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?

Moh's scale:	**Other items:**
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?

	Covalent bonds	**Ionic bonds**	**Hydrogen bonds**
Description	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.
Relative strength	Strongest	Medium	Weakest
Example	Diamond Quartz 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:0 ratios that result, and an example of a mineral that displays such structure:

Silicate structure	Cleavage type	Examples	Si:O ratio
Single Si-O tetrahedron connected to other tetrahedron by ionic bonds.	None	Olivine	1:4
Single chains connected to other chains by ionic bonds.	2 planes at 90° (square columns) or hairs/fibers	Pyroxene	1:3
Double chains connected to other chains by ionic bonds.	2 planes at 60 and 120° (sheared columns) or hairs/fibers	Hornblende	1:2.75
Sheets connected to other sheets by ionic bonds.	1 plane	Micas	1:2.5
Three dimensional framework of Si-O tetrahedrons with ionic bonds filling holes within.	2 planes at 90° (square tablets)	Feldspars	1:2
Three dimensional framework 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**
$Ca(Mg,Fe)_4Al(Si_7Al)O_{22}(OH)_2$

Feldspar family

- **Plagioclase Feldspar**: [$CaAl_2Si_2O_8$] to [$NaAlSi_3O_8$]
- **Potassium Feldspar**: [$KAlSi_3O_8$]

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 $(Mg,Fe)_2SiO_4$

Pyroxene family: Augite [Silicate with Fe, Mg]

Quartz SiO_2

Serpentine $Mg_6Si_4O_{10}(OH)_8$

Talc $Mg_3Si_4O_{10}(OH)_2$

CARBONATES

Calcite $CaCO_3$ {Dolomite $CaMg(CO_3)_2$}

SALTS

Halite NaCl

Fluorite CaF_2

SULFATES

Gypsum $CaSO_4*2(H_20)$

SULFIDES

Galena PbS

Pyrite FeS

OXIDES

Hematite Fe_2O_3

Magnetite Fe_3O_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?