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**THERMODYNAMIC FUNCTIONS OF  
TRANSFER OF SINGLE IONS FROM  
WATER TO NONAQUEOUS AND  
MIXED SOLVENTS: PART 1 — GIBBS  
FREE ENERGIES OF TRANSFER TO  
NONAQUEOUS SOLVENTS**

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THERMODYNAMIC FUNCTIONS OF TRANSFER OF SINGLE IONS FROM WATER  
TO NONAQUEOUS AND MIXED SOLVENTS: PART 1— GIBBS FREE ENERGIES  
OF TRANSFER TO NONAQUEOUS SOLVENTS

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1. INTRODUCTION

The transfer of ions from one solvent to another, or to its mixture with another, is of interest to chemists dealing with such diverse problems as phase transfer catalysis in organic synthesis, solvent extraction in hydrometallurgy, or common pH scales and standard electrode potential scales in electroanalytical chemistry. Commission V.5 of IUPAC, on Electroanalytical Chemistry, had therefore embarked in 1979 on the project "Thermodynamic Constants for Individual Ionic Species".

The meaningful quantities that can be compiled from the literature and critically evaluated are the standard thermodynamic functions of transfer of single ions from a selected reference solvent to other solvents and to their mixtures. Meant are mainly the standard Gibbs free energies, enthalpies and entropies of transfer, since only very few data exist concerning other functions, such as the standard volume or heat capacity changes on transfer. The standard thermodynamic functions pertain to infinitely dilute solutions of the solute ions, hence the additivity of the values reported is an important criterion of their validity.

Water has been selected as the reference solvent for the transfers, because of its general importance in chemistry, biophysics, etc., and because the properties of electrolyte solutions have been so much more fully investigated in water than in other solvents. Also, quantities pertaining to single ions, such as their hydration Gibbs free energies and enthalpies, or their standard partial molar entropies and volumes have been estimated much more extensively and accurately for aqueous solutions than for other solvents. Thus, in spite of some difficulties in applying certain methods (such as the polarographic determination of the standard potential of a redox couple like ferrocene/ferricenium), enough reliable data exist from other methods, to permit an indirect use of all transfer data, between any solvents, and make water the most useful reference solvent.

Since this report deals with the thermodynamic functions of transfer of single ions, extra-thermodynamic assumptions are necessary for dividing the thermodynamic data for complete electrolytes into ionic contributions. Those cases, where the data have not been treated in this manner by the original authors, and where this division cannot either be carried out by the compiler, have been left out of this survey. Included are therefore only cases where this division has been or can be made. These are classified into the following categories:

- (i) The division into the ionic contribution has been or can be made according to a reliable extrathermodynamic assumption. These cases have been given full weight in the evaluation.
- (ii) The division has been made according to a not completely satisfactory extra-thermodynamic assumption, but data have been provided for both cations and anions, and at least some data are available elsewhere for the solvent discussed, which belong to category (i). In such cases, adjustments can be made, by adding a constant to the values for the cations and subtracting it from the values for the anions (for 1:1 electrolytes). Such data have been given less than full weight in the evaluation.

- (iii) The division has been made according to unsatisfactory extrathermodynamic assumptions. Such data have been recorded in the compilation but have been given zero weight in the evaluation.

Extrathermodynamic assumptions, that are suitable for the present purpose, have been reviewed by many authors. The arguments in favor and against the one or the other need not be repeated here, having already been briefly reviewed by the present author (ref.1).

It must be remembered that any consensus attained at a given time concerning the acceptability of extrathermodynamic assumptions is subject to possible revision in the light of better data, theories, or insight. Necessary, but not sufficient, criteria that have to be met by acceptable assumptions are: the additivity of the cation and anion values to give the reliably experimentally established values for the electrolytes; constant differences between the values for the, say, cations, irrespective of the anions present (when data for the transfer of complete electrolytes are not obtained, as in certain polarographic methods); and a "smooth" dependence on monotonically varying properties of series of solvents or ions (provided other properties are kept essentially constant).

Reports on the enthalpy and entropy of transfer will follow.

## 2. GIBBS FREE ENERGIES OF TRANSFER TO NONAQUEOUS SOLVENTS

### 2.1. General Remarks

The literature has been surveyed practically completely to the end of 1980, with some data published in 1981 also included, and a critical evaluation of the data has been made. A preliminary form of this compilation and evaluation was submitted for publication in 1979, before this became a IUPAC project, and has since been published (ref.1). This has now been brought up to date and completed for solvents and ions not included in the publication (ref.1), for example, for divalent ions.

In the evaluation, the primary criteria have been the reliability of the experimental data, their being correctly converted to "standard" thermodynamic values, and the acceptability of the extrathermodynamic assumption.

The reliability of the experimental data has been judged, in addition to the usual criteria applying to the analytical determination, also as regards the pains taken to purify the solvents, and keep the inevitable impurities at a low and well characterized level (ref.2).

The acceptability of Gibbs free energies of transfer data as standard depends on how their application to the standard state of infinite dilution of the solute ions has been made. Inadequate corrections of data obtained at appreciable concentrations of the electrolytes and relatively low dielectric constants of the solvents for activity coefficients or ion pairing reduce the accuracy of the data.

These two criteria should account for the discrepancies found between the reported values pertaining to given solvent and ion and a particular extrathermodynamic assumption. Much larger differences generally occur between results reported for different extrathermodynamic assumptions. According to the categories described in the Introduction (Section 1) the following assumptions have been applied to Gibbs free energy of transfer data.

To category (i) belongs the tetraphenylarsonium tetraphenylborate assumption  $\{\Delta G_t^0(\text{Ph}_4\text{As}^+, \text{H}_2\text{O} \rightarrow \text{S}) = \Delta G_t^0(\text{BPh}_4^-, \text{H}_2\text{O} \rightarrow \text{S})\}$ , for any solvent S. Other "reference electrolyte" assumptions belong to the same category, provided the ions are large, singly charged and of nearly equal size. This includes  $\text{Ph}_4\text{P}^+\text{BPh}_4^-$ ,  $(i\text{-C}_5\text{H}_{11})_3(\text{C}_4\text{H}_9)\text{NBPh}_4^-$  and similar electrolytes. Some results obtained according to the "negligible liquid junction" assumption and to the assumption  $\Delta G_t^0(\text{AgBr}_2^-, \text{H}_2\text{O} \rightarrow \text{S}) + \Delta G_t^0(\text{AgCl}_2^-, \text{H}_2\text{O} \rightarrow \text{S}) = 0$  may also belong to this category, if supported by other reliable data.

To category (ii) belong the "reference Ion/molecule" assumptions, in particular the ferrocenium/ferrocene assumption, i.e.  $\Delta G_t^0\{\text{Fe}(\text{C}_5\text{H}_5)_2^+, \text{H}_2\text{O} \rightarrow \text{S}\} = \Delta G_t^0\{\text{Fe}(\text{C}_5\text{H}_5)_2, \text{H}_2\text{O} \rightarrow \text{S}\}$ . To this category belong also assumptions involving other pairs of ion/molecule, e.g.  $\text{Ct}^+[(\text{C}_6\text{H}_5)_2\text{J}_2^+ / \text{Cr}[(\text{C}_6\text{H}_5)_2\text{J}_2, \text{I}_3^-/\text{I}_2]$ , or even two ions of different charges, such as  $\text{Fe}(\text{o-phen})_3^{3+} / \text{Fe}(\text{o-phen})_2^{2+}$ .

To category (iii) belong results obtained on the basis of electrostatic calculations, involving the Born equation, possibly modified by including adjusted ionic radii, multiple interaction terms, or "neutral" terms. Also included in this category are results for  $\text{H}^+$  ions obtained by using the Hammett acidity function, and values obtained from "real" standard electrochemical potentials. In all these cases, the criterion of additivity of cation and anion values to give the experimentally established values for electrolytes was not satisfactorily met, or has not been tested.

In order to permit comparison and an evaluation, all the values have been selected for one temperature, 25°C, except for those solvents where 25°C is below the melting point {e.g., tetramethylene sulfone (sulfolane, TMS), where 30°C is commonly used}. They have been converted, if necessary, to the molar scale ( $\text{mol dm}^{-3}$ ) (ref.3) and to the units  $\text{kJmol}^{-1}$ .

The selected quantities have been obtained as weighted means of the reported values for each ion and solvent. Each report of an author or a group of authors is treated separately, even if it just repeats the values given in a previous report, since it reaffirms in doing so the author's acceptance of their validity. In those cases, where the results from reliable independent sources agree within ca.  $1-2 \text{ kJmol}^{-1}$ , the selected value is presented to one place beyond the decimal point, and may be considered as recommended. In other cases, where the values have not been confirmed by independent sources, or the agreement between such sources is only within  $2-5 \text{ kJmol}^{-1}$ , the values are presented as integral values, and should be considered as tentative, provided that they belong to categories (i) or (ii) characterized above. Values, which cannot be judged as reliable, but for which no better alternatives have been reported, are presented within parentheses, and must be used with great caution. Finally, ions for which the only entries available are known to be unsatisfactory {category (iii)}, have been left with a void space in the column of selected values.

The selected values and the compilation are given in subsections 2.4 and 2.5 below.

### References

1. Y. Marcus, *Rev.Anal.Chem.*, **5**, 53 (1980).
2. J.F. Coetzee, 'Solvent Purity : General Considerations' in *IUPAC Recommended Methods for Purification of Solvents*, Pergamon Press, Oxford (1982).
3. A. Ben-Naim, *J.Phys.Chem.*, **82**, 792 (1978).

### 2.2 List of Solvents

- |                             |                                    |
|-----------------------------|------------------------------------|
| 0. Deuterium oxide          | 29. N-Methylacetamide              |
| 1. Methanol                 | 30. 2-Pyrrolidone                  |
| 2. Ethanol                  | 31. N,N'-Dimethylformamide         |
| 3. 1-Propanol               | 32. N,N'-Diethylformamide          |
| 4. 2-Propanol               | 33. N,N'-Dimethylacetamide         |
| 5. 1-Butanol                | 34. N,N'-Dimethylthioformamide     |
| 6. 2-Butanol                | 35. N-Methylpyrrolidone            |
| 7. 2-Methyl-1-propanol      | 36. N-Methylthiopyrrolidone        |
| 8. 2-Methyl-2-propanol      | 37. Acetonitrile                   |
| 9. 3-Methyl-1-butanol       | 38. Propionitrile                  |
| 10. 1-Hexanol               | 39. $\alpha$ -Methylpropionitrile  |
| 11. 2,2,2-Trifluoroethanol  | 40. Benzonitrile                   |
| 12. 1,2-Ethanediol          | 41. Nitromethane                   |
| 13. Diethyl ether           | 42. Nitrobenzene                   |
| 14. Anisole                 | 43. Pyridine                       |
| 15. 1,2-Dimethoxyethane     | 44. Quinoline                      |
| 16. Tetrahydrofuran         | 45. Dimethyl sulfite               |
| 16a. 1,4-Dioxane            | 46. Ethylene sulfite               |
| 17. Acetone                 | 47. Dimethyl sulfoxide             |
| 17a. 4-Methyl-2-pentanone   | 48. Tetramethylene sulfoxide       |
| 18. Formic acid             | 49. Tetramethylene sulfone         |
| 19. Acetic acid             | 50. Trimethylphosphate             |
| 20. Trifluoroacetic acid    | 50a. Tri-n-butyl phosphate         |
| 21. $\gamma$ -Butyrolactone | 51. Hexamethyl phosphoric triamide |
| 22. Ethyl acetate           | 52. Benzyl fluoride                |
| 23. Ethylene carbonate      | 53. Dichloromethane                |
| 24. Propylene carbonate     | 54. 1,1-Dichloroethane             |
| 25. Ammonia                 | 55. 1,2-Dichloroethane             |
| 26. Hydrazine               | 56. 1,2-Dichlorobenzene            |
| 27. Formamide               | 57. 1,3-Dichlorobenzene            |
| 28. N-Methylformamide       |                                    |

## 2.3 Index of Ions

Given are the numbers of the solvents (see List of Solvents) for which data for the particular ion are reported. Numbers in parentheses designate solvents for which no value for the ion could be selected.

$H^+$	: 1, 2, 3, (4), (5), (6), (7), (8), (9), (10), 12, (15), (16), (17), (18), (19), (20), 24, (25), (26), (27), (29), (30), 31, 35, 37, (41), 42, (43), 47, (49), (51).
$Li^+$	: (0), 1, 2, 3, (5), 12, (13), (14), (16), (17), (17a), (18), (21), (22), 24, (25), (26), 27, (28), 31, (32), (33), 34, 35, (36), 37, (38), (40), 41, 42, 47, (50a), (51).
$Na^+$	: (0), 1, 2, 3, (5), (9), 12, (15), (16), (17), (17a), (18), (21), 24, (25), (26), 27, (28), 31, (32), 33, 34, 35, (36), 37, (38), (39), (40), 41, 42, 47, 49, (50), 54, 55.
$K^+$	: (0), 1, 2, 3, (4), (5), (9), 11, 12, (15), (16), 17, (18), (20), (21), 24, (25), (26), 27, (28), 31, (32), 33, 34, 35, (36), 37, (39), (40), 41, 42, 47, 49, (50), 51, 54, 55.
$Rb^+$	: (0), 1, 2, 3, (5), (9), (15), (16), 17, (18), (21), 24, (25), (26), 27, (28), 31, (32), 33, 35, (36), 37, (38), (39), (40), 41, 42, (44), 47, 49, (50), 54, 55.
$Cs^+$	: (0), 1, 2, 3, (5), (9), (12), (15), (16), 17, (18), (21), 24, (25), 27, (28), 31, (32), 33, 34, 35, 37, (40), 41, 42, 47, 49, 54, 55.
$Cu^+$	: (1), (18), (25), (37).
$Ag^+$	: 1, 2, 3, (5), (9), 11, 12, (15), (16), 17, (17a), (18), (19), (20), (23), 24, (25), (26), 27, (28), (30), 31, 33, 34, 35, 37, (38), 41, (45), (46), 47, (48), 49, 51.
$Tl^+$	: 1, 2, (17), (17a), (19), (21), 24, 31, 34, 35, (36), 37, (41), 42, (46), 47, (50), (52).
$MH_4^+$	: 1, 2, 35, 42.
$Me_4N^+$	: 1, 2, 3, 17, 24, (28), 31, 35, 37, (41), 42, 47, (53), 54, 55.
$Et_4N^+$	: 1, 2, (17), 24, 31, 37, 42, 47, (53), 54, 55.
$Pr_4N^+$	: 2, 24, (28), 31, 37, 42.
$Bu_4N^+$	: (0), 1, 2, 24, 31, 37, 42.
$Hx_4N^+$	: 42
$Ph_4As^+$	: 1, 2, 3, 12, 17, 24, 27, 31, 33, 35, 37, (41), 42, 47, 49, 51, 54, 55.
$Ca^{2+}$	: (0), (18), (25), (26), (37).
$Cu^{2+}$	: 1, (2), (3), (4), 24, (25), 31, 37, 47, 49.
$Zn^{2+}$	: (1), (2), (18), (25), (26), (37), 47.
$Cd^{2+}$	: (0), (1), (2), (18), (25), (26), (37), 47.
$Hg^{2+}$	: (1), (2), (3), (17), (19), (24), (25), (31), (37), (41), (47).
$Hg_2^{2+}$	: (1), (2), (3), (17), (18), (19), (24), (26), (31), (37), (41), (47).
$Pb^{2+}$	: (1), (2), (18), (26), (37).
$F^-$	: (0), 1, 24, 27, 31, 37.
$Cl^-$	: (0), 1, 2, 3, (4), (5), (7), (9), (10), 11, 12, (13), (14), (15), (16), 17, (17a), (18), (19), (20), (23), 24, (25), (26), 27, (28), (30), 31, 33, 35, 37, (38), 41, 42, (45), (46), 47, (48), 49, 51, (53), 54, 55.
$Br^-$	: (0), 1, 2, 3, (4), (5), (7), (9), 11, 12, 17 (17a), (18), (23), 24, (25), (26), 27, (28), (30), 31, 33, 35, 37, (38), 41, 42, (45), (46), 47, (48), 49, 51, (53), 54, 55.
$I^-$	: (0), 1, 2, 3, (5), (9), 11, 12, (15), (16), 17, (17a), (18), (20), (23), 24, (25), (26), 27, (30), 31, 33, 35, 37, (38), 41, 42, (45), (46), 47, (48), 49, 51, (53), 54, 55.
$I_3^-$	: 1, (2), 27, 31, 33, 37, 42, 47, (49).
$N_3^-$	: 1, 2, 12, 17, 24, 27, 31, 33, 35, 37, 41, 47, 49, 51.
$CN^-$	: 1, 2, 17, 24, 27, 31, 37, 47.
$SCN^-$	: 1, 12, 24, 27, (30), 31, 33, 35, 37, 41, 47, 49, 51.
$NO_3^-$	: 2, 37, (53), 55.
$ClO_3^-$	: 55.
$BrO_3^-$	: (47).
$IO_3^-$	: (47).
$ClO_4^-$	: 1, 2, 3, (11), (17), 24, 27, (28), 31, (33), 35, 37, 41, 42, (47), (49), 51, (53), 54, 55.
$ReO_4^-$	: (2), (28), (41).
$CH_3CO_2^-$	: (0), 1, 27, 31, 33, 37, 47.
$Pic^-$	: 1, (3), (4), (6), (7), (8), (10), 12, 24, 27, 31, 37, 42, (53).
$BPh_4^-$	: (0), 1, 3, (4), (5), (6), (7), (8), (10), 12, 17, 24, 27, 31, 33, 35, 37, (41), 42, 47, 49, 51, 54, 55.
$SO_4^{2-}$	: (1).

## 2.4 TABLES OF SELECTED DATA

$\Delta G_{\text{L}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C. Solvents with selected values for cations

No.*	1	2	3	11	12	17	24	27	31	33	34	35	37	41	42	47	49	51	54	55	
Solvent*	MeOH	EtOH	PrOH	TFE	En(OH) <sub>2</sub>	Me <sub>2</sub> CO	PC	FA	DMF	DMA	DMThF	NMPy	MeCN	MeNO <sub>2</sub>	PhNO <sub>2</sub>	DMSO	TMS	HMPT	1,1DCIE	1,2DCIE	
H <sup>+</sup>	10.4	11.1	9	5	5	50	50	-18	-18	-25	46.4	33	-19.4								
Li <sup>+</sup>	4.4	11	11	0	0	23.8	-10	-10	55	-35	25	48	38	-15							
Na <sup>+</sup>	8.2	14	17	-2	-2	14.6	-8	-9.6	-12.1	39	-15	15.1 (26)	34	-13.4	-3						
K <sup>+</sup>	9.6	16.4	18	39	-2	4	5.3	-4.3	-10.3	-11.7	27	-11	8.1	19	23	-13.0	-4	-16	30	26	
Rb <sup>+</sup>	9.6	16	19	4	4	4	-1.0	-5	-9.7	-8	-8	6.3 (5)	19	-10.4	-9						
Cs <sup>+</sup>	8.9	15	17	4	4	4	-7.0	-6.0	-10.8 (-17)	14	-10	6.0 (1)	15	-13.0	-10						
Ag <sup>+</sup>	6.6	4.9	1	50	1	9	18.8	-15.4	-20.8	-29.0	-102	-26	-23.2	21	-34.8	-4	-44				
Tl <sup>+</sup>	4.1	7					11.0	-11.5	-16	-15	8.0 (15)	-21.4									
MH <sub>4</sub> <sup>+</sup>	(5)	7						-24													
Me <sub>4</sub> N <sup>+</sup>	6	10.9	11	3	3	3	-11	-5.3	-3	3	4	-2	18	16							
Et <sub>4</sub> N <sup>+</sup>	1	6					-13	-8.0	-7	-5	(-9)	11	5								
Pr <sub>4</sub> N <sup>+</sup>	(-6)						-22	-17	-13	-16											
Bu <sub>4</sub> N <sup>+</sup>	-21	(-8)					-31	-29	-31	-24											
Ph <sub>4</sub> As <sup>+</sup>	-24.1	-21.2	-25	-21	-32	-36.0	-23.9	-38.5	-38.7	-40	-32.8	-36	-37.4	-36	-39	-27	-33				
Cu <sup>2+</sup>	(26)	(46)	(43)	(75)	(-18)	(95)	(-49)	(71)													
Zn <sup>2+</sup>																					
Cd <sup>2+</sup>																					

\* See list of solvents

Continued on the following page

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No.*	$\Delta G_t^0$ (X, H <sub>2</sub> O → S)/kJmol <sup>-1</sup> , mol dm <sup>-3</sup> scale, 25°C																Solvents with selected values for anions									
	MeOH	EtOH	PrOH	TFE	En(OH) <sub>2</sub>	Me <sub>2</sub> CO	PC	FA	DMF	DMA	NMPy	MeCN	MeNO <sub>2</sub>	PhNO <sub>2</sub>	DMSO	TMS	HMPT	1,1DCIE	1,2DCIE							
F <sup>-</sup>	16					56	25	51			71															
Cl <sup>-</sup>	13.2	20.2	26	-10	9	57	39.8	13.7	48.3	54.9	51	42.1	37	35	40.3	47	58	58	52	52						
Br <sup>-</sup>	11.1	18.2	22	-8	7	42	30.0	10.7	36.2	44.0	37	31.3	30	29	27.4	35	46	43	38	38						
I <sup>-</sup>	7.3	12.9	19	-8	3	25	13.7	7.3	20.4	21	19	16.8	17	18	10.4	21	30	31	25	25						
I <sub>3</sub> <sup>-</sup>	-12.6						-7	-27	-30			-15		-23	(-41)											
N <sub>3</sub> <sup>-</sup>	9.1	17.0			7	43	27	11	36	40	46	37	28		25.8	41	49									
CN <sup>-</sup>	8.6	7				48	36	13.3	40			35			35											
SCN <sup>-</sup>	5.6				5		7.0	7	18.4	21	18	14.4	15		9.7	22	20									
NO <sub>3</sub> <sup>-</sup>		14										21								7						
ClO <sub>4</sub> <sup>-</sup>	6.1	10	17			-3	-12	4		-12	2	(-5)	7			-7	-7	22	16	16						
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>	16.0						20	66	70		61				(50)											
Pic <sup>-</sup>	-6	0.5			-7		-6	-7	-7		-4															
BPh <sub>4</sub> <sup>-</sup>	-24.1	-21.2	-25		-21	-32	-36.0	-23.9	-38.5	-38.7	-40	-32.8		-36	-37.4	-36	-39	-27	-33	-33						

\* See list of solvents

## 2.5 COMPILED DATA WITH REFERENCES AND COMMENTS

0.  $\Delta G_{\text{L}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = D<sub>2</sub>O

Ref.	1	2	3	Ref.	1	2	3
wt.	0	0	0.5	wt.	0	0	0.5
Li <sup>+</sup>	-0.33	0.63	-0.22	Sr <sup>2+</sup>	0.33		
Na <sup>+</sup>	0	1.30	0.21	Ba <sup>2+</sup>	0.50		
K <sup>+</sup>	0.28	1.39	0.26	Cd <sup>2+</sup>	0.90		
Rb <sup>+</sup>	0.49		0.23	F <sup>-</sup>	-0.24	-2.43	-0.22
Cs <sup>+</sup>	0.26	1.22	0.10	Cl <sup>-</sup>	0.47	-1.58	0.32
NH <sub>4</sub> <sup>+</sup>	0.23		0.42	Br <sup>-</sup>	0.56	-1.37	0.54
Me <sub>4</sub> N <sup>+</sup>	0.10		0.28	I <sup>-</sup>	0.77	-1.41	0.77
Bu <sub>4</sub> N <sup>+</sup>	-0.54		-0.79	HCO <sub>2</sub> <sup>-</sup>	-0.06		
Mg <sup>2+</sup>	0.25			CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>	-0.13		
Ca <sup>2+</sup>	0.33			BPh <sub>4</sub> <sup>-</sup>	0.64		0.96

Deuterium Oxide - References and Comments

1. H.L. Friedman & C.V. Krishnan, in Water. A Comprehensive Treatise, F. Franks, ed., Plenum, New York, Vol. 3, 1973, p. 84; based on the convention that  $\Delta G_{\text{L}}^{\circ}(\text{Na}^+, \text{H}_2\text{O} \rightarrow \text{D}_2\text{O}) = 0$ .
2. From  $\Delta H_{\text{L}}^{\circ}$  data from ref. 1, p. 90; based on the Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, and  $\Delta S_{\text{L}}^{\circ}$  data of C.M. Criss, R.P. Held & E. Luksha, J. Phys. Chem., **72**, 2970 (1968), selected so as to make the cations and anions fall on the same curve, when  $\bar{S}^{\circ}(\text{X}, \text{D}_2\text{O})$  values are plotted against  $\bar{S}^{\circ}(\text{X}, \text{H}_2\text{O})$  values.
3. From data quoted by A. Ben-Naim, J. Phys. Chem., **79**, 1268 (1975), correlated with other measures of the effects of ions on the structure of water by Y. Marcus, Abstr. Int. Conf. Chem. Thermod., London, 1982.



Ref. wt.	1. $\Delta G_t^0$ (X, H <sub>2</sub> O → S)/kJmol <sup>-1</sup> , mol dm <sup>-3</sup> scale, 25°C									
	Solvent, S = Methanol									
	1	2	3	4	5	6	7	8	9	10
	0	0	0	0	0	0	0	0.5	1.0	0
H <sup>+</sup>	2	0	-1	21	18	-11		9.9	11.2	-11
Li <sup>+</sup>	-14			4	-9	-13	-12			
Na <sup>+</sup>	0			13	10	-9		9.3		-10
K <sup>+</sup>				8	11	-5		10.9	10.9	-7
Rb <sup>+</sup>	0				16			11.3	5.7	-7
Cs <sup>+</sup>				15	15			11.6		-8
Cu <sup>+</sup>	1									
Ag <sup>+</sup>	-2			17	20				5.1	
Tl <sup>+</sup>	-2									
NH <sub>4</sub> <sup>+</sup>										
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>										
Bu <sub>4</sub> N <sup>+</sup>										
Ph <sub>4</sub> As <sup>+</sup>										
Cu <sup>2+</sup>										
Zn <sup>2+</sup>	4			46	31					
Cd <sup>2+</sup>	1			65	29					
Hg <sup>2+</sup>										
Hg <sub>2</sub> <sup>2+</sup>	-4									
Pb <sup>2+</sup>	-5									
Cl <sup>-</sup>	-21			13	6	33	33	12.4	12.5	30
Br <sup>-</sup>	-15			4	6			9.7		28
I <sup>-</sup>	-15			-2	0			6.5		24
I <sub>3</sub> <sup>-</sup>										
N <sub>3</sub> <sup>-</sup>										
CN <sup>-</sup>										
SCN <sup>-</sup>										
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>										
ClO <sub>4</sub> <sup>-</sup>										
Pic <sup>-</sup>									-6	
BPh <sub>4</sub> <sup>-</sup>									-23.9	
SO <sub>4</sub> <sup>2-</sup>										

## Methanol - References and Comments

1. W.A. Pleskov, *Usp.Khim.*, **16**, 254 (1947); reference ion,  $\Delta G_t^0(\text{Rb}^+, \text{H}_2\text{O} \rightarrow \text{S}) = 0$ .
2. H. Strehlow, *Z.Elektrochem.*, **56**, 827 (1952); from H<sub>2</sub>O data.
3. H.M. Koepf, H. Wendt & H. Strehlow, *Z.Elektrochem.*, **64**, 483 (1960); electrostatic extrapolation method.
4. N.A. Izmailov, *Zh.Fiz.Khim.*, **34**, 2414 (1960); extrapolation method.
5. N.A. Izmailov, *Doklady Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.
6. D. Feakins & V. Watson, *J.Chem.Soc.*, **1963**, 4734; extrapolation method.
7. J.C. Lauer, *Electrochim.Acta*, **9**, 1617 (1964); electrostatic calculation.
8. H. Strehlow, in *Chemistry of Nonaqueous Solvents*, J.J. Lagowski, ed., Vol.1, Chap.4, 1966; ferrocene assumption, adjusted by adding +(-) 11.0 to cation (anion) values.
9. O. Popovych, *Anal.Chem.*, **38**, 558 (1966); iAm<sub>3</sub>BuNBPh<sub>4</sub> assumption.
10. M. Alfenaar & C.L. DeLigny, *Rec.Trav.Chim.*, **89**, 929 (1967); electrostatic calculation.

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1.  $\Delta G_{\text{E}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S}) / \text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Methanol

Ref. wt.	11	12	13	14	15	16	17	18	19	20
H <sup>+</sup>	-25		-12			-12		10.8	6.7	9.1
Li <sup>+</sup>	-29		-16			-16			5.9	6.5
Na <sup>+</sup>	-25		-12			-12		8.6	6.7	10.0
K <sup>+</sup>	-24	8.6	-8	10.3	8.6	-8	19.4	10.3	9.6	14.1
Rb <sup>+</sup>	-23					-17		10.3	10.5	
Cs <sup>+</sup>	-37	6.3		8.3	6.3	-11		9.7	10.1	
Cu <sup>+</sup>										
Ag <sup>+</sup>	-28	4.6		7.4	4.6		9.1	7.4		
Tl <sup>+</sup>	-22							4.0		
NH <sub>4</sub> <sup>+</sup>										
Me <sub>4</sub> N <sup>+</sup>									8.0	
Et <sub>4</sub> N <sup>+</sup>										
Bu <sub>4</sub> N <sup>+</sup>		-21.4		-21.1						
Ph <sub>4</sub> As <sup>+</sup>		-23.4			-23.4		-36.5	-23.4	-25.1	
Cu <sup>2+</sup>	-43									
Zn <sup>2+</sup>	-43									
Cd <sup>2+</sup>	-52									
Hg <sup>2+</sup>										
Hg <sub>2</sub> <sup>2+</sup>										
Pb <sup>2+</sup>	-62									
Cl <sup>-</sup>	46	14.3	36	11.4	14.3	36	11.4	12.6	15.5	13.5
Br <sup>-</sup>	44	12.0	38	9.2	12.0	34	9.1	11.4	13.4	10.2
I <sup>-</sup>	40	8.6	29	5.7	8.6	26	5.7	6.8	9.2	6.2
I <sub>3</sub> <sup>-</sup>		-12.6		-12.6	-12.6					
N <sub>3</sub> <sup>-</sup>				10.3						
CN <sup>-</sup>				8.6						
SCN <sup>-</sup>		6.8		4.0	6.8		4.0	5.7		
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>		16.0		16.6						
ClO <sub>4</sub> <sup>-</sup>				4.6	10.8			5.7	5.0	
Pic <sup>-</sup>				-6.2	-3.4		-13.1	-4.6		
BPh <sub>4</sub> <sup>-</sup>		-23.4		-23.4	-23.4		-24.5	-23.4	-25.1	
SO <sub>4</sub> <sup>2-</sup>	64									

## Methanol - References and Comments

11. B. Case & R. Parsons, *Trans.Faraday Soc.*, **63**, 1224 (1967); 'real' potentials.
12. R. Alexander & A.J. Parker, *J.Am.Chem.Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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17. R. Alexander, A.J. Parker, J.H. Sharp, & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
18. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **76**, 2024 (1972); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
19. D. Bax, C.L. DeLigny & M. Alfenaar, *Rec.Trav.Chim.*, **91**, 452 (1972); electrostatic calculation, adjusted by adding + (-) 4.0 to cation (anion) values.
20. J. Padova, *J.Chem.Phys.*, **56**, 1606 (1972); electrostatic calculation, adjusted by adding + (-) 12.0 to cation (anion) values.

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1.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = Methanol

Ref. wt.	21	22	22a	23	24	25	26	27	28	29	30
H <sup>+</sup>	10.9				20.1						
Li <sup>+</sup>	4.2	3.4		3.8						1.7	
Na <sup>+</sup>	8.4	8.4		8.4						4.0	
K <sup>+</sup>	10.0	9.9		10.0		15.5			14.9	6.1	9
Rb <sup>+</sup>	10.0	10.4		10.0						5.8	
Cs <sup>+</sup>	9.6	10.4		9.6						6.1	
Cu <sup>+</sup>											
Ag <sup>+</sup>	7.5			7.5	7.0	7.5			7.2		7
Tl <sup>+</sup>	4.2										
NH <sub>4</sub> <sup>+</sup>											
Me <sub>4</sub> N <sup>+</sup>		1.0									6
Et <sub>4</sub> N <sup>+</sup>				1.0	1.0						
Bu <sub>4</sub> N <sup>+</sup>											
Ph <sub>4</sub> As <sup>+</sup>	-23.4	-23.3		-23.4			-29.3				
Cu <sup>2+</sup>											
Zn <sup>2+</sup>											
Cd <sup>2+</sup>											
Hg <sup>2+</sup>								9.7			
Hg <sub>2</sub> <sup>2+</sup>								12.0			
Pb <sup>2+</sup>											
Cl <sup>-</sup>	12.6	13.2		12.6	13.5		12.9		13.6		14
Br <sup>-</sup>	11.3	11.0		11.3					11.4		11
I <sup>-</sup>	6.7	6.7		6.7	7.8				7.6		8
I <sub>3</sub> <sup>-</sup>											
N <sub>3</sub> <sup>-</sup>			7.9								
CN <sup>-</sup>											
SCN <sup>-</sup>				5.9							6
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>	16.0										
ClO <sub>4</sub> <sup>-</sup>	5.9	6.1		5.9	-13.9						
Pic <sup>-</sup>											
BPh <sub>4</sub> <sup>-</sup>	-23.4	-23.3		-23.4							

## Methanol - References and Comments

21. B.G. Cox, *Ann.Repts.Chem.Soc.*, **70**, 249 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
22. M.H. Abraham, *J.Chem.Soc.Faraday Trans. 1*, **69**, 1375 (1973); data relative to NH<sub>4</sub><sup>+</sup>, adjusted by adding + (-) 7.1 to cation (anion) values.
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23. B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr.J.Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
24. J. Badoz-Lambling & J.C. Bardin, *Electrochim.Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding + (-) 19.0 to cation (anion) values.
25. D.A. Owensby, A.J. Parker, and J.W. Diggle, *J.Am.Chem.Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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30. A.J. Parker, U. Mayer, R. Schmid & V. Gutman, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

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Ref. wt.	31	32	33	34	35	36	37	38	39	40	41	42	Selected
	1. $\Delta G_{\text{t}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S}) / \text{kJmol}^{-1}$ , mol dm <sup>-3</sup> scale, 25°C												Solvent, S = Methanol
H <sup>+</sup>	10.4										-2.9		10.4
Li <sup>+</sup>	3.6								6.7		-16.4		4.6
Na <sup>+</sup>	8.6										-3.9		8.2
K <sup>+</sup>	9.8		9	3.0									9.6
Rb <sup>+</sup>	10.3												9.6
Cs <sup>+</sup>	9.6	-14.3											8.9
Cu <sup>+</sup>													
Ag <sup>+</sup>	7.5										-6.8		6.6
Tl <sup>+</sup>	4.0												4.1
NH <sub>4</sub> <sup>+</sup>	4.9												(5)
Me <sub>4</sub> N <sup>+</sup>	7.1		6										6
Et <sub>4</sub> N <sup>+</sup>	1.0												1
Bu <sub>4</sub> N <sup>+</sup>													-21
Ph <sub>4</sub> As <sup>+</sup>	-23.0			-16.2			-25.7	-25.3					-24.1
Cu <sup>2+</sup>					25.9								(26)
Zn <sup>2+</sup>													
Cd <sup>2+</sup>													
Hg <sup>2+</sup>													
Hg <sub>2</sub> <sup>2+</sup>													
Pb <sup>2+</sup>													
La <sup>3+</sup>										42			
F <sup>-</sup>										16.3			(16)
Cl <sup>-</sup>	13.2		14								-26.1		13.2
Br <sup>-</sup>	11.0		11										11.1
I <sup>-</sup>	6.7		8										7.3
I <sub>3</sub> <sup>-</sup>													-12.6
N <sub>3</sub> <sup>-</sup>													9.1
CN <sup>-</sup>						8.6							8.6
SCN <sup>-</sup>													5.6
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>													16.0
ClO <sub>4</sub> <sup>-</sup>	6.1												6.1
Pic <sup>-</sup>	-4.4			-9.6									-6
BPh <sub>4</sub> <sup>-</sup>	-23.4			-16.2			-25.7	-25.3					-24.1
SO <sub>4</sub> <sup>2-</sup>													
IO <sub>3</sub> <sup>-</sup>												22.3	(22)

## Methanol - References and Comments

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33. A.J.Parker, unpublished results, presented at RACI Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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42. I.M.Kolthoff & M.K.Chantooni, *J.Phys.Chem.*, 77, 523 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

2.  $\Delta G_{\text{t}}^{\circ} (X, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Ethanol

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12
H <sup>+</sup>	14	25	22	-23	11.2	7			12.3			
Li <sup>+</sup>	16	8	17	-22		-1		10.7				
Na <sup>+</sup>	20	25	24	-17		13		13.7				8.9
K <sup>+</sup>	23	21	23	-26	16.8	13	24.0	15.8		19.2		11.9
Rb <sup>+</sup>	22		26	-22		13		15.9				
Cs <sup>+</sup>	23		22	-21		14		16.2				
Ag <sup>+</sup>	12	17	21	-27		2	8.0		4.2	6.7		
Tl <sup>+</sup>				-22		6						3.3
NH <sub>4</sub> <sup>+</sup>	15											
Me <sub>4</sub> N <sup>+</sup>	17					11		12.0				
Et <sub>4</sub> N <sup>+</sup>	15					-2						
Pr <sub>4</sub> N <sup>+</sup>						-6						
Bu <sub>4</sub> N <sup>+</sup>						-18						
Ph <sub>4</sub> As <sup>+</sup>							-32.5					
Cu <sup>2+</sup>				-68								
Zn <sup>2+</sup>		80	44	-20								
Cd <sup>2+</sup>		73	43	-39								
Hg <sup>2+</sup>											16	
Hg <sub>2</sub> <sup>2+</sup>											18	
Pb <sup>2+</sup>				-48								
Cl <sup>-</sup>	14	11	7	51	19.3	21	16.6	20.2	20.4			
Br <sup>-</sup>	10	8	7	49		18	13.7	17.3				
I <sup>-</sup>	8	2	5	43		13	9.7	11.7	13.5			
I <sub>3</sub> <sup>-</sup>						-3						
N <sub>3</sub> <sup>-</sup>							17.0					
CN <sup>-</sup>												
NO <sub>3</sub> <sup>-</sup>												
ClO <sub>4</sub> <sup>-</sup>	4					10		10.1	-12.2			
ReO <sub>4</sub> <sup>-</sup>						5						
PhCO <sub>2</sub> <sup>-</sup>	7											
Pic <sup>-</sup>					-0.3		-19.4					
BPh <sub>4</sub> <sup>-</sup>					-21.7	-20	-18.3					

## Ethanol - References and Comments

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2. N.A. Izmailov, *Zh.Fiz.Khim.*, **34**, 2414 (1960); extrapolation method.
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4. B. Case & R. Parsons, *Trans.Faraday Soc.*, **63**, 1224 (1967); from 'real' potentials.
5. O. Popovych & A.J. Dill, *Anal.Chem.*, **41**, 456 (1969); Ph<sub>4</sub>PBPh<sub>4</sub> assumption.
6. D. Box, C.L. DeLigny & A.G. Remijnse, *Rec.Trav.Chim.*, **91**, 965 (1972); electrostatic calculation.
7. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
8. M.H. Abraham, *J.Chem.Soc.Faraday Trans. 1*, **69**, 1375; assumption that  $\Delta G_{\text{t}}^{\circ}(\text{Me}_4\text{N}^+, \text{H}_2\text{O} \rightarrow \text{EtOH}) = 0$ , adjusted by adding +(-) 12.0 to cation (anion) values.
9. J. Badoz-Lambling & J.C. Bardin, *Electrochim.Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 23.0 to cation (anion) data.
10. D.A. Owensby, A.J. Parker & J.W. Diggle, *J.Am.Chem.Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
11. L.N. Balyatinskaya & T.V. Kurchenko, *Zh.Obshechei Khim.*, **46**, 1113 (1976); L.N. Balyatinskaya, *Russ.Chem.Rev.*, **48**, 418 (1979); ferrocene assumption.
12. G. Gritzner, *Inorg.Chim.Acta*, **24**, 5 (1977); bisbiphenylchromium assumption.

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2.  $\Delta G_{\text{L}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Ethanol

Ref. wt.	13	14	15	16	17	18	19	20	21	22	Selected
H <sup>+</sup>		9.7		13.1	10.3						11.1
Li <sup>+</sup>		10.5									11
Na <sup>+</sup>		15.9									14
K <sup>+</sup>	16.5	16.0	7		16.0	16					16.4
Rb <sup>+</sup>		16.2									16
Cs <sup>+</sup>		14.9									15
Ag <sup>+</sup>	4.6	5.4	3								4.9
Tl <sup>+</sup>		9.2									7
NH <sub>4</sub> <sup>+</sup>		6.7									7
Me <sub>4</sub> N <sup>+</sup>		12.0	10			10					10.9
Et <sub>4</sub> N <sup>+</sup>		6.3									6
Pr <sub>4</sub> N <sup>+</sup>											(-6)
Bu <sub>4</sub> N <sup>+</sup>											(-8)
Ph <sub>4</sub> As <sup>+</sup>		-20.4			-20.5				-22.5	-21.7	-21.2
Cu <sup>2+</sup>								46.0			(46)
Zn <sup>2+</sup>											
Cd <sup>2+</sup>											
Hg <sup>2+</sup>											
Hg <sub>2</sub> <sup>2+</sup>											
Pb <sup>2+</sup>											
Cl <sup>-</sup>	20.2	20.1	21		20.0	21					20.2
Br <sup>-</sup>	17.5	17.2	19		17.1	19					18.2
I <sup>-</sup>	13.1	11.7	14			14					12.9
I <sub>3</sub> <sup>-</sup>											
N <sub>3</sub> <sup>-</sup>		17.0	17								17.0
CN <sup>-</sup>							7.2				7
NO <sub>3</sub> <sup>-</sup>		13.8									14
ClO <sub>4</sub> <sup>-</sup>		10.0									10
ReO <sub>4</sub> <sup>-</sup>											
PhCO <sub>2</sub> <sup>-</sup>											
Pic <sup>-</sup>		0.3		0.5	0.6						0.5
BPh <sub>4</sub> <sup>-</sup>		-20.4			-20.5				-22.5	-21.7	-20.5

## Ethanol - References and Comments

- U. Mayer, *Monatsh.Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 6.0 to cation (anion) values.
- M.H. Abraham & A.F. Danil de Namor, *J.Chem.Soc.Faraday Trans. 1*, **74**, 2101 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **83**, 468 (1979); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, unpublished results, presented at RACI Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- M.J. Blandamer, J. Burgess & A.J. Duffied, *J.Chem.Soc.Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.
- F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977, quoted in ref.22; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

3.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 1-Propanol

Ref. wt.	1	2	3	4	Selected
	0.5	0.5	1.0	0.5	
H <sup>+</sup>		15.4	8.7		9
Li <sup>+</sup>			11.3		11
Na <sup>+</sup>			16.8		17
K <sup>+</sup>			17.7		18
Rb <sup>+</sup>			19.3		19
Cs <sup>+</sup>			17.4		17
Ag <sup>+</sup>			0.8		1
Me <sub>4</sub> N <sup>+</sup>			10.6		11
Ph <sub>4</sub> As <sup>+</sup>			-25.2		-25
Cu <sup>2+</sup>				43	(43)
Hg <sup>2+</sup>	18				
Hg <sub>2</sub> <sup>2+</sup>	27				
Cl <sup>-</sup>			25.5		26
Br <sup>-</sup>			21.9		22
I <sup>-</sup>			19.3		19
ClO <sub>4</sub> <sup>-</sup>			17.4		17
Pic <sup>-</sup>		1.7			
BPh <sub>4</sub> <sup>-</sup>		-18.3	-25.2		-25

#### 1-Propanol - References and Comments

1. L.N. Balatinskaya & T.V. Kurchenko, *Zh.Obshchei Khim*, **46**, 1113 (1976); L.N. Balatinskaya, *Russ.Chem.Rev.*, **48**, 418 (1979); ferrocene assumption.
2. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{MeOH} \rightarrow \text{1-PrOH})$  data, using the iAm<sub>3</sub>BuNBPh<sub>4</sub> assumption.
3. M.H. Abraham & A.F. Danil de Namor, *J.Chem.Soc.Faraday Trans. 1*, **74**, 2101 (1978); Ph<sub>4</sub>AsPh<sub>4</sub> assumption.
4. J. F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction assumption.

4.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 2-Propanol

Ref. wt.	1	2	3
	0.5	1.0	0.5
H <sup>+</sup>	21.6	2.9	
K <sup>+</sup>		22.8	
Cu <sup>2+</sup>			67
Cl <sup>-</sup>		28.5	
Br <sup>-</sup>		26.3	
Pic <sup>-</sup>	13.9	5.7	
BPh <sub>4</sub> <sup>-</sup>	-14.8	-14.8	

#### 2-Propanol - References and Comments

1. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{MeOH} \rightarrow \text{2-PrOH})$  data, iAm<sub>3</sub>BuNBPh<sub>4</sub> assumption.
2. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **83**, 468 (1979); iAm<sub>3</sub>BuNBPh<sub>4</sub> assumption.

5.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 1-Butanol

Ref. wt.	1	2	3
	0	0	0.5
H <sup>+</sup>	24	-17	15.9
Li <sup>+</sup>	10	-23	
Na <sup>+</sup>	23	-14	
K <sup>+</sup>	35	-6	
Rb <sup>+</sup>	51	10	
Cs <sup>+</sup>	25	-10	
Ag <sup>+</sup>	14		
Cl <sup>-</sup>	11	50	
Br <sup>-</sup>	4	39	
I <sup>-</sup>	8	51	
BPh <sub>4</sub> <sup>-</sup>			-16.3

#### 1-Butanol - References and Comments

1. N.A. Izmailov, *Doklady Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.
2. B. Case & R. Parsons, *Trans.Faraday Soc.*, **63**, 1224 (1967); from 'real' potentials.
3. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{MeOH} \rightarrow \text{1-BuOH})$  data, iAm<sub>3</sub>NBPh<sub>4</sub> assumption.

$$6. \Delta G_t^{\circ} (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^{\circ}C$$

Solvent, S = 2-Butanol

Ref. wt.	1
H <sup>+</sup>	17.6
Pic <sup>-</sup>	7.4
BPh <sub>4</sub> <sup>-</sup>	-13.6

#### 2-Butanol - References and Comments

1. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_t^{\circ} (X, MeOH \rightarrow 2-BuOH)$  data, *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.

$$7. \Delta G_t^{\circ} (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^{\circ}C$$

Solvent, S = 2-Methyl-1-propanol

Ref. wt.	1
H <sup>+</sup>	15.4
Pic <sup>-</sup>	3.7
BPh <sub>4</sub> <sup>-</sup>	-14.8

#### 2-Methyl-1-propanol - References and Comments

1. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_t^{\circ} (X, MeOH \rightarrow iBuOH)$  data, *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.

$$8. \Delta G_t^{\circ} (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^{\circ}C$$

Solvent, S = 2-Methyl-2-propanol

Ref. wt.	1	2
H <sup>+</sup>	22.2	6.3
Cl <sup>-</sup>		43.4
Br <sup>-</sup>		39.9
Pic <sup>-</sup>	13.1	13.1
BPh <sub>4</sub> <sup>-</sup>	-8.8	-8.8

#### 2-Methyl-2-propanol - References and Comments

1. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_t^{\circ} (X, MeOH \rightarrow tBuOH)$  data, *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.
2. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **83**, 468 (1979); *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.

$$9. \Delta G_t^{\circ} (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^{\circ}C$$

Solvent, S = 3-Methyl-1-butanol

Ref. wt.	1
H <sup>+</sup>	24
Na <sup>+</sup>	34
K <sup>+</sup>	31
Rb <sup>+</sup>	31
Cs <sup>+</sup>	25
Ag <sup>+</sup>	14
Cl <sup>-</sup>	17
Br <sup>-</sup>	17
I <sup>-</sup>	6

#### 3-Methyl-1-butanol - References and Comments

1. N.A. Izmailov, *Doklady Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.

$$10. \Delta G_t^{\circ} (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^{\circ}C$$

Solvent, S = 1-Hexanol

Ref. wt.	1	2
H <sup>+</sup>	15.9	13.1
Cl <sup>-</sup>		34.2
Pic <sup>-</sup>	8.5	8.6
BPh <sub>4</sub> <sup>-</sup>	-13.7	-13.7

#### 1-Hexanol - References and Comments

1. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **82**, 994 (1978); recalculated from  $\Delta G_t^{\circ} (X, MeOH \rightarrow 1-HxOH)$  data, *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.
2. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **83**, 468 (1979); *iAm<sub>3</sub>BuNBPh<sub>4</sub>* assumption.



11.  $\Delta G_t^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 2,2,2-Trifluoroethanol

Ref. wt.	1	2	3	4	5	6	7	Selected
	0.5	0.8	0.5	1.0	0.5	1.0	1.0	
K <sup>+</sup>	35.5	44.5		29.7	40	36	36	39
Ag <sup>+</sup>	46.8	53.6	51.8	49.0	51	49		50
Cl <sup>-</sup>	-11.0	-11.4	-9.6		-8	-10	-10	-10
Br <sup>-</sup>		-11.4			-8	-7	-7	-8
I <sup>-</sup>		-11.4	-9.6		-8	-7	-7	-8
ClO <sub>4</sub> <sup>-</sup>	2.7		-14.1					

2,2,2-Trifluoroethanol - References and Comments

1. A.J. Parker, Pure Appl.Chem., **25**, 345 (1971); I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumption, adjusted by adding +(-) 11.0 to cation (anion) values.
2. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, J.Am.Chem.Soc., **94**, 1148 (1972); negligible liquid junction assumption.
3. J. Badoz-Lambling & J.C. Bardin, Electrochim.Acta, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 17.0 to cation (anion) values.
4. D.A. Owensby, A.J. Parker & J.W. Diggle, J.Am.Chem.Soc., **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
5. U. Mayer, Monatsh.Chem., **108**, 1479 (1977); negligible liquid junction assumption, adjusted by adding - (+) 4 to cation (anion) values.
6. A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, J.Org.Chem., **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
7. A.J. Parker, unpublished results, presented at RACI Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

12.  $\Delta G_t^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 1,2-Ethanediol

Ref. wt.	1	2	3	4	Selected
	0.5	1.0	0	1.0	
H <sup>+</sup>		5.1			5
Li <sup>+</sup>		-0.1			0
Na <sup>+</sup>		-2.1			-2
K <sup>+</sup>		-2.1			-2
Cs <sup>+</sup>			-6.6		
Ag <sup>+</sup>	1.4				1
Ph <sub>4</sub> As <sup>+</sup>		-21.2		-20.6	-21
Cl <sup>-</sup>	10.0	8.1			9
Br <sup>-</sup>	7.7	6.4			7
I <sup>-</sup>	2.5	3.3			3
N <sub>3</sub> <sup>-</sup>	6.5				7
SCN <sup>-</sup>	4.8				5
Pic <sup>-</sup>		-6.8			-7
BPh <sub>4</sub> <sup>-</sup>		-21.2		-20.6	-21

1,2-Ethanediol - References and Comments

1. M. Breant & J. Georges, Bull.Soc.Chim. France, **1972**, 381; ferrocene assumption, adjusted by adding +(-) 18.0 to cation (anion) values.
2. A.K. Das & K.K. Kundu, Indian J.Chem., **A16**, 467 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
3. S. Rondinini, S. Ardizzone, P. Longhi & T. Mussini, J.Electroanal.Chem., **89**, 59 (1978); assumptions concerning liquid junction potentials.
4. F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977; quoted by J.I. Kim, J.Phys.Chem., **82**, 191 (1978).

13-16, 16a, 17a.  $\Delta G_{\text{L}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

## 13. Solvent, S = Diethyl ether

Ref.	1
wt.	0
Li <sup>+</sup>	-244
Cl <sup>-</sup>	280

Diethyl ether - References and Comments

1. J.G. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.

## 14. Solvent, S = Anisole

Ref.	1
wt.	0
Li <sup>+</sup>	-232
Cl <sup>-</sup>	274

Anisole - References and Comments

1. J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.

## 15. Solvent, S = 1,2-Dimethoxyethane

Ref.	1	2	3	4
wt.	0.5	0.5	0.5	0.5
H <sup>+</sup>		0	6	
Na <sup>+</sup>				-5
K <sup>+</sup>				8
Rb <sup>+</sup>				20
Cs <sup>+</sup>				26
Ag <sup>+</sup>	-15	-15	-37	
Cl <sup>-</sup>		80		31
I <sup>-</sup>		51		

1,2-Dimethoxyethane - References and Comments

1. A. Caillet & G. Demange-Guerin, J.Electroanal.Chem., **40**, 69 (1972); ferrocene assumption.
2. J. Badoz-Lambling & J.C. Bardin, Electrochim.Acta, **19**, 725 (1973); ferrocene assumption.
3. D. Bauer & M. Breant, in Electroanalytical Chemistry, A.J. Bard, ed., Dekker, New York, Vol.8, pp.281 to 348, 1975; ferrocene assumption.
4. M.H. Abraham & A.F. Danil de Namor, J.Chem.Soc.Faraday Trans. 1, **74**, 2101 (1978), from data of J. Strong & T.R. Tuttle, Jr., J.Phys.Chem., **77**, 533 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

## 16. Solvent, S = Tetrahydrofuran

Ref.	1	2	3	4	5	6	7
wt.	0	0.5	0	0.5	0.5	0.5	0.2
H <sup>+</sup>			40	0			
Li <sup>+</sup>	-97						-28
Na <sup>+</sup>						-9	
K <sup>+</sup>						11	
Rb <sup>+</sup>						26	
Cs <sup>+</sup>						27	
Ag <sup>+</sup>		-14		-14	-38		
Cl <sup>-</sup>	176			69		30	
I <sup>-</sup>				40			

Tetrahydrofuran - References and Comments

1. J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.
2. A. Caillet & G. Demange-Guerin, J.Electroanal.Chem., **40**, 69 (1972); ferrocene assumption.
3. J.M. Nigretto & M. Jozefowicz, Electrochim.Acta, **18**, 145 (1973); from acidity scales.
4. J. Badoz-Lambling & J.C. Bardin, Electrochim.Acta, **19**, 725 (1974); ferrocene assumption.
5. D. Bauer & M. Breant, in Electroanalytical Chemistry, A.J. Bard, ed., Dekker, New York, Vol.8, pp.281 to 348, 1975; ferrocene assumption.
6. M.H. Abraham & A.F. Danil de Namor, J.Chem.Soc.Faraday Trans. 1, **74**, 2101 (1978), from data of J. Strong & T.R. Tuttle, Jr., J.Phys.Chem., **77**, 533 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
7. A.I. Mishustin, Zh.Fiz.Khim., **55**, 61 (1981); Russ.J.Phys.Chem., **55**, 33 (1981); from quadrupole relaxation times.

## 16a. Solvent, S = 1,2-Dioxane

Ref.	1
wt.	
Ph <sub>4</sub> As <sup>+</sup>	-15.7
BPh <sub>4</sub> <sup>-</sup>	-15.7

Reference and Comment

1. J.I. Kim, Z.Phys.Chem.N.F., **113**, 129 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

## 17a. Solvent, S = 4-Methyl-2-pentanone

Ref.	1	Ref.	1
wt.	0	wt.	0
Li <sup>+</sup>	-1.1	Br <sup>-</sup>	68.5
Na <sup>+</sup>	-8.6	I <sup>-</sup>	50.2
Ag <sup>+</sup>	-3.4	AgCl <sub>2</sub> <sup>-</sup>	42.2
Tl <sup>+</sup>	-10.4	AgBr <sub>2</sub> <sup>-</sup>	28.5
Cl <sup>-</sup>	81.6		

4-Methyl-2-pentanone - Reference and Comments

1. J.Y. Cabon, M. L'Her & J. Courtot-Coupez, J.Chem.Res.(S) **1981** 196, (M) **1981** 2433; ferrocene assumption.

Solvent, S = Acetone

17.  $\Delta G_C^\circ (X, H_2O \rightarrow S) / kJmol^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Selec-	
	0	0	0	0.5	1.0	0.5	0.2	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	0.5	ted
H <sup>+</sup>	19				-2.9														-24.4
Li <sup>+</sup>		-22																	
Na <sup>+</sup>	59		17		14.0				4.0										
K <sup>+</sup>	38		12		2.9	9.1			2.2		2								4
Rb <sup>+</sup>	44		11		2.1	7.9			-0.9										4
Cs <sup>+</sup>	25				1.7	7.8			-0.7										4
Ag <sup>+</sup>				17.4	6.3		12	12.1			11	8							9
Tl <sup>+</sup>										2.4									
Me <sub>4</sub> N <sup>+</sup>						4.4						3	3						3
Et <sub>4</sub> N <sup>+</sup>						-2.2													
Ph <sub>4</sub> As <sup>+</sup>				-35.1	-29.7	-33.3									-32.9	-33.1			-32.5
Hg <sub>2</sub> <sup>2+</sup>								8											
Hg <sub>2</sub> <sup>2+</sup>								6											
Cl <sup>-</sup>	19	54		47.7	58.6	55.4	53				57	57	57						57
Br <sup>-</sup>	19			32.8	43.9	40.4					44	42	42						42
I <sup>-</sup>	15			16.8	28.0	24.7	22				25	26	26						25
CN <sup>-</sup>				38.0	46.0							44		48.0					48
N <sub>3</sub> <sup>-</sup>																			43
ClO <sub>4</sub> <sup>-</sup>					15.1	10.4	-14												
BPh <sub>4</sub> <sup>-</sup>				-35.1	-29.7	-33.3									-32.9	-33.1			-32.5

Acetone - References and Comments

1. N.A. Izmailov, Doklady Akad. Nauk SSSR, 149, 1364 (1963); extrapolation method.
2. J.C. Lauer, Electrochim. Acta, 9, 1617 (1964); electrostatic calculation.
3. D. Bax, C.L. Deligny & A.C. Remijnse, Rec. Trav. Chim., 91, 1225 (1972); electrostatic calculation.
4. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Maghorne, J. Am. Chem. Soc., 94, 1148 (1972); negligible liquid junction potential assumption, adjusted by adding +(-) 3.7 to the cation (anion) values.
5. B.G. Cox, Ann. Rept. Chem. Soc., 70, 249 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
6. M.H. Abraham, J. Chem. Soc. Faraday Trans. 1, 69, 1375 (1973); assumption that  $\Delta G^\circ (Me_4N^+, H_2O \rightarrow Me_2CO) = 0$ , adjusted by adding +(-) 6.4 to cation (anion) values.
7. J. Radoz-Janabing & J.C. Bardin, Electrochim. Acta, 19, 725 (1974); ferrocene assumption.
8. B.G. Cox, A.J. Parker & W.E. Maghorne, J. Phys. Chem., 78, 1731 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
9. L.N. Balyatinskaya & T.V. Kurchenko, Zh. Obshchei Khim., 46, 1113 (1976); L.N. Balyatinskaya, Russ. Chem. Rev., 48, 418 (1979); ferrocene assumption.
10. G. Gritzner, Inorg. Chim. Acta, 24, 5 (1977); bis(biphenylchromium) assumption.
11. U. Mayer, Monatsch. Chem., 108, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding +(-) 9 to cation (anion) values.
12. A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, J. Org. Chem., 43, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
13. A.J. Parker, unpublished data, presented at RACI Org. Chem. Div. Conf., Hobart, Tasmania, 1979, Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
14. M.J. Blandamer, J. Burgess & A.J. Duffied, J. Chem. Soc. Dalton Trans., 1980, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
15. F. Koppold, Dipl. thesis, Tech. Univ. Munich, 1977, quoted in ref. 16; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
16. J.I. Kim, J. Phys. Chem., 82, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
17. A.I. Mishustin, Zh. Fiz. Khim., 55, 61 (1981); Russ. J. Phys. Chem., 55, 33 (1981); from quadrupole relaxation times.

18-23.  $\Delta G_{\text{f}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale

18. Solvent, S = Formic acid									25°C				
Ref.	1	2	3	4	5	6	7	8					
wt.	0	0	0	0	0	0	0	0					
H <sup>+</sup>	51	27	50		57		29	-45					
Li <sup>+</sup>	1		4		14	-3	-9	-5					
Na <sup>+</sup>	17		-15		10		-17	-23					
K <sup>+</sup>	10		17		17		-13						
Rb <sup>+</sup>	0		5	5	11		-22						
Cs <sup>+</sup>	-1		-4		8		-16						
Cu <sup>+</sup>	23												
Ag <sup>+</sup>	-10		-37		-4		-31	-15					
Ca <sup>2+</sup>	9		264		30		51						
Zn <sup>2+</sup>	23		16		41		-46						
Cd <sup>2+</sup>	17		84		32		-17						
Pb <sup>2+</sup>	-6												
Hg <sub>2</sub> <sup>2+</sup>	-9												
Cl <sup>-</sup>	-6		-18		-19	8	10	-12					
Br <sup>-</sup>	-2				-7		20						
I <sup>-</sup>	-4				-5		28						

Formic acid - References and Comments

- W.A. Pleskov, Usp.Khim., **16**, 254 (1947); assumption that  $\Delta G_{\text{f}}^{\circ}(\text{Rb}^{\text{T}}, \text{H}_2\text{O} \rightarrow \text{HCOOH})=0$ .
- H. Strehlow, Z.Electrochem., **56**, 827 (1952); from H<sub>0</sub> data.
- N.A. Izmailov, Zh.Fiz.Khim., **34**, 2414 (1960); from extrapolation method.
- H.M. Koepp, H. Wendt & H. Strehlow, Z.Electrochem., **64**, 483 (1960); from electrostatic calculation.
- N.A. Izmailov, Doklady Akad.Nauk SSSR, **149**, 1364 (1963); from extrapolation method.
- J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); from electrostatic calculation.
- B. Case & R. Parsons, Trans.Faraday Soc., **63**, 1224 (1967); from 'real' potentials.
- R. Sasinski, High Energy Batteries, Plenum, New York (1967); from half-cell e.m.f.'s.

## 20. Solvent, S = Trifluoroacetic acid, 25°C

Ref.	1	2	Ref.	1
wt.	0	0	wt.	0
H <sup>+</sup>	91		Cl <sup>-</sup>	5
K <sup>+</sup>		<36	I <sup>-</sup>	3
Ag <sup>+</sup>	46			

Trifluoroacetic acid - References & Comments

- J. Badoz-Lambling & J.C. Bardin, Electrochim.Acta, **19**, 725 (1974); ferrocene assumption.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, J.Org.Chem., **43**, 1843 (1978); electrostatic estimation.

19. Solvent, S = Acetic acid					25°C			
Ref.	1	2	3	4				
wt.	0	0	0	0				
H <sup>+</sup>		41						
Ag <sup>+</sup>		3	5					
Tl <sup>+</sup>		-1						
Hg <sup>2+</sup>							30	
Hg <sub>2</sub> <sup>2+</sup>							22	
Cl <sup>-</sup>	128							

Acetic acid - References and Comments

- J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.
- J.C. Touller, Thesis, Univ. of Paris, 1970; quoted in ref.3 below, with no indication of the assumption used.
- D. Bauer & M. Breant, in Electroanalytical Chemistry, A.J. Bard, ed., Dekker, New York, Vol.8, 281 (1975); ferrocene assumption.
- L.N. Balyatinskaya & T.V. Kurchenko, Zh. Obshchei Khim., **46**, 1113 (1967); L.N. Balyatinskaya, Russ.Chem.Rev., **48**, 418 (1979); ferrocene assumption.

21. Solvent, S =  $\gamma$ -Butyrolactone, 25°C

Ref.	1	Ref.	1
wt.	0.2	wt.	0.2
Li <sup>+</sup>	16.2	Rb <sup>+</sup>	2.9
Na <sup>+</sup>	8.9	Cs <sup>+</sup>	1.2
K <sup>+</sup>	4.1	Tl <sup>+</sup>	2.3

 $\gamma$ -Butyrolactone - Reference and Comments

- G. Gritzner, Inor.Chim.Acta, **24**, 5(1977); bisbiphenylchromium assumption.

## 22. Solvent, S = Ethyl acetate, 25°C

Ref.	1	Reference and Comment	
wt.	0.5		
Li <sup>+</sup>	-28.9	1. A.I. Mishustin, <u>Zh.Fiz.Khim.</u> , <b>55</b> , 61 (1981); <u>Russ.J.Phys.Chem.</u> , <b>55</b> , 33 (1981); from quadrupole relaxation times.	

## 23. Solvent, S = Ethylene carbonate, 40°C

Ref.	1	Ref.	1
wt.		wt.	
Ag <sup>+</sup>	10.8	Br <sup>-</sup>	28.8
Cl <sup>-</sup>	38.0	I <sup>-</sup>	18.0

Ethylene carbonate - Reference & Comments

- J.Y. Cabon, M. L'Her & J. Courtot-Coupez, J.Electroanal.Chem., **64**, 219 (1975); ferrocene assumption.

24.  $\Delta G_{tr}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C Solvent, S = Propylene carbonate

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12
H <sup>+</sup>								50				
Li <sup>+</sup>		26.6			22.2		23.8					
Na <sup>+</sup>		17.0			10.9		15.1					
K <sup>+</sup>	-1.1	7.8			3.3		5.9			2.5		
Rb <sup>+</sup>		-1.0			-5.4		-2.9					
Cs <sup>+</sup>		-10.2			-14.6		-12.1					
Ag <sup>+</sup>	-1.1	25.4	18.6	21.4	13.8	-11.7	15.9	18.6		15.9	22.1	
Tl <sup>+</sup>					8.4				14.4			
Me <sub>4</sub> N <sup>+</sup>												
Et <sub>4</sub> N <sup>+</sup>												
Pr <sub>4</sub> N <sup>+</sup>												
Bu <sub>4</sub> N <sup>+</sup>												
Ph <sub>4</sub> As <sup>+</sup>	-36.0			-40.8	-35.6		-35.6					
Cu <sup>2+</sup>												
Hg <sup>2+</sup>												
Hg <sub>2</sub> <sup>2+</sup>												
F <sup>-</sup>			54.8				56.1					
Cl <sup>-</sup>	58.8	35.5	40.2	36.9	42.3		37.7	39.7				40.8
Br <sup>-</sup>		27.6	29.4	26.0	32.6	35.1	29.7					28.8
I <sup>-</sup>	25.7	17.1	15.7	6.6	19.2		17.6	9.4				11.8
N <sub>3</sub> <sup>-</sup>					23.0	30.0						
CN <sup>-</sup>												
SCN <sup>-</sup>	3.4		8.3	4.3								
ClO <sub>4</sub> <sup>-</sup>								-7.7				
Pic <sup>-</sup>												
BPh <sub>4</sub> <sup>-</sup>	-34.8		-23.7	-40.8	-35.6		-35.6					-46.0

Propylene carbonate - References and Comments

1. A.J. Parker, *Chem.Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
2. M. Salomon, *J.Phys.Chem.*, **74**, 2519 (1970); electrostatic calculation, adjusted by adding +(-) 15.0 to cation (anion) values.
3. J. Courtot-Coupez, M. LeDemez, A. Laouean & C. Madec, *J.Electroanal.Chem.*, **29**, 21 (1971); ferrocene assumption, adjusted by adding +(-) 10.0 to cation (anion) values.
4. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption, adjusted by adding -(+) 0.9 to cation (anion) values.
5. B.G. Cox, *Ann.Rept.Chem.Soc.*, **70**, 249 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
6. B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
7. B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr.J.Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
8. J. Badoz-Lambling & J.C. Bardin, *Electrochim.Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 10.0 to cation (anion) values.
9. N. Matsuura & K. Umemoto, *Bull.Chem.Soc.Japan*, **47**, 1334 (1974); corrected  $\Delta G_{tr}^{\circ}$ (Rb<sup>+</sup>, H<sub>2</sub>O → CH<sub>3</sub>CHCH<sub>2</sub>O<sub>2</sub>CO) = 0 assumption.
10. D.A. Owensby, A.J. Parker & J.W. Diggle, *J.Am.Chem.Soc.*, **96**, 2682 (1974); J.W. Diggle & A.J. Parker, *Electrochim.Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
11. B.G. Cox, A.J. Parker & W.E. Waghorne, *J.Phys.Chem.*, **78**, 1731 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
12. M. L'Her, D. Morin-Bozec & J. Courtot-Coupez, *J.Electroanal.Chem.*, **61**, 99 (1975); ferrocene assumption, adjusted by adding +(-) 10.0 to cation (anion) values.

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24.  $\Delta G_{\text{t}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S}) / \text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = Propylene carbonate

Ref. wt.	13	14	15	16	17	18	19	20	21	22	23	24	Selected
H <sup>+</sup>													50
Li <sup>+</sup>		24.9					23.0						23.8
Na <sup>+</sup>		16.6					13.4			17.4			14.6
K <sup>+</sup>		9.0	5	3		3	5.5			9.4			5.3
Rb <sup>+</sup>		5.8					1.7			7.6			-1
Cs <sup>+</sup>		4.1					-1.6			5.9			-7
Ag <sup>+</sup>			18	16	22		18.0			22.9			18.8
Tl <sup>+</sup>		13.0								10.0		12.4	11.0
Me <sub>4</sub> N <sup>+</sup>							-11.2						-11
Et <sub>4</sub> N <sup>+</sup>							-12.9						-13
Pr <sub>4</sub> N <sup>+</sup>							-21.7						-22
Bu <sub>4</sub> N <sup>+</sup>							-31.3						-31
Ph <sub>4</sub> As <sup>+</sup>							-35.5				36.0		-36.0
Cu <sup>2+</sup>								74.9					(75)
Hg <sup>2+</sup>	26												
Hg <sub>2</sub> <sup>2+</sup>	16												
F <sup>-</sup>													56
Cl <sup>-</sup>			41	42		42	40.2			36.0			39.8
Br <sup>-</sup>			30				29.7						30.0
I <sup>-</sup>			13	12		12	14.3						13.7
N <sub>3</sub> <sup>-</sup>				29									27
CN <sup>-</sup>									36.1				36
SCN <sup>-</sup>			9										7.0
ClO <sub>4</sub> <sup>-</sup>							0.9						-3
Pic <sup>-</sup>										-6.3			-6
BPh <sub>4</sub> <sup>-</sup>							-35.5				36.0		-36.0

## Propylene carbonate - References and Comments

- L.N. Balyatinskaya & T.V. Kurchenko, *Zh.Obshchei Khim.*, **46**, 1113 (1976); L.N. Balyatinskaya, *Russ.Chem.Rev.*, **48**, 418 (1979); ferrocene assumption, adjusted by adding 10.0 to the values.
- G. Gritzner, *Inorg.Chim.Acta*, **24**, 5 (1977); bisbiphenylchromium assumption.
- U. Mayer, *Monatsh.Chem.*, **108**, 1479 (1977); adjusted by adding -(+) 7.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- T. Kakutani, J. Morihira, M. Senda, R. Takahashi & K. Matsumoto, *Bull.Chem.Soc.Japan*, **51**, 2847 (1978); from assumptions concerning redox couples.
- A.J. Parker, summarized results, presented at RACI Org.Chem.Div.Conf. Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- M.H. Abraham, *Monatsh.Chem.*, **110**, 517(1979); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, from  $\Delta H_{\text{t}}^{\circ}$  and estimate of  $\Delta S_{\text{t}}^{\circ}$ .
- J.F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.
- M.J. Blandamer, J. Burgess & A.J. Duffied, *J.Chem.Soc.Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- M.K. Chantooni, Jr., & I.M. Kolthoff, *J.Chem.Eng.Data*, **25**, 208 (1980); iAm<sub>3</sub>BuNBPh<sub>4</sub> assumption.
- F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977; quoted by J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- Y. Sasaki, M. Takizawa, K. Umamoto & N. Matsuura, *Bull.Chem.Soc.Japan*, **54**, 65 (1981); from halide values obtained from the literature, averaged over Cl<sup>-</sup>, Br<sup>-</sup> and I<sup>-</sup>.

25.  $\Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}$ ,  
mol dm<sup>-3</sup> scale, -33°C

Solvent, S = Ammonia

Ref.	1	2	3	4
wt.	0	0	0	0
H <sup>+</sup>	-96	-96	-90	-96
Li <sup>+</sup>	-26	-29	-17	-26
Na <sup>+</sup>	-13	-13	-10	-13
K <sup>+</sup>	-5	-6	0	
Rb <sup>+</sup>	0	9	6	
Cs <sup>+</sup>	-2	-6	0	
Cu <sup>+</sup>	-88			
Ag <sup>+</sup>	-93	-84	-89	-93
Ca <sup>2+</sup>	+13	+52	+32	+3
Cu <sup>2+</sup>	-106			
Zn <sup>2+</sup>	-73	-184	-79	
Cd <sup>2+</sup>	-76	-115	-62	
Hg <sup>2+</sup>	-105			
Hg <sub>2</sub> <sup>2+</sup>				
Pb <sup>2+</sup>	-52			
Cl <sup>-</sup>	-21	36	27	-31
Br <sup>-</sup>	-22	22	21	
I <sup>-</sup>	-8	8	3	

Ammonia - References and Comments

1. V.A. Pleskov, *Usp.Khim.*, **16**, 254 (1954); assumption that  $\Delta G_t^0(Rb^+, H_2O \rightarrow NH_3)=0$ .
2. N.A. Izmailov, *Zh.Fiz.Khim.*, **34**, 2414 (1960); extrapolation method.
3. N.A. Izmailov, *Doklady Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.
4. R. Sasinski, *High Energy Batteries*, Plenum, New York (1967); from half-cell e.m.f.'s.

26.  $\Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Hydrazine

Ref.	1	2	3	4
wt.	0	0	0	0
H <sup>+</sup>	-88	-75		-88
Li <sup>+</sup>	-15	-15		-15
Na <sup>+</sup>	-3	8		-3
K <sup>+</sup>	-1	8		
Rb <sup>+</sup>	0	10		
Ag <sup>+</sup>	-91	-75		-91
Ca <sup>2+</sup>	-6	+34		-6
Zn <sup>2+</sup>	-54	-34		
Cd <sup>2+</sup>	-59	-39		
Pb <sup>2+</sup>	-42			
Hg <sub>2</sub> <sup>2+</sup>			-41	
Cl <sup>-</sup>		4		
Br <sup>-</sup>		8		
I <sup>-</sup>		4		

Hydrazine - References and Comments

1. V.A. Pleskov, *Usp.Khim.*, **16**, 254 (1947); assumption that  $\Delta G_t^0(Rb^+, H_2O \rightarrow N_2H_4)=0$ .
2. N.A. Izmailov, *Dokl.Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.
3. L.N. Balatinskaya, *Russ.Chem.Rev.*, **48**, 418 (1979); attributed to ref. 1.
4. R. Sasinski, *High Energy Batteries*, Plenum, New York (1967); from half-cell e.m.f.'s.

Solvent, S = Formamide

27.  $\Delta G_{\text{e}}^{\circ}$  (X, H<sub>2</sub>O  $\rightarrow$  S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Selected
wt.	0	0	0	0	1.0	0	1.0	1.0	0.1	0.5	1.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0	0
H <sup>+</sup>	4			-14		-17														-7
Li <sup>+</sup>		2				-23					-9.6									-10
Na <sup>+</sup>						-14					-7.9									-8
K <sup>+</sup>						-6					-6.3									-4.3
Rb <sup>+</sup>		1				10					-5.4									-5
Cs <sup>+</sup>						-5.7					-7.5									-6.0
Ag <sup>+</sup>						-15.4					-15.5									-15.4
Ph <sub>4</sub> As <sup>+</sup>						-24.0					-23.8									-23.9
F <sup>-</sup>											24.7									25
Cl <sup>-</sup>			-4			13.1	50				13.8									13.7
Br <sup>-</sup>						10.3	39				11.3									10.7
I <sup>-</sup>						6.8	51				7.5									7.3
I <sub>3</sub> <sup>-</sup>											-6.8									-7
N <sub>3</sub> <sup>-</sup>											11.4									11
CN <sup>-</sup>											10.8									13.3
SCN <sup>-</sup>						4.0					5.1									7
ClO <sub>4</sub> <sup>-</sup>											14.2									12.3
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>																				-12
Pic <sup>-</sup>																				20
BPh <sub>4</sub> <sup>-</sup>						-24.0					-23.8									-7
																				-23.9

- Formamide - References and Comments
- H. Strehlow, *Z. Elektrochem.*, **56**, 827 (1952); estimated from H<sub>0</sub> data.
  - H.M. Koepp, H. Wendt & H. Strehlow, *Z. Elektrochem.*, **64**, 483 (1960); electrostatic calculation.
  - J.C. Lauer, *Electrochim. Acta*, **9**, 1617 (1964); electrostatic calculation.
  - H. Strehlow, in *Chemistry of Nonaqueous Solvents*, J.J. Lagowski, ed., Vol. 1, Chapter 4, 1966; Ferrocene assumption.
  - R. Alexander & A.J. Parker, *J. Am. Chem. Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - B. Case & R. Parsons, *Trans. Faraday Soc.*, **53**, 1224 (1957); from 'real' potentials. (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> and I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumptions.
  - R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J. Am. Chem. Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> and I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumptions.
  - A.J. Parker, *Chem. Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J. Am. Chem. Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
  - J.W. Diggle & A.J. Parker, *Electrochim. Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr. J. Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - J. Badoz-Lambing & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 4.5 to cation (anion) values.
  - D.A. Owensby, A.J. Parker & J.W. Diggle, *J. Am. Chem. Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - U. Mayer, *Monatsh. Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 5.0 to cation (anion) values.
  - A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J. Org. Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - A.J. Parker, summarized results, presented at RACI Org. Chem. Div. Conf., Hobart, Tasmania, 1979, Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - M.J. Blandamer, J. Burgess & A.J. Duffied, *J. Chem. Soc. Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - F. Koppold, Dipl. thesis, Tech. Univ. Munich, 1977; quoted by J.I. Kim, *J. Phys. Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
  - R. Sasinski, *High Energy Batteries*, Plenum, New York (1967); from half-cell e.m.f.'s.



28.  $\Delta G_{\text{t}}^{\circ} (X, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = N-Methylformamide

Ref.	1	2	3	4	5	6
wt.	0	0	0	0	0	1.0
Li <sup>+</sup>	6	2	-15			
Na <sup>+</sup>		1	-8			
K <sup>+</sup>		1	-8			
Rb <sup>+</sup>			-8			
Cs <sup>+</sup>		4	-7			
Ag <sup>+</sup>			-27	-15		
Me <sub>4</sub> N <sup>+</sup>			-3			
Pr <sub>4</sub> N <sup>+</sup>			-16			
Ph <sub>4</sub> As <sup>+</sup>						-33.2
Cl <sup>-</sup>	-9	11	21	21	21	
Br <sup>-</sup>			15	15	15	
ClO <sub>4</sub> <sup>-</sup>			2			
ReO <sub>4</sub> <sup>-</sup>			2			
BPh <sub>4</sub> <sup>-</sup>						-33.2

N-Methylformamide - References and Comments

1. J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.
2. M. Salomon, J.Phys.Chem., **73**, 3299 (1969); electrostatic calculation.
3. C.L. DeLigny, H.J.M. Denessen & M. Alfenaar, Rec.Trav.Chim., **90**, 1265 (1971); electrostatic calculation.
4. A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, J.Org.Chem., **43**, 1843 (1978); the value for Ag<sup>+</sup> is a priv. comm. from H. Schneider & C. Kalidas, but the assumption used was not stated.
5. A.J. Parker, summarized data, RACI Org. Chem.Div.Conf. Hobart, Tasmania, 1979; the source of the data (probably ref.3) not stated.
6. F. Koppold, Dipl.thesis, Tech.Univ. Munich 1977; quoted by J.I. Kim, J.Phys.Chem. **82**, 191 (1978).

29.  $\Delta G_{\text{t}}^{\circ} (X, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = N-Methylacetamide

Ref.	1
wt.	
H <sup>+</sup>	38.8

N-Methylacetamide - Reference and Comment

1. A.E. Pucci, Thesis, Univ. Paris, 1970; quoted by D. Bauer & M. Breant in Electroanalytical Chemistry, A.J. Bard, ed., Dekker, New York, Vol.8, 281 (1975); based probably on the ferrocene assumption.

30.  $\Delta G_{\text{t}}^{\circ} (X, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ ,  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = 2-Pyrrolidone

Ref.	1	2
wt.	0.5	0.5
H <sup>+</sup>		-35.4
Ag <sup>+</sup>		36.0
Cl <sup>-</sup>	41.2	
Br <sup>-</sup>	30.2	
I <sup>-</sup>	27.9	
SCN <sup>-</sup>	18.0	

2-Pyrrolidone - References and Comments

1. M. Breant & M. Porteix, Compt.Rend., **273**, 1069 (1971); ferrocene assumption.
2. J.L. Mouton & C. Sinicki, J.Electroanal. Chem., **48**, 285 (1973); ferrocene assumption.

31.  $\Delta G_{\text{L}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = N,N'-Dimethylformamide

Ref. wt.	1	2	3	4	5	6	7	8	9	10
H <sup>+</sup>								-14.3		-14.2
Li <sup>+</sup>	-9									-9.6
Na <sup>+</sup>							-10.0	-9.1		-10.5
K <sup>+</sup>		-11.4	-12.6	-12.5			-11.7	-9.7	-0.6	-9.6
Rb <sup>+</sup>							-10.5	-10.3		-10.0
Cs <sup>+</sup>		-10.8	-12.6	-12.5			-10.0	-9.1		-9.2
Ag <sup>+</sup>		-23.4	-24.5	-24.5	-23.4			-17.1	-13.1	-17.2
Tl <sup>+</sup>								-11.4		-11.7
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>										-8.4
Pr <sub>4</sub> N <sup>+</sup>										
Bu <sub>4</sub> N <sup>+</sup>										
Ph <sub>4</sub> As <sup>+</sup>		-37.1	-38.8	-38.8				-38.2	-38.8	-38.1
Cu <sup>2+</sup>										
Hg <sup>2+</sup>										
Hg <sub>2</sub> <sup>2+</sup>										
Cl <sup>-</sup>	22	50.2	51.4	51.4	51.4	51.3		46.2	41.7	46.0
Br <sup>-</sup>		38.8	39.9	39.4	39.4	39.7		34.8	30.2	30.1
I <sup>-</sup>		22.3	23.4	23.4	21.1	23.2		18.8	13.7	18.8
I <sub>3</sub> <sup>-</sup>			-24.0							
N <sub>3</sub> <sup>-</sup>			38.2							
CN <sup>-</sup>			43.9							
SCN <sup>-</sup>		21.1	22.3	22.2	19.4			16.6	12.6	16.3
ClO <sub>4</sub> <sup>-</sup>		1.1	2.3	8.5						0.4
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>			69.1							
Pic <sup>-</sup>		-8.6		-5.7					-12.6	
PBh <sub>4</sub> <sup>-</sup>		-37.1	-38.8	-38.8	-14.8			-38.2	-38.8	-38.1

N,N'-Dimethylformamide - References and Comments

1. J.C. Lauer, Electrochim.Acta, **9**, 1617 (1964); electrostatic calculation.
2. R. Alexander & A.J. Parker, J.Am.Chem.Soc., **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
3. R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, J.Am.Chem.Soc., **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> and I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumptions.
4. A.J. Parker, Chem.Rev., **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
5. J. Courtot-Coupez, M. Ledemez, A. Laouean & C. Madec, J.Electroanal.Chem., **29**, 21 (1971); ferrocene assumption, adjusted by adding +(-) 4.0 to cation (anion) values.
6. A.J. Parker, Pure Appl.Chem., **25**, 345 (1971); I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumption.
7. M. Breant & J.L. Sue, J.Electroanal.Chem., **40**, 89 (1972); ferrocene assumption, adjusted by adding +(-) 14.0 to cation (anion) values.
8. I.M. Kolthoff & M.K. Chantooni, Jr., J.Phys.Chem., **76**, 2024 (1972); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
9. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, J.Am.Chem.Soc., **94**, 1148 (1972); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
10. B.G. Cox, Ann.Rept.Chem.Soc., **70**, 249 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

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31.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = N,N'-Dimethylformamide

Ref. wt.	11	12	13	14	15	16	17	18	19	20
H <sup>+</sup>					-28.5		-20.5			
Li <sup>+</sup>								-9.6		
Na <sup>+</sup>		-7.6						-10.5		-10.4
K <sup>+</sup>		-6.6		-9.2				-9.6		-8.4
Rb <sup>+</sup>		-7.4						-10.0		
Cs <sup>+</sup>								-9.2		
Ag <sup>+</sup>	-41.8			17.2			-20.5	-17.2		
Tl <sup>+</sup>						-9.9				-13.1
Me <sub>4</sub> N <sup>+</sup>		-5.5								
Et <sub>4</sub> N <sup>+</sup>		-7.6						-8.4		
Pr <sub>4</sub> N <sup>+</sup>		-17.3								
Bu <sub>4</sub> N <sup>+</sup>								-28.4		
Ph <sub>4</sub> As <sup>+</sup>		-38.1						-38.1		
Cu <sup>2+</sup>										
Hg <sup>2+</sup>									-59	
Hg <sub>2</sub> <sup>2+</sup>									-43	
F <sup>-</sup>								51.0		
Cl <sup>-</sup>		46.5					49.1	46.0		
Br <sup>-</sup>	35.1	34.8						30.1		
I <sup>-</sup>		18.2					21.1	18.8		
I <sub>3</sub> <sup>-</sup>										
N <sub>3</sub> <sup>-</sup>			33.9					34.3		
CN <sup>-</sup>										
SCN <sup>-</sup>								16.3		
ClO <sub>4</sub> <sup>-</sup>		4.9					7.4	0.4		
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>								61.5		
Pic <sup>-</sup>										
BPh <sub>4</sub> <sup>-</sup>		-38.1						-38.1		

N,N'-Dimethylformamide - References and Comments

11. B.G. Cox & A.J. Parker, *J. Am. Chem. Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
12. M.H. Abraham, *J. Chem. Soc. Faraday Trans. 1*, **69**, 1375 (1973); assumption that  $\Delta G_{\text{t}}^{\circ}(\text{Me}_4\text{N}^+, \text{H}_2\text{O} \rightarrow \text{CHON}(\text{CH}_3)_2) = 0$ , adjusted by adding -(+) 5.5 to cation (anion) values.
13. B.G. Cox & A.J. Parker, *J. Am. Chem. Soc.*, **95**, 408 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
14. D.A. Owensby, A.J. Parker & J.W. Diggle, *J. Am. Chem. Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
15. O. Popovych, *Anal. Chem.*, **46**, 2009 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
16. N. Matsuura & K. Umemoto, *Bull. Chem. Soc. Japan*, **47**, 1334 (1974); corrected  $\Delta G_{\text{t}}^{\circ}(\text{Rb}^+, \text{H}_2\text{O} \rightarrow \text{CHON}(\text{CH}_3)_2) = 0$  assumption.
17. J. Badoz-Lambling & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 8.0 to cation (anion) values.
18. B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr. J. Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
19. L.N. Balyatinskaya & T.V. Kurchenko, *Zh. Obshchei Khim.*, **46**, 1113 (1976); L.N. Balyatinskaya, *Russ. Chem. Rev.*, **48**, 418 (1979); ferrocene assumption.
20. G. Gritzner, *Inorg. Chim. Acta*, **24**, 5 (1977); bisdiphenylchromium assumption.

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31.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = N,N'-Dimethylformamide

Ref. wt.	21	22	23	24	25	26	27	28	29	30	31	32	Selected
H <sup>+</sup>											-3.7		-18
Li <sup>+</sup>									-10.9	-49.2			-10
Na <sup>+</sup>													-9.6
K <sup>+</sup>	-13.5	-9		-9									-10.3
Rb <sup>+</sup>													-9.7
Cs <sup>+</sup>													-10.8
Ag <sup>+</sup>	-20.7	-17	-12										-20.8
Tl <sup>+</sup>												-10.5	-11.5
Me <sub>4</sub> N <sup>+</sup>		-5		-5									-5.3
Et <sub>4</sub> N <sup>+</sup>													-8.0
Pr <sub>4</sub> N <sup>+</sup>													-17
Bu <sub>4</sub> N <sup>+</sup>													-29
Ph <sub>4</sub> As <sup>+</sup>								-39.3	-39.1				-38.5
Cu <sup>2+</sup>					-18								(-18)
Hg <sup>2+</sup>													
Hg <sub>2</sub> <sup>2+</sup>													
F <sup>-</sup>													51
Cl <sup>-</sup>	48.9	46		46									48.3
Br <sup>-</sup>	37.6	34		34									36.2
I <sup>-</sup>	20.6	18		18									20.4
I <sub>3</sub> <sup>-</sup>													-27
N <sub>3</sub> <sup>-</sup>													36
CN <sup>-</sup>							36.1						40
SCN <sup>-</sup>		16											18.4
ClO <sub>4</sub> <sup>-</sup>													4
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>													65
Pic <sup>-</sup>													-7
BPh <sub>4</sub> <sup>-</sup>								-39.3	-39.1				-38.5

N,N'-Dimethylformamide - References and Comments

- U. Mayer, *Monatsh.Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 10.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- T. Kakutani, Y. Morihiro, M. Senda, R. Takahashi & K. Matsumoto, *Bull.Chem.Soc.Japan*, **51**, 2847 (1978); from assumptions concerning redox couples.
- A.J. Parker, summarized results, RACI-Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.
- M.J. Blandamer, J. Burgess & A.J. Duffied, *J.Chem.Soc.Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977; quoted in ref.28; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.I. Mishustin, A.I. Podkovrin & Yu.M. Kessler, *Doklady Akad.Nauk SSSR*, **245**, 1420 (1979); from n.m.r. data assumed by the authors to be consistent with the Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.I. Mishustin, *Zh.Fiz.Khim.*, **55**, 61(1981); *Russ.J.Phys.Chem.*, **55**, 33 (1981); from quadrupole relaxation times.
- V.V. Aleksandrov & A.V. Kravchina, *Zh.Fiz.Khim.*, **54**, 1975 (1980); *Russ.J.Phys.Chem.*, **54**, 1124 (1980); from assumption concerning surface potential.
- Y. Sasaki, M. Takizawa, K. Umamoto & N. Matsuura, *Bull.Chem.Soc.Japan*, **54**, 65 (1981); from halide values obtained from the literature, averaged over Cl<sup>-</sup>, Br<sup>-</sup>, and I<sup>-</sup>.

Note: Table 32 for solvent N,N'-Diethylformamide is printed on the following page

33.  $\Delta G_C^0$  (X, H<sub>2</sub>O  $\rightarrow$  S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Solvent, S = N,N'-Dimethylacetamide

Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
wL <sup>+</sup>	1.0	1.0	1.0	0.2	0.5	0.2	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.5
Li <sup>+</sup>																	
Na <sup>+</sup>																	
K <sup>+</sup>				-5.7		-12				-13.0	-11.4						-54
Rb <sup>+</sup>																	
Cs <sup>+</sup>																	
Ag <sup>+</sup>																	
Ph <sub>4</sub> As <sup>+</sup>																	
Cl <sup>-</sup>																	
Br <sup>-</sup>																	
I <sup>-</sup>																	
I <sub>3</sub> <sup>-</sup>																	
N <sub>3</sub> <sup>-</sup>																	
SCN <sup>-</sup>																	
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>																	
ClO <sub>4</sub> <sup>-</sup>																	
BPh <sub>4</sub> <sup>-</sup>																	

#### Dimethylacetamide - References and Comments

- R. Alexander & A.J. Parker, *J. Am. Chem. Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J. Am. Chem. Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, *Chem. Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R. Alexander, A.J. Parker, J.H. Sharp & W.E. Wagborne, *J. Am. Chem. Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
- M. Breatant & J. Georges, *Bull. Soc. Chim. France*, 1972, 381; ferrocene assumption, adjusted by adding +(-) 4.0 to cation (anion) values.
- M. Breatant & J.J. Sue, *J. Electroanal. Chem.*, **40**, 89 (1972); ferrocene assumption, adjusted by adding + 15.0 to the cation values.
- J.W. Diggle & A.J. Parker, *Electrochim. Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J. Badoz-Lambling & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 4.0 to cation (anion) values.
- D.A. Owensby, A.J. Parker & J.W. Diggle, *J. Am. Chem. Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- G. Clune, W.E. Wagborne & B.G. Cox, *J. Chem. Soc. Faraday Trans. 1*, **72**, 1294 (1976); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- G. Gritzner, *Inorg. Chim. Acta*, **24**, 5 (1977); bisdiphenylchromium assumption.
- U. Mayer, *Monatsh. Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 11.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J. Org. Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, summarized results, presented at RACI Org. Chem. Div. Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- F. Koppold, Dipl. thesis, Tech. Univ. Munich, 1977; quoted in ref. 16; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.I. Kim, *J. Phys. Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.I. Mishustin, *Zh. Fiz. Khim.*, **55**, 61 (1981); *Russ. J. Phys. Chem.*, **55**, 33 (1981); from quadrupole relaxation times.

32.  $\Delta G_{\text{L}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = N,N'-Diethylformamide

Ref. wt.	1
Li <sup>+</sup>	-26.3
Na <sup>+</sup>	-12.4
K <sup>+</sup>	-10.3
Rb <sup>+</sup>	-7.7
Cs <sup>+</sup>	-9.4

N,N'-Diethylformamide - Reference and Comment

1. G. Gritzner, Inorg.Chim.Acta, 24, 5 (1977); bis(diphenyl)chromium assumption.

*Note: Table 33 for solvent N,N'-Dimethylacetamide is printed on the preceding page*

34.  $\Delta G_{\text{L}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = N,N'-Dimethylthioformamide

Ref. wt.	1	2	3	4	5	6	Selected
	0.1	0.5	1.0	0.5	0.5	1.0	
Li <sup>+</sup>	54.5				56.9		55
Na <sup>+</sup>	39.7				39.0		39
K <sup>+</sup>	26.8	26.8		25.2		28	27
Cs <sup>+</sup>	14.2						14
Ag <sup>+</sup>	-104.2	-99.6	-102.9	-101.4			-102
Tl <sup>+</sup>	-15.5				-15.8		-16

Dimethylthioformamide - References and Comments

1. R. Alexander, D.A. Owensby, A.J. Parker & W.E. Waghorne, Austr.J.Chem., 27, 933 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
2. D.A. Owensby, A.J. Parker & J.W. Diggle, J.Am.Chem.Soc., 96, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
3. G. Clune, W.E. Waghorne & B.G. Cox, J.Chem.Soc. Faraday Trans. 1, 72, 1294 (1976); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
4. U. Mayer, Monatsh.Chem., 108, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -4.0 to cation values.
5. G. Gritzner, Inorg.Chim.Acta, 24, 5 (1977); adjusted by adding +5.0 to cation values.
6. A.J. Parker, summarized results, RACI Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

35.  $\Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Ref. wt.	Solvent, S = N-Methylpyrrolidone																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Selected
	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	
H <sup>+</sup>			-25.0	-25.0	-25.0					-25.0								-25
Li <sup>+</sup>			-35.2	-35.2														-35
Na <sup>+</sup>			-13.0	-13.0	-10.7				-16.3		-20.1							-15
K <sup>+</sup>			-9.5	-9.5	-9.5				-13.8		-8.4		-10.5	-10				-11
Rb <sup>+</sup>			-7.3	-7.3	-9.5				-9.5		-7.7							-8
Cs <sup>+</sup>					-10.1						-8.4							-10
Ag <sup>+</sup>	-34.2		-24.4	-24.4			-20.0	-30.1		-23.8	-30.1		-23.7	-24				-26
Tl <sup>+</sup>										-15.0								-15
NH <sub>4</sub> <sup>+</sup>			-24.4	-24.4														-24
Me <sub>4</sub> N <sup>+</sup>			-3.3	-3.3										-3				-3
Ph <sub>4</sub> As <sup>+</sup>							-44.5	-39.7								-41.7	-38.9	-40
Cl <sup>-</sup>	60.5	60.5	50.6	50.6			45.1	55.2	48.9			53.1	49	49				51
Br <sup>-</sup>	46.8	46.8	37.5	37.5			30.8	40.6				39.2	35	35				37
I <sup>-</sup>	25.7	25.7	19.8	19.8			14.3	24.3	18.1			17.8	18	18				19
N <sub>3</sub> <sup>-</sup>	46.2	46.3											41					46
SCN <sup>-</sup>	23.4	23.3	14.7	14.7			16.0			-12.1			19					18
ClO <sub>4</sub> <sup>-</sup>																		-12
BPh <sub>4</sub> <sup>-</sup>			-33.3	-33.3			-44.5	-39.7								-41.7	-38.9	-40

## N-Methylpyrrolidone - References and Comments

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- J. Badoz-Lambaling & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 11.0 to cation (anion) values.
- D.A. Owensby, A.J. Parker & J.W. Diggle, *J. Am. Chem. Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- G. Gritzner, *Inorg. Chim. Acta*, **24**, 5 (1977); bisbiphenylchromium assumption.
- U. Mayer, *Monatsh. Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding +(-) 7.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J. Org. Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, summarized results, RACI-Org. Chem. Div. Conf., Hobart, Tasmania, 1970; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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- J.I. Kim, *J. Phys. Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

Note: Table 36 for solvent *N*-Methylthiopyrrolidone is printed after Table 37

37.  $\Delta G_{\text{t}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C Solvent, S = Acetonitrile

Ref. wt.	1	2	3	4	5	6	7	8	9	10
H <sup>+</sup>	24	11	15	31		39	15	11		
Li <sup>+</sup>	-2			10	-9			4		
Na <sup>+</sup>	9			14				-3		
K <sup>+</sup>	1			8				-11	20.0	28.9
Rb <sup>+</sup>	0			9				-12		
Cs <sup>+</sup>	1			6				-11	16.0	
Cu <sup>+</sup>	-46							-75		
Ag <sup>+</sup>	-31			-17		-28		-43	-23.4	
Tl <sup>+</sup>										
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>										
Pr <sub>4</sub> N <sup>+</sup>										
Bu <sub>4</sub> N <sup>+</sup>										
Ph <sub>4</sub> As <sup>+</sup>									-32.5	
Ca <sup>2+</sup>	25			45				50		
Cu <sup>2+</sup>	-53							-94		
Zn <sup>2+</sup>	26			44				29		
Cd <sup>2+</sup>	17			35				12		
Hg <sup>2+</sup>	-34									
Hg <sub>2</sub> <sup>2+</sup>										
Pb <sup>2+</sup>	25							26		
Cl <sup>-</sup>	-51			46	22			62	48.0	42.6
Br <sup>-</sup>	-34			29				44	33.7	31.7
I <sup>-</sup>	-21			13				32	20.0	18.6
I <sub>3</sub> <sup>-</sup>										
N <sub>3</sub> <sup>-</sup>										
CN <sup>-</sup>										
SCN <sup>-</sup>									19.4	15.2
NO <sub>3</sub> <sup>-</sup>										20.9
ClO <sub>4</sub> <sup>-</sup>										2.6
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>										
Pic <sup>-</sup>									-5.7	-4.2
BPh <sub>4</sub> <sup>-</sup>										

#### Acetonitrile - References and Comments

1. V.A. Pleskov, *Usp.Khim.*, **16**, 254 (1947); assumption that  $\Delta G_{\text{t}}^{\circ}(\text{Rb}^+, \text{H}_2\text{O} + \text{CH}_3\text{CN}) = 0$ .
2. H. Strehlow, *Z.Elektrochem.*, **56**, 827 (1952); from H<sub>0</sub> data.
3. H.M. Koepf, H. Wendt & H. Strehlow, *Z.Elektrochem.*, **64**, 483 (1960), ferrocene assumption.
4. N.A. Izmailov, *Doklady Akad.Nauk SSSR*, **149**, 1364 (1963); extrapolation method.
5. J.C. Lauer, *Electrochim.Acta*, **9**, 1617 (1964); electrostatic calculation.
6. I.M. Kolthoff & F.G. Thomas, *J.Phys.Chem.*, **69**, 3049 (1965); tris-*o*-phenantroline iron assumption; adjusted by adding 10.0 to values (see ref. 10).
7. H. Strehlow, in *Chemistry of Nonaqueous Solvents*, J.J. Lagowski, ed., Vol. **1**, Chap. 4, 1966, ferrocene assumption.
8. B. Case & R. Parsons, *Trans.Faraday Soc.*, **63**, 1224 (1967); from 'real' potentials.
9. R. Alexander & A.J. Parker, *J.Am.Chem.Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
10. J.F. Coetzee & J.J. Campion, *J.Am.Chem.Soc.*, **89**, 2513, 2517 (1967); tris-*o*-phenantroline iron assumption, adjusted by adding +(-) 10.0 to cation (anion) values.

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37.  $\Delta G_{\text{t}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S}) / \text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Acetonitrile

Ref. wt.	11	12	13	14	15	16	17	18	19	20
H <sup>+</sup>									46.2	46.4
Li <sup>+</sup>							39			29.7
Na <sup>+</sup>							29		13.7	13.8
K <sup>+</sup>	-0.6	4.0	4.6	12.0		18.3	20	6.8	8.0	7.9
Rb <sup>+</sup>							17	5.7	6.8	6.7
Cs <sup>+</sup>	-1.1	1.1						4.2	5.1	5.0
Cu <sup>+</sup>										
Ag <sup>+</sup>	-31.4	-31.4		-23.4	-26.2	-17.1			-21.7	-21.8
Tl <sup>+</sup>				3.4				11.4	9.1	9.2
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>										-8.8
Pr <sub>4</sub> N <sup>+</sup>										
Bu <sub>4</sub> N <sup>+</sup>	-29.7	-29.7								
Ph <sub>4</sub> As <sup>+</sup>	-32.5	-32.5	-30.8			-37.1		-32.3	-32.5	-32.6
Ca <sup>2+</sup>										
Cu <sup>2+</sup>										
Zn <sup>2+</sup>										
Cd <sup>2+</sup>										
Hg <sup>2+</sup>										
Hg <sub>2</sub> <sup>2+</sup>										
Pb <sup>2+</sup>										
Cl <sup>-</sup>	50.2	50.3	42.8		42.8	36.5	33	41.7	42.2	42.3
Br <sup>-</sup>	36.0	36.0	32.0		32.5	22.3	22	32.0	32.0	31.8
I <sup>-</sup>	22.3	22.3	18.9		17.1	8.6	9	18.7	18.8	18.8
I <sub>3</sub> <sup>-</sup>	-14.8									
N <sub>3</sub> <sup>-</sup>	37.1	37.1								29.3
CN <sup>-</sup>										
SCN <sup>-</sup>	21.7	21.6			14.8	8.0		14.7	12.6	
NO <sub>3</sub> <sup>-</sup>								20.4	21.1	
ClO <sub>4</sub> <sup>-</sup>								2.5	4.6	4.6
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>	61.1	61.1								
Pic <sup>-</sup>		2.9	-4.0			-10.3		-2.1	-1.7	
BPh <sub>4</sub> <sup>-</sup>	-32.5	-32.5	-30.8		-6.9	-32.5		-32.3	-32.5	-32.6

## Acetonitrile - References and Comments

- R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J.Am.Chem.Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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37.  $\Delta G_{\text{L}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Acetonitrile

Ref. wt.	21 0.5	22 0.1	23 1.0	24 1.0	25 0.5	26 0.5	27 0.5	28 0.5	29 0.5	30 0.5
H <sup>+</sup>			46.4					46.8		
Li <sup>+</sup>	31.0		29.7							
Na <sup>+</sup>	18.8		13.8			16.7				
K <sup>+</sup>	12.1		7.9		9.6		9.6			3.5
Rb <sup>+</sup>	10.2		6.7							
Cs <sup>+</sup>			5.0							
Cu <sup>+</sup>										
Ag <sup>+</sup>			-21.8		-21.8	-19.2	-21.8	-22.8		-23.3
Tl <sup>+</sup>			9.2		9.2		9.2			
Me <sub>4</sub> N <sup>+</sup>	2.1									
Et <sub>4</sub> N <sup>+</sup>	-3.9		-8.8							
Pr <sub>4</sub> N <sup>+</sup>	-13.4									
Bu <sub>4</sub> N <sup>+</sup>			-33.1							
Ph <sub>4</sub> As <sup>+</sup>	-32.6	-45.2	-32.6							
Ca <sup>2+</sup>										
Cu <sup>2+</sup>										
Zn <sup>2+</sup>										
Cd <sup>2+</sup>										
Hg <sup>2+</sup>									18	
Hg <sub>2</sub> <sup>2+</sup>									51	
Pb <sup>2+</sup>										
Cl <sup>-</sup>	39.3		42.3			36.8		42.2		42.8
Br <sup>-</sup>	27.2	26.8	31.8							30.8
I <sup>-</sup>	13.9		18.8					14.3		14.8
I <sub>3</sub> <sup>-</sup>										
N <sub>3</sub> <sup>-</sup>			30.5	29.3						
CN <sup>-</sup>										
SCN <sup>-</sup>										
NO <sub>3</sub> <sup>-</sup>										
ClO <sub>4</sub> <sup>-</sup>	0.8		4.6					-10.7		
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>										
Pic <sup>-</sup>										
BPh <sub>4</sub> <sup>-</sup>	-32.6		-32.6							

## Acetonitrile - References and Comments

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- B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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- L.N. Balyatinskaya & T.V. Kurchenko, *Zh.Obshchei Khim.*, **46**, 1113 (1976); L.N. Balyatinskaya, *Russ.Chem.Rev.*, **48**, 418 (1979); ferrocene assumption.
- U. Mayer, *Monatsh.Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 9 to cation (anion) values.

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37.  $\Delta G_{\text{t}}^{\circ}$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C Solvent, S = Acetonitrile

Ref. wt.	31	32	33	34	35	36	37	38	39	40	41	42	43	Selected
H <sup>+</sup>											13.5			46.4
Li <sup>+</sup>									18.4		-12.5	15.7	21.6	25
Na <sup>+</sup>											-1.9		13.6	15.1
K <sup>+</sup>		10		10									4.4	8.1
Rb <sup>+</sup>														6.3
Cs <sup>+</sup>														6.0
Cu <sup>+</sup>					-48									(-48)
Ag <sup>+</sup>	-22	-19									41.5		8.4	-23.2
Tl <sup>+</sup>													4.4	8.0
Me <sub>4</sub> N <sup>+</sup>		3		3										3
Et <sub>4</sub> N <sup>+</sup>														-7
Pr <sub>4</sub> N <sup>+</sup>														-13
Bu <sub>4</sub> N <sup>+</sup>														-31
Ph <sub>4</sub> As <sup>+</sup>							-34.1	-33.3						-32.8
Ca <sup>2+</sup>														
Cu <sup>2+</sup>					59									(59)
La <sup>3+</sup>										>88				
F <sup>-</sup>										70.7				(71)
Cl <sup>-</sup>		42		42									41.8	42.1
Br <sup>-</sup>		31		31									29.8	31.3
I <sup>-</sup>		14		14									13.8	16.8
I <sub>3</sub> <sup>-</sup>	-14.8													-15
N <sub>3</sub> <sup>-</sup>		29												37
CN <sup>-</sup>						34.9								35
SCN <sup>-</sup>		13												14.4
NO <sub>3</sub> <sup>-</sup>														21
ClO <sub>4</sub> <sup>-</sup>														2
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>														61
Pic <sup>-</sup>														-4
BPh <sub>4</sub> <sup>-</sup>							-34.1	-33.3						-32.4

31. R.L. Benoit, M.F. Wilson & S.Y. Lam, *Can.J.Chem.*, **55**, 792 (1977); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption (from ref. 11).
32. A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
33. T. Kakutani, Y. Morihiro, M. Senda, R. Takahashi & K. Matsumoto, *Bull.Chem.Soc.Japan*, **51**, 2847 (1978); from redox electrode potential measurements.
34. A.J. Parker, unpublished summarizing results, presented at RACI-Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
35. J.F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.
36. M.J. Blandamer, J. Burgess & A.J. Duffied, *J.Chem.Soc.Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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38. J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
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43. J.Y. Cabon, M. L'Her & J. Courtot-Coupez, *J.Chem.Res. (S)* **1981**, 196, (M) **1981**, 2433.

$$36. \Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ\text{C}$$

Solvent, S = N-Methylthiopyrrolidone

Ref.	1
wt.	
Li <sup>+</sup>	46.1
Na <sup>+</sup>	30.1
K <sup>+</sup>	24.4
Rb <sup>+</sup>	19.3
Tl <sup>+</sup>	-22.7

N-Methylthiopyrrolidone - Reference and Comment

1. G. Gritzner, Inorg.Chim.Acta, 24, 5 (1977); bis(biphenyl)chromium assumption.

*Note: Table 37 for solvent Acetonitrile is printed on the preceding pages*

$$38. \Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ\text{C}$$

Solvent, S = Propionitrile

Ref.	1	2
wt.	0	0.2
Li <sup>+</sup>	36	
Na <sup>+</sup>	26	
Rb <sup>+</sup>	16	
Ag <sup>+</sup>		-8.4
Cl <sup>-</sup>		39.7
Br <sup>-</sup>		29.3
I <sup>-</sup>		14.6

Propionitrile - References and Comments

1. D. Bax, C.L. DeLigny & A.C. Remijnse, Rec.Trav.Chim., 91, 1225 (1972); electrostatic calculation.
2. M. Salomon & B.K. Stevenson, J.Phys.Chem., 77, 3002 (1973); assumption that  $[\Delta G_t^0(\text{AgCl}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{CN}) + \Delta G_t^0(\text{AgBr}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{CN})] = 0$ .

$$39. \Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ\text{C}$$

Solvent, S =  $\alpha$ -Methylpropionitrile

Ref.	1
wt.	0
Na <sup>+</sup>	28
K <sup>+</sup>	21
Rb <sup>+</sup>	18

$\alpha$ -Methylpropionitrile - Reference and Comment

1. D. Bax, C.L. De Ligny & A.C. Remijnse, Rec.Trav.Chim., 91, 1225 (1972); electrostatic calculation.

$$40. \Delta G_t^0 (X, H_2O \rightarrow S)/kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ\text{C}$$

Solvent, S = Benzonitrile

Ref.	1	2
wt.	0	0.2
Li <sup>+</sup>	44	36.5
Na <sup>+</sup>	32	20.5
K <sup>+</sup>		13.8
Rb <sup>+</sup>	19	10.6
Cs <sup>+</sup>		9.9

Benzonitrile - References and Comments

1. D. Bax, C.L. DeLigny & A.C. Remijnse, Rec.Trav.Chim., 91, 1225 (1972); electrostatic calculation.
2. G. Gritzner, Inorg.Chim.Acta, 24, 5 (1977); bis(biphenyl)chromium assumption.

41.  $\Delta G_{\text{t}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = Nitromethane

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12
H <sup>+</sup>												
Li <sup>+</sup>		-7								50.4		
Na <sup>+</sup>										26.4		
K <sup>+</sup>						12.7				9.3	24.3	
Rb <sup>+</sup>										4.7		
Cs <sup>+</sup>										0.7		
Ag <sup>+</sup>			14.3	14.3	12.7	17.8	23.8	0.8		25.3	23.8	14.3
Tl <sup>+</sup>												
Me <sub>4</sub> N <sup>+</sup>												
Ph <sub>4</sub> As <sup>+</sup>						-52.4						
Hg <sup>2+</sup>												
Hg <sub>2</sub> <sup>2+</sup>												
Cl <sup>-</sup>		20	42.2	42.3	42.7	40.4				39.8		42.2
Br <sup>-</sup>					30.7	37.0		30.1		28.4		
I <sup>-</sup>			23.4	23.4	17.0	20.4				23.2		23.4
N <sub>3</sub> <sup>-</sup>			36.5						26.8			
SCN <sup>-</sup>			20.5	20.5	17.0	17.6				14.7		20.5
ClO <sub>4</sub> <sup>-</sup>										-4.7		
ReO <sub>4</sub> <sup>-</sup>	13.0											
BPh <sub>4</sub> <sup>-</sup>					-12.1	-21.2				-1.3		

## Nitromethane - References and Comments

1. Calculated by compiler, Y. Marcus, unpublished results, 1980, from data of H.L. Friedman & G.R. Haugen, *J.Am.Chem.Soc.*, **76**, 2060 (1954); G.R. Haugen & H.L. Friedman, *J.Phys.Chem.*, **60**, 1363 (1956); G.R. Haugen & H.L. Friedman, *J.Phys.Chem.*, **67**, 1757 (1963) and data for alkali cations, ref. 10 below.
2. J.C. Lauer, *Electrochim.Acta*, **9**, 1617 (1964); electrostatic calculation.
3. R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J.Am.Chem.Soc.*, **90**, 5049 (1968); nominally Ph<sub>4</sub>AsBPh<sub>4</sub> assumption (but with no data for Ph<sub>4</sub>As<sup>+</sup> or BPh<sub>4</sub><sup>-</sup>!).
4. A.J. Parker, *Chem.Rev.*, **69**, 1 (1969); nominally Ph<sub>4</sub>AsBPh<sub>4</sub> assumption; see ref.3.
5. J. Courtot-Coupez, M. LeDemez, A. Laouean & C. Madec, *J.Electroanal.Chem.*, **29**, 21 (1971); ferrocene assumption, adjusted by adding +(-) 7.0 to cation (anion) values.
6. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption, adjusted by adding +(-) 17.0 to cation (anion) values.
7. J.W. Diggle & A.J. Parker, *Electrochim.Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, but see ref. 3.
8. B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, but see ref. 3.
9. B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 408 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, but see ref. 3.
10. J. Badoz-Lambling & J.C. Bardin, *Electrochim.Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 7.0 to cation (anion) values.
11. D.A. Owensby, A.J. Parker & J.W. Diggle, *J.Am.Chem.Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, but see ref. 3.
12. B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr.J.Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, but see ref. 3.

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41.  $\Delta G_{\text{f}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C  
mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Nitromethane

Solvent, S = Nitromethane

Ref. wt.	13	14	15	16	17	18	19	Selected	Nitromethane - References and Comments	
H <sup>+</sup>	>93									13. D. Bauer & M. Breant, in <i>Electroanalytical Chemistry</i> , A.J. Bard, ed., Dekker, New York, Vol.8, pp.281-348 (1975); ferrocene assumption, adjusted by adding 7.0 to values.
Li <sup>+</sup>							45	(48)		
Na <sup>+</sup>								(26)		
K <sup>+</sup>				17	22	22		19		
Rb <sup>+</sup>								(5)		14. L.N. Balyatinskaya & T.V. Kurchenko, <i>Zh.Obschei Khim.</i> , <b>46</b> , 1113 (1976); L.N. Balyatinskaya, <i>Russ.Chem.Rev.</i> , <b>48</b> , 418 (1979); ferrocene assumption.
Cs <sup>+</sup>								(1)		
Ag <sup>+</sup>	25.3			22	26			21		
Tl <sup>+</sup>			15.9							15. G. Gritzner, <i>Inorg.Chim.Acta</i> , <b>24</b> , 5 (1977); bis(biphenyl)-chromium assumption.
Me <sub>4</sub> N <sup>+</sup>					1	1				16. U. Mayer, <i>Monatsh.Chem.</i> , <b>108</b> , 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -10 to values.
Ph <sub>4</sub> As <sup>+</sup>										
Hg <sup>2+</sup>		26								
Hg <sub>2</sub> <sup>2+</sup>		39								
Cl <sup>-</sup>					32	32		37		17. A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, <i>J.Org.Chem.</i> , <b>43</b> , 1843 (1978); Ph <sub>4</sub> AsBPh <sub>4</sub> assumption, but see ref. 3.
Br <sup>-</sup>								30		
I <sup>-</sup>					12	12		17		18. A.J. Parker, summarized results, presented at RACI-Org.Chem.Div. Conf., Hobart, Tasmania, 1979; Ph <sub>4</sub> AsBPh <sub>4</sub> assumption, but see ref. 3.
N <sub>3</sub> <sup>-</sup>					25			28		
SCN <sup>-</sup>					9			15		
ClO <sub>4</sub> <sup>-</sup>								(-5)		19. A.I. Mishustin, A.I. Podkovrin & Yu.M. Kessler, <i>Doklady Akad. Nauk SSSR</i> , <b>245</b> , 1420 (1979); from n.m.r. data, assumed by the authors to be consistent with the Ph <sub>4</sub> AsBPh <sub>4</sub> assumption.
ReO <sub>4</sub> <sup>-</sup>										
BPh <sub>4</sub> <sup>-</sup>										

42.  $\Delta G_{\text{f}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

Solvent, S = Nitrobenzene

Ref. wt.	1	2	3	4	5	Selected	Ref. wt.	1	2	3	4	5	Selected
H <sup>+</sup>	32.5					33	Bu <sub>4</sub> N <sup>+</sup>	-24.0					-24
Li <sup>+</sup>	38.2					38	Hx <sub>4</sub> N <sup>+</sup>				-51.4		-51
Na <sup>+</sup>	34.2	34.3				34	Ph <sub>4</sub> As <sup>+</sup>	-36.0					-36
K <sup>+</sup>	23.4					23	Cl <sup>-</sup>	29.7				38.5	35
Rb <sup>+</sup>	19.4					19	Br <sup>-</sup>		28.5			30.1	29
Cs <sup>+</sup>	15.4					15	I <sup>-</sup>	18.8			21.7	16.3	18
Tl <sup>+</sup>			14.9			(15)	I <sub>3</sub> <sup>-</sup>	-23.4					-23
NH <sub>4</sub> <sup>+</sup>	26.8					27	ClO <sub>4</sub> <sup>-</sup>	8.0				5.9	7
Me <sub>4</sub> N <sup>+</sup>	3.4			3.8		4	Pic <sup>-</sup>	-4.6					-5
Et <sub>4</sub> N <sup>+</sup>	-5.7			-4.1		-5	BPh <sub>4</sub> <sup>-</sup>	-36.0	-36.0				-36
Pr <sub>4</sub> N <sup>+</sup>				-16.3		-16							

## Nitrobenzene - References and Comments

- J. Rais, *Coll.Czech.Chem.Comm.*, **36**, 3253 (1971); solvent satd. with water, Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- C. Gavach & F. Henry, *J.Electroanal.Chem.*, **54**, 361 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption, solvent satd. with water.
- G. Gritzner, *Inorg.Chim.Acta*, **24**, 5 (1977); bis(biphenyl)chromium assumption.
- M.H. Abraham, *J.Chem.Soc.Perkin Trans. II*, **1972**, 1343; M. Gerin & J. Fresco, *Anal.Chim.Acta*, **97**, 165 (1978); evaluated in terms of individual ions in ref. 5, with no indication which assumption was used.
- M.H. Abraham & J. Liszi, *J.Inorg.Nucl.Chem.*, **43**, 143 (1981).

$$43. \Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ C$$

Solvent, S = Pyridine

Ref.	1
wt.	0

H<sup>+</sup> -17Pyridine - Reference and Comment

1. J.M. Nigretto & M. Jozefowicz, Electrochim. Acta, **18**, 145 (1973); estimated from acidity scales.

$$44. \Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ C$$

Solvent, S = Quinoline

Ref.	1
wt.	0

Rb<sup>+</sup> -14Quinoline - Reference and Comment

1. H.M. Koeppe, H. Wendt & H. Strehlow, Z. Electrochim., **64**, 483 (1960); electrostatic calculation.

$$45. \Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ C$$

Solvent, S = Dimethylsulfite

Ref.	1
wt.	

Ag<sup>+</sup> 20.5Cl<sup>-</sup> 19.2Br<sup>-</sup> 13.8I<sup>-</sup> 6.3Dimethylsulfite - Reference and Comment

1. M. Salomon, J. Phys. Chem., **79**, 2000 (1975); assumption that [ $\Delta G_t^0(\text{AgCl}_2^-, \text{H}_2\text{O} \rightarrow (\text{CH}_3\text{O})_2\text{SO}) + \Delta G_t^0(\text{AgBr}_2^-, \text{H}_2\text{O} \rightarrow (\text{CH}_3\text{O})_2\text{SO})$ ] = 0.

$$46. \Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ C$$

Solvent, S = Ethylene sulfite

Ref.	1	2
wt.		

Ag<sup>+</sup> 20.5Tl<sup>+</sup> 8.1Cl<sup>-</sup> 29.7Br<sup>-</sup> 23.8I<sup>-</sup> 8.4Ethylene sulfite - References and Comments

1. M. Salomon, J. Phys. Chem., **79**, 2000 (1975); assumption that [ $\Delta G_t^0(\text{AgCl}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_4\text{SO}_3) + \Delta G_t^0(\text{AgBr}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_4\text{SO}_3)$ ] = 0.  
2. G. Gritzner, Inorg. Chim. Acta, **24**, 5 (1977) bis(biphenyl)chromium assumption.

Note: Table 47 for solvent dimethylsulfoxide is printed on the following pages

$$48. \Delta G_t^0 (X, H_2O \rightarrow S) / kJmol^{-1}, \\ \text{mol dm}^{-3} \text{ scale, } 25^\circ C$$

Solvent, S = Tetramethylene sulfoxide

Ref.	1
wt.	

Ag<sup>+</sup> -38.5Cl<sup>-</sup> 47.3Br<sup>-</sup> 33.5I<sup>-</sup> 14.6Tetramethylene sulfoxide - Reference and Comment

1. M. Salomon, J. Phys. Chem., **79**, 2000 (1975); from assumption that [ $\Delta G_t^0(\text{AgCl}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_4\text{H}_8\text{SO}) + \Delta G_t^0(\text{AgBr}_2^-, \text{H}_2\text{O} \rightarrow \text{C}_4\text{H}_8\text{SO})$ ] = 0.

47.  $\Delta G_{\text{L}}^{\circ} (\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = Dimethylsulfoxide

Ref. wt.	1	2	3	4	5	6	7	8	9	10
H <sup>+</sup>				-24.1		-18.8		-18.8		
Li <sup>+</sup>				-20.1				-14.6		
Na <sup>+</sup>						-13.7	-13.8	-13.8		
K <sup>+</sup>	-15.4	-17.1	-17.2			-12.0	-15.5	-12.1		-12.1
Rb <sup>+</sup>						-10.8	-11.5	-10.9		
Cs <sup>+</sup>			-18.2			-12.6	-11.0	-12.6		
Ag <sup>+</sup>	-38.2	-42.2	-42.2	-35.5	-32.2	-33.7		-33.5	-61.5	-33.5
Tl <sup>+</sup>				-25.2		-20.5		-25.1		-20.5
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>								-5.0		
Ph <sub>4</sub> As <sup>+</sup>	-38.2	-38.2	-38.2		-46.2	-37.1		-36.8		
Cu <sup>2+</sup>										
Zn <sup>2+</sup>										
Cd <sup>2+</sup>										
Hg <sup>2+</sup>										
Hg <sub>2</sub> <sup>2+</sup>										
Cl <sup>-</sup>	41.7	45.6	45.7	40.7	36.5	38.8		38.5		
Br <sup>-</sup>	28.5	32.5	32.5	28.7	23.4	25.7		25.5	26.4	
I <sup>-</sup>	12.0	16.0	16.0	13.8	6.8	9.1		9.2		
I <sub>3</sub> <sup>-</sup>		-36.0								
N <sub>3</sub> <sup>-</sup>		30.2	30.2					23.8		
CN <sup>-</sup>										
SCN <sup>-</sup>	10.8	14.8	14.8	12.1	6.8	8.6				
ClO <sub>4</sub> <sup>-</sup>	1.7	2.9	9.1					-1.3		
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>		53.6	53.7					46.4		
BPh <sub>4</sub> <sup>-</sup>	-38.2	-38.2	-38.1	-14.1	-31.4	-37.1		-36.8		

Dimethylsulfoxide - References and Comments

1. R. Alexander & A.J. Parker, *J.Am.Chem.Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
2. R. Alexander, E.C.F. Ko, A.J. Parker & J.T. Broxton, *J.Am.Chem.Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> and I<sub>3</sub><sup>-</sup>/I<sub>2</sub> assumptions.
3. A.J. Parker, *Chem.Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
4. J. Courtot-Coupez, M. LeDemezet, A. Laouean & C. Madec, *J.Electroanal.Chem.*, **29**, 21 (1971); ferrocene assumption, adjusted by adding +(-) 9.0 to cation (anion) values.
5. R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972).
6. I.M. Kolthoff & M.K. Chantooni, Jr., *J.Phys.Chem.*, **76**, 2024 (1972); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
7. M. Breant & J.L. Sue, *J.Electroanal.Chem.*, **40**, 89 (1972); ferrocene assumption, adjusted by adding +(-) 9.0 to cation (anion) values.
8. B.G. Cox, *Ann.Rept.Chem.Soc.*, **70**, 249 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
9. B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
10. J.W. Diggle & A.J. Parker, *Electrochim.Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

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47.  $\Delta G_{\text{L}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C Solvent, S = Dimethylsulfoxide

Ref. wt.	11	12	13	14	15	16	17	18	19	20
H <sup>+</sup>		-18.8				-24.1				
Li <sup>+</sup>		-14.6								
Na <sup>+</sup>		-13.8					-16.3		-11.4	
K <sup>+</sup>		-12.1	-12.1	-12.1					-9.4	-13.5
Rb <sup>+</sup>		-10.9								
Cs <sup>+</sup>		-12.6								
Ag <sup>+</sup>		-33.5	-33.5	-33.5		-35.5	-32.2			-34.3
Tl <sup>+</sup>		-25.1	-20.5	-20.5	-18.0				-19.9	
Me <sub>4</sub> N <sup>+</sup>										
Et <sub>4</sub> N <sup>+</sup>		-12.6								
Ph <sub>4</sub> As <sup>+</sup>		-36.8								
Cu <sup>2+</sup>										
Zn <sup>2+</sup>										
Cd <sup>2+</sup>										
Hg <sup>2+</sup>								-67		
Hg <sub>2</sub> <sup>2+</sup>								-49		
Cl <sup>-</sup>		38.5				40.1				39.9
Br <sup>-</sup>		25.5								26.8
I <sup>-</sup>		9.2				10.4				11.5
I <sub>3</sub> <sup>-</sup>										
N <sub>3</sub> <sup>-</sup>	25.5	25.5								
CN <sup>-</sup>										
SCN <sup>-</sup>										
ClO <sub>4</sub> <sup>-</sup>		-1.3				-12.4				
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>										
BPh <sub>4</sub> <sup>-</sup>		-36.8								

## Dimethylsulfoxide - References and Comments

- B.G. Cox & A.J. Parker, *J. Am. Chem. Soc.*, **95**, 408 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr. J. Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- D.A. Owensby, A.J. Parker & J.W. Diggle, *J. Am. Chem. Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R. Alexander, D.A. Owensby, A.J. Parker & W.E. Waghorne, *Austr. J. Chem.*, **27**, 933 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- N. Matsuura & K. Umemoto, *Bull. Chem. Soc. Japan*, **47**, 1334 (1974); assumption that  $\Delta G_{\text{L}}^{\circ}(\text{Rb}^+, \text{H}_2\text{O} \rightarrow (\text{CH}_3)_2\text{SO}) = 0$ , modified by electrostatic calculation.
- J. Badoz-Lambling & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 9.0 to cation (anion) values.
- B.G. Cox, A.J. Parker & W.E. Waghorne, *J. Phys. Chem.*, **78**, 1731 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- L.N. Balyatinskaya & T.V. Kurchenko, *Zh. Obshchei Khim.*, **46**, 1113 (1976); L.N. Balyatinskaya, *Russ. Chem. Rev.*, **48**, 418 (1979); ferrocene assumption.
- G. Gritzner, *Inorg. Chim. Acta*, **24**, 5 (1977); bisbiphenylchromium assumption.
- U. Mayer, *Monatsh. Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 5.0 to cation (anion) values.

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47.  $\Delta G_L^\ominus$  (X, H<sub>2</sub>O → S)/kJmol<sup>-1</sup>, mol dm<sup>-3</sup> scale, 25°C Solvent, S = Dimethylsulfoxide

Ref. wt.	21	22	23	24	25	26	27	28	29	30	31	32	Selected
H <sup>+</sup>													-19.4
Li <sup>+</sup>											-49.4		-15
Na <sup>+</sup>													-13.4
K <sup>+</sup>		-12			-12								-13.0
Rb <sup>+</sup>													-10.4
Cs <sup>+</sup>													-13.0
Ag <sup>+</sup>		-34		-29								(-44.2)	-34.8
Tl <sup>+</sup>													-21.4
Me <sub>4</sub> N <sup>+</sup>		-2			-2								-2
Et <sub>4</sub> N <sup>+</sup>													(-9)
Ph <sub>4</sub> As <sup>+</sup>								-37.3	-37.2				-37.4
Cu <sup>2+</sup>						-49							(-49)
Zn <sup>2+</sup>			-45										(-45)
Cd <sup>2+</sup>			-58										(-58)
Hg <sup>2+</sup>													
Hg <sub>2</sub> <sup>2+</sup>													
Cl <sup>-</sup>		40			40								40.3
Br <sup>-</sup>		27			27								27.4
I <sup>-</sup>		9			9								10.4
I <sub>3</sub> <sup>-</sup>	-43.3												(-41)
N <sub>3</sub> <sup>-</sup>		24											25.8
CN <sup>-</sup>							35.3						35
SCN <sup>-</sup>		8											9.7
ClO <sub>4</sub> <sup>-</sup>													
CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>													(50)
BPh <sub>4</sub> <sup>-</sup>								-37.3	-37.2				-37.4
BrO <sub>3</sub> <sup>-</sup>												38.7	
IO <sub>3</sub> <sup>-</sup>											47.1	62.5	

Dimethylsulfoxide - References and Comments

- R.L. Benoit, M.F. Wilson & S.Y. Lam, *Can.J.Chem.*, **55**, 792 (1977); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J. Taraszewska & B. Behr, *J.Electroanal.Chem.*, **91**, 11 (1978); bis(biphenyl)chromium assumption.
- T. Kakutani, Y. Morihiro, M. Senda, R. Takahashi & K. Matsumoto, *Bull.Chem.Soc.Japan*, **51**, 2847 (1978); assumption concerning redox potentials.
- A.J. Parker, summarizing results presented at RACI-Org.Chem.Div.Conf., Hobart, Tasmania, 1979; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.F. Coetzee & W.K. Istone, *Anal.Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.
- M.J. Blandamer, J. Burgess & A.J. Duffied, *J.Chem.Soc.Dalton Trans.*, **1980**, 1; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977; quoted in ref.29; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.I. Mishustin, *Zh.Fiz.Khim.*, **55**, 61 (1981); *Russ.J.Phys.Chem.*, **55**, 33 (1981); from quadrupole relaxation times.
- I.M. Kolthoff & M.K. Chantooni, *J.Phys.Chem.*, **77**, 523 (1976); from Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- S. Janardhanan & C. Kalidas, *Bull.Chem.Soc.Japan*, **53**, 2363 (1980); at 30 °C, taking Ag<sup>+</sup> data from the literature.

49.  $\Delta G_f^\circ (X, H_2O \rightarrow S) / kJmol^{-1}$ , mol dm<sup>-3</sup> scale, 30°C

Solvent, S = Tetramethylene sulfone

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12	13	Selected
	0.5	0.5	0	0.5	0.1	0.5	0	0.5	1.0	1.0	0.5	0.5	0.5	
H <sup>+</sup>														
Na <sup>+</sup>									-2.9					-3
K <sup>+</sup>									-4.2		-1.4	6		-4
Rb <sup>+</sup>									-8.8					-9
Cs <sup>+</sup>									-10.0					-10
Ag <sup>+</sup>	-7	6.7		12.0	-28.5			-3.4	-3.8	3.0				-4
Ph <sub>4</sub> As <sup>+</sup>				-37.7					-35.6					-36
Cu <sup>2+</sup>													71	(71)
Cl <sup>-</sup>	47.4	47.4		37.1				52.5	52.7	47.1	42			47
Br <sup>-</sup>				24.5	41.0				39.7	34.6				35
I <sup>-</sup>	22.3	22.3		5.1				20.5	20.5	14.3				21
I <sub>3</sub> <sup>-</sup>										-14.8				
N <sub>3</sub> <sup>-</sup>	41.1					40.6								41
SCN <sup>-</sup>	21.7	21.6												22
ClO <sub>4</sub> <sup>-</sup>														
BPh <sub>4</sub> <sup>-</sup>	-35	-35		-18.8				-0.6	-35.6					-36

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## Tetramethylene sulfone - References and Comments

- R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J. Am. Chem. Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, *Chem. Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- D. Bax, C.L. DeLigny & A.C. Remijnse, *Rec. Trav. Chim.*, **91**, 1225 (1972); electrostatic calculation.
- R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J. Am. Chem. Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
- B.G. Cox & A.J. Parker, *J. Am. Chem. Soc.*, **95**, 402 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- B.G. Cox & A.J. Parker, *J. Am. Chem. Soc.*, **95**, 408 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R.L. Benoit & P. Pichet, *J. Electroanal. Chem.*, **43**, 59 (1973); from assumptions concerning acidity scales.
- J. Badoz-Lambling & J.C. Bardin, *Electrochim. Acta*, **19**, 725 (1974); ferrocene assumption.
- B.G. Cox, G.R. Hedwig, A.J. Parker & D.W. Watts, *Austr. J. Chem.*, **27**, 477 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R.L. Benoit, M.F. Wilson & S.Y. Lam, *Can. J. Chem.*, **55**, 792 (1977); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- U. Mayer, *Monatsh. Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 11.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J. Org. Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.F. Coetzee & W.K. Istone, *Anal. Chem.*, **52**, 53 (1980); negligible liquid junction potential assumption.

50, 50a, 51, 52.  $\Delta G_{\text{L}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

50. Solvent, S = Trimethyl phosphate

Ref. wt.	1
Na <sup>+</sup>	-10.4
K <sup>+</sup>	-5.5
Rb <sup>+</sup>	-5.7
Tl <sup>+</sup>	-7.3

Trimethyl phosphate - Reference and Comment

1. G. Gritzner, *Inorg.Chim.Acta*, **24**, 5 (1977); bis(biphenyl)chromium assumption.

52. Solvent, S = Benzyl fluoride

Ref. wt.	1
Tl <sup>+</sup>	15.9

Benzyl fluoride - Reference and Comment

1. G. Gritzner, *Inorg.Chim.Acta*, **24**, 5 (1977); bis(biphenyl)chromium assumption.

50a. Solvent, S = Tri-n-butyl phosphate

Ref. wt.	1
Li <sup>+</sup>	-45.6

Tri-n-butyl phosphate - Reference and Comments

1. A.I. Mishustin, *Zh.Fiz.Khim.*, **55**, 61 (1981); *Russ.J.Phys.Chem.*, **55**, 33 (1981); from quadrupole relaxation times.

51. Solvent, S = Hexamethyl phosphoric triamide

Ref. wt.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sele-cted
H <sup>+</sup>	0.5	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.5	
Li <sup>+</sup>								-41.2							
K <sup>+</sup>	-5.1	-18.8	-18.8	-8.6	-16.7		-16.7		-20.2	-17	-17				-16
Ag <sup>+</sup>	-37.7	-53	-52.5	-39.4	-39.3		-39.3	-44.6	-42.1	-43					-14
Ph <sub>4</sub> As <sup>+</sup>	-38.8	-38.8	-38.8	-48.5								-41.0	-38.9		-39
Cl <sup>-</sup>	49.7	64.5	64.5	53.6				58.9	57.5	59	59				58
Br <sup>-</sup>	37.7	52.5	52.5	41.7					45.4						56
I <sup>-</sup>				26.3				31.5	29.7	30	30				30
N <sub>3</sub> <sup>-</sup>		51.4				42.3									49
SCN <sup>-</sup>	11.4	26.2	18.8							22					20
ClO <sub>4</sub> <sup>-</sup>								-7.3							-7
BPh <sub>4</sub> <sup>-</sup>	-38.8	-38.8	-38.8	-33.1								-41.0	-38.9		39

Hexamethyl phosphoric triamide - References and Comments

- R. Alexander & A.J. Parker, *J.Am.Chem.Soc.*, **89**, 5549 (1967); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R. Alexander, E.C.F. Ko, A.J. Parker & T.J. Broxton, *J.Am.Chem.Soc.*, **90**, 5049 (1968); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, *Chem.Rev.*, **69**, 1 (1969); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- R. Alexander, A.J. Parker, J.H. Sharp & W.E. Waghorne, *J.Am.Chem.Soc.*, **94**, 1148 (1972); negligible liquid junction potential assumption.
- J.W. Diggle & A.J. Parker, *Electrochim.Acta*, **18**, 975 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- B.G. Cox & A.J. Parker, *J.Am.Chem.Soc.*, **95**, 408 (1973); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- D.A. Owensby, A.J. Parker & J.W. Diggle, *J.Am.Chem.Soc.*, **96**, 2682 (1974); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J. Badoz-Lambling & J.C. Bardin, *Electrochim.Acta*, **19**, 725 (1974); ferrocene assumption, adjusted by adding +(-) 9.0 to cation (anion) values.
- U. Mayer, *Monatsh.Chem.*, **108**, 1479 (1977); negligible liquid junction potential assumption, adjusted by adding -(+) 6.0 to cation (anion) values.
- A.J. Parker, U. Mayer, R. Schmid & V. Gutmann, *J.Org.Chem.*, **43**, 1843 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.J. Parker, summarized results presented at RACI-Org.Chem.Div.Conf., Hobart, Tasmania, 1979.
- F. Koppold, Dipl.thesis, Tech.Univ. Munich, 1977; quoted in ref. 13; Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- J.I. Kim, *J.Phys.Chem.*, **82**, 191 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- A.I. Mishustin, *Zh.Fiz.Chem.*, **55**, 61 (1981); *Russ.J.Phys.Chem.*, **55**, 33 (1981); from quadrupole relaxation times.

53-57.  $\Delta G_{\text{t}}^{\circ}(\text{X}, \text{H}_2\text{O} \rightarrow \text{S})/\text{kJmol}^{-1}$ , mol dm<sup>-3</sup> scale, 25°C

53. Solvent, S = Dichloromethane

55. Solvent, S = 1,2-Dichloroethane

Ref. wt.	1	2	Ref. wt.	1	2	Ref. wt.	1	2	3	4	Selected
Me <sub>4</sub> N <sup>+</sup>	21.3	23.0	I <sup>-</sup>	21.3	22.2	Na <sup>+</sup>		24.7			(25)
Et <sub>4</sub> N <sup>+</sup>	8.4		NO <sub>3</sub> <sup>-</sup>		32.6	K <sup>+</sup>		25.5			(26)
Cl <sup>-</sup>		42.3	ClO <sub>4</sub> <sup>-</sup>		4.1	Rb <sup>+</sup>		24.7			(25)
Br <sup>-</sup>		35.1	Pic <sup>-</sup>		2.5	Cs <sup>+</sup>		23.8			(24)

## Dichloromethane - References and Comments

- M.H. Abraham, *J.Chem.Soc.Perkin II*, 1972, 1343; solvent saturated with water, evaluated by M.H. Abraham & J. Liszi, *J.Inorg.Nucl.Chem.*, 43, 143 (1981) in terms of individual ions on the basis of an unstated assumption.
- K. Gustavii & G. Schill, *Acta Pharm.Suecica*, 3, 241, 259 (1966); G. Gustavii, *Acta Pharm.Suecica*, 4, 233 (1967); see ref. 1 for comment.

54. Solvent, S = 1,1-Dichloroethane

Ref. wt.	1	2	Selected
Na <sup>+</sup>		28.9	(29)
K <sup>+</sup>		29.7	(30)
Rb <sup>+</sup>		28.9	(29)
Cs <sup>+</sup>		28.0	(28)
Ag <sup>+</sup>	-25.7		
Me <sub>4</sub> N <sup>+</sup>		17.5	(18)
Et <sub>4</sub> N <sup>+</sup>		10.8	(11)
Ph <sub>4</sub> As <sup>+</sup>		-27.3	(-27)
Cl <sup>-</sup>		57.7	(58)
Br <sup>-</sup>		42.5	(43)
I <sup>-</sup>		30.6	(31)
ClO <sub>4</sub> <sup>-</sup>		22.3	(22)
BPh <sub>4</sub> <sup>-</sup>		-27.3	(-27)

## 1,1-Dichloroethane - References and Comments

- D. Bauer & M. Breant, in *Electroanalytical Chemistry*, A.J. Bard, ed., Dekker, New York, Vol.8, pp.281-348, 1975; estimation on unspecified basis for unspecified isomer of solvent.
- M.H. Abraham & A.F. Danil de Namor, *J.Chem.Soc.Faraday Trans. 1*, 74, 2101 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

56. Solvent, S = 1,2-Dichlorobenzene

Ref. wt.	1
Ph <sub>4</sub> As <sup>+</sup>	-27.8
BPh <sub>4</sub> <sup>-</sup>	-27.8

## Reference and Comment

- J.I. Kim, *Z.Phys.Chem.N.F.*, 113, 129 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

Ag<sup>+</sup> -25.7

Me <sub>4</sub> N <sup>+</sup>	15.4	21.8	17.6	(17)	
Et <sub>4</sub> N <sup>+</sup>	4.7		4.2	(4)	
Pr <sub>4</sub> N <sup>+</sup>			-8.8	(-9)	
Bu <sub>4</sub> N <sup>+</sup>			-21.8	(-22)	
Pn <sub>4</sub> N <sup>+</sup>			-34.7	(-35)	
Hx <sub>4</sub> N <sup>+</sup>			-47.7	(-48)	
Ph <sub>4</sub> As <sup>+</sup>	-32.6		-35.1	(-34)	
F <sup>-</sup>			56.1	(56)	
Cl <sup>-</sup>		53.6	42.3	46.4	(50)
Br <sup>-</sup>		39.3	34.3	38.5	(39)
I <sup>-</sup>		25.2	22.2	26.4	(26)
SCN <sup>-</sup>			25.5	(26)	
NO <sub>3</sub> <sup>-</sup>			7.1	33.9	(29)
ClO <sub>3</sub> <sup>-</sup>				33.1	(33)
ClO <sub>4</sub> <sup>-</sup>		17.0	13.0	17.2	(17)
BPh <sub>4</sub> <sup>-</sup>	-32.6			-35.1	

## 1,2-Dichloroethane - References and Comments

- D. Bauer & M. Breant, in *Electroanalytical Chemistry*, A.J. Bard, ed., Dekker, New York, Vol.8, pp.281-348 (1966); for unspecified isomer of the solvent, estimated on unspecified basis.
- M.H. Abraham & A.F. Danil de Namor, *J.Chem.Soc.Faraday Trans. 1*, 74, 2101 (1978); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.
- B. Czapewicz-Tutaj & J. Czapewicz, *Rocz.Chem.*, 49, 1353 (1975); evaluated in terms of individual ions by M.H. Abraham & J. Liszi, *J.Inorg.Nucl.Chem.*, 43, 143 (1981), on unspecified basis, for water-saturated solvent.
- J. Czapkiewicz & B. Czapkiewicz-Tutaj, *J.Chem.Soc.Faraday Trans. 1*, 76, 1663 (1980); Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.

57. Solvent, S = 1,3-Dichlorobenzene

Ref. wt.	1
Ph <sub>4</sub> As <sup>+</sup>	-22.6
BPh <sub>4</sub> <sup>-</sup>	-22.6

## Reference and Comment

- J.I. Kim, *Z.Phys.Chem.N.F.*, 113, 129 (1978) Ph<sub>4</sub>AsBPh<sub>4</sub> assumption.