

Did the Rock at Kettle Ridge Melt? A Claim-Evidence-Reasoning Case

Learning target: I can use observations and lab data from two rock samples to argue whether a rock was changed by heat and pressure while solid, or melted and re-formed, and explain the energy behind the change.

Claim, evidence, reasoning

About 45 min

Individual

MS-ESS2-1 · practice

writing

data analysis

Name _____

Date _____

Period _____

Directions

Read the scenario, then study the evidence table carefully; every row matters. Answer the warm-up questions first, because they organize the evidence for you. Then write your Claim, Evidence and Reasoning in the boxes. A strong response uses specific numbers and observations from the table, says what each piece of evidence rules out, and explains where the energy for the change came from.

You will need: This worksheet, Pencil, Scrap paper for the two-column test

The scenario

Kettle Ridge is a long hill of dark gray, thinly layered rock. At its west end, a mass of pink crystalline rock (an old intrusion, now exposed by erosion) pushes into the gray rock. A geology student, Priya, collects two samples of the gray rock: **Sample F**, from 3 kilometers east of the pink rock, and **Sample N**, from 20 meters from the contact with it. Sample N looks different: harder, shinier, with a faint wavy banding. Priya's question is simple to ask and harder to answer: **did Sample N melt and then re-harden, or was it changed while it stayed solid?** Her field notes and lab results are below. The site and numbers are a teaching case built from patterns geologists see at real contacts.

Priya's observations and lab results for the two samples (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Feature	Sample F (3 km from the pink rock)	Sample N (20 m from the pink rock)
Layering	Thin, flat layers 2 to 5 mm thick	Layers still present, but bent into gentle waves and thinned to 1 to 3 mm
Fossils	Small shell outlines, common	Faint, stretched shell outlines, rare
Crystal size and arrangement	Too small to see (under 0.05 mm), no preferred direction	0.5 to 1 mm, flattened, nearly all lined up in the same direction
Silica content (lab)	61 percent	60 percent
Glass or gas bubbles	None	None
Boundary with the pink rock	Not in contact	Sharp line; no mixing of gray and pink rock across it
Highest temperature the sample ever reached (lab estimate)	About 100 °C	About 500 °C
Temperature at which this rock begins to melt (lab)	About 700 °C	About 700 °C

Simulated data for teaching. Peak temperatures were estimated in the lab from which minerals are present; the melting temperature is for this rock's composition.

Warm-up: organize the evidence

1. List every feature that Sample N **kept** from the original gray rock, even in changed form. Why would a rock that had melted completely be unlikely to keep those features?

2. Compare the highest temperature Sample N reached with the temperature at which this rock starts to melt. What does the comparison tell you?

3. Sample N's crystals are larger than Sample F's and lined up in one direction. Name the two metamorphic processes these two observations point to, and say what caused each one.

Your argument

CLAIM

Claim: State whether Sample N formed by melting and re-cooling (an igneous process) or by change in solid rock (a metamorphic process), and name the rock type it is now.

EVIDENCE

Evidence: Give at least four specific pieces of evidence from the table, with numbers where they exist. For each one, say which explanation (melting or solid-state change) it supports or rules out.

REASONING

Reasoning: Explain how your evidence connects to your claim using what you know about how igneous and metamorphic rocks form. Your reasoning must explain where the energy for the change came from and why the change happened at 20 m but not at 3 km.

4. Suppose a third sample from 300 meters away reached a peak temperature of about 250 °C. Predict what its layers, fossils and crystals would look like, and explain your prediction.

5. What single new result would **force you to change** your claim? Describe it and say what it would mean.

Two-column test

On scrap paper, make two columns headed 'If it melted, I would expect...' and 'If it changed while solid, I would expect...'. Under the first, write: no layers, no fossils, brand-new crystals growing in all directions, maybe glass or bubbles, temperature above the melting point. Under the second, write: layers and fossils kept but squashed, crystals regrown and lined up by pressure, temperature below the melting point, sharp boundary with the heat source. Then go down the table row by row and put a check in the column each row matches. Your evidence section is the list of checks.

Reading the pink rock

The pink rock has interlocking crystals 6 to 10 mm across and no layers. Write a second, shorter CER for the pink rock: what it is, how you know, and what its crystal size tells you about where and how slowly it cooled. Then explain how the pink rock and Sample N together show two different routes of the rock cycle driven by the same energy source, and describe what must have happened to the land for both to be at the surface today.