CRITICAL STABILITY CONSTANTS

Volume 5: First Supplement

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PREFACE

Over the past twenty years the Commission on Equilibrium Data of the Analytical Division of the International Union of Pure and Applied Chemistry has been sponsoring a noncritical compilation of metal complex formation constants and related equilibrium constants. This work was extensive in scope and resulted in publication of two large volumes of *Stability Constants* by the Chemical Society (London). The first volume, edited by L. G. Sillen (for inorganic ligands) and by A. E. Martell (for organic ligands), was published in 1964 and covered the literature through 1962. The second volume, subtitled Supplement No. 1, edited by L. G. Sillen and E. Hogfeldt (for inorganic ligands), and A. E. Martell and R. M. Smith (for organic ligands), was published in 1971 and covered the literature up to 1969. These two large compilations attempted to cover all papers in the field related to metal complex equilibria (heats, entropies, and free energies). Most recently a noncritical compilation of organic ligands by D. D. Perrin (Pergamon Press) extended coverage of the literature through 1973. A similar volume for inorganic ligands by E. Hogfeldt should be in print soon. Since it was the policy of the Commission during that period to avoid decisions concerning the quality and reliability of the published work, the compilation would frequently contain from ten to twenty values for a single equilibrium constant. In many cases the values would differ by one or even two orders of magnitude, thus frustrating readers who wanted to use the data without doing the extensive literature study necessary to determine the correct value of the constant in question.

Because of difficulties of this nature, and because of the general lack of usefulness of a noncritical compilation for teaching purposes and for scientists who are not sufficiently expert in the field of equilibrium to carry out their own evaluation, we have decided to concentrate our efforts in this area toward the development of a critical and unique compilation of metal complex equilibrium constants. Although it would seem that decisions between available sets of data must sometimes be arbitrary and therefore possibly unfair, we have found the application of reasonable guidelines leads directly to the elimination of a considerable fraction of the published data of doubtful value. Additional criteria and procedures that were worked out to handle the remaining literature are described in the *Introduction* of this book. Many of these methods are quite similar to those used in other compilations of critical data.

In cases where a considerable amout of material has accumulated, it is felt that most of our critical constants will stand the test of time. Many of the data listed, however, are based on only one or a very few literature references and are subject to change when better data come along. It should be fully understood that this compilation is a continually changing and growing body of data, and will be revised from time to time as new results of these systems appear in the literature. The present volume represents the first supplement to the previous four volumes, and covers the literature that has appeared through 1979.

The scope of these tables includes the heats. entropies, and free energies of all metal ion complexation reactions involving organic and inorganic ligands. Volume 1 (1974), 2 (1975), 3 (1977), and 4 (1976) covered the range of different types of ligands of binary complexation reactions in aqueous solutions through 1973, mid-1974, 1975 and 1974 respectively. The present volume updates the coverage of the four volumes through 1979. The critical surveys of EDTA by G. Anderegg (77Aa), of 1,10-phenanthroline, 2,2'-bipyridyl, and related compounds by W. A. E. McBryde (78M), of fluoride complexes by A. M. Bond and G. T. Hefter (80BH), and the noncritical survey of organic ligands from 1969 through 1973 by D. D. Perrin (79P) were of significant aid in making the coverage more complete.

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INTRODUCTION

Purpose

This compilation of metal complex equilibrium (formation) constants and the corresponding enthalpy and entropy changes represent the authors' selection of the most reliable values among those available in the literature. In many cases wide variations in published constants for the same metal complex equilibrium indicate the presence of one or more errors in ligand purity, in the experimental measurements, or in calculations. Usually, the nature of these errors is not readily apparent in the publication, and the reader is frequently faced with uncertainties concerning the correct values. In the course of developing noncritical compilations of stability constants, the authors have long felt that these wide variations in published work constitute a serious impediment to the use of equilibrium data. Thus these critical tables were developed in order to satisfy what is believed to be an important need in the field of coordination chemistry

Scope

These tables include all organic and inorganic ligands for which reliable values have been reported in the literature. The present volume supplements the first four volumes to make the coverage more current.

New ligands and revisions of previous critical values are included. When new values require revision or additional values at other ionic strengths become available, the entire new set of values is repeated for that metal ion with that ligand, and supercedes the previous set. These new sets now become the recommended critical values. When a new set of metal constants is included, the proton ligand constants are also included, even if they have not been revised. Reference to the ligand page in the previous volume is given just below the ligand name.

Selection Criteria

When several workers are in close agreement on a particular value, the average of their results has been selected for that value. Values showing considerable scatter have been eliminated. In cases where the agreement is poor and few results are available for comparison, more subtle methods were needed to select the best value. This selection was often guided by a comparison with values obtained for other metal ions with the same ligand and with values obtained for the same metal ion with similar ligands.

While established trends among similar metal ions and among similar ligands were valuable in deciding between widely varying values, such guidelines were used cautiously, so as not to overlook occasionally unexpected real examples of specificity of anomalous behavior.

When there was poor agreement between published values and comparison with other metal ions and ligands did not suggest the best value, the results of more experienced research groups who had supplied reliable values for other ligands were selected. When such assurances were lacking, it was sometimes possible to give preference to values reported by an investigator who had published other demonstrably reliable values obtained by the same experimental method.

In some cases the constants reported by several workers for a given group of metal ions would have similar relative values, but would differ considerably in the absolute magnitudes of the constants. Then a set of values from one worker near the median of all values reported were selected as the best constants

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By this method it is believed that internal consistency was preserved to a greater extent than would be obtained by averaging reported values for each individual metal ion. When an important constant was missing from the selected set of values, but was available in another set of values not selected for this compilation, the missing constant was obtained by adjusting the nonselected values by a common factor, which was set so as to give the best agreement between the two groups of data.

Values reported by only one investigator are included in these tables unless there was some reason to doubt their validity. It is recognized that some of these values may be in error, and that such errors will probably not be detected until the work is repeated by other investigators, or until more data become available for analogous ligands or other closely related metal ions. Some values involving unusual metal ions have been omitted because of serious questions about the form of their complexes.

Papers deficient in specifying essential reaction conditions (e.g., temperature, ionic strength, nature of supporting electrolyte) were not employed in this compilation. Also used as a basis for disqualification of published data is lack of information on the purity of the ligand. Frequent deficiencies are lack of calibration of potentiometric apparatus, and failure to define the equilibrium quotients reported in the paper. Papers in which both temperature and ionic strength are not controlled have been omitted from the bibliography.

A bibliography for each ligand is included so that the reader may determine the completeness of the literature search employed in the determination of critical values. The reader may also employ these references to make his own evaluation if he has any questions or reservations concerning this compilation.

Arrangement

The arrangement of the tables is based on the placement of similar ligands together. Ligands containing carboxylic acid functional groups are placed together except for aminocarboxylic acids and for phenolic carboxylic acids, which are listed with the phenols. Within each group of tables, ligands with a smaller number of coordinating groups are placed before those with a larger number of coordinating groups. Next there is a table of protonation constants for ligands for which no stability constants or only questionable metal stability constants are reported. Finally, there is a list of other ligands considered but not included in the tables for various reasons. Macrocyclic polyamines have been grouped together in a seperate heading because of a surge of interest in these ligands.

Metal Ions

The metal ions within each table are arranged in the following order: hydrogen, alkali metals, alkaline earth metals, lanthanides (including Sc and Y), actinides, transition metals, and posttransition metals. Within each group the arrangement is by increasing oxidation state of the metal, and within each oxidation state the arrangement follows the periodic table from top to bottom and from left to right. An exception is that Cu^+, Ag^+, Pd^{2+}, and Pt^{2+} are included with the posttransition metals.

Equilibrium

An abbreviation equilibrium quotient expression in the order products/reactants is included for each constant, and periods are used to separate distinct entities. Charges have been omitted as these can be determined from the charge of the metal ion and the abbreviated ligands formulas (such as HL) given after the name. Water has not been included in the equilibrium expressions since all of the values cited are for aqueous solutions. For example, $ML_2/M \cdot L^2$ for Cu^{2+} and acetic acid would represent the equilibrium: $Cu^{2+} + 2CH_3CO_2^- = (CH_3CO_2)_2Cu$. The symbol M represents the metal ion given in the first column and may include more than one atom as in the case of Hg_2^{2+}. The symbol H_{-1} (H_{-2}, etc.) is used for the ionization from the ligand of a proton that would not be ionized in the absence of the metal ion.

Equilibria involving protons are written as stability constants (protonation constants) rather than as ionization constants to be consistent with the metal complex formation constants. Consequently the ΔH and ΔS values have signs opposite to those describing ionization constants.

Solids and gases are identified by (s) and (g) respectively and are included for identification purposes even though they are not involved in the equilibrium quotient.

Log *K* Values

The log *K* values are the logarithms of the equilibrium quotients given in the second column at the specified conditions of temperature and ionic strength. The selected values are those considered to be the most reliable of the ones available. In some cases the value is the median of several values and in other cases it is the average of two or more values. The range of other values considered reliable is indicated by + or − quantities describing the algebraic difference between the other values and the selected values. The symbol ±0.00 indicates that there are one or more values which agree exactly with the stated value to the number of significant figures given. Values considered to be of questionable validity are enclosed in parentheses. Such values are included when the evidence available is not strong enough to exclude them on the basis of the above criteria. Values concerning which there is considerable doubt have been omitted.

The log *K* values are given for the more commonly reported ionic strengths. The ionic strengths most used are 0.1, 0.5, 1.0, 2.0, 3.0, and 0. Zero ionic strength is perhaps more important from a theoretical point of view, but several assumptions are involved in extrapolating or calculating from the measured values. The Davies equation is often used to calculate constants to zero from low-ionic-strength measurements. It was established from results obtained with monovalent and divalent ions and its extension to trivalent ions is extremely questionable. Values listed at 0.1 ionic strength may also include ionic strengths from 0.05 to 0.2, especially when results of several workers are averaged. Footnotes give conditions for values measured under conditions differing from those listed at the top of the table. Letters for footnotes, in the majority of cases, are uniform throughout the volume and refer to the same conditions.

The temperature of 25 °C was given preference in the tables because of its widespread use in equilibrium measurements and reporting other physical properties. When available, enthalphy changes (ΔH) were used to calculate log *K* at 25 °C when only measurements at other temperatures were available.

Other temperatures frequently employed are 20 °C, 30 °C, and 37 °C. These are not included in the tables when there is a lack of column space and ΔH is available, since they may be calculated using the ΔH value. Values at other temperatures, especially those at 20 °C and 30 °C, were converted to 25 °C to facilitate quantitative comparisons with the 25 °C values listed.

Equilibria involving protons have been expressed as concentration constants in order to be more consistent with the metal ion stability constants which involve only concentration terms. Concentration constants may be determined by calibrating the electrodes with solutions of known hydrogen ion concentrations or by conversion of pH values using the appropriate hydrogen ion activity coefficient. When standard buffers are used, mixed constants (also known as Bronsted or practical constants) are obtained which include both activity and concentration terms. Literature values expressed as mixed constants have been converted to concentration constants by using the hydrogen ion activity coefficents determined in KCl solution before inclusion in the tables. In some cases, papers were omitted because no indication was given as to the use of concentration or mixed constants. Some papers were retained despite this lack of information when it could be ascertained which constant was used by comparing to known values or by personal communication with the authors. For those desiring to convert the listed protonation constants to mixed constants, the following values should be added to the listed values at the appropriate ionic strength (the tabulation applies only to single proton association constants):

Ionic strength	Increase in log *K*
0.05	0.09
0.10	0.11
0.15	0.12
0.2	0.13
0.5	0.15
1.0	0.14
2.0	0.11
3.0	0.07

The values in the tables have not been corrected for complexation with medium ions for the most part. There are insufficient data to make corrections for most of the ligands, and in order to make values between ligands more comparable, the correction has not been made in the few cases where it could be made. In general the listed formation constants at constant ionic strength include competition by ions from KNO_3 and $NaC10_4$ and are somewhat smaller than they would be if measured in solutions of tetraalkylammonium salts.

Protonation constants with a log value higher than possible for the reported ionic strength in basic solutions, or lower than possible in acidic solutions, have been placed in parentheses or discarded because of their possibly incorrect ionic strength, or considerably reduced accuracy if based on extrapolation of measurements at other acidities or alkalinities. Variation of activity coefficients for hydroxide ion and hydrogen ion at high concentrations reduces the accuracy of the calculated ionic strength. Values measured at relatively high ionic strength and then corrected or extrapolated to zero ionic strength have been retained.

Equilibria involving B(III), As(III), Ge(IV), and Te(VI) complexes with polyhydroxy ligands have been written showing the loss of a proton on complex formation. Thus the equilibrium quotient $M(OH)_2(H_{-2}L)\cdot H/M(OH)_3\cdot L$ is employed for the reaction of B(III) with glycerol as a representation for the reaction. These equilibria are often reported in the literature with the ionization constant of the metal species $(H_2MO_3\cdot H/M(OH)_3)$ divided into this quotient, thus eliminating the proton from the complex formation reaction $(M(OH)_2(H_{-2}L)/H_2MO_3\cdot L)$.

Enthalpy Values

The enthalpy of complexation values (ΔH) listed in the tables have the units kcal/mole because of the widespread use of these units by workers in the field. These may be converted to SI units of kj/mole by multiplying the listed values by 4.184.

Calorimetrically determined values and temperature-variation determined values from cells without liquid junction were considered of equal validity for the tables. Other temperature-variation determined values were rounded off to the nearest kcal/mole and were enclosed in parentheses because of their reduced accuracy. Other values considered to be reliable but differing from the listed value were indicated by + or − quantities describing the algebraic difference between the other values and the selected values.

The magnitude of ΔH may vary with temperature and ionic strength, but usually this is less than the variation between different workers and little attempt has been made to show ΔH variation with changing conditions except for certain carefully measured equilibria such as the protonation of hydroxide ion and of ammonia. These ΔH values may be used for estimating log K values at temperatures other than those listed, using the relationship

$$\frac{\Delta H}{2.303RT^2} = \frac{d \log K}{dT}$$

or, at 25 °C

$$\log K_2 = \log K_1 + \Delta H(T_2 - T_1)(0.00246).$$

This assumes that $\Delta C_p = 0$, which is not necessarily the case. The greater the temperature range employed, the greater the uncertainty of the calculated values.

Entropy Values

The entropy of complexation values (ΔS) listed in the tables have the units cal/mole/degree and have been calculated from the listed log K and ΔH values, using the expression

$$G = \Delta H - T\Delta S$$

or, at 25 °C

$$\Delta S = 3.36(1.363 \log K + \Delta H).$$

These entropy values have been rounded off to the nearest cal/mole/degree, except in cases where ΔH values were quite accurate.

Bibliography

The references considered in preparing each table are given at the end of the table. The more reliable references are listed after the ions for which values are reported. In some tables groups of similar metal ions have been grouped together for the bibliography. The term "Other references" is used for those reporting questionable values, or values at conditions considerably different from those used in the tables, or values for metal ions not included in the tables because of questionable knowledge about the forms of their complexes. These additional references are cited to inform the reader of the extent of the literature search made in arriving at the selected values. Some values in this volume are repeated from a previous volume but the references are not repeated unless there was an error in the previous volume. Therefore those desiring a complete set of references must also consult the Bibliography of the previous volume.

The bibliographical symbols used represent the year of the reference and the first letter of the surnames of the first two listed authors. In cases of duplication, letters a, b, c, etc., or the first letter of the third author's name are employed. The complete reference is given in the bibliography at the end of each volume.

Miscellaneous Comments

The formulation of polynuclear complexes is often made on the basis of improving the fit to the experimental data and not on experimental evidence for their existence. They should therefore be used with caution since other sets of complexes might equally fit the data.

A knowledge of the optical activity of potentially optically active ligands in binuclear complexes is necessary for the characterization of the complexes. When the optical activity is not stated or a DL-mixture is used, there is considerable doubt as to the precise nature of the complex and the values are placed in parentheses.

Hydrolysis constants are usually expressed as proton ionizations in the tables except when the author gives them as hydroxide stability constants and fails to give the value of the constant for the ionization of water employed in the calculations.

In a work of this magnitude, there will certainly be errors and a few pertinent publications will have been overlooked by the compilers. We should like to request those who believe they have detected errors in the selection process, know of publications that were omitted, or have any suggestions for improvement of the tables, write to:

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It is the intention of the authors to publish more complete and accurate revisions of these tables as demanded by the continually growing body of equilibrium data in the literature.

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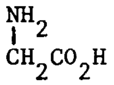

$$\overset{NH_2}{\overset{|}{CH_2CO_2H}}$$

$C_2H_5O_2N$

Aminoacetic acid (glycine)

(Other values on Vol.1, p.1)

HL

Metal ion	Equilibrium	Log K 25°, 0.1	Log K 25°, 1.0	Log K 25°, 0	ΔH 25°, 0	ΔS 25°, 0
H^+	HL/H.L	9.56 ±0.02 9.55^b ±0.02	9.63 ±0.06 9.22^n ±0.05	9.778 ±0.00 10.14^e ±0.07	-10.6 ±0.0 -12.2^e	9
	H_2L/HL.H	2.36 ±0.04 2.36^b ±0.04	2.37 ±0.06 2.30^n ±0.04	2.350 ±0.00 2.74^e ±0.06	-1.0 ±0.1 -2.2^e	7
Mg^{2+}	ML/M.L	1.34^b			(1)^r	(10)^{b*}
Sr^{2+}	ML/M.L	0.6		0.91		
Mn^{2+}	ML/M.L	2.80 ±0.05 2.60^b ±0.05	2.71^n	3.19 ±0.02	-0.3 ±0.0	14
	$ML_2/M.L^2$	4.5 ±0.2	4.76^n			
	$ML_3/M.L^3$	5.3 ^{b} ±0.4	5.5 ^{n}			
	MHL/ML.H		7.3^n			
Co^{2+}	ML/M.L	4.67 ±0.04 4.55^b ±0.04		5.07 -0.05	-2.8^a ±0.7	12^a
	$ML_2/M.L^2$	8.46 ±0.04 8.22^b ±0.06		9.04 ±0.05	-6.4^a +1	17^a
	$ML_3/M.L^3$	10.8 ±0.1 10.7 ^{b} ±0.1		11.6	-9.8	20
Ni^{2+}	ML/M.L	5.78 ±0.05 5.68^b ±0.05	5.70 -0.01	6.18 -0.05	-4.5^a ±0.5	11^a
	$ML_2/M.L^2$	10.58 ±0.07 10.48^b ±0.03	10.52 ±0.03	11.13 ±0.01	-9.1^a ±0.4	18^a
	$ML_3/M.L^3$	14.0 ±0.2 14.0 ^{b} ±0.0	14.0 ±0.1	(14.2)	-14.7^a ±0.2	15^a
Cu^{2+}	ML/M.L	8.13 ±0.07 8.14^b ±0.02	8.00^n ±0.02	8.56 ±0.06	-6.3^a ±0.5	16^a
	$ML_2/M.L^2$	15.0 ±0.1 15.0^b ±0.1	14.69^n ±0.04	15.64 ±0.05	-13.1^a ±0.5	25^a
	MHL/ML.H	2.92	2.9^n ±0.3			
CH_3Hg^+	ML/M.L	7.88^u	7.52			
	$ML_2/M.L^2$		9.5			
Zn^{2+}	ML/M.L	4.96 ±0.03	4.90^n ±0.02	5.38 +0.1	-2.7^a ±0.7	14^a
	$ML_2/M.L^2$	9.19 ±0.08	8.98^n ±0.03	9.81 +0.2	-5.8^a ±0.6	23^a
	$ML_3/M.L^3$	11.6 ±0.1	11.29^n ±0.02	12.3	-9.4	24
	MHL/ML.H		4.6 ^{n} ±0.0			
	ML/MOHL.H		8.8 ^{n} ±0.1			
Cd^{2+}	ML/M.L	4.24 ±0.03 4.18^b	4.14	4.69 +0.1	-2.1	14
	$ML_2/M.L^2$	7.71 ±0.02 7.50^b	7.60	8.40 +0.4	-5.4	20
	$ML_3/M.L^3$	9.76^b	9.74	10.7	-8.6	20

---

[a] 25°, 0.1; [b] 25°, 0.5; [e] 25°, 3.0; [n] 37°, 0.15; [r] 0-30°, 0.09; [u] 25°, 0.25; *assuming ΔH for 0.09=ΔH for 0.5

Glycine (continued)

Metal ion	Equilibrium	Log K 25°, 0.1	Log K 25°, 1.0	Log K 25°, 0	ΔH 25°, 0	ΔS 25°, 0
Pb^{2+}	ML/M.L	4.36^{b}	4.78	5.28^{e}	(-3)^{s}	(14)^{e}
	ML_2/M.L^2	7.7 7.62^{b}	7.66	8.32^{e}		
	MHL/ML.H		5.97	6.13^{e}	(-3)^{s}	(18)^{e}
	ML/MOHL.H			(7.64)^{e}	(-7)^{s}	(11)^{e}
	$M(HL)_2$/ML(HL).H		6.5			
	ML(HL)/ML_2.H		7.0			
Ga^{3+}	ML/M.L	9.33^{t}		9.60^{e}		
	MHL/ML.H			2.63^{e}		

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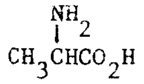
^{b}25°, 0.5; ^{e}25°, 3.0; ^{s}10-40°, 3.0; ^{t}22°, 0.1

Bibliography:

H^+	69CP,73GS,74CPS,74CNF,75BHP,75CM,75DOd,75FL,75HV,75IP,76GMa,78JIa,78L,78RM,78VV,79EB,79EM,79HJ,79MTN,79SP,79VK
Mg^{2+}	69HL
Sr^{2+}	52SL
Mn^{2+}	69CP,69HL,74MMN
Co^{2+}	69HL,75IP
Ni^{2+}	74MMN,75IP,75SGP,76DOC,79EB,79SG
Cu^{2+}	61DR,69CP,69PP,69YH,70GS,73GS,73HR,75FL,75IP,75NW,75SS,76PSa,77DOa,78FM,78RM,79MB,79SP
CH_3Hg^+	74RO,78JIa
Pd^{2+}	76AM
Zn^{2+}	69CP,74MMN,75CM,75DOd,79SP
Cd^{2+}	69HL,75IP,77SFb
Pb^{2+}	69HL,76CWa,78BS,79MTN
Ga^{3+}	75BHP

Other references: 67K,68CWI,68GS,68KR,68RK,70CB,70CBa,70FM,70FMb,70GS,71KS,72UT,73BF,73DR,73FA,73H,73RD,73RK,73SKa,73TG,74DB,74FA,74FAa,74FAb,74FLa,74KH,74KNP,74KU,74SK,74SS,74Wa,75CB,75JB,76BBC,76HS,76KFA,76KVP,76NF,76TG,77KDK,77KKc,77MSc,77PU,77RS,78AE,78SKG,79BBG,79BK,79FS,79JK,79KC,79KKK,79KM,79NL,79RRS



$CH_3CH(NH_2)CO_2H$

$C_3H_7O_2N$ **L-2-Aminopropanoic acid (alanine)** HL

(Other values on Vol.1, p.4)

Metal ion	Equilibrium	Log K 25°, 0.1	Log K 25°, 1.0	Log K 25°, 0	ΔH 25°, 0	ΔS 25°, 0
H^+	HL/H.L	9.70 ±0.02	9.72 ±0.05	9.867	-10.8 ±0.2	9
		9.65^{b} ±0.05	9.38^{n}	10.25^{e} ±0.05	-11.8^{c}	
	$H_2L/HL.H$	2.31 ±0.04	2.30 +0.01	2.348	-0.7 ±0.1	8
		2.31^{b} ±0.02		2.75^{e} ±0.04		
Mn^{2+}	ML/M.L	2.50 ±0.05	2.39^{n}	3.02		
	$ML_2/M.L^2$		4.29^{n}			
	$ML_3/M.L^3$		5.7^{n}			
Ni^{2+}	ML/M.L	5.40 ±0.08	5.40 -0.01	5.83 ±0.1	-5.6^{a} ±0.4	13^{a}
		5.31^{b} ±0.1			-4.0^{c}	
	$ML_2/M.L^2$	9.9^{y} ±0.1	9.91 +0.01	10.5 ±0.1	-7.8^{a} ±0.9	19^{a}
		9.73^{b} ±0.2			-8.9^{c}	
	$ML_3/M.L^3$	12.9 -0.1	13.0 +0.1		-13.5^{c}	14^{c}
Cu^{2+}	ML/M.L	8.15 ±0.07		8.55 ±0.04	-5.2^{a} ±0.4	20^{a}
		8.14^{b} ±0.07	8.02^{n}			
	$ML_2/M.L^2$	14.9^{y} ±0.1		15.5 ±0.1	-11.9^{a} ±0.4	28^{a}
		14.9^{b} ±0.1	14.6^{n}			
	MHL/ML.H		2.6^{n}			
Ag^+	ML/M.L			3.64		
	$ML_2/M.L^2$	$(7.02)^{w}$		$(7.18)^{w}$		
CH_3Hg^+	ML/M.L		7.52			
	$ML_2/M.L^2$		$(9.5)^{w}$			
Zn^{2+}	ML/M.L	4.56 ±0.06	4.55	4.95 +0.2	-1.5^{a}	16^{a}
		4.56^{b} ±0.01	4.57^{n}			
	$ML_2/M.L^2$	8.55^{y} ±0.05	8.54	9.23 +0.2	-4.3^{a}	25^{a}
		8.54^{b} ±0.02	8.56^{n}			
	$ML_3/M.L^3$	10.6^{b} ±0.0	10.6^{n}			
	ML/MOHL.H	8.2	8.5^{n}			
Pb^{2+}	ML/M.L	4.15^{i}		5.17^{e}		
	$ML_2/M.L^2$			$(8.13)^{e,x}$		
	MHL/ML.H			6.41^{e}		

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[a] 25°, 0.1; [b] 25°, 0.5; [c] 25°, 1.0; [e] 25°, 3.0; [i] 20°, 0.4; [n] 37°, 0.15; [w] optical isomerism not stated; [x] DL-mixture; [y] L-,D-, and DL-isomers had same value.

Bibliography:

H^+	69CP,71KS,73GS,75HV,78RM,78JIa,78L,79EB, 79EM,79MTN
Mn^{2+}	69CP,70GP
Ni^{2+}	75SGP,77GK,79EB,79GKD
Cu^{2+}	69CP,70GM,70GP,73GS,74GNK,78RM
Ag^+	79MST
CH_3Hg^+	78JIa
Zn^{2+}	69CP,79GKD
Pb^{2+}	79MTN

Other references: 68GS,70CB.70CBa,70FM, 70FMb,73BS,73FA,73RK,73SKa,73VB,74FA, 74FAa,74FAb,74FLa,74KH,74KU,74SK,74SS, 75FN,75JB,76BBC,76KFA,76KVP,76NF,77KDK, 77KKc,77RRa,78AE,78CK,78KZa,78MST, 79RRS

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