Dense as a Rock

Rocks are pretty dense, but some are denser than others. Estimation of a rock's or mineral's density can help in its identification. Density is the mass (grams) of a substance found in a particular volume (cubic centimeters). A related value, specific gravity, compares a mineral's volume to that of an equal volume of water. Both specific gravity and density are the same number, but density has units, (grams per cubic centimeter or g/cc) while specific gravity is unitless. Thus quartz has a specific gravity of 2.65 and a density of 2.65 g/cc.

One can heft a rock to estimate density. Less dense rocks will feel unusually light. Pumice is a good example of a low density rock. It has tiny air pockets, making it light enough to float on water. Or think of a geode with a large cavity in it. It will feel lighter than one that is nearly solid. Rocks that feel unusually heavy contain dense minerals such as iron ore, sulfides, gold or garnet. Most rock hounds have picked up enough rocks to know what a "average" rock should weigh for its size. Quartz, feldspar, granite and sandstone have "average" densities. If you pick up a chunk of vitreous red mineral, and it feels heavy for its size, you should consider that you aren't hefting quartz. Maybe you have a garnet, or scheelite.

A famous story is based on the use of density. The Greek scientist Archimedes was given a problem by his king, Heiro II. The king had sent a metal smith some gold to make a crown. He didn't want the smith to be adding silver and keeping some of the gold for himself. The king asked Archimedes how he could tell if the crown were pure gold. Archimedes had no immediate answer. He decided a relaxing bath may help him think. As he got into the tub, the rising water gave him his answer. The crown would displace a volume of water related to its mass, and its mass per volume would tell how much pure gold was present. Archimedes was supposedly so excited by this discovery, that he leaped from his bath and ran naked through the streets shouting "EUREKA" or "I've found it!" The crown was weighed. Then it was immersed in a vat full of water. The water that escaped was carefully measured, giving the volume. The density was then easily calculated. The crown was not pure gold, and the metal smith was suddenly the one in hot water.

Heft tests are fine for quick determinations of relatively pure minerals. Should one wish to get a mineral's density more accurately, Archimedes' measurements can be done with a equipment found in a typical high school lab. Here's one way to do it. Get a rather pure chunk of the mineral, perhaps 1 cm across. Measure the sample's mass (grams) on a balance. Then submerge the sample in a small graduated cylinder and note the increase in

volume (milliliters = cubic centimeters of water). Divide the volume into the mass to get the density. Leave off the units to get the specific gravity. Most mineral books have charts listing minerals by their specific gravity. Remember, just like King Heiro's crown, the density you measure will be affected by any impurities, so don’t be too fussy about how well you match a particular mineral’s recorded density.

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