

7 KEYS TO RECOGNISING MINERALS

Key No. 1: Lustre

Every mineral has either a metallic or a non-metallic lustre (i.e., reflection of light from the mineral surface). A metallic lustre is typical of a metal, e.g., gold, silver, copper, aluminum, etc. Such minerals are opaque and when crushed they yield a powder which is black or darker in colour than the mineral itself. Minerals having a non-metallic lustre become transparent on a thin edge, and when crushed they yield a powder which is white or lighter than the mineral itself. The common ones are —

- | | |
|---------------|--|
| 1. Vitreous | Quartz, Malachite, Azurite,
Barite, Halite, Topaz |
| 2. Pearly | Mica, Chlorite, Gypsum,
Calcite, Talc, Dolomite |
| 3. Adamantine | Diamond, Lead, Rutile,
Cinnabar, Corundum |
| 4. Resinous | Sphalerite, Wolframite, Sulphur,
Sphene |
| 5. Silky | Gypsum |
| 6. Earthy | Carnotite, Kaolinite, Bauxite |
| 7. Greasy | Cryolite, Serpentine, Scheelite |
| 8. Waxy | Turquoise |

Key No. 2: Hardness

Hardness is described by Mohs scale. He placed talc, the softest of all minerals as No. 1 in the series and diamond, the hardest of all known minerals as No. 10, as follows—

10	Diamond	5	Apatite
9	Corundum	4	Fluorite
8	Topaz	3	Calcite
7	Quartz	2	Gypsum
6	Feldspar	1	Talc

The scale does not indicate the exact hardness; it only means that any mineral can scratch all those beneath it. Some familiar objects we can use in the field to test are—

- 6.5 Steel File
- 5.5 Knife Blade, Window Glass
- 3.0 Copper Coin
- 2.5 Fingernail

Minerals under 2.5 will leave a mark on paper; those under 5.5 can be scratched by a knife; and those over 5.5 will scratch glass.

Key No. 3: Colour

There are minerals that are reasonably constant in their colour and are diagnostic of them, as follows—

1.	Yellow	Sulphur
2.	Pink	Feldspar
3.	Blue	Azurite
4.	Green	Malachite
5.	Brass	Chalcopyrite
6.	Auburn	Apatite
7.	Bronze	Pyrrhotite
8.	Black	Pitchblende
9.	White	Kaolinite

Key No. 4: Streak

The colour of a powdered mineral, called streak is obtained by rubbing it against a piece of unglazed porcelain, called streak plate. It is diagnostic of some minerals, as follows—

1.	Indian-red	Haematite
2.	Black	Magnetite, Graphite

3. Greenish	Galena	1
4. Greenish-black	Chalcopyrite	1
5. Gray	Chalcocite	
6. Pale Green	Malachite	
7. Light Blue	Azurite	1
8. Scarlet	Cinnabar	
9. Orange	Realgar	
10. Yellow	Carnotite	

Key No. 5: Cleavage

Crystalline minerals are said to cleave or have cleavage when they break in definite directions along smooth surfaces. These are diagnostic of some minerals as follows—

1. Octahedral Diamond
2. Platy Covellite, Molybdenite
3. Cubic Galena, Halite
4. Scaly Graphite
5. Rhombic Calcite, Dolomite,
Siderite, Magnesite
6. Flaky Mica, Chlorite
7. Diamond-shaped Barite
8. Blocky Anhydrite, Feldspar

Key No. 6: Fracture

Minerals that break in irregular directions are said to fracture. These are also typical of some minerals—

1. Conchoidal Quartz, Malachite, Azurite,
Magnesite, Opal, Tourmaline,
Beryl
2. Hackly Gold, Copper

Key No. 7: Specific Gravity

It implies how heavy it is with respect to equal volume of water and can be diagnostic of some minerals as follows—

1. Very Heavy Gold, Silver, Cinnabar,
Pyromorphite, Wulfenite
2. Heavy Galena, Copper, Pitchblende,
Wolframite, Malachite, Azurite,
Siderite, Corundum, Zircon,
Garnet

3. Medium Chalcopyrite, Cuprite, Pyrite,
Haematite, Magnesite, Gypsum,
Calcite, Talc, Dolomite, Kyanite,
Bauxite, Kaolinite, Quartz
4. Light Graphite, Halite, Stilbite,
Natrolite, Sulphur, Borax,
Opal

SELECTED SPECIMENS OF MINERALS

Mineral	BAUXITE (ore of aluminium)
Chemical composition	$\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O} + \text{Fe}_2\text{O}_3, \text{AlOH}_3$ etc.
Colour	Dirty white, greenish, brown, yellow or reddish brown
Lustre	Dull
Transparency, Translucency	Opaque
Feel	—
Form/Crystalline system	Amorphous in granular or pisolitic masses
Hardness	—
Fracture	—
Cleavage	—
Specific gravity	—
Magnetism/Special property streak	Gives aluminium, reaction when heated with cobalt nitrate
Refractive index/other opt. Property	—

Mineral	CALCITE
Chemical composition	CaCO ₃
Colour	Colourless or white, sometimes with grey, yellow, blue etc.
Lustre	Vitreous to earthy
Transparency, Translucency	Transparent to opaque
Feel	—
Form/Crystalline system	Hexagonal with Ca-ions along rhombohedral edges
Hardness	3 (scratched by knife)
Fracture	Conchoidal but difficult to observe
Cleavage	Perfectly parallel to unit rhombohedron
Specific gravity	2.71
Magnetism/Special property streak	Reacts with HCl, white streak
Refractive index/other opt. Property	1.658, in polarized light develops twinkles when nicol is rotated

Mineral	CHALCOPYRITE (ore of copper – 34.5%)
Chemical composition	CuFeS_2
Colour	Brass yellow
Lustre	Metallic
Transparency, Translucency	Opaque
Feel	—
Form/Crystalline system	Tetragonal wedge shaped crystals
Hardness	3.5 – 4
Fracture	Conchoidal, uneven
Cleavage	—
Specific gravity	4.1 – 4.3
Magnetism/Special property streak	Greenish black, slightly shining
Refractive index/other opt. Property	—

Mineral	ORTHOCLASE
Chemical composition	KAlSi_3O_8
Colour	White, reddish-white, red, flesh coloured, also colourless
Lustre	Vitreous to pearly on cleavage
Transparency, Translucency	Semi-transparent to transparent
Feel	—
Form/Crystalline system	Monocline crystals
Hardness	6
Fracture	Conchoidal to uneven
Cleavage	Perfect parallel to the basal pinacoid
Specific gravity	2.57
Magnetism/Special property streak	—
Refractive index/other opt. Property	Twining, lower than canada-balsam or quartz

Mineral	PLAGIOCLASE FELDSPARS : ALBITE
Chemical composition	$\text{NaAlSi}_3\text{O}_8$
Colour	White with bluish, greyish tint
Lustre	Vitreous, pearly on basal cleavage plane
Transparency, Translucency	Transparent to translucent
Feel	—
Form/Crystalline system	Triclinic crystals
Hardness	6 – 6.5
Fracture	Uneven
Cleavage	Perfect parallel to the basal pinacoid
Specific gravity	2.605
Magnetism/Special property streak	—
Refractive index/other opt. Property	1.535, Twinning

Mineral	GALENA
Chemical composition	PbS
Colour	Lead grey
Lustre	Metallic, often dull
Transparency, Translucency	Opaque
Feel	—
Form/Crystalline system	Cubic, massive and coarsely or finely granular
Hardness	2.75
Fracture	Flat even
Cleavage	Perfect cubic
Specific gravity	7.4 – 7.6
Magnetism/Special property streak	Lead grey
Refractive index/other opt. Property	—

Mineral	GYPSUM
Chemical composition	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
Colour	Crystals colourless; massive vitreous colourless or white, or grey etc.
Lustre	Shining and pearly on cleavage planes
Transparency, Translucency	Transparent like glass to translucent and even opaque
Feel	—
Form/Crystalline system	Monoclinic crystals as combinations of prism
Hardness	1.5 – 2 (scratched by finger nail)
Fracture	—
Cleavage	Perfect parallel to clinopinacoid, giving thin flexible plates
Specific gravity	2.3
Magnetism/Special property streak	Soluble in dilute HCl
Refractive index/other opt. Property	—

Mineral	HEMATITE (ore of iron – 70%)
Chemical composition	Fe ₂ O ₃
Colour	Steel grey or iron black
Lustre	Metallic and splendent when cryatallized
Transparency, Translucency	Opaque
Feel	—
Form/Crystalline system	Hexagonal, trigonal rhomohedron
Hardness	5.5 – 6.5
Fracture	Subconchoidal to uneven
Cleavage	Poorly parallel to the rhombohedron
Specific gravity	4.9 – 5.3
Magnetism/Special property streak	Very low magnetic, cherry red
Refractive index/other opt. Property	—

Mineral	MAGNETITE (ore of iron – 72.4%)
Chemical composition	Fe_3O_4
Colour	Iron black
Lustre	Metallic to submetallic
Transparency, Translucency	Opaque
Feel	—
Form/Crystalline system	Cubic octahedron
Hardness	5.5 – 6.5
Fracture	Sub-conchoidal
Cleavage	Poor Octahedral
Specific gravity	5.18
Magnetism/Special property streak	Highly magnetic; black
Refractive index/other opt. Property	Shapeless grains, reflects light

Mineral	BIOTITE
Chemical composition	$K(Mg,Fe)_3 (AlSi_3) O_{10} (OH, F)_2$
Colour	Black or dark green
Lustre	Splendent
Transparency, Translucency	Transparent to opaque
Feel	—
Form/Crystalline system	Monoclinic pseudo-hexagonal prismatic crystals
Hardness	2.5 – 3
Fracture	—
Cleavage	Perfect basal
Specific gravity	2.7 – 3.1
Magnetism/Special property streak	Thin elastic laminae, decomposes in strong H_2SO_4
Refractive index/other opt. Property	Higher than balsam

Mineral	MUSCOVITE
Chemical composition	$KAl_2(AlSi_3)O_{10} (OH, F)_2 \cdot Al$
Colour	White, black, brown, yellow or green
Lustre	More or less pearly
Transparency, Translucency	Transparent to translucent
Feel	—
Form/Crystalline system	Monoclinic six-sided tabular crystals
Hardness	2 – 2.5
Fracture	—
Cleavage	Perfect parallel to the basal pinacoid
Specific gravity	2.76 – 3
Magnetism/Special property streak	—
Refractive index/other opt. Property	Lowest index is not much higher than balsam, yields a biaxial interference figure

Mineral	QUARTZ
Chemical composition	SiO ₂
Colour	Colourless when pure, coloured by impurities
Lustre	Vitreous
Transparency, Translucency	Transparent to opaque
Feel	—
Form/Crystalline system	Crystals usually hexagonal prisms
Hardness	7 (cannot be scratched by knife)
Fracture	Conchoidal
Cleavage	Nil
Specific gravity	2.65
Magnetism/Special property streak	
Refractive index/other opt. Property	1.553

Mineral	TALC
Chemical composition	$Mg_3[Si_4O_{10}](OH)_2$
Colour	White, apple green, greenish grey, dark green
Lustre	Pearly
Transparency, Translucency	Sub-transparent to translucent
Feel	Greasy
Form/Crystalline system	Monoclinic tabular
Hardness	1 (scratched by finger nail)
Fracture	—
Cleavage	Perfect basal giving thin plates
Specific gravity	2.7 – 2.8
Magnetism/Special property streak	—
Refractive index/other opt. Property	1.589, Polarisation colours, delicate high order pink and green

Mineral	TOURMALINE
Chemical composition	$XY_3B_3(Al, Fe^{3+})_6O_{27}(OH, F)_4$ [X=Na, Ca, MgFe ²⁺ , & Y = Mg, Fe ²⁺ ; Al, Li]
Colour	Black
Lustre	Vitreous
Transparency, Translucency	Transparent to opaque
Feel	—
Form/Crystalline system	Hexagonal prismatic crystals
Hardness	7 – 7.5
Fracture	Subconchoidal to uneven
Cleavage	Rhombohedral
Specific gravity	2.98 – 3.2
Magnetism/Special property streak	Colourless, brittle
Refractive index/other opt. Property	1.642