GEOL 333 - Lab 2 (Physical Properties of Minerals II) - Student Notes

More Physical Properties of Minerals

1) **Color, Streak and Luminescence:** Color obvious but not always reliable. Opaque minerals (e.g., pyrite) often have consistent color (assuming surface is not oxidized) but many transparent minerals (e.g., quartz) don't have consistent color (see Fig. 3.5 on p. 43 and Fig. 7.11 on 167 of Klein + Philpotts, Earth Materials)

   Mineral color is not considered a true physical property because it results from light and mineral interactions (mineral color can change with different light colors used); mineral color depends on chemical composition (abundance of major, minor, or trace element,s especially transition elements such as Fe, Cu, and Mn) and crystal structure (defects).

   Streak =

   Streak is more reliable than hand sample color because usually only a single streak color (see Fig. 3.12 on p. 48 of Klein + Philpotts).

   Practical Information for Streak Determinations: Rub mineral against unglazed porcelain plate, with hardness of 7. Can't determine streak of minerals with hardness ≥7. Why?

   Transparent minerals usually have a white streak. Don't confuse white streak of transparent mineral on white porcelain plate with "no streak." Use black porcelain plate for minerals with a light colored streak.

   Fluorescence =

   Mineral fluorescence is relatively uncommon (but an awesome property) and not usually used for mineral ID.

2) **Luster:** Luster =

Metallic = shiny appearance of polished metal and non-metallic = ~all other lusters. Table 3.1 lists many types of non-metallic luster, e.g., vitreous (glassy) and dull or earthy (little light reflectance) (see Fig. 3.5 on p. 43, Fig. 7.11 on p. 167, and Fig. 10.9 on p. 295 of Klein + Philpotts).

Table 3.1 (from Perkins, 2011, Mineralogy)
Terms Used to Describe Luster of Nonmetallic Minerals

Luster	Meaning	Minerals That Sometimes Exhibit the Luster
vitreous	having a glassy appearance	quartz, tourmaline
resinous	having the appearance of resin	sphalerite, sulfur
greasy	reflecting light to give a play of colors; similar to oil on water	chlorite, nepheline
silky	having surfaces appearing to be composed of fine fibers	chrysotile (asbestos), gypsum
adamantine	bright, shiny, brilliant appearance similar to that of diamonds	diamond, cerussite
pearly	appearing iridescent, similar to pearls or some seashells	Muscovite, talc
dull	Not reflecting significant amounts of light or showing any play of colors	kaolinite (clay), niter

3) **Magnetism:** acts like or attracted to a magnet due to spinning of unshared electrons in 3d orbital.

   Only common mineral that is strongly magnetic?

More Physical Properties of Minerals (continued)

4) Solubility and Reaction with Acid: Solubility =

Mineral solubility is not usually used for ID, but is important property.

High solubility mineral definition and example =

Low solubility (insoluble) mineral definition and example =

What controls a mineral's solubility?

Dissolution Reaction of High Solubility Mineral

Dissolution Reaction of Low Solubility Mineral

Chemical Composition of Selected Natural Waters

Species	Average Concentration (ppm)			
	Rainwater	**River water**	**Seawater**	**Groundwater**
Sodium (Na^+)	0.4	6.3	10,500	highly
Calcium (Ca^{2+})	1.4	15	400	variable
Potassium (K^+)	-	2.3	380	
Magnesium (Mg^+)	-	4.1	1,350	
Chloride (Cl^-)	0.2	7.8	19,000	
Sulfate (SO_4^{2-})	2.1	11	2,700	
Bicarbonate (HCO_3^-)	-	58	142	
Silica (SiO_2)	-	13	6.4	
Total Dissolved Solids (TDS)	**~4**	**~120**	**~34,000**	**~100 to 100,000's**

From data in Hem (1970) Study + Interpretation of Chemical Characteristics of Natural Water: USGS Water Supply Paper 1473.

Thought Question: Why is ocean salty?

More Physical Properties of Minerals (continued)

Reaction with Acid: Which mineral reacts vigorously with dilute acid, forming abundant bubbles?

Mineral is much more soluble (i.e., dissolves more) in acidic water than in neutral water.

Bubbles are from?

Dissolution Reaction of Mineral that becomes more Soluble with Increasing Acidity

Reading for Next Week

p. 183 - 187, 295 - 301, 436 - 442 Klein and Philpotts (2013) Earth Materials

Remember that at the beginning of next week's Lab there will be a quiz, which is based on key concepts from this week's Lab and the assigned reading for next week's Lab!