PROPERTIES OF AMINO ACIDS

This table gives selected properties of some important amino acids and closely related compounds. The first part of the table lists the 20 "standard" amino acids that are the basic constituents of proteins. The second part includes other amino acids and related compounds of biochemical importance. Within each part of the table the compounds are listed by name in alphabetical order. Structures are given in the following table.

Symbol : Three-letter symbol for the standard amino acids
M_r: Molecular weight
t_m: Melting point
pK_a , pK_b , pK_c , pK_d : Negative of the logarithm of the acid dissociation constants for the COOH and NH_2 groups (and, in some cases, other groups) in the molecule (at 25°C)
pI: pH at the isoelectric point
S: Solubility in water in units of grams of compound per kilogram of water; a temperature of 25°C is understood unless otherwise stated in a superscript. When quantitative data are not available, the notations sl.s. (for slightly soluble), s. (for soluble), and v.s. (for very soluble) are used.
V_2^0: Partial molar volume in aqueous solution at infinite dilution (at 25°C)

Data on the enthalpy of formation of many of these compounds are included in the table "Standard Thermodynamic Properties of Chemical Substances" in Section 5 of this Handbook. Absorption spectra and optical rotation data can be found in Reference 3. Partial molar volume is taken from Reference 5; other thermodynamic properties, including solubility as a function of temperature, are given in References 3 and 5. Most of the p*K* values come from References 1, 6, and 7.

References

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Symbol	Name	Mol. form	M_r	t_m/°C	pK_a	pK_b	pK_c	pK_d	pI	S/g kg^{-1}	V_2^0/cm^3 mol^{-1}
Ala	*L*-Alanine	$C_3H_7NO_2$	89.09	297	2.33	9.71			6.00	166.9	60.54
Arg	*L*-Arginine	$C_6H_{14}N_4O_2$	174.20	244	2.03	9.00	12.10		10.76	182.6	127.42
Asn	*L*-Asparagine	$C_4H_8N_2O_3$	132.12	235	2.16	8.73			5.41	25.1	78.0
Asp	*L*-Aspartic acid	$C_4H_7NO_4$	133.10	270	1.95	9.66	3.71		2.77	5.04	74.8
Cys	*L*-Cysteine	$C_3H_7NO_2S$	121.16	240	1.91	10.28	8.14		5.07	v.s.	73.45
Gln	*L*-Glutamine	$C_5H_{10}N_2O_3$	146.14	185	2.18	9.00			5.65	42.5	
Glu	*L*-Glutamic acid	$C_5H_9NO_4$	147.13	160	2.16	9.58	4.15		3.22	8.6	89.85
Gly	Glycine	$C_2H_5NO_2$	75.07	290	2.34	9.58			5.97	250.2	43.26
His	*L*-Histidine	$C_6H_9N_3O_2$	155.15	287	1.70	9.09	6.04		7.59	43.5	98.3
Ile	*L*-Isoleucine	$C_6H_{13}NO_2$	131.17	284	2.26	9.60			6.02	34.2	105.80
Leu	*L*-Leucine	$C_6H_{13}NO_2$	131.17	293	2.32	9.58			5.98	22.0	107.77
Lys	*L*-Lysine	$C_6H_{14}N_2O_2$	146.19	224	2.15	9.16	10.67		9.74	5.8	108.5
Met	*L*-Methionine	$C_5H_{11}NO_2S$	149.21	281	2.16	9.08			5.74	56	105.57
Phe	*L*-Phenylalanine	$C_9H_{11}NO_2$	165.19	283	2.18	9.09			5.48	27.9	121.5
Pro	*L*-Proline	$C_5H_9NO_2$	115.13	221	1.95	10.47			6.30	1622	82.76
Ser	*L*-Serine	$C_3H_7NO_3$	105.09	228	2.13	9.05			5.68	250	60.62
Thr	*L*-Threonine	$C_4H_9NO_3$	119.12	256	2.20	8.96			5.60	98.1	76.90
Trp	*L*-Tryptophan	$C_{11}H_{12}N_2O_2$	204.23	289	2.38	9.34			5.89	13.2	143.8
Tyr	*L*-Tyrosine	$C_9H_{11}NO_3$	181.19	343	2.24	9.04	10.10		5.66	0.46	
Val	*L*-Valine	$C_5H_{11}NO_2$	117.15	315	2.27	9.52			5.96	88	90.75

Name	Mol. form	M_r	t_m/°C	pK_a	pK_b	pK_c	pK_d	pI	S/g kg^{-1}	V_2^0/cm^3 mol^{-1}
N-Acetylglutamic acid	$C_7H_{11}NO_5$	189.17	199						s.	
*N*6-Acetyl-*L*-lysine	$C_8H_{16}N_2O_3$	188.22	265	2.12	9.51					
β-Alanine	$C_3H_7NO_2$	89.09	200	3.51	10.08				723.6	58.28
2-Aminoadipic acid	$C_6H_{11}NO_4$	161.16	207	2.14	4.21	9.77		3.18	2.2[40]	
DL-2-Aminobutanoic acid	$C_4H_9NO_2$	103.12	304	2.30	9.63			6.06	210	75.6
DL-3-Aminobutanoic acid	$C_4H_9NO_2$	103.12	194.3	3.43	10.05			7.30	1250	76.3
4-Aminobutanoic acid	$C_4H_9NO_2$	103.12	203	4.02	10.35				971	73.2
10-Aminodecanoic acid	$C_{10}H_{21}NO_2$	187.28	188.5							167.3

Name	Mol. form	M_r	t_m/°C	pK_a	pK_b	pK_c	pK_d	pI	S/g kg^{-1}	V_2^0/cm^3 mol^{-1}
7-Aminoheptanoic acid	$C_7H_{15}NO_2$	145.20	195						v.s.	120.0
6-Aminohexanoic acid	$C_6H_{13}NO_2$	131.17	205					7.29	863	104.2
L-3-Amino-2-methylpropanoic acid	$C_4H_9NO_2$	103.12	185						s.	
2-Amino-2-methylpropanoic acid	$C_4H_9NO_2$	103.12	335	2.36	10.21			5.72	137	77.55
9-Aminononanoic acid	$C_9H_{19}NO_2$	173.26	191							151.3
8-Aminooctanoic acid	$C_8H_{17}NO_2$	159.23	192							136.1
5-Amino-4-oxopentanoic acid	$C_5H_9NO_3$	131.13	118	4.05	8.90					
5-Aminopentanoic acid	$C_5H_{11}NO_2$	117.15	157 dec						s.	87.6
o-Anthranilic acid	$C_7H_7NO_2$	137.14	146	2.05	4.95				3.5[14]	
Azaserine	$C_5H_7N_3O_4$	173.13	150		8.55				v.s.	
Canavanine	$C_5H_{12}N_4O_3$	176.17	172	2.50	6.60	9.25		7.93	v.s.	
L-γ-Carboxyglutamic acid	$C_6H_9NO_6$	191.14	167	1.70	9.90	4.75	3.20			
Carnosine	$C_9H_{14}N_4O_3$	226.23	260	2.51	9.35	6.76			322	
Citrulline	$C_6H_{13}N_3O_3$	175.19	222	2.32	9.30			5.92	s.	
Creatine	$C_4H_9N_3O_2$	131.13	303	2.63	14.30				16	
L-Cysteic acid	$C_3H_7NO_5S$	169.16	260	1.89	8.70	1.30			v.s.	
L-Cystine	$C_6H_{12}N_2O_4S_2$	240.30	260	1.50	8.80	2.05	8.03		0.11	
2,4-Diaminobutanoic acid	$C_4H_{10}N_2O_2$	118.13	118.1	1.85	8.24	10.44		9.27	s.	
3,5-Dibromo-*L*-tyrosine	$C_9H_9Br_2NO_3$	338.98	245						2.72	
3,5-Dichloro-*L*-tyrosine	$C_9H_9Cl_2NO_3$	250.08	247						1.97	
3,5-Diiodo-*L*-tyrosine	$C_9H_9I_2NO_3$	432.98	213	2.12	9.10	6.16			0.62	
Dopamine	$C_8H_{11}NO_2$	153.18			10.36	8.88			s.	
L-Ethionine	$C_6H_{13}NO_2S$	163.24	273	2.18	9.05	13.10				
N-Glycylglycine	$C_4H_8N_2O_3$	132.12	263	3.13	8.10				225	
Guanidinoacetic acid	$C_3H_7N_3O_2$	117.11	282	2.82					5	
Histamine	$C_5H_9N_3$	111.15	83		9.83	6.11			v.s.	
L-Homocysteine	$C_4H_9NO_2S$	135.19	232	2.15	8.57	10.38		5.55	s.	
Homocystine	$C_8H_{16}N_2O_4S_2$	268.35	264	1.59	9.44	2.54	8.52		0.2	
L-Homoserine	$C_4H_9NO_3$	119.12	203	2.27	9.28			6.17	1100	
3-Hydroxy-*DL*-glutamic acid	$C_5H_9NO_5$	163.13	209					3.28		
5-Hydroxylysine	$C_6H_{14}N_2O_3$	162.19		2.13	8.85	9.83		9.15		
trans-4-Hydroxy-*L*-proline	$C_5H_9NO_3$	131.13	274	1.82	9.47			5.74	361	84.49
L-3-Iodotyrosine	$C_9H_{10}INO_3$	307.08	205	2.20	9.10	8.70			sl.s.	
L-Kynurenine	$C_{10}H_{12}N_2O_3$	208.21	194						sl.s.	
L-Lanthionine	$C_6H_{12}N_2O_4S$	208.24	294						1.5	
Levodopa	$C_9H_{11}NO_4$	197.19	277	2.32	8.72	9.96	11.79		5[20]	
L-1-Methylhistidine	$C_7H_{11}N_3O_2$	169.18	249	1.69	8.85	6.48			200	
L-Norleucine	$C_6H_{13}NO_2$	131.17	301	2.31	9.68			6.09	15	107.7
L-Norvaline	$C_5H_{11}NO_2$	117.15	307	2.31	9.65				107	91.8
L-Ornithine	$C_5H_{12}N_2O_2$	132.16	140	1.94	8.78	10.52		9.73	v.s.	
O-Phosphoserine	$C_3H_8NO_6P$	185.07	166	2.14	9.80	5.70				
L-Pyroglutamic acid	$C_5H_7NO_3$	129.12	162	3.32						
Sarcosine	$C_3H_7NO_2$	89.09	212	2.18	9.97				428	
Taurine	$C_2H_7NO_3S$	125.15	328	-0.3	9.06				105	
L-Thyroxine	$C_{15}H_{11}I_4NO_4$	776.87	235	2.20	10.01	6.45			sl.s.	