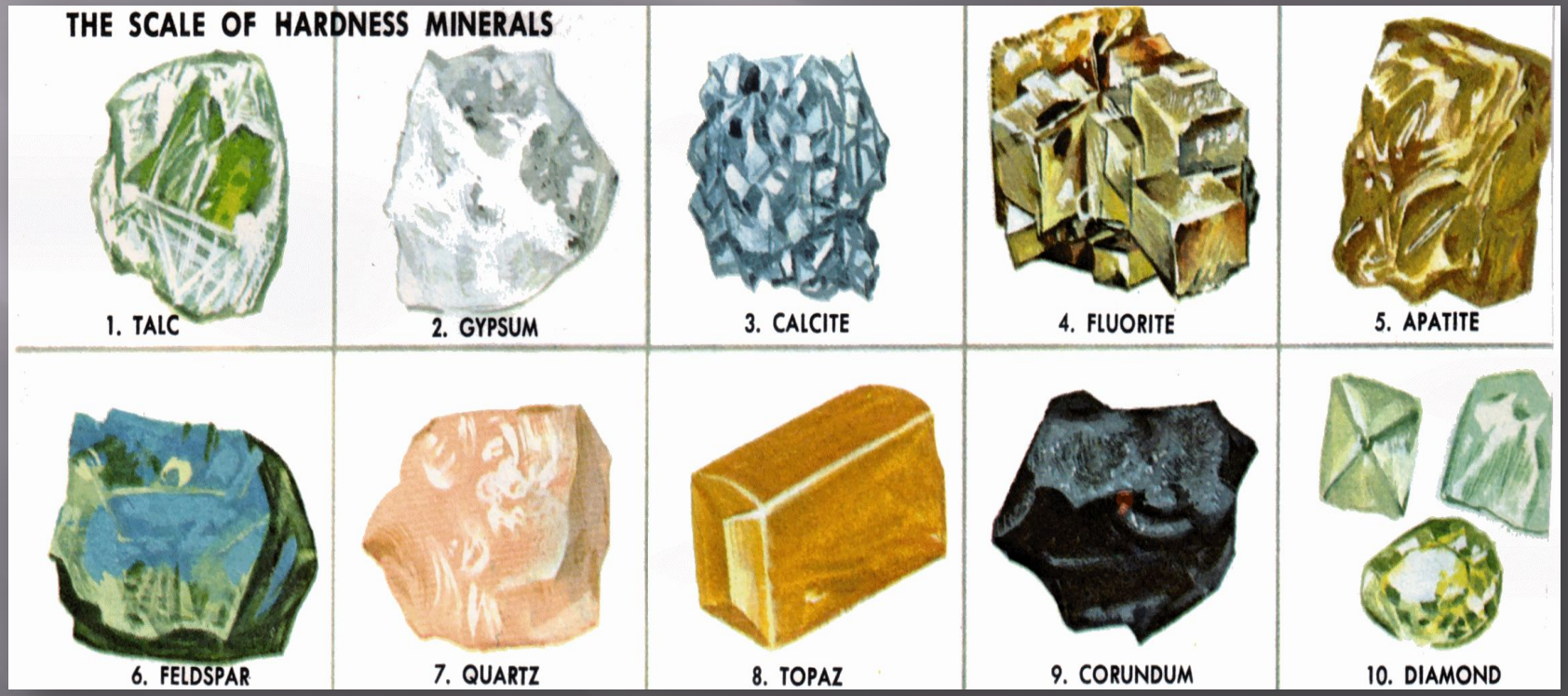
Mohs scale of mineral hardness

Mohs scale of mineral hardness

The Mohs scale of mineral hardness is a qualitative ordinal scale characterizing scratch resistance of various minerals through the ability of harder material to scratch softer material. Created in 1812 by German geologist and mineralogist Friedrich Mohs, it is one of several definitions of hardness in materials science, some of which are more quantitative. The method of comparing hardness by seeing which minerals can visibly scratch others is, however, of great antiquity, having been mentioned by Theophrastus in his treatise On Stones, c. 300 BC, followed by Pliny the Elder in his Naturalis Historia, While greatly facilitating the identification of minerals in the field, the Mohs scale does not show how well hard materials perform in an industrial setting.



Hardness

Hardness is a mineral's ability to resist abrasion or scratching. One mineral (or common object) of known hardness is scratched against another mineral, the harder mineral will leave a scratch in the softer mineral. The Moh's Hardness Scale arranges common minerals by relative hardness.

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

THE MOHS SCALE

(The measurement of the durability [or hardness] of a gemstone)

Hardness of the gemstone is defined as the ease with which the surface of the gemstone will scratch or the gemstone will break. In the gemstone industry, this feature is measured by Mohs hardness scale.

DIAMOND
Diamond is the hardest natural occurring material. Diamond is a natural allotrope of carbon.

TOPAZ
Topaz is a silicate mineral created from a combination of aluminum and fluorine.

ORTHOCLASE
Orthoclase is an igneous rock forming tectosilicate (silicate) mineral and is a key component in granite.

FLOURITE
Fluorite (fluor-spar) is a mineral composed of calcium fluoride.

GYPSUM
Gypsum is a soft mineral composed of calcium sulfate dihydrate.

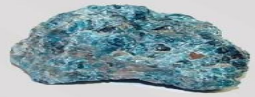
HARDEST MINERAL

10	Diamond (ex.)
9	Corundum (ex. Ruby, Sapphire)
8	Topaz (ex.)
7	Quartz (ex. Amethyst, Citrine)
6	Orthoclase (ex.)
5	Apatite (ex.)
4	Flourite (ex.)
3	Calcite (ex.)
2	Gypsum (ex.)
1	Talc (ex.)

SOFTEST MINERAL

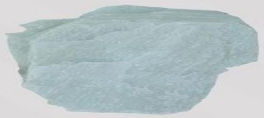
CORUNDUM
Corundum is the crystalline form of aluminum oxide and one of the basic rock-forming minerals.

QUARTZ
Quartz is one of the most common minerals found in the Earth's crust.



APATITE
Apatite is one of few minerals that are produced by biological organisms.

CALCITE
Calcite is one of the most widely distributed minerals on the Earth's surface.

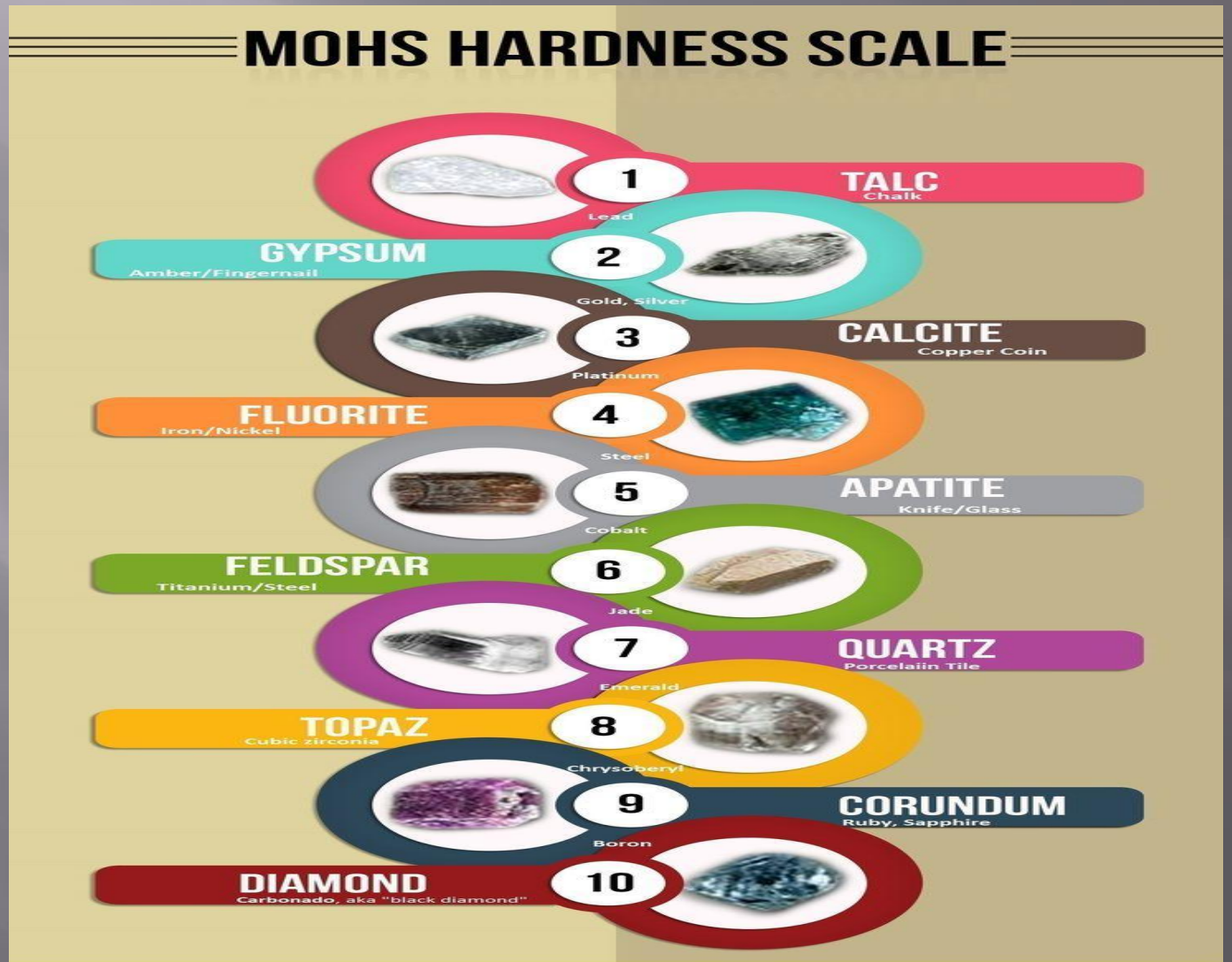


TALC
Talc is the world's softest mineral and the lowest mineral on the Mohs scale.

WHO IS FRIEDRICH MOHS?

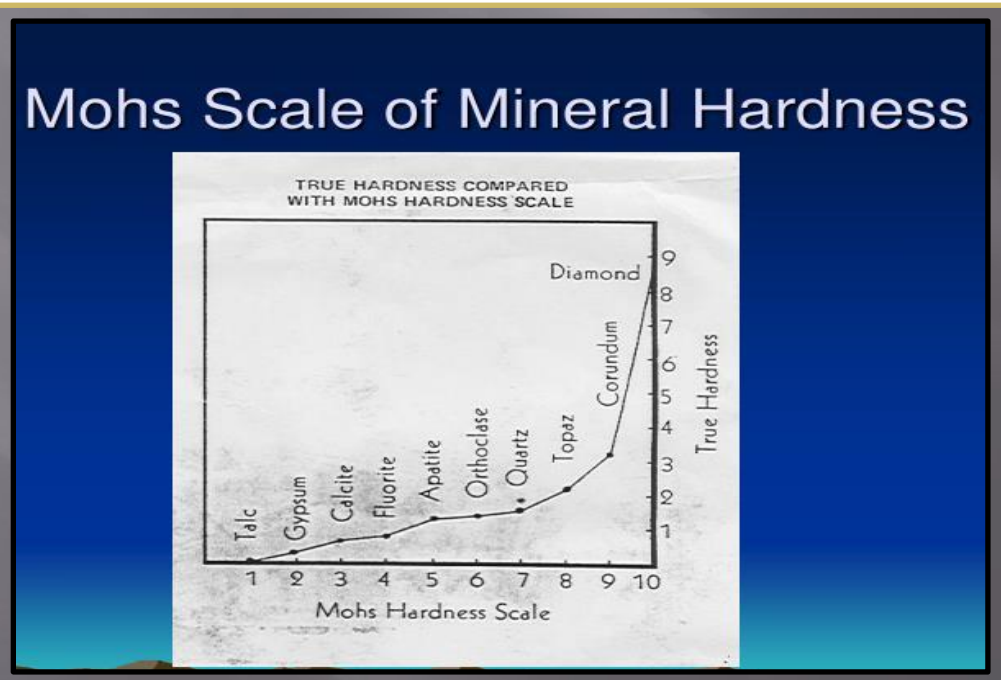
Carl Friedrich Christian Mohs (29 January 1773 – 29 September 1839) was a German geologist/mineralogist. Around 1810 Mohs gave up his job as mine foreman and in 1812 became a professor of mineralogy in Gratz where he finalized his work on hardness. Creating a scale of one to ten, he assigned each mineral a value, which was to become the Mohs' Scale of Hardness.

The Mohs scale is a purely ordinal scale. For example, corundum is twice as hard as topaz but diamond is four times as hard as corundum. The table below shows the comparison with the absolute hardness measured by a sclerometer, with pictorial examples

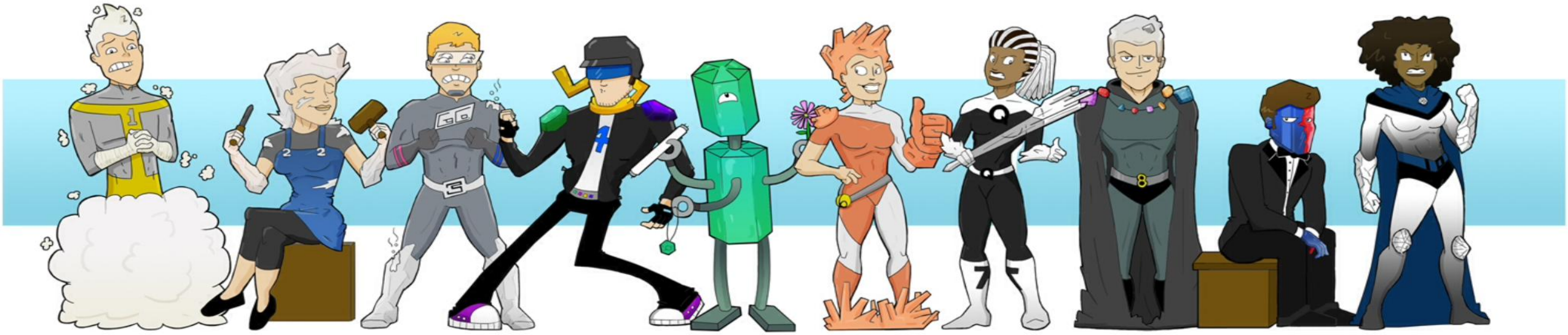


Minerals

The Mohs scale of mineral hardness is based on the ability of one natural sample of mineral to scratch another mineral visibly. The samples of matter used by Mohs are all different minerals. Minerals are pure substances found in nature. Rocks are made up of one or more minerals. As the hardest known naturally occurring substance when the scale was designed, diamonds are at the top of the scale. The hardness of a material is measured against the scale by finding the hardest material that the given material can scratch, and/or the softest material that can scratch the given material. For example, if some material is scratched by apatite but not by fluorite, its hardness on the Mohs scale would fall between 4 and 5."Scratching" a material for the purposes of the Mohs scale means creating non-elastic dislocations visible to the naked eye. Frequently, materials that are lower on the Mohs scale can create microscopic, non-elastic dislocations on materials that have a higher Mohs number. While these microscopic dislocations are permanent and sometimes detrimental to the harder material's structural integrity, they are not considered "scratches" for the determination of a Mohs scale number.

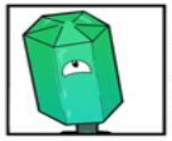


The Mohs Scale of SUPER-MINERAL Hardness



1:Talc In loose form, it is the substance known as talcum powder. It occurs as foliated and fibrous masses. It is the softest known mineral with a hardness of 1.

3:Calcite Its birefringence causes objects viewed through a clear piece to appear doubled. It will dissolve with most acids and has a hardness of 3.



5:Apatite The primary uses of apatite are fertilizer, gems, and the posphour systems in fluorescent tubes. It is a 5 on the hardness scale.

7:Quartz Quartz is the second most abundant mineral in the Earth's crust. There are many different varieties of quartz and it has a hardness of 7.

9:Corundum A gemstone quality specimen of corundum with a deep red color is known as a ruby and one with a blue color is called a sapphire. Corundum's hardness is 9.

2:Gypsum It is the main component in many forms of plaster. It is widely mined for this and for use in fertilizer. It forms as an evaporite mineral with a hardness of 2.

4:Fluorite Fluorite is a colorful mineral, both in visible and ultraviolet light. In 1852 fluorite gave its name to the anomaly of fluorescence. It's hardness is 4.

6:Orthoclase Orthoclase is a common constituent of most granites and other felsic igneous rocks and often forms huge crystals. It has a hardness of 6.

8:Topaz Pure topaz is colorless and transparent but is usually tinted by impurities. It can be pale gray, reddish orange, blue, or pink and has a hardness of 8.

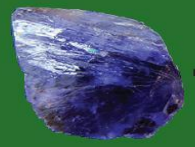
10:Diamond Most natural diamonds are formed at high temperature and pressure. It is the hardest known natural material on the scale at 10.

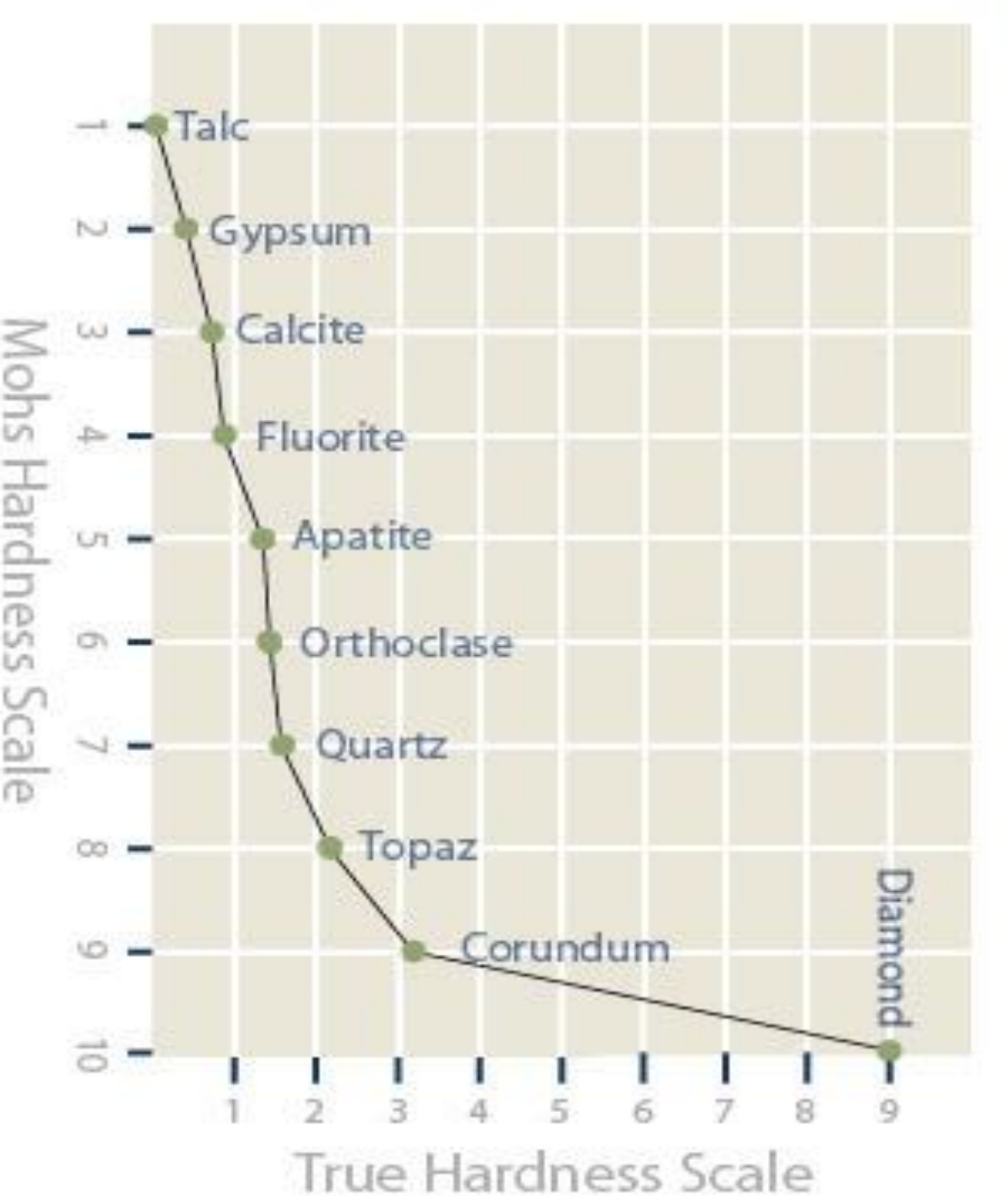
Mohs hardness	Mineral	Chemical formula	Absolute hardness[11]	Image
1	Talc	$Mg_3Si_4O_{10}(OH)_2$	1	
2	Gypsum	$CaSO_4 \cdot 2H_2O$	3	
3	Calcite	$CaCO_3$	9	
4	Fluorite	CaF_2	21	
5	Apatite	$Ca_5(PO_4)_3(OH^-,Cl^-,F^-)$	48	
6	Feldspar	$KAlSi_3O_8$	72	
7	Quartz	SiO_2	100	
8	Topaz	$Al_2SiO_4(OH^-,F^-)_2$	200	
9	Corundum	Al_2O_3	400	
10	Diamond	C	1600	

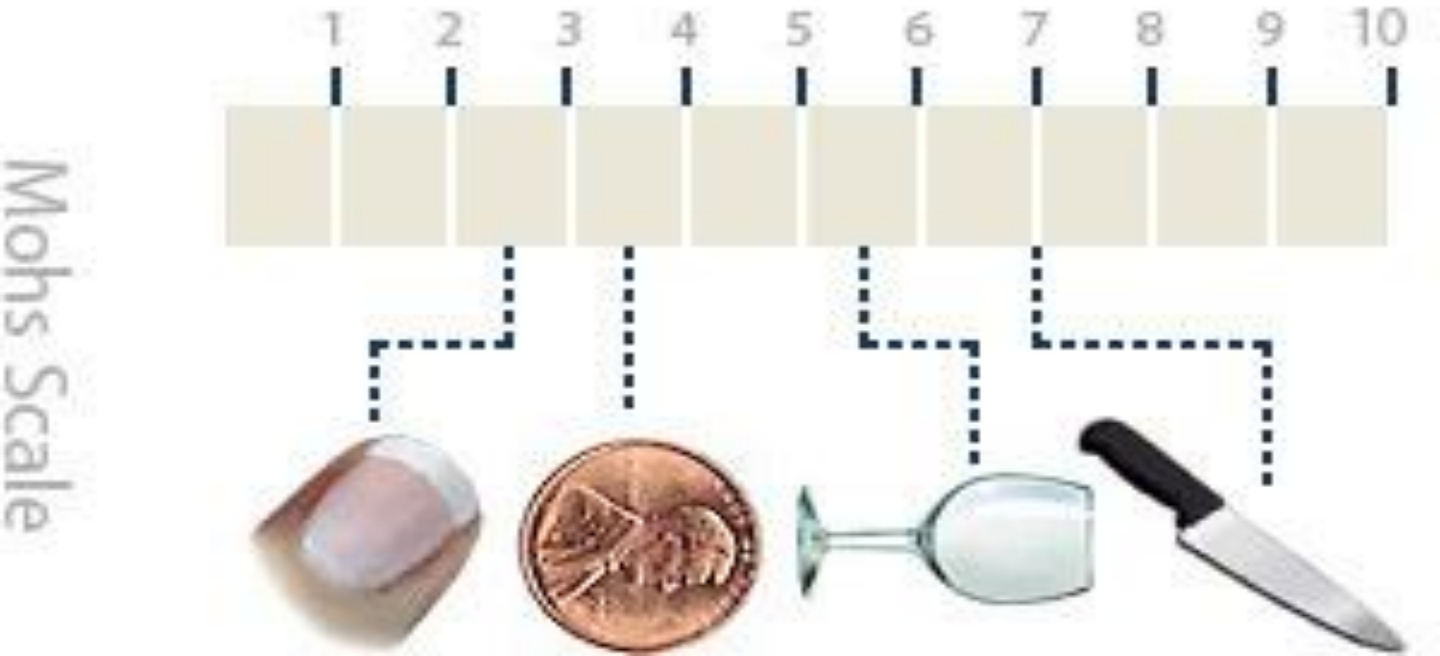
Mohs Hardness Scale

Mineral Name	Scale Number	Common Object
Diamond	10	
Corundum	9	Masonry Drill Bit (8.5)
Topaz	8	
Quartz	7	Steel Nail (6.5)
Orthoclase	6	
Apatite	5	Knife/Glass Plate (5.5)
Fluorite	4	Copper Penny (3.5)
Calcite	3	
Gypsum	2	Fingernail (2.5)
Talc	1	

Increasing Hardness




Talc
Gypsum
Calcite
Fluorite
Apatite
Orthoclase
Quartz
Topaz
Corundum
Diamond
1
2
3
4
5
6
7
8
9
10
Mohs Hardness Scale
1 2 3 4 5 6 7 8 9
True Hardness Scale


1 2 3 4 5 6 7 8 9 10
Mohs Scale