
Glencoe Science
Earth Science
NATIONAL GEOGRAPHIC
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6th grade science standard

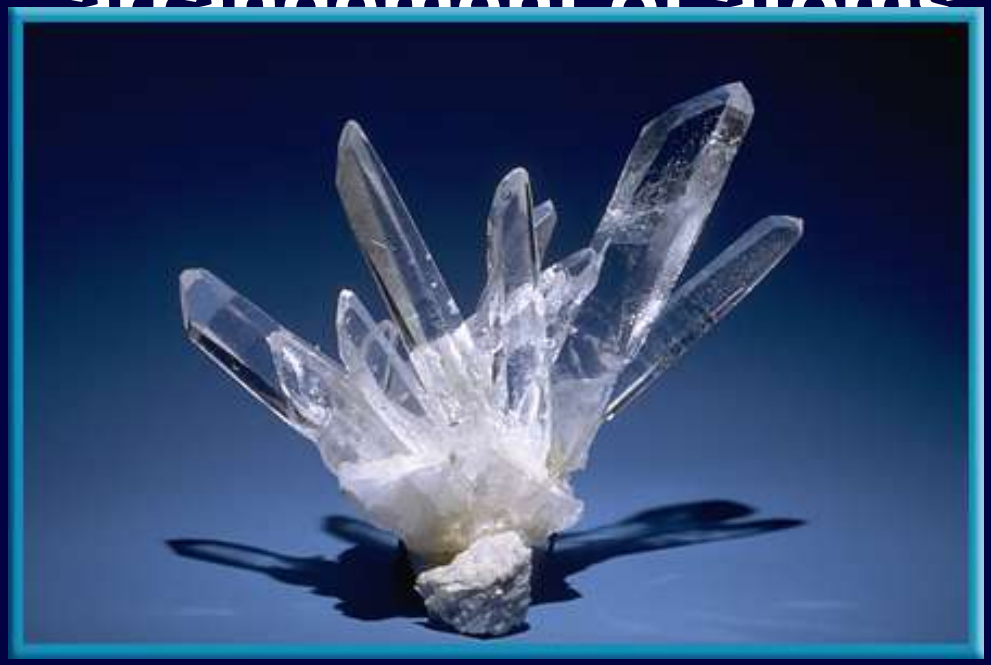
S6E5: Students will investigate the scientific view of how the earth's surface is formed.

b. investigate the contribution of mineral to the rock composition

1

What is a mineral?

- A **mineral** is a naturally occurring, inorganic solid with a definite chemical composition and an orderly arrangement of atoms.



- About 4,000 different minerals are found on Earth, but they all share these four characteristics.

Write this for Minerals!

4 CHARACTERISTICS OF A MINERAL

Write this for Minerals!

CHARACTERISTICS OF A MINERAL

1.Naturally occurring

- Minerals are formed by natural processes
- they occur on or inside Earth with no input from humans (naturally occur – form in nature).

Write this for Minerals!

CHARACTERISTICS OF A MINERAL

2. Inorganic Solid

- Minerals are inorganic. This means that they are NOT made by life processes. Not Living.

Write this for Minerals!

CHARACTERISTICS OF A MINERAL

3. Definite Chemical Composition

- EVERY mineral is an element or compound with a definite chemical composition.

Write this for Minerals!

CHARACTERISTICS OF A MINERAL

4. Orderly Arrangement of Atoms

- Minerals are crystalline solids. All solids have a definite volume and shape.

1

Mineral Characteristics

- *Only a solid can be a mineral, but not all solids are minerals.*

1

Crystals from Magma

- Hot melted rock material beneath the Earth is called magma. It cools when it reaches Earth's surface, or even if it's trapped below the surface.

- As magma cools, its atoms lose heat energy, move closer together, and begin to combine into compounds.

1

Crystals from Magma

- When magma cools slowly, the crystals that form are generally large enough to see with the unaided eye. *(Cooling Slow=larger crystals)*
- When magma cools rapidly, the crystals that form will be small. *(Cooling Fast=small crystals)*

Examples

Granite – small crystals

Diorite – large crystals

1

Crystals from Solution

- Crystals also can form from minerals dissolved in water.

- When water evaporates, as in a dry climate, ions that are left behind can come together to form crystals.

1

Mineral Compositions and Groups

- Most of the common rock-forming minerals belong to a group called the silicates.
- Silicates (SIH luh kayts) are minerals that contain silicon (Si) and oxygen (O) and usually one or more other elements.
- These two elements alone combine to form the basic building blocks of most of the minerals in Earth's crust and mantle.

1

Question 1

Which of these is a characteristic of minerals?

A. crystalline solid
B. formed by life processes
C. indefinite chemical composition
D. organic substances

1

Answer

The answer is A. Minerals are crystalline solids. Only a solid can be a mineral, but not all solids are minerals.

1

Question 2

When magma cools rapidly, it forms _____.

A. evaporites
B. large crystals
C. opals
D. small crystals

1

Answer

The answer is D. When magma cools rapidly, it forms small crystals that are difficult to see.

1

Question 3

Minerals that contain silicon and oxygen are _____.

A. magma
B. opals
C. silicates
D. solutions

1

Answer

The answer is C. Silicates contain silicon and oxygen and usually one or more other elements.

2

Physical Properties—Mineral Appearance

- **Mineral Properties** – Used to identify a mineral
- **Color and appearance** are two obvious clues that can be used to **identify**

- Some other properties to study include **how hard** a mineral is, **how it breaks**, and its **color** when crushed into a **powder**.

Write this down!

Properties of Minerals -

Color

Transparency

Luster

Hardness

Cleavage/Fracture

Streak

2

Hardness

- A measure of how easily a mineral can be scratched is its hardness.
- Sometimes the concept of hardness is confused with whether or not a mineral will break.
- It is important to understand that even though a diamond is extremely hard, it can shatter if given a hard blow in the right direction along the crystal.

2

Mohs Scale

- In 1824, the Austrian scientist Friedrich Mohs developed a list of common minerals to compare their hardnesses.
- This list is called Mohs scale of hardness.

Mineral Hardness

Mohs Scale	Hardness	Hardness of Common Objects	
Talc (softest)	1		
Gypsum	2	fingernail	(2.5)
Calcite	3	piece of copper	(2.5 to 3.0)
Fluorite	4	iron nail	(4.5)
Apatite	5	glass	(5.5)
Feldspar	6	steel file	(6.5)
Quartz	7	streak plate	(7.0)
Topaz	8		
Corundum	9		
Diamond (hardest)	10		

Write this down!

Mohs scale of hardness- Developed by Austrian scientist Friedrich Mohs a list of common minerals to compare their hardness's.

2

Luster

- **The way a mineral reflects light** is known as **luster**.
- Luster can be **metallic or nonmetallic**.
- Minerals with a metallic luster shine like metal.

2

Luster

- When a mineral **does not shine** like a metal, its luster is **nonmetallic.**
- Terms for **nonmetallic luster = dull,**
- **Metallic = pearly, silky, and glassy.**

2

Specific Gravity

- Minerals also can be distinguished by comparing the weights of equal-sized samples.
- The specific gravity of a mineral is the ratio of its weight compared with the weight of an equal volun of water.
- Specific gravity is expressed as a number.

2

Streak

- When a mineral is rubbed across a piece of unglazed porcelain tile, a streak of powdered mineral is left behind.

- **Streak** is the **color** of a mineral when it is in a powdered form.

2

Streak

- The streak test works only for minerals that are softer than the streak plate.
- Some soft minerals will leave a streak even on paper.

- The last time you used a pencil to write on paper, you left a streak of the mineral graphite.

2

Cleavage

Salt - cubic

- Minerals that break along **smooth, flat surfaces** have **cleavage** (KLEE vihj).

- Cleavage is determined partly b arrangement of the mineral's atoms.

fluorite

Micia- flat layers

2

Fracture

- Not all minerals have cleavage
- Minerals that break with **uneven, rough, or jagged surfaces** have fracture.
- Quartz is a mineral with fracture.

chrysotile fracture

flint fracture

Quartz

Shale fracture

END

2

Question 1

The Mohs scale uses _____ to compare minerals.

A. cleavage
B. color
C. hardness
D. luster

Properties of Minerals

Mineral	Hardness	Streak
Copper	2.5–3	copper-red
Galena	2.5	dark gray
Gold	2.5–3	yellow
Hematite	5.5–6.5	red to brown
Magnetite	6–6.5	black
Silver	2.5–3	silver-white

2

Answer

The answer is C. The Mohs scale, developed by Friedrich Mohs, rates the hardness of minerals from one to ten.

2

Question 2

Minerals that break easily along smooth, flat surfaces have _____.

A. cleavage
B. fracture
C. luster
D. streak

2

Answer

The answer is A. Cleavage is determined partly by the arrangement of the mineral's atoms. Minerals that break with uneven surfaces have fracture.

2

Question 3

If a mineral is metallic & reflects light, this describes the minerals _____.

A. Hardness
B. color
C. luster
D. transparency

2

Answer

The answer is C. Luster

QUIZ!!!

1. What is the scale to measure hardness?
2. Who developed it?
3. In what year?
4. What is the softest mineral?
5. What is the hardest mineral?

3

Gems—Properties of Gems

- **Gems** or gemstones are **highly prized minerals** because they are **rare** and **beautiful**.
  - Most gems are special varieties of a particular mineral.
  - They are clearer, brighter, or more colorful than common samples of that mineral.

3

Properties of Gems

- Sometimes a gem has a crystal structure that allows it to be cut and polished to a higher quality than that of a non-gem mineral.

- The table lists popular gems and some locations where they have been collected.

3

Properties of Gems

Minerals and Their Gems

Fun Facts	Mineral	Gem Example	Some Important Locations	Fun Facts	Mineral	Gem Example	Some Important Locations
Beryl is named for the element beryllium, which it contains. Some crystals reach several meters in length.	Beryl	Emerald	Columbia, Brazil, South Africa, North Carolina.	Olivine composes a large part of Earth's upper mantle. It is also present in moon rocks.	Olivine	Peridot	Myanmar (Burma), Zebirget (Saint John's Island, located in the Red Sea), Arizona, New Mexico
A red spinel in the British crown jewels has a mass of 352 carats. A carat is 0.2 grams.	Spinel	Ruby spinel	Sri Lanka, Thailand, Myanmar (Burma)	Gamet is a common mineral found n a wide variety of rock types. The red color of the variety almandine is caused by iron in its crystal structure.	Garnet	Almandine	Ural Mountains, Italy, Madagascar, Czech Republic, India, Sri Lanka, Brazil, North Carolina, Arizona, New Mexico
Purplish-blue examples of zoisite were discovered in 1967 near Arusha, Tanzania.	Zoisite	Tanzanite	Tanzania	Quartz makes up about 30 percent of Earth's continental crust.	Quartz	Amethyst	Colorless varieties in Hot Springs, Arkansas; Amethyst in Brazil, Uruguay, Madagascar, Montana, North Carolina, California, Maine
The most valuable examples are yellow, pink, and blue varieties.	Topaz (uncut)	Topaz (gem)	Siberia, Germany, Japan, Mexico, Brazil, Colorado, Utah, Texas, California, Maine, Virginia, South Carolina	The blue color of sapphire is caused by iron or titanium in corundum. Chromium in corundum produces the red color of ruby.	Corundum	Blue Sapphire	Thailand, Cambodia, Sri Lanka, Kashmir

3

Important Gems

- **All gems are prized**, but some are truly spectacular and have played an important role in history.
  - The Cullinan diamond, found in South Africa in 1905, was the largest uncut diamond ever discovered.

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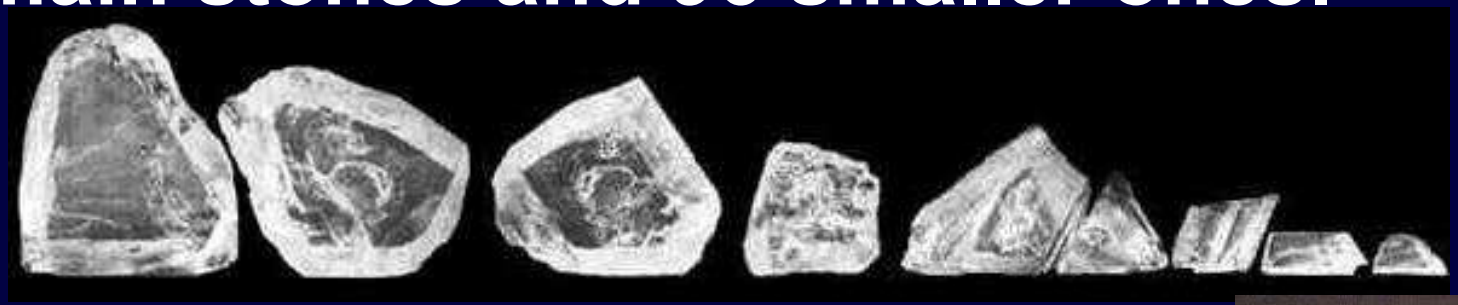
Important Gems

- The Cullinan diamond was cut into 9 main stones and 96 smaller ones.



- The largest of these is called the Cullinan 1 or Great Star of Africa, and it is now part of the British monarchy's crown jewels.

3

Important Gems

- Another well-known diamond is the blue Hope diamond.
- The Hope diamond has gained a reputation for bringing its owner bad
- The Hope diamond's mass is 45.52 carats (about 9 g). Currently, it is displayed in the Smithsonian Institution in Washington, D.C.

END

3

Useful Gems

- Diamonds have a hardness of 10 on Mohs scale.
- They can scratch almost any material—a property that makes them useful as industrial abrasives and cutting tools.

3

Useful Gems

- Other useful gems include rubies, which are used to produce specific types of laser light.
- Quartz crystals are used in electronics and as timepieces.
- Most industrial diamonds and other gems are **synthetic, which means that humans make them.**

3 Useful Elements in Minerals Ores

- Iron, used in everything from frying pans to ships, is obtained from its ore, hematite.

- A mineral or rock is an ore if it contains a useful substance that can be mined at a profit.

3

Ores

- Aluminum sometimes is refined, or purified, from the ore bauxite.
- In the process of refining aluminum, aluminum oxide powder is separated from unwanted materials that are

inal bauxite.

- After this, the aluminum oxide powder is converted to molten aluminum by a process called smelting.

END

Vein Minerals

3

- Under certain conditions, metallic elements can dissolve in fluids.

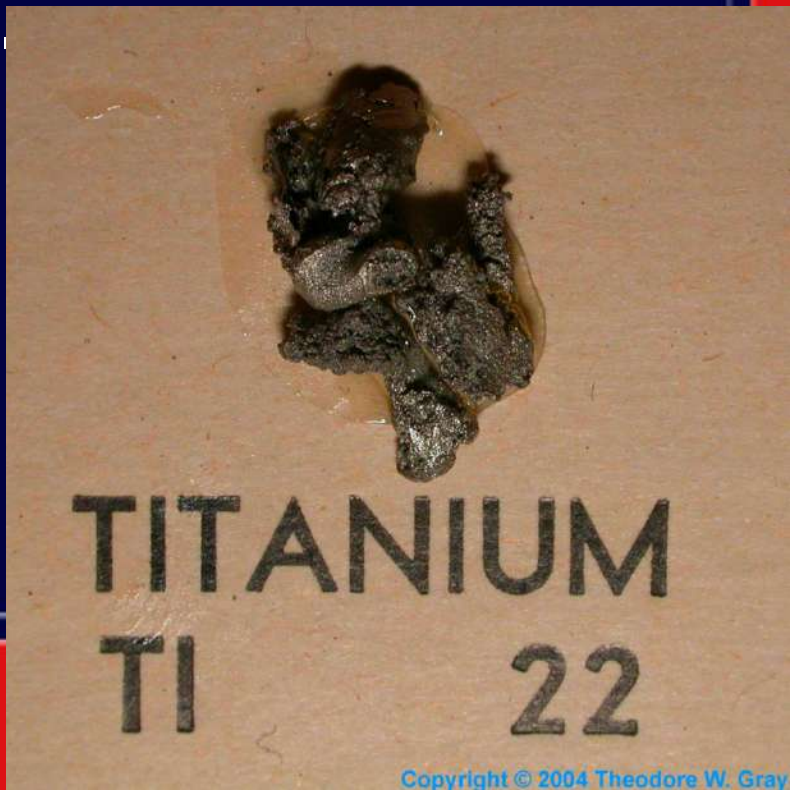
- These fluids then travel through weaknesses in rocks and form mineral deposits.
- Mineral deposits left behind that fill in the open spaces created by the weaknesses are called vein mineral deposi

Quartz with gold

3

Minerals Containing Titanium

- Titanium is a durable, lightweight, metallic element derived from minerals that contain this metal in their crystal structures.
- Two minerals that are sources of the element titanium are ilmenite (IHL muh nite) and rutile (rew TEEL).



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Uses of Titanium

- **Titanium is used in automobile body parts**, such as connecting rods, valves, and suspension springs.
- **Wheelchairs** used by people who want to race or play basketball often are made from titanium.

3

Question 1

Highly prized minerals called _____ are rare and beautiful.

A. crystals
B. gems
C. grains
D. ores

3

Answer

The answer is B. Most gems are special varieties of a particular mineral. All minerals are crystalline solids, but not all of these are gems.

3

Question 2

What must be true of a mineral or rock in order for it to be an ore?

Answer

A mineral or rock is an ore if it contains a useful substance that can be mined at a profit.

3

Question 3

The ore bauxite can be processed to obtain _____.

A. aluminum
B. iron
C. magnetite
D. titanium

3

Answer

The answer is A. Aluminum oxide is separated from the original bauxite, then converted to molten aluminum.