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Mineral Makeup Worksheet #2 ANSWERS

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.*

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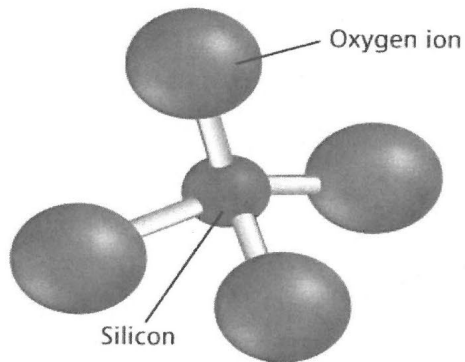
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Part C: Mineral Groups

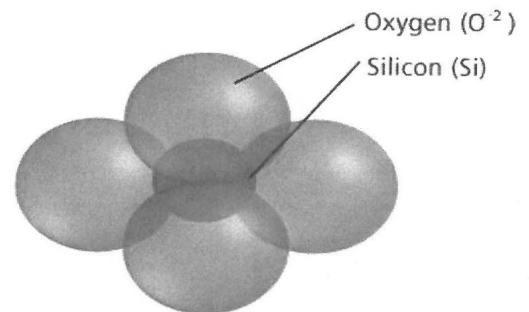
➤ Silicates

- 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).

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Mineral Makeup Worksheet #2

| <i>Mineral</i> | <i>Chemical Formula</i> | <i>Atoms of Each Element per Molecule of the Mineral</i> | <i>Mineral Group</i> |
|-----------------------------|--|---|----------------------|
| Biotite (a mica) | $K(Mg,Fe)_3AlSi_3(OH)_2$ | 1 potassium; 3 magnesium or iron; 1 aluminum; 3 silicon; 2 oxygen- hydrogen groups = 2 oxygen and 2 hydrogen | Silicate |
| Halite | NaCl | | |
| Pyrite | FeS | | |
| Cinnabar | HgS | | |
| Galena | PbS | | |
| Covellite | CuS | | |
| Quartz | SiO ₂ | | |
| Cassiterite | SnO ₂ | | |
| Marcasite | FeS ₂ | | |
| Fluorite | CaF ₂ | | |
| Hematite | Fe ₂ O ₃ | | |
| Calcite | CaCO ₃ | | |
| Anhydrite | CaSO ₄ | | |
| Orthoclase (a feldspar) | K(AlSi ₃ O ₈) | | |
| Plagioclase (a feldspar) | Na(AlSi ₃ O ₈) | | |
| Corundum | Al ₂ O ₃ | | |
| Alabaster (gypsum) | Ca(SO ₄) * 2H ₂ O | | |
| Sulfur | S | | |
| Iron | Fe | | |
| Jadeite | NaAl(Si ₂ O ₆) | | |
| Beryl | Be ₃ Al ₂ (SiO ₃) ₆ | | |
| Apatite | Ca ₅ (F,Cl)(PO ₄) | | |
| Muscovite (a mica) | KAl ₃ Si ₃ O ₁₀ (OH) ₂ | | |
| Talc | Mg ₃ Si ₄ O ₁₀ (OH) ₂ | | |

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RESULT & Conclusion

Use your completed table to answer the following questions.

1. Which mineral is a carbonate, a compound that contains a -CO_3 group?
2. Which mineral is a sulfate, a compound that contains a -SO_4 group?
3. Which minerals are sulfides, compounds that consist of sulfur and one other element?
4. Which minerals are oxides, compounds that consist of oxygen and one other element?
5. About 92 percent of the rock-forming minerals in the Earth's crust are silicates, compounds that contain silicon, oxygen, and one or more metals. Which minerals are silicates?
6. Which mineral provides the liquid element mercury?
7. Which mineral is an ore for the metal tin?