

Rock Words That Work Together: Sorting, Mapping and Choosing Terms

Learning target: I can sort rock-cycle terms by what kind of thing they name, place processes on the arrows of a cycle, and choose the right term for a new situation.

Vocabulary in action

About 35 min

Individual

MS-ESS2-1 · practice

independent practice

writing

Standards connections

MS-ESS2-1 (practice): Placing the names of processes (weathering, deposition, crystallization, deformation, melting) on the arrows of a cycle and tying each to its energy source builds the vocabulary students need to label the model this PE asks for. It is practice, not yet the student's own model.

Purpose: build · **Time:** about 35 minutes · **Format:** individual

Answers with reasoning

mineral

A naturally formed solid with a fixed chemical makeup whose atoms sit in a repeating pattern. Most rocks are built from one or more minerals.

crystal

A solid whose atoms repeat in an orderly pattern. Every mineral grain in a rock is a crystal, whether or not it looks shiny.

texture

How big a rock's grains or crystals are, what shape they have and how they are arranged: a clue to how the rock formed.

magma

Melted rock below Earth's surface. When it reaches the surface it is called lava.

igneous rock

Rock that formed when melted rock cooled and its minerals crystallized.

intrusive

Describes igneous rock that cooled slowly underground, so its crystals had time to grow large.

extrusive

Describes igneous rock that cooled quickly at the surface, so its crystals are tiny or it is mostly glass.

weathering

The breaking down of rock where it sits, either into pieces (physical) or by chemical reactions that change or dissolve its minerals (chemical).

erosion

The carrying away of weathered material by water, wind, ice or gravity.

deposition

The dropping of sediment when the water, wind or ice carrying it slows down and loses energy.

sediment

Loose pieces of rock, mineral grains, shells or other material that can be carried and dropped.

compaction and cementation

Two steps that turn loose sediment into sedimentary rock: the weight of overlying layers squeezes the grains together, and minerals carried by water glue them.

sedimentary rock

Rock made from sediment that was compacted and cemented, or from minerals that crystallized out of water, or from the remains of living things.

metamorphic rock

Rock whose texture or minerals were changed by heat and pressure while it stayed solid.

deformation

The slow bending and squeezing of solid rock, which can stretch its crystals and line them up in bands.

recrystallization

The regrowth of a rock's crystals into new or larger crystals while the rock stays solid, for example when heat flows in from nearby magma.

rock cycle

A model of all the routes by which rock material changes from one type to another, and of the energy that drives each route.

Part A: What kind of thing is it?

Some words in this chapter name a **kind of rock**. Some name a **process**, which is something that happens to rock. Some name a **material that is not rock yet**. Sort each word below into one of those three bins and write the clue that told you.

1. Complete the table. Then count the words in each bin and name the word that was hardest to place.

Answer: Rock type: sandstone, basalt, marble. Process: weathering, recrystallization, deposition. Material (not yet rock): magma, sediment, lava. Each bin has exactly three words. Lava or magma is usually the hardest word to place, because both sound like rock. Clues: for example 'sandstone is a solid rock you can hold'; 'weathering is something that happens (breaking down)'; 'magma is melted rock, not solid rock yet.'

Why: The sort checks that students separate things from events. The most common slip is placing lava or magma with rocks; both are melted material that has not yet crystallized.

Also acceptable: Accept 'lava' described as 'magma at the surface' in the clue column.

- All nine words in the correct bin
- A clue written for each that fits the bin's test

2. Two words in the table name the same material in two different places. Which two, and what decides which word you use?

Answer: Magma and lava. Both are melted rock; the word depends on location. Below the surface it is magma; once it flows out onto the surface it is lava.

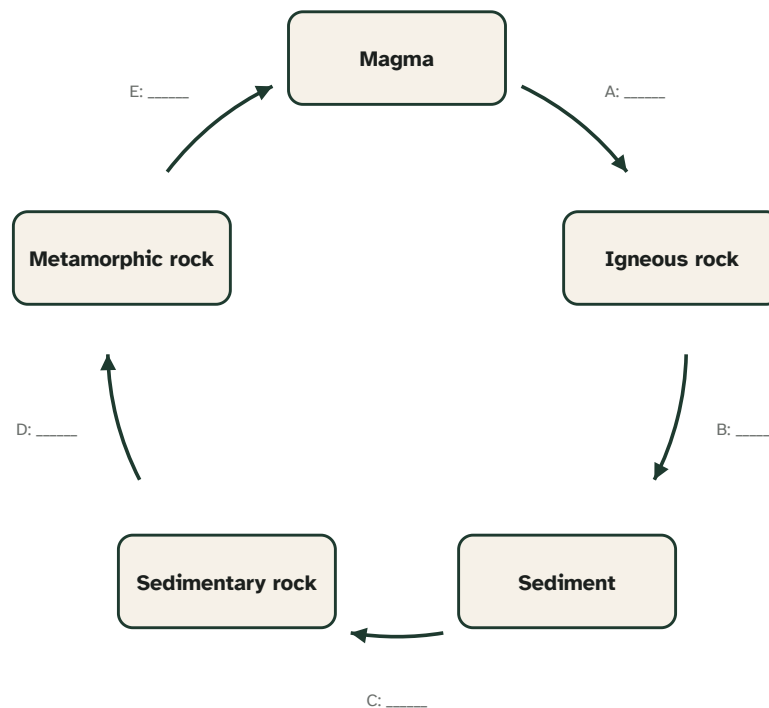
Why: Students must identify the location rule rather than treating the two as different substances.

Also acceptable: Accept 'inside Earth vs. outside' for the location rule.

- Names magma and lava
- States that location (below vs. at the surface) decides the word

Part B: Fill the arrows

One loop through the rock cycle (processes missing)



A simplified rock cycle with the process names removed from the arrows. Each arrow is lettered. The figure shows only one loop on purpose; you will fix that in q4.

3. Write the process (or pair of processes) that belongs on each arrow. A: magma to igneous rock. B: igneous rock to sediment. C: sediment to sedimentary rock. D: sedimentary rock to metamorphic rock. E: metamorphic rock to magma.

Answer: A: cooling and crystallization (hardening). B: weathering and erosion (breaking down and carrying away). C: deposition, then compaction and cementation. D: heat and pressure acting on solid rock (deformation and/or recrystallization). E: melting.

Why: Each arrow is a change of state or form. Arrow C may be written as 'compaction and cementation' alone since deposition could be read as the arrow into the sediment node; accept either as long as compaction and cementation appear.

Also acceptable: For D accept 'metamorphism'. For A accept 'cooling' alone. A student who writes 'melting' for D has made the central error of the chapter; use it as a teaching moment.

- A names cooling/crystallization
- B names weathering (erosion optional)
- C names compaction and cementation
- D names heat and pressure without melting
- E names melting

4. The figure makes it look as if rock must travel the loop in order. Name two arrows that are missing from the figure but belong in a correct rock cycle, and say which process each one needs.

Answer: Any two of: metamorphic rock to sediment (weathering and erosion at the surface after uplift); sedimentary rock to sediment (weathering and erosion); igneous rock to metamorphic rock (heat and pressure); sedimentary rock to magma (melting); igneous rock to magma (melting); metamorphic rock to another metamorphic rock (more heat and pressure); sediment that is dissolved crystallizing directly as rock (chemical sedimentation).

Why: The key idea is that any rock type can become any other, so the real model is a web of arrows, not a loop. The process named must match the arrow (anything to sediment needs weathering; anything to magma needs melting; anything to metamorphic needs heat and pressure).

Also acceptable: Accept 'igneous rock straight to magma by melting' even though it seems to skip steps; it is a real route.

- Two valid missing arrows
- Correct process for each

5. Sort arrows A to E by energy source. Which arrows run on energy from Earth's hot interior? Which run on energy from the Sun (plus gravity)? Explain one of your choices.

Answer: Earth's interior: A (cooling of magma that the interior melted; crystallization happens as that heat escapes), D (heat and pressure deep underground) and E (melting). Sun plus gravity: B (weathering and erosion by water, wind and ice, which the Sun drives; gravity pulls material downhill) and C (deposition as moving water slows, and burial under the weight of more sediment, which is gravity). Example explanation: 'Arrow B runs on the Sun because rain, rivers and wind get their energy from sunlight heating Earth's surface and air.'

Why: Arrow A is debatable: the magma exists because of interior heat, and it cools by giving that heat away, so it belongs with the interior-driven group. Accept students who argue A is 'losing heat' as long as they link the magma's existence to the interior.

Also acceptable: Accept A in either group if the student explains the cooling-vs-heating distinction. Accept 'gravity' listed as a third source for C.

- D and E assigned to Earth's interior
- B and C assigned to Sun and gravity
- One choice explained

Part C: Which term fits?

Each description below is a situation a geologist might meet. Write the **one or two** terms from the word bank that fit best and give a reason of one sentence.

6. A broken piece of rock shows interlocking crystals so large you can see each one without a lens.

Answer: Igneous, intrusive. Large interlocking crystals grow only when melted rock cools slowly, which happens underground.

Why: Interlocking crystals (not cemented grains) point to crystallization from a melt; size points to slow cooling.

Also acceptable: Accept 'coarse-grained igneous'. A student who says 'metamorphic' needs to be shown that metamorphic crystals are usually flattened or banded, which the description does not mention.

- Says intrusive or igneous with slow cooling

7. A gray rock is made of flattened, shiny flakes that all lie in the same direction, in wavy bands.

Answer: Metamorphic, deformation. Flakes lined up in wavy bands form when solid rock is squeezed and heated so that its crystals stretch, line up and bend.

Why: Alignment and banding are the signature of deformation under pressure.

Also acceptable: Accept 'foliated' if the student knows the term.

- Says metamorphic
- Mentions pressure, squeezing or deformation

8. A desert lake dries up every summer and leaves a white crust of cube-shaped crystals on its bed.

Answer: Sedimentary rock (chemical sedimentation); crystal or mineral. As the water evaporates, dissolved minerals become concentrated and crystallize out, building rock such as rock salt.

Why: This is the crystallization-from-water route; cube-shaped crystals hint at halite but naming the mineral is not required.

Also acceptable: Accept 'deposition' if the student explains the minerals come out of the water. Do not require the word halite.

- Links evaporation to crystals forming
- Identifies the product as sedimentary

9. Water seeping between buried sand grains leaves behind a mineral coating that glues the grains to each other.

Answer: Cementation (part of compaction and cementation). Minerals left behind by water act as glue between grains, turning loose sediment into sedimentary rock.

Why: This is the gluing step specifically, not the squeezing step.

Also acceptable: Accept 'compaction and cementation' with the gluing explained.

- Says cementation

10. A light, frothy gray rock full of tiny holes floats on water and is mostly natural glass.

Answer: Extrusive, igneous. The rock cooled so fast at the surface that new crystals had no time to grow (it froze mostly as glass), and the holes are where gas bubbles were trapped; the holes make it light enough to float.

Why: This describes pumice. The glass and the gas holes both point to very fast cooling of frothy magma in an eruption.

Also acceptable: Naming pumice is fine but not required.

- Says extrusive (or igneous with fast cooling)
- Connects glass or holes to fast cooling or gas

11. A river slows as it enters a lake and drops its load of sand near the river mouth.

Answer: Deposition; sediment. The river loses energy as it slows, so it can no longer carry the sand and drops it.

Why: Deposition is tied to a loss of energy in the moving water.

Also acceptable: Accept 'erosion ends and deposition begins.'

- Says deposition
- Connects it to the water slowing down

12. Two words are often confused: **weathering** and **erosion**. A boulder cracks in half during a freezing night. Later, a flood rolls one half down the valley. Which word goes with each event, and what is the difference between the two words?

Answer: The boulder cracking in half is weathering (the rock breaks down where it sits, here by water freezing and expanding in cracks). The flood rolling the piece down the valley is erosion (the piece is carried away). Weathering breaks rock down; erosion moves the pieces.

Why: The distinction is 'breaking in place' versus 'moving'. Both are Sun-driven surface processes.

Also acceptable: Accept 'physical weathering' or 'frost weathering' for the crack.

- Cracking = weathering
- Rolling downhill = erosion
- States the break-vs-move distinction

Part D: Use the words in a new situation

A volcanic island rises from the sea. Lava pours out and hardens on its slopes. Rain and waves attack the hardened rock for thousands of years, and the pieces collect on the seafloor just offshore. Much later, plates collide, the seafloor layers are squeezed deep under a new mountain range, and some of them are heated by a body of magma.

13. Retell the island's story in your own words using at least **six** terms from the word bank. Underline each term. Your story must say which rock type exists at each stage and must name the energy source behind at least two of the changes.

Answer: Model response (terms underlined in the student's copy): Lava flows out of the volcano and cools quickly, so it hardens into extrusive igneous rock with tiny crystals. Rain and waves, powered by the Sun, cause weathering of the rock, and erosion carries the pieces offshore, where deposition builds layers of sediment on the seafloor. Over time, compaction and cementation turn the sediment into sedimentary rock. When plates collide, the layers are pushed deep and deformation under pressure, together with heat from Earth's interior, changes them into metamorphic rock while they stay solid. Near the body of magma, recrystallization grows new crystals; if any rock gets hot enough to melt, it becomes magma and can start the igneous part of the cycle again.

Why: Full credit requires six underlined terms used correctly, the rock type at each stage (igneous, sediment, sedimentary, metamorphic), and two energy sources (Sun for weathering and erosion; Earth's interior for deformation, recrystallization or melting).

Also acceptable: A story that ends at sedimentary rock is incomplete; a story that has the squeezed layers 'melt into metamorphic rock' has the chapter's key error and should be returned for revision.

- At least six word-bank terms, underlined and used correctly
- Rock type or material named at each stage
- Two energy sources named and matched to the right changes
- Metamorphic change described as happening without melting

Teacher notes

Definitions in the word bank are written to be accurate where the textbook simplifies: a mineral is naturally formed; pumice is mostly glass rather than 'no crystals at all'; metamorphism keeps the rock solid. The Part B figure is a single loop on purpose so that q4 can surface the branching nature of the real model; project a web-shaped cycle during the debrief. In q5, arrow A is the one students argue about; use the argument to

establish that magma exists because of interior heat and that crystallization is that heat leaving. Part D answers are a good quick check before W4, where students draw their own model.

Scaffold offered to students: A test for each bin

Ask one question for each word. 'Can I hold a piece of it and call it a rock?' If yes, it is a rock type. 'Is it something that happens, something I could describe with a verb like breaking, carrying, dropping or growing?' If yes, it is a process. 'Is it stuff that could become rock but is not rock now, like loose grains or melted rock?' If yes, it is a material. For Part B, remember the two energy sources: anything that happens at the surface with water, wind or ice runs on the Sun; anything that needs heat or squeezing deep underground runs on Earth's interior.

Extension: One grain, many names

Choose a single mineral grain inside an intrusive igneous rock. Write a diary of that grain, in six short entries, in which the grain passes through at least four different stages of the rock cycle in an order that is NOT the loop shown in Part B. At each entry, name the rock type or material the grain is part of, the process that moved it to the next stage, and the energy source. Then explain in two sentences why the grain's atoms never disappear even though the rock around it changes.