GS104 Lab 4 Answer Key - Mineral Identification

Pre-Lab Reading Questions

Color - wavelengths and appearance of reflected visible light

Streak - color of a mineral in powdered form

Luster - appearance of mineral in reflected light (metallic or nonmetallic)

Density (Heft) - D=mass / volume (gm/cm^3), relates to specific gravity

S.G. = wt. mineral of given volume / wt. of water of same volume

High specific gravity and high density imply compact atomic structure, or composition of atoms with relatively high atomic mass.

Hardness - resistance of a mineral to scratching. Measured on a scale of 1 (soft) to 10 (hard) (Moh's hardness scale)

Crystal Form- during the growth of a mineral, if there is enough space for the mineral to grow, some species tend to form crystals with well-defined geometric shapes (e.g. quartz crystals = 6-sided prism topped by a 6-sided pyramid)

Cleavage- tendency of a mineral to break along well-defined planes of atomic weakness. Cleavage types nclude: basal - 1 direction of cleavage (e.g. biotite, muscovite), prismatic = 2 directions of cleavage (e.g. feldspar), cubic = 3 directions of cleavage at 90 degrees (e.g. halite, galena), rhombohedral = 3 directions of cleavage not at 90 degrees (e.g. calcite), and octohedral = 4 directions of cleavage (tends to form 8-sided octohedrons, e.g. fluorite).

Fracture - tendency for minerals to break along irregular zones. An example of conchoidal, or glassy, fracture of quartz. If a mineral does not have cleavage, then it will break with fracture.

Magnetism - property that a mineral is attracted to a magnetic field or magnet (e.g. magnetite)

Taste - property of particular taste to minerals (e.g. halite or NaCl - salty taste)

Effervescence in HCl = a drop of hydrochloric acid will cause the mineral surface to "fizz" via the release of gas from the mineral structure (e.g. calcite fizzes in HCl by releasing carbon dioxide)

Station 1 - Luster and Color

1. metallic luster minerals = galena, pyrite, chalcopyrite, hematite
   nonmetallic luster minerals = clacite (dull), quartz (glassy)

   luster - appearance of reflected light from a mineral surface (shines like metal, or not, in our case)

2. Quartz colors = smoky gray (smoky quartz), milky white (milky quartz), and pink (rose quartz).

All the quartz specimens are the same general chemical compostion (SiO_2), but small amounts of elemental impurites (like food coloring) can cause color changes (e.g. iron, Fe, commonly creates a reddish color).

3. No, color seems variable, and is not necessarily a distinguishing property for minerals.

Station 2 - Other Properties

Streak, magnetism and effervescence are defined in the pre-lab reading questions above.

Specimen Name	**Sample No.**	**Streak**	**Magnetism**	**Reaction to HCl**
Magnetite	2	black	yes, magnetic	no reaction
Calcite	13	white	no, not magnetic	reacts with HCl (fizzes)
Hematite	1	redish brwn	no, not magnetic	no reaction

Station 3 - Cleavage, Fracture, and Crystal Form

1. Cleavage is a result of weak atomic bonds between well-organized atoms. The result is a tendency to break along well-defined planes of weakness. Fracture is a result of breaking strong bonds, with a resulting irregular pattern of breaking.

2. Crystal form also displays geometric shapes to the mineral specimens, but crystal form is the result of mineral growth in an unrestricted environment. Cleavage relates to geometric patterns that develop by breaking the mineral into pieces.

Cleavage, fracture and crystal form are defined in the pre-lab reading questions above.

Cleavage / Fracture Samples

Mineral Name	**Sample No.**	**No. of Directions**	**Angle**
Halite	6	3 (6 sides - cube shape)	90 degrees
Calcite	13	3 (6 sides - rhombohedron)	not at 90 degrees
Quartz	3	no cleavage - this is conchoidal fracture	
Biotite	19	1 direction (flat sheets)	N/A

Station 4 Density

Density = mass / volume = gm/cm^3

Example measurement with quartz crystal:

Specimen mass = 26.5 gm

Volume Displacement = 10 ml = 10 cm^3

Density = 26.5 gm/10 cm^3 = 2.65 gm/cm^3

1. D = M/V ... by re-arranging the equation V = M/D = 1 gm /(2.65 gm/cm^3) = 0.38 cm^3

check: D = M/V = 1 gm / 0.38 cm^3 = 2.65 gm/cm^3

2. Since oil floats on water, it is less dense, and its specific gravity would be less than water (< 1)
3. A substance with a S.G. of 2.54 would be 2.54 times denser than water and would sink.
4. Since ice floats in water, it is less dense and has a specific gravity less than water (<1).

Station 5 Hardness

Mineral Name	Sample No.	Hardness
Garnet	7	greater than 5.5
Fluorite	12	between 3.5 - 5.5
Graphite	20	between 2.5-5.5
Gypsum	0	less than 2.5

Station 6 - Mineral I.D. Table

Sample	Luster	Hardness	Streak	Cleavage xl form	Color/ Other	Name
1	Metallic	>glass	red-brwn	n/a	red-gray	Hematite
2	Metallic	>glass	drk gray	n/a	magnetic	Magnetite
3	NM- Light	>glass	N/A	fracture	hard, glass	Quartz
4	Metallic	>glass	black	cubes	fools gold	Pyrite
6	NM-Light	<glass	white	3 dir@90	salty	Halite
8	Metallic	<glass	black	n/a	tarnished	Chalcopyri
9	NM-Dark	>glass	greenish	n/a	green glass	Olivine
10	NM-light	>glass	white	2 dir	pink	Orthoclase
12	Metallic	<glass	drk gray	3 dir@90	very dense	Galena
13	NM-light	<glass	white	3 dir n/a90	fizzes/HCl	Calcite
15	NM-light	<glass	white	1 dir	book like	Muscovite
16	NM-dark	>glass	white	2 dir	splintery	Hornblend
18	NM-light	>glass	white	2 dir	striations	Plagioclase
19	NM-dark	<glass	white	1 dir	book like	Biotite
21	NM-light	<glass	whte	4 dir	octohedron	Fluorite

dir = directions of cleavag, NM = nonmetallic, > harder than, < softer than, n/a = not applicable

Post-Lab Questions

1. Procedure for Mineral I.D. : observe physical properties, follow flow chart, arrive at mineral name
2. Breaks along smooth planes = cleavage
   scratches glass = hardness
   red power = streak
3. Three directions of cleavage at 90 degrees will result in a mineral that when broken, will form cube shapes.
4. Feldspar minerals have 2 directions of cleavage (prismatic)
5. To tell the difference between a crystal face and cleavage plane... look for growth striations on the crystal face, and try breaking the mineral, the cleavage planes will be defined.
6. Luster and hardness together will help i.d. a mineral. All the physical properties are controlled by the chemical composition of the mineral, and the arrangement of the atoms in the crystal lattice.