TEACHER EDITION

PREP · KEYS · QUESTIONS
STANDARDS · SCAFFOLDS
GRADES 5–8 CORE · K–16 ADAPTABLE

CER & ACE Case Files

OBSERVE. TEST. EXPLAIN. EXTEND.

Five hands-on cases, one reasoning routine, and two response formats. Each case is a Page 1 investigation plus your choice of a Page 2 response: **CER** or **ACE**.

01	**Mystery Mixture**	Physical properties and separation
02	**Density Deception**	Mass, volume, and relative density
03	**State Detectives**	Melting, condensation, and evaporation
04	**Magnet or Mimic?**	Magnetic properties
05	**Conductor Clues**	Electrical conductivity

ABOUT THE STANDARDS IN THIS GUIDE
This guide treats standards matches carefully: direct matches are separated from prior-grade bridges and extensions. Confirm local pacing, materials, accommodations, and laboratory safety rules before use.

Quick Start

One routine, five cases, two reasoning choices

BEFORE THE FIRST CASE

Run the completed density example before the first investigation. Students see what counts as an observation, data, and explanation. Then print Page 1 plus either CER or ACE for the case you want to use.

FOUR MOVES TO RUN IT

01

Choose the response

CER fits formal argument-from-evidence practice. ACE fits reflection, connection, and transfer. Both require Page 1 evidence.

02

Prepare one evidence tray

Keep sample amounts small. Test every setup before class. Put only the materials students need on the tray.

03

Assign case roles

Use evidence manager, recorder, skeptic, and reporter. Rotate roles across cases.

04

Debrief the reasoning

Ask which result changed a first idea, which explanation was ruled out, and what remains uncertain.

WHAT CHANGED IN THIS EDITION

- Coordinated, original case visuals with layout-added text
- State-change case uses melting, condensation, and evaporation only
- Low-voltage circuit includes a troubleshooting check before classification
- Standards table distinguishes direct matches from bridges and extensions

WHICH RESPONSE FORMAT

USE CER WHEN

Use CER when students need a formal scientific argument. They state a claim, cite specific evidence, and connect that evidence to a science idea.

USE ACE WHEN

Use ACE when you want to hear more of the student's thinking. Students articulate what they learned, connect it to prior knowledge, and extend it with a prediction, application, or new test.

Standards Planning Map

Direct matches are labeled; bridges and extensions are not overclaimed

GRADE BAND

Core packet level: grades 5–8. Adapt the writing demand, instruments, precision, and analysis for younger students, high school, or introductory college courses.

CASE	TEXAS CONNECTION	NGSS CONNECTION
01 **Mystery Mixture**	**Direct:** 5.6B and 6.6B, mixture properties	**Practice:** 5-PS1-3; add material identification for the full PE
02 **Density Deception**	**Direct:** 6.6D; Grade 5 bridge: 5.6A	**DCI connection:** MS-PS1.A; 5-PS1-3 excludes density
03 **State Detectives**	**Content:** 6.6A; add particle comparisons for the full SE	**Phenomenon:** MS-PS1-4; add a particle model for the full PE
04 **Magnet or Mimic?**	**Direct:** 5.6A, compare magnetism	**Direct property match:** 5-PS1-3; 3-PS2-3 only with distance/orientation
05 **Conductor Clues**	**Direct:** 5.6A, conduct or insulate electric energy	**Direct property match:** 5-PS1-3

SCIENCE AND ENGINEERING PRACTICES USED ACROSS CASES

- Ask questions and define problems
- Plan and conduct investigations
- Collect qualitative and quantitative evidence
- Analyze data, develop explanations, and communicate reasoning

VERIFICATION SOURCES

Texas Education Agency TEKS	tea.texas.gov/curriculum-and-instruction/texas-essential-knowledge-and-skills-teks
Texas Education Agency Science	tea.texas.gov/educators/subject-areas/science/science
NGSS MS-PS1-4	nextgenscience.org/pe/ms-ps1-4-matter-and-its-interactions
NGSS 5-PS1-3	nextgenscience.org/pe/5-ps1-3-matter-and-its-interactions
NGSS 3-PS2-3	nextgenscience.org/pe/3-ps2-3-motion-and-stability-forces-and-interactions

Mystery Mixture

Separate the evidence without changing it

CASE 01 · PHYSICAL PROPERTIES AND SEPARATION

THE MYSTERY

Four mixtures are made from familiar solids. Choose a separation method for each sample, then use physical properties to explain why your method worked.

PREP AND SETUP

Prepare A: iron filings + sand; B: salt + sand; C: gravel + sand; D: steel washers + plastic beads. Keep the amounts small and place each sample on a labeled tray.

ANSWER KEY

A separates with a magnet. B separates by dissolving salt, filtering sand, then evaporating the water. C separates by particle size with a sieve. D separates with a magnet or by hand sorting.

QUESTIONS TO ASK WHILE CIRCULATING

- Which property are you using as evidence?
- Did the components change identity when you separated them?
- What would you try if your first method failed?

COMMON MISCONCEPTION

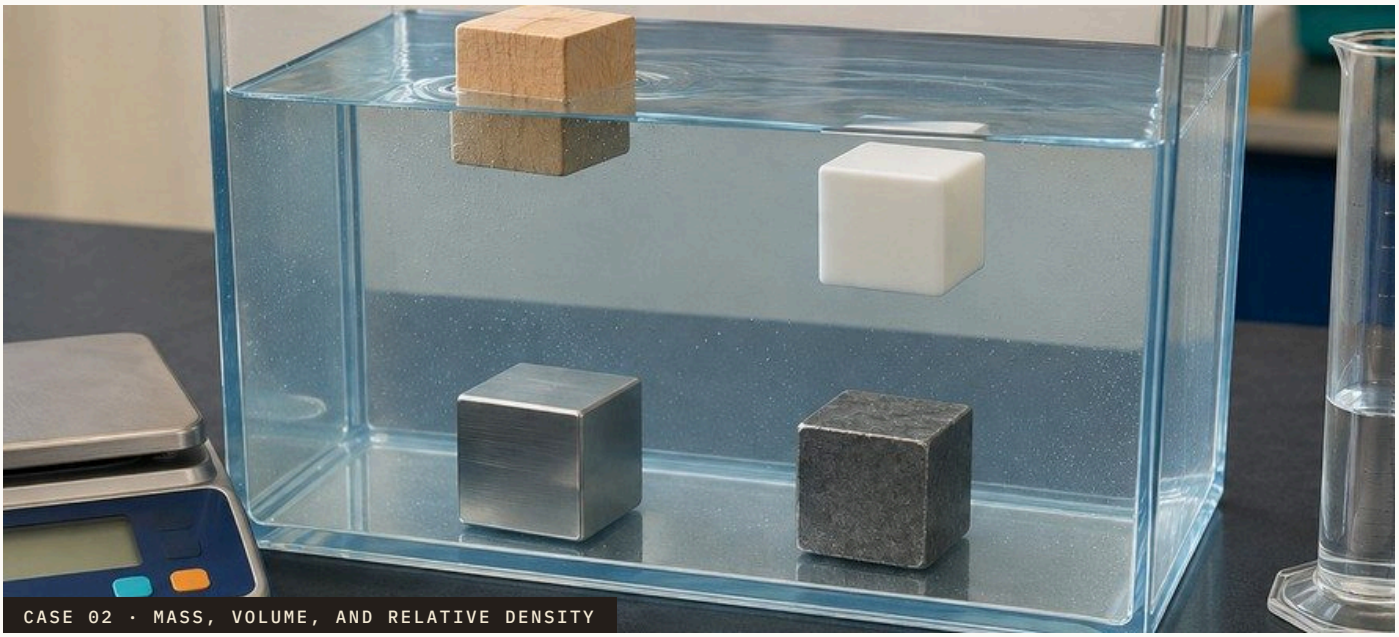
Dissolving is not the same as disappearing. The dissolved substance remains in the solution.

EXTEND

Have students design the fewest-step process that separates a three-part mixture.

Density Deception

Use mass and volume to identify the unknown



CASE 02 · MASS, VOLUME, AND RELATIVE DENSITY

THE MYSTERY

Four equal-size cubes look similar. Which cube is aluminum? Measure mass and volume, calculate density, and compare your results with the reference table.

PREP AND SETUP

For controlled data cards, use four 2 cm cubes: A 4.0 g, B 7.6 g, C 21.6 g, D 56.8 g; each volume is 8 cm^3. If using physical samples, measure them first and revise the table because wood and plastic densities vary.

ANSWER KEY

A = wood (0.50), B = plastic (0.95), C = aluminum (2.70), D = zinc (7.10 g/cm^3). Cube C is aluminum.

QUESTIONS TO ASK WHILE CIRCULATING

- Why can two equal-size cubes have different masses?
- What does a density greater than 1.0 predict in fresh water?
- How close must a measured value be to count as a match?

COMMON MISCONCEPTION

Weight alone does not determine floating. Compare an object's density with the fluid's density.

EXTEND

Predict and test each cube in vegetable oil, freshwater, and saltwater. Compare cube density with fluid density before testing.

State Detectives

Follow the water and the energy

CASE 03 · MELTING, CONDENSATION, AND EVAPORATION

THE MYSTERY

Water is changing at three stations. Identify melting, condensation, and evaporation, then explain whether the water undergoing each state change absorbs or releases energy.

PREP AND SETUP

A: ice in a clear beaker; B: metal cup filled with ice water and dried on the outside; C: a wide, shallow dish with a measured mass of warm water. Set all stations on trays and observe for 10–15 minutes.

ANSWER KEY

A is melting: solid water absorbs energy. B shows condensation: water vapor from the air releases energy as it becomes liquid. C shows evaporation: surface molecules absorb enough energy to enter the gas phase; the remaining liquid may cool.

QUESTIONS TO ASK WHILE CIRCULATING

- Where did the droplets on the outside of the cup come from?
- What evidence shows a physical change rather than a new substance?
- How would surface area affect evaporation?

COMMON MISCONCEPTION

Condensation outside the cup does not leak through the cup; water vapor from the air forms the droplets.

EXTEND

Change one variable, such as exposed surface area, and predict the effect on evaporation rate.

Magnet or Mimic?

Metallic shine is not enough evidence

THE MYSTERY

Several objects look metallic, but only some respond strongly to a magnet. Which objects are magnetic, and what second property could help you classify the mimics?

PREP AND SETUP

Mix ferromagnetic and nonmagnetic objects that look metallic. Include at least one painted plain-carbon-steel item and one shiny aluminum item so appearance will not reveal the answer.

ANSWER KEY

The iron nail, plain-carbon-steel washer, and steel paper clip should attract. Aluminum, copper, brass, wood, and plastic should not. Some stainless steels respond weakly or not at all; test the actual samples before class.

QUESTIONS TO ASK WHILE CIRCULATING

- Which evidence changed your first prediction?
- Does 'metal' always mean 'magnetic'?
- What additional property would separate two nonmagnetic samples?

COMMON MISCONCEPTION

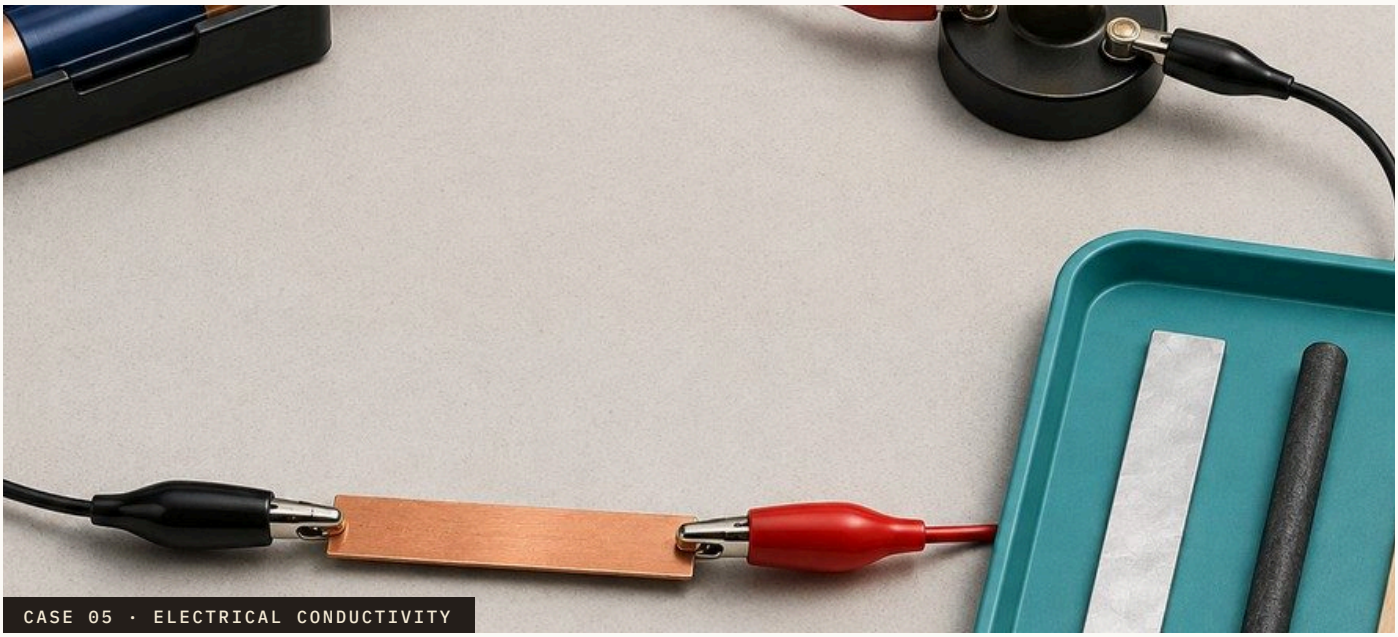
Not all metals are magnetic. Magnetic response depends on the material, not on shine or color.

EXTEND

Compare magnetic force at increasing distances using paper spacers as a simple distance scale.

Conductor Clues

A dark lamp needs a second look



CASE 05 · ELECTRICAL CONDUCTIVITY

THE MYSTERY

Which samples conduct electricity well enough to complete a low-voltage circuit? Test one sample at a time, then rule out loose clips or weak batteries before classifying an insulator.

PREP AND SETUP

Build and test a low-voltage series circuit with one sample gap. Use a current-limited 3 V LED lamp module intended for two AA cells. Place unused samples away from the connected circuit.

ANSWER KEY

Copper and aluminum should light the lamp. Graphite conducts, but its resistance and dimensions may keep this lamp dark. Plastic is an insulator. Check the circuit before treating a dark lamp as evidence.

QUESTIONS TO ASK WHILE CIRCULATING

- What must you check before calling a sample an insulator?
- Why might graphite produce a dimmer lamp than copper?
- Which material would you choose for a wire and for its covering?

COMMON MISCONCEPTION

A dark lamp does not prove insulation until the circuit and components have been checked.

EXTEND

Rank conductors by lamp brightness, then discuss why brightness is only a rough comparison.

Assessment, Scaffolds, and Adaptation

Keep the evidence demand while changing the language demand

CRITERION	CER QUICK CHECK	PTS	ACE QUICK CHECK	PTS
Finding	Claim answers the mystery	2	Articulate states the finding	1
Evidence	Specific, accurate evidence	4	Finding uses Page 1 evidence	2
Meaning	Reasoning connects evidence to concept	3	Connect explains a meaningful relationship	3
Transfer / limits	Alternative and confidence	1	Extend offers a testable or useful transfer	4
TOTAL		10		10

LANGUAGE AND ACCESS SCAFFOLDS

- Preteach: property, evidence, result, claim, density, conductor, and insulator
- Let students sketch observations before writing
- Provide a word bank, labeled tools, and one stem at a time
- Accept oral ACE responses while a partner records key evidence
- Keep the same mystery and evidence; reduce the writing load rather than the thinking load

ADAPT THE SAME CASE ACROSS K–16

K–2	Observe two objects, sort, draw, and explain orally
GRADES 3–5	Use qualitative tests and one measurement
GRADES 6–8	Calculate, compare variables, and write CER or ACE
GRADES 9–12	Add uncertainty, repeated trials, error analysis, and graphing
COLLEGE / EDUCATOR PD	Critique the method, redesign controls, and score competing explanations

> **TEACHER SAFETY CHECK**
> Test tools and circuits before class. Follow district lab rules, accommodations, and disposal procedures. Replace any material that creates an allergy, ingestion, cut, burn, or electrical risk.