

Properties of amino acid residues

ONE-LETTER ABBREVIATION	MASS (daltons)	VOLUME (Å ³)	ACCESSIBLE SURFACE AREA (Å ²)	ΔG ^o _{acetyl} (kcal/mol)	PK _a OF IONIZING SIDE CHAIN	OCCURRENCE IN PROTEINS (%)	
Alanine	A	71.08	88.6	115	0.42		9.0
Arginine	R	156.20	173.4	225	-1.37	-12	4.7
Asparagine	N	114.11	117.7	160	-0.82		4.4
Aspartate	D	115.09	111.1	150	-1.05	4.5	5.5
Cysteine	C	103.14	108.5	135	2.09	9.1 to 9.5	2.8
Glutamine	Q	128.14	143.9	180	-0.30		3.9
Glutamate	E	129.12	138.4	190	-0.37	4.6	6.2
Glycine	G	57.06	60.1	75	0.0		7.5
Histidine	H	137.15	153.2	195	0.18	6.2	2.1
Isoleucine	I	113.17	166.7	175	2.45		4.6
Leucine	L	113.17	166.7	170	2.31		7.5
Lysine	K	128.18	168.6	200	-1.45	10.4	7.0
Methionine	M	131.21	162.9	185	1.67		1.7
Phenylalanine	F	147.18	189.9	210	2.43		3.5
Proline	P	97.12	122.7	145	0.98		4.6
Serine	S	87.08	89.0	115	-0.05		7.1
Threonine	T	101.11	116.1	140	0.35		6.0
Tryptophan	W	186.21	227.8	255	3.06		1.1
Tyrosine	Y	163.18	193.6	230	1.31	9.7	3.5
Valine	V	99.14	140.0	155	1.66		6.9

Adapted from Creighton, *Proteins*, (1984), & Karplus, *Protein Science*, (1997).

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Table 1. Amino Acids

Common Name ^a	Root ^b	Notes	Systematic Name
Arginine	L <i>argentum</i> , silver	forms a well-defined silver salt	(S)-2-amino-5-guanidinopentanoic acid
Asparagine	<i>asparagus</i>	first found in asparagus	(S)-2-amino-3-carbamoylpropanoic acid
Aspartic acid	—	related to asparagine	(S)-2-aminobutanedioic acid
Cysteine	—	reduction product of cystine (which see)	(R)-2-amino-3-mercaptopropanoic acid
Cystine	Gk <i>kystis</i> , bladder	first isolated from a bladder stone	bis(2-amino-2-carboxylethyl)disulfide
Glutamic acid	gluten + amino	obtained by the hydrolysis of gluten, a protein-rich product obtained in the separation of starch from corn or wheat	(S)-2-aminopentanedioic acid
Glutamine	—	derived from glutamic acid (which see)	(S)-2-amino-4-carbamoylbutanoic acid
Glycine	Gk <i>glykys</i> , sweet	tastes sweet	aminoethanoic acid
Histidine	Gk <i>histon</i> , tissue	—	(S)-2-amino-3-(5-imidazolyl)propanoic acid
Isoleucine	—	isomer of leucine (which see)	(2S, 3S)-2-amino-3-methylpentanoic acid
Leucine	Gk <i>leukos</i> , white	obtained in the form of white plates	(S)-2-amino-4-methylpentanoic acid
Lysine	Gk <i>lysis</i> , loosening	discovered among the products from the hydrolysis of casein	(S)-2,6-diaminohexanoic acid
Methionine	<i>methyl + thio</i>	contains a S atom (Gk <i>theion</i> , sulfur) with a methyl group attached	(S)-2-amino-4-methylthiobutanoic acid
Proline	<i>pyrrolidine</i>	contains a pyrrolidine ring	2-pyrrolidinecarboxylic acid
Serine	L <i>sericum</i> , silk	first isolated from silk	(S)-2-amino-3-hydroxypropanoic acid
Threonine	<i>threose</i>	spatial configuration analogous to that of D-threose, a 4-carbon sugar	(2S, 3R)-2-amino-3-hydroxybutanoic acid
Tryptophan	<i>tryptic + phane</i>	obtained from the pancreatic (tryptic) digestion of proteins: <i>tryptic</i> , the adjective form of <i>trypsin</i> , a pancreatic digestive enzyme; <i>phane</i> , from Gk <i>phanein</i> , to appear	(S)-2-amino-3-(3-indolyl)propanoic acid
Tyrosine	Gk <i>tyros</i> , cheese	found in cheese	(S)-2-amino-3-(4-hydroxyphenyl)propanoic acid 3,
Valine	<i>valeric</i>	carbon skeleton corresponds to isovaleric acid (3-methylbutanoic acid)	(S)-2-amino-3-methylbutanoic acid

^aThese biologically important α -amino acids are almost always called by their common names. The suffix *-ine* is a common ending for α -amino acids. ^bL indicates Latin; Gk indicates Greek.