TABLE 1 Bond Lengths and Bond Energies for Selected Covalent Bonds

Bond	Average bond length (pm)	Average bond energy (kJ/mol)	Bond	Average bond length (pm)	Average bond energy (kJ/mol)
H–H	75	436	C–C	154	346
F–F	142	159	C–N	147	305
Cl–Cl	199	243	C–O	143	358
Br–Br	229	193	C–H	109	418
I–I	266	151	C–Cl	177	327
H–F	92	569	C–Br	194	285
H–Cl	127	432	N–N	145	163
H–Br	141	366	N–H	101	386
H–I	161	299	O–H	96	459

All individual hydrogen atoms contain a single, unpaired electron in a 1*s* atomic orbital. When two hydrogen atoms form a molecule, they share electrons in a covalent bond. As **Figure 8** shows, sharing electrons allows each atom to have the stable electron configuration of helium, $1s^2$. This tendency for atoms to achieve noble-gas configurations by bonding covalently extends beyond the simple case of a hydrogen molecule.

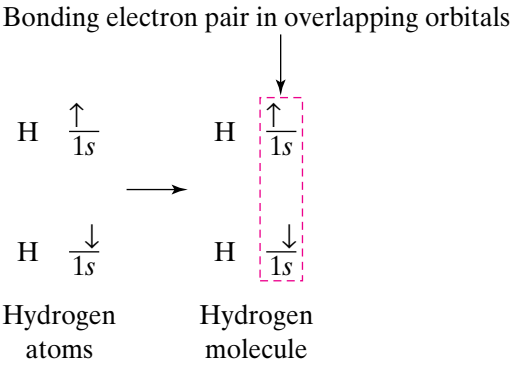

FIGURE 8 By sharing electrons in overlapping orbitals, each hydrogen atom in a hydrogen molecule experiences the effect of a stable $1s^2$ configuration.

The Octet Rule

Unlike other atoms, the noble-gas atoms exist independently in nature. They possess a minimum of energy existing on their own because of the special stability of their electron configurations. This stability results from the fact that, with the exception of helium and its two electrons in a completely filled outer shell, the noble-gas atoms' outer *s* and *p* orbitals are completely filled by a total of eight electrons. Other main-group atoms can effectively fill their outermost *s* and *p* orbitals with electrons by sharing electrons through covalent bonding. Such bond