MINERAL PROPERTIES, USES, and IDENTIFICATION

part 2

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INTRODUCTION

- **Seven physical properties** are commonly used to identify minerals

- Students should be able to analyze minerals for all of these common properties (in red on the next page)

- Students should also become familiar with less common properties that may be used to distinguish specific minerals (in blue on the next page)

Physical Properties of Minerals

Seven Common Properties

1. Color and Clarity
2. Crystal Habits and Forms
3. Luster
4. Streak
5. Hardness
6. Cleavage
7. Fractures

Other Properties

a. Tenacity
b. Reaction with Acid
c. Magnetism
d. Striations
e. Exsolution Lamellae
f. Specific Gravity
g. Piezoelectricity
h. Double refraction

1. Color and Clarity

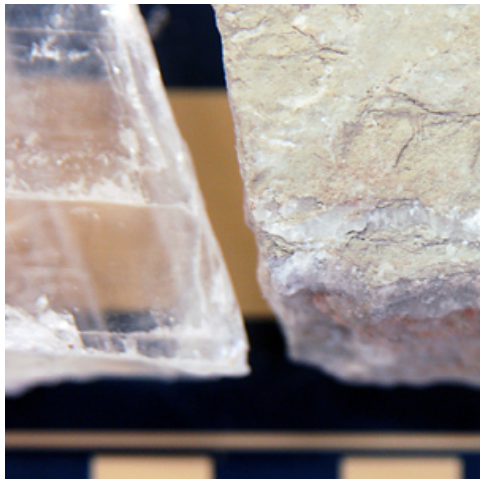
Color is easy to notice, but is often not reliable as a property.

Some minerals present varieties, different forms or colors, so other properties must be observed to identify it.

Most minerals also present a color on a freshly broken surface, and a different color on a tarnished or weathered surface

These are crystals of the same mineral, Quartz, SiO_2
Some crystals are milky white, some crystals are purple in color. A Quartz with purple color constitutes the variety *Amethyst*, which would have the same composition of "regular" Quartz, SiO_2

- Different minerals might present the same color. How would you tell one from the other?
- You must determine other physical properties in addition to color

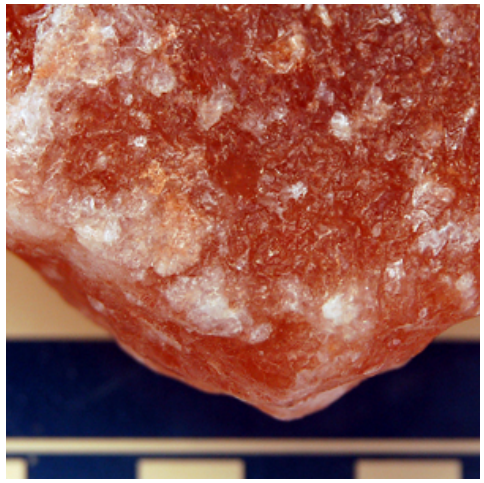


A
Crystals of **Gypsum**
$CaSO_4*2H_2O$

Looks like B, but has different properties

B
Crystals of **Halite**
(Table Salt) NaCl

Looks like A, and is the same as C

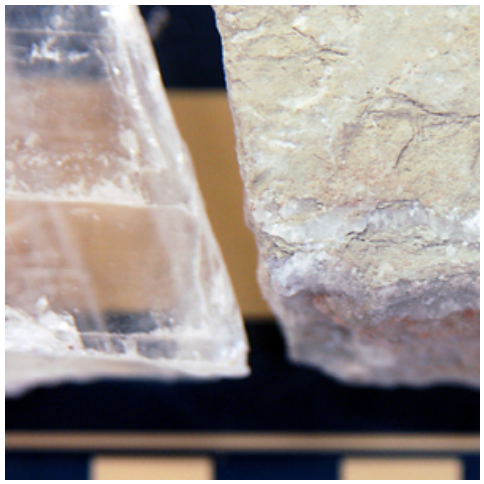


C
Crystals of **Halite**
(Table Salt) NaCl

Same as B, but has a different color

Clarity

- Mineral crystals also vary in their clarity (clearness, or ability to transmit light)
  - Transparent (clear and see-through, like glass)
  - Translucent (foggy, like a steamed-up shower door)
  - Opaque (impervious to light, like concrete and metals)

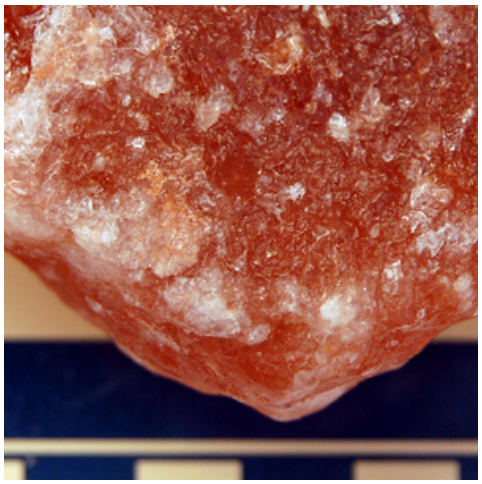


A
Crystals of **Gypsum**
$CaSO_4*2H_2O$

Left: transparent
Right: Opaque

B
Crystals of **Halite**
(Table Salt) NaCl

Translucent



C
Crystals of **Halite**
(Table Salt) NaCl

Opaque

2 – Crystal Habits and Forms

- The Crystal Form is the geometric shape of a crystal

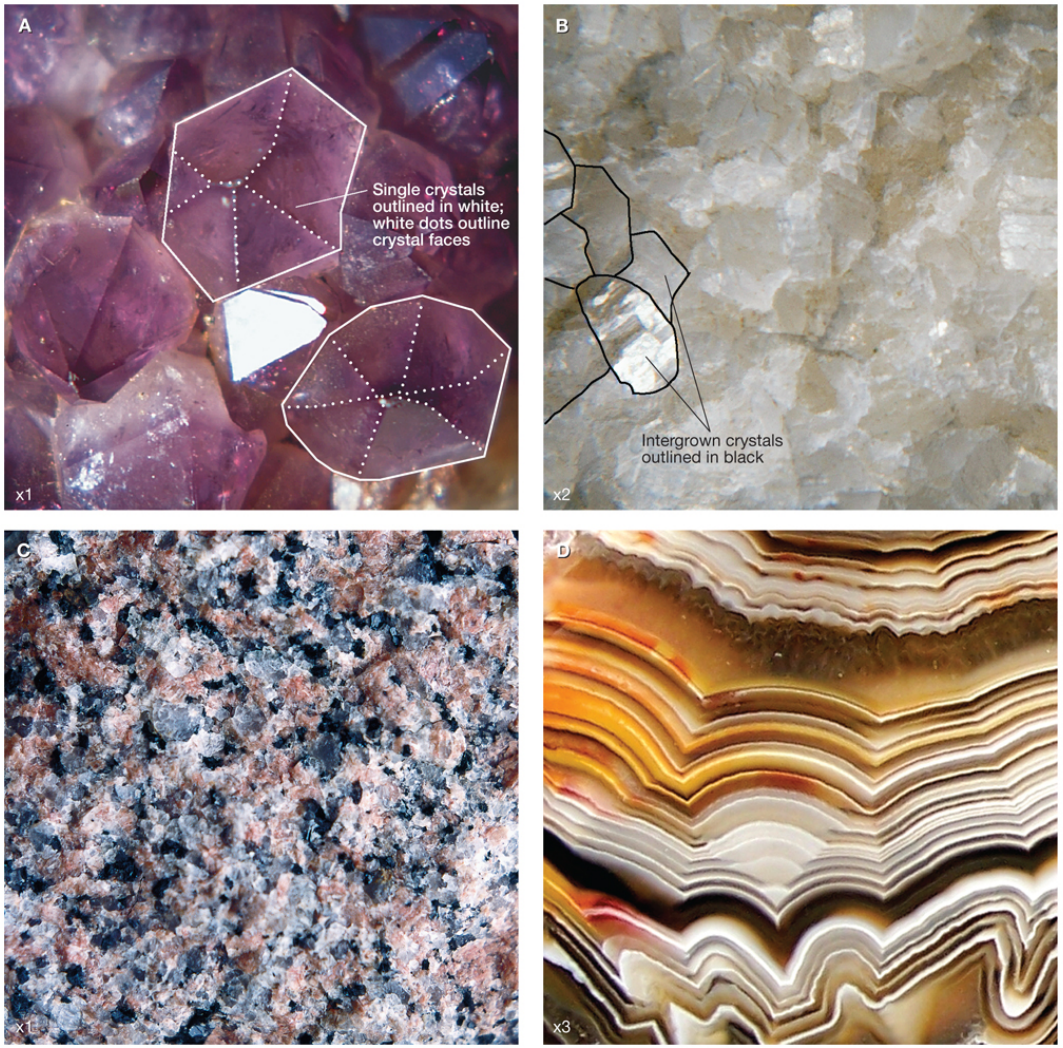
- The Crystal Habit refers to the general crystal form(s) and combination(s) in which a mineral habitually forms.

A. Amethyst (variety of purple Quartz SiO_2)

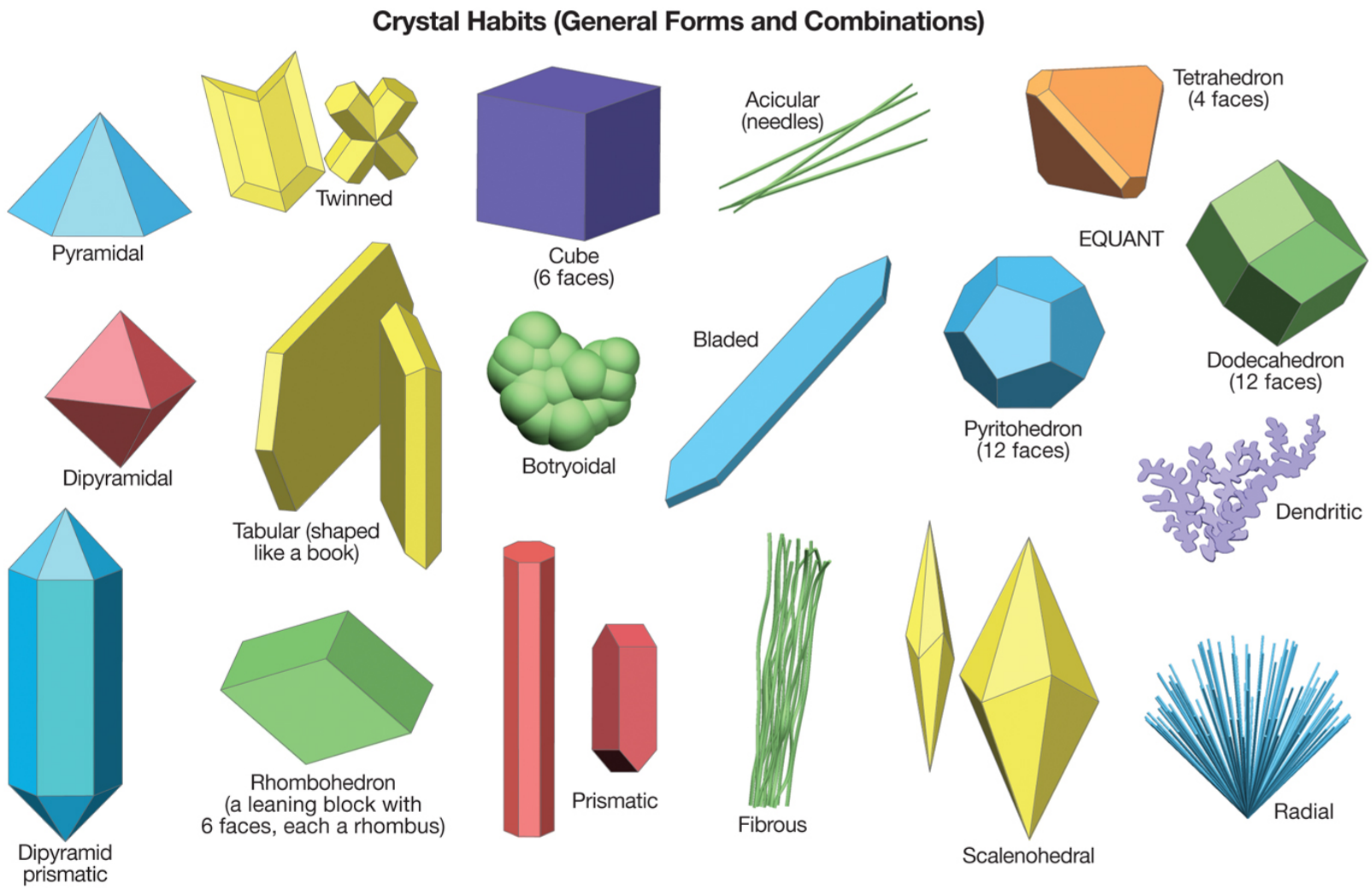
B. Calcite $CaCO_3$: crystals are so tightly intergrown that crystal form is not visible

C. Rock made of black, white, gray and pink crystals, also tightly intergrown so that crystal form is not visible

D. Agate (variety of multicolored Quartz SiO_2) that are cryptocrystalline (so tiny that they are not visible in hand samples



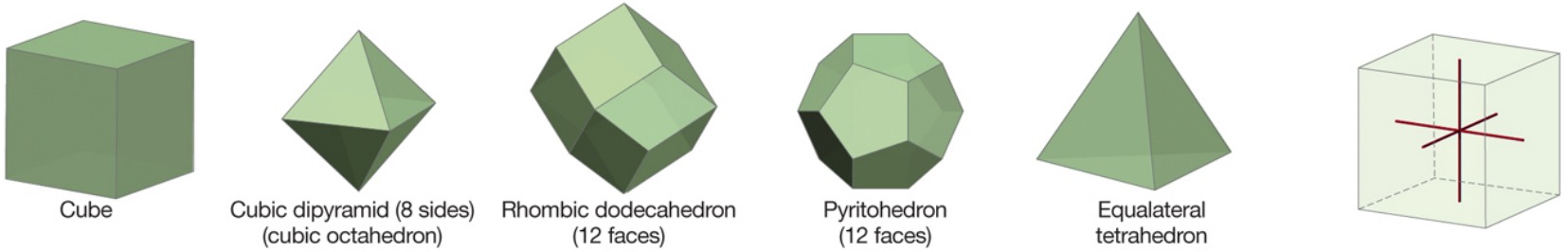
Common crystal habits, general geometric forms and combination of crystals



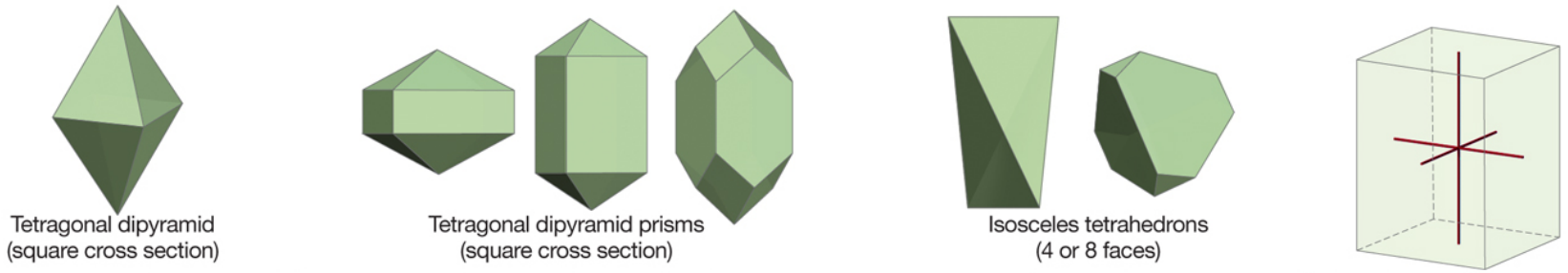
- Crystal habit refers to general forms and combination of crystals

- Each specific crystal form can be classified into one of six crystal systems, according to the number, length, and angular relationships of imaginary geometric axes along which its crystal faces grew

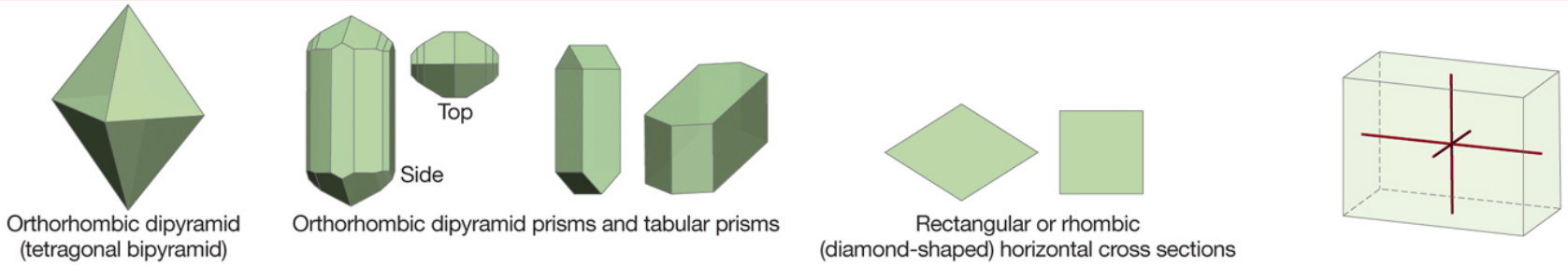
Crystal Forms (Specific Geometric Shapes) and Classification into Six Systems



Isometric (Cubic): Cubes and equidimentional shapes–three axes intersect at 90° and are *isometric* (same in length).

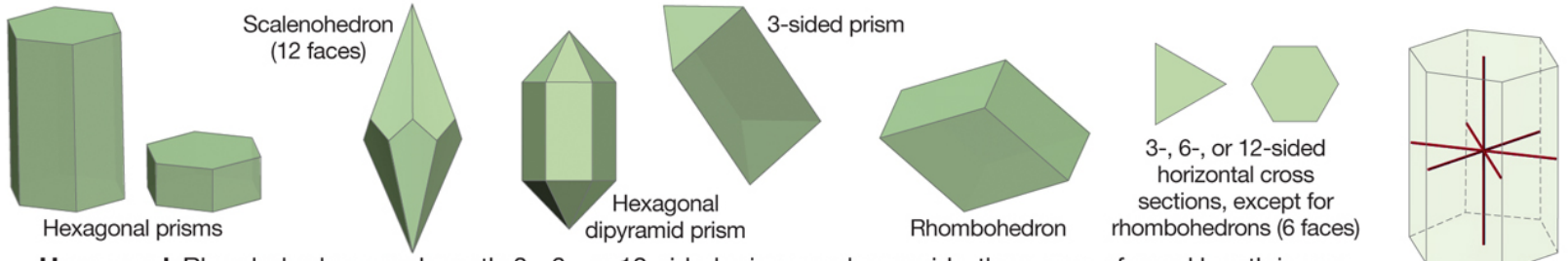


Tetragonal: Like isometric but longer in one direction–three axes intersect at 90° but only two are equal in length.

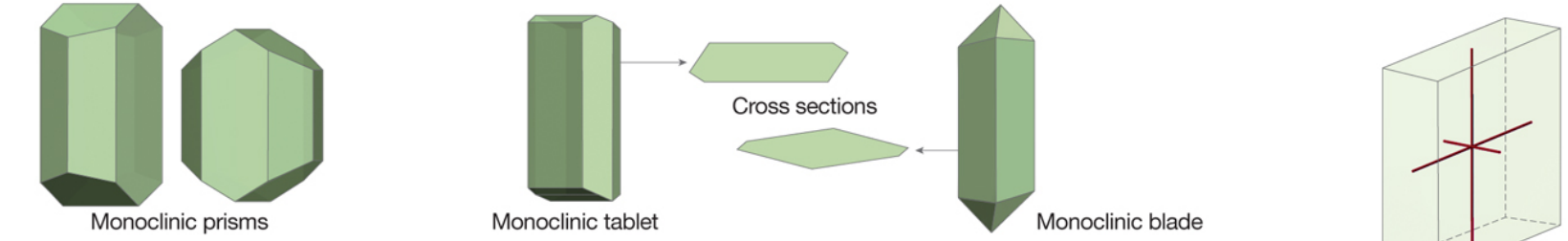


Orthorhombic: Prisms and dipyramids with rhombic or rectangular cross sections–three axes intersect at 90° but have different lengths.

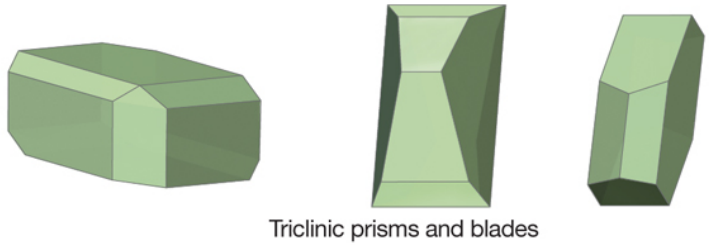
Crystal Forms (Specific Geometric Shapes) and Classification into Six Systems



Hexagonal: Rhombohedrons and mostly 3-, 6-, or 12-sided prisms and pyramids–three axes of equal length in one plane and perpendicular to a fourth axis of different length.



Monoclinic: Tablets (two very large faces like a book), prisms, and blades with four or six sides in parallelogram-shaped cross section–three axes of unequal length, two in one plane and perpendicular to a third axis.



Triclinic: Tabular shapes, often not symmetrical from one side to the other–three axes of different lengths and all inclined at each other (none are perpendicular to others).

- Crystal form is an external feature of mineral crystals. Perfect crystals can only develop if a mineral crystal is unrestricted as it grows.

- This is rare. When crystals grow together (they are *intergrown*), they do no exhibit their crystal form.

- Most crystalline rocks show intergrown patterns

- Most minerals you will be looking at will not have an evident crystal form. If they do though, it should be noted and used as evidence for classification

- In the end, you should not confuse **Crystal Forms and Habits** with another property, called **Cleavage**, that we will see later

3 - Luster

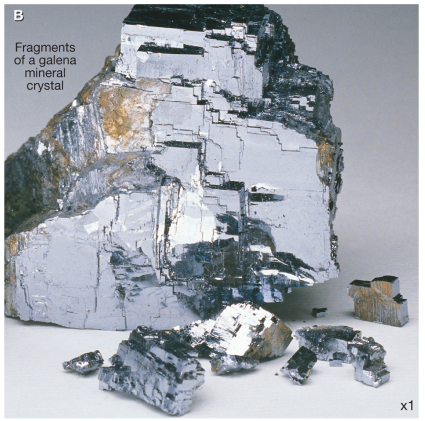
- The quality and intensity of light reflected from the surface of a mineral is called its **luster**

- Luster cannot always be seen in a photograph: you need to have the mineral in your hands

- Luster of a mineral is described by comparing it to familiar substances

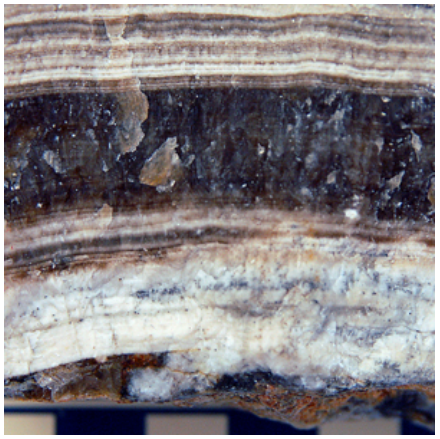
Luster is either Metallic or Nonmetallic

- Metallic luster (M) occurs when minerals reflect light "like a metal"
- Nonmetallic luster (NM) occurs in all other minerals



Metallic luster

Galena PbS



Nonmetallic luster

Travertine (a form of Limestone) made of Calcite $CaCO_3$

photo: © Alessandro Grippo

Metallic Luster

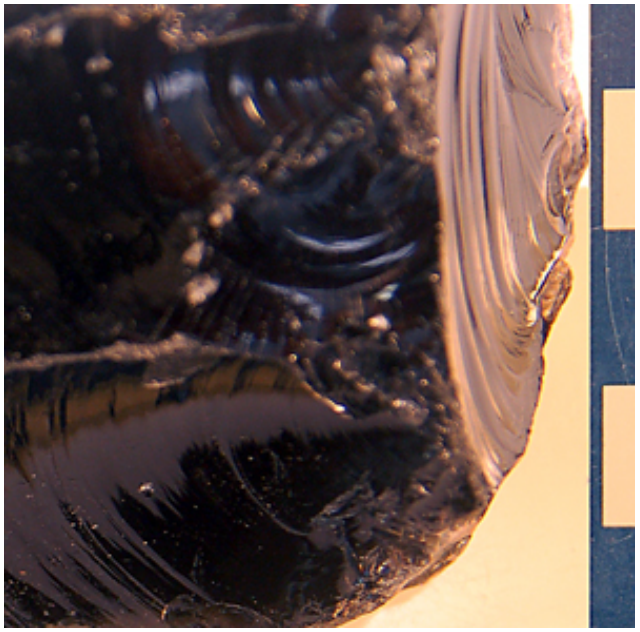
- Metallic objects can vary from bright to dull
  - Bright could be very reflective, shiny, polished
  - Dull is not very reflective, not very shiny, not very polished

Both these coins show a metallic luster. The coin to the left (from 1985) is dull, while the one to the right (2015) is bright.

You should be able to tell if luster is metallic even if your mineral is dull

Nonmetallic Luster

- Nonmetallic luster is more common
- Nonmetallic luster can also be described with more specific terms:
  - Vitreous
  - Waxy
  - Pearly
  - Satiny
  - Earthy
  - Greasy
  - Porcelaneous



Vitreous nonmetallic luster in a volcanic glass (a rock called Obsidian)

- Sometimes, metallic minerals will tarnish or weather to a nonmetallic luster: you should always observe a freshly broken surface of a mineral to determine luster

- Sometimes a mineral looks *submetallic*. For identification purposes, it should be treated as metallic

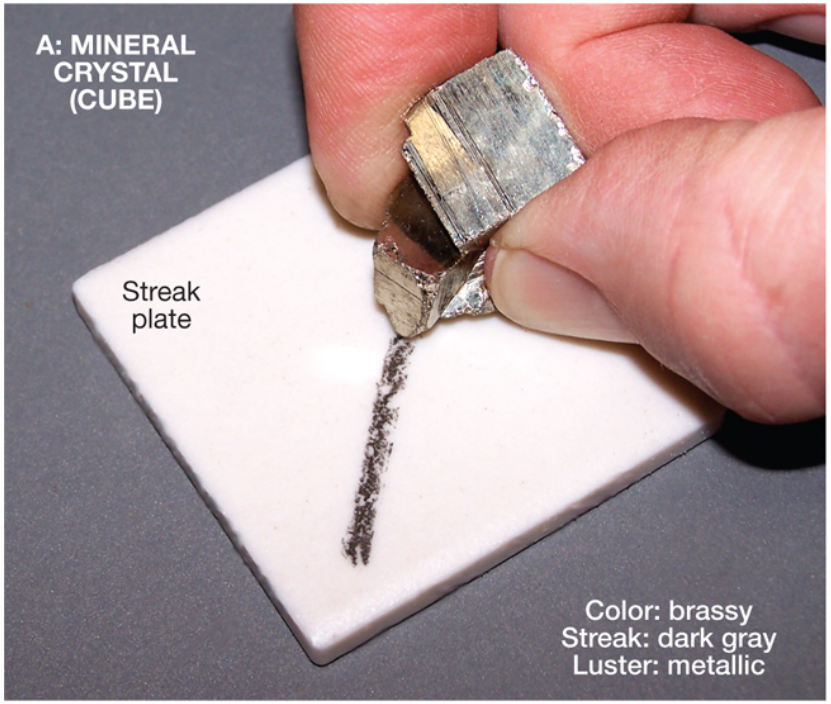
4 - Streak

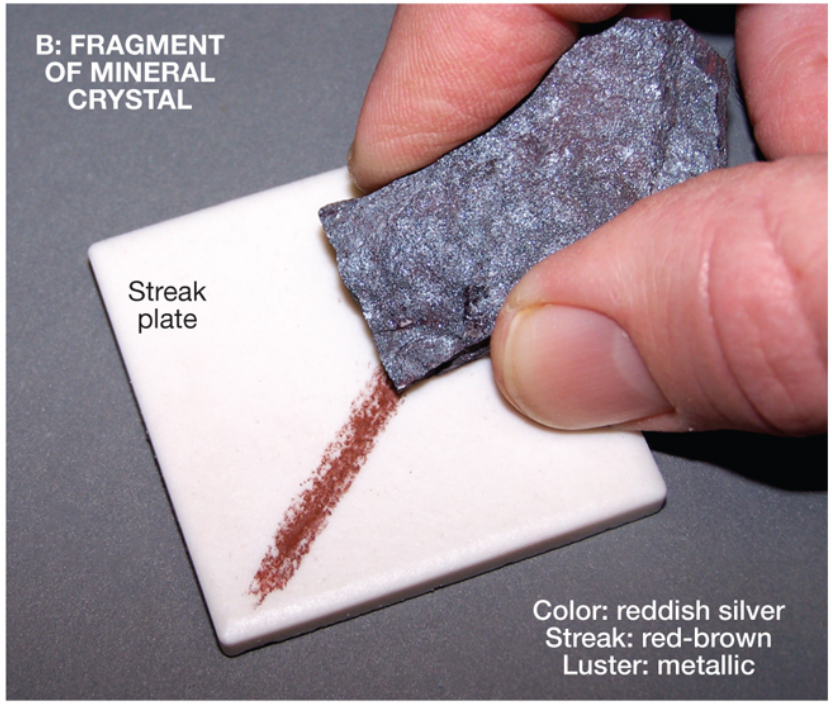
- Streak is the color of a substance after it has been ground to a fine powder.
- To obtain a powder, the easiest way is to scratch a mineral on a porcelain streak plate
- The color of the powder is its streak

- Sometimes, the color of the mineral and the color of the streak are different

- If the mineral is harder than the streak plate, it will scratch the plate and not leave a streak

  – in this case, you can crush a tiny piece with a hammer, or record the streak as unknown
  – in the end, all minerals have a streak, even if you do not see one on a streak plate

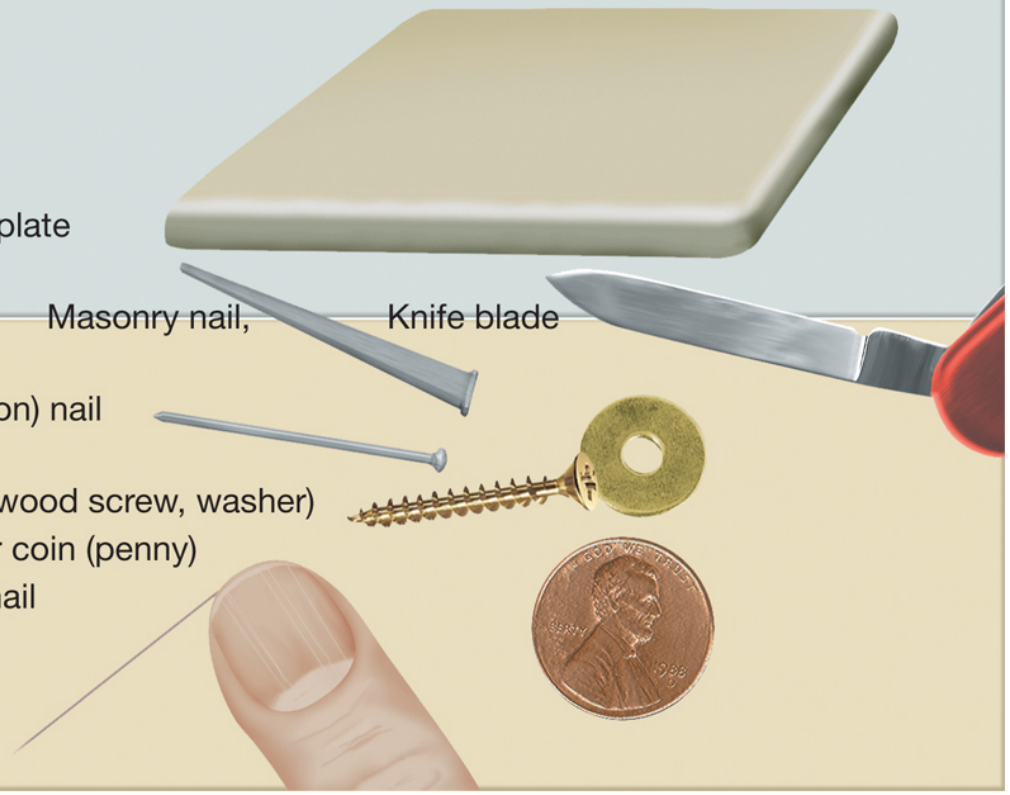




5 - Hardness

- Hardness is a measure of resistance to scratching
- A harder substance will scratch a softer one, but a softer one cannot scratch a harder one
- Mohs developed a quantitative scale of relative mineral hardness
- In the Mohs scale, the softest mineral (Talc) has a hardness of 1, and the hardest mineral (Diamond) has a hardness of 10

	Mohs Scale of Hardness*	Hardness of Some Common Objects (Harder objects scratch softer objects)
HARD	10 Diamond	
	9 Corundum	
	8 Topaz	
	7 Quartz	
	6 Orthoclase Feldspar	6.5 Streak plate
		5.5 Glass, Masonry nail, Knife blade
SOFT	5 Apatite	
	4 Fluorite	4.5 Wire (iron) nail
	3 Calcite	3.5 Brass (wood screw, washer)
	2 Gypsum	2.9 Copper coin (penny)
	1 Talc	2.5 Fingernail



* A scale for measuring relative mineral hardness (resistance to scratching).

- A piece of glass has a hardness of 5.5
- Glass is used as a reference to distinguish between **hard and soft minerals**

- If the mineral scratches the glass, it is hard
- If the mineral cannot scratch the glass, it is soft

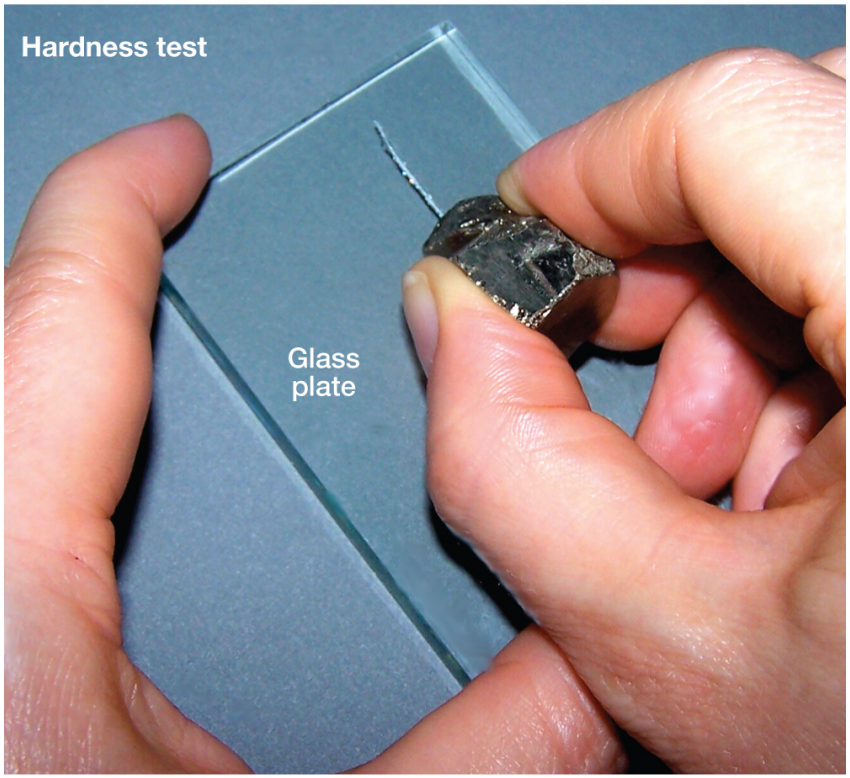
- You can use your hardness kit to determine a mineral's hardness number

A hardness kit includes:

A set of minerals with known hardness
A magnifying lens
A porcelain streak plate (H = 6.5)
A glass square (H = 5.5)
A wire (iron) nail (H = 4.5)
A penny (H = 2.9)
A magnet

You should also remember that your fingernail has a H = 2.5

How to determine hardness



- Scratch your mineral on the glass plate
- If the mineral scratches the glass, it is hard
- If the mineral does not scratch the glass, it is soft

- This mineral scratches the glass (H = 5.5): it is a hard mineral

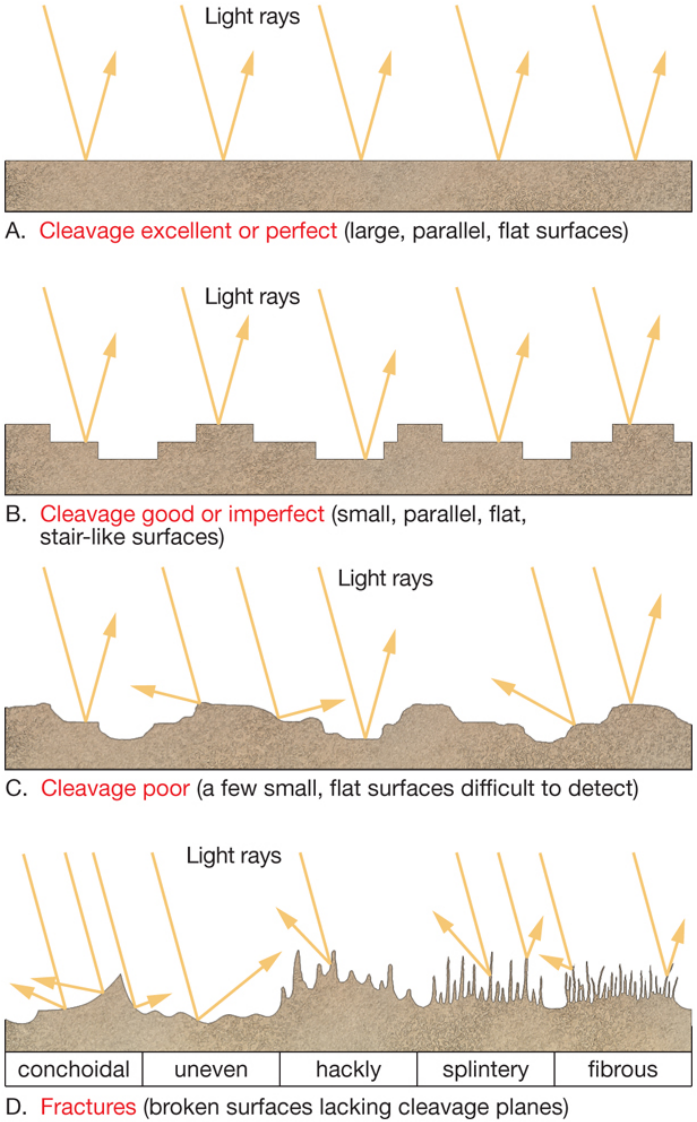
6 – Cleavage, and 7 - Fracture

- **Cleavage** is the tendency of some minerals to break (cleave) along flat, parallel surfaces

- Cleavage can be excellent, good, poor, or absent. If cleavage is absent, the mineral has a **fracture**

- Fracture refers to any break in a mineral that does not occur along a cleavage plane

- Excellent cleavage
  - light is reflected in one direction from a set of large parallel surfaces
- Good cleavage
  - light is reflected in one direction from a set of many small parallel surfaces
- Poor cleavage
  - light is reflected from a set of small flat parallel surfaces difficult to detect
- Fracture
  - light is reflected randomly

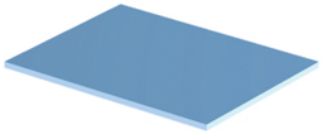
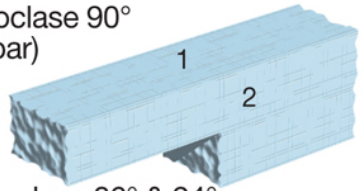
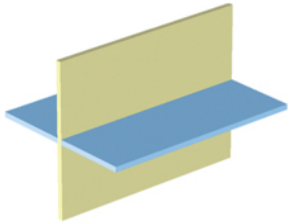


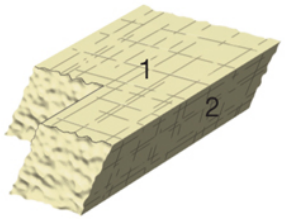
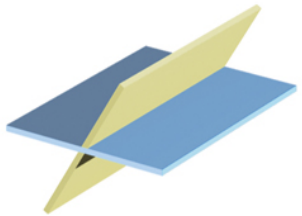
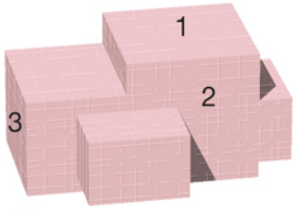
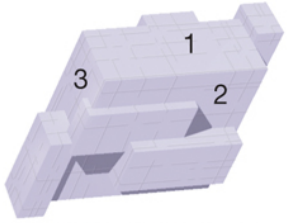
- Do not confuse cleavage with crystal habit:
  - cleavage relates to how a crystal breaks
  - crystal habit relates to what shape the crystal has
  - a crystal with an excellent crystal habit might have no cleavage (and hence, a fracture surface)
    - example: Quartz

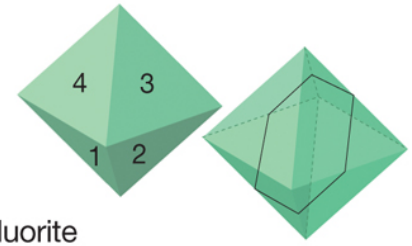
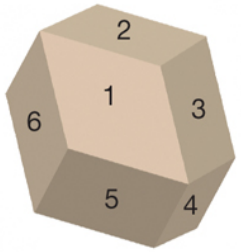
Fractures

- Fractures can be described as:
  - Conchoidal (like glass, with ribbed, smoothly curved surfaces)
  - Uneven (rough)
  - Hackly (having jagged edges)
  - Splintery (like splintered wood)
  - Fibrous (showing fiber-like structures)

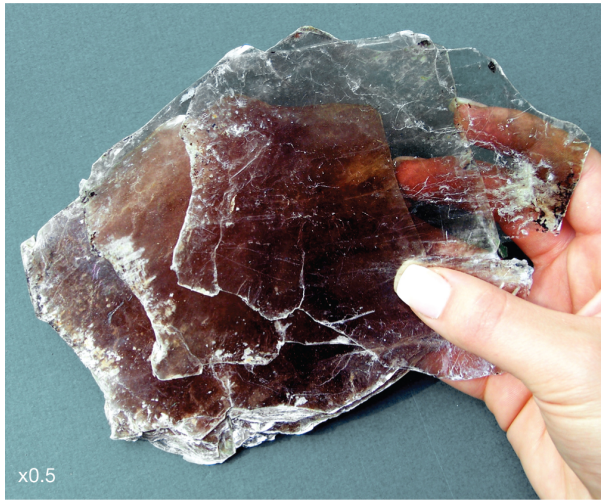
- Cleavage planes are parallel surfaces of weak chemical bonds
- More than one set of of cleavage planes can be present
- Each set constitutes a cleavage direction

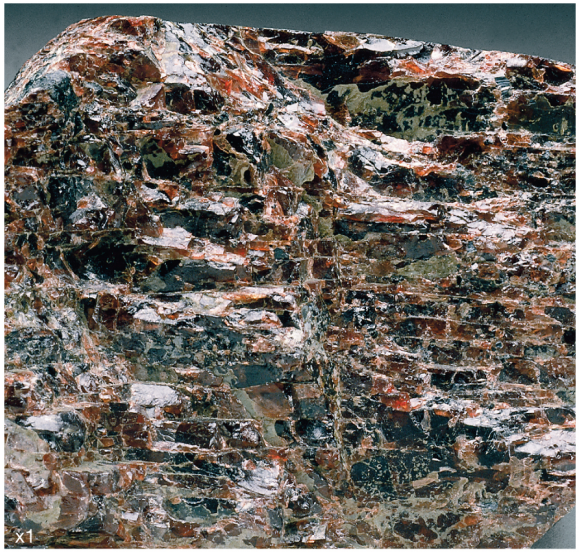
Number of Cleavages and Their Directions	Name and Description of How the Mineral Breaks	Shape of Broken Pieces (cleavage directions are numbered)	Illustration of Cleavage Directions
No cleavage (fractures only)	No parallel broken surfaces; may have conchoidal fracture (like glass)	 Quartz	None (no cleavage)
1 cleavage	**Basal (book) cleavage** "Books" that split apart along flat sheets	 Muscovite, biotite, chlorite (micas)	
2 cleavages intersect at or near 90°	**Prismatic cleavage** Elongated forms that fracture along short *rectangular* cross sections	Orthoclase 90° (K-spar)  Plagioclase 86° & 94°, pyroxene (augite) 87° & 93°	

Number of Cleavages and Their Directions	Name and Description of How the Mineral Breaks	Shape of Broken Pieces (cleavage directions are numbered)	Illustration of Cleavage Directions
2 cleavages do not intersect at 90°	**Prismatic cleavage** Elongated forms that fracture along short *parallelogram* cross sections	 Amphibole (hornblende) 56° & 124°	
3 cleavages intersect at 90°	**Cubic cleavage** Shapes made of cubes and parts of cubes	 Halite, galena	
3 cleavages do not intersect at 90°	**Rhombohedral cleavage** Shapes made of rhombohedrons and parts of rhombohedrons	 Calcite and dolomite 75° & 105°	

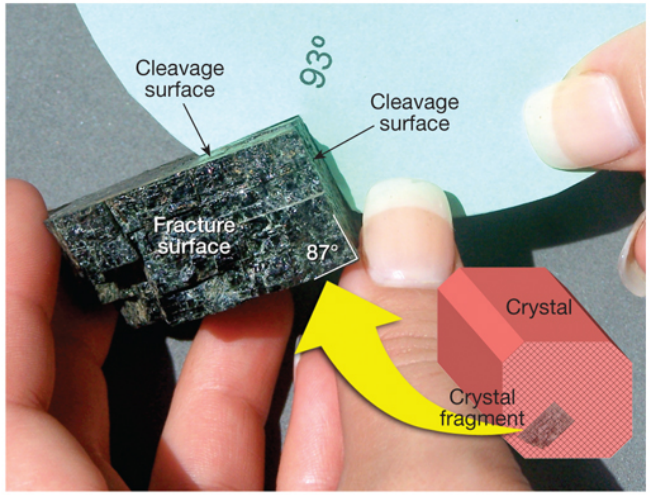
Number of Cleavages and Their Directions	Name and Description of How the Mineral Breaks	Shape of Broken Pieces (cleavage directions are numbered)	Illustration of Cleavage Directions
4 main cleavages intersect at 71° and 109° to form octahedrons, which split along hexagon-shaped surfaces; may have secondary cleavages at 60° and 120°	**Octahedral cleavage** Shapes made of octahedrons and parts of octahedrons	 Fluorite	
6 cleavages intersect at 60° and 120°	**Dodecahedral cleavage** Shapes made of dodecahedrons and parts of dodecahedrons	 Sphalerite	

Muscovite

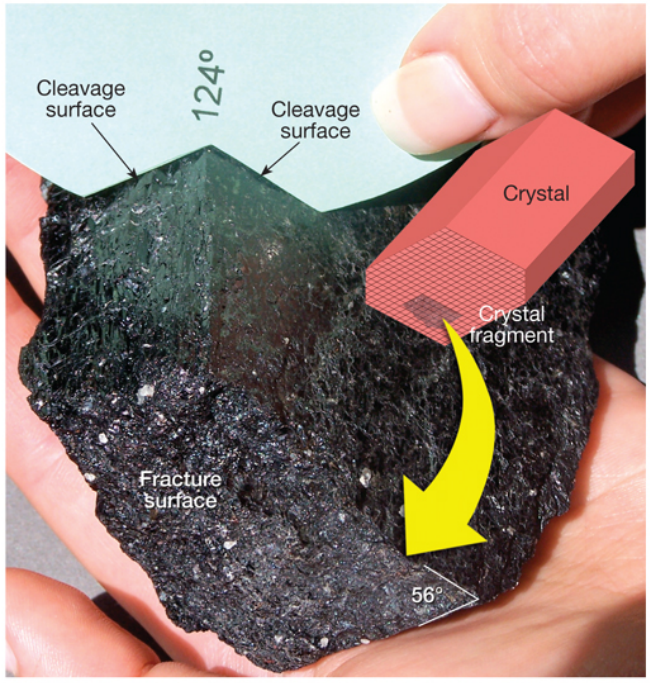




Parting surfaces in Garnet

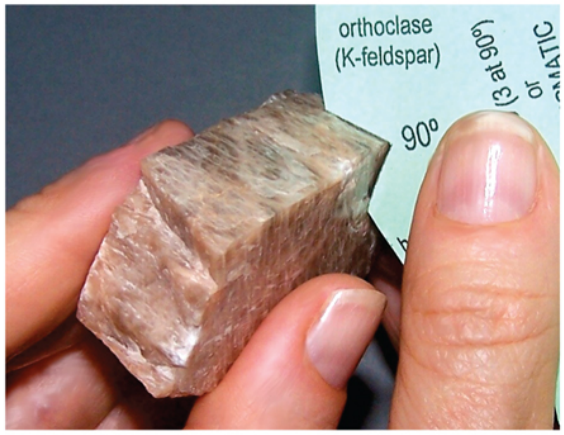


A. Cleavage in Pyroxenes (e.g., Augite)



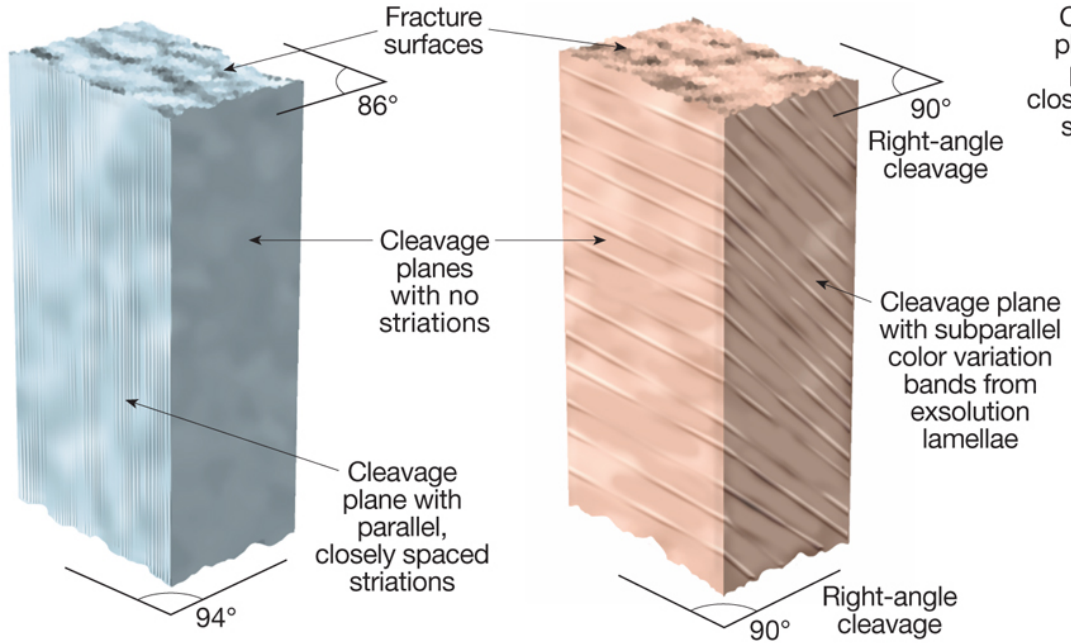
B. Cleavage in Amphiboles (e.g., Hornblende)

Plagioclase



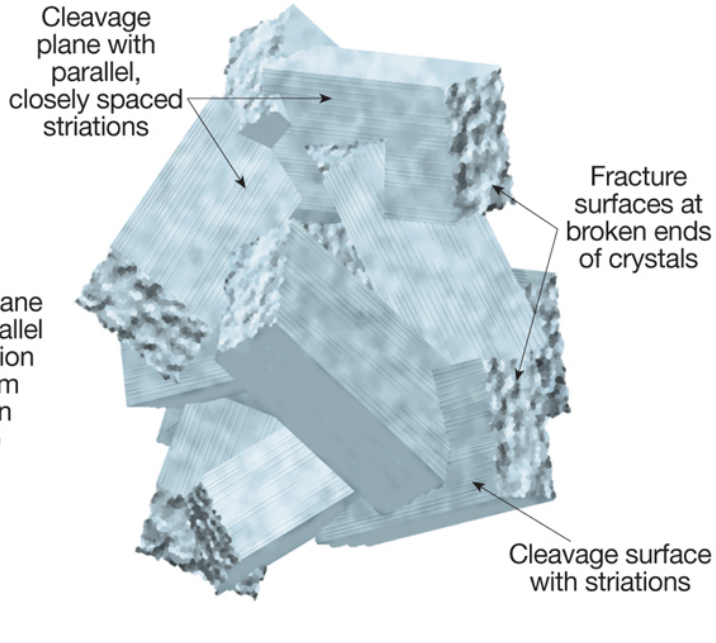
Pink K-feldspar (orthoclase)

White K-feldspar (orthoclase)



A. Plagioclase

B. Pink K-feldspar (orthoclase)



C. Rock comprised of plagioclase crystals

Other Properties

a. Tenacity
   - the manner in which a substance resists breakage
   - (brittle, malleable, elastic, sectile)

b. Reaction to Acid
   - only carbonate minerals, mostly Calcite $CaCO_3$, will "fizz" when a drop of dilute HCl is applied to their surface

c. Magnetism
   - some minerals will be attracted to a magnet

d. Striations
   - "hairline" grooves on the cleavage surface of some minerals (typical of K-feldspar)

e. Exsolution Lamellae
   - similar to striations, these are thin discontinuous layers of Plagioclase within K-feldspar

f. Specific Gravity
   - The ratio of density of a mineral divided by density of water

g. Piezoelectricity
   - Quartz can generate electricity when squeezed in a certain direction

h. Double refraction
   - Calcite crystals can split light into two components

Gold Au is malleable

Magnetite Fe_3O_4 is magnetic

Calcite $CaCO_3$ reacts with HCl

Striations and Exsolution Lamellae

Striations in Uvite Tourmaline

http://www.johnbetts-fineminerals.com/jhbnyc/mineralmuseum/picshow.php?id=40595

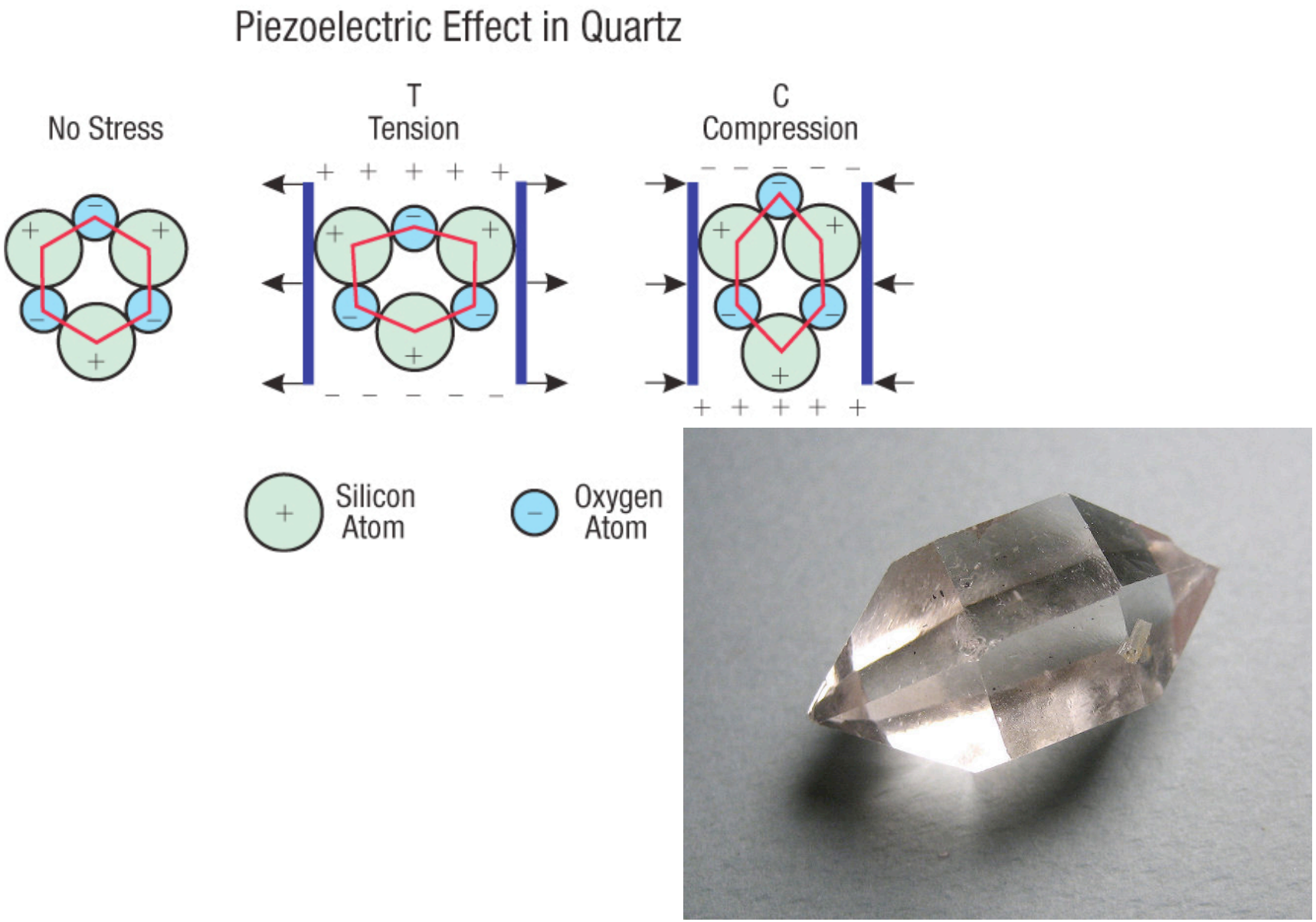
Exsolution lamellae in K-feldspar.

Notice how white Plagioclase mingles with pink K-feldspar

Specific Gravity

- Specific Gravity (SG) is the Density of your mineral (D_{min}) divided by the Density of water (D_{H_2O})
- For instance, what is the Specific Gravity of Copper Cu, when its density is $9 g/cm^3$?
- SG Copper = $D_{Cu} / D_{H_2O} = 9 g/cm^3 / 1 g/cm^3 = 9$
- Specific Gravity is always a number (without units)
- Density always has units (mass divided by volume)
- Specific Gravity has the same numerical value of density (without numbers)

Piezoelectricity



Double Refraction

In

METALLIC AND SUBMETALLIC (M) MINERALS

Step 1: What is the mineral's hardness?	Step 2: What is the mineral's streak?	Step 3: Compare the mineral's physical properties to other characteristic properties below.	Step 4: Find mineral name(s) and check the mineral database for additional properties (Figure 3.21).
HARD (H > 5.5) Scratches glass Not scratched by masonry nail or knife blade	Dark gray	Color silvery gold; tarnishes brown; H 6–6.5; Cleavage absent to poor; Brittle; Crystals: cubes (often striated) or pyritohedrons	Pyrite
		Silvery dark gray to black; Tarnishes gray or rusty yellow-brown; Strongly attracted to a magnet and may be magnetized; H 6–6.5; No cleavage; Crystals: octahedrons	Magnetite
HARD or SOFT	Yellow-brown	Color silvery brown to dark brown; Tarnishes dull yellow-brown to brown; Amorphous; H 1–5.5; More common in softer (H 1–5) nonmetallic yellow-brown forms	Limonite
	Brown	Color silvery black to black; Tarnishes gray to black; H 5.5–6; No cleavage; May be weakly attracted to a magnet; Crystals: octahedrons	Chromite
	Red to red-brown	Color steel gray to glittery silver (var. specular); Tarnishes gray to dull red; May be attracted to a magnet; H 5–6.0; Also occurs in soft (H 1–5) nonmetallic earthy red forms	Hematite
SOFT (H ≤ 5.5) Does not scratch glass Scratched by masonry nail or knife blade	Dark gray	Color bright silvery gold; Tarnishes bronze brown brassy gold, or iridescent blue-green and red; H 3.5–4.0; Brittle; No cleavage; Crystals: tetrahedrons	Chalcopyrite
		Color brownish bronze; Tarnishes bright purple, blue, and/or red; May be weakly attracted to a magnet; H 3; Cleavage absent or poor; Rarely forms crystals	Bornite
		Color bright silvery gray; Tarnishes dull gray; Cleavage good to excellent; H 2.5; Crystals: cubes or octahedrons	Galena
		Color dark silvery gray to black; Can be scratched with your fingernail; Easily rubs off on your fingers and clothes, making them gray; H 1–2	Graphite
	Yellow-brown	Color dark brown to black; Forms layers of radiating microscopic crystals; H 5–5.5	Goethite
	White to pale yellow-brown	Color silvery yellow-brown, silvery red, or black; Tarnishes brown or black; H 3.5–4.0; Cleavage excellent to good; Smells like rotten eggs when scratched/powdered	Sphalerite
	Copper	Color copper; Tarnishes dark brown or green; Malleable; No cleavage; H 2.5–3.0; Forms odd-shaped masses, nuggets, or dendritic forms	Copper (Native Copper)
	Gold	Color yellow gold; Does not tarnish; Malleable; No cleavage; H 2.5–3.0; Forms odd-shaped masses, nuggets, or dendritic forms	Gold (Native Gold)

d?

LIGHT-COLORED NONMETALLIC (NM) MINERALS

Step 1: What is the mineral's hardness?	Step 2: What is the mineral's cleavage?	Step 3: Compare the mineral's physical properties to other distinctive properties below.	Step 4: Find mineral name(s) and check the mineral database for additional properties (Figure 3.21).
HARD (H > 5.5) Scratches glass Not scratched by masonry nail or knife blade	Cleavage excellent or good	White or gray; 2 cleavages at nearly right angles and with striations; H 6	Plagioclase feldspar
		Orange, brown, white, gray, green, or pink; H 6; 2 cleavages at nearly right angles; Exsolution lamellae	Potassium feldspar
		Pale brown, white, or gray; Long slender prisms; 1 excellent cleavage plus fracture surfaces; H 6–7	Sillimanite
		Blue, very pale green, white, or gray; Crystals are blades; H 4–7	Kyanite
	Cleavage poor or absent	Gray, white, or colored (dark red, blue, brown) hexagonal prisms with flat striated ends; H 9	Corundum Ruby (red var.), Sapphire (blue var.)
		Colorless, white, gray, or other colors; Greasy luster; Massive or hexagonal prisms and pyramids; Transparent or translucent; H 7	Quartz Milky quartz (white var.), Citrine quartz (yellow var.), Rose quartz (pink var.)
		Opaque gray or white; Luster waxy; H 7	Chert (variety of quartz)
		Colorless, white, yellow, light brown, or pastel colors; Translucent or opaque; Laminated or massive; Cryptocrystalline; Luster waxy; H 7	Chalcedony (variety of quartz)
		Pale olive green to yellow; Conchoidal fracture; Transparent or translucent; Forms short stout prisms; H 7	Olivine
SOFT (H ≤ 5.5) Does not scratch glass Scratched by masonry nail or knife blade	Cleavage excellent or good	Colorless, white, yellow, green, pink, or brown; 3 excellent cleavages; Breaks into rhombohedrons; Effervesces in dilute HCl; H 3	Calcite
		Colorless, white, gray, creme, or pink; 3 excellent cleavages; Breaks into rhombohedrons; Effervesces in dilute HCl only if powdered; H 3.5–4	Dolomite
		Colorless or white with tints of brown, yellow, blue, black; Short tabular crystals and roses; Very heavy; H 3–3.5	Barite
		Colorless, white, or pastel colors; Massive or tabular crystals, blades, or needles; Transparent to opaque; Can be scratched with your fingernail; H 2	Gypsum Selenite (colorless transparent var.) Alabaster (opaque white or pastel var.) Satin spar (fibrous silky translucent var.)
		Colorless, white, gray, or pale green, yellow, or red; Spheres of radiating needles; Luster silky; H 5–5.5	Natrolite
		Colorless, white, yellow, blue, brown, or red; Cubic crystals; Breaks into cubes; Salty taste; H 2.5	Halite
		Colorless, purple, blue, gray, green, yellow; Cubes with octahedral cleavage; H 4	Fluorite
		Colorless, yellow, brown, or red-brown; Short opaque prisms; Splits along 1 excellent cleavage into thin flexible transparent sheets; H 2–2.5	Muscovite (white mica)
	Cleavage poor or absent	Yellow crystals or earthy masses; Luster greasy; H 1.5–2.5; Smells like rotten eggs when powdered	Sulfur (Native sulfur)
		Opaque pale blue to blue-green; Amorphous crusts or massive; Very light blue streak; H 2–4	Chrysocolla
		Opaque green, yellow, or gray; Dull or silky masses or asbestos; White streak; H 2–5	Serpentine
		Opaque white, gray, green, or brown; Can be scratched with fingernail; Greasy or soapy feel; H 1	Talc
		Opaque earthy white to very light brown; Powdery, greasy feel; H 1–2	Kaolinite
		Colorless to white, orange, yellow, brown, blue, gray, green, or red; May have play of colors; Conchoidal fracture; H 5–5.5	Opal
		Colorless or pale green, brown, blue, white, or purple; Brittle hexagonal prisms; Conchoidal fracture; H 5	Apatite

DARK-COLORED NONMETALLIC (NM) MINERALS

Step 1: What is the mineral's hardness?	Step 2: What is the mineral's cleavage?	Step 3: Compare the mineral's physical properties to other distinctive properties below.	Step 4: Find mineral name(s) and check the mineral database for additional properties (Figure 3.21).
HARD (H > 5.5) Scratches glass Not scratched by masonry nail or knife blade	Cleavage excellent or good	Translucent dark gray, blue-gray, or black; May have silvery iridescence; 2 cleavages at nearly 90° and with striations; H 6	Plagioclase feldspar
		Translucent brown, gray, green, or red; 2 cleavages at nearly right angles; Exsolution lamellae; H 6	Potassium feldspar (K-spar)
		Dark green to black; 2 cleavages at about 56° and 124°; H 5.5–6	Actinolite (Amphibole)
		Dark gray to black; 2 cleavages at about 56° and 124°; H 5.5–6	Hornblende (Amphibole)
		Dark green to black; 2 cleavages at nearly right angles (93° and 87°); H 5.5–6	Augite (Pyroxene)
	Cleavage poor or absent	Transparent or translucent gray, brown, or purple; Greasy luster; Massive or hexagonal prisms and pyramids; H 7	Quartz Smoky quartz (black/brown var.), Amethyst (purple var.)
		Gray, black, or colored (dark red, blue, brown) hexagonal prisms with flat striated ends; H 9	Corundum Emery (black impure var.) Ruby (red var.), Sapphire (blue var.)
		Opaque red-brown or brown; Luster waxy; Cryptocrystalline; H 7	Jasper (variety of quartz)
		Transparent to translucent dark red to black; Equant (dodecahedron) crystal form or massive; H 7	Garnet
		Opaque gray; Luster waxy; Cryptocrystalline; H 7	Chert (gray variety of quartz)
		Opaque black; Luster waxy; Cryptocrystalline; H 7	Flint (black variety of quartz)
		Black or dark green; Long striated prisms; H 7–7.5	Tourmaline
		Transparent or translucent olive green; Conchoidal fracture; Transparent or translucent; H 7	Olivine
		Opaque dark gray to black; Tarnishes gray to rusty yellow-brown; Cleavage absent; Strongly attracted to a magnet; May be magnetized; H 6–6.5	Magnetite
		Opaque green; Poor cleavage; H 6–7	Epidote
		Opaque brown prisms and cross-shaped twins; H 7	Staurolite
SOFT (H ≤ 5.5) Does not scratch glass Scratched by masonry nail or knife blade	Cleavage excellent or good	Translucent to opaque yellow-brown to brown; May appear submetallic; Dodecahedral cleavage; H 3.5–4	Sphalerite
		Purple cubes or octahedrons; Octahedral cleavage; H 4	Fluorite
		Black short opaque prisms; Splits easily along 1 excellent cleavage into thin sheets; H 2.5–3	Biotite (black mica)
		Green short opaque prisms; Splits easily along 1 excellent cleavage into thin sheets; H 2–3	Chlorite
	Cleavage poor or absent	Opaque rusty brown or yellow-brown; Massive and amorphous; Yellow-brown streak; H 1–5.5	Limonite
		Opaque rusty brown to brown-gray rock with shades of gray, yellow, and white; Contains pea-sized spheres that are laminated internally; Pale brown streak; H 1–3	Bauxite
		Deep blue; Crusts, small crystals, or massive; Light blue streak; H 3.5–4	Azurite
		Opaque green or gray-green; Dull or silky masses or asbestos; White streak; H 2–5	Serpentine
		Opaque green in laminated crusts or massive; Streak pale green; Effervesces in dilute HCl; H 3.5–4	Malachite
		Translucent or opaque dark green; Can be scratched with your fingernail; Feels greasy or soapy; H 1	Talc
		Transparent or translucent green, brown, blue, or purple; Brittle hexagonal prisms; Conchoidal fracture; H 5	Apatite
		Opaque red or red-gray; H 1.5–5	Hematite

MINERAL DATA CHART

Sample Letter or Number	Luster*	Hardness	Cleavage	Color / Streak	Other Properties	Name (Fig. 3.18, 3.19, or 3.20)	Some Uses (Fig. 3.21)

*M = metallic or submetallic, NM = nonmetallic