7. Minerals III

Mineral Families

O and Si make up ______% of all atoms available to make minerals in the Earth's crust.

Minerals in which cations combine with $O^{2-}$ anions are called ________________.

If Si gets added, O and Si combine to form the ________________ anion: $(SiO_4)^{4-}$. Minerals containing this anion are called ________________.

The most abundant family of minerals is the ________________.

The second most abundant are the ________________.

Minerals that are not silicates are called ________________

Types of non-silicates:

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<th>Anion Present</th>
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99% of all rocks in the crust are made up of ________________, ________________, ________________, and ________________ (a total of about 30 minerals).

These 30 or so minerals are called the **rock-forming minerals** because they are the main components of most common rock types.

75% of the Earth's crust is made up of two types of silicate minerals:

______________ and ________________

Less common types of minerals in rocks are called ________________ minerals.

Silicates

What does a silica anion look like? ________________

________________________________________

What is meant by the word tetrahedron? ________________
Why do silica tetrahedra have a charge of negative-4: \((\text{SiO}_4)^{-4}\)?

___________________________________________________________________

How do silica tetrahedra get rid of the negative charges? ______________________

What mineral is pure silica?
(Clue: its chemical formula is \(\text{SiO}_2\)) ______________________

By sharing oxygen atoms in the crystal lattice (rather than just sharing electrons), silica anions can form several types of atomic arrangements:

• independent tetrahedra (no sharing) (e.g. ________________)
• single chains (e.g. ________________)
• double chains (e.g. ________________)
• sheets (e.g. ________________ and ________________)
• 3D framework (e.g. ________________ and ________________)

Each of these patterns results in different types of silicate minerals.

Cations fill in gaps between the silica tetrahedra. Five common cations that bond with silica tetrahedra are:

_________ ___________ ___________ ___________ ______

The exact silicate mineral that forms depends on the arrangement of the silica tetrahedra and the types of cations that bond with them.

**Ferromagnesian Silicates**

These are the silicate minerals that contain _____________ and _____________.

Typical dark colors of ferromagnesian silicates:

___________ , _____________ , _____________ , _____________

Examples of ferromagnesian silicates:

___________ , _____________ , _____________ , _____________ , _____________

**Nonferromagnesian Silicates**

Typical color of nonferromagnesian silicates: _____________________________
Examples of nonferromagnesian silicates:

________________ ,   ____________ ,   ___________________

The two types of feldspar are in the feldspar group of minerals are:

__________________ (contains the element _________)

And

___________________ (contains the elements _______ and _______)

Non-silicates

Oxides

Any mineral that contains O atoms but no Si are called oxides.

Examples of oxides: _____________________ and ____________________

Carbonates

Minerals containing the carbonate anion (CO\(_3\))\(^2-\) are carbonates.

Examples of carbonates: _____________________ and ____________________

How can you tell the difference between the above two carbonate minerals?

____________________________________________________

Sulfides and Sulfates

What are sulfides? ______________________________________________________

Examples of sulfides: ______________ and ______________

What are sulfates? ______________________________________________________

Example of a sulfate: ______________

Native Elements

Some minerals are comprised of only a single type of element arranged into a complex 3D crystal lattice. These are called native elements.
Examples: _____________, _______________, ______________, ______________

What are polymorphs of an element?

_____________________________________________________________________

Where do Minerals Come From?

There are many ways that minerals can form in the Earth's crust:

• Cooling of magma or lava: _____________________________________________
• Hydrothermal: _______________________________________________________
• Evaporation: _________________________________________________________
• Alteration: __________________________________________________________

Naming Minerals

Minerals may be named in a number of ways:

• after their discoverers (famous mineralogists or people with inflated egos)
• after the locality where they were discovered (e.g. vesuvianite from Mt. Vesuvius)
• after their physical properties (e.g. magnetite is magnetic)
• after their chemistry (e.g. fluorite contains F; chromite contains Cr)

Uses of Minerals

How many tons of minerals does each of us use every year? _____________

Uses:

• ____________: glass, optical instruments, sandpaper, steel alloys
• ____________: drywall
• ____________: ceramics, paper
• ____________: porcelain, ceramics, enamel, glass
• ________________: catalytic converters, chemotherapy, jewelry

Economic Classification of Minerals

Economic minerals are classified as either mineral resources or mineral reserves.

Mineral _____________: the actual amount of a mineral that exists in rocks.

How does the amount change through time? _________________________________
Mineral ______________: the amount of the mineral that can be economically extracted.

How does the amount change through time? ____________________________

**FINAL QUESTION:**

Which is greatest in amount: mineral reserve or mineral resource?

_____________________________