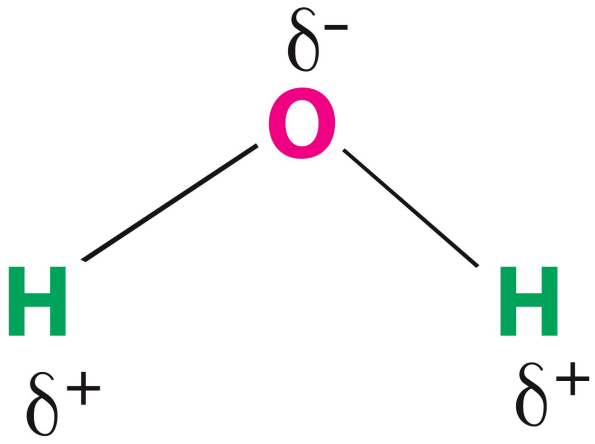

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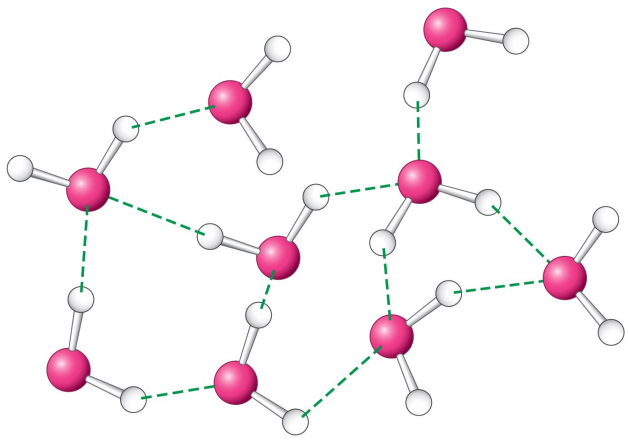

Figure 2.1
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Figure 2.2
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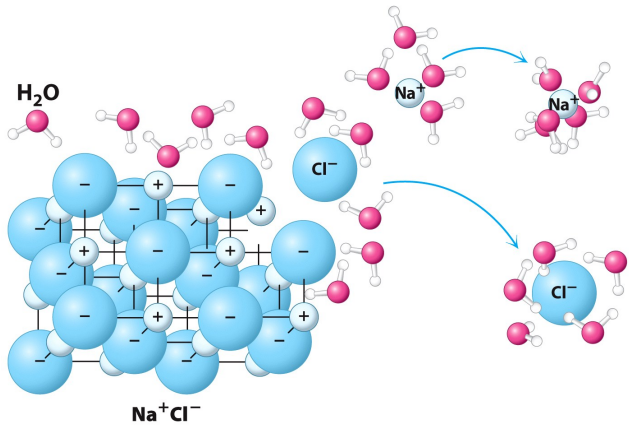

Figure 2.3
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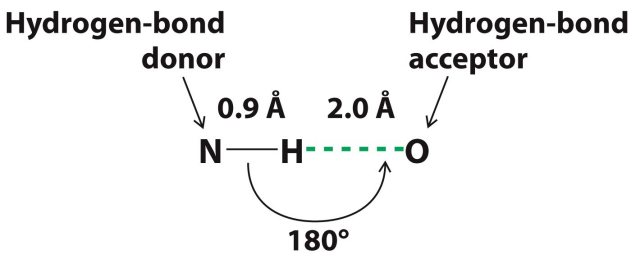

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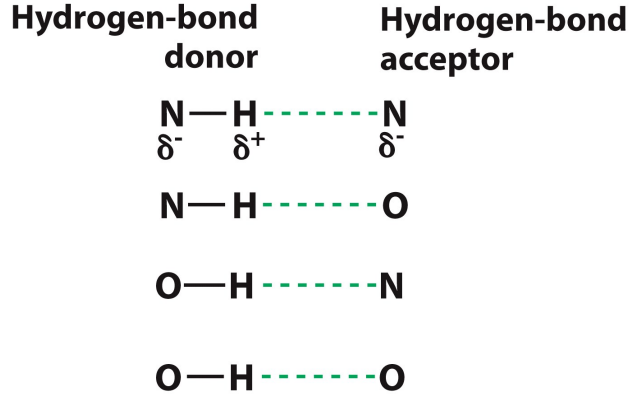

Figure 2.4
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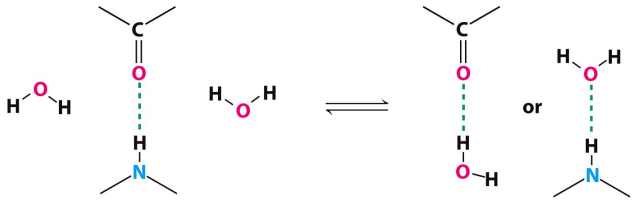

Figure 2.5
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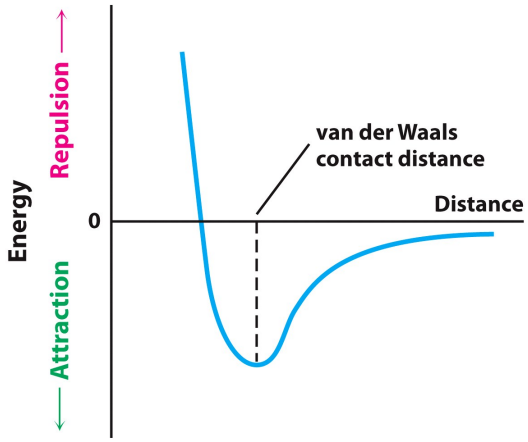

Figure 2.6
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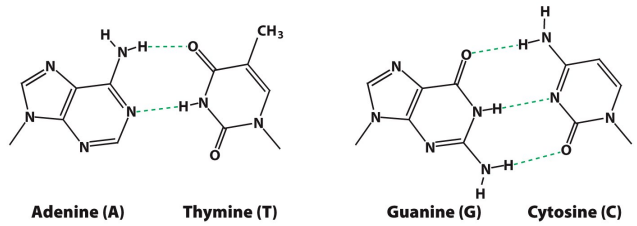

Figure 2.8
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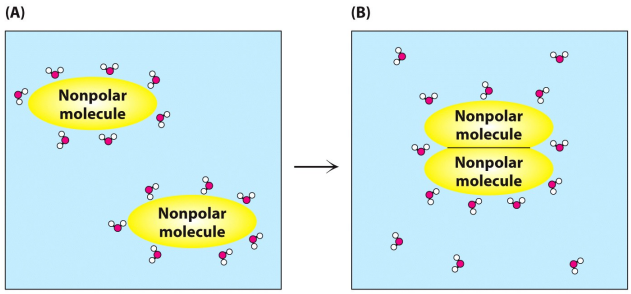

Figure 2.9
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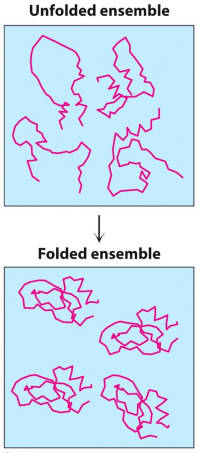

Figure 2.10
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Table 2.1 Some key functional groups in biochemistry

Functional group	Class of compounds	Structural formula	Example
Hydrophobic	Hydrocarbon chains (aliphatic)	R—CH_3	$H_2N-CH(CH_3)-C(=O)-OH$ Alanine
	Aromatic (hydrocarbons in a ring structure with multiple double bonds)	R—C_6H_5	$H_2N-CH(CH_2-C_6H_5)-C(=O)-OH$ Phenylalanine
Hydroxyl	Alcohol	R—OH	H_3C-CH_2-OH Ethanol
Aldehyde	Aldehydes	$R-C(=O)-H$	$H_3C-C(=O)-H$ Acetaldehyde
Keto	Ketones	$R-C(=O)-R$	$H_3C-C(=O)-CH_3$ Acetone

Note: There are many aliphatic (hydrocarbon chains) and aromatic groups. The methyl group and benzyl groups are shown as examples. Notice also that many of the examples have more than one functional group. The letter R stands for the remainder of the molecule. Finally, note that a *carbon atom double-bonded* to an *oxygen atom*, , called a carbonyl group, is present in aldehydes, ketones, and carboxylic acids, including amino acids. Carbonyl groups are common in biochemicals.

Table 2.1 part 1
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Table 2.1 Some key functional groups in biochemistry

Functional group	Class of compounds	Structural formula	Example
Carboxyl	Carboxylic acid		 Acetic acid
Amino	Amines		 Alanine
Phosphate	Organic phosphates		 3-Phosphoglyceric acid
Sulfhydryl	Thiols		 Cysteine

Note: There are many aliphatic (hydrocarbon chains) and aromatic groups. The methyl group and benzyl groups are shown as examples. Notice also that many of the examples have more than one functional group. The letter R stands for the remainder of the molecule. Finally, note that a *carbon atom double-bonded* to an *oxygen atom*, , called a carbonyl group, is present in aldehydes, ketones, and carboxylic acids, including amino acids. Carbonyl groups are common in biochemicals.

Table 2.1 part 2
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Monoprotic acids
Acetic acid
($K_a = 1.74 \times 10^{-5}$ M)

Ammonium ion
($K_a = 5.62 \times 10^{-10}$ M)

Diprotic acids
Carbonic acid
($K_a = 1.70 \times 10^{-4}$ M)
Bicarbonate
($K_a = 6.31 \times 10^{-11}$ M)

Glycine, carboxyl
($K_a = 4.57 \times 10^{-3}$ M)
Glycine, amino
($K_a = 2.51 \times 10^{-10}$ M)

Triprotic acids
Phosphoric acid
($K_a = 7.25 \times 10^{-3}$ M)
Dihydrogen phosphate
($K_a = 1.38 \times 10^{-7}$ M)
Monohydrogen phosphate
($K_a = 3.98 \times 10^{-13}$ M)

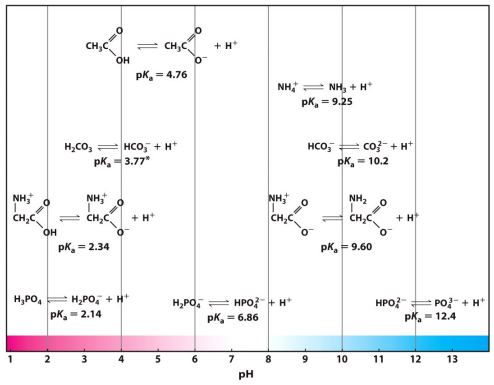

Figure 2.11
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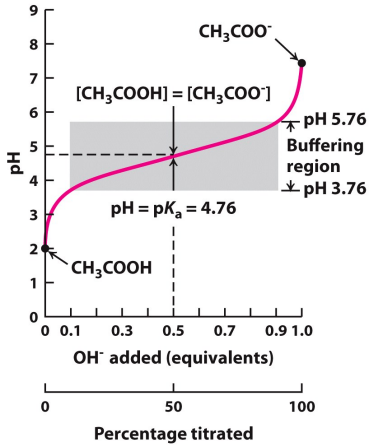

Figure 2.12
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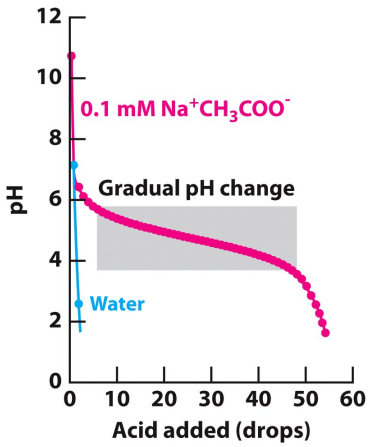

Figure 2.13
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