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12.001 Introduction to Geology
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12.001 LAB 1: MINERAL IDENTIFICATION INDEX

Minerals with a Metallic Luster

	Cleavage	Streak	Properties	Comments and Uses	Name and Composition
Harder than Glass	No	Greenish Black	<i>Brass-yellow</i> ; H = 6.0–6.5; S.G. = 5.0; opaque; conchoidal fracture; commonly in masses of intergrown <i>cubic crystals</i> with <i>striated faces</i>	Known as “fools gold”; used in manufacture of sulphuric acid	Pyrite FeS ₂
	No	Black	Black; H = 6.0; S.G. = 5.0; opaque; <i>strongly magnetic</i> ; commonly occurs as massive aggregates	Known as “lodestone”; ore of iron	Magnetite Fe ₃ O ₄
Hardness Similar to Glass	No	<i>Red or brown</i>	Reddish-brown or black; H = 5.5–6.5; S.G. = 5.0; opaque; may occur in aggregates of small, shiny, flakes (specular variety) or as more massive, dull looking masses; can be nonmetallic and soft (H = 1.5)	Ore of iron	Hematite Fe ₂ O ₃
	No	<i>Yellow or brown</i>	Yellowish-brown; H = 1.0–5.5; S.G. = 3.5–4.0; opaque; usually occurs as porous aggregates with a dull or earthy appearance; can be nonmetallic	Resembles rust; common weathering product of iron-bearing minerals	Limonite FeO(OH) · H ₂ O
Softer than Glass	Yes	Gray or black	<i>Silvery gray</i> ; H = 2.5; S.G. = 7.5; <i>3 perfect cleavages at 90°</i>	Ore of lead	Galena PbS
	Yes-d	Black	Silvery gray or black; H = 1; S.G. = 2.5; 1 perfect cleavage; usually occurs in very fine-grained aggregates with a <i>greasy feel</i> ; <i>marks fingers</i>	Source of carbon; used as a lubricant and for electrical components	Graphite C
	No	<i>Greenish black</i>	<i>Brass-yellow</i> , <i>may tarnish with a purple hue</i> ; H = 3.5–4.0; S.G. = 4.2; opaque	Ore of copper	Chalcopyrite CuFeS ₂

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Dark-Colored

	Cleavage	Properties	Comments and Uses	Name and Composition
Harder than Glass	Yes-d	Black to brownish-pink; H = 7.5; S.G. = 3.0; opaque; 2 poorly-developed cleavages; L = vitreous. Often occurs as <i>needlelike crystals with triangular cross-sections</i> ; crystal faces may have <i>striations</i>	Common accessory mineral in many types of rocks; gemstone when pure and large crystals are found	Tourmaline Complex Silicate
	Yes-d	Brown; H = 7.0; S.G. = 3.8; opaque; 1 good cleavage; L = vitreous or resinous; <i>good crystals with a flattened cubic shape</i> commonly occur; some may be intergrown in the shape of crosses	Formed only in metamorphic rocks	Staurolite $\text{FeAlSi}_2\text{O}_{10}(\text{OH})_2$
	No	<i>Red or brown</i> ; H = 7.0; S.G. = 3.5–4.3; translucent; L = vitreous or resinous; may have subparallel fracture planes with conchoidal patterns; often occurs as <i>round crystals with diamond-shaped faces</i>	Most often occurs in metamorphic rocks; used as a gemstone and as an abrasive	Garnet Fe-Ca-Mg-Mn-Al Silicate
	No	<i>Olive green</i> ; H = 6.5–7.0; S.G. = 3.3–4.4; translucent to transparent; L = vitreous; commonly occurs in granular aggregates with a sugary texture	Occurs most often in mafic igneous rocks; seldom found in association with quartz	Olivine $(\text{Mg, Fe})_2\text{SiO}_4$
Hardness Similar to Glass	Yes-d	<i>Dark green or black</i> ; H = 5.0 – 6.0; S.G. = 3.3; opaque; <i>2 cleavages nearly at 90°</i> ; L = vitreous or resinous	Most common type of pyroxene; found in many types of rocks	Augite (Pyroxene Group) Fe-Ca-Mg-Al Silicate
	Yes	<i>Dark green or black</i> ; H = 5.0 – 6.0; S.G. = 3.3; translucent on edges; <i>2 good cleavages at 60° and 120°</i> ; L = vitreous to slightly resinous; often has a splintery appearance due to intersecting cleavages	Most common type of amphibole; found in many types of rocks	Hornblende (Amphibole Group) Fe-Ca-Mg-Al Silicate

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Dark-Colored (*Continued*)

	Cleavage	Properties	Comments and Uses	Name and Composition
Softer than Glass	Yes	<i>Brown to yellowish-brown; H = 3.5–4.0; S.G. = 4.0; translucent; L = vitreous or resinous; 3 good cleavages not at 90°, powder may effervesce in HCl acid</i>	Has been used as an ore of iron	Siderite FeCO ₃
	Yes-d	<i>Mottled yellowish-brown may be black; H = 3.5–4.0; S.G. = 4.0; 6 directions of cleavage; L = resinous; may have a pale yellow streak; some varieties may have a metallic luster</i>	Major ore of zinc	Sphalerite ZnS
	Yes-d	<i>Grass green; H = 3.5–4.0; S.G. = 4.0; translucent; one direction of cleavage but poorly developed; L = dull or earthy; weakly effervesces in HCl acid; may have a blue streak</i>	Has been used as an ore of copper	Malachite Cu ₂ (OH) ₂ CO ₃
	Yes-d	<i>Azure blue; H = 3.5–4.0; S.G. = 3.8; translucent; one directions of cleavage but poorly developed; L = dull or earthy; weakly effervesces in HCl acid; may have a blue streak</i>	Common gemstone	Azurite Cu ₂ (OH) ₂ (CO ₃) ₂
	Yes	<i>Brown; H = 2.5–3.0; S.G. = 2.8–3.0; transparent or translucent; one perfect cleavage; L = vitreous; thin sheets are elastic</i>	Common type of mica; abundant in many rock types	Biotite Fe-Mg-K-Al Silicate
	Yes-d	<i>Dark or light green; H = 2.0–2.5; S.G. = 2.6–2.9; transparent or translucent; one perfect cleavage; L = vitreous or pearly; may have a pale green streak; often occurs in fine-grained aggregates</i>	Most common in metamorphic rocks	Chlorite Fe-Mg-Al Silicate
	No	<i>Green or white-gray; H = variable; S.G. = 2.5; opaque; occurs as fibrous aggregates which split into strands</i>	Fibrous variety of serpentine group; used for insulation	Asbestos Mg ₆ Si ₄ O ₁₀ (OH) ₈

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Light-Colored

	Cleavage	Properties	Comments and Uses	Name and Composition
Harder than Glass	Yes-d	<i>Pistachio green</i> ; H = 7.0; S.G. = 3.3–3.6; translucent; one good direction of cleavage; L = vitreous	Most common in low-grade metamorphic rocks	Epidote Ca-Al-Fe Silicate
	Yes-d	Clear or milky white; H = 7.0; S.G. = 3.3; transparent or translucent; one good cleavage; most typically occurs in <i>silky mats of slender needle-like crystals</i>	Formed only in high-grade metamorphic rocks	Sillimanite Al ₂ SiO ₅
	Yes	Variable color, most are creamy white or salmon pink; H = 6.0; S.G. = 2.5; translucent; <i>2 good cleavages at nearly right angles</i> ; L = vitreous or pearly; often confused with plagioclase but lack close-spaced parallel markings	Member of the feldspar group; one of the most common rock-forming minerals	Orthoclase (Potassium Feldspar) KAlSi ₃ O ₈
	Yes	Creamy white or gray; H = 6.0; S.G. = 2.6–2.8; translucent; <i>2 good cleavages at 90°</i> ; L = vitreous or pearly; <i>closely-spaced parallel markings</i> on cleavage faces differentiate from orthoclase feldspar	Member of the feldspar group; one of the most common rock-forming minerals	Plagioclase (Calcium-Sodium Feldspar) NaAlSi ₃ O ₈ - CaAl ₂ Si ₂ O ₈
	No	Brown, gray, or white most common, may be red or green; H = 9.0; S.G. = 4.0; transparent or translucent; L = vitreous; may occur as six-sided forms with conchoidal fracture; note hardness and specific gravity	Used as an abrasive; gemstones known as ruby or sapphire depending on color	Corundum Al ₂ O ₃
	No	Color extremely variable; H = 7.0; S.G. = 2.7; transparent, translucent or opaque; L = vitreous; may occur as six-sided crystals with striations on faces; displays conchoidal fracture	Common rock-forming mineral; very resistant to weathering	Quartz SiO ₂

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Light-Colored (*Continued*)

	Cleavage	Properties	Comments and Uses	Name and Composition
Hardness Similar to Glass	Yes-d	<i>Bluish-gray</i> ; H = 5.0–7.0; S.G. = 3.5; translucent; one good cleavage; L = vitreous or pearly; usually occurs as bladelike crystal which are complexly intergrown	Formed only in metamorphic rocks; used for electrical insulators and in ceramic industry	Kyanite Al ₂ SiO ₅
	Yes-d	<i>Mottled green</i> ; may be brown; H = 5.0; S.G. = 3.2; translucent; one poorly-developed cleavage; L = vitreous	Common component of bone and teeth; fossil deposits used for fertilizer	Apatite Ca ₅ (PO ₄)F
Softer than Glass	Yes	Variable colors, most common are clear, purple, and yellow; H = 4.0; S.G. = 3.2; <i>4 perfect cleavages</i> ; L = vitreous or resinous; transparent or translucent; samples often have tetrahedral shapes because of intersecting cleavages; may be dark-colored	High quality material finds use in optical instruments; commercial source of fluorine	Fluorite CaF ₂
	Yes-d	White, gray, pink; H = 3.5–4.0; S.G. = 2.8; translucent; <i>3 directions of cleavage not at right angles</i> ; L = vitreous or pearly; often occurs as aggregates of small crystals; <i>reacts with HCl acid of powdered</i>	Major mineral constituent of some sedimentary rocks; used as cement aggregate and as a flux in steel manufacturing	Dolomite (Ca, Mg)CO ₃
	Yes-d	Clear, milky white, light yellow; H = 3.0; S.G. = 4.5; transparent or translucent; 2 directions of cleavage at 90°; L = vitreous or pearly; note unusually large specific gravity for a light-colored mineral	Major ore of barium	Barite BaSO ₄
	Yes	Colorless or bluish-violet; H = 3.0; S.G. = 2.4; transparent or translucent; 3 good cleavages at 90°; L = resinous or pearly; may occur as aggregates	Common deposit in certain types of sedimentary rocks	Anhydrite CaSO ₄

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Light-Colored (*Continued*)

	Cleavage	Properties	Comments and Uses	Name and Composition
Softer than Glass (cont.)	Yes	Variable color, most common are white and clear; H = 3.0; S.G. = 2.7; transparent or translucent; <i>3 directions of perfect cleavage not at right angles</i> ; L = vitreous or oily; <i>reacts vigorously with HCL acid</i> ; shows distinct double refraction	Common in many rock types, most abundant in sedimentary rocks; used in cement manufacturing and for making lime for fertilizer	Calcite CaCO ₃
	Yes	Clear or milky white; H = 2.5; S.G. = 2.2; transparent or translucent; <i>3 directions of perfect cleavage at right angles</i> ; L = vitreous, greasy, or resinous; <i>distinctive taste</i>	Salt, enhances food taste; commercial source of chlorine	Halite NaCl
	Yes-d	White or tan; H = 2.5; S.G. = 2.6; opaque; one perfect cleavage; L = dull or earthy; typically occurs as massive aggregates which have an <i>earthy odor when moist</i> ; cleavage difficult to observe without the aid of a microscope	Common type of clay mineral; used extensively in making brick and porcelain products	Kaolinite Al ₄ Si ₄ O ₁₀ (OH) ₈
	Yes	Light yellow or brown but often clear and colorless; H = 2.0–2.5; S.G. = 2.5–3.0; transparent or translucent; <i>one perfect cleavage</i> ; L = vitreous, pearly, or silky; thin sheets are elastic	Common type of mica; found in many types of rocks	Muscovite KAl ₂ (AlSi ₃)O ₁₀ (OH) ₂
	Yes-d	Variable color, often creamy white, gray, or yellow; H = 2.0; S.G. = 2.3; transparent or translucent; 3 directions of cleavage at 90°; cleavage easy to see in well-formed bladed crystals (selenite variety) but most occurrences are dull, massive aggregates (alabaster variety) and cleavage is not apparent	Mostly occurs in sedimentary rocks; used for making plaster and some types of wallboard	Gypsum CaSO ₄ ·H ₂ O

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.

Minerals with a Nonmetallic Luster – Generally Light-Colored (*Continued*)

	Cleavage	Properties	Comments and Uses	Name and Composition
Softer than Glass (cont.)	Yes-d	Light green or silvery white; <i>H = 1.0</i> ; S.G. = 2.7; translucent; one perfect cleavage; L = pearly or greasy; <i>has a soapy feel</i> ; occurs as fine-grained, micaceous aggregates	Powdered for use in toilet preparations; also used as an industrial lubricant	Talc $Mg_3Si_4O_{10}(OH)_2$
	No	White or yellowish-brown; H = 1.3; S.G. = 2.0–2.5; opaque; L = dull or earthy; found as <i>massive, earthy aggregates</i> or as <i>small, pea-shaped grains</i>	Major ore of aluminum	Bauxite $Al_2O_3 \cdot H_2O$
	No	<i>Yellow</i> ; H = 1.5–2.5; S.G. = 2.0; translucent; L = resinous or greasy; some varieties are sectile; has a <i>distinctive sulphurous odor</i>	Major ore of sulphur	Sulphur S

H = hardness; Yes-d, had cleavage but may be difficult to observe; S.G. = specific gravity; L = luster. The most distinctive physical properties of each mineral species are in italics.