITE-05 at 13–14) — one measurement difficulty, one confound possibility.

Climb one or two rungs in a week. Do not shove the whole ladder into Thursday.

Uptake lines you can steal

- “You said ; *our table shows* .”
- “Point again — which row is doing the work?”
- “Keep your words. I’ll add the unit on a second line if we need it.”
- “Wrong prediction stays in the notebook. We looked.”
- “You may revise. Date both versions.”

Struggle before rescue (talk edition)

Ask the locked opening → wait ~3 s → hint that is a question (“Which column?”) → model one because-notebook sentence once → stop talking. Do not grab the answer. Do not fill the silence with the chapter’s definition. Do not paste a machine’s CER as theirs.

First try-it for the student

TALK-02 — Because the Notebook. Sentence frame: “I claim ____ because the notebook shows ____.” Say it twice with two different evidence bits if possible. Exit: one complete because-notebook sentence.

Pair it the same week with **WRITE-04 — CER Light Paragraph** from a full record already on the table.

Fade map for a month

Week A: You hold the because-frame; they fill and point.

Week B: They say the frame unaided; you only uptake.

Week C: They write WRITE-04; you ask one limitation question.

Week D: They run TALK-07 on two honest disagreeing trials; no erasing; redesign plan.

If Week A is still shaky at month's end, stay on Week A kindness. Place by skill. A ready younger student may jump to Week C. A rusty older student may need Week A without shame.

How to fade help

Early: you supply the frame and wait. They fill the blanks while pointing.

Next: they say the frame without looking at your card. You only uptake.

Later: they write the paragraph; you ask one limitation question; you do not rewrite their voice.

When to stop talking: after the locked opening; while they search the table; mid-sentence. Struggle before rescue.

This week, honestly

Focus move: because-the-notebook; claim sentence → CER light; refuse invent-data.

- **Monday:** TALK-01 Three-Second Evidence on last week's table.
- **Tuesday:** Science try (any fair test) + WRITE-01 labels before materials start.
- **Wednesday:** TALK-02 Because the Notebook + WRITE-03 results caption.
- **Thursday:** WRITE-04 CER light paragraph (oral triangle fine at 11–12).
- **Friday:** WRITE-06 honesty card; sticky exit; one diagnostic wrong (overwrite, invent neat rows, rapid-fire).
- **Weekend optional OUT:** museum one-exhibit CER oral-then-write, or library journal peek (caption + claim from a named graph — second-hand labelled).

Practice that actually builds learning

In-home try-its — TALK bank

TALK-01 — Three-Second Evidence

Time: 10–20 min. *Materials:* Open notebook; timer optional. *Steps:* One evidence question. Silent count to three. Student answers pointing at the page. No stacked questions. *The fun:* The quiet that makes room for a real answer. *The skill:* Wait + evidence pointer. *Exit:* Wait happened; one evidence pointer given. *Safety:* None.

TALK-02 — Because the Notebook

Time: 15–25 min. *Materials:* Notebook. *Steps:* “I claim ____ because the notebook shows ____.” Twice with two evidence bits if possible. *The fun:* Sounding like someone who has data. *The skill:* Because-notebook, not because-feeling. *Exit:* One complete sentence. *Safety:* None.

TALK-03 — Sibling Challenge Soft

Time: 15–25 min. *Materials:* Shared trial record. *Steps:* Sibling asks “Where is your evidence?” Speaker points, not personality. Adult referees kindness. *The fun:* A fair challenge. *The skill:* Finger on a number under pressure. *Exit:* One challenge answered with a finger on a number. *Safety:* Emotional — stop if mean.

TALK-04 — Predict Then Wait

Time: 15–25 min. *Materials:* About-to-run trial. *Steps:* Predict aloud with reason. Wait. Run. Compare without “I told you so.” *The fun:* Being wrong safely. *The skill:* Prediction as honest, not as a trap. *Exit:* Predict vs result one line. *Safety:* Per trial.

TALK-05 — Fair Box Middle

Time: 10–20 min. *Materials:* Setup cards. *Steps:* Change? Measure? Same? Can we tell for sure? Wait between prompts. *The fun:* A chorus that gates the start. *The skill:* Fair-test talk before materials fly. *Exit:* All four answered. *Safety:* Gate start.

TALK-06 — Student Asks Investigation

Time: 15–25 min. *Materials:* Notebook wonder list. *Steps:* Student poses one testable question for a future hour. Adult helps narrow to one IV. Write it. *The fun:* Owning tomorrow’s question. *The skill:* Testable scope. *Exit:* Testable question with named IV. *Safety:* Vet hazards before promising the try.

TALK-07 — Disagree Redesign

Time: 20–30 min. *Materials:* Two disagreeing honest trials. *Steps:* Both results stay. Confound or real difference? Plan redesign. No erasing. *The fun:* Science as revision, not as a fight. *The skill:* Redesign one IV. *Exit:* Redesign plan. *Safety:* Per redesign.

In-home try-its — WRITE bank**WRITE-01 — Variable Labels Three**

Time: 15–25 min. Write Change / Measure / Same with units where needed. Tape above today's table. *Exit:* three labels present *before* trial.

WRITE-02 — Methods Two Sentences

Time: 15–25 min. After a fair test: two sentences another student could follow to repeat the try. Include the one change. *Exit:* two-sentence methods. Not a novel. Not a template for steps never done.

WRITE-03 — Results Table Caption

Time: 15–25 min. Caption under table: what was measured, units, how many trials. No claim yet — caption $\neq$ CER. *Exit:* caption sentence.

WRITE-04 — CER Light Paragraph

Time: 25–40 min. Full record required. About 4–6 sentences at 11–12; 5–8 at 13–14. Must cite numbers. *Exit:* claim + two evidence bits + reasoning. No AP padding. No chatbot paste.

WRITE-05 — Error Analysis Soft (13–14)

Time: 20–30 min. Name one measurement difficulty and one possible confound. Say how it limits the claim. Not a blame essay. *Exit:* one limit sentence.

WRITE-06 — Refuse Invented Data Card

Time: 10–20 min. Read aloud: (1) no inventing rows; (2) no generated observation as data; (3) no worksheet dump as the hour; (4) no AP packet as weekly spine. Sign/date in notebook. *Exit:* dated card. Revisit when Friday gets busy.

Out-of-home try-its**OUT-04 — Museum One Exhibit CER**

Observe one exhibit. Note model vs specimen. CER oral at the exhibit, then written crumb. Second-hand labelled. Adult present. *Exit:* oral then write.

Library and museum outings motivate talking and writing from a real look. They do not replace the because-the-notebook move at the kitchen table.

OUT-07 — Library Journal Peek Soft

Find one graph or table in a science magazine or reliable article. Explain what it measures. Ask one question it does not answer. Second-hand labelled. Not a research-paper assignment. Exit: “Graph shows . *It does not tell* .”

Week plan (hypothetical, not a script law)

Focus: because-the-notebook + CER light + honesty card.

- **Monday (20–25 min):** TALK-01 on last week’s density table. One question. Count three. Finger on mass/volume cells.
- **Tuesday (35–40 min):** New fair test (insulation or soil). WRITE-01 labels before pour. Measure. Record. TALK-05 fair box gates the start.
- **Wednesday (25–30 min):** TALK-02 twice with two evidence bits. WRITE-03 caption under the table.
- **Thursday (30–40 min):** WRITE-04 CER light from *this* notebook. At 13–14 add WRITE-05 one limit sentence.
- **Friday (20–25 min):** WRITE-06 honesty card dated. Sticky exit. Diagnose one wrong (overwrite, invent neat rows, or chatbot itch).
- **Saturday optional:** OUT-04 museum oral-then-write *or* OUT-07 library graph: “shows ____ / does not tell ____.”

Label **hypothetical**. Busy weeks may compress to Tuesday try + Thursday CER + Friday honesty. Depth beats a coverage talk week.

Exact parent scripts for common stuck moments

They stare at you for the “right” claim.

“I am not holding the sentence. The table is. What do the numbers let you say?”

They say “because I think so.”

“Thinking starts questions. Which cell supports the claim? Point.”

They write a page with no numbers.

“Circle every number you measured. Now rewrite the claim so at least two numbers appear.”

They want the chatbot to ‘fix’ the paragraph.

“Tools can give *me* revision questions after you draft. They do not write your CER. Unaided first.”

Silence feels unbearable.

Look at the notebook. Count three again. Soft hint: “Start at the units row.” Do not lecture the explanation.

Connection to earlier chapters (one breath each)

ch02 gave table → graph → sentence — writing here uses that record. ch03 gave fair-test talk — TALK-05 is that talk with wait. ch04 gave model limits — a limit sentence is WRITE-05’s cousin. ch05 gave CER light — this chapter makes the mouth and pencil practice it until it is ordinary. ch06 gave phenomena — talk and write stay tied to *those* trials, not to a floating essay prompt.

Talk box**Opening (locked):**

“What do you claim — and why does that evidence count?”

Follow-ups:

1. Observe — “What do you see in the record?”
2. Record — “Point. Which row or cell?”
3. Reason — “Why does *that* number count for this claim?”
4. Check — “What would change your mind? What can’t this trial tell?”
5. Revise — “You may change your claim. Keep both versions dated if you revise.”

How to wait: Slow three after the question. Wait again after they stop. Do not cut off mid-measure or mid-claim. Look at the notebook if silence is hard.

Stuck silence usually means: vague question; zero wait; hunting a vocabulary word; guessing what you want; materials never landed; book-only guess; they think science means “repeat the parent’s explanation”; inventing neatness because the trial was messy. Pose, wait, point. Do not fill the silence with the right vocabulary, and do not turn the table into a fight.

Blocked and mixed

Blocked: Two days of because-the-notebook on the *same* table before hopping topics.

Mixed: Friday asks last week's fair-box questions and this week's CER limitation in one short sit.

Composite illustration (not a reported family)

On Wednesday, Jordan (composite) opens Tuesday's soil-permeability table. Parent asks the locked opening and counts three while looking at the times column. Jordan says, "I claim sandy soil drained faster because the notebook shows 28 seconds for sand and 67 seconds for clay with the same water amount." Parent uptake: "You said sand was faster; our table shows 28 versus 67." Jordan writes WRITE-03 caption: "Drainage time (s) for 100 mL water through two soils; two trials each." Thursday Jordan writes a five-sentence CER and one limit: "Holes may not have been identical." No chatbot paragraph. No erased clay trial.

More incorrect examples

Rapid-fire vocabulary as "discussion."

Parent asks ten definition questions in four minutes. No notebook open. Adolescent shrugs.

Miss: talk without evidence; zero wait.

Repair: TALK-01. One question. Notebook open. Count three.

Overwrite mid-sentence.

Adolescent writes "I claim the magnet..." Parent crosses out and writes a textbook force sentence.

Miss: adult voice replaced student looking.

Repair: Restore their words. Adult note on a sticky labelled "parent." Teach the term tomorrow after another look.

Sibling challenge without kindness.

Younger sibling laughs at a wrong prediction. Speaker shuts down.

Miss: TALK-03 emotional safety.

Repair: Stop. Reset rules: finger on page only; no mockery. Or skip sibling challenge for a month.

One incorrect example to diagnose

Chatbot CER with no trial.

Parent pastes a blank “lab report” template into a chat and asks it to complete a density CER. Adolescent copies the fluent paragraph into the notebook. No masses. No volumes. No sink/float check.

Miss: write-my-lab-report; invent-data; performance as looking.

Repair: Real density try (PHYS-03). Blank table first. WRITE-04 from *those* numbers only. Honesty card WRITE-06 dated. Tool may later give *you* revision questions — not their paragraph.

Safety note for talk-and-write days

Talk-and-write sits usually need no new hazards. If the hour includes a fresh try first, the ordinary safety spine still holds: adult present for heat, electricity, outdoor water, chemicals, glassware; no unauthorized mixing; living things unharmed. Do not let a “quick CER day” become an excuse for unmarked bottles because “we’re only writing.” The notebook records what was safely tried.

For the student

Talking science is not a quiz show. Writing science is not a five-page lab report.

What this idea is.

You claim something about a try you did. You point at evidence in your notebook. You say why that evidence counts. At first that is one strong sentence. Later it is a short paragraph that also names what you still cannot tell.

Tiny worked example.

Table: wrapped cup $72^{\circ}\text{C} \rightarrow 68^{\circ}\text{C}$ in twelve minutes; bare cup $72^{\circ}\text{C} \rightarrow 61^{\circ}\text{C}$ in twelve minutes. Same start, same room, same cup size.

Oral: “I claim the wrap slowed heat loss because the notebook shows a 4° drop wrapped and an 11° drop bare by minute twelve.”

Written (13–14 add-on): “One limit: we only ran one trial each, so a draft could have changed the result.”

Try 1. Open yesterday’s table. Say: “I claim ____ because the notebook shows ____.” Point while you say it.

Try 2. Write a results caption under the table (what was measured, units, how many trials) — *before* you argue. Then write your claim sentence or short CER paragraph.

Explain it back. Tell someone what would change your mind. If you cannot name anything, your claim may be too big for this trial.

Oral triangle (11–12 home base).

1. Claim in one sentence.
2. Evidence: point and read the number.
3. Because: one reason that ties the number to the claim.

Say it out loud before you write. Writing can be two sentences that match what you said.

Limitation starters (13–14).

- “We only ran ____ trials, so ____.”
- “We did not control , *so we cannot tell for sure about .*”
- “The model shows , *but it leaves out .*”

Pick one. Do not write a confession essay.

What does *not* count as your argument.

A paragraph that never needed your table. A caption that argues instead of describing. A neat table you did not measure. A machine’s fluent CER. A feeling with no pointer (“I just know”).

Challenge. Trade notebooks with a sibling or parent for two minutes. They ask only: “Where is your evidence?” You answer with a finger, not a speech. Or complete WRITE-06: read the four refuses aloud and date the card.

You are allowed to wait before you answer. You are allowed to revise a claim when the numbers disagree. You are not required to sound like a textbook.

If it isn’t clicking

Diagnostic 1 — Zero wait; answers are guesses at your face.

What it usually means: rapid-fire habit; authentic question missing.

Next move: TALK-01 only for three days. One question. Count three out loud if you must. Look at the page, not at them.

Diagnostic 2 — Because-feeling or because-book with no pointer.

What it usually means: evidence talk was never required.

Next move: TALK-02 with a rule — no sentence accepted until a finger lands on a cell. Kind voice. Firm rule.

Diagnostic 3 — Paragraphs are fluent and empty; or neat rows appeared overnight.

What it usually means: performance or invent-data.

Next move: WRITE-06 honesty card. Compare thermometer photos or raw scratch paper to the “final” table. Redo the try if needed. Refuse machine-written CER.

Diagnostic 4 — Sibling talk turns cruel; or you overwrite mid-sentence.

What it usually means: challenge without kindness; or adult anxiety about “correct” wording.

Next move: Stop TALK-03. Adult models uptake of *their* words. Keep a second labelled adult note if you must teach a term later.

Diagnostic 5 — They think “argument” means win a fight.

What it usually means: debate culture arrived without a notebook.

Next move: Redefine: argument = claim + notebook evidence. TALK-02 only. No winner language. Rival claim soft: “What else could explain these numbers?” then redesign or limit — not personal victory.

When to slow down: They cannot yet point at a number — stay on oral because-notebook before paragraph length.

When to go ahead: They cite two evidence bits and name a limit — add WRITE-05 and TALK-07.

When to get a human tutor: Persistent shutdown around writing that a scribe-then-type bridge does not ease, or a learning difference that needs specialist print support — still keep the looking hour; do not replace looking with a packet mill.

Tools, including AI

Point back to the Science Hour AI box for the full allow-and-ban list. Keep this short.

You may, on your account, after they have tried (or before, for your prep): ask for discussion questions *you* will vet and ask; ask for revision questions after *their* claim draft — not a rewrite; ask for a labelled SCRIPT you will speak after the try; ask for extra isomorphic blank CER frames with a parent key; diagnose work

they already produced (crop to the paper; no face upload).

You may not: write their CER or lab report; invent a table or observation; let them prompt a window until it agrees; park an unsupervised chatbot as the only talk partner; generate a “what I should have seen” paragraph; detector-grade “the wrap dropped 4°”; hand them an agent as a writing partner.

A fluent filled blank from a machine is performance, not their science argument. At 11–12 you hold the account. At 13–14 you co-hold and stay in the room. Turning 13 is not a licence. Unaided first on the claim that is today’s lesson. SCRIPT after the try.

One off-age caution, labelled: a high-school math study found unguarded chatbot practice can look better in the moment and leave students weaker when the window closes. That is not an 11–14 science RCT. The kitchen rule it supports: the model may prepare you and the next looking page; it may not do their looking, measuring, recording, or CER when those are the lesson.

What “done enough” looks like

Before you treat talk-and-write as warm:

- ☐ Locked opening asked with a real wait at least three times this week.
- ☐ At least one because-the-notebook sentence that points at *this* table.
- ☐ Writing rung climbed once: labels, caption, methods, or CER light — not all four in a panic.
- ☐ Honesty: WRITE-06 dated this month; no invented rows filed as student data.
- ☐ 11–12: oral triangle or short write. 13–14: paragraph with numbers + one limitation when the record supports it.
- ☐ Optional OUT: museum CER oral-then-write or library graph caption + claim.

Life of the habit (not a ninth chapter): Revisit Tuesday’s claim on Friday — does it still hold after a night? Mix last week’s fair-box questions into a warm-up. Stop while a look and a sentence remain. A path through middle-grades arguing from evidence is the promise. A diploma is not. A percentile is not.

Place by skill, not birthday. A publisher’s “grade 8 lab report” is not a legal grade and not your weekly spine. The stranger-readable title is still **Science**. Never

Young Minds Science I.

Revisit next Tuesday. Open Friday’s claim. Ask: “Does it still hold? What would we measure again?” Mix last week’s fair-box questions into a two-minute warm-up. That rhythm is the life of the habit — session-sized, not a ninth teaching chapter.

Records preview (one sentence). The dated notebook, the fair-test talk, and the CER sentence live inside **Science**. Titles a stranger can read wait in the records chapter. Never Young Minds Science I.

Illustration seed for this chapter: a talk-box sticky beside an open notebook; optionally a sibling-challenge card kept kind. No adolescent portraits. No brand logos.

Done enough this week: one claim that needs the notebook, spoken or written, with a wait that was real. You can lengthen the paragraph later. You do not owe a debate trophy. You owe a finger on the page and a wait that was real.

Access note: sources and norms for this manual use access date 17 September 2026. Full citations live in endnotes, not in the teaching voice.

Chapter 8 — Short assessments and progress checks

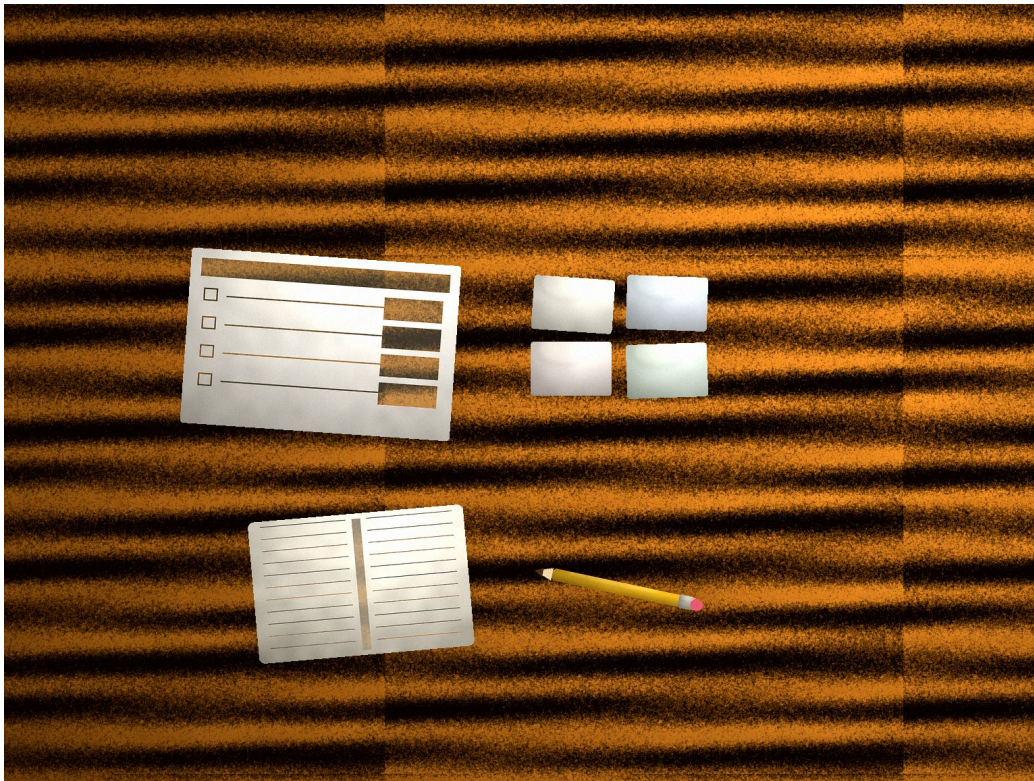


Figure 10: A fairness ladder card and an honesty card with four refuses beside a dated notebook titled Science — still-life, no people, no logos.

Why this matters

A check at ages 11–14 is a skill object, not a score that follows an adolescent around the house.

Can they name what changed and what was measured for *this* trial? Can they turn a table into a graph into a sentence? Can they write or say a claim that points at the notebook? Can they catch a confound? Can they name one limit of a model? If Friday’s look still holds after a night, and they can show a skill two ways — oral and notebook — the week taught something. If it does not, you have a next move. That is enough.

This is worth the struggle because the wrong kind of check teaches the wrong kind of science. A vocabulary list trains name-first. A percentile sticker trains identity: “science kid” or not. A public quiz trains performance. An app that awards points for minutes trains sitting, not looking. A generated observation filed in a portfolio trains dishonesty. An AP free-response packet every Tuesday trains high-school theater, not middle looking. None of those is this book’s job.

Progress is local and showable. Last month they needed co-built “same” lists; this month they catch a two-change setup on the fair ladder without a hint. That is progress. It will not appear on a national science sample for homeschooled middle-graders that this book can quote as a cut score — and it does not need to.

There is no nationally published homeschool NAEP Science score for this age band that this book can turn into a kitchen cut score. Some states ask for tests in reading and mathematics, or for a narrative, or for a parent-written list of subjects. Those sittings stay in their lane. This chapter does not give legal advice. You read your own statute when you need to. The stranger who later opens a notebook wants **Science** work they can see — a dated page, a fair test note (what changed / stayed the same / can we tell for sure?), one CER sentence — not a brand, and never a course called Young Minds Science I.

Screening a skill is not an identity. An adolescent who cannot yet catch a confound today is not “not scientific.” They need a clearer “same” list, a fair ladder card, or one more redesign. You already know how to reteach a shoe pair. Use that kindness here.

Five-state texture once, in plain language — not legal advice. Texas and North Carolina patterns often do not name science as the tested subject. Pennsylvania shall include science in the program while grade-8 portfolio tests in that set focus

on reading and math. Virginia lets the parent write the subject list; evidence of progress is not a science exam. New York requires science in the lower grades and two units of science across grades 7–8. None of those patterns requires a course titled Young Minds Science I. Your kitchen check is still the notebook + fair test + CER sentence. Compliance sittings, when they exist, stay in their lane.

Sister manuals in other subjects use a dedicated short-assessment chapter so checks are not buried. This book does the same for science kitchen objects. Exit tickets in every chapter remain. This chapter is where the objects, diagnostics, honesty refuses, and done-enough language live together.

Kitchen skill checks are load-bearing in this book, not garnish. That is why this chapter is dedicated — the same grain as a sister assessment chapter in another subject, adapted for science looking. Exit crumbs still live in every teaching chapter. This chapter gathers the objects, the diagnostic wrongs, the progress charts without percentiles, and the done-enough language in one place.

Exit crumbs are still assessment. A sticky on Tuesday counts. Friday gathers two kitchen objects so the house has a rhythm: look all week, check short, name next practice, stop. You do not need a 180-day testing calendar.

The locked question for this chapter is how a check should feel:

“What can you show me two ways today — and what still needs practice?”

Two ways means the look is theirs, not a lucky nod. What still needs practice means the next hour already has a job. A diploma is not in the room. A path through middle-grades looking is — and that path is enough for this week.

For the parent: understand it yourself

Here is the everyday picture.

Friday night becomes a quiz. Twenty vocabulary words. Five “what is a scientist” sentences. A parent and an adolescent both get tight. The adolescent guesses. The parent hears “not ready.” The notebook gets a sad face. Next week the same list, louder. Or: a national percentile printout from a reading/math sitting gets copied onto a science identity.

Here is the precise picture.

Friday is short. Name IV/DV for a trial already on the table this week. Table → graph → sentence on numbers they measured. Claim–evidence–reasoning tied to those numbers. Rank three setups on a fair ladder (confounded / almost / fair) and explain. Name one model limit if a model was the week’s work. If they can show a skill two ways — say it *and* point at the notebook; rank *and* explain — you mark the dated page. If a miss has a reason you can use tomorrow, you keep the reason. You do not keep a label.

Done enough is local. An eleven-year-old who names change and measure orally and points at two rows is done enough for that check. A fourteen-year-old who redesigns a confounded try and writes a CER paragraph with a limitation is done enough for that check. Holding both to the same AP lab rubric is a different product.

When a program you already use includes chapter review questions, you may sit them as *listening and recall* inside that scope. They check whether a story was heard. They do not license a national rank. They do not replace the kitchen objects below. Label them as the program’s tools, not as a research trial of your kitchen.

Depth beats a coverage tour on checks as well as on lessons. A long vocabulary list leaves few traces. A small pattern — IV/DV for this trial, table→graph→sentence, claim that points, catch a confound, model limit — built slowly, is what the mind will keep. This is a useful study shape borrowed carefully, not a promise that every home will see the same result.

No CLEP as the default middle check. No AP. No athletic-eligibility lab language for a twelve-year-old. When the adolescent is older and the family needs those grains, open *Science for Homeschooling*. Then return here for the kitchen objects.

Wrong answers you should be able to hear

1. Percentile identity.

“This CER means you are in the top group.” Or: “This miss means you are behind the nation.”

What it usually means: a hope, or a reading/math compliance battery, got copied onto a kitchen science skill.

What you say: “This is a skill we can practice. It is not a rank.”

2. “Not a science kid.”

One blank table or one confounded try becomes a personality.

What it usually means: screening turned into identity.

What you say: “You mixed two changes. Tomorrow we try one IV only.”

3. Birthday lock.

“You’re 14, so you must write AP-length labs.” Or: “You’re 11, so you cannot fair-test yet.”

What it usually means: birthday placement replaced skill placement.

What you say: “We place by what you can show. Co-build the same list if looking is shaky. Redesign practice if you are ready.”

4. NAEP panic / CLEP-AP as middle default.

A grade-8 national sample, or a college exam, becomes Tuesday’s kitchen cut score.

What it usually means: the wrong object landed in the wrong band.

What you say: “Our check is the notebook and these skill objects. National samples and college exams are not this hour.”

5. Invented portfolio table or detector score as honesty.

A neat data table appears for a try that never measured — or a window grades “drainage took 42 s” as machine-written.

What it usually means: the portfolio wanted proof more than the student looked — or a fraud tool landed on a student’s sentence.

What you say: Refuse invent-data. Close the detector. Read the sentence yourself. Detectors fail. Looking is not a crime.

Five-to-eight-minute parent warm-up

Choose two kitchen skill objects for Friday. Prepare one diagnostic wrong (confound pride or invent neat rows).

Plan Monday’s isomorphic retest: same skill shape, fresh apparatus (new soil pair, new magnet distance, new insulation wrap).

Practice the locked opening aloud. Practice the second half kindly: “What still needs practice?” You are naming tomorrow, not a verdict.

Lay out tomorrow’s check pieces: sticky exit CER or fair ladder or error-pattern card or honesty card. Do the check yourself once as if you were the student.

How to teach it this week

A check week is still a Science Hour week. The try *is* the check. You do not add a second, colder hour titled Assessment.

Session shape (~25–45 minutes)

1. **Observe / frame (4–8 min).** A familiar try or a close cousin — not a surprise stack of new content.
2. **Plan (4–8 min).** Light; the check needs looking, not a lecture.
3. **Try / check object (10–18 min).** One kitchen object below — not a battery.
4. **Talk + record (6–12 min).** Two-ways evidence in the dated notebook. Locked opening.
5. **Exit crumb (2–5 min).** “What still needs practice?” Adult error-pattern note private.

Twenty-five-minute Friday: one sticky CER *or* one fair ladder *or* one IV/DV oral-and-page. Two ways on that one object. Stop.

Exact wording you can say

Opening, locked:

“What can you show me two ways today — and what still needs practice?”

Then wait.

Follow-ups:

- “Show me with the notebook.”
- “Show me orally.”
- “What still needs practice?”
- “Where should we place next week by skill — not by birthday?”
- “You may try the isomorphic cousin Monday. Same skill, new materials.”

If they freeze: “Pick one: name the change and the measure for Tuesday’s try — say it, then point at the headers.”

If they perform for a grade: “There is no percentile here. Show the skill two ways.”

Age-band moves

Ages 11–12. Kitchen objects lean oral + short write. Co-built “same” list acceptable on the fair ladder if they can explain after. Sticky exit CER (claim / one evidence / one reasoning word). Band placement soft: if they need co-built controls and oral CER, stay on 11–12 cards. Honesty card monthly.

Ages 13–14. Unconfounded design unaided on a familiar apparatus. CER paragraph that cites numbers. Error-pattern card names the fix for tomorrow. Band placement soft: if they redesign and write the paragraph, lean 13–14 bank picks — birthday does not decide. Still refuse AP FRQ as the weekly check.

Isomorphic retest (Monday after a miss)

Same skill shape. Fresh materials. If Friday’s confound catch failed on a drawn ramp, Monday uses cups and wraps — still “which setup changed two things?” If sticky CER was empty, Monday’s sticky uses yesterday’s real table only. You are not punishing. You are giving the skill another fair look.

What “two ways” can look like

Skill	Way A	Way B
IV/DV	Say change and measure	Write headers on blank table
Table→graph→sentence	Point at axes labels	Read the sentence that needs the graph
CER	Oral triangle	Written claim with number pointer
Confound	Rank fair ladder	Redesign plan one IV
Model limit	Say shows/leaves out	Sticky on the model

If Way A works and Way B does not, practice Way B on a familiar try — do not jump to a harder topic.

Private adult note (not for the fridge)

After Friday, write six words for yourself: pattern + Monday fix. Example: “Confound pride — ladder + redesign.” Keep it private. The student hears “still needs practice,” not a diagnosis speech.

First try-it for the student

AS-01 — Sticky Exit CER at the end of an ordinary hour: claim / one evidence / one reasoning word on a sticky. Stick on fridge or notebook.

Pair Friday with **AS-02 — Fair Ladder Check**: three setups drawn — confounded / almost / fair — student ranks and explains.

Kitchen skill objects (the load-bearing list)

Use these as the check menu. Pick two for a Friday. Not all six every week.

1. **Name IV/DV for *this* trial** — oral and written headers.
2. **Table → graph → sentence** — axes before points; one sentence that needs the graph.
3. **Claim that points at the notebook** — finger + words.
4. **Catch a confound** — fair ladder or redesign talk.
5. **Model limit** — “shows ____ / leaves out ____.”
6. **Honesty** — refuse invent-data / generated observation / worksheet dump / AP-as-weekly-spine.

This week, honestly

Focus move: two-ways check; diagnostic wrong; done-enough without percentile identity.

- **Monday–Thursday**: Ordinary Science Hours on one phenomenon (any prior chapter move). Exit crumbs as usual.
- **Friday**: AS-01 sticky + AS-02 fair ladder *or* AS-03 error pattern. AS-06 done-enough week checklist.
- **Monthly**: AS-05 honesty card. AS-04 band placement soft when you are unsure which bank grain fits.
- **Optional short transfer OUT**: museum exhibit CER as a check; park measure as transfer of table→sentence — not a field-trip packet.

Practice that actually builds learning

In-home try-its — AS bank

AS-01 — Sticky Exit CER

Time: 5–10 min end of hour. *Materials:* Sticky note. *Steps:* Claim / one evidence / one reasoning word. Stick on fridge or notebook. *The fun:* A tiny public record that is still theirs. *The skill:* CER crumb without quiz theater. *Exit:* The sticky is the ticket. *Error patterns:* Empty stickies; parent writing the sticky; graded quiz theater. *Safety:* None.

AS-02 — Fair Ladder Check

Time: 15–25 min. *Materials:* Three setups drawn: confounded / almost / fair. *Steps:* Student ranks and explains. Diagnostic: which error pattern (changed two; forgot same list; good). *The fun:* Being the judge of fairness. *The skill:* Catch a confound with reasons. *Exit:* Rank order + one reason. *Error patterns:* Lucky guessing without explanation; shame for wrong rank. *Safety:* None.

AS-03 — Error Pattern Card Middle

Time: 15–25 min. *Materials:* Card list: invent-data; force-as-fuel; caption-first; confounded proof; AP-spine; generated obs. *Steps:* Match a recent wrong turn to a pattern. Plan one fix for tomorrow. *The fun:* Naming the goblin. *The skill:* Diagnosis without identity. *Exit:* Pattern named + fix. *Error patterns:* Card as insult; skipping the fix plan. *Safety:* None.

AS-04 — Band Placement Soft

Time: 20–30 min. *Materials:* One FAIR + one CER task. *Steps:* If student needs co-built “same” list and oral CER, lean 11–12 cards. If designs unconfounded and writes CER paragraph, lean 13–14. Birthday does not decide. *The fun:* Permission to fit the work to the skill. *The skill:* Placement by showable work. *Exit:* Band note for next week’s bank picks. *Error patterns:* Age lock; pushing AP tasks to “advance”; holding back a ready student from redesign practice. *Safety:* None.

AS-05 — Honesty Card — Four Refuses

Time: 10–15 min. *Materials:* Card. *Steps:* Read: refuse worksheet dump; refuse invent-data; refuse generated observation as data; refuse AP-as-weekly-spine. Date in notebook. Revisit monthly. *The fun:* A house rule you can point at. *The skill:* Integrity as practice. *Exit:* Dated initials. *Error patterns:* Ignoring card when Friday is busy; replacing hour with AP FRQ packet “just this once” every week. *Safety:* None.

AS-06 — Done-Enough Week Soft

Time: 15–25 min Friday. *Materials:* Week’s notebook pages. *Steps:* Checklist: dated pages? one fair test or model? one CER crumb? one talk wait? one OUT or plan? Not 100%. Done-enough = honest attempts + records. *The fun:* Seeing a week that was real. *The skill:* Enough without perfection mania. *Exit:* Checklist with three yeses minimum or a repair plan. *Error patterns:* Perfection bar; quantity mania; inventing pages to check boxes. *Safety:* None.

Exit-ticket shapes (crumbs from every chapter)

Keep these short. They are not a second test.

- **IV/DV crumb:** “Today we changed ____ and measured ____.”
- **Stranger crumb:** “A stranger needs ____ in this table.”
- **Fair crumb:** “We kept ____ the same. Can we tell for sure? ____.”
- **Model crumb:** “Shows . *Leaves out* .”
- **CER crumb:** Claim + pointer + because.
- **Two-ways crumb:** Say it. Show the page.

Diagnostic wrongs (Friday menu — pick one)

1. **Name-first** — vocabulary before look. *Repair:* materials down; locked opening from ch01.
2. **Force-as-fuel** — unrepaired after a motion try. *Repair:* another look; PHYS-02.
3. **Confound pride** — “It proved it” after two things changed. *Repair:* AS-02 ladder; redesign once.
4. **Invent neat rows** — perfect table, messy trial. *Repair:* WRITE-06 / AS-05; keep messy numbers.
5. **Generated observation** — machine picture or paragraph as data. *Repair:* refuse; real try; Science Hour AI box.
6. **Demo with no record** — parent show, blank notebook. *Repair:* student measures next time; blank table first.
7. **Coverage hour** — three chapters, no phenomenon. *Repair:* one card next week; ch06 depth rule.
8. **Chatbot CER** — fluent paragraph, no trial. *Repair:* claim from *this* notebook only.

9. **Kitchen-as-Chemistry-credit** — fizz pictured as transcript Chemistry. *Repair*: change picture; title stays Science.
10. **Birthday lock** — age decided the bank. *Repair*: AS-04 showable work.

Progress without percentile identity

Keep a simple private chart if it helps you — not a wall of ranks.

Week of	Skill shown two ways?	Still needs practice	Next bank grain
(date)	IV/DV yes/no	confound catch	11–12 fair cards
(date)	CER pointer yes/no	axes before points	REC mix

No national cut score. No “science kid” column. Screening $\neq$ identity.

Out-of-home short transfer (not a packet)

Museum one-exhibit CER as check: Can they claim and point at exhibit evidence oral *and* write a crumb? Second-hand labelled.

Park measure as transfer: Distance/time or tree-height soft $\rightarrow$ table $\rightarrow$ sentence. Same craft, new place.

Refuse a scavenger worksheet dump titled “field assessment.”

Week plan (hypothetical, not a script law)

Focus: two-ways checks + diagnostic wrong + done-enough.

- **Monday–Wednesday:** Ordinary Science Hours on one phenomenon (fair test + notebook + CER crumb). Exit stickies as usual.
- **Thursday (25–35 min):** Light review try — isomorphic cousin of the week’s apparatus. AS-03 match a wrong turn if one appeared.
- **Friday (25–35 min):** AS-01 sticky from a real table. AS-02 fair ladder. AS-06 done-enough checklist. Private six-word adult note.
- **Monthly add-on:** AS-05 honesty card. AS-04 band placement when bank picks feel wrong for the skill.

- **Optional transfer:** Saturday museum CER as check *or* park table → sentence — fifteen to thirty focused minutes, not a packet.

Label **hypothetical**. A thin week may be Wednesday try + Friday AS-01 + AS-06 only. Honest thin beats fake thick.

Scripts for the locked opening

After they show way one: “Good — now the other way.”

If they only nod: “Nodding is not a way. Say it or show the page.”

After “still needs practice”: “Pick one skill word — confound, units, wait, claim pointer — not a story about yourself.”

If they ask for a grade: “We use done-enough and next practice. No percentile here.”

How this chapter relates to records

Kitchen checks feed the file you keep. The records chapter will say: dated notebook + fair test talk + one CER sentence + optional vendor review. Screening ≠ identity. No national diploma as the design center. This chapter builds the showable skills that make those records honest.

Talk box

Opening (locked):

“What can you show me two ways today — and what still needs practice?”

Follow-ups:

1. Observe — “What do you see in your record that proves you can do it?”
2. Record — “Show me on the page.”
3. Reason — “How do you know you can do it another way?”
4. Check — “What still needs practice — one skill, not a personality?”
5. Revise — “Where do we place next week by skill?”

How to wait: Slow three. Especially after “what still needs practice?” — do not rush in with your verdict.

Stuck silence usually means: they think “two ways” means a trick; they fear a rank; the check object was brand-new content; wait was zero; they are hunting the

answer you want. Soften: “Oral and notebook. Same skill.” Point at the week’s familiar try.

Composite illustration (not a reported family)

Friday, Sam (composite) ranks three insulation setups. Setup 1: different wraps *and* different start temperatures. Setup 2: same start, wrap vs bare, thermometer method differs. Setup 3: same start, same method, wrap vs bare only. Sam ranks 3 fairest, explains “only one change.” Parent asks two ways: oral rank, then finger on the drawing. Still needs practice: “I forget to check the thermometer method.” Monday isomorphic: soil bottles — same water, two soils, timer method held same. AS-06 shows dated pages, one fair test, one CER sticky, one wait — three yeses. No percentile sticker.

Sample fair-ladder prompts you can draw

1. Ramp: height changed + car changed / height changed only but one trial / height changed only, three trials, same car.
2. Dissolving: temp changed + stir changed / temp changed, stir same, different cup sizes / temp changed only, same cups, same stir.
3. Magnet: distance measured with phone “guess” / ruler used but barrier and orientation both changed / ruler, one barrier change, orientation same.

Student ranks and explains. You diagnose the pattern. No shame for wrong rank.

Vendor review questions (optional, labelled)

If your program includes end-of-chapter questions, you may sit five as listening and recall. Say aloud: “These check whether we heard the story. They are not a national rank. They do not replace the sticky and the ladder.” Then return to kitchen objects.

One incorrect example to diagnose

Percentile Friday.

Parent prints a practice “grade 8 science” multiple-choice set from a search. Ado-

lescent scores 60%. Parent says, “You’re behind.” Notebook from the real insulation fair test is ignored.

Miss: wrong object; identity from a score; kitchen looking erased.

Repair: AS-01 + AS-02 on *this week’s* apparatus. AS-06 done-enough. Say: “This is a skill we practice. It is not a national rank.” Optional vendor review questions may sit as listening — labelled — not as NAEP.

For the student

A check is a chance to show what you can do — two ways — and to name what to practice next. It is not a verdict on whether you are a “science person.”

What this idea is.

Two ways means you can say it and show it on the page (or rank and explain; or sketch and caption). If you can only nod, we are not done yet. “What still needs practice” is a to-do for next week, not a label on you.

Tiny worked example.

Skill: catch a confound.

Way one (oral): “Setup A changed ramp height *and* car weight — we cannot tell for sure.”

Way two (page): You circle two differences on the fair-ladder drawing and write “two changes.”

Still needs practice: “I rush the ‘same’ list — next time I write three sames before we start.”

Try 1. Sticky exit: claim / one evidence / one because from today’s or yesterday’s table.

Try 2. Fair ladder: rank three setups. Explain one reason. Or show IV/DV two ways for this week’s try.

Explain it back. Tell your parent one skill you can show two ways and one skill that still needs practice — without calling yourself names.

Done-enough week checklist (you can copy into the notebook).

- [] Pages dated
- [] One fair test or model
- [] One CER crumb (sticky counts)
- [] One talk wait that was real

- [] One OUT done or planned

Three yeses = enough for a busy week. Zero inventing pages to make boxes green.

Band placement soft — questions to answer with your parent.

- Do I need help building the “same” list? → lean 11–12 cards.

- Can I design an unconfounded try and write a CER with numbers? → lean 13–14 cards.

- Does my birthday disagree with those answers? → ignore the birthday for bank picks.

Challenge. Fill AS-06 for the week with honesty. Three yeses minimum — or a repair plan. Do not invent pages to check boxes. Date the honesty card (AS-05) if you have not this month.

You are allowed to miss a check and try an isomorphic cousin Monday. You are allowed to be eleven and write a strong CER, or fourteen and need a co-built same list for a week. Birthday does not decide.

If it isn’t clicking

Diagnostic 1 — Every Friday becomes a fight or a shame spiral.

What it usually means: check felt like identity; or too many objects at once.

Next move: One object. Two ways. Kind voice. Private adult note. No wall ranks.

Diagnostic 2 — They pass oral and blank the page — or neat the page and freeze orally.

What it usually means: one channel is carrying the skill; two-ways not yet.

Next move: Practice the weak channel on a *familiar* try. Scribe once if print is the bottleneck — labelled — then fade. Or require a finger on the page before oral credit.

Diagnostic 3 — Portfolio looks perfect; you never saw the try.

What it usually means: invent-data or tool-filled blanks.

Next move: AS-05. Redo one try together. Refuse generated results. Compare raw scratch to “final.”

Diagnostic 4 — You keep reaching for NAEP, CLEP, AP, or birthday rules.

What it usually means: anxiety about “enough” borrowed the wrong object.

Next move: AS-04 and AS-06 only for two weeks. Read your own statute separately if compliance is the real worry — that sitting is not this chapter. Pointer to

records chapter for titles a stranger can read.

Diagnostic 5 — Quantity mania: ten stickies, no real try.

What it usually means: checklist theater replaced looking.

Next move: AS-06 rule — honest attempts + records. One sticky from a real table beats ten empty ones. Delete invent-to-check-box habit with AS-05.

When to slow down: Looking/recording shaky — kitchen objects on fair test and table before CER paragraph length.

When to go ahead: Two-ways steady on IV/DV, confound catch, and CER pointer — add model-limit checks and redesign.

When to get a human tutor: Persistent panic around any check, or a learning difference that needs specialist support — a calm human who will put apparatus on the table beats a percentile mill.

Tools, including AI

Point back to the Science Hour AI box for the full allow-and-ban list.

You may: ask a tool for isomorphic practice cards with a **parent key** the student never sees; ask it to help *you* design three fair-ladder drawings; ask revision questions after *their* claim; diagnose work already produced (crop to paper; no face upload); ask for discussion questions you will vet before Friday.

You may not: photo-to-key a blank table during the check; invent a portfolio table; generate a “result” image as evidence of progress; detector-grade their sticky; print a certificate of science; hand them an agent as a testing partner; let a window write the done-enough checklist for a week that did not happen; park unsupervised chat as the check partner.

At 11–12 you hold the account. At 13–14 you co-hold and stay in the room. Turning 13 is not a licence. Unaided first on the skill that is the check. A detector score is not honesty. Looking is not a crime.

What “done enough” looks like

Before you treat assessment as a settled house habit:

- ☐ Friday used kitchen skill objects — not a percentile battery, not NAEP panic.

- ☐ Student showed at least one skill two ways this week.
- ☐ One diagnostic wrong named with a Monday repair — no identity label.
- ☐ AS-06 week checklist honest (three yeses or a repair plan) — no invented pages.
- ☐ AS-05 honesty card dated within the month.
- ☐ Placement note by skill (AS-04) when bands feel unclear — birthday does not decide.
- ☐ Optional short OUT transfer only — not a field-trip packet.

Life of the habit (not a ninth chapter): Revisit yesterday's IV/DV card. Mix last week's fair test into Friday's ladder. Stop while a look remains. Done-enough tips live here, in ch07, in the Science Hour rhythm, and in records. Do not invent a ninth teaching chapter titled "life of the habit."

Place by skill, not birthday. A path through middle-grades science looking is the promise. A diploma is not. A percentile is not. A culture-war win is not.

Titles a stranger can read: Science. Life Science / Physical Science / Earth Science only when the work is actually that. Never a brand. Never Young Minds Science I.

Revisit next Tuesday. Pull Friday's "still needs practice" line. Run the isomorphic cousin for fifteen minutes. Mix last week's IV/DV card into the warm-up. Stop while a look remains.

Records preview (one sentence). Short check for a stranger: dated notebook + fair test (what changed / stayed the same / can we tell for sure?) + one CER sentence + optional vendor review. Details live in the records chapter. Never a brand title as the credit line.

Done enough this week: one skill shown two ways, one honest "still needs practice," and a notebook that matches what really happened. You can check another skill next Friday. You do not owe a national cut score.

Chapter 9 — Records



Figure 11: An open Science notebook, a pencil, and a library postcard — still-life, no diploma seal, no brand.

You do not need a national diploma for ages eleven to fourteen. You do need a file a stranger can read — if anyone outside your kitchen ever asks.

That file is ordinary. It is a **dated notebook** with a fair test written in plain words and one short claim that points at the page. The title on the outside, when a title is needed at all, is **Science**. When a whole season of work truly is life, physical, or earth looking, you may write **Life Science**, **Physical Science**, or **Earth Science**. You do not write a brand. The title is never *Young Minds Science I*.

This chapter is the life of the habit as *the file you keep*. The Science Hour and Chapters 7 and 8 already carry the weekly rhythm. Here you learn what to call the year, what to put inside the notebook, and how five common state maps touch middle-grades science without turning your kitchen into a law office.

What to write on the outside

Print these nouns, and only these, if someone needs a subject name:

- **Science**
- **Life Science**, **Physical Science**, or **Earth Science** — only when the year's work is actually that band

That is the whole locked list for this age. Reading, mathematics, history, art, music, and physical education sit beside science on a family list when your state wants a list. They are neighbors. They are not substitutes for a fair-test notebook when the work was looking and claiming.

Materials can live in a notes column: the book you read, the kit box you opened, the library stack, the museum postcard. The **credit line** stays Science — or Life / Physical / Earth Science when accurate. “We used a published middle program” is honest. Putting the program's product name in the credit line is not how a stranger maps the year.

Prefer Life Science, Physical Science, or Earth Science over a catalog's “General Science” when the substance matches. Ordinary U.S. middle-school usage already understands those three nouns. A catalog title can stay in your materials note.

Computer science, coding apps, and build-only kits are neighbors. A robot hour can be wonderful and still need its own honest label if anyone asks. Health, when a statute names it beside science, is still not a substitute for Science when the work was insulation trials or cell looking.

The short check that travels

Assessment at eleven to fourteen, for this book, is a **short check**, not a national score.

Keep four objects together:

1. **Dated notebook** — date; materials; enough procedure that a stranger could repeat the try.
2. **Fair test talk** — what changed on purpose; what stayed the same; can we tell for sure?
3. **One CER sentence** (or a short CER paragraph at thirteen to fourteen) — claim about what happened; evidence from *this* notebook; reasoning that links them.
4. **Optional chapter review** from a published program — useful as practice, not as a percentile promise.

Drawing and living-or-not checks may still help a child at the young edge of the band. They are not the default middle check once the child can name a change and point at a table.

Here is a composite illustration — not a reported family, not a normed score:

17 Sep 2026. Fair test: insulation wrap vs bare cup. Temp drop after 10 min. Changed: wrap. Same: water volume, start temp, cup size, room. Claim: wrap slows heat loss. Evidence: wrap cup fell 2° vs bare 8°. Reasoning: less heat transfer when air is trapped. Limitation: only two cups, one trial.

That paragraph is a **record shape**. It travels to a portfolio log, a quarterly note, or a later high-school planner without needing a seal. A brand name does not improve it. A percentile does not improve it.

Screening is not identity. A child who cannot yet write a clean CER sentence is not “not a science kid.” A child who confounds two variables once is not behind forever. The check finds the next teaching move — another look, a blank table, a redesign once. It does not mint a label.

You do not need CLEP, AP, or athletic-eligibility paperwork as the year’s main check at this age. When that day arrives, open *Science for Homeschooling*. Then come back to the notebook.

Why the pond matters — and what it does not prove

About **3.4 percent** of U.S. school-age children — roughly **1.765 million** — were homeschooled in 2022–23 (NCES Parent and Family Involvement First Look, 2024-113). Instruction at home that mixes homeschool *or* full-time virtual was a larger figure; that larger figure is not the homeschooled rate. In the middle cell that matches this book’s band, about **3.0 percent** of sixth-through-eighth-grade equivalents were homeschooled. Those numbers describe how large the pond is. They do not tell you which kit to buy. They do not create a national diploma.

The last published NCES subject-taught table set with science detail is the 2016 Parent and Family Involvement survey. It does **not** give one overall “science” percent the way some other subjects appear. It gives **sub-subjects**. For grades **6–8 that year**:

- scientific inquiry or experiments — **45 percent**
- earth sciences or geology — **54 percent**
- biology — **33 percent**
- chemistry or physics — **16 percent** (NCES flags that cell with a caution)

Those are the honest middle science rows this book can quote. Inquiry and earth science were the thick objects. Biology was already in the thirties. Chemistry or physics was still a minority *that year*. Social-studies percents from another subject are not science rows. A 2016 share is a snapshot, not a promise that every home in 2026 looks the same.

This is a useful survey snapshot, not a promise that your kitchen will match the national cell. Then teach.

Many readers of this manual are not in the homeschooled pond at all. They teach after school, on weekends, or at a kitchen table beside enrolled schoolwork. The record shape still fits. The state map below is mainly for families who home educate under state rules. The notebook habit helps both.

Five states — a map, not legal advice

Homeschool law is a **five-state pattern** in this book: Texas, North Carolina, Pennsylvania, Virginia, and New York as opened examples. It is not a fifty-state treatise. Read your own statute, regulation, and department page. This chapter is not legal

advice.

Texas. The opened TEA pattern restates *Leeper*: bona fide instruction with a written curriculum in reading, spelling, grammar, math, and a course in good citizenship. The word **science** is not on that list. A Texas middle-grades year can lawfully include science every day — and still needs no brand as a credit. The state does not award a homeschool diploma. If a receiving school asks later, the work under Science (or Life / Physical / Earth Science) is what travels, not a product name.

North Carolina. Notice, a qualified instructor, nine calendar months, and an annual nationally standardized test in English grammar, reading, spelling, and mathematics. **Science is not on the test list.** The department does not prescribe a science curriculum. Choose an ordinary school name; do not name the homeschool after a curriculum brand. A co-op or tutor hour can be lawful without turning the packet title into the credit line.

Pennsylvania. Elementary **shall include** science. Secondary **shall include** science; biology and chemistry *may* be included at the supervisor's discretion. Portfolio tests in grades 3, 5, and **8** are in reading/language arts and mathematics — **not science**. Grade 8 sits inside this age band for many families. A dated science notebook can live in the log. It does not become a required extra science test. Time rules cover the program as a whole; there is no invented science-minutes number here.

Virginia. Notice; the parent writes a **list of subjects**. There is no required-course list that names Science for you — you write the list. Listing Science, Life Science, Physical Science, or Earth Science is the ordinary middle line. Evidence of progress (composite scores, certain test paths, or an evaluation letter) is not a science exam and not a kitchen CER substitute.

New York. Grades 1–6 include science among required subjects. **Grades 7–8** require **science (two units)** cumulative, with the other named subjects. The individual home instruction plan lists syllabi or materials. Quarterly reports describe what was covered. Annual assessment follows the regulation. No local diploma is issued for home instruction. Later high-school lab-evidence rules are not the design center for ages eleven to fourteen.

Across these five: none requires *Young Minds Science I*. None requires a brand as the credit line. Some name science; some do not. Some test reading and math inside the band; none of those sittings measured your insulation trial. A book that claims “homeschool law requires lab science for every sixth grader” is false as a

national sentence and false as a *lab* mandate in every opened state above.

Two readers, when anyone asks

Often there is still **no college-facing transcript** at this age. There may still be two kinds of readers:

1. **The state**, in a thicker jurisdiction — a plan, an affidavit, a portfolio, a reading/math sitting.
2. **A later stranger** — a receiving school, a future high-school transcript planner, sometimes dual enrollment near the top of the band.

Compliance is not a science diploma. A thick Pennsylvania portfolio can be lawful with science samples in the log and a grade-8 reading/math sitting. A quiet Texas year can be lawful with little or no file, provided bona fide *Leeper* subjects are happening. Neither fact is a reason to skip fair tests. Both are a reason not to fake a credit.

“With Lab” is usually the wrong default object here. Kitchen fair tests and notebook CER sentences are looking, trying, and claiming. They are not a high-school Biology-with-Lab claim. Keep middle titles readable without the lab suffix unless you are already building a high-school transcript *and* the work matches that claim — care that belongs in the older book.

Informal learning does not arrive labelled “Science, 1.0, B+.” A library hour, a creek look, and a kitchen trial still happened. If a thicker state later wants a log, translate: name the task, name the materials, date it, keep the CER. The translation is paperwork. It is not a verdict on the creek.

Combining materials without renaming the year

A family may read a conversational middle text on Monday and still run this book’s fair-test Hour on Friday. A family may use a free digital life-science chapter and still need a blank table the student fills. A family may open a kit box and still refuse an invented neat table when the trial was messy.

Combine honestly. The materials line can sit in a notes column or a portfolio description. The stranger-readable title is still **Science** — or Life / Physical / Earth

Science when the year's substance is that band. Do not put the product name in the credit line.

Three composite title choices (illustrations, not reported families):

- A season of plant light trials, biodiversity soft looks, and cell models → **Life Science** (or Science).
- A season of ramp surfaces, density measures, insulation wraps, and particle pictures → **Physical Science** (or Science).
- A season of moon-phase logs, soil trays, weather tables, and rock-and-water looking → **Earth Science** (or Science).

If the year mixes all three with fair tests as the spine, **Science** is the cleanest single noun. Split titles only when the work truly splits.

The file you keep — life of the habit

You already practice the habit in the Science Hour: revisit yesterday's IV/DV card; mix last week's fair test; stop while a look remains. Chapter 7 and Chapter 8 carry talking, writing, and short checks. This chapter's piece is simpler: **keep the pages**.

A binder, a composition book, or a shared folder works. Date every try. Leave blank rows when the trial was short. Write the CER from the notebook, not from a fluent screen summary. When you use a published chapter quiz, label it as practice from that program — useful, not a national score.

There is no nationally representative study of daily homeschool science minutes for this band opened for this book, and no homeschool NAEP Science lock for ages eleven to fourteen as a kitchen cut score. Regular looking plus one fair test and CER on a named schedule is an honest dose. It is not a subject percent NCES measured.

Place by skill, not birthday. An eleven-year-old may still need spoken fair-test talk before a written CER. A fourteen-year-old may already write a short paragraph with a limitation. Vendor age labels are starting guesses. Moving “down” into review is not a shame label. Moving “up” because a box says grade eight is not required when the child cannot yet name what stayed the same.

What “done enough” looks like for the file

You are done enough for this chapter’s job when:

- You can name the year **Science** — or Life / Physical / Earth Science when accurate — without a brand in the credit line.
- The notebook holds dates, materials, what changed, what stayed the same, and a claim that points at the page.
- You know that screening a skill is not labelling a child.
- You know your state’s map well enough to open the real page — and you know this chapter is not that page.
- You are not using CLEP, AP, or athletic paperwork as the default middle check.
- You can revisit next Tuesday’s fair test without needing a diploma ceremony to feel finished.

Keep the file. Keep looking. The habit is the notebook you can open next week — not a ninth teaching chapter, and not a seal.

Chapter 10 — Resources



Figure 12: A library card, a museum postcard, a generic book spine with the title unreadable — still-life, no logos.

You do not need a ranked top ten. You need a **fit**: parent load you can sustain, a worldview you can live with, a placement that matches fair-test and CER skill, and

a cost shape your household can keep.

Start with what many families already use — a library card, a museum or historical-site day, a zoo or aquarium visit, a yard or creek look. Those are the **\$0 first** path. Then, if you want a published spine, choose middle-grades programs by fit, not by a crown. Titles you write for a stranger stay **Science** (or Life / Physical / Earth Science when accurate). Materials stay in the notes column. Chapter 9 holds the record shape; this chapter holds the menu.

Omit sticker prices here. Prices move. Fit notes age better than a cart screenshot.

Library, museum, and nature — \$0 first

Before a catalog, open the free path.

In 2022–23, among households in the Homeschool row of NCES’s activities table, about **53 percent** had visited a library in the past month (against about **29 percent** of all K–12 students). About **43 percent** had visited an art gallery, museum, or historical site (against about **23 percent**). About **28 percent** had visited a zoo or aquarium (against about **21 percent**). Those are outing neighbors, not achievement scores. They license a plain teaching sentence: library, museum, and nature looking are ordinary tools in this pond — and they are available to after-school kitchen tables too.

In the older 2016 subject-and-sources tables, about **61 percent** of sixth-through-eighth-grade homeschool households used the library as a source of curriculum and books. That is a different question in a different year from the past-month visit cell. Keep them separate. Both point the same direction: the free shelf is real.

Library hour (middle grain). Find two sources on this week’s phenomenon. Name them. Write one CER sentence from a try or from what the sources claim and what evidence is missing. At eleven to fourteen this is often a **research** hour, not storytime as the default. A library earth-science trade book plus a dated notebook is science work. It is not a franchise.

Museum or historical-site hour. One exhibit. One claim the exhibit supports. One piece of evidence that is missing. Photograph nothing you are not allowed to photograph; draw or note instead. A natural-history hall, a science-center floor,

or a planetarium show is a looking hour. It is not a transcript line by itself. The notebook that follows it can be.

Nature hour. Zoo or aquarium when that is your free or low-cost day; yard bird list; sidewalk crack plant survey; puddle after rain with one fair-test question; stream edge soft with an adult. Outdoor looking has ordinary care — weather, traffic, water edges, plants that must not be tasted, insects that sting. Free is not the same as unsupervised.

A research hour, a gallery walk, a zoo visit, or a creek look is not a credit by itself. The dated fair test and CER that follow can be. Library, walk, museum, kitchen, and yard *are* practice. They do not replace the fair-test-with-notebook move.

Nature study and living books remain a **method**, not a brand. Outdoor looking and narration sit beside many families' weeks without buying a named program. At this age the notebook wants more than a caption: a fair-test talk and a short claim with evidence. You can use the method without a franchise.

Kitchen-table science is still science. An insulation wrap versus bare cup is looking. A plant trial with one deliberate change is a fair test. A weather or earth-materials table is earth looking. None of those is a Chemistry credit. All of them can be dated and named if a thicker state later wants a log. Keep the safety spine from the Science Hour: adult present for heat, electricity, outdoor water, chemicals, and glass; household-safer materials when a chemical is needed at all; no unauthorized mixing; living things — care, return, wash hands. Curiosity is not a permit.

Cost shape without a fake average. The \$0 path is a card, a free museum day or library pass where it exists, a zoo free day where it exists, a yard, and a cupboard. The paid path is a printed program, a kit box, or a dashboard subscription. Fit includes what you can sustain. It does not include a made-up “average family spends this much on science” claim. That is why this chapter skips list prices.

In the 2016 who-teaches tables for grades 6–8, mothers were the main providers in most homeschooled households; tutors and co-ops appeared for a real minority. Formal curriculum was common; a smaller informal cell was real too. Treat those as a snapshot of who sits at the table, not as a staffing rule for your kitchen. A co-op science hour can be wonderful. It still does not convert the packet brand into the transcript title. Where a homeschool title is needed, write **Science** or Life / Physical / Earth Science.

How to read the list below

Each paragraph says what the publisher or organization describes, plus a fit note. None is crowned. A chapter review quiz is practice from that program — not a certified kitchen trial of “which brand wins.” Worldview is named because choosing science at home often includes choosing a worldview whether you admit it or not. This book names the fit and teaches the idea on the table. It does not pick a church. It does not pick a culture war.

Parent load is a fit variable. A scripted teacher guide fits a parent who wants the next step written down. A conversational student text fits a parent who will read along and coach the CER. Short open-and-go lessons fit a parent who wants pacing already decided. A library bag fits a parent who will not buy a box this month. Keep the child’s hands on the materials and the child’s voice in the claim.

High-school Biology–Chemistry–Physics paths, Launch for older teens, college OpenStax texts, athletic-eligibility lab language, AP, and CLEP belong in *Science for Homeschooling*. Elementary picture-book and Grammar-stage banks belong in *Science for Little Thinkers*. One pointer each. Then stay here.

Apologia — General Science / Physical Science

The publisher describes a Christian conversational curriculum written to the student. Middle titles commonly named for this band: **General Science** and **Physical Science**. Hands-on work with household items is encouraged in publisher copy. Looking and trying still want an adult present and a notebook. A reading-only season is reading; a fair-test season needs evidence that trying happened.

Fit: a Christian family that wants student-facing narrative science at middle grain. Not a fit if you need a secular text. Transcript title: **Science** or **Physical Science** when the substance is that band — not the product name as the credit line. High-school Biology, Chemistry, Physics, and neighboring advanced titles are the older book’s objects.

Elemental Science — Logic Stage

The publisher describes classical Grammar / Logic / Rhetoric stages. **Logic Stage** programs are the middle object: Biology; Earth Science and Astronomy; Chem-

istry; Physics for the Logic Stage. Physical Science appears as a neighboring middle product line on opened navigation. Teacher guides, notebooking, demonstrations, and reading are the method grain. Grammar Stage belongs with younger ages. High-school Biology–Chemistry–Physics stay fenced.

Fit: a classical homeschool that wants doing, reading, and writing-it-down at middle grain, with more structure than a picture-book year. Still a curriculum, not a lab safety plan. Transcript title: **Science**, or Life / Earth / Physical Science if the year’s work truly matches.

Real Science-4-Kids — Books 5–7

The publisher describes an atoms-first K–8 system. **Books 5–7** are the middle band for this book. Books 1–4 and younger dashboards belong with *Science for Little Thinkers*. Lessons are often described as short sittings across a few days each week; treat pacing as publisher guidance, not a national minutes study. Experiment kits are named for some books on opened pages; availability changes — check the current page rather than a frozen list here.

Fit: a middle-grades family that wants secular-leaning, atoms-first science with short lessons and optional kits. Transcript title: **Science** or Life / Physical / Earth Science by substance — not a book-number credit line.

BJU Press — Life / Earth / Physical Science

The publisher describes middle titles that already match stranger-readable nouns: **Life Science, Earth Science, Physical Science**. Biblical worldview framing, including young-earth framing on opened neighboring pages, is part of the product — label it when worldview is your fit variable. Textbook and video-course kit paths exist on neighboring homeschool pages.

Fit: a Christian family that wants a traditional textbook look and optional video, often already using the same publisher for other subjects, with titles that map cleanly to Life / Earth / Physical Science. Transcript title: those nouns — never the publisher name as the credit line.

Home Science Tools — Science Unlocked Accelerate

Home Science Tools describes Science Unlocked as an all-in-one kit curriculum. **Accelerate** covers upper elementary through middle (grades 3–7 as the vendor labels it) — this book’s edge. **Wonder** is younger. **Launch** (8–12) is the older edge; do not treat Launch as this book’s default spine. Each kit typically includes a teacher’s guide, student workbook, and activity materials. Publisher FAQ language describes NGSS alignment and a stance that does not dictate a philosophical or religious worldview. Inclusive language is part of the product copy.

Separately, the same store sells kits and supplies for other brands. Supply convenience is not a curriculum rank.

Fit: a family that wants secular-leaning, materials-in-the-box science with less supply hunting at the upper-elementary / middle edge. Not a fit if you refuse NGSS-aligned framing. Transcript title: **Science**, not a year-tab as a credit line.

CK-12 — Life / Physical / Earth Science

FlexBooks are described as free, online, customizable digital textbooks. Life / Physical / Earth Science titles match the locked stranger-readable nouns. Simulations may appear as features; they can illustrate. They do not replace a real fair test when the skill is controlling variables in the room. For ages eleven and twelve, keep child logins off by default unless you have read the operator’s under-thirteen policy; library books and a notebook need no child account.

Fit: a secular or mixed-worldview family that wants free adaptable texts whose titles already match the locked list. Not a packaged lab kit. Transcript title: Life / Physical / Earth Science or Science by substance.

Berean Builders — chronological titles

The publisher describes Christian science by Dr. Jay Wile, with chronological titles from early elementary through later middle and neighboring listings. Hands-on work is described as woven in. Exact which title lands at ages eleven to fourteen for *your* child is **placement by skill**, not a birthday rule. Check a current scope page before you assign a year. High-school Discovering Design titles are the older book’s objects.

Fit: a Christian family that wants chronological science stories with experiments woven in and is willing to place by reading and fair-test skill. Worldview is part of the product. Transcript title: **Science** (or Life / Physical / Earth Science if accurate), not the book subtitle as a credit line.

Combining honestly

You may use a conversational Christian text as a spine and still run this book's fair-test Hour on Friday. You may use free digital chapters and still need a dated notebook. You may use a kit box and still refuse invent-data and generated "result" images. You may live mostly on library / museum / nature and still write Science on the outside when a title is needed.

Combine without crowning. Put materials in the notes. Keep the credit line ordinary. Multi-age kitchens are common: a younger child and a fourteen-year-old can share apparatus with different notebook expectations. The title still follows the work.

Place by skill, not birthday. Vendor age bands (middle General / Physical Science; Logic Stage; Books 5–7; Accelerate 3–7; Life / Earth / Physical textbook years; chronological titles) are starting guesses. An eleven-year-old consolidating spoken fair-test talk may need a lighter text and more oral CER. A fourteen-year-old already writing a short CER paragraph with a limitation may be ready for denser Physical Science reading. Moving into review is not a shame label. Jumping ahead because a box says "grade eight" is not required when the child cannot yet name what stayed the same.

Informal learning — kitchen, garden, museum, outdoor looking without a purchased spine — is a named practice in some homes. It is a poor match for a plan that must list syllabi unless you translate lived science into a course title after the fact. The translation is work: name the task, date it, keep the CER. The library, museum, and nature hours above stay available to both the formal and the informal.

No opened national survey ranks these programs inside the homeschooled pond. Sales copy is not a census. "Award-winning" is organization or award-committee language — useful as a breadcrumb, not as this book's ranking.

Digital caution in one breath. Ages eleven to twelve are still under thirteen for commercial child-directed services. Prefer objects that need no child login when

you have not read the operator's policy. Ages thirteen to fourteen are off that bright line; co-hold and stay in the room remain this house's rule. A login is not a science year. Tools, if any, stay parent-hosted and point back to the Science Hour AI box — unaided first on looking and measuring; no invent-observation; generated image is not data.

What this chapter will not do

It will not invent a national minutes claim. It will not invent 2026 list prices. It will not pretend a kitchen fair test is automatic high-school lab credit. It will not send a parent of a twelve-year-old to AP, CLEP, or athletic paperwork as the year's main check. It will not dump every PE code from a standards document as your weekly spine. It will not reprint elementary banks with longer words or reprint the grades 1–12 high-school chapter under a new cover.

When Klahr's control-of-variables classroom trial, NGSS middle moves, or the Framework are named elsewhere in this book, they are labelled classroom or standards origin. They are maps for teaching moves. They are not a kitchen randomized trial of Brand A versus Brand B.

A plain choosing card

Ask yourself, once, before you buy or renew:

1. Can we sustain the parent load this week — not in a fantasy month?
2. Does the worldview on the page match what we are willing to teach out loud?
3. Is placement by **skill** (fair test + notebook + CER), not by birthday or a grade stamp alone?
4. Have we tried the **\$0** path this month — library, museum or site, nature — before we assume we need another box?
5. Will the stranger-readable title stay **Science** (or Life / Physical / Earth Science), with materials in the notes?

If the answers are clear, pick one spine or none, put a blank table on the table, and look. Fit is enough. A crown is not required.

What “done enough” looks like for choosing

You are done enough for this chapter when:

- You have used or scheduled at least one **\$0** looking hour this month — library, museum or site, or nature — and know how a notebook CER follows it.
- You can name one published option that fits *your* load and worldview, or honestly name “library bag this season,” without needing a ranked winner.
- You know which high-school and elementary objects are fenced to sister books.
- You can combine a spine with this book’s fair-test Hour without putting a brand in the credit line.
- You omit price bragging and percentile promises from the choosing talk.

Then stop shopping for a while. Put materials down. Ask what changed and what stayed the same. Let the adolescent point at the page. The resource that matters most is already in the room: a blank notebook, a fair question, and time to look.

A Note on Sources

Studies named in the chapters are listed in Notes, in one series at the back. That is where the full citations live, so the teaching pages can stay a teaching voice.

Some items the research behind this book did not open stay out of the teaching voice. I did not invent a coefficient, a statute, or a product feature to fill a hole. If a study is in the chapter, it is in the notes. If we could not open it, it is not used as a finding here.

Program hours, credit claims, and product descriptions in the resources chapter are taken from the companies' own pages. Access date 17 September 2026.