



Minerals

Essential Question

What are minerals?

Cue: Review:
Thoughts: Main Idea

NOTE Taking AREA:

• 5 characteristics of a mineral

↳

↳ 4000 different types of minerals

↳ Used everyday of your life

• Mineral

↳ is an element of chemical compounds that is normally crystalline and that has been formed as a result of a geological process.

element

↳ a substance that cannot be broken down into simpler substances by physical or chemical means.

Chemical Compounds

↳ formed by elements that bond together.

- ↳ Ionic
- ↳ Covalent
- ↳ Metallic

Rock forming minerals are primarily composed of 8 common elements.



Topic/Objective CHAPTER:

NAME:

DATE

Cue: Review:
Thoughts: Main Idea

NOTE Taking AREA:

8 most
Common
elements

8 most Common elements that form
minerals.

- | | |
|------------------|-------------------|
| 1. Oxygen 46.6% | 5. Calcium 3.6% |
| 2. Silicon 27.7% | 6. Sodium 2.8% |
| 3. Aluminum 8.1% | 7. Potassium 2.6% |
| 4. Iron 5.0% | 8. Magnesium 2.1% |
- 1.5% other elements

Crystalline

↳ arrangement of Atoms in a consistent and orderly geometric pattern.

Crystalline form

↳ is the external expression of a mineral's internal orderly arrangement of Atoms.

↳ Repeating pattern that's a solid

SUMMARY:

Crystal

german word meaning Frost "Kryos"

2 types

• **ISO**morphs: 2 minerals same structure different chemical composition
e.g. FeS_2 Pyrite/Halite/galena. $[PbS]$

• **Poly**morphs: 2 minerals w/same chemical composition but different structures.
e.g. graphite / Diamond $\Rightarrow C$



Topic/Objective CHAPTER: 4

NAME:

Minerals

Pd: 1 2 4 5 other

DATE

Essential Question

What are Minerals

Cue: Review:
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NOTE Taking AREA:

Mineral

↳ used everyday of your life

↳ is an element of Chemical compounds that is normally Crystalline and that has been formed as a result of a geological process.

element

↳ 4000 different types of minerals

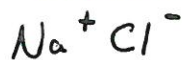
↳ a substance that cannot be broken down into simpler substances by physical or chemical means.

Chemical compounds

↳ formed by elements that BOND together

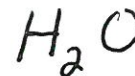
1) Ionic

↳ held by
OPP. charges



2) Covalent

↳ Sharing



3) Metallic

↳ (w/metal)
(on metal)

Crystalline

↳ arrangement of Atoms in a consistent & orderly geometric pattern

Crystalline form

↳ is the external expression of a mineral's internal orderly arrangement

NOTES CONTINUE ON OTHER SIDE

of Atoms.



Topic/Objective CHAPTER:

NAME:

DATE

Cue: Review:
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NOTE Taking AREA:

Crystal

↳ Repeating pattern that's a Solid
↳ German word meaning Frost "Kryos"

Geological
Process

↳ See next page Front side on bottom.

Solid
shape
or structure

↳ 2 types.

~~ISO~~ ISOMORPHS

Poly-morphs

↓
2 minerals same
structure different
chemical composition

↓
2 minerals w/same
chemical composition
but different structures

E. g.

(Salt)

Pyrite (FeS_2)
Halite ($NaCl$)
Galena (PbS) } Cubic

Graphite } come from sheet
diamonds } Carbon. complex

8 most common elements. that form minerals.

SUMMARY:

- | | |
|------------------|-------------------|
| 1. 46.6% Oxygen | 5. 3.6% Calcium |
| 2. 27.7% Silicon | 6. 2.8% Sodium |
| 3. 8.1% Aluminum | 7. 2.6% Potassium |
| 4. 5.0% Iron | 8. 2.1% Magnesium |

1.5% other elements



Topic/Objective CHAPTER: 4

NAME:

Minerals

Pd: 1 2 4 5 other

DATE

20/5

Essential Question

What are Xstal shapes & Physical Prop.

Cue: Review:
Thoughts: Main Idea

NOTE Taking AREA:

Crystal
shapes
dice

↳ 6 Basic types of crystal structures.

Name

e.g.

1. Cubic (isometric)

salt, Pyrite, galena
fluorite, gold, silver

2. Hexagonal

quartz, calcite,
graphite, corundum

Stop sign

3. Tetragonal

Zircon, rutile

Jolly Rancher
cereal box

4. Orthorhombic

sulfur, topaz, olivine

Big eraser

5. monoclinic

Feldspar, mica,
gypsum

6. Triclinic

albite

geological
Processes

↳ Are the internal & external forces that shape the physical makeup of a planet.

4 basic geological processes

1. Impacting Cratering
2. Weathering / Erosion
3. Tectonism ... Earthquakes
4. Volcanism ... hot springs



Topic/Objective CHAPTER:

NAME:

DATE

Cue: Review:

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5 Characteristics

All Minerals Have

How to identify minerals

Color

Luster

Texture

Streak

NOTE Taking AREA:

↳ Naturally Occuring, Inorganic, solid, with a definite composition, and definite structure.

↳ Identify minerals using tests based on the physical & chemical properties

↳ how the mineral appears to look

↳ most noticeable ; least reliable

↳ how a mineral reflects light from its ^{Surface}

↳ 2 types → metallic (look like metal)

↳ Non metallic (every thing else)
↓ see texture

↳ how a mineral feels to the touch

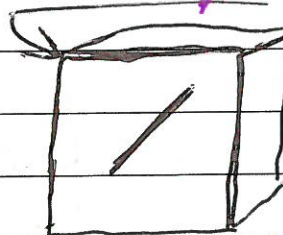
↳ this is subjective

↳ smooth, rough, greasy, soapy, waxy, vitreous, & earthy

↳ color of a mineral when it is broken up and powdered.

↳ involves rubbing a mineral against an unglazed porcelain plate.

↳ *most useful*



Continued



Topic/Objective CHAPTER: 4

NAME:

Minerals

Pd: 1 2 4 5 other

DATE

3 of 5

Essential Question

What's Mohs Scale Hardness/Breakage

Cue: Review:
Thoughts: Main Idea

NOTE Taking AREA:

How to
Identify
a mineral:
• **HARDNESS**

↳ Another good test is: **HARDNESS**
↳ how easily a mineral can be scratched. or **Ability to resist abrasion**

Mohs
hardness
Scale

↳ Scale we use was 1st developed by a german geologist Friedrich Mohs

• * Mohs Scale of Hardness

↳ unknown sample can be compared to the known hardness of 10 easily recognized minerals.

10	Hardest diamond
9	Corundum Rubies & Sapphires
8	Topaz
7	Quartz All electronics; Most common
6	Feldspar Porcelain
5.5	← 5.5 glass
5	Apatite
4.5	← 4.5 Fe Nail
4	Fluorite Toothpaste
3.5	← 3.5 Penny
3	Calcite Reacts w/ Hydrochloric Acid (HCl)
2.5	← 2.5 Finger nail
2	Gypsum Zn Plaster
1	Softest Talc Baby Powder

NOTES CONTINUE ON OTHER SIDE



Topic/Objective CHAPTER:

NAME:

DATE

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NOTE Taking AREA:

• Breakage

↳ How a mineral breaks apart or splits

2 types

↳ 2 types

1. Cleavage

2. Fracture

• Cleavage

↳ splits easily and evenly along 1 or more planes of weak atomic bonds

↳ smooth break e.g. mica; Feldspar

↳ Basal cleavage: parallel to the base usually 1 direction

↳ Cubic cleavage: crystallized in cube shapes

↳ Octahedral cleavage: "wedges"

↳ others: Prismatic, Pinicoidal, Rhombohedral

• Fracture

↳ breaks w/ jagged edges or "chipping away"

↳ Irregular shape

↳ Types of Fractures

SUMMARY:

↳ Conchoidal: semicircular shell w/ smooth curved surface. (e.g. glass)

↳ UNEVEN: rough or irregular shape

↳ Hackly: Jagged ends

↳ Splintery:

↳ Earthy/crumby:



Topic/Objective CHAPTER: 4

NAME:

Minerals

Pd: 1 2 4 5 other

DATE

4 of 5

Essential Question

What are Special Properties

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NOTE Taking AREA:

Special Properties

density

$$\text{density } (\rho) = \frac{\text{Mass of the object}}{\text{Volume of the object}}$$

specific gravity

Specific Gravity is a ratio of the mass:
mass of equal volume of water @ 4°C

$$\text{S.G.} = \frac{\text{Weight}_{(\text{in the Air})}}{(\text{Weight}_{(\text{in the Air})} - \text{Weight}_{(\text{in water})})}$$

Magnetism

↳ attracted to a magnet e.g.: lodestone
: magnetite

Radioactive

↳ will contain radioactive ISO tope

incandescent

fluorescent

↳ gives off visible light when exposed
to ultraviolet light [AKA. Blacklight]

Fire Resistance

↳ Asbestos is sample that is fire Resistance



Topic/Objective CHAPTER:

NAME:

DATE

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NOTE Taking AREA:

Acid Test

↳ when a drop of Hydrochloric Acid (HCl) is added to a sample, the sample may begin to "fuzz" or Bubbles.

↳ if the sample is: EFFERVESCENCE then it contains Calcium w/in the mineral. e.g. Calcite, Chalk, Dolomite

Double Refraction

↳ will bend light or distort the image

Striations

↳ grooves or "scratch like" marks
↳ sometimes called "Twinning streaks"

Mineral Groups

↳ Minerals are placed into 2 groups

(1) Silicates

↳ 3-d Arrangement of Atoms.

↳ contains Si & O

↳ the basic building block of ALL Silicates is the Tetrahedron

(2) NON-Silicates

↳ contain 6 subgroups

1) Carbonates: CO_3

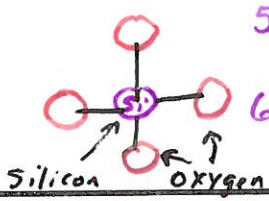
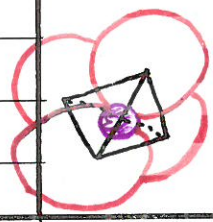
2) Oxides: metal w/ Oxygen

3) Sulfates: SO_4

4) Sulfides: metal w/ Sulfur

5) Halides: combined w/ Cl, F, Br, I, Na, K, Ca

6) Native elements: pure substance





Minerals

Essential Question

What are Rock Forming Minerals & Gems?

Cue: Review:
Thoughts: Main Idea

NOTE Taking AREA:

Rock-forming Minerals

↳ minerals can form in many ways

↳ Some of the more common ways are:

1) From Magma/Lava

↳ magma cools @ different rates

• if magma cools slowly → large mineral crystals can grow

• if magma cools rapidly → small mineral crystals will form

Intrusive

Extrusive

2) from a solution

↳ once a liquid cannot hold anymore substance we call it Saturated.

↳ But if the liquid is heated it can become: Super Saturated in which minerals will form out of the solution.

↳ The solution will disappear or dry up leaving the mineral behind. this is known as: Evaporites

Saturated

Evaporites



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NAME:

DATE

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NOTE Taking AREA:

Economic Value

↳ minerals are used to make computers, medicines, paints, etc... even jewelry

↳ If a mineral contains an **useful substance** that can be mined @ a profit

↳ It must also have a supply & demand then we call it an **ORE**.

↳ Remove it from the ground in 1 of 2 ways

1. Underground mining

2. Open-pit mining near the surface

↳ Removal of unwanted rock & dirt from mining can be expensive & harmful to the environment.

ORE

GEMS

↳ are valuable minerals that are prized for their rarity and beauty

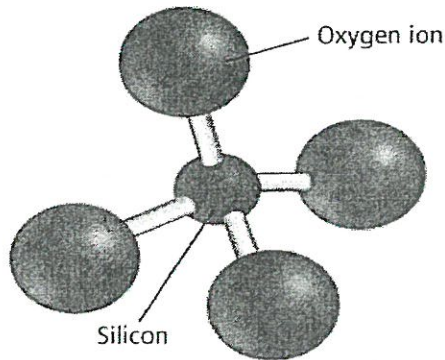
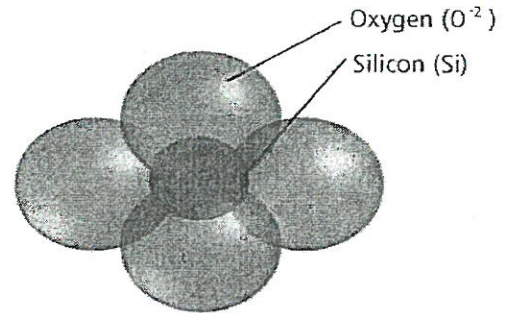
SUMMARY:

↳ are cut and polished

↳ Commercially useful.

Part C: Mineral Groups➤ **Silicates**

- Minerals that contain silicon and oxygen, and usually one or more other elements, are known as **silicates**. Silicates make up approximately 96 percent of the minerals present in Earth's crust.
- The basic building block of the silicates is the silica tetrahedron. A **tetrahedron** (plural, tetrahedra) is a three-dimensional shape that **resembles a pyramid**.
- Because silicon atoms have four valence electrons, they can bond with four oxygen atoms.

Ball-and-Stick Model**Space-Filling View**

- Individual tetrahedron ions are strong and can bond together to form sheets, chains, and complex three-dimensional structures.
- The bonds between the atoms help determine several mineral properties, including cleavage or fracture.

➤ **Carbonates**

- Carbonates are minerals composed of one or more metallic elements and the carbonate ion CO_3^{2-} .

➤ **Sulfates**

- Sulfates are compounds of elements with the sulfate ion (SO_4^{2-}), such as anhydrite (CaSO_4).

➤ **Sulfides**

- Sulfides** are compounds of sulfur and one or more elements, such as pyrite (FeS_2).

➤ **Oxides**

- Oxides are compounds of oxygen and a metal, such as hematite (Fe_2O_3).

➤ **Halides**

- Halides are made up of chloride or fluoride along with calcium, sodium, or potassium, such as halite (NaCl).

➤ **Native elements**

- Native elements** are made up of one element only, such as silver (Ag).

Si
+
O

CO_3

SO_4

S

O

Cl, F, Br, I,

Rare

Mineral Makeup Worksheet #2

Part A: Elementary, My Dear

Rocks and minerals, like all other forms of matter, are made of one or more elements. Elements are the simplest pure substances. Examples of elements include carbon, oxygen, silicon, and gold.

Take a look at the periodic table of the elements in your book. The periodic table gives a great deal of information about the known elements. (Don't worry! You won't need all the information in the periodic table for this activity. However, a copy of the periodic table is always a useful thing to have when you're studying geology or any other science.)

As you can see, each element has a one- or two-letter symbol. Hydrogen is represented by the symbol H, helium is represented by He, and so on. Each element also has an atomic number. Lithium, for instance, has the atomic number 3.

1. What are the chemical symbols for:
 - a. Oxygen (atomic number 8)
 - b. Silicon (atomic number 14)
 - c. Zinc (atomic number 30)
2. What is the name and chemical symbol of the element with atomic number 13?
3. What are the chemical symbols for
 - d. Copper (atomic number 29)
 - e. Silver (atomic number 47)
 - f. Gold (atomic number 79)

You might be wondering why some elements have chemical symbols that do not seem to make much sense—the symbol Hg, for example, looks nothing like the word mercury! This is because many of the symbols are based on the Latin names for the elements. And the Latin words for mercury, copper, silver, and gold are hydrargyrum, cuprum, argentum, and aurum, respectively.

Part B: Cracking the Code

Chemical symbols are used to write down chemical formulas. Chemical formulas are used to represent substances that are made of more than one kind of element. The combinations of letters and numbers in chemical formulas may seem a bit confusing at first glance. But they are actually quite simple to read, once you know how. Consider the chemical formula for water: H₂O. The H means that water contains the element hydrogen. The O means that water also contains the element oxygen. The subscript numeral 2 means that a molecule of water contains two atoms of hydrogen and one atom of oxygen. (A molecule is made of two or more atoms chemically bonded, or joined, together.)

Using what you have learned about chemical symbols and formulas, complete the table on the back side and answer the questions. *The first row has been completed for you.*