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QUARTZ: ITS VARITIES AND OCCURRENCE
(please see photo at bottom of article)

Introduction: Quartz, the most abundant mineral of the continental crust, is everywhere. Most sand is quartz. It is a major component of igneous, metamorphic and sedimentary rocks. It is fairly easy to synthesize. Common does not mean "useless", though. Even quartz sand is in demand: if clean and pure, it is used to make glass. Quartz sand is used as an abrasive. Carefully cut plates of quartz crystals resonate so regularly that they are used in the hearts of our watches. In our modern world, perhaps the most important use of quartz is as a source of silicon for semiconductors. In addition to practical uses, many varieties of quartz are prized for their beauty as specimens or cut into gemstones.

1. QUARTZ crystal from Arkansas. Quartz is the most common form silicon dioxide (SiO_2) and this is its natural crystal shape and color (colorless). It is also called rock crystal.
2. ROSE QUARTZ (South Dakota or Brazil). The color is from trace amounts of iron, titanium and manganese.
3. QUARTZ variety AMETHYST from Brazil. This amethyst specimen formed in open spaces in basalt, an igneous rock. The color is from trace amounts of iron.
4. SMOKY QUARTZ occurs in granite in New Hampshire, Colorado and many other places in the USA. The black or smoky color is caused by natural radiation in the granite.
5. Quartz variety CHALCEDONY, New Mexico. Chalcedony is a cryptocrystalline variety of quartz. This means the internal crystals are so small they cannot be seen even with a microscope. It is formed in cavities in extrusive igneous rocks like basalt and rhyolite.
6. MILKY QUARTZ from Arkansas or Colorado. The white color is caused by many minute bubbles in the quartz. This is one of the most common forms of quartz.
7. QUARTZ variety CHERT from Texas. Chert is a common form of cryptocrystalline quartz found in sedimentary rocks. It was used to make tools and arrows by the Indian tribes. Its internal structure differs from chalcedony.
8. QUARTZ variety FLINT. It is cryptocrystalline like Chert and also forms in sedimentary rocks. Its dark color distinguishes it from Chert. Flint is less porous and more uniform looking than Chert. It was valued by Native Americans for tools and weapons.
9. QUARTZ variety CARNELIAN. This orange chalcedony is colored by iron.
10. QUARTZ geode from Brazil. This polished half geode has quartz crystals in the cavity but the outer shell is made from chalcedony.
11. QUARTZ variety AGATE from Mexico. The patterns and colors in this chalcedony make it desirable for jewelry. It has many names but moss agate is the most common. The "moss" is made of dendrite (tree-shaped) crystals of iron oxide.

12. **SILICIFIED WOOD from Texas. Wood becomes "petrified" when silica fills in the open spaces in the wood cells. Silicified wood is composed of any of the cryptocrystalline varieties of quartz: chalcedony, jasper, agate, chert, carnelian, etc.**
13. **Sandstone is a sedimentary rock composed of sand. Most sand grains are QUARTZ. Iron staining causes the red or brown color. The grains can be held together by more quartz, by calcite, or by iron oxide.**
14. **Granite, from Texas. An intrusive igneous rock created deep within the earth. It is composed of QUARTZ (gray-white), feldspar (red-brown) and biotite and hornblende (black). Granite is the most abundant rock type in the continental crust. Sand is mostly quartz from granites worn small and rounded from long transport to the sea.**
15. **Rhyolite, from New Mexico or western Texas. An extrusive igneous rock with the same composition as granite but cooled very rapidly, so the Quartz grains are very small and can only be seen with a microscope.**
16. **Quartzite. A metamorphic rock composed predominantly of the mineral QUARTZ. It is metamorphosed sandstone.**
17. **Obsidian, from Mexico. Obsidian is an igneous rock, a volcanic glass that is composed of silicon dioxide just like quartz. Since obsidian formed on the earth's surface and cooled very rapidly no crystal structure formed. Therefore it is a glass.**

QUESTIONS TO THINK ABOUT:

Quartz has a Mohs hardness of 7. Glass is softer with a hardness of 5. Feldspar that occurs in many rocks like granite, rhyolite and some sandstone has a hardness of 6. Considering all the specimens in the box, which one is the softest?

1. **Quartz has a good hardness and durability that makes it an ideal gemstone. Which of these specimens would be suitable for cutting and polishing as an ornamental gemstone for jewelry making?**
2. **Feel the texture of specimen 13, sandstone, and compare it with no. 16, quartzite. What has the metamorphism done to the individual sand grains you can feel in specimen 13?**
3. **Specimen no. 7, chert, and no. 8, flint, are cryptocrystalline forms of quartz, which were used by the Indians for arrow- and tool making. What other specimens in this box were also used for this purpose?**
4. **Sandstone, no. 13, is composed of quartz like flint and chert. Why would it not make a good material for tool making?**
5. **Specimens 13 through 17 are all rocks. If these rocks were left on the surface of the earth and exposed to weathering, which ones would decompose into sandstone?**
6. **If you wanted to make a stone knife blade, which would be the better material between flint, no. 8, and obsidian, no. 17? Why?**
7. **A diamond with a Moh's hardness of 10 is the hardest material known. Which quartz form could be cut and faceted like a diamond and be substituted for a diamond? Would this faceted stone scratch glass like a diamond? How could you tell the two (the diamond and the quartz) apart from using hardness tests?**
8. **If you were looking on the earth's surface today, where would you go to find a place (a sedimentary environment) that might eventually form sandstone?**

ANSWERS:

1. **Obsidian, no. 17, is a volcanic glass with a hardness of only 5.**
2. **Probably all of them except sandstone and rhyolite. Obsidian would be less hard and durable but is also used as a gemstone. Transparency and pretty colors make stones more desirable for faceted stones. Interesting patterns, optical effects, and nice colors make stones useful as cabochons (smooth dome-shaped stones).**
3. **In the sandstone, you can see and feel the individual sand grains – the rock has a texture like sandpaper. In the quartzite, the heat and pressure of metamorphosis has made individual sand grains grow together into a smooth mosaic.**
4. **Any of the cryptocrystalline varieties of quartz including chalcedony, carnelian, agate, petrified wood and also some quartzite and some obsidian. Only rarely were rock crystal and smoky quartz used.**
5. **It is composed of individual grains of quartz that can fall out and it is usually too rough to be able to be made into a sharp cutting edge.**
6. **"Sandstone" is a size term and not a composition term. Any rock, regardless of composition, can weather to produce sandstone if the rock breaks up into sand-sized pieces (grains between 1/16 and 2 mm). Fine-grained rhyolite would get included in sandstones only as rock fragments and the glassy obsidian would probably disintegrate.**
7. **Trick question. ☺ The flint has a hardness of 7 and the obsidian is only a hardness of 5. The microcrystalline quartz of the flint would also make a tougher blade than the glass of the obsidian. But the obsidian breaks to a very thin edge and might be sharper – surgeons have made scalpels from obsidian. So, what do you want: hard and tough or *really* sharp?**
8. **Rock crystal, no.1, is colorless and transparent so it would be the best candidate. A real diamond would scratch glass very easily and quartz would scratch it with a little more effort. The diamond would scratch the quartz crystal. (Yes, there are lots of other tests!)**
9. **A beach, sandy riverbed or river bar, a river's delta, or a sand dune might eventually be buried and form a sandstone.**


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