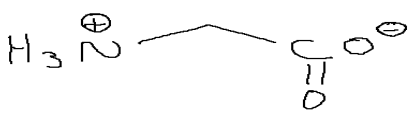
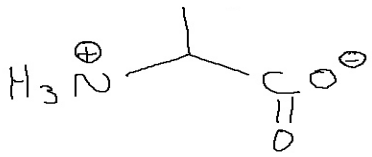
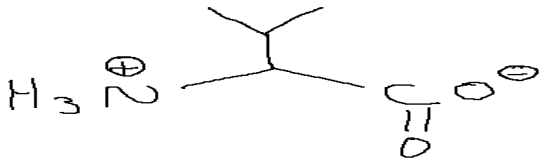
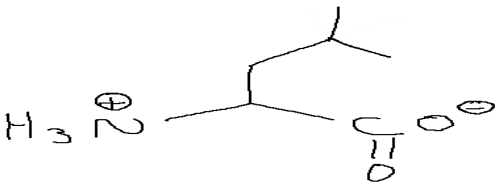
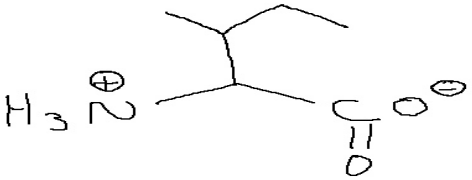
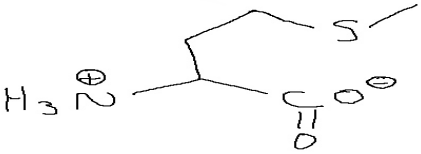
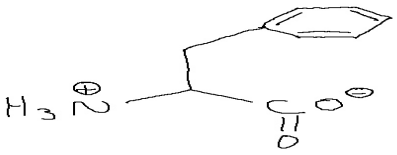
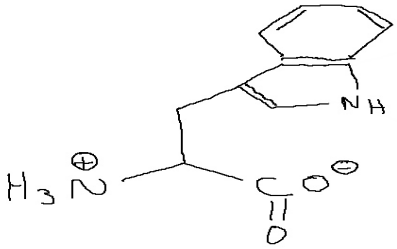
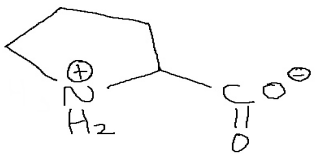
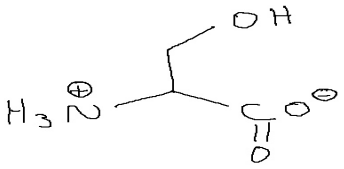
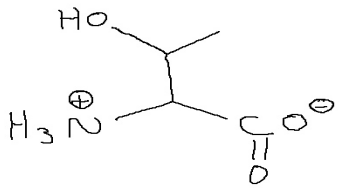
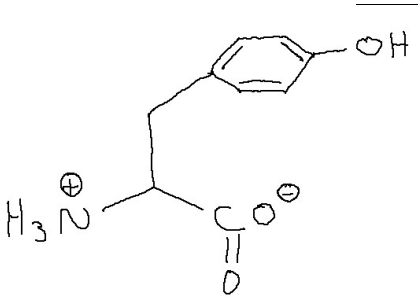
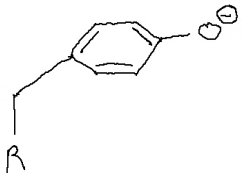
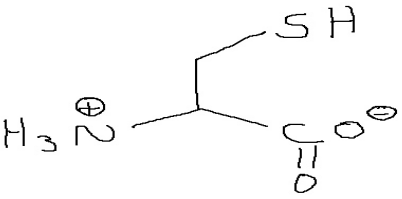
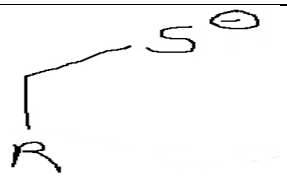
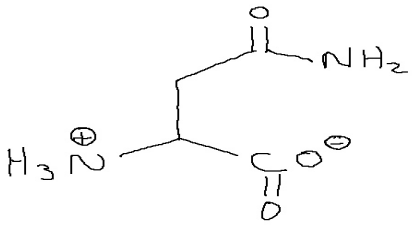
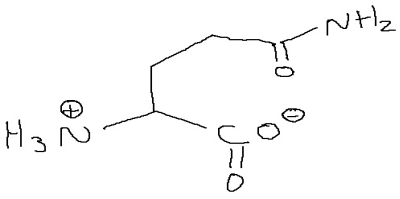
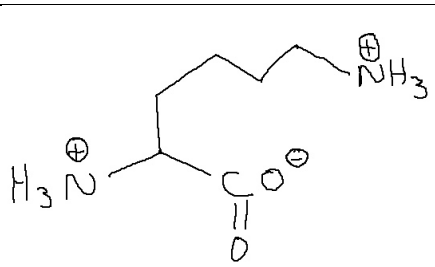
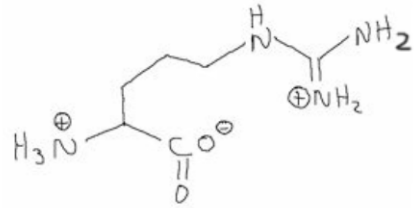
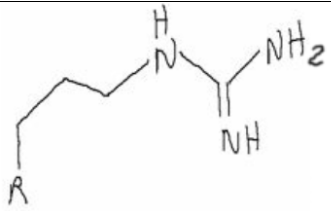
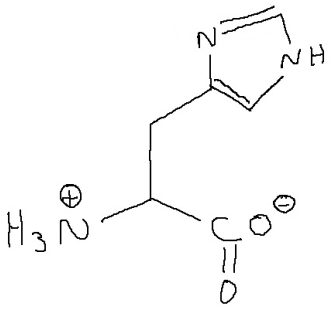
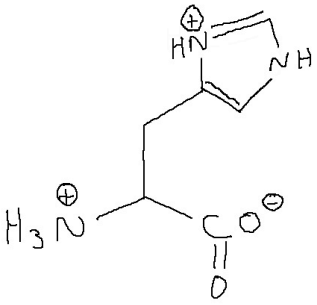
amino acids with nonpolar side chains

name	abbreviation	structure at physiological pH
glycine	gly	
alanine	ala	
valine	val	
leucine	leu	
isoleucine	ile	
methionine	met	
phenylalanine	phe	
tryptophan	trp	
proline	pro	

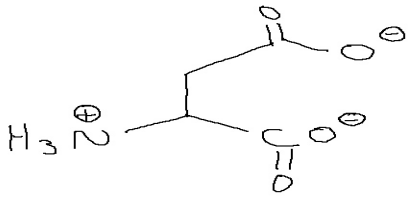
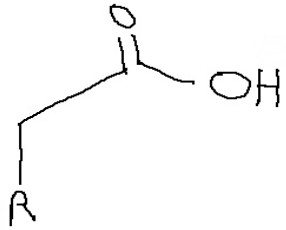
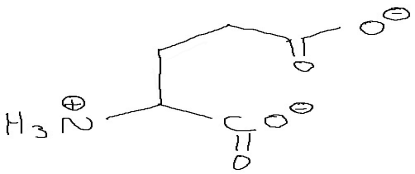
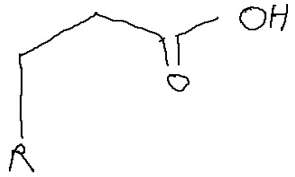
amino acids with polar side chains

name	**abbre-viation**	**structure at physiological pH**	**alternative structure for side chain ("R" = main chain)**	**"ball-park" side chain pK_a**
serine	ser			
threonine	thr			
tyrosine	tyr			≈11
cysteine	cys			≈8
asparagine	asn			
glutamine	gln			

amino acids with positively charged side chains

name	**abbre-viation**	**structure at physiological pH**	**alternative structure for side chain ("R" = main chain)**	**"ball-park" side chain pK_a**
lysine	lys			≈11
arginine	arg			12.5
histidine	his	90%  10% 		6

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 pK_a**
aspartate also known as aspartic acid	asp			≈4
glutamate also known as glutamic acid	glu			≈4

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

In a free amino acid, the main chain carboxy group has a $pK_a \approx 2$ In a free amino acid, the main chain amino group has a $pK_a \approx 9$
In a peptide chain, the terminal main chain carboxy group has a $pK_a \approx 3$ In a peptide chain, the terminal main chain amino group has a $pK_a \approx 8$