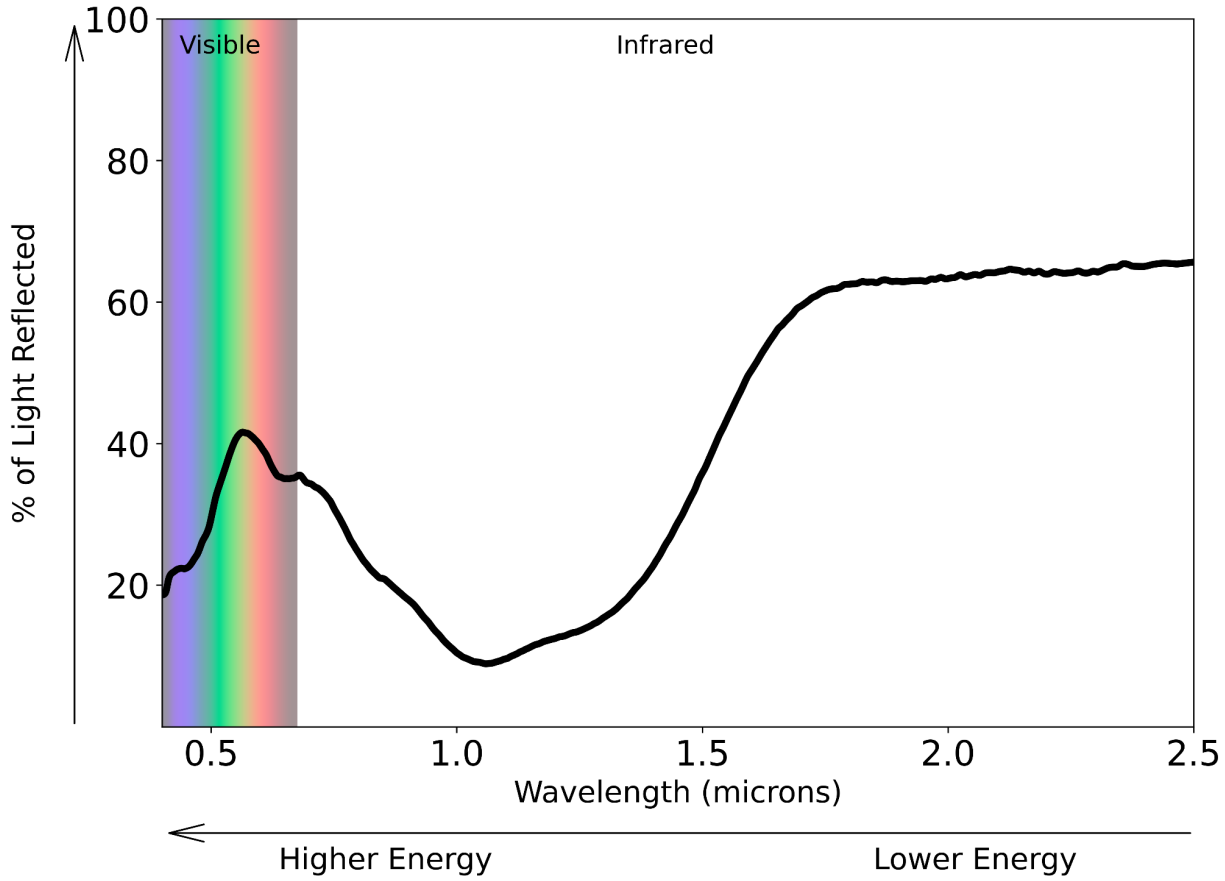
Mineral Fingerprints

Olivine (Volcanic)



A graph of the reflectance spectrum of the volcanic mineral olivine. The percentage of reflected light ranges from 0 – 100 on the Y axis and wavelength in microns ranges from 0.4 – 2.5 on the X axis. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. For olivine, the reflectance increases from a very low value at 0.4 microns, up to a peak of about 40% in the green to yellow portion of the visible range. The reflectance then drops down to a minimum at about 1 micron in the near-infrared. From that minimum the reflectance increases again and is pretty constant at about 60% for wavelengths greater than 1.6 microns.

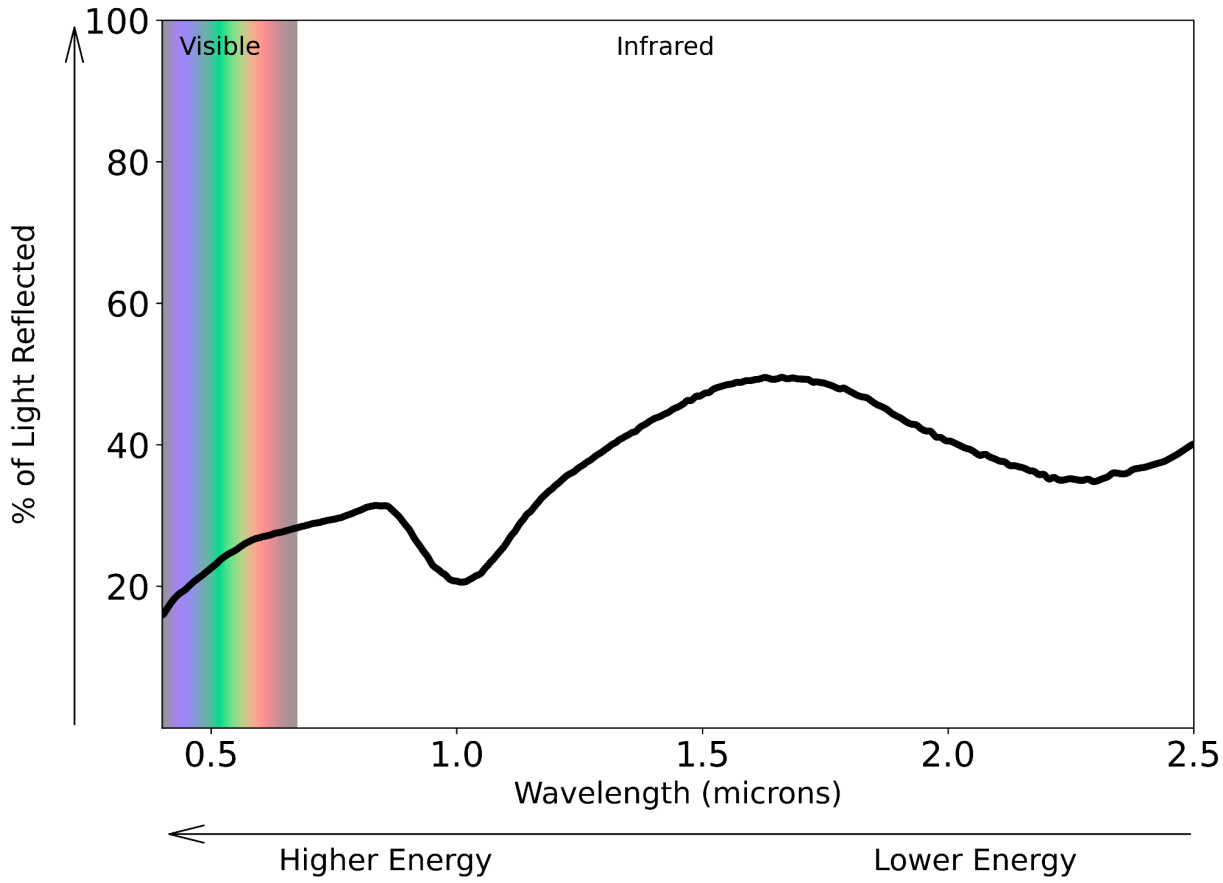
A photograph of four polished olivine crystals (also known as the gem peridot), showing the mineral's green color.

Image source: NASA/JPL/Caltech

Olivine Audio File: https://hov.to/f56f4a2c

Mineral Fingerprints

Pyroxene (Volcanic)



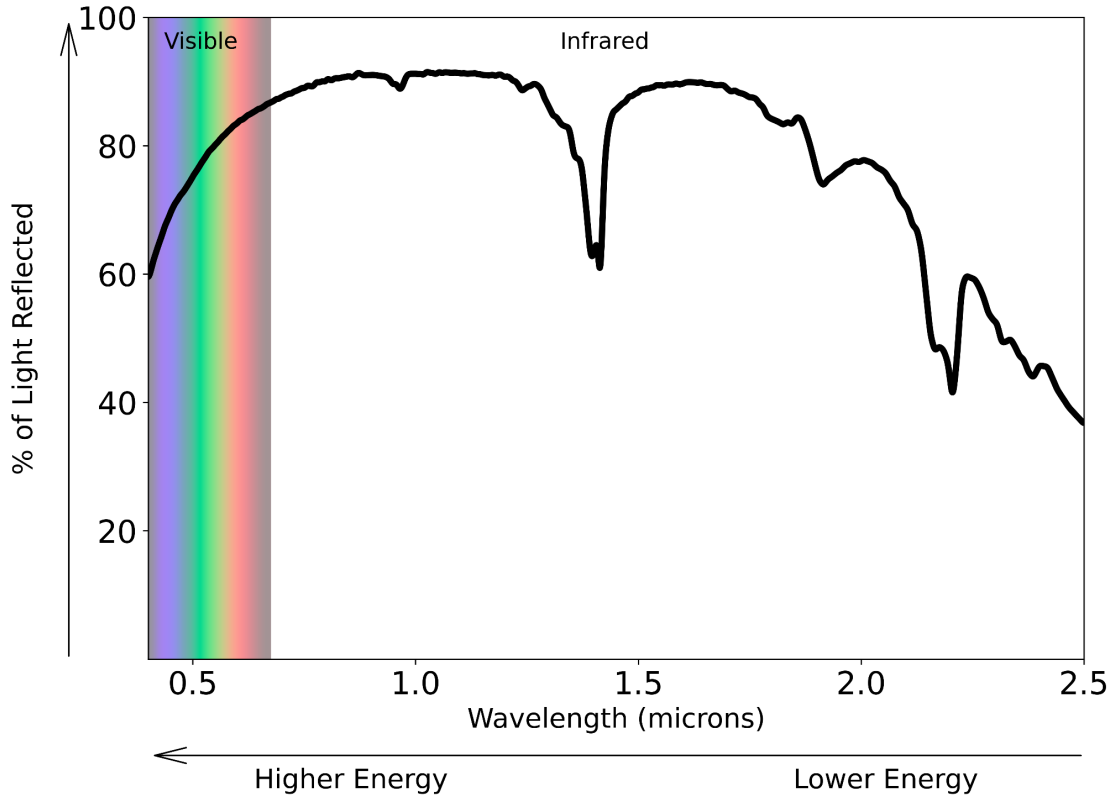
A graph of the reflectance spectrum of the volcanic mineral pyroxene. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0.4 – 2.5. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. For pyroxene, the reflectance steadily increases through the visible range to about 30% at 0.8 microns. Then there is a small dip in reflectance down to 20% at 1 micron. After the dip, the reflectance rises again to a broad maximum around 50% at 1.6 microns, followed by a broad minimum of about 35% at 2.25 microns.

A photograph of a large, brownish crystal of pyroxene. Image source: Rob Lavinsky, iRocks.com – CC-BY-SA-3.0

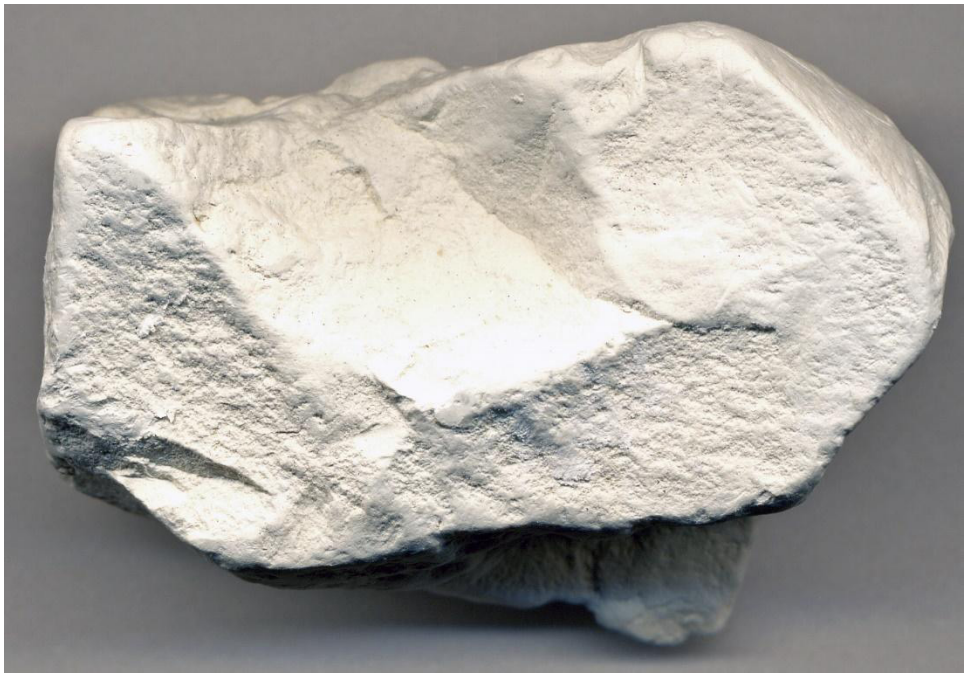
Pyroxene Audio File: https://hov.to/bb998631

Mineral Fingerprints

Kaolinite (Clay) (forms in water)



A graph of the reflectance spectrum of the clay mineral kaolinite, which forms in water. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. The reflectance of kaolinite starts at about 20% in the UV range but rapidly rises through the visible range to a maximum of about 90% in the range between 1 and 1.5 microns. From there the reflectance decreases down to almost zero at 2.7 microns before rising slightly. The smooth curve of the reflectance graph is broken up by many small, sharp drops in reflectance. These are caused by water molecules in the crystal absorbing infrared light at particular wavelengths. The largest drop is at 1.4 microns, with a minimum reflectance of about 60%.



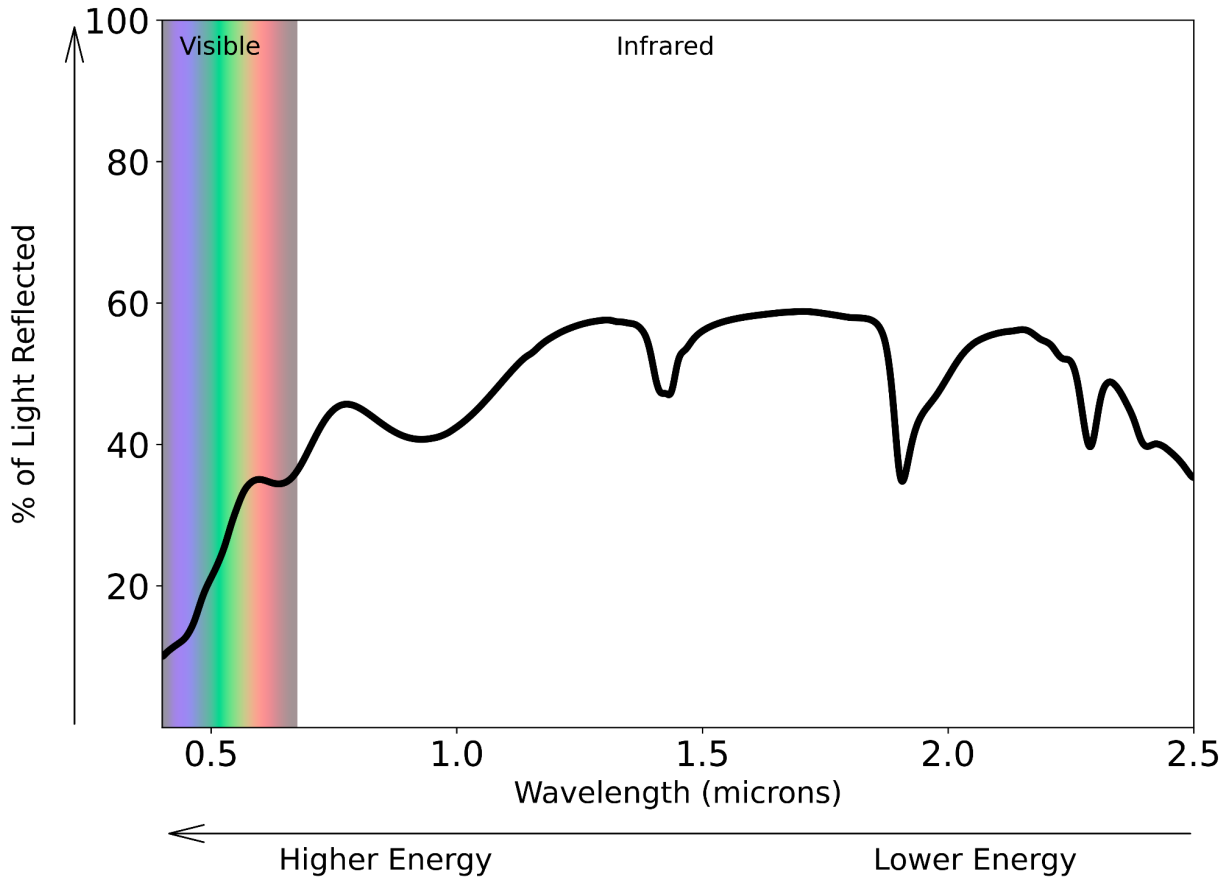
Photograph of a piece of kaolinite. It is an off-white rock with a rough surface but rounded at the edges.

Image source: James St. John, CC BY 2.0

Kaolinite Audio File: https://hov.to/f33731fb

Mineral Fingerprints

Nontronite (forms in water)



A graph of the reflectance spectrum of the clay mineral nontronite, which forms in water. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0.4 – 2.5. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. The reflectance of nontronite increases from about 10% up to about 60% at 1.7 microns. There is a slight dip in the reflectance in the red part of the visible range, and a broader dip around 1 micron. Three more sharp, narrow decreases in reflectance occur at 1.4 microns, 1.9 microns, and 2.3 microns. These are caused by water molecules in the crystals absorbing particular wavelengths of infrared light.

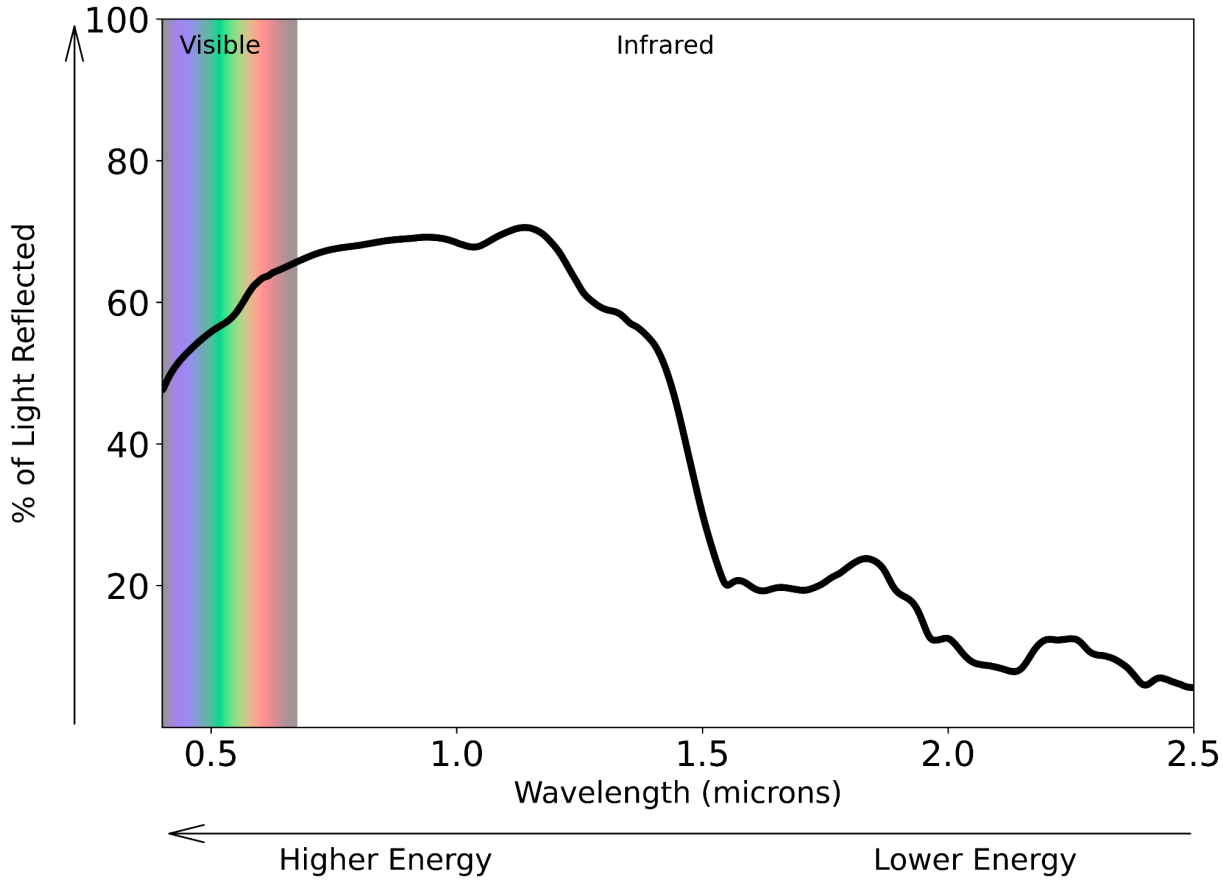
Photograph of nontronite that has been crushed into a brownish powder.

Image source: USGS

Nontronite Audio File: https://hov.to/e3b3b722

Mineral Fingerprints

Kieserite (forms in water)



A graph of the reflectance spectrum of the sulfate mineral kieserite, which forms in water. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0.4 – 2.5. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. The kieserite reflectance spectrum increases from about 50% to 70% around 1 micron. It then drops sharply down to about 20% at 1.5 microns. Beyond 1.5 microns, the reflectance varies, forming a wiggly line on the plot, but generally continues to decrease except for a peak at about 1.8 microns and a smaller peak at 2.2 microns.

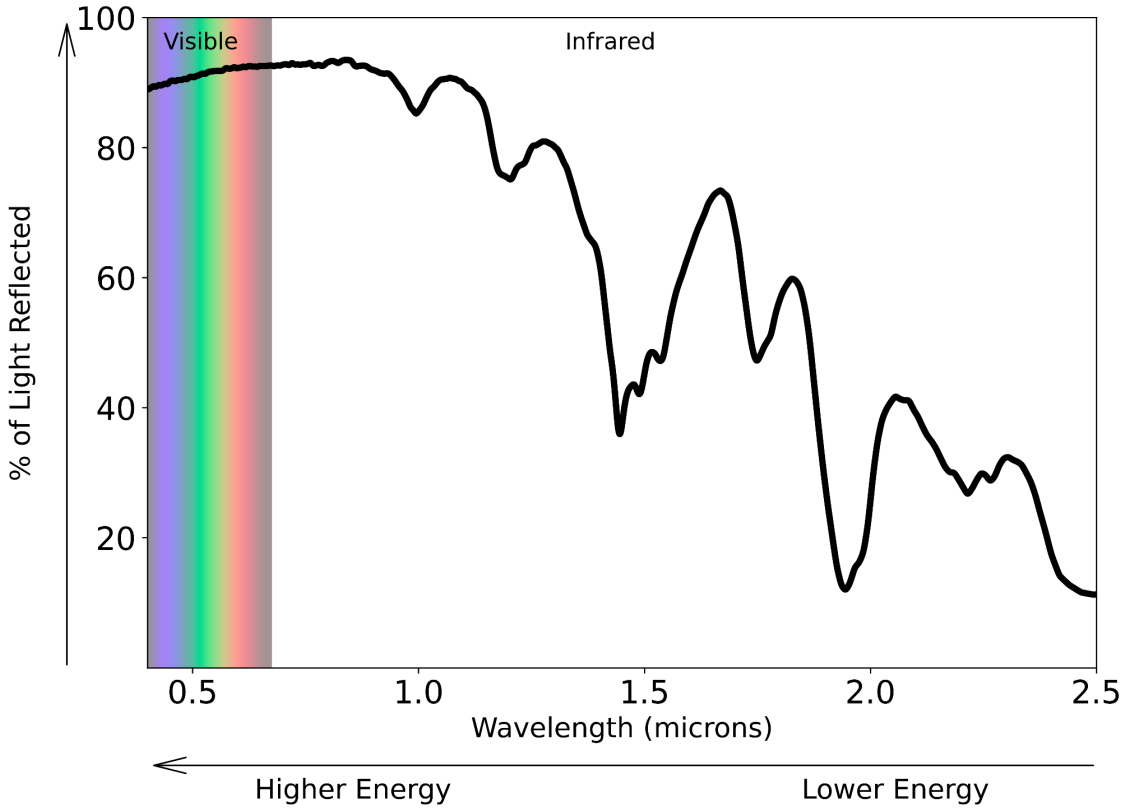
Photograph of kieserite, a sulfate mineral that forms in water. In this image it has been crushed into a white powder.

Image source: Wikipedia user Rasbak, CC BY-SA 3.0

Kieserite Audio File: https://hov.to/6c252747

Mineral Fingerprints

Gypsum (forms in water)



A graph of the reflectance spectrum of the sulfate mineral gypsum, which forms in water. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, between about 0.4 to 0.7 microns. Gypsum starts with a reflectance of about 75% in the UV range which increases to 90% in the visible range and beyond to about 1 micron. From 1 micron to 3 microns, the spectrum varies up and down dramatically, making a jagged line that overall decreases down to very low reflectance near 3 microns. The largest dips in reflectance occur at 1.4 microns, where the reflectance drops from 80% to 40% and then back up to 75%, and 1.9 microns, where the reflectance drops from about 60% to 10% and then goes back up to 40%. These large dips in the spectrum are due to water in the crystals.

Photograph of large transparent crystals of gypsum, a sulfate mineral that forms in water.

Image source: James St. John, CC-BY-2.0

Gypsum Audio File: https://hov.to/ea339853