Topic/Objective CHAPTER: 4

Minerals

NAME:

Pd: 1 2 4 5 other

DATE

extra 1 of 5

Essential Question

What are minerals?

Cue: Review: Thoughts: Main Idea

NOTE Taking AREA:

- 5 char. 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.

↳ made by nature

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.

NOTES CONTINUE ON OTHER SIDE

	Topic/Objective CHAPTER:	NAME:
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Cue: Review: Thoughts: Main Idea

NOTE Taking AREA:

8 most Common elements

8 most Common elements that form minerals.

1. Oxygen 46.6%
2. Silicon 27.7%
3. Aluminum 8.1%
4. Iron 5.0%
5. Calcium 3.6%
6. Sodium 2.8%
7. Potassium 2.6%
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 "Kayos"

2 types

- Isomorphs: 2 minerals same structure different chemical composition
  e.g. Pyrite (Fool's)/Halite/galena. [PbS]
- Poly-morphs: 2 minerals w/same chemical composition but different structures.
  e.g. graphite / Diamond ⇒ C

Topic/Objective CHAPTER: 4

Minerals

NAME:

Pd: 1 2 4 5 other

DATE 2 of 5

Essential Question

What are Xstal shapes & Physical Prop.

Cue: Review: Thoughts: Main Idea

NOTE Taking AREA:

Crystal shapes

dice

Stop Sign

Jolly Rancher

cereal box

Big eraser

geological Processes

↳ 6 Basic types of crystal structures.

name	e.g.
1. Cubic (Isometric)	Salt, Pyrite, galena fluorite, gold, silver
2. Hexagonal	quartz, calcite, graphite, corrundum
3. Tetragonal	Zircon, rutile
4. Orthorhombic	Sulfur, topaz, olivine
5. monoclinic	Feldspar, mica, gypsum
6. Triclinic	albite

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

4 basic geological processes

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

NOTES CONTINUE ON OTHER SIDE

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Cue: Review: Thoughts: Main Idea

5 Characteristic All Minerals Have

- How to identify minerals

NOTE Taking AREA:

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

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

- **Color**

↳ how the mineral appears to look

↳ most noticeable; least reliable

- **Luster**

↳ how a mineral reflects light from its surface

↳ 2 types → metallic (look like metal)

→ Non metallic (every thing else)

↓ see Texture

Texture

↳ how a mineral feels to the touch

↳ this is subjective

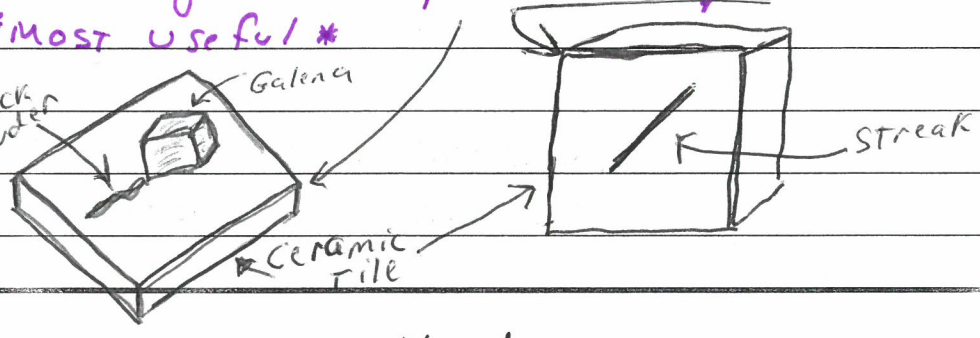
↳ smooth, Rough, greasy, Soapy, Waxy, vitreous, & earthy

Streak

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

↳ involves rubbing a mineral against an unglazed porcelain plate.

↳ *MOST useful*



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Topic/Objective CHAPTER: 4

Minerals

NAME:

Pd: 1 2 4 5 other

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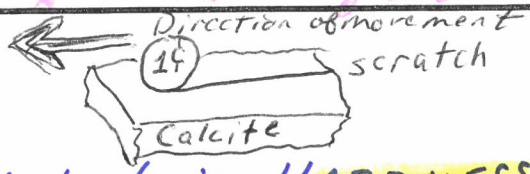
Essential Question

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.

Mohs Scale of Hardness

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

NOTES CONTINUE ON OTHER SIDE

	Topic/Objective CHAPTER:	NAME:
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Cue: Review: Thoughts: Main Idea	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/crumbly:

	Topic/Objective CHAPTER: 4 Minerals	NAME:
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Essential Question

What are Special Properties

Cue: Review: Thoughts: Main Idea

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

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

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

Radioactive ↳ will contain radioactive ISOtope

incandescent

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

Fire Resistance ↳ Asbestos is sample that is fire Resistance

NOTES CONTINUE ON OTHER SIDE

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		DATE

Cue: Review:
Thoughts: Main Idea

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

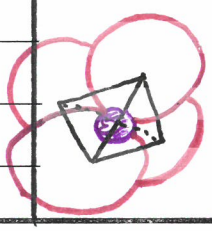
↳ groves or "scratch like" marks

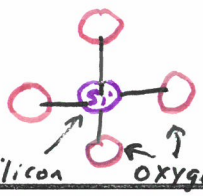
↳ some times called "Twinning streaks"

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 sub groups
  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

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Essential Question

What are Rock-forming Minerals?

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 can not hold anymore substance we call it Saturated.

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

Evaporites

NOTES CONTINUE ON OTHER SIDE

	Topic/Objective CHAPTER:	NAME:
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Cue: Review: Thoughts: Main Idea

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

ORE

↳ 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.

GEMS

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

SUMMARY:

↳ are cut and polished

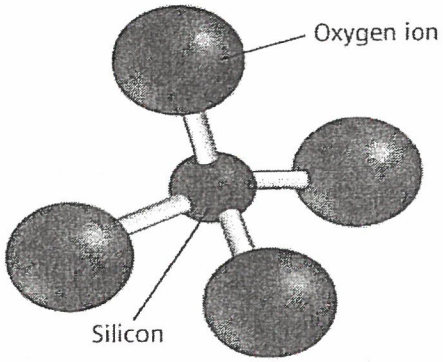
↳ Commercially useful.

NAME: DATE: PD:

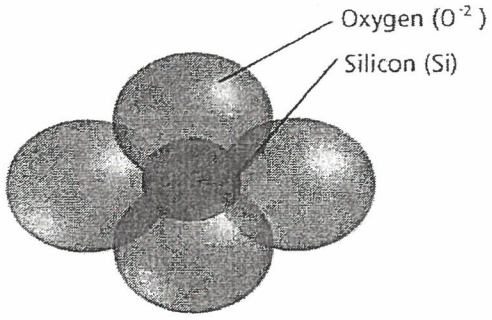
Part C: Mineral Groups

- **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).

NAME: DATE: PD:

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: H_2O. 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.*

Intermediate hardness [edit]

The table below incorporates additional substances that may fall between levels:

Hardness	Substance or mineral
0.2–0.3	caesium, rubidium
0.5–0.6	lithium, sodium, potassium
1	talc
1.5	gallium, strontium, indium, tin, barium, thallium, lead, graphite, ice[12]
2	hexagonal boron nitride,[13] calcium, selenium, cadmium, sulfur, tellurium, bismuth, gypsum
2–2.5	halite (rock salt)
2.5–3	gold, silver, aluminium, zinc, lanthanum, cerium, Jet (lignite)
3	calcite, copper, arsenic, antimony, thorium, dentin
3.5	platinum
4	fluorite, iron, nickel
4–4.5	steel
5	apatite (tooth enamel), zirconium, palladium, obsidian (volcanic glass)
5.5	beryllium, molybdenum, hafnium, glass, cobalt
6	orthoclase, titanium, manganese, germanium, niobium, rhodium, uranium
6–7	fused quartz, iron pyrite, silicon, ruthenium, iridium, tantalum, opal, peridot, tanzanite, jade
7	osmium, quartz, rhenium, vanadium
7.5–8	emerald, hardened steel, tungsten, spinel
8	topaz, cubic zirconia
8.5	chrysoberyl, chromium, silicon nitride, tantalum carbide
9	corundum, tungsten carbide, titanium nitride
9–9.5	silicon carbide (carborundum), titanium carbide
9.5–10	boron, boron nitride, rhenium diboride (*a*-axis),[14] stishovite, titanium diboride
10	diamond, carbonado
>10	nanocrystalline diamond (hyperdiamond, ultrahard fullerite), rhenium diboride (*c*-axis)[14]