Igneous Rock
Aphanitic -- Porphyritic -- Phenocrysts are olivine and pyroxene (therefore mafic)
Olivine Pyroxene Basalt Porphyry
Mineral (Silicate -- Sheet -- Mica)
Not metallic -- 1 flexible cleavage plane (sheet), light colored; white streak.
Muscovite

Igneous Rock
Aphanitic -- Dark colored (therefore mafic)
Basalt

<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minerals</strong> ............................................. 1</td>
</tr>
<tr>
<td>Actinolite .............................................. 14</td>
</tr>
<tr>
<td>Biotite .................................................. 3</td>
</tr>
<tr>
<td>Calcite .................................................. 4, 5, 6</td>
</tr>
<tr>
<td>Chlorite ................................................ 31</td>
</tr>
<tr>
<td>Corundum ............................................... 23</td>
</tr>
<tr>
<td>Epidote ............................................... 17</td>
</tr>
<tr>
<td>Fluorite ............................................... 7, 8</td>
</tr>
<tr>
<td>Galena ............................................... 24</td>
</tr>
<tr>
<td>Garnet ............................................... 21, 22</td>
</tr>
<tr>
<td>Graphite ............................................... 15</td>
</tr>
<tr>
<td>Gypsum ................................................. 29</td>
</tr>
<tr>
<td>Halite ................................................ 30</td>
</tr>
<tr>
<td>Hematite ............................................ 25</td>
</tr>
<tr>
<td>Hornblende ........................................... 10</td>
</tr>
<tr>
<td>Kyanite ............................................... 16</td>
</tr>
<tr>
<td>Magnetite ........................................... 26</td>
</tr>
<tr>
<td>Muscovite ............................................ 2</td>
</tr>
<tr>
<td>Olivine ............................................... 20</td>
</tr>
<tr>
<td>Plagioclase Feldspar ............................. 13</td>
</tr>
<tr>
<td>Potassium Feldspar ................................. (K-Feldspar) .......................... 12</td>
</tr>
<tr>
<td>Pyrite ................................................. 27</td>
</tr>
<tr>
<td>Pyroxene ............................................. 11</td>
</tr>
<tr>
<td>Quartz ............................................... 18, 19</td>
</tr>
<tr>
<td>Serpentine .......................................... 9</td>
</tr>
<tr>
<td>Talc ............................................... 28</td>
</tr>
<tr>
<td><strong>Igneous Rocks</strong> ................................. 33</td>
</tr>
<tr>
<td>Andesite ........................................... 49</td>
</tr>
<tr>
<td>Andesite Porphyry (Hornblende) ................. 50</td>
</tr>
<tr>
<td>Basalt ............................................... 51</td>
</tr>
<tr>
<td>Basalt Porphyry (Olivine &amp; Pyroxene) .......... 53</td>
</tr>
<tr>
<td>Basalt Porphyry (Plagioclase Feldspar) ........ 52</td>
</tr>
<tr>
<td>Diorite .............................................. 40</td>
</tr>
<tr>
<td>Gabbro ............................................ 41, 42, 43</td>
</tr>
<tr>
<td>Granite ............................................ 37, 38</td>
</tr>
<tr>
<td>Granite Pegmatite .................................. 39</td>
</tr>
<tr>
<td>Obsidian ........................................... 54</td>
</tr>
<tr>
<td>Peridotite ......................................... 44, 46</td>
</tr>
<tr>
<td>Peridotite ........................................ 45</td>
</tr>
<tr>
<td>Pumice .............................................. 55</td>
</tr>
<tr>
<td>Rhyolite Porphyry (K-Feldspar &amp; Quartz) ...... 47</td>
</tr>
<tr>
<td>Rhyolite Porphyry (K-Feldspar) .................. 48</td>
</tr>
<tr>
<td>Scoria ............................................ 34</td>
</tr>
<tr>
<td>Volcanic Tuff ................................ 35, 36</td>
</tr>
</tbody>
</table>
Mineral (Silicate -- Sheet -- Mica)
Not metallic -- 1 flexible cleavage plane (sheet), dark colored; brown streak.

Igneous Rock
Frothy -- Light colored (therefore felsic or intermediate)

Lamprophyre
Aphanitic -- Phenocrysts are dark colored, brown streak.

Greenstone
Basalt/gabbro
B, R, S
Low
Very fine grained (too small to see crystals); light to yellow green (from chlorite, epidote, and/or actinolite).

Eclogite
Basalt/gabbro
S
High
Red garnets scattered uniformly throughout a finer-grained green groundmass (bright-green pyroxene, amphibole). May have quartz, talc, or biotite.

Serpentinite
Peridotite
H
Med-high
Green, mottled, massive. Smooth, striated (slippery surfaces). Can be black or red. Usually displays slickensides.

Soapstone
Serpentinite
S
High
White to green. Very soft. Soapy feel. Primary mineral is talc, can be scratched with fingernail.

Non foliated
Hornfels
Basalt/gabbro, mudstone
C
All
Sugary or microcrystalline, usually dark colored.

Marble
Pure limestone (only CaCO3)
B, R, S, C
All
Sugary, sandy, or crystalline; calcite or dolomite (form of calcite with Mg) crystals fused together. White to gray. Might have dark streaks.

Quartzite
Silica (only SiO2)
B, R, S, C
All
Sugary, sandy, or crystalline; can have sometimes ne quartz sand grains fused together, or quartz crystals. Usually ups and downs of the sand grains.

Skarn
Impure limestone or chert, arkose, greywacke...
C
All
Crystalline; usually with large crystals, including calcite, quartz, garnet, epidote, pyroxene, and other crystals, like stilbite.
### Sedimentary Rock Identification Chart

<table>
<thead>
<tr>
<th>Composition and Texture</th>
<th>Grain size</th>
<th>Name</th>
<th>Depositional environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium carbonate (CaCO₃)</td>
<td>Gravel</td>
<td>Coquina (limestone)</td>
<td>Beach with fringing reef (usually); Macro/microscopic shell fragments (mostly mollusks)</td>
</tr>
<tr>
<td></td>
<td>Sand</td>
<td>Calcarenite (limestone)</td>
<td>At outside edges of fringing reefs (usually); Macro/microscopic shell fragments (mostly mollusks)</td>
</tr>
<tr>
<td></td>
<td>Med</td>
<td>Chalk (limestone)</td>
<td>Deep sea floor (usually); Macro/microscopic shell fragments (mostly mollusks)</td>
</tr>
<tr>
<td></td>
<td>&lt; 2 mm</td>
<td>Siliceous sandstone (chert)</td>
<td>Deep sea floor (usually); Macro/microscopic shell fragments (mostly mollusks)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Muddy sandstone (chert)</td>
<td>Deep sea floor (usually); Macro/microscopic shell fragments (mostly mollusks)</td>
</tr>
</tbody>
</table>

### Detrital sedimentary rock (clasts are mostly rock and/or mineral fragments)

<table>
<thead>
<tr>
<th>Grain size</th>
<th>Texture and composition</th>
<th>Name</th>
<th>Depositional environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1/16 mm</td>
<td>High density (clasts packed so tightly that they are not visible)</td>
<td>Breccia</td>
<td>Basal, faulted, andesite; debris flows from andesite volcanoes</td>
</tr>
<tr>
<td>&gt; 1/32 mm</td>
<td>Mostly quartz grains; well sorted; well rounded</td>
<td>Quartz sandstone</td>
<td>Beach, sand dunes, fluvial alluvium, and other fine to coarse grained sands</td>
</tr>
<tr>
<td>&gt; 1/16 mm</td>
<td>Mixed mineral grains and/or rock fragments</td>
<td>Graywacke</td>
<td>Basal, faulted, andesite; debris flows from andesite volcanoes</td>
</tr>
<tr>
<td>Med</td>
<td>Microscopic quartz/tiny grains; can be bedded</td>
<td>Muddy sandstone or Muddy sandstone</td>
<td>Shallow, quiet nearshore; fluvial, coastal, and other fine to coarse grained sands</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shale</td>
<td>Shallow, quiet nearshore; fluvial, coastal, and other fine to coarse grained sands</td>
</tr>
</tbody>
</table>

### Igneous Rock

Igneous rock is classified as either extrusive or intrusive. Extrusive rocks are formed from lava that cools on the surface of the Earth, while intrusive rocks are formed from magma that cools underground. Igneous rocks can also be classified as either plutonic (formed underground) or volcanic (formed on the surface). The most common types of igneous rocks are granite, basalt, and rhyolite.
Igneous Rock
Aphanitic -- Porphyritic -- Phenocrysts are K-Feldspar (therefore Felsic)
K-Feldspar Rhyolite Porphyry

Mineral (Carbonate)
Not metallic -- Bubbles in HCL. Double refraction (2 images visible through clear sample). Rhombs, 3 cleavage planes (not 90), H=3.
Calcite CaCO₃
Mineral (Carbonate)
Not metallic -- Bubbles in HCL. Double refraction (2 images visible through clear sample). Rhombs, 3 cleavage planes (no 90).
Calcite CaCO₃
H=3.

Sedimentary Rock
Detrital Clastic -- Mud-sized grains --
Not white -- doesn't break in layers
Mudstone

Igneous Rock
Aphanitic -- Porphyritic -- Phenocrysts are
K-Feldspar and Quartz (therefore Felsic)
K-Feldspar & Quartz Rhyolite Porphyry

Igneous Rock Identification Chart

To identify (name) igneous rocks, you determine two things about the rock: composition and texture. First determine composition, which is based
on mineral content or color, if you can’t see minerals. Then determine the texture of the rock and based on the two, identify the rock name.

<table>
<thead>
<tr>
<th>Composition</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>Phaneritic</td>
</tr>
<tr>
<td>Potassium</td>
<td>Aphanitic</td>
</tr>
<tr>
<td>Feldspar</td>
<td>Glassy</td>
</tr>
<tr>
<td>Muscovite</td>
<td>Frothy</td>
</tr>
<tr>
<td>Hornblend</td>
<td>Pyroclastic</td>
</tr>
<tr>
<td>Plagioclase</td>
<td>(fragments of ash, crystals, pumice, rocks)</td>
</tr>
<tr>
<td>Pyroxene</td>
<td>Pegmatitic (see below for naming information)</td>
</tr>
<tr>
<td>Olivine</td>
<td>Porphyritic (see below for naming information)</td>
</tr>
</tbody>
</table>

Phaneritic
Most crystals too small to see
Greater than 90% glass (and is usually glass-filled)

Aphanitic
Most crystals too small to see
Greater than 90% crystals

Glass
100% glass

Frothy
100% visible crystals

Pyroclastic
(fragments of ash, crystals, pumice, rocks)

Add PEGMATITE to the name if the rock displays pegmatitic texture. If an intrusive igneous rock has extremely large minerals (>2 inches long), the rock is called a pegmatite. (Naming example: granite pegmatite)

Add PORPHYRY to the name if the rock displays porphyritic texture. If an aphanitic igneous rock has phenocrysts in it (large minerals surrounded by a non-plagioclase matrix), it is called porphyritic. Add the name of the prominent phenocryst mineral to the front of the rock name. (Naming example: olivine basalt porphyry)

NOTE: All pegmatites are phaneritic rocks.

NOTE: All porphyries are aphanitic rocks, because the majority of the rock (the groundmass, or matrix) is aphanitic.
Igneous Rock
Phaneritic -- Olivine & pyroxene
(therefore Ultramafic)
Peridotite

Mineral (Halide)
Not metallic -- Cubic or octahedral form.
4 directions of cleavage.
Fluorite

Metamorphic Rock
Not foliated -- 100% Quartz (no reaction with acid)
Parent rock: Chert (including Flint and Diatomite), Quartz Sandstone
Setting: Low to High grade BRSC
Quartzite

Sedimentary Rock
Detrital Clastic -- Mud-sized grains --
NOT white -- doesn't break in layers
Mudstone
Mineral (Halide)
Not metallic -- Cubic or octahedral form.
4 directions of cleavage.
Fluorite

Igneous Rock
Phaneritic -- Olivine (therefore Ultramafic)
Periodotite

Sedimentary Rock
Detrital Clastic -- Mud-sized grains --
NOT white -- breaks in layers
Shale

Metamorphic Rock
Weakly foliated -- Mottled green color --
Can have slickensides -- Smooth -- Harder than fingernail (not talc or soapstone)
Parent rock: Mantle rock (Peridotite)
Setting: High grade H
Serpentinite
Igneous Rock
Phaneritic -- Olivine (therefore Ultramafic)
Peridotite

Mineral (Silicate)
Serpentine

Metamorphic Rock
Weakly foliated -- Actinolite background with scattered garnets and kyanite
Parent rock: Basalt -- Setting: High grade S Eclogite

Sedimentary Rock
Detrital Clastic -- Sand-sized grains --
Grains are mostly quartz
Quartz Sandstone
Mineral (Silicate -- Double Chain -- Amphibole)
Not metallic -- H=5.5. Dark green or black.
2 cleavages at 60 & 120. Splintery fracture.
Long prisms.
Hornblende

Igneous Rock
Phaneritic -- Plagioclase Feldspar, Pyroxene
(the therefore Mafic)
Gabbro

Sedimentary Rock
Detrital Clastic -- Sand-sized grains --
Grains are mostly quartz
Quartz Sandstone

Metamorphic Rock
Weakly or not foliated -- Crystals too small to see -- Green colored -- Dull
Parent rock: Basalt
Setting: Low grade BRS
Greenstone
Igneous Rock
Phaneritic -- Plagioclase Feldspar, Pyroxene
(therefore Mafic)
Gabbro

Mineral (Silicate -- Single Chain)
Not metallic -- H=5.5. Dark green or black.
2 cleavages at 90. (Looks like HB.)
Pyroxene

Metamorphic Rock
Foliation: Migmatitic Texture
Parent rock: Shale/Mudstone (via Slate and Phyllite and Schist and Gneiss) OR Granite (via Gneiss)
Setting: Very High grade BRS
Migmatite

Sedimentary Rock
Detrital Clastic -- Sand-sized grains -- Grains contain a significant amount of K-Feldspar
Arkose
Mineral (Silicate -- Framework)
Not metallic -- Subparallel exsolution lamellae. 2 cleavages at 90. Pink or white color. H = 6. No twinning.
Potassium Feldspar (K-Feldspar)

Igneous Rock
Phaneritic -- Plagioclase Feldspar, Pyroxene (therefore Mafic)
Gabbro

Sedimentary Rock
Detrital Clastic -- Sand-sized grains -- Grains contain a significant amount of K-Feldspar
Arkose

Metamorphic Rock
Foliation: Gneissic Texture
Parent rock: Shale/Mudstone (via Slate and Phyllite and Schist) OR Granite
Setting: High grade BRS
Gneiss
Igneous Rock
Phaneritic -- Plagioclase Feldspar, Hornblende, Biotite (therefore Intermediate)
Diorite

Mineral (Silicate -- Framework)
Not metallic -- Twinning. 2 cleavages at 90.
H = 6.
Plagioclase Feldspar

Metamorphic Rock
Foliation: Gneissic Texture
Parent rock: Shale/Mudstone (via Slate and Phyllite and Schist) OR Granite
Setting: High grade BRS
Gneiss

Sedimentary Rock
Detrital Clastic -- Sand-sized grains --
Grains are mostly rock fragments
Graywacke
Mineral (Silicate -- Double Chain -- Amphibole)
Not metallic -- Green, thin needles.
Actinolite

Igneous Rock
Phaneritic -- Pegmatitic -- K-Felspar, Quartz,
Muscovite (therefore Felsic)
Granite Pegmatite

Sedimentary rock
Detrital Clastic -- Gravel-sized, rounded grains -
Grains are a mixture of rock fragments and minerals
Conglomerate

Metamorphic Rock
Foliation: Schistose -- 100% visible crystals --
Actinolite
Parent rock: Basalt (via Greenstone)
Setting: Med grade BR
Greenschist
Igneous Rock
Phaneritic -- K-Feldspar, Quartz, Biotite, Muscovite, Hornblende (therefore felsic)
Granite

Mineral (Native Element)
Graphite

Metamorphic Rock
Foliation: Schistose -- 100% visible crystals -- Blue (Glauophane)
Parent rock: Basalt (via Greenstone)
Setting: Med grade S
Blueschist

Sedimentary Rock
Detrital Clastic -- Gravel-sized, rounded grains - Grains are a mixture of rock fragments and minerals
Conglomerate
Mineral (Silicate)
Not metallic -- Blue, flexible blades.
Kyanite

Igneous Rock
Phaneritic -- Quartz, K-Feldspar, Muscovite, Biotite (therefore Felsic)
Granite

Sedimentary Rock
Detrital Clastic -- Gravel-sized, angular grains -- Grains are a mixture of rock fragments and minerals
Breccia

Metamorphic Rock
Foliation: Schistose -- 100% visible crystals -- Micas
Parent rock: Shale/Mudstone (via Slate and Phyllite)
Setting: Med grade BRS
Schist
Igneous Rock
Pyroclastic
Volcanic Tuff

Mineral (Silicate -- Single Chain)
Not metallic -- H=7. Green.
Striated crystal faces. Massive.
Epidote

Metamorphic Rock
Foliation: Phyllitic Texture
A few, isolated visible crystals -- Silky luster
Parent rock: Shale/Mudstone (via Slate)
Setting: Low-Med grade BRS
Phyllite

Sedimentary Rock
Chemical -- 100% Quartz composition
(doesn't react with acid)
Chert
Mineral (Silicate -- Framework)
Not metallic -- Glassy, conchoidal fracture, H=7. Hex. prism with pointed end.
Quartz SiO₄

Igneous Rock
Pyroclastic
Volcanic Tuff

Sedimentary Rock
Chemical -- 100% Quartz composition (doesn't react with acid)
Chert

Metamorphic Rock
Foliation: Slaty Cleavage -- No visible crystals
Parent rock: Shale/Mudstone
Setting: Low grade BRS
Slate
Igneous Rock
Frothy -- Dark colored (therefore mafic)
Scoria

Mineral (Silicate -- Framework)
Not metallic -- Glassy, conchoidal fracture, H=7.
Hex. prism with pointed end.
Quartz SiO$_4$

Metamorphic Rock
Not foliated -- Calcite, Garnet, Wollastonite
Parent rock: Mudstone, Sandstone,
Conglomerate, Breccia (as long as contains mixture of minerals)
Setting: Low to High grade C
Skarn

Sedimentary Rock
Chemical -- 100% Quartz composition
(doesn't react with acid) -- Black inside --
Coating of Chalk on outside
Flint
Mineral (Silicate -- Independent tetrahedra) Not metallic -- Green, conchoidal fracture, glassy, H=7. Usually granular. Not a hexagonal crystal. Olivine

Sedimentary Rock
Chemical -- 100% Calcite composition (reacts with acid)
Limestone

Metamorphic Rock
Not foliated -- Quartz, Calcite, Garnet, Rhodochrosite
Parent rock: Mudstone, Sandstone, Conglomerate, Breccia (as long as contains mixture of minerals)
Setting: Low to High grade C
Skarn
Mineral (Silicate)
Not metallic -- Dodecahedron form, red (sometimes), glassy, conchoidal fracture, H=7.
Garnet

Metamorphic Rock
Not foliated -- Quartz, Calcite, Garnet, Epidote
Parent rock: Mudstone, Sandstone, Conglomerate, Breccia (as long as contains mixture of minerals)
Setting: Low to High grade C
Skarn

Sedimentary Rock
Chemical -- 100% Calcite composition (reacts with acid) -- Layers of visible crystals
Crystalline Limestone
Mineral (Silicate)
Not metallic -- Dodecahedron form, red (sometimes), glassy, conchoidal fracture, H=7.
Garnet

Mineral (Silicate -- Sheet)
Not metallic -- Green, nonflexible sheets. Very small flakes.
Chlorite

Sedimentary Rock
Chemical -- 100% Calcite composition (reacts with acid) -- Layers of microcrystals
Evaporitic Limestone

Metamorphic Rock
Not foliated -- 100% Dark Composition (crystals not visible)
Parent rock: Mudstone or Basalt
Setting: Low to High grade C
Hornfels
Mineral (Halide)
Halite

Mineral (Oxide)
Corundum

Metamorphic Rock
Not foliated -- 100% Calcite (reaction with acid)
Parent rock: Limestone (including Coquina, Calcarenite, and Chalk)
Setting: Low to High grade BRSC
Marble

Sedimentary Rock
Chemical -- 100% Calcite composition (reacts with acid) -- Made of tiny beads
Oolitic Limestone
Mineral (Sulfide)
Metallic -- H=2.5 -- SG=8!
Silver cubes (form and cleavage).
Galena

Mineral (Sulfate)
Not metallic -- H=2.1 cleavage plane.
Translucent.
Gypsum

Sedimentary Rock
Organic Clastic -- 100% Calcite composition
(white -- reacts with acid) -- Mud-sized shells
Chalk

Metamorphic Rocks
Mineral (Silicate -- Sheet)
Talc

Mineral (Oxide)
Hematite

Sedimentary Rock
Organic Clastic -- 100% Calcite composition (reacts with acid) -- Sand-sized shells
Calcarenite
Mineral (Oxide)
Metallic -- Attracted to a magnet. SG=5.2.
No cleavage.
Magnetite

Mineral (Sulfide)
Metallic -- Cubic form, brassy color, and SG=5.
Pyrite

Sedimentary Rock
Organic Clastic -- 100% Calcite composition
(reacts with acid) -- Gravel-sized shells
Coquina

Sedimentary Rock
Organic Clastic -- 100% Quartz composition
(white -- doesn't react with acid) --
Mud-sized shells
Diatomite