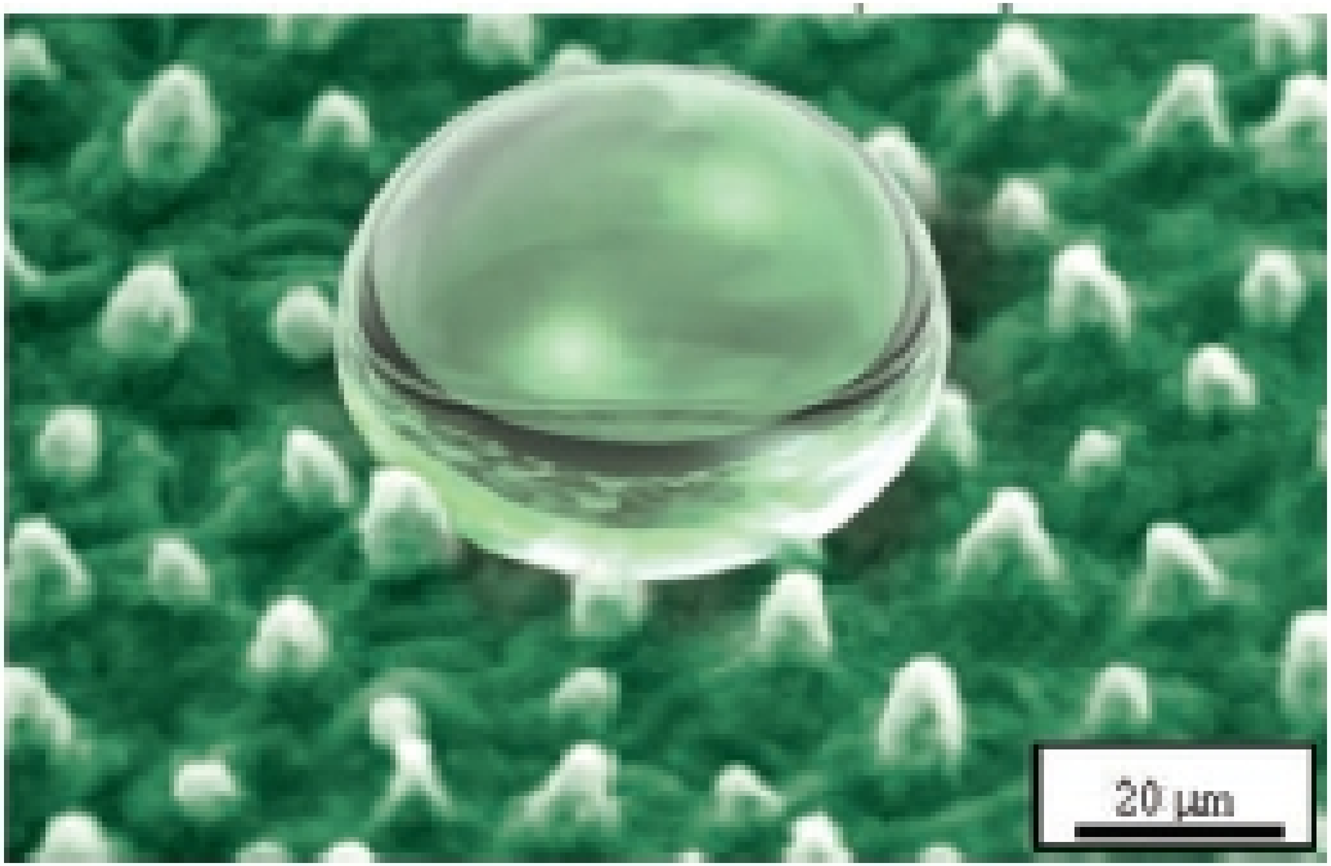
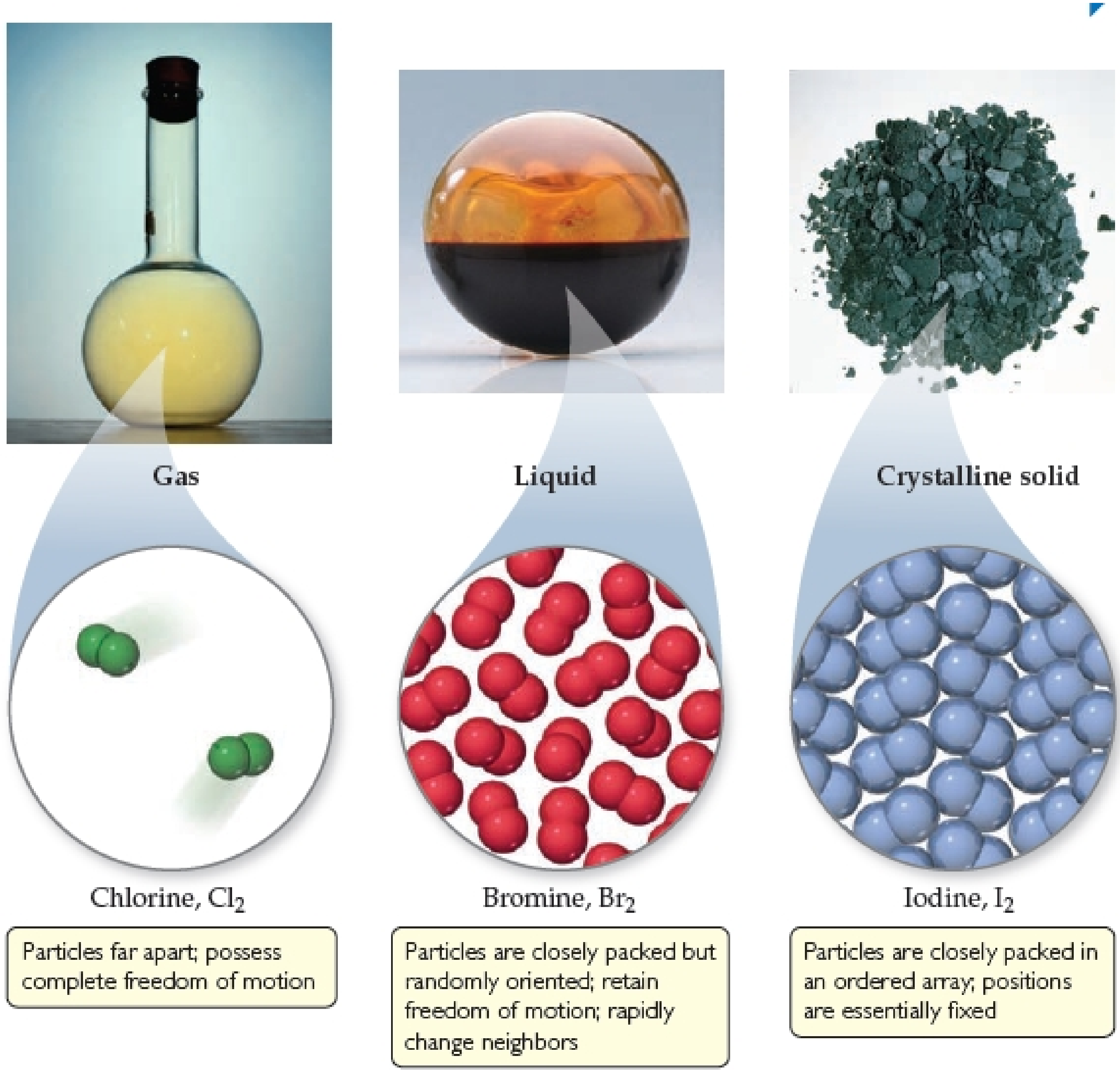
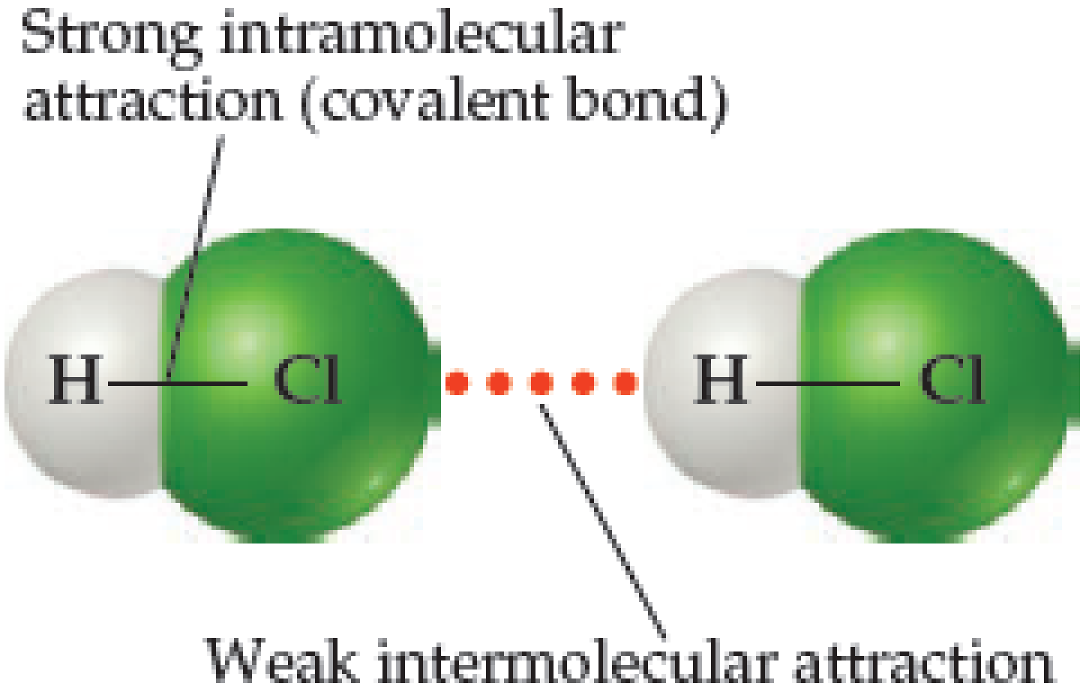
Interações Intermoleculares



▲ **Figure 11.1** A microscopic view of a water droplet on the surface of a lotus leaf.


Gas
Liquid
Crystalline solid
Chlorine, Cl_2
Bromine, Br_2
Iodine, I_2
Particles far apart; possess complete freedom of motion
Particles are closely packed but randomly oriented; retain freedom of motion; rapidly change neighbors
Particles are closely packed in an ordered array; positions are essentially fixed

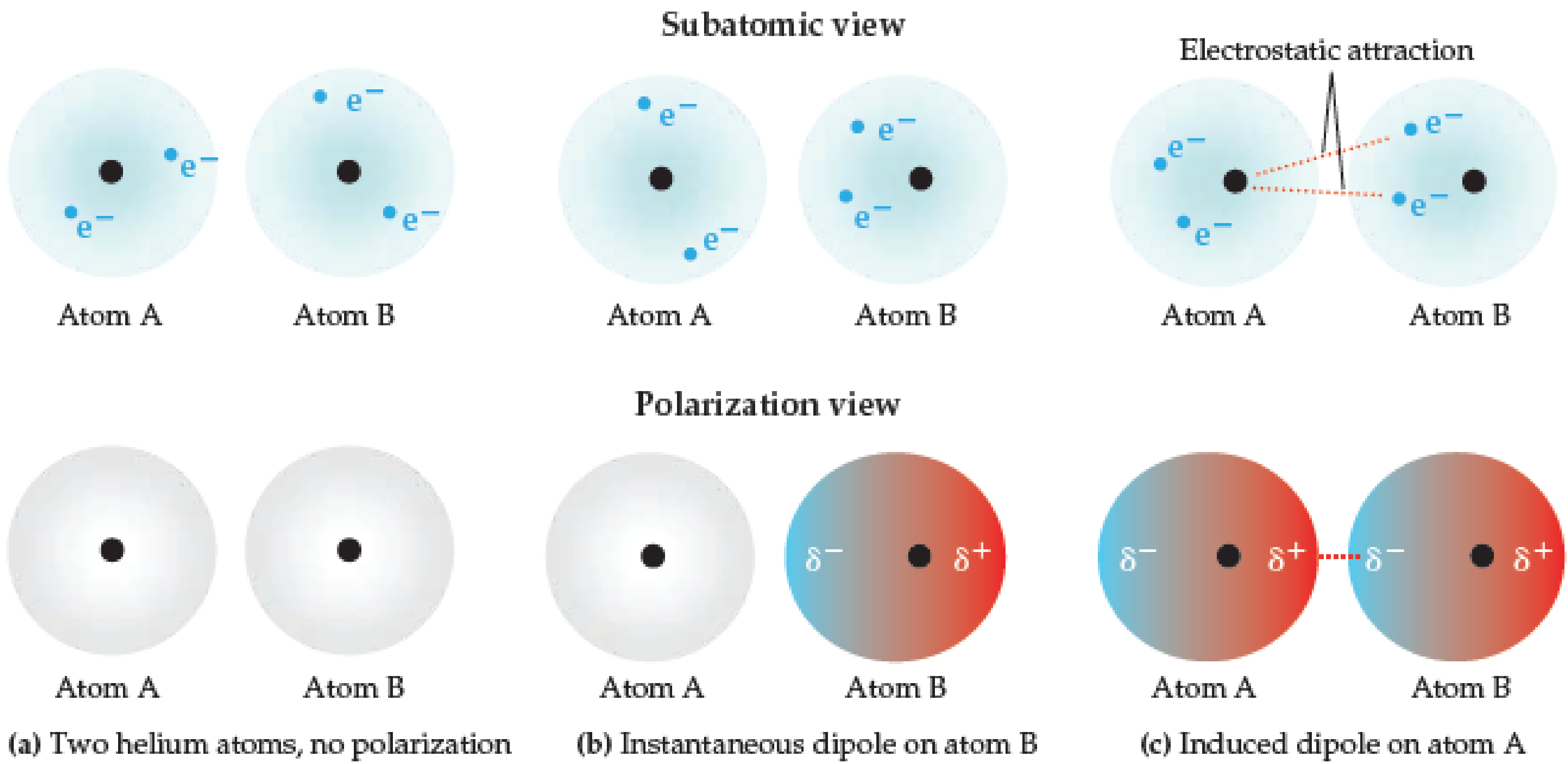


▲ **Figure 11.3** **Intermolecular and intramolecular interactions.**

Table 11.3 Melting and Boiling Points of Representative Substances

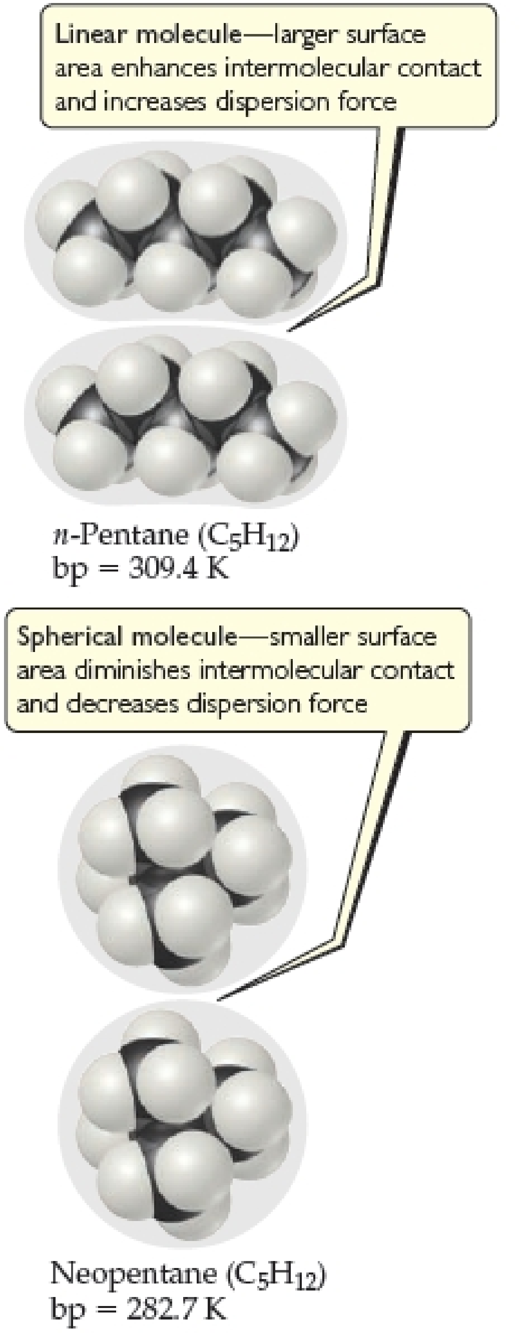
Force Holding Particles Together	Substance	Melting Point (K)	Boiling Point (K)
Chemical bonds			
Ionic bonds	Lithium fluoride (LiF)	1118	1949
Metallic bonds	Beryllium (Be)	1560	2742
Covalent bonds	Diamond (C)	3800	4300
Intermolecular forces			
Dispersion force	Nitrogen (N_2)	63	77
Dipole–dipole force	Hydrogen chloride (HCl)	158	188
Hydrogen-bonding force	Hydrogen fluoride (HF)	190	293

Forças de Dispersão
(Forças de London)

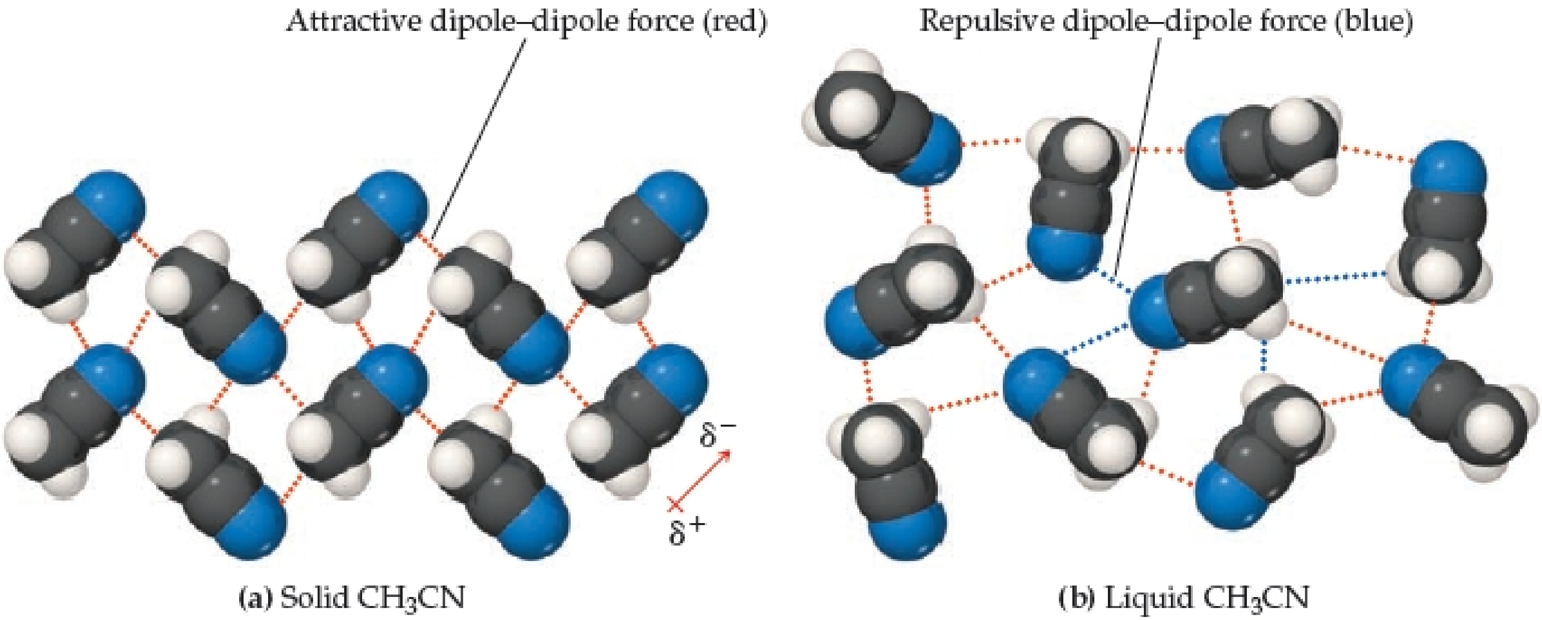


▲ **Figure 11.4** **Dispersion forces.** "Snapshots" of the charge distribution for a pair of helium atoms at three instants.

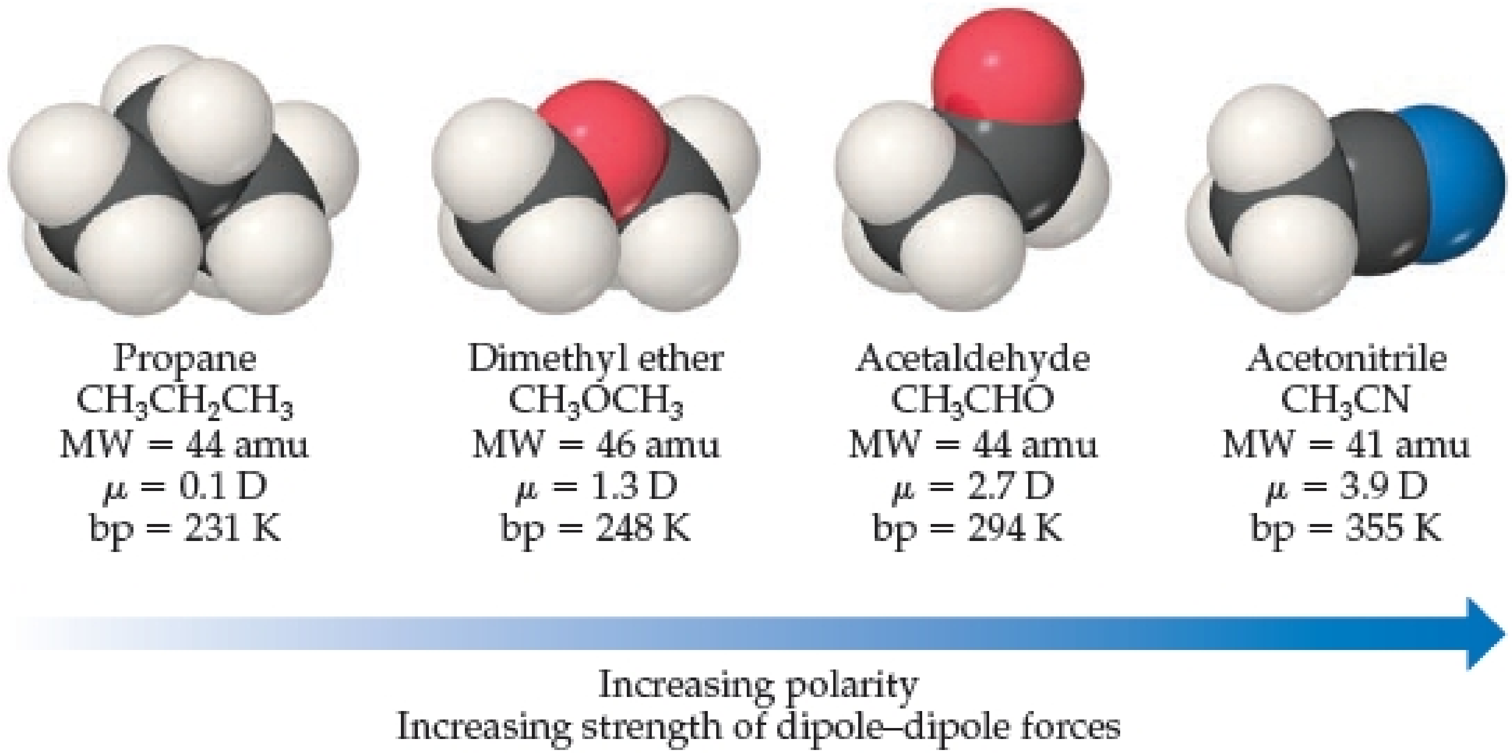
Efeito da Forma da Molécula



Interação Dipolo-Dipolo



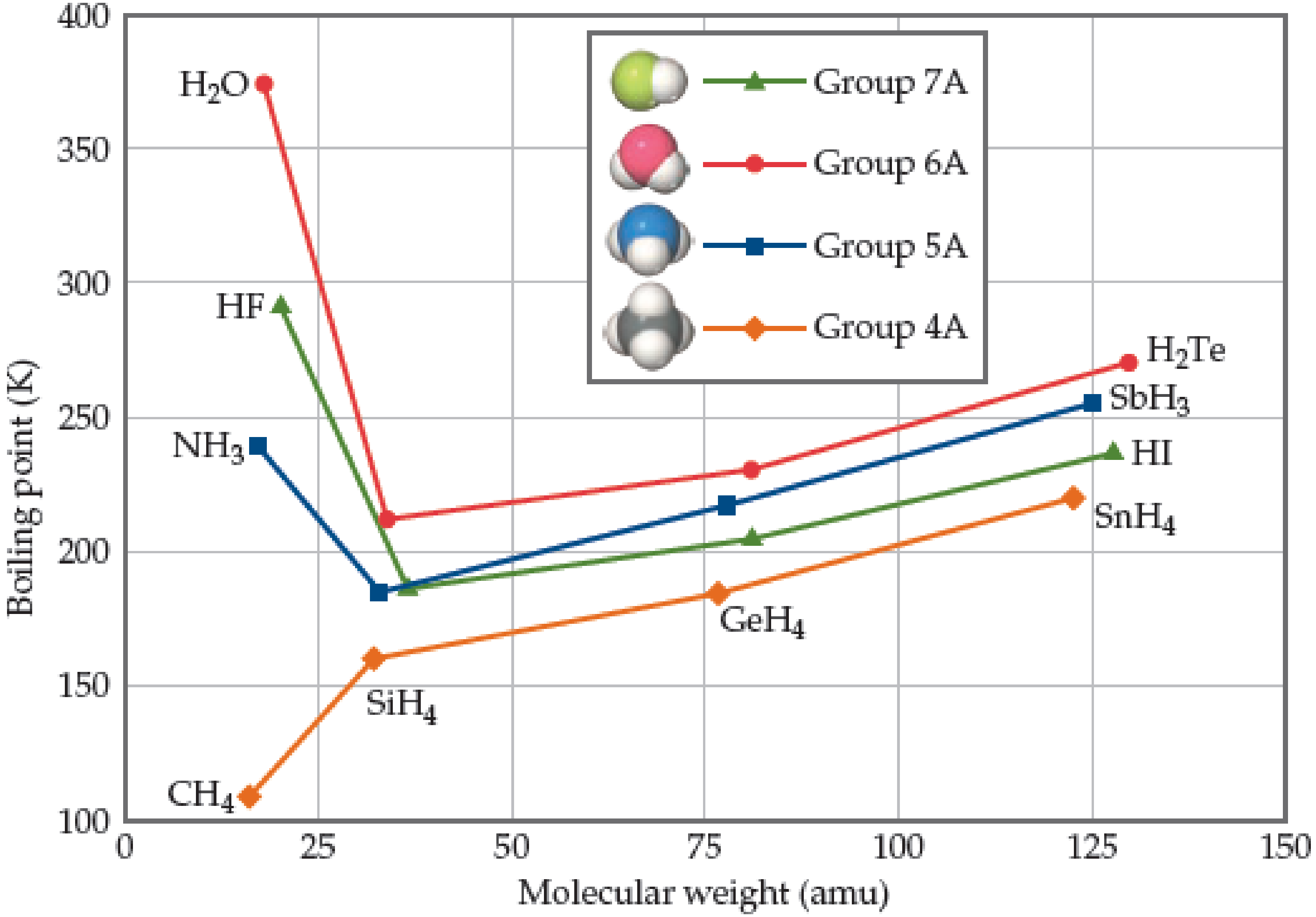
▲ **Figure 11.7 Dipole–dipole interactions.** The dipole–dipole interactions in (**a**) crystalline CH_3CN and (**b**) liquid CH_3CN.



▲ **Figure 11.8** **Molecular weights, dipole moments, and boiling points of several simple organic substances.**

Ligação de Hidrogênio

Why is the boiling point of SiH_4 higher than that of CH_4?



▲ **Figure 11.9** **Boiling points of the covalent hydrides of the elements in groups 4A–7A as a function of molecular weight.**

Onde as ligações de hidrogênio são mais importantes?

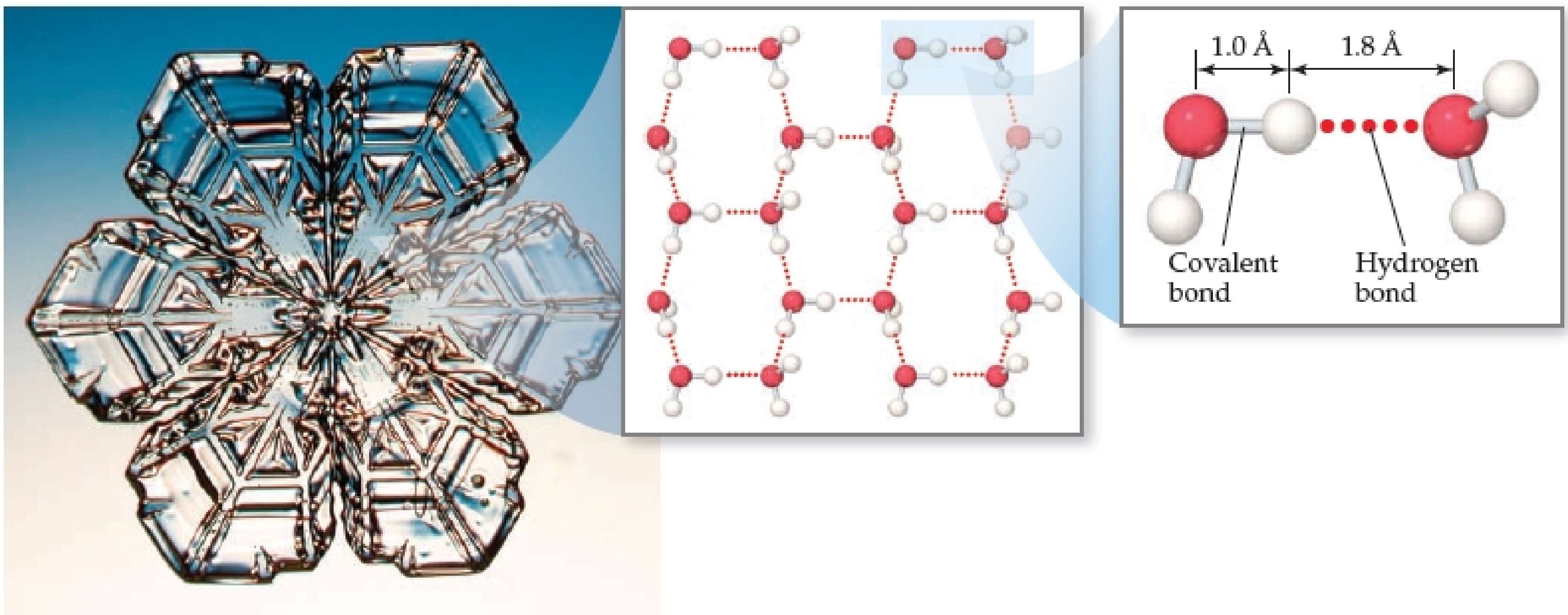
CH_4

H_2NNH_2

CH_3F

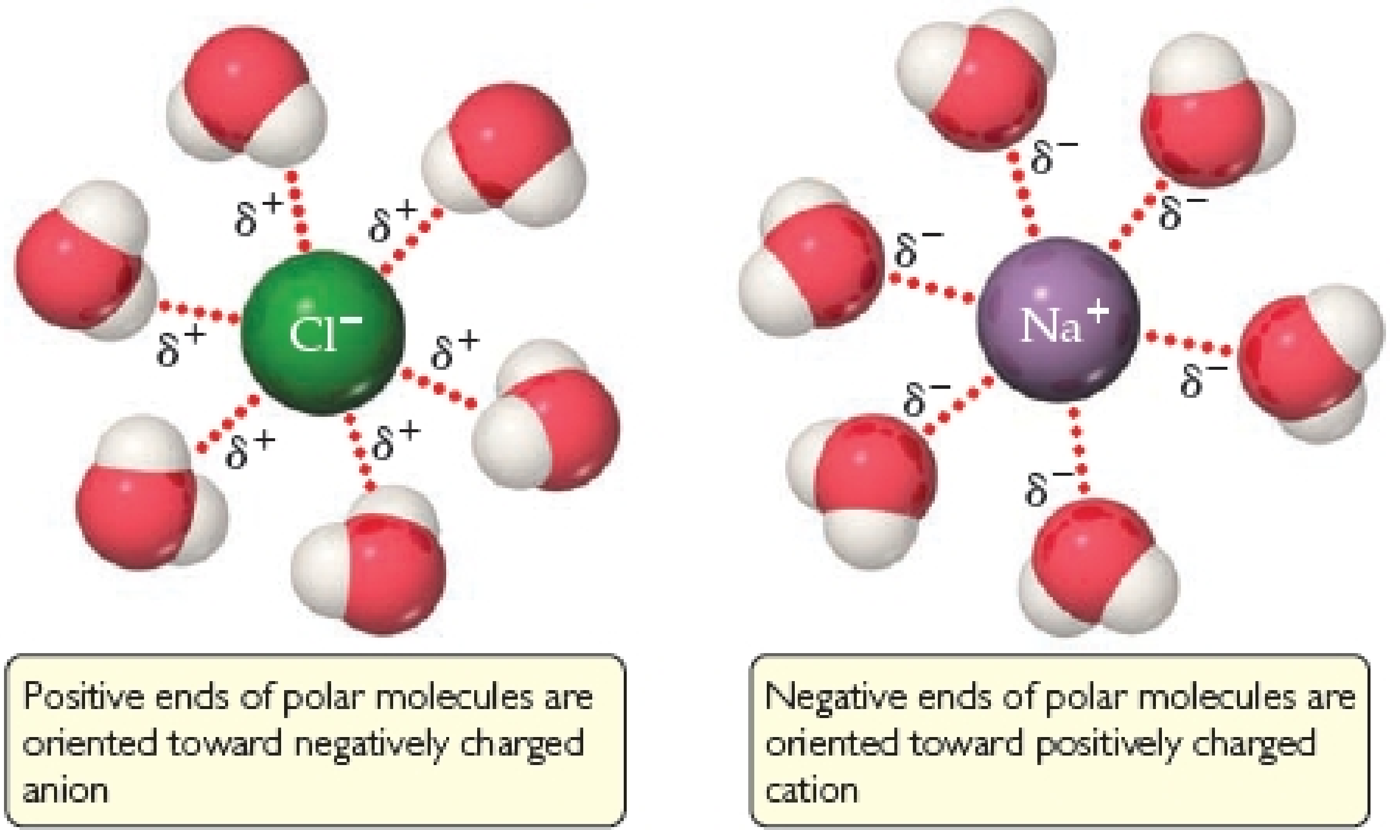
H_2S?

What is the approximate H—O · · · H bond angle in ice, where H—O is the covalent bond and O · · · H is the hydrogen bond?



▲ **Figure 11.11** **Hydrogen bonding in ice.** The empty channels in the structure of ice make water less dense as a solid than as a liquid.

Why does the O side of H_2O point toward the Na^+ ion?



▲ **Figure 11.13** **Ion–dipole forces.**

At which point in this flowchart would a distinction be made between SiH_4 and SiH_2Br_2?