

Substitute Guide: Physical vs. Chemical Changes

Course: Integrated Physics and Chemistry (Grades 9–12) **Subject:** Science **Time:** ~50 min standard · ~90 min block Science

Learning goal (plain language)

Students learn to tell a **physical change** (a change in state, shape, or size with **no new substance** — like melting or dissolving) from a **chemical change** (a reaction that forms **one or more new substances** — like burning or rusting), and to use the **signs of a reaction** — gas/bubbles, color change, temperature change, a precipitate, or light — as **evidence**. Working alone with a pencil, students read a short passage, study a particle-model diagram, analyze a table of described changes and their observations, classify and justify each, and write an evidence-based explanation (CER). **You do not need a science background to run this.** Everything students need is printed in their packet. This is a **paper** activity — no lab, no materials, no hazards; nothing is mixed, heated, or measured.

Standards alignment

Framework: 19 TAC Chapter 112 (Integrated Physics and Chemistry). Knowledge & skills on **changes in matter and evidence of chemical reactions**.

- **Provisional — physical vs. chemical change:** distinguish physical changes (state, shape, size; no new substance) from chemical changes in which one or more new substances form.
- **Provisional — evidence of a reaction:** recognize signs that a chemical reaction has occurred, such as gas production, color change, temperature change, precipitate formation, or emission of light.

Provisional — pending educator verification against the current official TAC source. No section number or code letters are asserted here; they are to be confirmed.

(Standards are paraphrased here, not quoted. Please confirm the section and wording against your official source. This packet does not claim formal alignment to the TEKS.)

Setup Before class (5 min)

- Count and hand out one **student packet** per student.
- Confirm each student has a **pencil**. No calculators, computers, or lab items are needed — there is no math and nothing to mix or measure.
- Write the date on the board and remind students to fill in the name line.
- Keep the **answer key** with you — it is a separate file and is **not** in the student packet.

Materials What's needed

- Printed student packet (4–6 pages) per student.
- Pencil per student.
- This guide and the separate answer key (teacher only).
- No technology, no calculator, no lab equipment, no chemicals, no safety hazards.

Timing Suggested pacing — standard vs. block

Segment	Standard (~50 min)	Block (~90 min)	What students do
Start — Notice & Wonder	5 min	5 min	Q1–Q2 warm-up
Build — Read the science	8–12 min	12 min	Read passage, word bank, particle-model diagram; Q3
Apply — Use the data	20–25 min	25 min	Table 1; Q4–Q8 (classify & justify, strongest sign, trap check, observation vs. inference, look-alikes)
Explain — CER	7–10 min	10 min	Q9 borderline case (claim/evidence/reasoning); block adds the conservation-of-mass paragraph
Close — ACE	5 min	5 min	Articulate / Connect / Extend
Continue — early finishers	optional	+30 min	Build a sorting table; block adds the sealed-bag evidence-test plan

On a **standard ~50-minute** period, the core stops after the CER (Q9) and ACE; the early-finisher sorting table is optional. On a **~90-minute block**, everyone also writes the **conservation-of-mass** addition to Q9 (why a tarnishing spoon gains mass while a burning candle loses it, yet both obey conservation of mass) and completes the sealed-bag evidence-test plan.

Script Read aloud to start

"Today's assignment is a paper science investigation called *Physical vs. Chemical Changes*. You will work by yourself with just a pencil — no computers or calculators, and nothing to build, mix, or measure. First read the short passage and study the diagram that shows tiny particles before and after a change. Then look at the table: it describes six changes and gives you the observations someone already recorded, so you don't have to do any experiments. Your job is to decide whether each one is a **physical** change (same substance — just melting, dissolving, or changing shape) or a **chemical** change (a new substance forms, like rusting or burning), and to point to the **evidence** that tells you. Answer the questions in order; if one is tricky, skip it and come back. Write in complete sentences where it asks you to explain. You may quietly read the passage aloud to yourself. Put your name, class period, and date at the top now. You have about 50 minutes (or the full block); raise your hand if you need help understanding a word."

Support When students ask for help

- **You may read any part aloud** to a student or the class.
- If they are unsure "physical or chemical," point them to the one key question: "**Did a new substance form?**" — and to **Figure 1** (same particles vs. new particles).
- Remind them a single sign is a **clue, not proof**: boiling bubbles and paint-mixing color changes are physical. The reference box lists this.
- Encourage the printed **sentence stems** for the CER (Q9) and ACE sections.
- Do **not** give answers; prompt with "What did the observation say?" or "Could you get the original substance back?"
- It is fine if a student cannot finish the optional early-finisher or block task.

Access Accommodations & language support

- **Read-aloud** of any passage or question is allowed for all students.
- Point students to the **sentence stems** and the **Word Bank** (definitions provided).

- Extended time is fine; the core can stop after Q9 if time runs short.
- Students may answer in phrases if writing full sentences is a barrier, as long as they name the evidence.
- The packet is grayscale-safe — it prints and reads clearly in black and white; the particle diagram uses patterns (dots, hatching, solid) and labels, not color.

Tools Allowed & not allowed

Allowed: pencil, the printed packet, quiet self-read-aloud. **Not needed / not allowed:** calculator (there is no math), phones, computers, lab materials or chemicals.

Collect at the end: Collect every packet, whether finished or not, with names on them. Stack them for the teacher. Note on a sticky how far most students got and any questions that caused confusion.

Answer key: The **answer key is a separate file** (answerkey.html) and is for the teacher only. Please do not hand it to students.

Teacher follow-up (for the returning teacher)

Watch for the two highest-value misconceptions: students thinking *dissolving or melting is chemical*, and thinking *any bubbles or any color change means a chemical reaction*. A quick next-day discussion contrasting boiling water and paint-mixing (physical) with rust and burning (chemical), and returning to the particle model (same particles vs. new particles), would reinforce this well. The classify-and-justify item (Q4) and the CER (Q9) responses show who can cite **evidence** rather than just guess a label; the observation- vs-inference item (Q7) shows who can separate what was recorded from what was concluded.

HS_IPC_PhysChemChange_01 — Physical vs. Chemical Changes Substitute Guide