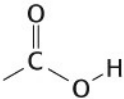

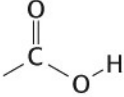

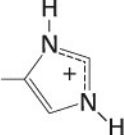
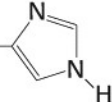
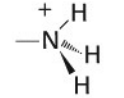

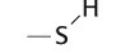

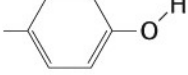
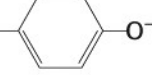
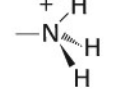

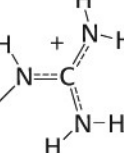
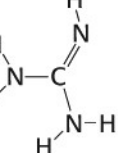


A K			VdW (Å ³)
alanin	Ala	A	67
arginin	Arg	R	148
asparagin	Asn	N	96
aspartat	Asp	D	91
cistein	Cys	C	86
glutamin	Gln	Q	114
glutamat	Glu	E	109
glicin	Gly	G	48
histidin	His	H	118
izolevcin	Ile	I	124
levcin	Leu	L	124
lizin	Lys	K	135
metionin	Met	M	124
fenilalanin	Phe	F	135
prolin	Pro	P	90
serin	Ser	S	73
treonin	Thr	T	93
triptofan	Trp	W	163
tirozin	Tyr	Y	141
valin	Val	V	105

Side Chain	Hydropathy
Ile	4.5
Val	4.2
Leu	3.8
Phe	2.8
Cys	2.5
Met	1.9
Ala	1.8
Gly	0.4
Thr	0.7
Ser	0.8
Trp	0.9
Tyr	1.3
Pro	1.6
His	3.2
Glu	3.5
Gln	3.5
Asp	3.5
Asn	3.5
Lys	3.9
Arg	4.5

Source: Kyte, J. and Doolittle, R.F., *J. Mol. Biol.* **157**, 110 (1982).

TABLE 3.1 Typical pK_a values of ionizable groups in proteins

Group	Acid	\rightleftharpoons	Base	Typical pK_a^*
Terminal α -carboxyl group		\rightleftharpoons		3.1
Aspartic acid Glutamic acid		\rightleftharpoons		4.1
Histidine		\rightleftharpoons		6.0
Terminal α -amino group		\rightleftharpoons		8.0
Cysteine		\rightleftharpoons		8.3
Tyrosine		\rightleftharpoons		10.9
Lysine		\rightleftharpoons		10.8
Arginine		\rightleftharpoons		12.5

* pK_a values depend on temperature, ionic strength, and the microenvironment of the ionizable group.