8.22: Silicon Dioxide

Silicon dioxide, or silica, (SiO_2) is another important example of a macromolecular solid. Silica can exist in six different crystalline forms. The best known of these is *quartz*, whose crystal structure shown previously is shown again below.

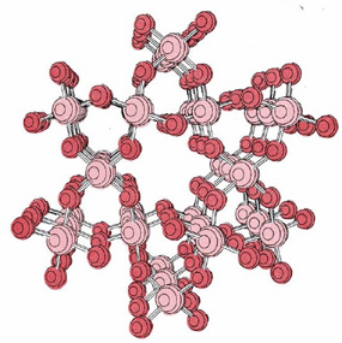

Figure 8.22.1 A portion of the giant covalent molecule $(SiO_2)_n$. The lattice shown would extend indefinitely in all directions in a macroscopic crystal. Each silicon atom (light color) is covalently bonded to four oxygen atoms (dark color). Each oxygen bonds to two silicons. The ratio of silicon to oxygen is 2:4 or 1:2, in accord with the formula. Computer-generated. (Copyright © 1976 by W. G. Davies and J. W. Moore.)

Sand consists mainly of small fragments of quartz crystals. Quartz has a very high melting point, though not so high as diamond.

If you refer back to the examples on silicon, you can remind yourself of the reason that SiO_2 is macromolecular. Silicon is reluctant to form multiple bonds, and so discrete O=Si=O molecules, analogous to O=C=O, do not occur. In order to satisfy silicon's valence of 4 and oxygen's valence of 2, each silicon must be surrounded by four oxygens and each oxygen by two silicons. This can be represented schematically by the Lewis diagram