amino acids with nonpolar side chains

name abbreviation structure at physiological pH				
glycine	gly			
		H <sub>3</sub> N Co		
		Ö		
alanine	ala	\		
		H <sub>3</sub> N COO		
		H310		
		<u> </u>		
valine	val			
		H <sub>3</sub> N Co		
		H3 10.		
_	_	Ö		
leucine	leu			
		H3N COO		
isoleucine	ile			
		H3 N CO		
		Ö		
methionine	met	~ ~ ~ /		
		H3 N CTO		
		11 0		
phenylalanine	phe			
		H <sub>3</sub> N COO		
		H <sub>3</sub> N		
tryptophan	trp			
		NH		
		H <sub>3</sub> N COO		
proline	pro			
		CO®		
		H <sub>2</sub> II		
		712 0		

amino acids with polar side chains

	ahbro	amino acids with polar side o		<i>(</i> (1 11
name	abbre- viation	structure at physiological pH	alternative structure for side chain ("R" = main chain)	"ball- park" side chain <b>pK</b> a
serine	ser	H <sub>3</sub> N COO		
threonine	thr	H <sub>3</sub> N C 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
tyrosine	tyr	H <sub>3</sub> N Coo	R	≈11
cysteine	cys	H <sub>3</sub> N C <sub>10</sub>	50 R	≈8
asparagine	asn	H <sub>3</sub> N		
glutamine	gln	H <sub>3</sub> N Coo		

amino acids with positively charged side chains

name	abbre-					
name	viation	sa actare at physiological ph	for side chain	park" side		
			("R" = main chain)	chain <b>pK</b> a		
lysine	lys	H <sub>3</sub> N COO NH <sub>3</sub>	NH <sub>2</sub>	≈11		
arginine	arg	H <sub>3</sub> N NH <sub>2</sub>	H NH NHZ	12.5		
histidine	his	90% H <sub>3</sub> N		6		
		10% H <sub>3</sub> N				

amino acids with negatively charged side chains

name	abbre- viation	structure at physiological pH	alternative structure for side chain ("R" = main chain)	"ball- park" side chain <b>pK</b> a
aspartate also known as aspartic acid	asp	H <sub>3</sub> 2	OH	≈4
glutamate also known as glutamic acid	glu	H32	OH OH	≈4

"ballpark"  $pK_a$ 's for main chain carboxy and amino groups

In a free amino acid, the main chain carboxy group has a p $K_a \approx 2$  In a free amino acid, the main chain amino group has a p $K_a \approx 9$ 

In a peptide chain, the terminal main chain carboxy group has a p $K_a \approx 3$  In a peptide chain, the terminal main chain amino group has a p $K_a \approx 8$