

18. Quartz (silicon dioxide, SiO₂)

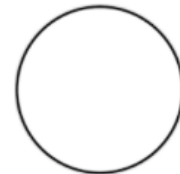
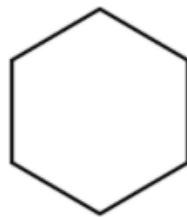


Quartz is the most common mineral on land and the Earth's surface. It is so common because it consists of silicon and oxygen, the most important chemical elements in the Earth's crust. It is a constituent of most light-colored igneous rocks, many metamorphic rocks such as gneiss, and sedimentary rocks such as sandstone. Beach sand is

usually made up mostly of small, rounded pieces of quartz. Quartz is one of the most important economic minerals as a major component of cement and glass in the form of sand. Quartz is used commercially as an abrasive because it is the most common mineral that has a hardness of 7 or more on the Mohs hardness scale for minerals, which means it is harder than glass or steel. Quartz crystals are a piezoelectric material, so if an alternating voltage is applied to them, it causes the crystals to create mechanical vibrations or electronic oscillations at a constant frequency. This signal is extremely stable across a wide range of temperatures and environmental conditions. Thus, billions of quartz crystals are used as components in watches, video games, computers, cell phones, and other electronic equipment.

Activities:

K-2: Quartz crystals are often used as gemstones because they are very hard, so they resist scratching, and they come in a variety of colors depending on the impurities they contain. The crystals form as hexagonal prisms. The most popular is amethyst, which is the purple variety of quartz. Circle which shape is a hexagon (six-sided polygon) and color it purple, like one face of an amethyst crystal.



3-5: Because quartz sand is very hard, it makes good sandpaper. It is harder than most minerals and is harder than steel. Examine some sandpaper at your house, a hardware store, or an online retailer. Is the sandpaper labeled "flint" on the paper side or on the package? Yes No. If so, this means that it is made from quartz.

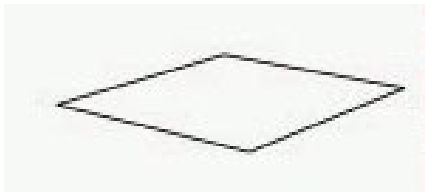
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18. Quartz continued

If it is not labeled “flint,” is there another label on the back or on the package? Circle the one that you find: Garnet Silicon carbide Ceramic Aluminum oxide (the synthetic form of the mineral corundum, which is 9 on the Mohs hardness scale of 1–10. Some forms of corundum are the gemstones of ruby and sapphire.)

K-5: When many minerals break, they crack along very smooth, straight sides called cleavage planes that are determined by the crystalline structure. Quartz does not have any perfect cleavage faces, so when it breaks, the fracture surfaces look like broken glass, forming a concave (bowl-shaped) conchoidal fracture. Take an ice cube outside, put it in a clear plastic bag, and hit it softly with a hammer until it breaks. Does ice break along smooth, even faces or does it break along curved surfaces? Circle what you find:



Smooth cleavage face



Conchoidal fracture

6-8: Quartz gemstones come in many colors depending on what impurities are in the quartz molecular structure. Iron is the source of purple in amethyst and yellow in citrine, and titanium or manganese produce the pink in rose quartz. Agates are very fine-grained quartz crystals with impurities such as iron and manganese that give the individual bands in the rock the wide range of colors. When quartz crystals are being cut and polished to make finished gemstones, the person doing the grinding always drips water on the crystal to capture dust, because the quartz dust, also known as silica, can cause damage to a person’s lungs. Because quartz is such a common commercially used mineral, there are many construction and industrial activities that produce these very small particles of respirable crystalline silica. Research activities that could expose workers to silica dust and list some of them:

8+: A geode is a hollow subspherical stone nodule. Quartz crystals are a common lining of the internal cavity of geodes. Research how geodes form in areas of volcanic activity or by sedimentary processes and explain how the quartz crystals got inside of a hollow rock: _____
