

# GEOLOGY TEST 1 STUDY GUIDE

## MINERALS

8 most abundant elements:	Common ionic form:	Relative Ionic Size:	Coordination #:
Oxygen (O)	O <sup>-2</sup>	1.4	depends on size
Silicon (Si)	Si <sup>+4</sup>	.26	4
Aluminum (Al)	Al <sup>+3</sup>	.39	4 or 6
Iron (Fe)	Fe <sup>+2</sup>	.63	6
Calcium (Ca)	Ca <sup>+2</sup>	1.00	8
Sodium (Na)	Na <sup>+1</sup>	.99	8
Potassium (K)	K <sup>+1</sup>	1.37	8 or 12
Magnesium (Mg)	Mg <sup>+2</sup>	.72	6

### **Crystalline vs Non-crystalline:**

A crystalline solid has its molecules (or atoms) arranged in a lattice. That is, they are arranged in a regular fashion with equal spacing and angular relationships in all three directions.

A non-crystalline solid, also called amorphous, has no such regular arrangement of molecules.

### **Silicate Minerals:**

olivines -  $(Mg,Fe)_2SiO_4$  ; independent tetrahedra

pyroxenes -  $(Mg,Fe)_2Si_2O_6$  ; single chain

amphiboles -  $(W,X,Al)_7-8(Z_4O_{11})_2(OH)_2$  ; double chains

biotite mica -  $K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$  ; sheet silicates

muscovite mica -  $KAl_2(AlSi_3O_{10})(OH)_2$  ; sheet silicates

alkali feldspars -  $KAlSi_3O_8$ --- $NaAlSi_3O_8$  (solid solution series) ; framework silicates

plagioclase feldspars -  $NaAlSi_3O_8$ --- $CaAl_2Si_2O_8$  (solid solution series) ; framework silicates

quartz -  $SiO_2$  ; framework silicates

### **Atomic/Ionic substitution in silicates:**

### **Relationship of cleavage to structure in silicate minerals:**

**Mafic-** rocks low in silicon  
**Felsic-** rocks high in silicon

### EARTH'S HEAT

**Heat Transfer:**

**Radiation-** Electromagnetic waves that directly transport ENERGY through space.

**Conduction-** transfer of energy through matter from particle to particle

**Convection-** transfer of heat by the actual movement of the warmed matter.

**Origin of Earth's Heat:**

comets, asteroids, and other smaller masses

**Geothermal Gradient:** rate at which the temperature increases with depth in the Earth

**Geobarometric Gradient:**

### MAGMAS

**Melting of Silicate rocks:** Volatiles (water)- Temperatures of minerals are reduced under high water pressure. Wet rocks melt at lower temps than dry rocks.

**Factors influencing viscosity-** silica content and temperature.

**Crystallization of magmas:**

**Fractional Crystallization-** Rapid cooling, crystal settling or mineral overgrowth inhibiting diffusion prevents melt reacting with crystals

**Equilibrium Crystallization-** slow cooling allows previously formed crystals to react with melt to bring them into equilibrium as melt composition changes

**Magma rise to shallow crustal levels:**

1. The most obvious is an increase in temperature.
2. The introduction of water into rock. Water lowers the melting point of rocks.
3. A decrease in pressure of rocks that are already hot will cause them to melt.

**Magma originate:** crust or mantle

## IGNEOUS ROCKS

**Volcanic rocks (small crystals)** – basalt- mafic, fine grained, dark color, andesite- intermediate, fine grained, rhyolite- felsic, fine grained, light color

**Plutonic rocks (large crystals)** – peridotite- ultramafic, coarse grained, gabbro- mafic, coarse grained, dark colored, diorite- intermediate, coarse grained, granite- felsic, coarse grained, light colored

### **Textures of rocks-**

**Batholith-** a very large igneous intrusion extending deep in the earth's crust.

**Dike-** a long wall built to prevent flooding from the sea

**Extrusive-** igneous rocks that have been forced out in a molten or plastic condition upon the surface of the earth.

**Intrusive-** having been forced while in a plastic state into cavities or between layers

**Pluton-** body of intrusive igneous rock that is crystallized from magma slowly cooling below the surface of the Earth.

## VOLCANOES

### **Types of Volcanoes:**

**Volcanic fields-** small eruptions occur over a wide area

**Cone Volcano-** succession of small moderate eruptions from one location

**Caldera Volcano-** infrequent but moderate large eruptions

**Cinder Volcano-** steep conical hill with straight sides, explosive

**Shield Volcano-** very gentle slopes, convex upward, quiet

**Strato Volcano-** gentle lower slopes, steep upper slopes, concave upward, explosive