

## Minerals - Chapter Questions

1. **\*\*What are the 5 MAIN requirements of a substance to be called a mineral?** (*Naturally occurring, solid, has a crystal structure, can be defined by a chemical formula, and is inorganic. To be inorganic, the chemical formula cannot contain O, C, AND H (all three together)*).
2. How do minerals differ from rocks? Which of these are minerals: gold, glass, sugar, salt, ice?
3. What is ionic substitution? What physical characteristics of a mineral does it most affect?
4. **\*\*What's the difference between fracture and cleavage? Luster and color?**
5. Gold has a density (or specific gravity) of 20. If a pail of water weighs 2 kg, what does the same size pail of gold weigh?
6. How can you use the hardness scale to determine the hardness of a mineral?

| <b>Moh's scale:</b> | <b>Other items:</b>                      |
|---------------------|--|
| 1. Talc             |  |
| 2. Gypsum           | 2.5 fingernail                           |
| 3. Calcite          | 3.5 copper wire                          |
| 4. Fluorite         | 4.5 iron wire or nail                    |
| 5. Apatite          | 5.5 glass or masonry nail or knife blade |
| 6. Orthoclase       | 6.5 streak plate                         |
| 7. Quartz           |  |
| 8. Topaz            |  |
| 9. Corundum         |  |
| 10. Diamond         |  |

7. **\*\*What is the basic structure of an atom? What are the main particles? How do they differ?**
8. If the number of electrons in an atom is 20; its atomic mass is 41; how many protons? Neutrons? The atomic number? The number of electrons in its outer shell (**valence electrons**)?
9. **\*\*What is an isotope? How do isotopes vary from each other?**
10. **\*\*Compare and contrast the three main bond types: how is each formed? Why?**

|                          | <b>Covalent bonds</b>                              | <b>Ionic bonds</b>  | <b>Hydrogen bonds</b>   |
|--------------------------|--|---|---|
| <b>Description</b>       | Shared electrons to complete outer shell.          | Atoms exchange electrons to complete outer shell. Now atoms are ions that are oppositely charged and attracted to each other. | Water molecules (because of shape) have a slightly positive end and slightly negative end. These molecules are attracted to each other and to other ions. |
| <b>Relative strength</b> | Strongest  | Medium  | Weakest   |
| <b>Example</b>           | Diamond<br>Quartz<br>Water (between H and O atoms) | Halite (salt)   | Water (between water molecules - how they stick to each other)  |

11. **\*\*What are polymorphs? Give an example of a set.**
12. **\*\*What is the most abundant mineral group? What do all minerals within this group have in common?**

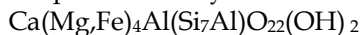
13. Be sure you understand how silicate structures form, the cleavage and Si:O ratios that result, and an example of a mineral that displays such structure:

| Silicate structure   | Cleavage type   | Examples   | Si:O ratio |
|--|---|------------|------------|
| <b>Single</b> Si-O tetrahedron connected to other tetrahedron by ionic bonds.                  | None  | Olivine    | 1:4        |
| <b>Single chains</b> connected to other chains by ionic bonds.                                 | 2 planes at 90° (square columns) or hairs/fibers          | Pyroxene   | 1:3        |
| <b>Double chains</b> connected to other chains by ionic bonds.                                 | 2 planes at 60 and 120° (sheared columns) or hairs/fibers | Hornblende | 1:2.75     |
| <b>Sheets</b> connected to other sheets by ionic bonds.  | 1 plane   | Micas      | 1:2.5      |
| <b>Three dimensional framework</b> of Si-O tetrahedrons with ionic bonds filling holes within. | 2 planes at 90° (square tablets)                          | Feldspars  | 1:2        |
| <b>Three dimensional framework</b> of Si-O tetrahedrons with no ionic bonds.                   | None  | Quartz     | 1:2        |

14. Describe the basic distinguishing characteristics of these rock-forming minerals (bolded minerals only): (Be able to distinguish on exam based on definition.)

**SILICATES**

Amphibole family: **Hornblende**



Feldspar family

- **Plagioclase Feldspar:**  $[\text{CaAl}_2\text{Si}_2\text{O}_8]$  to  $[\text{NaAlSi}_3\text{O}_8]$

- **Potassium Feldspar:**  $[\text{KAlSi}_3\text{O}_8]$

**Garnet** Fe,Mg,Ca, Al Silicate

**Mica** family:

- Biotite [Silicate with K, Mg, Fe, Al, Ti, OH, F]

- Muscovite [Silicate with K, Al, OH, F]

**Olivine**  $(\text{Mg,Fe})_2\text{SiO}_4$

**Pyroxene** family: Augite [Silicate with Fe, Mg]

**Quartz**  $\text{SiO}_2$

**Serpentine**  $\text{Mg}_6\text{Si}_4\text{O}_{10}(\text{OH})_8$

**Talc**  $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$

**CARBONATES**

**Calcite**  $\text{CaCO}_3$  {Dolomite  $\text{CaMg}(\text{CO}_3)_2$ }

**SALTS**

**Halite** NaCl

**Fluorite**  $\text{CaF}_2$

**SULFATES**

**Gypsum**  $\text{CaSO}_4 \cdot 2(\text{H}_2\text{O})$

**SULFIDES**

**Galena** PbS

**Pyrite** FeS

**OXIDES**

**Hematite**  $\text{Fe}_2\text{O}_3$

**Magnetite**  $\text{Fe}_3\text{O}_4$

**NATIVE ELEMENTS**

**Graphite** (C)

15. What's the best test for distinguishing calcite from quartz or anything else?  
 16. \*\*What are the chemical formulas of quartz and calcite? (The only two you need to know.)  
 17. What is the best means of distinguishing between plagioclase and potassium feldspar?