Mineral Field Clues

Use tests, formulas, and bonding to identify minerals.

ESS.2A.3 "Investigate the physical and/or chemical characteristics of mineral specimens to identify minerals and mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, and phosphates)..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each test result in the passage, circle each mineral formula, and number each stated use. Use your marks to connect a mineral's properties to its identity and use.

Four Finds at a Road Cut

1 At a road cut, four pale mineral specimens can look alike until their properties are tested. One specimen scratches glass but has no flat cleavage surfaces. Its formula, SiO_2, identifies it as quartz, a silicate. In quartz, silicon and oxygen atoms form a continuous network of strong covalent bonds. A second specimen forms cubes, splits along flat faces, and dissolves readily in water. It is halite, NaCl, a halide. Its oppositely charged sodium and chloride ions form an ionic crystal, and water can separate those ions. Quartz supplies silica for glassmaking, while dissolved halite helps deice roads.

2 Another specimen fizzes when a drop of dilute acid touches it. This reaction helps identify calcite, $CaCO_3$, a carbonate found in limestone deposits. Calcium ions are attracted to carbonate ions, whose carbon and oxygen atoms share covalent bonds. Ground limestone can reduce soil acidity. The fourth specimen can be scratched by a fingernail and splits into thin sheets, but it does not fizz with dilute acid. It is gypsum, $CaSO_4 \cdot 2H_2O$, a sulfate that dissolves only slightly in water. Its calcium and sulfate ions attract, and water is part of its crystal structure. Gypsum wallboard releases water when heated.

3 These minerals can occur in the same region without forming the same deposit. Evaporation of salty water can leave beds rich in halite and gypsum, while calcite may build up as limestone in a shallow sea. Quartz may crystallize in veins where hot fluids cool. A field geologist checks more than appearance: scratch resistance, cleavage, dissolving, and reaction to dilute acid help separate look-alikes. Testing one tiny spot first protects the specimen. Never taste a sample to identify it. A formula reveals which elements or ions are present, but observed properties and the rock setting provide crucial additional evidence.

2 ANSWER WITH EVIDENCE

Use the passage

1. A specimen scratches glass and has no flat cleavage surfaces. What mineral group does it belong to, and how does its bonding fit the scratch result?

2. A specimen has cubic cleavage and dissolves readily in water. Give its name and formula, then connect its dissolving to a use.

3. A specimen fizzes in dilute acid. Identify its mineral group and explain why it could help treat acidic soil.

4. A specimen can be scratched by a fingernail but does not fizz. Identify its mineral group and connect a part of its formula to a stated use.

3 YOUR TURN

Your own words

An unknown specimen is one of the four minerals in the passage. Write a field plan using three kinds of tests to distinguish at least three of them, then explain how the formula or bonding of one identified mineral supports a use not discussed in Questions 1 to 4.

ANSWER KEY

Mineral Field Clues

HIGH SCHOOL · ESS.2A.3

PART 1 · READ AND MARK

Underline each test result in the passage, circle each mineral formula, and number each stated use. Use your marks to connect a mineral's properties to its identity and use. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	A specimen scratches glass and has no flat cleavage surfaces. What mineral group does it belong to, and how does its bonding fit the scratch result?	**It is quartz, a silicate. Its strong covalent network fits its ability to scratch glass.**
2	A specimen has cubic cleavage and dissolves readily in water. Give its name and formula, then connect its dissolving to a use.	**It is halite, NaCl. Dissolved halite helps deice roads.**
3	A specimen fizzes in dilute acid. Identify its mineral group and explain why it could help treat acidic soil.	**It is a carbonate, specifically calcite. Ground limestone containing calcite can reduce soil acidity.**
4	A specimen can be scratched by a fingernail but does not fizz. Identify its mineral group and connect a part of its formula to a stated use.	**It is gypsum, a sulfate. The water shown in $CaSO_4 \cdot 2H_2O$ is part of its crystal structure; gypsum wallboard releases water when heated.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

First, put a drop of dilute acid on a small spot. Fizzing points to calcite. If it does not fizz, test scratch resistance: a fingernail scratch suggests gypsum, while a specimen that scratches glass suggests quartz. For an uncertain result, place a tiny chip in water. Rapid dissolving points to halite, not gypsum, which dissolves only slightly. Quartz has the formula SiO_2, so it supplies silica for glassmaking.

Accept equivalent test sequences that distinguish at least three minerals using evidence from the passage. The use connection must be supported by the identified mineral's formula or bonding.