

TABLE 2-4 van der Waals Radii and Covalent (Single-Bond) Radii of Some Elements

<i>Element</i>	<i>van der Waals radius (nm)</i>	<i>Covalent radius for single bond (nm)</i>
H	0.11	0.030
O	0.15	0.066
N	0.15	0.070
C	0.17	0.077
S	0.18	0.104
P	0.19	0.110
I	0.21	0.133

Sources: For van der Waals radii, Chauvin, R. (1992) Explicit periodic trend of van der Waals radii. *J. Phys. Chem.* **96**, 9194-9197. For covalent radii, Pauling, L. (1960) *Nature of the Chemical Bond*, 3rd edn, Cornell University Press, Ithaca, NY.

Note: van der Waals radii describe the space-filling dimensions of atoms. When two atoms are joined covalently, the atomic radii at the point of bonding are less than the van der Waals radii, because the joined atoms are pulled together by the shared electron pair. The distance between nuclei in a van der Waals interaction or a covalent bond is about equal to the sum of the van der Waals or covalent radii, respectively, for the two atoms. Thus the length of a carbon-carbon single bond is about $0.077 \text{ nm} + 0.077 \text{ nm} = 0.154 \text{ nm}$.