

# Thermochemical Data on Gas-Phase Ion-Molecule Association and Clustering Reactions

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# Thermochemical Data on Gas-Phase Ion-Molecule Association and Clustering Reactions

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A comprehensive tabulation of the standard enthalpy change,  $\Delta H^\circ$ , entropy change,  $\Delta S^\circ$ , and free energy change,  $\Delta G^\circ$ , for the formation of ion clusters from ion-molecule association reactions is given. The experimental methods which are used to derive the data are briefly discussed. For some experiments, dissociation energies of ion clusters are reported and listed under the category of  $\Delta H^\circ$ . The relationship between  $\Delta H^\circ$  and dissociation energy is discussed in the text.

Key words: cluster ions; ion-molecule reactions; thermodynamics.

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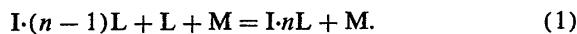
## 1. Introduction

The last 15 years have been marked by a dramatic increase in research work on the formation and properties of gas-phase ion-molecule complexes and cluster ions. As a result of this interest, a large amount of data on the thermochemical properties of cluster ions has appeared in the literature. Work in this area spans a broad range of fields including geophysics, electrochemistry, organic chemistry, and chemical physics to name a few. The scope of applications of such data is due to the recognition of the value of the investigation of cluster ion formation in bridging the gap between the gas and condensed phases and in probing the details of molecular interactions and energy transfer. Studies of cluster ions are relevant to phenomena such as nucleation, the development of surfaces, catalysis, solvation, acid-base chemistry, combustion, and atmospheric processes. The entire research area has been the subject of a recent extensive review<sup>1</sup> to which the interested reader is referred.

Cluster ion thermochemistry has been discussed in several early reviews including three general ones by Kebarle<sup>2-4</sup> covering the period up through 1976. Several others devoted largely to the authors' own works, but with some attention to the general field include Kebarle<sup>5,6</sup> and Castleman and co-workers.<sup>7-10</sup> Other general reviews<sup>11-18</sup> also contain some information related to this topic. However, until the present, there has been no complete tabulation of thermochemical data on cluster ions. In this paper we have attempted to compile all known thermodynamic data on the bonding of ligands to ions. Since such a lofty goal is difficult to accomplish in practice, and since thermodynamic data are sometimes presented in articles whose titles do not always suggest their full content, we wish to apologize in advance to authors whose works we may have inadvertently overlooked. The subject of proton transfer and proton affinities is not covered and the interested reader is referred to other sources.<sup>11,12,19</sup>

## 2. Thermodynamics of Cluster Reactions

Cluster formation can be represented by a series of step-wise association reactions of the form



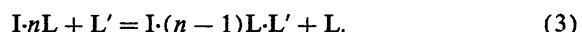
Here, I designates a positive or negative ion, L the clustering neutral (ligand), and M the third body necessary for collisional stabilization of the complex. Taking the standard state to be 1 atm, and making the usual assumptions<sup>20</sup> concerning

ideal gas behavior and the proportionality of the chemical activity of an ion cluster to its measured intensity, the equilibrium constant  $K_{n-1,n}$  for the nth clustering step is given by

$$\begin{aligned} \ln K_{n-1,n} &= \ln \frac{C_n}{C_{n-1} P_L} = - \frac{\Delta G_{n-1,n}^\circ}{RT} \\ &= - \frac{\Delta H_{n-1,n}^\circ}{RT} + \frac{\Delta S_{n-1,n}^\circ}{R}. \end{aligned} \quad (2)$$

Here,  $C_{n-1}$  and  $C_n$  represent the respective measured ion intensities;  $P_L$  the pressure (in atm) of the clustering species L;  $\Delta G_{n-1,n}^\circ$ ,  $\Delta H_{n-1,n}^\circ$ , and  $\Delta S_{n-1,n}^\circ$  the standard Gibbs free energy, enthalpy, and entropy changes, respectively; R the gas-law constant; and T, absolute temperature. By measuring the equilibrium constant  $K_{n-1,n}$  as a function of temperature, the enthalpy and entropy change for each sequential association reaction can be obtained from the slope and intercept of the van't Hoff plot ( $\ln K_{n-1,n}$  versus  $1/T$ ).

Thermodynamic information also can be obtained by studying switching or exchange reactions of the form



The thermodynamic quantities for the association of L' onto I·(n-1)L are the sum of those for reactions (1) and (3).

## 3. Temperature Dependence of $\Delta H^\circ$ and $\Delta S^\circ$

Experimental techniques that employ van't Hoff plots lead to enthalpy changes derived from slopes which are representable as straight lines over moderate temperature ranges. In actuality, the enthalpy change is a weak function of temperature due to the difference in heat capacity  $\Delta C_p$  between products and reactants,

$$\Delta H_{T_2} = \Delta H_{T_1} + \int_{T_1}^{T_2} \Delta C_p(T) dT. \quad (4)$$

The various experimental techniques measure and report various related values: the enthalpy change  $\Delta H_T^\circ$  of association, the bond dissociation energy  $D_0$  ( $= -\Delta H_0^\circ$ ), or the potential well depth  $D_e$  ( $= D_0 + \frac{1}{2} \sum_i h\nu_i$ ), where  $\nu_i$  are the frequencies of the vibrational modes related to the association bond.

In almost all situations of interest to the field of cluster ions, the electronic contribution to the heat capacity is negligible. Important contributions to the heat capacity, then, are those arising from translation, rotation, and vibration. At temperatures above a few tens of kelvins, rotation is usually fully activated and it is the quantitative evaluation of the vibrational contribution which is difficult to make because it requires a knowledge of the vibrational frequencies of the cluster. Since ion-neutral bonds are relatively weak, the frequencies associated with these are typically low. Therefore, they are particularly important in calculating  $\Delta C_p$  in the temperature range 100–600 K over which most association reaction thermochemical data are derived.

A few investigators (e.g., Conway and co-workers,<sup>21–24</sup> Castleman and co-workers,<sup>10</sup> and Keesee<sup>25</sup>) have considered in detail the problem of the effect of the vibrational contribution in heat capacity on the temperature dependence of  $\Delta H^\circ$ . For example, in the case of  $\text{Cl}^-$  associated with water,<sup>10,25</sup> the measured enthalpy change  $\Delta H_{470}^\circ$  is  $-14.9 \text{ kcal/mol}$ . Using the calculated vibrational frequencies of Kistenmacher *et al.*,<sup>26</sup>  $\Delta H_{298}^\circ$  and  $\Delta H_0^\circ$  ( $= -D_0$ ) were calculated to be  $-14.9$  and  $-14.2 \text{ kcal/mol}$ , respectively. Thus the common practice in the literature to discuss measured enthalpy changes in terms of "bond energies" appears to be a reasonable approximation.

The van't Hoff plots also enable a determination of the entropy change. Rigorously the entropy is also dependent on temperature, although only weakly so. The entropy change can be calculated through use of standard statistical mechanics<sup>27</sup> with knowledge of both the structure, to determine moments of inertia, and vibrational frequencies. Based on the calculated frequencies and structure of  $\text{Cl}^- \cdot \text{H}_2\text{O}$ ,<sup>26</sup> the entropy change at 470 K for the association of water onto  $\text{Cl}^-$  is calculated to be  $-19.1 \text{ cal/K mol}$  compared to the experimentally determined value of  $-19.7$ . At 298 K, the entropy change is computed to be  $-18.9 \text{ cal/K mol}$ .

The translational contribution to the entropy change due to the loss of translational degrees of freedom upon association is largely responsible for the overall negative value of  $\Delta S^\circ$ . The rotational and particularly the vibrational contributions are significant in that they reflect the details about the structure of the cluster ion. For examples of applications in this regard, the reader is referred to Dzidic and Kebarle<sup>28</sup> and Castleman *et al.*<sup>29</sup>

#### 4. Experimental Techniques

The Knudsen cell technique<sup>30</sup> was apparently the method which provided one of the first direct measurements of a thermodynamic quantity for the formation of a cluster ion ( $\text{K}^+ \cdot \text{H}_2\text{O}$ ) that has stood the test of time. Other early obser-

vations of ion clusters were obtained in ion sources operated in the neighborhood of  $10^{-4}$  Torr (1 Torr  $\approx 133 \text{ Pa}$ ); but, equilibrium conditions were generally not attainable with the few collisions taking place and thermodynamic parameters could usually not be measured with confidence. Field,<sup>31</sup> Melton and Rudolf,<sup>32</sup> and Wexler and Marshall<sup>33</sup> were successful in observing reactions which required a third body for stabilization by using essentially conventional mass spectrometric ion sources, but equipped with small ion exit slits and improved pumping. However, it was generally impossible to ensure that complete thermalization of the ions and the attainment of equilibrium with respect to clustering had occurred.

The advent of high-pressure mass spectrometry (HPMS) has been particularly valuable in quantitatively determining the thermodynamic properties of ion clusters. The first application and development of this technique specifically to determine the thermodynamics of clustering reactions was made by Kebarle and co-workers.<sup>34</sup> In this technique, ions effuse from a high-pressure source (typically a few Torr) through a small aperture into a mass filter where the distribution of ion clusters is determined. Ionization may be initiated by various methods including radioactive sources, heated filaments, and electric discharges. The pressure of the ion source is maintained sufficiently high such that ions reside in a region of well-defined temperature for a time adequate to ensure the attainment of equilibria among the various ion cluster species of interest; but, at the same time, the pressure must be low enough to avoid additional clustering via adiabatic expansion as the gas exits the sampling orifice.

Other variations of the theme include low field drift tubes with sampling mass spectrometer (DTMS) and pulsed ionization sources as in pulsed high-pressure mass spectrometry (PHPMS) or stationary afterglow-mass spectrometry (SAMS). In pulsed ion sources, the kinetics (with corrections for diffusional losses) and approach to equilibrium with increasing residence time of the ions in the high-pressure source can be directly monitored. Thermodynamic data can be obtained at lower source pressures in the pulsed mode compared to continuous ionization modes. This is so since the collection of data can be delayed for some time after the pulse, thus avoiding those ions which exit the source with insufficient residence time.

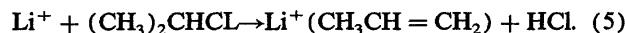
The flowing afterglow technique (FA) developed by Ferguson, Fehsenfeld, and Schmeltekopf<sup>35</sup> and other related flow reactors such as the selected ion flow tube (SIFT)<sup>36</sup> have provided a wealth of data on general ion-molecule reactions<sup>37</sup> and in the process several ion clusters have also been studied.

In the flowing afterglow apparatus, the ionization with, for instance, a microwave discharge or electron gun, occurs upstream directly in the carrier gas. The flow tube is generally about 1 m long and 8 cm in diameter. Flow velocities are on the order of  $10^2 \text{ m s}^{-1}$  and tube pressures are typically around 1 Torr. While most of the gas is pumped away, a

small fraction is sampled through an orifice where the ions are mass identified and counted. Reactant gases are added into the flow, so kinetic data and the approach to equilibrium can be determined by varying the position of the reactant injection, the flow rate of reactant into the tube, or the bulk flow velocity. In comparison to PHPMS, the flow tube technique affords more versatility in making kinetic measurements and identifying mechanisms, whereas high-pressure mass spectrometry is more amenable to temperature control and enables measurements at higher pressures where equilibrium conditions can be more readily assured.

All the experimental techniques thus far described involve extraction of ions from a relatively high pressure into the high-vacuum region of a mass spectrometer. In these methods, draw-out potentials must be kept small to avoid cluster fragmentation. Additionally, Conway and Janik<sup>24</sup> pointed out that measurements made on larger clusters may be slightly influenced by unimolecular decomposition of the cluster ions following their exit from the high-pressure region. They specifically made estimates on the O<sub>2</sub><sup>+</sup>·nO<sub>2</sub> cluster system. Sunner and Kebarle<sup>38</sup> have also considered this problem for the K<sup>+</sup>·nH<sub>2</sub>O system.

Ion cyclotron resonance (ICR) experiments are typically performed at pressures of 10<sup>-5</sup> Torr or less, so three-body association reactions are not likely to achieve equilibrium during typical ion trapping time (on the order of 1 s). Consequently, ICR data on ion clusters have been restricted to measuring the free energy change of switching reactions where the initial ion-molecule complex is formed by an elimination reaction such as<sup>39</sup>



If a switching reaction involves an ion-molecule complex whose ΔG° of association is known by some other technique, then an absolute scale can be affixed to the ICR data. Enthalpy changes are estimated by calculating the entropy changes of the switching reactions based on the translational and rotational contributions.<sup>40,41</sup> The latter requires some assumption about the structure of the complex, but the result is not usually sensitive to the assumed structure. Also the vibrational contribution to the entropy change of the switching reaction is commonly assumed to be negligible. Some systems for which relative values are available, but an absolute scale is lacking, are η<sup>5</sup>C<sub>5</sub>H<sub>5</sub>Ni<sup>+</sup>,<sup>42</sup> Al<sup>+</sup>,<sup>43</sup> Mn<sup>+</sup>,<sup>44</sup> Cu<sup>+</sup>,<sup>45</sup> Ni<sup>+</sup>,<sup>46</sup> FeBr<sup>+</sup>,<sup>47</sup> Co<sup>+</sup>,<sup>48</sup> and CH<sub>3</sub>Hg<sup>+</sup>,<sup>49</sup> largely with organic ligands. Due to the low pressures in ICR experiments, questions concerning the temperature of the ions involved in the switching reactions are sometimes raised.

Photofragmentation (PF) and collision induced dissociation (CID) involve measurement of the energy thresholds of dissociation of ions and ion clusters in beams. Photoionization (PI) and electron impact ionization (EI) thresholds for clusters in neutral beams also have been used to derive bond energies D<sub>0</sub> for ion clusters. The bond ener-

gies can be derived from measurements of appearance potentials if it is assumed that adiabatic values are obtained from the measurements and if the bonding of the neutral precursor is known or can be adequately estimated. The bonding of ammonia to NH<sub>4</sub><sup>+</sup> has been derived from the photoionization of ammonia clusters,<sup>50</sup> where similar measurements have been determined by Stephan *et al.*<sup>51</sup> using electron impact ionization. The values differ significantly from those derived by high-pressure mass spectrometric techniques in the cases where ionization is followed by a spontaneous "internal" reaction such as NH<sub>3</sub><sup>+</sup>(NH<sub>3</sub>)<sub>n</sub> → NH<sub>4</sub><sup>+</sup>(NH<sub>3</sub>)<sub>n-1</sub> + NH<sub>2</sub>.

Other methods which have produced information on the bonding in ion-molecule association complexes include inversion of ionic mobility data (M) in rare gases which lead to potential well-depths D<sub>e</sub>, scattering experiments (S), emission spectroscopy (ES), reactive energy thresholds (RET), and various drift tube experiments (DT). Arnold and co-workers<sup>52,53</sup> have made rough estimates of thermodynamic quantities of several cluster ions found in the stratosphere based on balloon measurements of relative ion densities along with estimates of atmospheric temperature and appropriate neutral concentrations. McDaniel and Vallee<sup>54</sup> measured halide-hydrogen halide bond energies by measuring the heat of absorption of HX into a crystal MX, where M<sup>+</sup> was chosen to minimize the lattice energy of the crystal, and assuming that this quantity was identical to the gas-phase process X<sup>-</sup> + HX → HX<sub>2</sub><sup>-</sup>.

## 5. Thermodynamic Data

Tables 1–9 represent a compilation of thermodynamic data of ion-molecule association reactions as given by reaction (1) for the neutral (L) and the ion (I) for each addition step n. The tabulations are hopefully complete through 1984 and also include some more recent data. All thermodynamic values are expressed in the calorie system of units because most of the literature covered employs these units. For comparison of SI units, note that 1 cal = 4.184 J. The tables are arranged according to the clustering neutral species. Tables 1–3 compile data on the hydration of inorganic positive ions, inorganic negative ions, and organic ions, respectively. In Tables 1 and 2, atomic ions are listed first, then molecular ions, and finally cluster ions. In Table 3, the organic ions are ordered according to the number of carbon atoms followed by the number of hydrogen atoms, nitrogen atoms, and oxygen atoms. Cluster ions and negative organic ions are found at the end of this table. Tables 4–7 give data for the rare gases, diatomics, triatomics (except water), and inorganic

polyatomics. Table 8 presents data on the association of organic species with gaseous ions. The organic species are ordered as in Table 3 by the number of carbon atoms and then sequentially by the number of hydrogen, nitrogen, and oxygen atoms. The ions are listed in order of inorganic positive ions, organic positive ions (again ordered by number of carbon atoms except in the cases of cluster ions which immediately follow the listing for the unassociated ion), and negative ions. Table 9 includes data for organic systems where more than just the first association reaction was reported.

Our survey has been largely confined to data obtained by direct measurements of association or exchange reactions. In general, we have not attempted to follow up on values which may be derived through circuitous routes employing appearance potential measurements except where the original authors have devoted their paper to cluster-ion bonding. As an example, electron impact appearance potentials exist for several metal carbonyls from which thermodynamic data on the  $M^+ \cdot nCO$  system could be derived. The interested reader is referred to the recent compilation of appearance potentials by Levin and Lias.<sup>55</sup> Also, in many cases where data are given for  $AH^+ \cdot B$  or  $A^- \cdot HB$ , the thermodynamic values for  $BH^+ \cdot A$  and  $B \cdot HA$ , are not included although they can be calculated if proton transfer (proton affinity) data are known. Such data are available in sources such as Lias *et al.*,<sup>19</sup> Taft,<sup>11</sup> and Bartmess *et al.*<sup>56</sup>

Thermodynamic data which are not directly measured quantities are shown in parentheses (with the caveat mentioned in the experimental section for those based on methods involving direct ionization of neutral clusters). Values annotated by an "s" indicate that the indirect measurement is based on a simple switching reaction or, in the case for ICR measurements, on a scale based on the indicated complex. Those annotated by a "c" involved more indirect thermodynamic cycles where an "s" indicates that measured switch-

ing reactions were used in the cycle. Bracketed values are entropy changes given in the cited references which have been assumed or calculated (particularly for switching reactions) from statistical mechanics and the enthalpy changes are those derived from the entropy changes and measured Gibbs free energy changes. Indirect measurements which require proton affinity differences have been based on the proton affinities of Lias *et al.*,<sup>19</sup> except in studies where these differences were measured directly during the same study. The abbreviation for the experimental methods are given in the previous section. When several references are listed for indirectly determined values, the experimental method shown is that of the reference listed first. The subsequent ones refer to the additional sources of the other thermodynamic values which are required. In the cases where cycles are used, it is assumed the measured reactions do not involve different isomeric forms. One should note, however, that Hiraoka and Kebarle,<sup>57</sup> for instance, found evidence of two isomeric forms of  $C_2H_7^+$  from the association of  $H_2$  with  $C_2H_5^+$  depending on the temperature range of the reaction.

Enthalpy changes, bond dissociation energies, and potential well-depths are all listed under the heading of  $-\Delta H^\circ$  for convenience. The actual quantity reported depends on the experimental method as described in the previous section. Many of the Gibbs energy changes,  $-\Delta G^\circ$ , which are given for 298 or 300 K were not measured at that temperature, but were extrapolated from van't Hoff plots. The temperature range of nearly all the reported van't Hoff plots lies between 100 and 600 K.

As a general guide, the uncertainties of the values in these tables are often reported to be in the range  $\pm$  (0.5 to 1.5) kcal/mol for enthalpy changes,  $\pm$  (2 to 4) cal/K mol for entropy changes, and  $\pm$  (0.2 to 0.5) kcal/mol for free energy changes. The interested reader should, however, consult the specific references for reported uncertainties.

Table 1. Thermodynamic quantities for the gas-phase hydration of inorganic positive ions  $M^+(H_2O)_{n-1} + H_2O \rightarrow M^+(H_2O)_n$ .

Ref.	Ion	$-\Delta H_{n-1,n}^\circ$ (kcal/mol)								$-\Delta S_{n-1,n}^\circ$ (cal/K mol)							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
28	$Li^+$	(34)	25.8	20.7	16.4	13.9	12.1			[23]	21.1	24.9	29.9	31.4	32.0		
28	$Na^+$	24.0	19.8	15.8	13.8	12.3	10.7			21.5	22.2	21.9	25.0	28.1	26.0		
58		---	---	14.9	12.6	10.6				---	---	20.8	23.7	24.9			
59		---	---	---	13.6	11.6				---	---	---	26.0	26.5			
20		---	---	---	12.6					---	---	---	22.0				
297		26.5								22							
60	$K^+$	17.9	16.1	13.2	11.8	10.7	10.0			21.6	24.2	23.0	24.7	25.2	25.7		
61		16.9								19.9							
30		---								---							
297		19.4								21.3							
28	$Rb^+$	15.9	13.6	12.2	11.2	10.5				21.2	22.2	24.0	24.8	25.7			
297		16.0								20.1							
28	$Cs^+$	13.7	12.5	11.2	10.6					19.4	22.2	23.7	25.4				
62		11.9	11.3	9.7						14.3	16.6	16.6					
63	$Ag^+$	33.3	25.4	15.0	14.9	13.7	13.3			28.4	22.3	21.6	29.5	30.3	32.2		
64	$Bi^+$	22.8	17.7	14.0	12.0	10.5	9.7			27.1	25.5	24.4	23.5	22.7	23.6		
63	$Cu^+$	---	---	16.4	16.7	14.0				---	---	23.9	30.2	29.1			
59	$Pb^+$	22.4	16.9	12.2	10.8	10.0	9.6			35.5	25.3	20.2	20.8	22.3	23.6		
58	$Sr^+$	34.5	30.5	25.7	22.3	20.6	18.3	17.3	16.4	31.1	28.1	28.6	28.2	30.5	30.5	34.4	37.6
297	$SrOH^+$	29.9								21.5							
297	$CaOH^+$	34.4								21.5							
65	$NO^+$	18.5	16.1	---						23.0	25.5	---					
66		---								---							
67		---								---							
68		---								---							
69		---								22.7		23.9					
70	$H_3O^+$	31.6	19.5	17.5	---					24.3	21.7	27.3	---				
71		36	22.3	17	15.3	13	11.7	10.3		33.3	29	28.3	32.6	30.3	29.6	27	
72		---	---	17.9	12.7	11.6	10.7			---	28.4	23.4	25.0	26.1			
73		33	21	16	---					33.6	19.8	20.3	---				
74		---	20	16.2	14.8					---	31	26.7	31.7				
75		7	13	16.8	12.9	8.5				-1	14	28	28	17			
76		16.5	---	---	---					16.3	---	---	---				
77		16.3	14.8	17.6	---					17.2	16.9	30	---				
78		---	---	12.7	11.4					---	---	23.3	23.5				
79		32	23	17	---					---	---	---	---				
69		---	---	---	---					---	---	---	---				
80		---	---	---	---					---	---	---	---				
81		---	---	---	---					---	---	---	---				
82		---	---	---	---					---	---	---	---				
83		---	---	---	---					---	---	---	---				
68		---	---	---	---					---	---	---	---				
84	$NH_4^+$	17.3	14.7	13.4	12.2	9.7				19.7	21.9	25.1	27.3	22.4			
85		19.9	(14.8)	12.2	10.8	10.6	(9.1)	(8.4)		23.1	[24.5]	21.2	23.0	27.0	[21.2]	[23]	
73	$H_3S^+$	17.0	(21.2) <sup>c</sup> (20.3) <sup>c</sup>							17.8							
86,70,87										(24.5)	(21.8)						
88,70,19	$H_2CN^+$	(27.6) <sup>c</sup>	27.4	21.4	17.2					(23.8)							
146										24.2	25.3	26.2					
89	$O_2^+$	>16								---							
90	$H_2O^+$	>36								---							
91,19	$HCO^+$	(43.2) <sup>c</sup>	---	(24.1)						---							
85										[26]							
93,85,19	$PH_4^+$	(13)								---							
94	$Na^+SO_2$	19.8								20.2							
95,28	$Na^+CO_2$	(20.7) <sup>c</sup> (17.4) <sup>c</sup> (12.4) <sup>c</sup>	(22.9) <sup>c</sup>							(25.3)	(23.6)	([23])	(25.6)				
96,28,95																	
86,70,19	$H_3S^+H_2S$	(19.1) <sup>c</sup>								(21.8)							
84	$NH_4^+NH_3$	12.9	12.7	12.2						20.3	25.0	28.5					
84	$NH_4^+2NH_3$	12.4	11.7							24.6	27.8						
84	$NH_4^+3NH_3$	11.7								27.9							
97,60	$K^+C_6H_6$	(18.1) <sup>s</sup> (12.7) <sup>c</sup> (11.8) <sup>c</sup>								(29.9)	(21.4)	(26.3)					
97,60	$K^+2C_6H_6$	(13.7) <sup>s</sup> (12.2) <sup>c</sup>								(26.1)	(29.4)						

Ion	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)							(K) T	Method	Comments
	1	2	3	4	5	6	7			
$\text{Li}^+$	(27.2)	18.9	13.3	7.5	4.5	2.5		298	HPMS	(interpolated)
$\text{Na}^+$	17.6	13.2	9.3	6.3	3.9	2.9		298	HPMS	
	---	---	8.7	5.5	3.2			298	HPMS	
	---	---	---	5.9	3.7			298	HPMS	
	---	---	---	6.0	---			298	HPMS	
			19.9					298	MS	Flame Source (~1600 K)
$\text{K}^+$	11.5	8.9	6.3	4.4	3.2	2.3		298	HPMS	
	11.0	---						298	HPMS	
	0.4	---						840±50	MS	Knudsen Cell Source
	13.0							298	MS	Flame Source (~1600 K)
$\text{Rb}^+$	9.6	7.0	5.0	3.8	2.8			298	HPMS	
	10.0							298	MS	Flame Source (~1600 K)
$\text{Cs}^+$	7.9	5.9	4.2	3.0				298	HPMS	
	7.6	6.4	4.8					298	DTMS	
$\text{Ag}^+$	24.8	18.6	8.6	6.1	4.7	3.7		298	HPMS	
$\text{Bi}^+$	14.7	10.0	6.6	5.0	3.6	2.6		298	HPMS	
$\text{Cu}^+$	---	---	9.3	7.7	5.3			298	HPMS	
$\text{Pb}^+$	11.6	9.3	6.2	4.6	3.3	2.5		298	HPMS	
$\text{Sr}^+$	25.2	22.1	17.1	13.8	11.5	9.2	7.0	298	HPMS	
$\text{SrOH}^+$	23.3							290	MS	Flame Source (~1600 K)
$\text{CaOH}^+$	28.0							298	MS	Flame Source (~1600 K)
$\text{NO}^+$	11.6	8.5	5.4*					298, 308*	PHPMS	
	---	8.5	6.0					296	FA	
	---	8.4	5.9					293	HPMS	
	---	---	6.2					295	FA	
	(12.7)s	8.5	6.0					296	SAMS	s $\text{NO}^+$ -NO
		15.6						298	MS	Flame Source (~1600 K)
$\text{H}_3\text{O}^+$	24.3	13.0	9.3	---				298	PHPMS	
	25	13.6	8.5	5.5	3.9	2.8	2.2	298	HPMS	
	---	---	9.5	5.6	4.1	3.0		298	PHPMS	
	22.9	15.1	9.9	---				300	PHPMS	
	---	10.8	8.2	5.4				298	HPMS	
	7.7	9.3	8.4	4.8	3.4			300	HPMS	
	11.7	---	---	---				298	HPMS	
	11.2	9.7	8.6	---				298	HPMS	
	---	---	---	5.7	4.35			300	HPMS	Optimum of several values
	---	---	9.2	5.4				---	CI	Deuterated
	---	---	9.4	5.3				298	FA	
	---	---	8.3	5.0				307	PHPMS	
	---	---	8.4	5.0				300	PHPMS	
	8.1	8.6	9.1	7.0				300	HPMS	Optimum of several values
	---	---	---	4.7				295	FA	
$\text{NH}_4^+$	11.4	8.2	5.9	4.1	3.0			298	PHPMS	
	13.0	4.6‡	5.9	3.9	2.6	3.2*	2.8@	298; 414‡	HPMS	*266; @254
$\text{H}_3\text{S}^+$	11.7							298	PHPMS	
	(14.2)	(13.8)						300	HPMS	c $\text{H}_2\text{O}/\text{H}_2\text{S}(s)+\Delta PA$
$\text{H}_2\text{CN}^+$	(20.5)							298	ICR	c $\text{H}_3\text{O}^+-\text{H}_2\text{O}(s)+\Delta PA$
	20.2	13.9	9.4					298	HPMS	
$\text{O}_2^+$	---							---	FA	> $\text{O}_2^+-\text{SO}_2$
$\text{H}_2\text{O}^+$	---							---	PI	
$\text{HCO}^+$	---		9.0					298	---	c $\Delta H_f+\Delta PA$ ; cf. Ref. 92
$\text{PH}_4^+$	---							582	HPMS	
$\text{Na}^+\text{SO}_2$	13.8							298	ICR	bracketed; see $\text{H}_3\text{O}^+-\text{PH}_3$
$\text{Na}^+\text{CO}_2$	(13.2)	(10.4)	(5.5)					298	HPMS	c $\text{H}_2\text{O}/\text{CO}_2$
	(15.3)							298	FA	c $\text{H}_2\text{O}/\text{CO}_2$
$\text{H}_3\text{S}^+\text{H}_2\text{S}$	(12.9)							300	PHPMS	c $\text{H}_2\text{O}/\text{H}_2\text{S}(s)+\Delta PA$
$\text{NH}_4^+\text{NH}_3$	6.9	5.3	3.7					300	PHPMS	[s-cf. Ref. 109]
$\text{NH}_4^+\text{2NH}_3$	5.0	3.5						300	PHPMS	[s-cf. Ref. 109]
$\text{NH}_4^+\text{3NH}_3$	3.4							300	PHPMS	[s-cf. Ref. 109]
$\text{K}^+\text{C}_6\text{H}_6$	(9.3)	(6.3)	(3.9)					298	HPMS	s $\text{K}^+\text{C}_6\text{H}_6-\text{C}_6\text{H}_6$ ; c $\text{H}_2\text{O}/\text{C}_6\text{H}_6(s)$
$\text{K}^+\text{2C}_6\text{H}_6$	(5.9)	(3.4)						298	HPMS	s $\text{K}^+\text{2C}_6\text{H}_6-\text{C}_6\text{H}_6$ ; c $\text{H}_2\text{O}/\text{C}_6\text{H}_6(s)$

Table 2. Thermodynamic quantities for the gas-phase hydration of inorganic negative ions  $M^-(H_2O)_{n-1} + H_2O \rightarrow M^-(H_2O)_n$ 

Ref.	Ion	$-\Delta H_{n-1,n}^\circ$ (kcal/mol)						$-\Delta S_{n-1,n}^\circ$ (cal/K mol)					
		1	2	3	4	5	6	1	2	3	4	5	6
98 99	F <sup>-</sup>	23.3 ---	16.6	13.7	13.5	13.2		17.4 ---	18.7	20.4	26.9*	30.7	
98 100 330 101 99 295,4 297	Cl <sup>-</sup>	13.1 14.9 14.7	12.7 12.6 13.0	11.7 11.5 11.8	11.1 10.9			16.5 19.7 19.7	20.8 20.5 21.4	23.2 22.4 22.3	25.8 24.8		
297	(14.4) 14.8							[20.1] 20.1					
98 99 297	Br <sup>-</sup>	12.6 ---	12.3	11.5	10.9			18.4 ---	22.9	24.8	26.8		
98 100 99	I <sup>-</sup>	10.2 11.1 ---	9.8	9.4				16.3 19.3 ---	19.0	21.3			
102	H <sup>-</sup>	~17						---					
101,103	O <sup>-</sup>	(<30) <sup>c</sup>						---					
103 104 105 101 102 298	OH <sup>-</sup>	22.5 25 34.5	16.4 17.9 23	15.1	14.2	14.1		19.1 20.8 ---	19.3 21.2 ---	24.8 ---	29.5	33.2	
103 99 106 101	O <sub>2</sub> <sup>-</sup>	18.4 ---	17.2	15.4	---			20.1	25.1	28.2			
101	O <sub>3</sub> <sup>-</sup>	---						---					
104 107 99 108 101	NO <sub>2</sub> <sup>-</sup>	14.3 15.2 ---	12.9 13.6	10.4 11.7	---	11.6		21 23.8	23.7 26.4	21.2 25.8	29.0		
104 107 108 101	NO <sub>3</sub> <sup>-</sup>	12.4 14.6 ---	---	---	14.3	13.8		19.1 25.0	30.3	33.2			
110 101	CO <sub>3</sub> <sup>-</sup>	14.1 ---	13.6	13.1				25.2	29.6	32.5			
111 101,103	CO <sub>4</sub> <sup>-</sup>	~14.6 ---	~10.6					---					
110	HCO <sub>3</sub> <sup>-</sup>	15.7	14.9	13.6	13.4			24.1	29.1	30.2	33.3		
104	CN <sup>-</sup>	13.8						19.8					
101	SO <sub>3</sub> <sup>-</sup>	---						---					
101	SO <sub>4</sub> <sup>-</sup>	---						---					
112	HSO <sub>4</sub> <sup>-</sup>	11.9						19.8					
149	PO <sub>3</sub> <sup>-</sup>	13.0						22.5					
94 101	Cl <sup>-</sup> •SO <sub>2</sub>	10.4 ---	9.3					19.4 ---	19.7				
94	Cl <sup>-</sup> •2SO <sub>2</sub>	9.9						22.7					
113	Cl <sup>-</sup> •HCl	10.5	9.6					18.7	20.4				
113	Cl <sup>-</sup> •2HCl	7.6						15.2					

Ion	$-\Delta G_{n-1,n}^{\circ}$ (T) (kcal/mol)						(K)	Method	Comments
	1	2	3	4	5	6			
F <sup>-</sup>	18.1 ---	11.0 ---	7.6 ---	5.5 6.1	4.1* 4.7		298 298	HPMS HPMS	* typographical error in ref.
Cl <sup>-</sup>	8.2 9.0 8.8 8.2 ---	6.5 6.5 6.6 6.7 ---	4.8* 4.8 5.1 4.9 5.4	3.4 3.5 --- --- 4.0		3.0	298 298 298 296 298 298 298	HPMS HPMS HPMS FA HPMS ICR MS	typographical error in ref. sCl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH Flame Source (~1600 K)
Br <sup>-</sup>	7.0 ---	5.5 5.8	4.1 4.5	2.9 3.3			298 298 298	HPMS HPMS MS	Flame Source (~1600 K)
I <sup>-</sup>	5.4 5.3 5.6	4.2 3.9 4.3	3.1 3.0 3.4	---			298 298 298	HPMS HPMS HPMS	
H <sup>-</sup>	---						---	RET	Deuterated
O <sup>-</sup>	---						---	FA	Based on O <sup>-</sup> (H <sub>2</sub> O)+H <sub>2</sub> O + OH <sup>-</sup> (H <sub>2</sub> O)+OH
OH <sup>-</sup>	16.9 18.8 ---	10.7 11.6 ---	7.7 ---	5.4 ---	4.2		298 298 ---	HPMS HPMS CID	Deuterated
							298 298 ---	FA RET	Deuterated Deuterated
O <sub>2</sub> <sup>-</sup>	12.4 ---	9.7 6.25	7.0 4.55	3.4			298 298	HPMS HPMS	
							300.5	SA-MS	
							296	FA	
O <sub>3</sub> <sup>-</sup>	---	6.2	4.5				296	FA	
NO <sub>2</sub> <sup>-</sup>	8.0 8.1 ---	5.8 5.8 6.2	4.1 4.0 4.6	3.0 3.5			298 298 298	HPMS HPMS HPMS	
							300	SAMS	
							296	FA	
NO <sub>3</sub> <sup>-</sup>	6.7 7.1 7.0 6.8	---	---	3.9			298 298 300 296	HPMS HPMS SAMS FA	
CO <sub>3</sub> <sup>-</sup>	6.6 6.7	4.8 4.3	3.4 ---				298 296	HPMS FA	
CO <sub>4</sub> <sup>-</sup>	---	---	---				296	HPMS FA	CO <sub>2</sub> <sup>-</sup> in CO <sub>2</sub> /H <sub>2</sub> O(s)
HCO <sub>3</sub> <sup>-</sup>	8.5	6.2	4.6	3.5			298	HPMS	
CN <sup>-</sup>	7.9						298	HPMS	
SO <sub>3</sub> <sup>-</sup>	5.9						296	FA	
SO <sub>4</sub> <sup>-</sup>	5.1	1.6					296	FA	
HSO <sub>4</sub> <sup>-</sup>	6.0						298	FA	
PO <sub>3</sub> <sup>-</sup>	6.3						298	HPMS	
Cl <sup>-</sup> •SO <sub>2</sub>	4.7 (5.5) <sup>c</sup>	3.5					296 296	HPMS FA	cH <sub>2</sub> O/SO <sub>2</sub> (s)
Cl <sup>-</sup> •2SO <sub>2</sub>	3.2						296	HPMS	
Cl <sup>-</sup> •HCl	4.9	3.5					298	HPMS	Deuterated
Cl <sup>-</sup> •2HCl	3.1						298	HPMS	Deuterated

Table 3. Thermodynamic quantities for the gas-phase hydration of organic ions.

Ref.	Formula	Compound	-ΔH <sub>n-1,n</sub> <sup>0</sup> (kcal/mol)								-ΔS <sub>n-1,n</sub> <sup>0</sup> (cal/K mol)								
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	
91,19 85 326	CH <sub>3</sub> <sup>+</sup>	CH <sub>3</sub> <sup>+</sup>	(66.6) <sup>c</sup>	(25) <sup>i</sup>	25.4	21.0	14.8	11.6	9.1	9.4	(8.9)	—	—	23.0	28.9	25.9	22.1	18.5	22.2 [22]
115,70 85,(70,19) 88,70,19 116,70,19	CH <sub>3</sub> O <sup>+</sup>	H <sub>2</sub> COH <sup>+</sup>	(26.8) <sup>c</sup> (27.7) <sup>c</sup> (26.5) <sup>c</sup>	(18.5) <sup>c</sup> (17.0) <sup>c</sup>	21.5	17.6	12.9	11.1	9.5	10.0	—	(23.9) (21.9) (22.1)	(22.0) (27.0) —	(25.5) 25.5	23.2	22.6	20.8	25.7	
117	CH <sub>3</sub> O <sub>2</sub> <sup>+</sup>	prot. formic acid	(24.1)	—	—	—	—	—	—	—	[26]	—	—	—	—	—	—	—	
85	CH <sub>4</sub> NO <sup>+</sup>	(H <sub>2</sub> NCHO)H <sup>+</sup>	21.2	14.0	11.8	9.7	9.9	—	—	—	—	27.2	22.8	21.0	20.2	25.6	—	—	
260,19	CH <sub>5</sub> <sup>+</sup>	CH <sub>5</sub> <sup>+</sup>	(42.5) <sup>c</sup>	—	—	—	—	—	—	—	(25.5)	—	—	—	—	—	—	—	
—	CH <sub>5</sub> O <sup>+</sup>	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
93,19 118	CH <sub>5</sub> S <sup>+</sup>	CH <sub>3</sub> SH <sub>2</sub> <sup>+</sup>	(13.5) (16.9)	—	—	—	—	—	—	—	[25]	—	—	—	—	—	—	—	
119 85	CH <sub>6</sub> N <sup>+</sup>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	18.8 16.8	14.6	12.4	—	10.3	(9.0)	(8.5)	—	—	26.3 21.8	26.7 24.2	26.4 24.1	22.0	[22.1] [21.2]	—	—	
299,70,19	C <sub>2</sub> H <sub>2</sub> O <sub>2</sub> F <sub>3</sub>	CF <sub>3</sub> COOH	(28.3)	—	—	—	—	—	—	—	[23.3]	—	—	—	—	—	—	—	
120 121 85	C <sub>2</sub> H <sub>3</sub> O <sup>+</sup>	CH <sub>3</sub> CO <sup>+</sup>	24.6 —	—	21.9 20.1	17.8	12.9	10.8	(10.3)	—	—	33.1 —	—	—	21.0	26.4	23.2	20.4 [22.1]	
249,70,19	C <sub>2</sub> H <sub>3</sub> OF <sub>3</sub> <sup>+</sup>	CF <sub>3</sub> CH <sub>2</sub> OH <sub>2</sub> <sup>+</sup>	(30.5)	—	—	—	—	—	—	—	[23.8]	—	—	—	—	—	—	—	
85	C <sub>2</sub> H <sub>4</sub> N <sup>+</sup>	CH <sub>3</sub> CNH <sup>+</sup>	24.8	17.5	15.6	11.2	10.4	10.1	—	—	—	28.4	25.1	24.8	21.8	23.4	25.5	—	
4;(91,19) 326	C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	CH <sub>3</sub> CH <sub>2</sub> <sup>+</sup>	(38.5) <sup>c</sup> —	24 —	19.2 18.7	14.2	12.5	—	9.7	13.1	—	—	26 —	28 26.9	26 24.7	26 22.8	26 20.9	28	
119	C <sub>2</sub> H <sub>5</sub> NF <sub>3</sub> <sup>+</sup>	CF <sub>3</sub> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	21.1	17.3	14.2	—	—	—	—	—	—	30.0	29.9	29.2	—	—	—	—	
85	C <sub>2</sub> H <sub>5</sub> O <sup>+</sup>	CH <sub>3</sub> CHOH <sup>+</sup>	25.0	16.8	17.0	11.3	9.4	9.3	9.8	—	—	27.6	25.2	27.9	21.4	18.8	21.7	25.8	
93,19 118	C <sub>2</sub> H <sub>5</sub> OF <sub>2</sub> <sup>+</sup>	CF <sub>2</sub> CH <sub>2</sub> OH <sub>2</sub> <sup>+</sup>	(25)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	C <sub>2</sub> H <sub>5</sub> O <sub>2</sub> <sup>+</sup>	prot. acetic acid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
85	C <sub>2</sub> H <sub>5</sub> O <sub>2</sub> <sup>+</sup>	(CH <sub>3</sub> OCHO)H <sup>+</sup>	21.5	16.2	13.6	(11.0)	—	—	—	—	—	25.0	26.5	21.4	[21.6]	—	—	—	
—	C <sub>2</sub> H <sub>7</sub> O <sup>+</sup>	CH <sub>3</sub> CH <sub>2</sub> OH <sub>2</sub> <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
122 85	C <sub>2</sub> H <sub>7</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	22.6 24.0	15.3	13.8	10.2	—	—	—	—	—	26.5 29.0	26.3	25.4	19.0	—	—	—	
93,19 118	C <sub>2</sub> H <sub>7</sub> S <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> SH <sup>+</sup>	(12) 14.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
119	C <sub>2</sub> H <sub>8</sub> N <sup>+</sup>	CH <sub>3</sub> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	17.5	14.7	13.2	—	—	—	—	—	—	25.9	29.7	30.8	—	—	—	—	
85	C <sub>2</sub> H <sub>8</sub> N <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	15.0	13.5	11.3	10.5	9.4	(8.4)	—	—	—	22.9	24.7	24.4	25.2	24.4	[21.2]	—	
123 92	C <sub>3</sub> H <sub>5</sub> O <sup>+</sup>	CH <sub>3</sub> CH <sub>2</sub> CO <sup>+</sup>	23.7 —	—	16.4	12.7	—	—	—	—	—	35.1 —	—	24	24	—	—	—	
326	C <sub>3</sub> H <sub>7</sub> <sup>+</sup>	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> <sup>+</sup>	—	—	17.9	13.0	11.0	9.5	8.8	—	—	—	—	26.3	24.4	22.9	20.7	20.8	
77 91,19,124 326	C <sub>3</sub> H <sub>7</sub> <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	17.6 (23.6) <sup>c</sup>	13.5 —	14.9 —	—	—	—	—	—	—	27.7 —	12.7 —	21.5 —	—	—	—	—	
85	C <sub>3</sub> H <sub>7</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	20.5	13.6	12.7	10.3	10.3	—	—	—	—	26.0	23.2	21.9	20.2	23.5	—	—	
118	C <sub>3</sub> H <sub>7</sub> O <sup>+</sup>	CH <sub>3</sub> CH <sup>+</sup> CH <sub>3</sub>	11.2	—	—	—	—	—	—	—	—	18.8	—	—	—	—	—	—	
—	C <sub>3</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	prot. propionic acid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	C <sub>3</sub> H <sub>9</sub> O <sup>+</sup>	n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	C <sub>3</sub> H <sub>9</sub> O <sup>+</sup>	1-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
300	C <sub>3</sub> H <sub>9</sub> Sn <sup>+</sup>	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(25.7)	—	—	—	—	—	—	—	[27.6]	—	—	—	—	—	—	—	
85	C <sub>3</sub> H <sub>10</sub> N <sup>+</sup>	nC <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	15.1	11.6	10.3	9.9	—	—	—	—	—	21.5	21.3	23.1	24.5	—	—	—	
125;85	C <sub>3</sub> H <sub>10</sub> N <sup>+</sup>	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	14.5	11.4	10.0	(8.4)	—	—	—	—	—	24.1	24.8	24.9	[21.6]	—	—	—	
118	C <sub>4</sub> H <sub>5</sub> O <sup>+</sup>	turanit <sup>+</sup>	20.8	—	—	—	—	—	—	—	43.4	—	—	—	—	—	—	—	
118	C <sub>4</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	(CH <sub>3</sub> COOCH=CH <sub>2</sub> )H <sup>+</sup>	(19.2)	—	—	—	—	—	—	—	[28.5]	—	—	—	—	—	—	—	
114 91,19,124	C <sub>4</sub> H <sub>9</sub> <sup>+</sup>	(CH <sub>3</sub> ) <sub>3</sub> C <sup>+</sup>	11.2 (10.6) <sup>c</sup>	—	17.7	14	—	—	—	—	22	—	29	28.7	—	—	—	—	
117	C <sub>4</sub> H <sub>9</sub> O <sup>+</sup>	c-C <sub>4</sub> H <sub>8</sub> OH <sup>+</sup>	21.8	—	—	—	—	—	—	—	28.8	—	—	—	—	—	—	—	
117	C <sub>4</sub> H <sub>9</sub> O <sub>2</sub> <sup>+</sup>	1,4-dioxanet <sup>+</sup>	20.9	—	—	—	—	—	—	—	25.8	—	—	—	—	—	—	—	

Formula	Compound	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)								T(K)	Method	Comments
		1	2	3	4	5	6	7	8			
$\text{CH}_3^+$	$\text{CH}_3^+$	---	18.5	12.4	7.1	5.0	3.6	2.8	3.0*	298 298, *269	HPMS HPMS	$c\Delta H_f^{\circ}$ 's+PA; <sup>i</sup> interpolated; see Ref. 114
$\text{CH}_3\text{O}^+$	$\text{H}_2\text{COH}^+$	(19.7) (21.2) (19.9) (20.0)c	(11.9) (13.4) (9.2)c	(9.4) (10.0) (9.2)c	6.0	4.4	3.3	2.3		298 298 298 299	FA HPMS ICR FA	$\text{CH}_3\text{O}^+-\text{H}_2\text{O}/\text{H}_2\text{CO(s)}$ $\text{CH}_3\text{O}^+-\text{H}_2\text{O}+\Delta\text{PA}$ $\text{CH}_3\text{O}^+-\text{H}_2\text{O}+\Delta\text{PA}$ $\text{CH}_2\text{O}^+-\text{H}_2\text{O}/\text{H}_2\text{CO(s)}$
$\text{CH}_3\text{O}_2^+$	prot. formic acid	9.0								582	HPMS	
$\text{CH}_4\text{NO}^+$	$(\text{H}_2\text{NCHO})\text{H}^+$	13.1	7.2	5.5	3.7	2.3				298	HPMS	
$\text{CH}_5^+$	$\text{CH}_5^+$	(34.9)								298	---	$\text{CH}_3\text{O}^+-\text{CH}_4+\Delta\text{PA}$
$\text{CH}_5\text{O}^+$	$\text{CH}_3\text{OH}_2^+$	---								---	---	see $\text{CH}_3^+$
$\text{CH}_5\text{S}^+$	$\text{CH}_3\text{SH}_2^+$	5.2								467	ICR HPMS	bracketed ( $\pm 2$ kcal)
$\text{CH}_6\text{N}^+$	$\text{CH}_3\text{NH}_3^+$	11.0 10.3	6.7 7.4	4.5 3.7	3.5*	3.1*				298 298	PHPMS HPMC	$\pm 269, *259$
$\text{C}_2\text{H}_2\text{OF}_3$	$\text{CF}_3\text{COOH}$	(21.4)c								309	ICR	$\text{CH}_3\text{O}^+-\text{H}_2\text{O}+\Delta\text{PA}$
$\text{C}_2\text{H}_3\text{O}^+$	$\text{CH}_3\text{CO}^+$	14.7								298	HPMS	
		---	13.8	9.9	6.0	4.7	4.1*			298, *280	HPMS HPMS	converts to $\text{CH}_3\text{C}(\text{OH})_2^+$ from Figure; quoted in Ref. 93
$\text{C}_2\text{H}_3\text{OF}_3^+$	$\text{CF}_3\text{CH}_2\text{OH}_2^+$	(23.4)c								298	ICR	$\text{CH}_3\text{O}^+-\text{H}_2\text{O}+\Delta\text{PA}$
$\text{C}_2\text{H}_4\text{N}^+$	$\text{CH}_3\text{CNH}^+$	16.3	10.0	8.2	4.7	3.4	2.5			298	HPMS	
$\text{C}_2\text{H}_5^+$	$\text{CH}_3\text{CH}_2^+$	---	16.3	10.9	6.5	4.8	3.5	4.8		298 298	HPMS HPMS	$c\Delta H_f^{\circ}$ 's + PA (cf. Ref. 114)
$\text{C}_2\text{H}_5\text{NF}_3^+$	$\text{CF}_3\text{CH}_2\text{NH}_3^+$	12.1	8.4	5.5						298	PHPMS	
$\text{C}_2\text{H}_5\text{O}^+$	$\text{CH}_3\text{CHOH}^+$	16.8	9.3	8.7	4.9	3.8	2.8	2.1		298	HPMS	
$\text{C}_2\text{H}_5\text{OF}_2^+$	$\text{CF}_2\text{CH}_2\text{OH}_2^+$	---								---	ICR	bracketed ( $\pm 2$ kcal)
$\text{C}_2\text{H}_5\text{O}_2^+$	prot. acetic acid	---								---	---	see $\text{CH}_3\text{CO}^+$
$\text{C}_2\text{H}_5\text{O}_2^+$	$(\text{CH}_3\text{CHO})\text{H}^+$	14.0	8.3	7.2	3.8*					258, *334	HPMS	
$\text{C}_2\text{H}_7\text{O}^+$	$\text{CH}_3\text{CH}_2\text{OH}_2^+$	---								---	---	see $\text{C}_2\text{H}_5^+$
$\text{C}_2\text{H}_7\text{O}^+$	$(\text{CH}_3)_2\text{OH}^+$	14.6 15.4	7.5	6.2	4.5					300 298	PHPMS HPMS	
$\text{C}_2\text{H}_7\text{S}^+$	$(\text{CH}_3)_2\text{SH}^+$	6.8								298	ICR HPMS	bracketed ( $\pm 2$ kcal)
$\text{C}_2\text{H}_8\text{N}^+$	$\text{CH}_3\text{CH}_2\text{NH}_3^+$	9.8	5.8	4.0						298	PHPMS	
$\text{C}_2\text{H}_8\text{N}^+$	$(\text{CH}_3)_2\text{NH}_2^+$	8.2	6.1	4.0	3.0	2.1	3.0*			298, *255	HPMS	
$\text{C}_3\text{H}_5\text{O}^+$	$\text{CH}_3\text{CH}_2\text{CO}^+$	13.2			9.2	5.4				298 298	PHPMS HPMS	
$\text{C}_3\text{H}_7^+$	$\text{CH}_3\text{CH}_2\text{CH}_2^+$	---	---	10.1	5.7	4.2	3.3	2.6		298	HPMS	
$\text{C}_3\text{H}_7^+$	$(\text{CH}_3)_2\text{CH}^+$	9.2	9.7	8.5	---	---	---			300 298	HPMS ---	$c\Delta H_f^{\circ}$ 's + PA (as in Ref. 114)
$\text{C}_3\text{H}_7\text{O}^+$	$(\text{CH}_3)_2\text{COH}^+$	12.8	6.7	6.2	4.3	3.3				298	HPMS	
$\text{C}_3\text{H}_7\text{O}^+$	$\text{CH}_3\text{CH}^+\text{OCH}_3$	5.6								298	HPMS	
$\text{C}_3\text{H}_7\text{O}_2^+$	prot. propionic acid	---								---	---	see $\text{C}_3\text{H}_5\text{O}^+$
$\text{C}_3\text{H}_9\text{O}^+$	$n\text{-C}_3\text{H}_7\text{OH}_2^+$	---								---	---	see $\text{C}_3\text{H}_7^+$
$\text{C}_3\text{H}_9\text{O}^+$	$1\text{-C}_3\text{H}_7\text{OH}_2^+$	---								---	---	see $\text{C}_3\text{H}_7^+$
$\text{C}_3\text{H}_9\text{Sn}^+$	$(\text{CH}_3)_3\text{Sn}^+$	((11.2)) <sup>b</sup>								525	PHPMS	$s(\text{CH}_3)_3\text{Sn}^+-\text{CH}_3\text{OH}$
$\text{C}_3\text{H}_{10}\text{N}^+$	$n\text{C}_3\text{H}_7\text{NH}_3^+$	8.7	5.3	3.4	2.5					298	HPMS	
$\text{C}_3\text{H}_{10}\text{N}^+$	$(\text{CH}_3)_3\text{NH}^+$	7.3	4.0	2.6	3.0*					298, *254	HPMS	
$\text{C}_4\text{H}_5\text{O}^+$	furan $\text{H}^+$	7.9								298	HPMS	
$\text{C}_4\text{H}_7\text{O}_2^+$	$(\text{CH}_3\text{COOCH}=\text{CH}_2)\text{H}^+$	5.4								492	HPMS	
$\text{C}_4\text{H}_9^+$	$(\text{CH}_3)_3\text{C}^+$	4.6	---	9.1	5.4					298 298	PHPMS ---	$c\Delta H_f^{\circ}$ 's + PA (as in Ref. 114)
$\text{C}_4\text{H}_9\text{O}^+$	c-C <sub>4</sub> H <sub>8</sub> OH $\text{H}^+$	13.2								298	HPMS	tetrahydrofuran $\text{H}^+$
$\text{C}_4\text{H}_9\text{O}_2^+$	1,4-dioxane $\text{H}^+$	13.2								298	HPMS	

Table 3. (continued) Thermodynamic quantities for the gas-phase hydration of organic ions.

Ref.	Formula	Compound	$-\Delta_{n-1,n}^{\theta}$ (kcal/mol)						$-\Delta_{n-1,n}^{\theta}$ (cal/K mol)								
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	
118	C <sub>4</sub> H <sub>9</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (CH <sub>3</sub> COOCH <sub>2</sub> CH <sub>3</sub> )	20.3								28.5						
85	C <sub>4</sub> H <sub>10</sub> NO <sup>+</sup>	CH <sub>3</sub> (N(CH <sub>3</sub> ) <sub>2</sub> )COH <sup>+</sup>	16.5	12.3	9.3	(9.0)					26.3	26.4	19.2	{21.6}			
110	C <sub>4</sub> H <sub>10</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup> (OOH <sub>3</sub> )	10.8								23.3						
---	C <sub>4</sub> H <sub>11</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>3</sub> COH <sub>2</sub> <sup>+</sup>	---								---						
117	C <sub>4</sub> H <sub>11</sub> O <sup>+</sup>	(CH <sub>3</sub> CH <sub>2</sub> ) <sub>2</sub> OH <sup>+</sup>	20.9								30.0						
117	C <sub>4</sub> H <sub>11</sub> O <sub>2</sub> <sup>+</sup>	CH <sub>3</sub> OH <sup>+</sup> (CH <sub>2</sub> ) <sub>2</sub> OCH <sub>3</sub>	15.1								21.3						
324	C <sub>4</sub> H <sub>12</sub> N <sup>+</sup>	N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	9.0	(9.4)							21.5	{22}					
121	C <sub>5</sub> H <sub>5</sub> NC <sub>1</sub> <sup>+</sup>	4-ClpyridineH <sup>+</sup>	---								---						
121	C <sub>5</sub> H <sub>5</sub> N <sub>2</sub> O <sub>2</sub> <sup>+</sup>	4-N <sub>2</sub> O <sub>2</sub> pyridineH <sup>+</sup>	---								---						
121	C <sub>5</sub> H <sub>6</sub> N <sup>+</sup>	pyridineH <sup>+</sup>	15.0	9.6	8.3						25.5	19.6	19.6				
125			16.1								27.0						
126	C <sub>5</sub> H <sub>9</sub> NO <sub>2</sub> <sup>+</sup>	prolineH <sup>+</sup>	18.9								36.8						
85	C <sub>5</sub> H <sub>9</sub> O <sup>+</sup>	(c-C <sub>3</sub> H <sub>5</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	18.2	11.8	10.2	(10.0)	(9.7)				26.8	20.8	19.3	{21.6}	{22.1}		
117	C <sub>5</sub> H <sub>11</sub> O <sup>+</sup>	c-C <sub>5</sub> H <sub>10</sub> OH <sup>+</sup>	19.5								25.2						
126	C <sub>5</sub> H <sub>12</sub> NO <sub>2</sub> <sup>+</sup>	valineH <sup>+</sup>	19.3								36.3						
117	C <sub>5</sub> H <sub>13</sub> O <sub>2</sub> <sup>+</sup>	CH <sub>3</sub> OH <sup>+</sup> (CH <sub>2</sub> ) <sub>3</sub> OCH <sub>3</sub>	(9)								{22}						
121	C <sub>6</sub> H <sub>5</sub> N <sub>2</sub> <sup>+</sup>	4-CNpyridineH <sup>+</sup>	16.0	10.4	8.9	8.2					25.7	20.2	20.2	19.7			
121	C <sub>6</sub> H <sub>5</sub> N <sub>2</sub> <sup>+</sup>	3-CNpyridineH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	o-NO <sub>2</sub> phenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	m-NO <sub>2</sub> phenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	p-NO <sub>2</sub> phenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	o-ClphenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	m-ClphenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	p-ClphenolH <sup>+</sup>	---								---						
93,70,19	C <sub>6</sub> H <sub>7</sub> <sup>+</sup>	benzeneH <sup>+</sup>	(<17)								---						
128	C <sub>6</sub> H <sub>7</sub> NF <sup>+</sup>	m-FanilineH <sup>+</sup>	(14.8)								{22}						
128	C <sub>6</sub> H <sub>7</sub> NC <sub>1</sub> <sup>+</sup>	m-CianilineH <sup>+</sup>	(14.8)								{22}						
127	C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	o-OHphenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	m-OHphenolH <sup>+</sup>	---								---						
127	C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	p-OHphenolH <sup>+</sup>	---								---						
121	C <sub>6</sub> H <sub>8</sub> N <sup>+</sup>	4-CH <sub>3</sub> pyridineH <sup>+</sup>	14.7								26.6						
128	C <sub>6</sub> H <sub>8</sub> N <sup>+</sup>	anilineH <sup>+</sup>	(15.1)								{22}						
121	C <sub>6</sub> H <sub>8</sub> NO <sup>+</sup>	4-CH <sub>3</sub> OpyridineH <sup>+</sup>	---								---						
128	C <sub>6</sub> H <sub>8</sub> NO <sup>+</sup>	m-OHanilineH <sup>+</sup>	(12.5)								{22}						
128	C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	o-NH <sub>2</sub> anilineH <sup>+</sup>	(13.9)								{22}						
128	C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	m-NH <sub>2</sub> anilineH <sup>+</sup>	(9.9)								{22}						
128	C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	p-NH <sub>2</sub> anilineH <sup>+</sup>	(14.7)								{22}						
117	C <sub>6</sub> H <sub>11</sub> O <sup>+</sup>	(c-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	16.6								26.0						
129	C <sub>6</sub> H <sub>12</sub> NO <sub>3</sub> <sup>+</sup>	(CH <sub>3</sub> CONICH(CH <sub>3</sub> )-CO <sub>2</sub> CH <sub>3</sub> )H <sup>+</sup>	13.0	12.4	9.5						21.2	26.0	21.5				
117	C <sub>6</sub> H <sub>15</sub> O <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	21.3								33.8						
117	C <sub>6</sub> H <sub>15</sub> O <sup>+</sup>	(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	17.8								29.4						
118	C <sub>6</sub> H <sub>15</sub> S <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> SH <sup>+</sup>	12.2								25.7						
125	C <sub>6</sub> H <sub>16</sub> N <sup>+</sup>	(CH <sub>3</sub> CH <sub>2</sub> ) <sub>3</sub> NH <sup>+</sup>	13.2								27.3						
123;121	C <sub>7</sub> H <sub>5</sub> O <sup>+</sup>	C <sub>6</sub> H <sub>5</sub> CO <sup>+</sup>	25.8	18.7*							42.9						
127	C <sub>7</sub> H <sub>6</sub> NO <sup>+</sup>	p-CNphenolH <sup>+</sup>	---								---						
128	C <sub>7</sub> H <sub>7</sub> NP <sub>3</sub> <sup>+</sup>	m-CF <sub>3</sub> anilineH <sup>+</sup>	(16.1)								{22}						
128	C <sub>7</sub> H <sub>7</sub> N <sub>2</sub> <sup>+</sup>	m-CNanilineH <sup>+</sup>	(17.3)								{22}						

Formula	Compound	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)								T(K)	Method	Comments
		1	2	3	4	5	6	7	8			
C <sub>4</sub> H <sub>9</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (CH <sub>3</sub> COOCH <sub>2</sub> CH <sub>3</sub> )	11.8								298	HPMS	prot. ethyl acetate
C <sub>4</sub> H <sub>10</sub> NO <sup>+</sup>	CH <sub>3</sub> (N(CH <sub>3</sub> ) <sub>2</sub> ) <sub>2</sub> COH <sup>+</sup>	8.7	4.4	3.6	3.2*					298,*268	HPMS	
C <sub>4</sub> H <sub>10</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup> (OCH <sub>3</sub> )	3.9								298	HPMS	
C <sub>4</sub> H <sub>11</sub> O <sup>+</sup>	(CH <sub>3</sub> ) <sub>3</sub> COH <sub>2</sub> <sup>+</sup>	---								---	---	see (CH <sub>3</sub> ) <sub>3</sub> C <sup>+</sup>
C <sub>4</sub> H <sub>11</sub> O <sup>+</sup>	(CH <sub>3</sub> CH <sub>2</sub> ) <sub>2</sub> OH <sup>+</sup>	12.0								298	HPMS	
C <sub>4</sub> H <sub>11</sub> O <sub>2</sub> <sup>+</sup>	CH <sub>3</sub> OH <sup>+</sup> (CH <sub>2</sub> ) <sub>2</sub> OCH <sub>3</sub>	8.8								298	HPMS	
C <sub>4</sub> H <sub>12</sub> N <sup>+</sup>	N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	2.6		3.6*						298,*259	HPMS	
C <sub>5</sub> H <sub>5</sub> NC <sub>1</sub> <sup>+</sup>	4-C <sub>1</sub> pyridineH <sup>+</sup>	4.9								400	PHPMS	
C <sub>5</sub> H <sub>5</sub> N <sub>2</sub> O <sub>2</sub> <sup>+</sup>	4-N <sub>2</sub> pyridineH <sup>+</sup>	5.9								400	PHPMS	
C <sub>5</sub> H <sub>6</sub> N <sup>+</sup>	pyridineH <sup>+</sup>	4.8	1.8	0.5						400	PHPMS	
C <sub>5</sub> H <sub>9</sub> NO <sub>2</sub> <sup>+</sup>	prolineH <sup>+</sup>	11.9								300	HPMS	
C <sub>5</sub> H <sub>9</sub> O <sup>+</sup>	(c-C <sub>3</sub> H <sub>5</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	10.2	5.6	4.4	4.0*	3.5*				298,*284	HPMS	*281
C <sub>5</sub> H <sub>11</sub> O <sup>+</sup>	c-C <sub>5</sub> H <sub>10</sub> OH <sup>+</sup>	12.0								298	HPMS	
C <sub>5</sub> H <sub>12</sub> NO <sub>2</sub> <sup>+</sup>	valineH <sup>+</sup>	8.4								300	HPMS	
C <sub>5</sub> H <sub>13</sub> O <sub>2</sub> <sup>+</sup>	CH <sub>3</sub> OH <sup>+</sup> (CH <sub>2</sub> ) <sub>3</sub> OCH <sub>3</sub>	1.9								324	HPMS	
C <sub>6</sub> H <sub>5</sub> N <sub>2</sub> <sup>+</sup>	4-CNpyridineH <sup>+</sup>	5.7	2.3	0.8	0.4					400	PHPMS	
C <sub>6</sub> H <sub>5</sub> N <sub>2</sub> <sup>+</sup>	3-CNpyridineH <sup>+</sup>	6.0								400	PHPMS	
C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	o-NO <sub>2</sub> phenolH <sup>+</sup>	6.7								427	PHPMS	
C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	m-NO <sub>2</sub> phenolH <sup>+</sup>	8.1								427	PHPMS	
C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub> <sup>+</sup>	p-NO <sub>2</sub> phenolH <sup>+</sup>	6.8								427	PHPMS	
C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	o-ClphenolH <sup>+</sup>	2.9								436	PHPMS	
C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	m-ClphenolH <sup>+</sup>	4.8								443	PHPMS	
C <sub>6</sub> H <sub>6</sub> OCl <sup>+</sup>	p-ClphenolH <sup>+</sup>	6.2								453	PHPMS	
C <sub>6</sub> H <sub>7</sub> <sup>+</sup>	benzeneH <sup>+</sup>	---								---	ICR	from H <sub>3</sub> O <sup>+</sup> -C <sub>6</sub> H <sub>6</sub> < H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O
C <sub>6</sub> H <sub>7</sub> NF <sup>+</sup>	m-FanilineH <sup>+</sup>	5.3								433	PHPMS	
C <sub>6</sub> H <sub>7</sub> NC <sub>1</sub> <sup>+</sup>	m-CianilineH <sup>+</sup>	5.3								433	PHPMS	
C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	o-OHphenolH <sup>+</sup>	2.9								454	PHPMS	
C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	m-OHphenolH <sup>+</sup>	4.5								454	PHPMS	
C <sub>6</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	p-OHphenolH <sup>+</sup>	4.4								454	PHPMS	
C <sub>6</sub> H <sub>8</sub> N <sup>+</sup>	4-CH <sub>3</sub> pyridineH <sup>+</sup>	4.1								400	PHPMS	
C <sub>6</sub> H <sub>8</sub> N <sup>+</sup>	anilineH <sup>+</sup>	5.6								433	PHPMS	
C <sub>6</sub> H <sub>8</sub> NO <sup>+</sup>	4-CH <sub>3</sub> 0pyridineH <sup>+</sup>	3.4								400	PHPMS	
C <sub>6</sub> H <sub>8</sub> NO <sup>+</sup>	m-OHanilineH <sup>+</sup>	3.0								433	PHPMS	
C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	o-NH <sub>2</sub> anilineH <sup>+</sup>	4.4								433	PHPMS	
C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	m-NH <sub>2</sub> anilineH <sup>+</sup>	0.4								433	PHPMS	ring protonated
C <sub>6</sub> H <sub>9</sub> N <sub>2</sub> <sup>+</sup>	p-NH <sub>2</sub> anilineH <sup>+</sup>	5.2								433	PHPMS	
C <sub>6</sub> H <sub>11</sub> O <sup>+</sup>	(c-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	8.9								298	HPMS	
C <sub>6</sub> H <sub>12</sub> NO <sub>3</sub> <sup>+</sup>	(CH <sub>3</sub> CONHCH(CH <sub>3</sub> )-CO <sub>2</sub> CH <sub>3</sub> )H <sup>+</sup>	6.7	4.7	3.1						298	HPMS	N-acetyl alanine methyl ester
C <sub>6</sub> H <sub>15</sub> O <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	11.2								298	HPMS	
C <sub>6</sub> H <sub>15</sub> O <sup>+</sup>	(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	9.0								298	HPMS	
C <sub>6</sub> H <sub>15</sub> S <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> SH <sup>+</sup>	4.5								298	HPMS	
C <sub>6</sub> H <sub>16</sub> N <sup>+</sup>	(CH <sub>3</sub> CH <sub>2</sub> ) <sub>3</sub> NH <sup>+</sup>	5.1								298	PHPMS	
C <sub>7</sub> H <sub>5</sub> O <sup>+</sup>	C <sub>6</sub> H <sub>5</sub> CO <sup>+</sup>	13.0								298	PHPMS	*from Figure in Ref. 121
C <sub>7</sub> H <sub>6</sub> NO <sup>+</sup>	p-CNphenolH <sup>+</sup>	7.7								426	PHPMS	
C <sub>7</sub> H <sub>7</sub> NF <sub>3</sub> <sup>+</sup>	m-CF <sub>3</sub> anilineH <sup>+</sup>	6.6								433	PHPMS	
C <sub>7</sub> H <sub>7</sub> N <sub>2</sub> <sup>+</sup>	m-CNanilineH <sup>+</sup>	7.8								433	PHPMS	

Table 3. (continued) Thermodynamic quantities for the gas-phase hydration of organic ions.

Ref.	Formula	Compound	-ΔH <sub>n-1,n</sub> <sup>o</sup> (kcal/mol)								-ΔS <sub>n-1,n</sub> <sup>o</sup> (cal/K mol)							
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
—	C <sub>7</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	prot. benzoic acid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>7</sub> H <sub>7</sub> O <sub>3</sub> <sup>+</sup>	prot. o-OH benzoic acid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	o-CH <sub>3</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	m-CH <sub>3</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	p-CH <sub>3</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
125	C <sub>7</sub> H <sub>10</sub> N <sup>+</sup>	2,6(CH <sub>3</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	13.2	—	—	—	—	—	—	—	25.9	—	—	—	—	—	—	—
128	C <sub>7</sub> H <sub>10</sub> N <sup>+</sup>	m-CH <sub>3</sub> anilineH <sup>+</sup>	(13.5)	—	—	—	—	—	—	—	[22]	—	—	—	—	—	—	—
128	C <sub>7</sub> H <sub>10</sub> NO <sup>+</sup>	m-CH <sub>3</sub> OanilineH <sup>+</sup>	(10.3)	—	—	—	—	—	—	—	[22]	—	—	—	—	—	—	—
128	C <sub>7</sub> H <sub>10</sub> NS <sup>+</sup>	m-CH <sub>3</sub> SanilineH <sup>+</sup>	(10.6)	—	—	—	—	—	—	—	[22]	—	—	—	—	—	—	—
121	C <sub>7</sub> H <sub>11</sub> N <sub>2</sub> <sup>+</sup>	4-(CH <sub>3</sub> ) <sub>2</sub> N pyridineH <sup>+</sup>	12.0	—	—	—	—	—	—	—	24.8	—	—	—	—	—	—	—
85	C <sub>7</sub> H <sub>11</sub> O <sup>+</sup>	(c-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	16.5	11.2	8.9	(9.1)	—	—	—	—	24.0	22.3	17.1	[21.6]	—	—	—	—
74	C <sub>7</sub> H <sub>15</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (t-C <sub>5</sub> H <sub>11</sub> OOCH <sub>3</sub> )	13.8	—	—	—	—	—	—	—	12	—	—	—	—	—	—	—
85	C <sub>8</sub> H <sub>9</sub> O <sup>+</sup>	(C <sub>6</sub> H <sub>5</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	19.5	12.7	(12.1)	(9.1)	—	—	—	—	29.1	21.1	[22]	[21.6]	—	—	—	—
127	C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	o-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	m-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	p-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
125	C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	2- <i>t</i> -C <sub>3</sub> H <sub>7</sub> pyridineH <sup>+</sup>	14.2	—	—	—	—	—	—	—	28.8	—	—	—	—	—	—	—
128	C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	m-C <sub>2</sub> H <sub>5</sub> anilineH <sup>+</sup>	(13.2)	—	—	—	—	—	—	—	[22]	—	—	—	—	—	—	—
130	C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub> H <sup>+</sup>	10.9	—	—	—	—	—	—	—	21	—	—	—	—	—	—	—
324	C <sub>8</sub> H <sub>20</sub> N <sup>+</sup>	H(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> <sup>+</sup>	(7.0)	—	—	—	—	—	—	—	[20]	—	—	—	—	—	—	—
74	C <sub>9</sub> H <sub>11</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> OOCH <sub>3</sub> )	13.7	—	—	—	—	—	—	—	12	—	—	—	—	—	—	—
129	C <sub>9</sub> H <sub>12</sub> NO <sup>+</sup>	(C <sub>6</sub> H <sub>5</sub> )(N(CH <sub>3</sub> ) <sub>2</sub> )COH <sup>+</sup>	15.1	—	—	—	—	—	—	—	26.3	—	—	—	—	—	—	—
125	C <sub>9</sub> H <sub>14</sub> N <sup>+</sup>	2,6(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	[13]	—	—	—	—	—	—	—	(28.6)	—	—	—	—	—	—	—
125	C <sub>9</sub> H <sub>14</sub> N <sup>+</sup>	2- <i>t</i> -C <sub>4</sub> H <sub>9</sub> pyridineH <sup>+</sup>	14.2	—	—	—	—	—	—	—	30.8	—	—	—	—	—	—	—
125	C <sub>4</sub> H <sub>7</sub> N <sub>2</sub> <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> NH <sup>+</sup>	12.5	—	—	—	—	—	—	—	30.2	—	—	—	—	—	—	—
301	C <sub>10</sub> H <sub>21</sub> O <sub>5</sub> <sup>+</sup>	15-crown-5 etherH <sup>+</sup>	21.6	—	—	—	—	—	—	—	33.0	—	—	—	—	—	—	—
125	C <sub>11</sub> H <sub>18</sub> N <sup>+</sup>	2,6( <i>t</i> -C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	12.8	—	—	—	—	—	—	—	32.1	—	—	—	—	—	—	—
301	C <sub>12</sub> H <sub>25</sub> O <sub>6</sub> <sup>+</sup>	18-crown-6-etherH <sup>+</sup>	26.4	—	—	—	—	—	—	—	34.6	—	—	—	—	—	—	—
117	C <sub>12</sub> H <sub>27</sub> O <sup>+</sup>	(n-C <sub>6</sub> H <sub>13</sub> ) <sub>2</sub> OH <sup>+</sup>	18.2	—	—	—	—	—	—	—	31.8	—	—	—	—	—	—	—
125	C <sub>12</sub> H <sub>28</sub> N <sup>+</sup>	(n-C <sub>6</sub> H <sub>9</sub> ) <sub>3</sub> NH <sup>+</sup>	13.6	—	—	—	—	—	—	—	36.4	—	—	—	—	—	—	—
125	C <sub>13</sub> H <sub>22</sub> N <sup>+</sup>	2,6( <i>t</i> -C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	12.5	—	—	—	—	—	—	—	41	—	—	—	—	—	—	—
118,(131)	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •CH <sub>3</sub> OH	—	—	—	11.2	10.4	(9.4)	—	—	—	—	—	—	—	23.0	23.5	[22]	—
118,(131)	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •2CH <sub>3</sub> OH	—	—	—	11.8	9.2	(9.3)	—	—	—	—	25.5	20.2	[22]	—	—	—	—
118	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •3CH <sub>3</sub> OH	12.1	—	—	8.6	(9.1)	—	—	—	—	27.0	19.0	[22]	—	—	—	—	—
118	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •4CH <sub>3</sub> OH	10.0	—	—	—	—	—	—	—	—	23.8	—	—	—	—	—	—	—
118	CH <sub>3</sub> CNH <sup>+</sup> •CH <sub>3</sub> CN	15.9	—	—	15.3	10.3	(9.7)	—	—	—	24.6	25.2	22.3	[22.1]	—	—	—	—
118	CH <sub>3</sub> CNH <sup>+</sup> •2CH <sub>3</sub> CN	—	—	—	9.7	—	—	—	—	—	—	—	—	[22]	—	—	—	—
122	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> •(CH <sub>3</sub> ) <sub>2</sub> O	16.3	—	—	13.6	11.6	—	—	—	—	38.8	24.6	26.8	—	—	—	—	—
122,(131)	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> •2(CH <sub>3</sub> ) <sub>2</sub> O	(23.0) <sup>c</sup>	—	—	11.4	—	—	—	—	—	(37.8)	30.3	—	—	—	—	—	—
302,132 132,104	CH <sub>3</sub> O <sup>+</sup>	(19.9)	—	—	—	—	—	—	—	—	[22]	—	—	—	—	—	—	—
132,104,302,11	CH <sub>3</sub> O <sup>+</sup> •CH <sub>3</sub> OH	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Formula	Compound	$-\Delta G_{n-1,n}^0(T)$ (kcal/mol)								T(K)	Method	Comments
		1	2	3	4	5	6	7	8			
C <sub>7</sub> H <sub>7</sub> O <sub>2</sub> <sup>+</sup>	prot. benzoic acid	---								---	---	see C <sub>7</sub> H <sub>5</sub> O <sup>+</sup>
C <sub>7</sub> H <sub>7</sub> O <sub>3</sub> <sup>+</sup>	prot. o-OH benzoic acid	5.5								452	HPMS	
C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	o-CH <sub>3</sub> phenolH <sup>+</sup>	4.4								447	HPMS	
C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	m-CH <sub>3</sub> phenolH <sup>+</sup>	4.2								454	HPMS	
C <sub>7</sub> H <sub>9</sub> O <sup>+</sup>	p-CH <sub>3</sub> phenolH <sup>+</sup>	4.6								447	HPMS	
C <sub>7</sub> H <sub>10</sub> N <sup>+</sup>	2,6(CH <sub>3</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	5.5								298	HPMS	
C <sub>7</sub> H <sub>10</sub> N <sup>+</sup>	m-CH <sub>3</sub> anilineH <sup>+</sup>	4.0								433	HPMS	ring to N protonation on hydration
C <sub>7</sub> H <sub>10</sub> NO <sup>+</sup>	m-CH <sub>3</sub> OanilineH <sup>+</sup>	0.8								433	HPMS	ring protonated
C <sub>7</sub> H <sub>10</sub> NS <sup>+</sup>	m-CH <sub>3</sub> SanilineH <sup>+</sup>	1.1								433	HPMS	ring to N protonation on hydration
C <sub>7</sub> H <sub>11</sub> N <sub>2</sub> <sup>+</sup>	4-(CH <sub>3</sub> ) <sub>2</sub> NpyridineH <sup>+</sup>	2.1								400	HPMS	
C <sub>7</sub> H <sub>11</sub> O <sup>+</sup>	(-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	8.5	3.9	3.8	3.3*					298,*269	HPMS	
C <sub>7</sub> H <sub>15</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (t-C <sub>5</sub> H <sub>11</sub> OOCCH <sub>3</sub> ) <sub>10</sub>									298	HPMS	prot. t-amyl acetate
C <sub>8</sub> H <sub>9</sub> O <sup>+</sup>	(C <sub>6</sub> H <sub>5</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	9.3	4.6	3.9*	3.0*					298,*375	HPMS	*284
C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	o-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	3.6								455	HPMS	
C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	m-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	3.9								453	HPMS	
C <sub>8</sub> H <sub>11</sub> O <sup>+</sup>	p-C <sub>2</sub> H <sub>5</sub> phenolH <sup>+</sup>	4.2								455	HPMS	
C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	2-t-C <sub>3</sub> H <sub>7</sub> pyridineH <sup>+</sup>	5.6								298	HPMS	
C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	m-C <sub>2</sub> H <sub>5</sub> anilineH <sup>+</sup>	3.7								433	HPMS	ring to N protonation on hydration
C <sub>8</sub> H <sub>12</sub> N <sup>+</sup>	C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub> H <sup>+</sup>	4.6								298	---	
C <sub>8</sub> H <sub>20</sub> N <sup>+</sup>	N(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> <sup>+</sup>	2.4								233	HPMS	
C <sub>9</sub> H <sub>11</sub> O <sub>2</sub> <sup>+</sup>	H <sup>+</sup> (C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> OOCCH <sub>3</sub> ) <sub>10</sub>									298	HPMS	prot. benzyl acetate
C <sub>9</sub> H <sub>12</sub> NO <sup>+</sup>	(C <sub>6</sub> H <sub>5</sub> )(N(CH <sub>3</sub> ) <sub>2</sub> )COH <sup>+</sup>	7.3								298	HPMS	
C <sub>9</sub> H <sub>14</sub> N <sup>+</sup>	2,6(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	2.3								394	HPMS	
C <sub>9</sub> H <sub>14</sub> N <sup>+</sup>	2-t-C <sub>4</sub> H <sub>9</sub> pyridineH <sup>+</sup>	5.0								298	HPMS	
C <sub>9</sub> H <sub>22</sub> N <sup>+</sup>	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> NH <sup>+</sup>	3.5								298	HPMS	
C <sub>10</sub> H <sub>21</sub> O <sub>5</sub> <sup>+</sup>	15-crown-5 etherH <sup>+</sup>	11.8								298	HPMS	
C <sub>11</sub> H <sub>18</sub> N <sup>+</sup>	2,6(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	3.2								298	HPMS	
C <sub>12</sub> H <sub>25</sub> O <sub>6</sub> <sup>+</sup>	18-crown-6-etherH <sup>+</sup>	16.1								298	HPMS	
C <sub>12</sub> H <sub>27</sub> O <sup>+</sup>	(n-C <sub>6</sub> H <sub>13</sub> ) <sub>2</sub> OH <sup>+</sup>	8.7								298	HPMS	
C <sub>12</sub> H <sub>28</sub> N <sup>+</sup>	(n-C <sub>4</sub> H <sub>9</sub> ) <sub>3</sub> NH <sup>+</sup>	2.8								298	HPMS	
C <sub>13</sub> H <sub>22</sub> N <sup>+</sup>	2,6(t-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> pyridineH <sup>+</sup>	0.3								298	HPMS	
CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •CH <sub>3</sub> OH	(7.3)c	(2.4)c	0.8	-0.2	3.5*					452,*269	HPMS	c H <sup>+</sup> -CH <sub>3</sub> OH/H <sub>2</sub> O
CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •2CH <sub>3</sub> OH	(3.1)c	0.3	0.1	3.3*						452,*274	HPMS	c H <sup>+</sup> -CH <sub>3</sub> OH/H <sub>2</sub> O
CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •3CH <sub>3</sub> OH	4.0	2.9	3.1*							300,*274	HPMS	
CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •4CH <sub>3</sub> OH	2.9									300	HPMS	
CH <sub>3</sub> CH <sub>2</sub> <sup>+</sup> •CH <sub>3</sub> CN	8.5	7.7	3.6	2.9*						300,*318	HPMS	
CH <sub>3</sub> CNH <sub>2</sub> <sup>+</sup> •2CH <sub>3</sub> CN	—	2.8								316	HPMS	
(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> •(CH <sub>3</sub> ) <sub>2</sub> O	(4.7)	6.3	3.6							300	PHPMS	
(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> •2(CH <sub>3</sub> ) <sub>2</sub> O	(11.7)	2.4								300	PHPMS	c H <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O/H <sub>2</sub> O
CH <sub>3</sub> O <sup>-</sup>	(13.3)c	(8.3)c	—	(6.7)c						296	HPMS	c OH <sup>-</sup> -H <sub>2</sub> O/CH <sub>3</sub> OH(s)
CH <sub>3</sub> O <sup>-</sup> •CH <sub>3</sub> OH	(8.3)c									296	FA	c OH <sup>-</sup> -H <sub>2</sub> O/CH <sub>3</sub> OH(s)

Table 4. Thermodynamic quantities for the gas-phase association of the rare gases to ions.

Ref.	Neut.	Ion	(kcal/mol)			(cal/K mol)			(kcal/mol)			(K)	Method	Comments	
			1	2	3	1	2	3	1	2	3				
150	He	He <sup>+</sup>	54.5	—	—	—	—	—	—	—	—	—	ES		
151			58.8	—	—	—	—	—	—	—	—	—	S		
152			—	4.2*	—	—	18.4*	—	—	-1.6	—	300	DI		
153			—	—	—	—	—	—	—	-1.9	—	300	SAMS		
154			—	—	—	—	—	—	—	—	0.6	77	DTMS		
150			—	—	—	—	—	—	—	—	—	—	ES		
150		Ne <sup>+</sup>	16.0	—	—	—	—	—	—	—	—	—	ES		
155		Ar <sup>+</sup>	0.60	—	—	—	—	—	—	—	—	—	ES		
156		Li <sup>+</sup>	—	—	—	—	—	-3.7	—	309*	—	—	DTMS	*low E/N	
304			3.16	—	—	—	—	—	—	—	—	—	M		
305			1.09	—	—	—	—	—	—	—	—	—	M		
306			1.71	—	—	—	—	—	—	—	—	—	M		
307			1.69	—	—	—	—	—	—	—	—	—	M		
307			1.64	—	—	—	—	—	—	—	—	—	S		
156		Na <sup>+</sup>	1.38	—	—	—	—	—	—	—	—	—	M		
304			0.93	—	—	—	—	—	—	—	—	—	M		
306			0.79	—	—	—	—	—	—	—	—	—	M		
307			1.19	—	—	—	—	—	—	—	—	—	S		
156		K <sup>+</sup>	0.53	—	—	—	—	—	—	—	—	—	M		
308			0.57	—	—	—	—	—	—	—	—	—	M		
306			0.53	—	—	—	—	—	—	—	—	—	M		
307			0.58	—	—	—	—	—	—	—	—	—	S		
304		Cs <sup>+</sup>	0.32	—	—	—	—	—	—	—	—	—	M		
307			0.36	—	—	—	—	—	—	—	—	—	S		
150	Ne	Ne <sup>+</sup>	31.4	—	—	—	—	—	—	—	—	—	PI		
151			30.0	—	—	—	—	—	—	—	—	—	S		
150		Ar <sup>+</sup>	1.8	—	—	—	—	—	—	—	—	—	PI		
150		Kr <sup>+</sup>	1.27	—	—	—	—	—	—	—	—	—	PI		
150		Xe <sup>+</sup>	0.95	—	—	—	—	—	—	—	—	—	PI		
156		Li <sup>+</sup>	3.34	—	—	—	—	—	—	—	—	—	M		
306			2.84	—	—	—	—	—	—	—	—	—	M		
307			2.63	—	—	—	—	—	—	—	—	—	S		
156		Na <sup>+</sup>	1.45	—	—	—	—	—	—	—	—	—	M		
306			1.52	—	—	—	—	—	—	—	—	—	M		
307			1.76	—	—	—	—	—	—	—	—	—	S		
156	Ne	K <sup>+</sup>	0.95	—	—	—	—	—	—	—	—	—	M		
308		(cont'd)	0.99	—	—	—	—	—	—	—	—	—	M		
306			0.92	—	—	—	—	—	—	—	—	—	M		
307			1.09	—	—	—	—	—	—	—	—	—	S		
156		Rb <sup>+</sup>	0.78	—	—	—	—	—	—	—	—	—	M		
306			0.77	—	—	—	—	—	—	—	—	—	M		
156		Cs <sup>+</sup>	0.65	—	—	—	—	—	—	—	—	—	M		
156			0.56	—	—	—	—	—	—	—	—	—	S		
157	Ar	Ar <sup>+</sup>	28.8	—	—	—	—	—	—	—	—	—	S		
158;23;159			(27.8)*	5.1	—	—	(12.8)	20.5	—	(24.0)	3.5	2.0	(298);77	PHPMS	
160			28.4	—	—	—	—	—	—	—	—	—	PI		
150			29.3	—	—	—	—	—	—	—	—	—	PI		
161			30.7	—	—	—	—	—	—	—	—	—	PF		
151			30.9	—	—	—	—	—	—	—	—	—	S		
150		Kr <sup>+</sup>	12.2	—	—	—	—	—	—	—	—	—	PI		
162			13.6	—	—	—	—	—	—	—	—	—	PI		
150		Xe <sup>+</sup>	4.1	—	—	—	—	—	—	—	—	—	PI		
162			3.2	—	—	—	—	—	—	—	—	—	PI		
163			6.0	—	19.4	—	—	0.2	—	—	298	—	SIFT		
164		Li <sup>+</sup>	4.1	—	~7	—	—	2.6	—	215	—	—	DTMS		
165			—	—	—	—	—	1.9	—	319*	—	—	DTMS		
156			12.7	—	—	—	—	—	—	—	—	—	M		
305			6.46	—	—	—	—	—	—	—	—	—	M		
307			7.22	—	—	—	—	—	—	—	—	—	S		
164		Na <sup>+</sup>	4.4	—	—	—	—	—	—	—	—	—	DTMS		
156			4.87	—	—	—	—	—	—	—	—	—	M		
306			4.39	—	—	—	—	—	—	—	—	—	M		
307			3.76	—	—	—	—	—	—	—	—	—	S		
156		K <sup>+</sup>	2.74	—	—	—	—	—	—	—	—	—	M		
304			2.79	—	—	—	—	—	—	—	—	—	M		
309			3.16	—	—	—	—	—	—	—	—	—	M		
308			2.63	—	—	—	—	—	—	—	—	—	M		
305			1.97	—	—	—	—	—	—	—	—	—	M		
306			2.94	—	—	—	—	—	—	—	—	—	M		
307			2.87	—	—	—	—	—	—	—	—	—	S		
150		Rb <sup>+</sup>	2.84	—	—	—	—	—	—	—	—	—	M		
305			2.03	—	—	—	—	—	—	—	—	—	M		
306			1.98	—	—	—	—	—	—	—	—	—	M		

\*corrected for neglect of ln T term

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## THERMOCHEMICAL DATA ON THE FORMATION OF ION CLUSTERS

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Table 4. (continued) Thermodynamic quantities for the gas-phase association of the rare gases to ions.

Ref.	Neut.	Ion	(kcal/mol) -ΔH <sub>n-1,n</sub> <sup>o</sup>			(cal/K mol) -ΔS <sub>n-1,n</sub> <sup>o</sup>			(kcal/mol) -ΔG <sub>n-1,n</sub> <sup>o</sup> (T)			T (K)	Method	Comments
			1	2	3	1	2	3	1	2	3			
156	Ar (cont'd)	Cs <sup>+</sup>	2.28	—	—	—	—	—	—	—	—	M		
305			1.95									M		
306			1.96									M		
307			1.46									S		
323		Hg <sup>+</sup>	5.3	—	—	—	—	—	—	—	—	PI		
158		N <sub>2</sub> <sup>+</sup>	(25.4) <sup>8</sup>	(13.7)		(21.3)			298			PHPMS		N <sub>2</sub> <sup>+</sup> -N <sub>2</sub>
166		CO <sub>2</sub> <sup>+</sup>	6.0	—	—	—	—	—	—	—	—	PI		
305		Br <sup>-</sup>	1.36	—	—	—	—	—	—	—	—	M		
150	Kr	Kr <sup>+</sup>	26.5	—	—	—	—	—	—	—	—	PI		
160			26.5									PI		
167			26.3									PF		
151			27.9									S		
150	Xe	Xe <sup>+</sup>	8.9	—	—	—	—	—	—	—	—	PI		
162			8.5									PI		
156	Li <sup>+</sup>	Li <sup>+</sup>	16.4	—	—	—	—	—	—	—	—	M		
306			9.2									M		
307			10.6									S		
164	Na <sup>+</sup>	Na <sup>+</sup>	5.8	—	18.5	—	1.6	—	225	—	—	DTMS		
156			6.57									M		
306			5.08									M		
307			4.84									S		
156	K <sup>+</sup>	K <sup>+</sup>	3.71	—	—	—	—	—	—	—	—	M		
305			3.21									M		
306			2.94									M		
307			2.89									S		
156	Rb <sup>+</sup>	Rb <sup>+</sup>	3.34	—	—	—	—	—	—	—	—	M		
305			2.64									M		
306			2.67									M		
156	Cs <sup>+</sup>	Cs <sup>+</sup>	3.07	—	—	—	—	—	—	—	—	M		
305			2.79									M		
306			2.72									M		
307			2.33									S		
310	O <sub>2</sub> <sup>+</sup>	O <sub>2</sub> <sup>+</sup>	7.6	—	—	—	—	—	—	—	—	PF		
305		Br <sup>-</sup>	2.01	—	—	—	—	—	—	—	—	M		
157	Xe	Xe <sup>+</sup>	22.4	—	6.75 <sup>8</sup>	—	18.7 <sup>8</sup>	—	1.2	—	298	S		
168			22.8									DTMS		
169			23.8									PI		
170			22.8									PI		
151			22.8									S		
156	Li <sup>+</sup>	Li <sup>+</sup>	20.8	—	—	—	—	—	—	—	—	M		
306			12.6									M		
307			12.3									S		
156	Na <sup>+</sup>	Na <sup>+</sup>	9.52	—	—	—	—	—	—	—	—	M		
306			5.94									M		
307			5.97									S		
156	K <sup>+</sup>	K <sup>+</sup>	5.33	—	—	—	—	—	—	—	—	M		
305			4.31									M		
306			4.84									M		
307			3.78									S		
156	Rb <sup>+</sup>	Rb <sup>+</sup>	3.62	—	—	—	—	—	—	—	—	M		
305			2.84									M		
306			4.26									M		
156	Cs <sup>+</sup>	Cs <sup>+</sup>	3.55	—	—	—	—	—	—	—	—	M		
304			2.44									M		
305			2.51									M		
306			2.62									M		
307			2.75									S		
171	F <sup>-</sup>	F <sup>-</sup>	6.5	—	—	—	—	—	—	—	—	S		
172		Cl <sup>-</sup>	3.1	—	—	—	—	—	—	—	—	M		
305	Br <sup>-</sup>	Br <sup>-</sup>	3.11	—	—	—	—	—	—	—	—	M		
305			3.35	—	—	—	—	—	—	—	—	M		

Table 5. Thermodynamic quantities for the gas-phase association of diatomics to ions.

Ref.	Neut.	Ion	-ΔH <sub>n-1,n</sub> <sup>0</sup> (kcal/mol)					-ΔS <sub>n-1,n</sub> <sup>0</sup> (cal/K mol)				
			1	2	3	4	5	1	2	3	4	5
173	H <sub>2</sub>	H <sub>3</sub> <sup>+</sup>	9.6	4.1	3.8	2.4		24.6	19.8	20.2	19.3	
174			9.7	1.8				25.5	10.8			
175			5.1					9.6				
176			5.8					12.5				
177			8.6 <sup>#</sup>					23.5 <sup>#</sup>				
178			6.6	3.1				14.5	16.9			
179			5.6					11.5				
178			7.1	3.4				17.0	16.1			
180		HN <sub>2</sub> <sup>+</sup>	7.2	1.8				22.6	17			
180		HO <sub>2</sub> <sup>+</sup>	12.5					22				
180		H(O <sub>2</sub> ) <sub>2</sub> <sup>+</sup>	4.0					17				
181		HCO <sup>+</sup>	3.9					20.5				
182		Li <sup>+</sup>	6.5					---				
91,19		CH <sub>3</sub> <sup>+</sup>	(44.4) <sup>c</sup>					---				
57		C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	4.0	T<140 K				19.6				
			11.8	T>170 K				25				
57		i-C <sub>3</sub> H <sub>7</sub> <sup>+</sup>	(<2.5)					[20]				
102		OH <sup>-</sup>	~7					---				
183	N <sub>2</sub>	N <sup>+</sup>	60					---				
184			59					---				
91			59.4					---				
91		O <sup>+</sup>	55.3					---				
185		Li <sup>+</sup>	---					---				
186		Na <sup>+</sup>	---					---				
96			8.0	5.3				18.6	18			
186		K <sup>+</sup>	---					---				
187		Ca <sup>+2</sup> .N <sub>2</sub>	---	---	---	---	---	---	---	---	---	---
188		N <sub>2</sub> <sup>+</sup>	22.8					19.5				
158			24.4					16.2				
189			20.1					11				
190			11.5					-1				
191			20.8					---				
22		O <sub>2</sub> <sup>+</sup>	5.69					18.9				
192			5.2	4.3	3.5			15.8	13.8	12.1		
193			---					---				
194		O <sub>4</sub> <sup>+</sup>	2.94	---				10.1	---			
21		NO <sup>+</sup>	5.16					18.9				
195			4.45 <sup>#</sup>					15.7 <sup>#</sup>				
192			4.4	3.9	---	---		13.3	12.6	---	---	
196			---					---				
180		HN <sub>2</sub> <sup>+</sup>	16.0	4.0	3.8	3.5	(3.2)	24	18	20	20	[20]
197			14.5					20.4				
198		H <sub>2</sub> CN <sup>+</sup>	7.6	5.1	3.2	3.1	3.2	22.2	19.9	13.1	13.8	15.2
19,180		H <sub>3</sub> <sup>+</sup>	(24.1) <sup>c</sup>					(24.3)				
199		CH <sub>5</sub> <sup>+</sup>	6.8					19.7				
199		C <sub>2</sub> H <sub>5</sub>	6.9	4.6				18.2	10.9			
200	O <sub>2</sub>	O <sup>+</sup>	48	6.9	0.9			---	---	---		
201			49.9					---				
202			42.9					---				
203		O <sub>2</sub> <sup>+</sup>	9.5					20				
24			10.8	6.87	2.54	2.46	1.84	25.0	31.8	19.8	23.9	17.0
204			9.0					20.6				
200			9.7					---				
205			6.0					---				
206			---					---				
207			---					---				

Neut.	Ion	$\Delta G_{n-1,n}^{\circ}$ (T) (kcal/mol)					T (K)	Method	Comments
		1	2	3	4	5			
H <sub>2</sub>	H <sub>3</sub> <sup>+</sup>	2.3 2.0 2.2 2.1 1.6 2.2 2.2 2.0	-1.8 -1.4    -2.0  -1.4	-2.3     300 300 300 300 300 300 300	-3.4		300	PHPMS PHPMS PHPMS DT DTMS PHPMS PHPMS HPMS	#corrected for neglect of ln T term deuterated deuterated
	HN <sub>2</sub> <sup>+</sup>	0.4	-3.3				298	PHPMS	
	HO <sub>2</sub> <sup>+</sup>	6.0					298	PHPMS	
	H(O <sub>2</sub> ) <sub>2</sub> <sup>+</sup>	-1.1					298	PNPMS	
	HCO <sup>+</sup>	-2.3					300	PHPMS	
	Li <sup>+</sup>	---					---	EI	(±4.6 kcal/mol)
	CH <sub>3</sub> <sup>+</sup>	---					298	---	from $\Delta H_f$ +PA's; cf. Ref. 57
	C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	1.3 7.3					140 180	HPMS	
N <sub>2</sub>	i-C <sub>3</sub> H <sub>7</sub> <sup>+</sup>	<0.9					170	HPMS	
	OH <sup>-</sup>	---					---	RET	
	N <sup>+</sup>	---					---	EI	
		---					298	EI	
		---					---	---	$\Delta H_f$ 's
	O <sup>+</sup>	---					0	---	$\Delta H_f$ 's + IP (N <sub>2</sub> O)
	Li <sup>+</sup>	5.6	4.4				318*	DTMS	*low E/N
	Na <sup>+</sup>	1.95 2.2	-0.3				310*	DTMS FA	*low E/N
O <sub>2</sub>	K <sup>+</sup>	1.0					310*	DTMS	*low E/N
	Ca <sup>2+</sup> *N <sub>2</sub>	---	---	---	---	4.6	296	FA	
	N <sub>2</sub> <sup>+</sup>	17.1 19.6 16.8 11.8 ---					298 298 298 298 ---	HPMS PHPMS DTMS DT PI	
	O <sub>2</sub> <sup>+</sup>	0.1 0.5 0.0	0.2 -0.1	0.7†	0.7*		296 296,*184 296	PHPMS HPMS FA	#204
	O <sub>4</sub> <sup>+</sup>	0.6	0.5				230	HPMS	
	NO <sup>+</sup>	1.3 1.25 1.7 ~0.5	1.3 0.9	0.9	0.4		204 204 204 200	PHPMS DTMS HPMS FA	#corrected for neglect of ln T term
	HN <sub>2</sub> <sup>+</sup>	8.8 8.4	-1.4	-2.2	1.35*		298, <sup>*</sup> 92 298	PHPMS PHPMS	
O <sub>2</sub>	H <sub>2</sub> CN <sup>+</sup>	0.9	-0.9	-0.7	-1.0	-1.4	300	HPMS	
	H <sub>3</sub> <sup>+</sup>	(16.8)					298	---	cHN <sub>2</sub> <sup>+</sup> -H <sub>2</sub> + ΔPA
	CH <sub>5</sub> <sup>+</sup>	0.9					298	HPMS	
	C <sub>2</sub> H <sub>5</sub>	1.5	1.3				298	HPMS	n=2, deuterated
	O <sup>+</sup>	---	---	---			---	PI	
		---	---	---			---	PF	
	O <sub>2</sub> <sup>+</sup>	3.5 3.36 3.5 ---	2.60 -3.36 3.3	-4.66	-3.23		298 298 298 ---	PHPMS PHPMS PHPMS PI	
		3.8					300	DTMS DTMS	

Table 5. (continued) Thermodynamic quantities for the gas-phase association of diatomics to ions.

Ref.	Neut.	Ion	$-\Delta H_{n-1,n}^{\circ}$ (kcal/mol)					$-\Delta S_{n-1,n}^{\circ}$ (cal/K mol)				
			1	2	3	4	5	1	2	3	4	5
193 89	$O_2$	$O_2^+$ (cont'd)	---	---	---	---	---	---	---	---	---	---
196		$NO^+$	---	---	---	---	---	---	---	---	---	---
180		$HO_2^+$	20.0	6.6	(3.2)			27	22	[20]		
180		$H_3^+$	(12.5) <sup>c</sup>	(11.5) <sup>c</sup>				(19.6)	(22)			
155		$Li^+$	---	---	---	---	---	---	---	---	---	---
208		$Na^+$	---	---	---	---	---	---	---	---	---	---
187		$Ca^+$	---	---	---	---	---	---	---	---	---	---
187		$Ca^{+2}$	---	---	---	---	---	---	---	---	---	---
291 209 210 211		$O^-$	(<32) <sup>c</sup>	42	38	(39.0) <sup>c</sup>		---	---	---	---	---
212 213		$O_2^-$	13.55	---				32	---	---	---	---
214 215 197 191	CO	$CO^+$	28	---	(>25.4)	22.4		[20]	---	---	---	---
180 197 216		$HCO^+$	12.8	6.6	6.3	6.2	5.8	24 20.9	24	26	29	32
19,181		$H_3^+$	(44.5) <sup>c</sup>					(23.3)				
217		$Na^+$	12.6	7.5				20.4	15.1			
191 218 69	NO	$NO^+$	13.8	7.4	3.7	3.5	2.3	---	---	---	---	---
13.6			---	---	---	---	---	---	---	---	---	---
219	HF	$H_2F^+$	25	14.8				---	---	---	---	---
41,98		$F^-$	(38.5)					(21.9)				
295,4		$Cl^-$	(21.8)					[22.5]				
219	HCl	$HCl^+$	20					---				
96		$Na^+$	12.2					20.4				
332		$C_6H_6^+$	7.3					---				
220 113,100 295,4		$Cl^-$	23.7 (20.4) <sup>c</sup> (23.1)	15.2	11.7	10.3		23.5 (22.8) [23.5]	24.4	23.4	26.7	
113,(220)		$Cl^- \cdot H_2O$	16.0	(12.3) <sup>c</sup>				21.8	(20.9)			
113,100		$Cl^- \cdot 2H_2O$	(13.0) <sup>c</sup>					(21.7)				
112		$HSO_4^-$	(15.7) <sup>s</sup>					(15.1)				
221		$I^-$	14.2					22.7				
219	HBr	$HBr^+$	23					---				
222		$Br^-$	(>17.5) <sup>c</sup>					[22]				
222		$NO_3^- \cdot HNO_3$	(16.0) <sup>s</sup>					(22.9)				
222		$NO_3^-$	(>21) <sup>s</sup>					[23]				

Neut. Ion	$\Delta G_{n-1,n}^{\circ}$ (T) (kcal/mol)					T (K)	Method	Comments
	1	2	3	4	5			
O <sub>2</sub> (cont'd)	O <sub>2</sub> <sup>+</sup> 3.4 5.9					296 200	FA FA	
	NO <sup>+</sup> <-0.4					200	FA	
	HO <sub>2</sub> <sup>+</sup> 12.0	0.0	1.1*			298, *105	PHPMS	
	H <sub>3</sub> <sup>+</sup> (6.7) (4.9)					298	PHPMS	c <sub>HO<sub>2</sub><sup>+</sup>-H<sub>2</sub></sub> + ΔPA; c <sub>O<sub>2</sub>/H<sub>2</sub></sub> system
	Li <sup>+</sup> 4.2					319*	DTMS	xlow E/N
	Na <sup>+</sup> 0.2					310*	DTMS	xlow E/N
	Ca <sup>+</sup> 6.0					296	FA	
	Ca <sup>+2</sup> ---	---	---	---	4.6	296	FA	
	O <sup>-</sup> ---					---	PF	c <sub>based on D(O<sub>2</sub><sup>-</sup>-O)</sub>
	---					---	CID	
	---					---	PF	
	---					---	---	c from EA(O <sub>3</sub> ), D(O-O <sub>2</sub> ), and EA(O)
	O <sub>2</sub> <sup>-</sup> 4.0 3.5					298 300	PHPMS DTMS	
CO	CO <sup>+</sup> 4.92 >11.5 ---					---	EI	from IP's and ΔH <sub>f</sub> 's (error ±7 kcal/mol) reported but equilibrium uncertain
	HCO <sup>+</sup> 5.7 5.4 4.1	-0.6	-1.4	-2.5	-3.8	298 300 298	PHPMS PHPMS PHPMS	
	H <sub>3</sub> <sup>+</sup> (37.5)					298	---	c <sub>HCO<sup>+</sup>-H<sub>2</sub></sub> + ΔPA
	Na <sup>+</sup> 6.5	3.0				298	HPMS	
NO	NO <sup>+</sup> ---					---	PI	
	---					---	PI	
	7.0	1.9				296	SAMS	
HF	H <sub>2</sub> F <sup>+</sup> ---					---	PI	
	F <sup>-</sup> (32.0)s					298	ICR	s <sub>F<sup>-</sup>-H<sub>2</sub>O</sub>
	Cl <sup>-</sup> (15.1)s					298	ICR	s <sub>Cl<sup>-</sup>-t-C<sub>4</sub>H<sub>9</sub>OH</sub>
HCl	HCl <sup>+</sup> ---					---	PI	
	Na <sup>+</sup> 6.1					298	FA	
	C <sub>6</sub> H <sub>6</sub> <sup>+</sup> ---					---	PI	benzene <sup>+</sup>
	Cl <sup>-</sup> 16.7 (13.6) (16.0) <sup>a</sup>	7.9	4.7	2.4		298 298 298	PHPMS HPMS ICR	c <sub>HCl/H<sub>2</sub>O</sub> s <sub>Cl<sup>-</sup>-t-C<sub>4</sub>H<sub>9</sub>OH</sub>
	Cl <sup>-</sup> • H <sub>2</sub> O 9.5 (6.1)					298	HPMS	c <sub>HCl/H<sub>2</sub>O</sub> ; deuterated mixture
	Cl <sup>-</sup> • 2H <sub>2</sub> O (6.5)					298	HPMS	c <sub>HCl/H<sub>2</sub>O</sub> ; mixed clusters deuterated
	HSO <sub>4</sub> <sup>-</sup> (11.2)					298	FA	s <sub>HSO<sub>4</sub><sup>-</sup>-H<sub>2</sub>O</sub>
	I <sup>-</sup> 7.4					298	HPMS	
HBr	HBr <sup>+</sup> ---					---	PI	
	Br <sup>-</sup> (>9.4)					367	FA	c <sub>Br<sup>-</sup>/NO<sub>3</sub><sup>-</sup>-HNO<sub>3</sub>/HBr(s)</sub>
	NO <sub>3</sub> <sup>-</sup> • HNO <sub>3</sub> (9.2)					298	FA	s <sub>NO<sub>3</sub><sup>-</sup>• HNO<sub>3</sub>-HNO<sub>3</sub></sub>
	NO <sub>3</sub> <sup>-</sup> >12.7)					367	FA	s <sub>NO<sub>3</sub><sup>-</sup>-HNO<sub>3</sub></sub>

Table 5. (continued) Thermodynamic quantities for the gas-phase association of diatomics to ions.

Ref.	Neut.	Ion	$-\Delta H_{n-1,n}^0$ (kcal/mol)					$-\Delta S_{n-1,n}^0$ (cal/K mol)				
			1	2	3	4	5	1	2	3	4	5
223,91	Cl <sub>2</sub>	Cl <sup>-</sup>	(17.0)					---				
224	I <sub>2</sub>	I <sup>-</sup>	(24.0)					---				
320	NaF	Na <sup>+</sup>	62.7	47				---	---			
320		ScF <sub>2</sub> <sup>+</sup>	---	83	72	67		---	---	---	---	---
30	NaCl	Na <sup>+</sup>	42.4					17.6				
322	KF	F <sup>-</sup>	46.4					---				
30	KCl	K <sup>+</sup>	41.2					19.6				
30 319	KBr	K <sup>+</sup>	40.8					22.8				
			41.5					---				

		$\Delta G_{n-1,n}^0(T)$ (kcal/mol)					Method	Comments	
Neut.	Ion	1	2	3	4	5			
Cl <sub>2</sub>	Cl <sup>-</sup>	---					298	SAMS	based on Cl <sup>-</sup> +SO <sub>2</sub> Cl <sub>2</sub> ↔ Cl <sub>3</sub> <sup>-</sup> +SO <sub>2</sub>
I <sub>2</sub>	I <sup>-</sup>	---					---	---	$\Delta H_f$ 's
NaF	Na <sup>+</sup>	---	---				---	MS	Knudsen cell
	ScF <sub>2</sub> <sup>+</sup>	---					---	MS	Knudsen cell
NaCl	Na <sup>+</sup>	28.3					800	MS	Knudsen cell
KF	F <sup>-</sup>	---					1100	MS	Knudsen cell
KCl	K <sup>+</sup>	25.5					800	MS	Knudsen cell
KBr	K <sup>+</sup>	22.6	---				800	MS	Knudsen cell
							800	MS	Knudsen cell

Table 6. Thermodynamic quantities for the gas-phase association of triatomics (except H<sub>2</sub>O) to ions.

Ref.	Neut.	Ion	-ΔH <sub>n-1,n</sub> <sup>o</sup> (kcal/mol)						-ΔS <sub>n-1,n</sub> <sup>o</sup> (cal/K mol)					
			1	2	3	4	5	6	1	2	3	4	5	6
95 96 208	CO <sub>2</sub>	Na <sup>+</sup>	15.9 13.7	11.0	9.7	(8.4)			20.1 19.8	21.7	24.0	[25]		
9 225		K <sup>+</sup>	8.5 ---						15.2 ---					
62		Cs <sup>+</sup>	6.2						14.3					
95		Na <sup>+</sup> •H <sub>2</sub> O	12.6						22.5					
95		Na <sup>+</sup> •2H <sub>2</sub> O	10.3						23.9					
95		Na <sup>+</sup> •3H <sub>2</sub> O	(7.2)						[25]					
187		Ca <sup>+2</sup> •CO <sub>2</sub>	---						---					
187		Ca <sup>+2</sup> •CaCO <sub>3</sub>	---						---					
166 226 227 228 229 328		CO <sub>2</sub> <sup>+</sup>	13.6 16.2 15.8 17 11.8 15.6	6.0					---	21.1 22.8	24.0			
230 231,24 226 207 328		O <sub>2</sub> <sup>+</sup>	<10.6 (10.5) <sup>s</sup> (>21.4)	7.5					---	(20.7) [20]	15			
196		NO <sup>+</sup>	<13.8						---					
327		HCO <sup>+</sup>	12.6	7.2	6.9				21.4	19.7	22.7			
226 216 327		HCO <sub>2</sub> <sup>+</sup>	20.1 19.1 18.0		6.9				24.2 27.1					
226 327		H <sub>3</sub> O <sup>+</sup>	14.4 15.3	12.4	10.5				22.2	23.0				
187		NH <sub>4</sub> <sup>+</sup>	---						---					
232		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	13.2						21.4					
232		C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup>	11.2						20.8					
148		F <sup>-</sup>	---						---					
221 327		Cl <sup>-</sup>	8.0 7.6	7.2	6.8				19.6 18.2	20.8	22.4			
221		I <sup>-</sup>	5.6						18.2					
233 234 235 236,210 221		O <sup>-</sup>	52.1 42*						---	21.8				
298		OH <sup>-</sup>	88						---					
237 101,103 89,212		O <sub>2</sub> <sup>-</sup>	18.4 ---						21					
101,103		O <sub>2</sub> <sup>-</sup> •H <sub>2</sub> O	---						---					
221		NO <sub>2</sub> <sup>-</sup>	9.3						24.2					
221		SO <sub>3</sub> <sup>-</sup>	6.5						20.7					
238	OCS	OCS <sup>+</sup>	17.2	1.6					---	---				
238		CS <sub>2</sub> <sup>+</sup>	5.8						---					

		$-\Delta G_{n-1,n}^{\circ}$ (T) (kcal/mol)						T (K)	Method	Comments
Neut.	Ion	1	2	3	4	5	6			
CO <sub>2</sub>	Na <sup>+</sup>	9.7 7.6 6.6	4.3 4.8	2.3	0.65			310 310 310 <sup>x</sup>	HPMS FA DTMS	x low E/N
	K <sup>+</sup>	3.8 3.7						310 310 <sup>x</sup>	HPMS DTMS	x low E/N
	Cs <sup>+</sup>	1.9						298	DTMS	
	Na <sup>+</sup> •H <sub>2</sub> O	5.9						298	HPMS	
	Na <sup>+</sup> •2H <sub>2</sub> O	3.2						298	HPMS	
	Na <sup>+</sup> •3H <sub>2</sub> O	-0.25						298	HPMS	
	Ca <sup>+2</sup> •CO <sub>2</sub>	---	---	---	---	8.0		296	FA	
	Ca <sup>+2</sup> •CaCO <sub>3</sub>	---	---	---	---	7.6		296	FA	
	CO <sub>2</sub> <sup>+</sup>	---	9.9 9.0	1.2				298 298 ---	PI PHPMS PHPMS	
		---	9.9	4.3	0.5			298	EI PI HPMS	(±5 kcal/mol)
	O <sub>2</sub> <sup>+</sup>	---	(4.3) >9.4 4.4 4.5	3.0 <sup>*</sup>	0.3	0.5		298 600, <sup>*</sup> 298 298 298	PF FA PHPMS DTMS HPMS	s O <sub>2</sub> <sup>+</sup> -O <sub>2</sub>
	NO <sup>+</sup>	---						---	FA	< NO <sup>+</sup> -NO
	HCO <sup>+</sup>	6.2	1.3	0.1				298	HPMS	
	HCO <sub>2</sub> <sup>+</sup>	12.9 11.0 11.4		0.0				298 298 298	PHPMS PHPMS HPMS	
	H <sub>3</sub> O <sup>+</sup>	8.2 8.0	4.5	2.5				298 298	PHPMS HPMS	
	NH <sub>4</sub> <sup>+</sup>	2.25						296	FA	
	CH <sub>3</sub> NH <sub>2</sub> <sup>+</sup>	6.8						298	PHPMS	
	C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup>	5.0						298	PHPMS	
	F <sup>-</sup>	>11.6						298	FA	
	Cl <sup>-</sup>	2.2 2.2	1.0	0.1				298 298	HPMS HPMS	
	I <sup>-</sup>	0.2						298	HPMS	
	O <sup>-</sup>	---	0.6					---	PF PF CID FA HPMS	*not lowest state s O <sup>-</sup> -O <sub>2</sub>
	OH <sup>-</sup>	---						---	CID	
	O <sub>2</sub> <sup>-</sup>	12.1 (12.9) <sup>s</sup> (10.0) <sup>s</sup>						298 296 298	DT FA FA	s O <sub>2</sub> <sup>-</sup> -H <sub>2</sub> O s O <sub>2</sub> <sup>-</sup> -O <sub>2</sub>
	O <sub>2</sub> <sup>-</sup> •H <sub>2</sub> O	(8.2) <sup>s</sup>						296	FA	s O <sub>2</sub> <sup>-</sup> -H <sub>2</sub> O-H <sub>2</sub> O
	NO <sub>2</sub> <sup>-</sup>	2.1						298	HPMS	
	SO <sub>3</sub> <sup>-</sup>	0.3						298	HPMS	
OCS	OCS <sup>+</sup>	---	---					---	PI	
	CS <sub>2</sub> <sup>+</sup>	---						---	PI	

Table 6. (continued) Thermodynamic quantities for the gas-phase association of triatomics (except H<sub>2</sub>O) to ions.

Ref.	Neut.	Ion	-ΔH <sub>n-1,n</sub> <sup>0</sup> (kcal/mol)						-ΔS <sub>n-1,n</sub> <sup>0</sup> (cal/K mol)					
			1	2	3	4	5	6	1	2	3	4	5	6
239	CS <sub>2</sub>	S <sup>+</sup>	39.7						---					
226		S <sub>2</sub> <sup>+</sup>	21.9						17.1					
239			28.8						---					
239		CS <sup>+</sup>	36.0						---					
226		CS <sub>2</sub> <sup>+</sup>	21.9						21.9					
240			17.5	4.4	3.9	2.6			---					
226		HCS <sub>2</sub> <sup>+</sup>	11.1						26.4					
241		C <sub>6</sub> H <sub>6</sub> <sup>+</sup>	12.2						24					
89	N <sub>2</sub> O	O <sub>2</sub> <sup>+</sup>	---						---					
229		N <sub>2</sub> O <sup>+</sup>	13.1						---					
235	ONO	O <sup>-</sup>	41.5						---					
235	O <sub>2</sub> N	O <sup>-</sup>	110						---					
242	O <sub>3</sub>	NO <sup>+</sup>	<13.8						---					
231,24		O <sub>2</sub> <sup>+</sup>	(14.5) <sup>s</sup>						(20.5)					
292		Na <sup>+</sup>	12.5						---					
40,28	HCN	Li <sup>+</sup>	(36.4)						(25.8)					
147		H <sub>2</sub> CN <sup>+</sup>	30.0	13.8	11.8	9.2			32	23	25	26		
146			26.1	14.4					23	21.2				
146		NH <sub>4</sub> <sup>+</sup>	20.5	17.5	13.7	11.1	8.5	7.4	20.2	25.6	23.4	22.1	20.5	19.9
118		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	20.8						22.9					
118		(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	16.8						23.0					
118		(C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> NH <sup>+</sup>	13.8						29.0					
147		(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	30.8						32					
147		t-C <sub>4</sub> H <sub>9</sub> <sup>+</sup>	16.3						25					
88,70 146,(19)		H <sub>3</sub> O <sup>+</sup>	(32.5) (32.3)	18.8	13.2				(24.3) (24.9)	20.4	16.1			
243,115,70		H <sub>2</sub> COH <sup>+</sup>	---						---					
41,98		F <sup>-</sup>	(39.5)						(22.2)					
295,4		Cl <sup>-</sup>	(21.0)						[23.7]					
244	H <sub>2</sub> S	H <sub>2</sub> S <sup>+</sup>	17.0	3.2	1.2	1.4	2.6		---	---				
245			21.2	4.2					---	---				
86		H <sub>3</sub> S <sup>+</sup>	15.4	9.1	8.4	6.7	(6.1)		24.4	20.9	24.5	24.7	[24]	
73			12.8	7.2	5.4	3.3			18.7	17.3	14	10		
245			10.6	---					---	---				
312			10.8	6.0	4.4	2.5			---	---	---	---		
86,(70) 73,19		H <sub>3</sub> O <sup>+</sup>	(24.9) <sup>s</sup> (20.7) <sup>c</sup>	13.3					(25.5) (17.3)	21.7				
86,70		H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(13.6) <sup>s</sup>						(23.0)					
145,19		CH <sub>5</sub> <sup>+</sup>	(42.1) <sup>c</sup>						(22.7)					
91,19		CH <sub>3</sub> <sup>+</sup>	(82.4) <sup>c</sup>											
118		NH <sub>4</sub> <sup>+</sup>	12.0						18.5					
118		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(11.3)						[22]					

Neut.	Ion	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)						Method	Comments
		1	2	3	4	5	6		
CS <sub>2</sub>	S <sup>+</sup>	---						PI	
	S <sub>2</sub> <sup>+</sup>	16.8				298		PHPMS	
		---				---		PI	
	CS <sup>+</sup>	---						PI	
	CS <sub>2</sub> <sup>+</sup>	15.4				298		PHPMS	
		---				---		PI	
	HCS <sub>2</sub> <sup>+</sup>	3.2				298		PHPMS	
	C <sub>6</sub> H <sub>6</sub> <sup>+</sup>	5.0				298		PHPMS	
N <sub>2</sub> O	O <sub>2</sub> <sup>+</sup>	(8.9) <sup>s</sup>					200	FA	s O <sub>2</sub> <sup>+</sup> -O <sub>2</sub>
	N <sub>2</sub> O <sup>+</sup>	---					---	PI	
ONO	O <sup>-</sup>	---					---	CID	
O <sub>2</sub> N	O <sup>-</sup>	---					---	CID	
O <sub>3</sub>	NO <sup>+</sup>	---					---	FA	<NO <sup>+</sup> •CO <sub>2</sub>
	O <sub>2</sub> <sup>+</sup>	(8.4)					298	FA	s O <sub>2</sub> <sup>+</sup> -O <sub>2</sub>
	Na <sup>+</sup>	---					---	FA	
HCN	Li <sup>+</sup>	(28.7) <sup>s</sup>					298	ICR	s Li <sup>+</sup> -H <sub>2</sub> O
	H <sub>2</sub> CN <sup>+</sup>	20.5 19.3	6.9 8.1	4.4	1.5		298 298	PHPMS HPMS	
	NH <sub>4</sub> <sup>+</sup>	14.5	9.9	6.7	4.5	2.4	1.5	298	HPMS
	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	14.0					298	HPMS	
	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	9.9					298	HPMS	
	(C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> NH <sup>+</sup>	5.2					298	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	21.3					298	PHPMS	
	t-C <sub>4</sub> H <sub>9</sub> <sup>+</sup>	8.8					298	PHPMS	
	H <sub>3</sub> O <sup>+</sup>	(25.3) <sup>s</sup> (25.0) <sup>c</sup>	12.7	8.4			298 298	ICR HPMS	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O c H <sub>2</sub> CN <sup>+</sup> -H <sub>2</sub> O+ΔPA
	H <sub>2</sub> COH <sup>+</sup>	(20.6) <sup>s</sup>					298	FA	s H <sub>2</sub> COH <sup>+</sup> -H <sub>2</sub> CO
	F <sup>-</sup>	(32.9) <sup>s</sup>					298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
	Cl <sup>-</sup>	(13.9) <sup>s</sup>					298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
H <sub>2</sub> S	H <sub>2</sub> S <sup>+</sup>	---					---	PI	
		---					---	PI	
	H <sub>3</sub> S <sup>+</sup>	8.1 7.2 ---	2.8 2.0 ---	1.0 1.2 ---	-0.7 0.5 ---	1.66 <sup>*</sup>	298, <sup>*</sup> 185 300 ---	PHPMS PHPMS PI PI	
	H <sub>3</sub> O <sup>+</sup>	(17.2) (15.5)	6.8				300 300	PHPMS ---	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O c H <sub>3</sub> S <sup>+</sup> -H <sub>2</sub> O + ΔPA
	H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O	(6.7)					300	PHPMS	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O-H <sub>2</sub> O
	CH <sub>5</sub> <sup>+</sup>	(35.3)					298	---	c H <sub>3</sub> S <sup>+</sup> -CH <sub>4</sub> + ΔPA
	CH <sub>3</sub> <sup>+</sup>						298	---	c ΔH <sub>f</sub> 's + PA's
	NH <sub>4</sub> <sup>+</sup>	6.5					298	HPMS	
	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	5.4					270	HPMS	

Table 6. (continued) Thermodynamic quantities for the gas-phase association of triatomics (except H<sub>2</sub>O) to ions.

Ref.	Neut.	Ion	-ΔH <sub>n-1,n</sub> <sup>0</sup> (kcal/mol)						-ΔS <sub>n-1,n</sub> <sup>0</sup> (cal/K mol)					
			1	2	3	4	5	6	1	2	3	4	5	6
41,98 96 217	H <sub>2</sub> S (cont'd) SO <sub>2</sub>	F <sup>-</sup> Na <sup>+</sup>	(34.6) 18.9 ---		16.6	14.3	(12.3)		(18.7) 20.3 ---		25.5	26.9	[27]	
62		Cs <sup>+</sup>	10.8						18.9					
94		Na <sup>+</sup> •H <sub>2</sub> O	14.1						17.4					
246,69		NO <sup>+</sup>	---						---					
89,24		O <sub>2</sub> <sup>+</sup>	---						---					
247		SO <sup>+</sup>	13.8						---					
247		SO <sub>2</sub> <sup>+</sup>	15.2						---					
333		C <sub>4</sub> H <sub>6</sub> <sup>+</sup>	3.7						---					
333		C <sub>4</sub> H <sub>8</sub> <sup>+</sup>	2.4						---					
223 41,98		F <sup>-</sup>	>59 (43.8)						---					
221 101		Cl <sup>-</sup>	21.8 ---	12.3	10.0	8.6			23.2 ---	22.7	23.1	23.2		
112,100 311,4			(22.2) <sup>s</sup> (20.9)						(24.1) [20.8]					
221		I <sup>-</sup>	12.9	10.1	9.2				20.2	21.6	24.7			
101,233 221		O <sup>-</sup>	(>60) <sup>s</sup> ---		13.3				---		18.9			
221,101		CO <sub>3</sub> <sup>2-</sup>	(>14)						[20]					
94,(100) 101		Cl <sup>-</sup> •H <sub>2</sub> O	17.4 ---	(11.8) <sup>c</sup>					20.2 ---	(26.0)				
94,100		Cl <sup>-</sup> •2H <sub>2</sub> O	(14.1) <sup>c</sup>						(19.4)					
221 248 112,107		NO <sub>2</sub> <sup>-</sup>	25.9 ---	9.0 9.8	6.6				36.8 ---	16.8 21.5	13.4			
248 101,107 112,107		NO <sub>3</sub> <sup>-</sup>	18.2 ---	8.8 ---					31.6 ---	14.1 (25.2)				
221,249		SO <sub>2</sub> <sup>-</sup>	24.0	8.3					33.8	16.0				
101		SO <sub>4</sub> <sup>2-</sup>	---						---					
149		HSO <sub>4</sub> <sup>-</sup>	13.7						26.1					

Neut.	Ion	$-\Delta G_{n-1,n}^{\circ}$ (T) (kcal/mol)						Method	Comments
		1	2	3	4	5	6		
	F <sup>-</sup>	(29.0)s						298	ICR
SO <sub>2</sub>	Na <sup>+</sup>	12.8 ---	9.0	6.3	3.2*			298 298,*328	FA HPMS
	Cs <sup>+</sup>	5.2						298	DTMS
	Na <sup>+</sup> •H <sub>2</sub> O	8.9						298	HPMS
	NO <sup>+</sup>	(7.8)s						296	SAMS
	O <sub>2</sub> <sup>+</sup>	(9.6)s						298	FA
	SO <sup>+</sup>	---						---	PI
	SO <sub>2</sub> <sup>+</sup>	---						---	PI
	C <sub>4</sub> H <sub>6</sub> <sup>+</sup>	---						---	PI
	C <sub>4</sub> H <sub>8</sub> <sup>+</sup>	---						---	PI
	F <sup>-</sup>	---						---	SAMS
		(36.9)s						298	ICR
	Cl <sup>-</sup>	14.9 (14.2)s (15.0) (14.7)s	5.5	3.1	1.7			298 296 298 298	HPMS FA FA ICR
	I <sup>-</sup>	6.9	3.7	1.8				298	HPMS
	O <sup>-</sup>	---	---	7.7				---	FA HPMS
	CO <sub>3</sub> <sup>2-</sup>	(>8.0)s						296	HPMS
	Cl <sup>-</sup> •H <sub>2</sub> O	11.4 (11.5)s	(4.1)					296 296	HPMS FA
	Cl <sup>-</sup> •2H <sub>2</sub> O	(8.4)						296	HPMS
	NO <sub>2</sub> <sup>-</sup>	14.9 --- (14.9)	4.0 3.4	2.6				298 298 298	HPMS HPMS FA
SO <sub>2</sub>	NO <sub>3</sub> <sup>-</sup>	8.8 (10.6)s (9.7)	4.6					298 298 298	HPMS FA FA
	SO <sub>2</sub> <sup>-</sup>	13.9	3.5					298	HPMS
	SO <sub>4</sub> <sup>-</sup>	(6.7)s						296	FA
	HSO <sub>4</sub> <sup>-</sup>	5.9						298	HPMS

Table 7. Thermodynamic quantities for the gas-phase association of inorganic polyatomics to ions.

Ref.	Neut.	Ion	-ΔH <sub>n-1,n</sub> <sup>0</sup> (kcal/mol)						-ΔS <sub>n-1,n</sub> <sup>0</sup> (cal/K mol)							
			1	2	3	4	5	6	1	2	3	4	5	6		
40,28 20	NH <sub>3</sub>	Li <sup>+</sup>	(39.1)	---	33.1	21.0	16.5	11.1	9.3	(23.5)	---	29.7	25.3	32.6	28.0	25.3
20		Na <sup>+</sup>	29.1	22.9	17.1	14.7	10.7	9.7		25.7	25.1	24.0	29.0	29.8	29.7	
133 134		K <sup>+</sup>	20.1	16.3	13.5	11.6				23.0	22.8	27.7	25.4			
133		Rb <sup>+</sup>	18.7	15.2	13.1	11.4	10.2			24.3	23.6	25.1	38.0			
63		Ag <sup>+</sup>	---	36.9	14.6	13.0	12.8			---	32.7	24.6	30.0	34.1		
133		Bi <sup>+</sup>	35.5	23.2	13.4					35.7	33.0	26.0				
63		Cu <sup>+</sup>	---	---	14.0	12.8	12.8			---	---	23.8	28.7	33.1		
90 51		NH <sub>3</sub> <sup>+</sup>	18.1							---	---					
51			23.1	9.2						---	---					
84 135 136 137 138 139 140 141 51 50 109 142 143		NH <sub>4</sub> <sup>+</sup>	24.8	15.7*	13.8	12.5				25.9	22.9	25.7	29.4			
			27	17	16.5	14.5	7.5			32	26.8	34	36	25		
			---	---	17.8	15.9				---	---	38	40.5			
			25.4	17.3	14.2	11.8				24.3	23.9	25.3	27.1			
			---	16.9	15.1	13.5	9.6			---	24.8	29.7	31.6	32		
			---	---	13.2	10.6				---	---	24.1	21.1			
			21.5	16.2	13.5	11.7	7.0	6.5		20	23.7	25.2	27.9	21.5	21.9	
			---	---	---	12.9				---	---	---	---			
91,19		CH <sub>3</sub> <sup>+</sup>	(103.1) <sup>c</sup>							---						
144		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	21.4							26						
118,19		CH <sub>3</sub> CNH <sup>+</sup>	(43.2)							(26.2)						
144		(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	20.6							28.2						
117		(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	17.3							23.9						
117		(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NH <sup>+</sup>	16.3							29.6						
117		C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup>	17.3							22.5						
126		C <sub>5</sub> H <sub>12</sub> O <sub>2</sub> N <sup>+</sup>	20.9							28.8						
126		C <sub>5</sub> H <sub>9</sub> O <sub>2</sub> N <sup>+</sup>	20.6							28.9						
91,19		C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	(70.1) <sup>c</sup>							---						
145,19		CH <sub>5</sub> <sup>+</sup>	(75.6) <sup>c</sup>							(23.5)						
60,(19)		H <sub>3</sub> O <sup>+</sup>	(54.8) <sup>c</sup>				18.4	17.1	15.0		(22.7)	23.0	31.8	34.3		
60,(70,19)		H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(37.9) <sup>c</sup>				18.2	15.7			(20.3)	30.3	33.9			
60,(70,19)		H <sub>3</sub> O <sup>+</sup> •2H <sub>2</sub> O	(31.0) <sup>c</sup>				17.3				(23.7)	35.1				
60,70,19		H <sub>3</sub> O <sup>+</sup> •3H <sub>2</sub> O	(26.5) <sup>c</sup>								(22.7)					
60,72,19		H <sub>3</sub> O <sup>+</sup> •4H <sub>2</sub> O	(23.5) <sup>c</sup>								(22.7)					
146,19,84		H <sub>2</sub> CN <sup>+</sup>	(53) <sup>c</sup>				(22.0) <sup>c</sup>				(23)	(25.9)				
148		F <sup>-</sup>	<23								---					
149 295,4		Cl <sup>-</sup>	8.2 (10.5)								15.4 [19.9]					
149		Br <sup>-</sup>	7.7								19.1					
149		I <sup>-</sup>	7.4								20.9					
300		(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(36.9)								[29.1]					

		$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)						T(K)	Method	Comments	
Neut.	Ion	1	2	3	4	5	6				
NH <sub>3</sub>	Li <sup>+</sup>	(32.1) <sup>s</sup>	---	24.2	13.5	6.8	2.8	1.8	298 298	ICR HPMS	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O interpolated value in Ref. 28
	Na <sup>+</sup>	21.4	15.4	9.9	6.1	1.8	0.8		298	HPMS	
	K <sup>+</sup>	13.2	9.5	6.6	4.0				298 298	HPMS HPMS	
	Rb <sup>+</sup>	11.5	8.2	5.6	3.4	1.3			298	HPMS	
	Ag <sup>+</sup>	---	27.3	7.3	4.1	2.6			298	HPMS	
	Bi <sup>+</sup>	34.9	13.4	5.7					298	HPMS	
	Cu <sup>+</sup>	---	---	6.9	4.2	2.9			298	HPMS	
NH <sub>3</sub> <sup>+</sup>	---	---	---					---	PI		
	---	---	---					---	EI	(error ±4.6 kcal/mole)	
NH <sub>4</sub> <sup>+</sup>	17.1	8.9	6.1	3.7				298	PHPMS	*typographical error in ref.	
	17.5	9.0	6.4	3.8	0.05			298	HPMS		
	---	---	6.4	3.8	0.5			298	HPMS		
	18.1	10.2	6.7	3.7				298	HPMS		
	---	9.5	6.3	4.1	0.7			298	DTMS		
	---	---	6.0	4.3				298	HPMS	Optimum value	
	15.5	9.4	6.0	3.4	0.4	0.0		298	HPMS		
	---	---	---	---				---	HPMS		
	---	---	---	---				---	EI	(error ±4.6 kcal/mole)	
	---	---	---	---				---	PI		
	---	29.7	6.5	3.4				296	FA		
	---	10.1	6.4	---				296	SAMS		
	6.3	5.5						400	HPMS		
CH <sub>3</sub> <sup>+</sup>	---							298	---	c ΔH <sub>f</sub> 's and PA's	
CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	7.1							550	PHPMS		
CH <sub>3</sub> CNH <sup>+</sup>	(35.4) <sup>s</sup>							298	HPMS	<sup>s</sup> from proton transfer	
(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	5.1							550	PHPMS		
(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	4.2							550	HPMS		
(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NH <sup>+</sup>	0.0							550	HPMS		
C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup>	4.9							550	HPMS	pyridineH <sup>+</sup>	
C <sub>5</sub> H <sub>12</sub> O <sub>2</sub> N <sup>+</sup>	12.6							300	HPMS	valineH <sup>+</sup>	
C <sub>5</sub> H <sub>9</sub> O <sub>2</sub> N <sup>+</sup>	11.9							300	HPMS	prolineH <sup>+</sup>	
C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	---							298	---	c ΔH <sub>f</sub> 's and PA; cf. Ref. 114	
CH <sub>5</sub> <sup>+</sup>	(68.5)							298	---	c NH <sub>4</sub> <sup>+</sup> -CH <sub>4</sub> +ΔPA	
H <sub>3</sub> O <sup>+</sup>	(48.0)	11.6	7.6	4.7				300	HPMS	c NH <sub>3</sub> /H <sub>2</sub> O+ΔPA	
H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(31.8)	9.2	5.6					300	HPMS	c NH <sub>3</sub> /H <sub>2</sub> O [scf. Ref. 109]	
H <sub>3</sub> O <sup>+</sup> •2H <sub>2</sub> O	(24.7)	6.5						300	HPMS	c NH <sub>3</sub> /H <sub>2</sub> O [scf. Ref. 109]	
H <sub>3</sub> O <sup>+</sup> •3H <sub>2</sub> O	(19.4)							300	HPMS	c NH <sub>3</sub> /H <sub>2</sub> O [scf. Ref. 109]	
H <sub>3</sub> O <sup>+</sup> •4H <sub>2</sub> O	(16.7)							300	HPMS	c NH <sub>3</sub> /H <sub>2</sub> O	
H <sub>2</sub> CN <sup>+</sup>	(46.3) (14.3)							298	HPMS	c HCN/NH <sub>3</sub>	
F <sup>-</sup>	---							---	FA	< F <sup>-</sup> -H <sub>2</sub> O	
Cl <sup>-</sup>	3.6 (4.5) <sup>s</sup>							298 298	HPMS ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
Br <sup>-</sup>	2.0							298	HPMS		
I <sup>-</sup>	1.2							298	HPMS		
(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(21.6) <sup>s</sup>							525	PHPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	

Table 7. (continued) Thermodynamic quantities for the gas-phase association of inorganic polyatomics to ions.

Ref.	Neut.	Ion	$-\Delta H_{n-1,n}^0$ (kcal/mol)						$-\Delta S_{n-1,n}^0$ (cal/K mol)					
			1	2	3	4	5	6	1	2	3	4	5	6
107	HNO <sub>2</sub>	NO <sub>2</sub> <sup>-</sup>	32.5 (31) <sup>s</sup>	21.3 21.6					---	---	---			
107	HNO <sub>3</sub>	NO <sub>3</sub> <sup>-</sup>	---	17.7	16.0				---	---	---			
222			(>23)	18.3	16.1				[24]	22.1	28.9			
230				16.0	13.9	9.3	7.4	4.6	---	23.1	26.7	19.9	18.6	7.3
251				---	---				---	---	---			
222		Br <sup>-</sup>	(>20) <sup>c</sup>	(18.1) <sup>c</sup>					[18.5]	(23.6)				
96		Na <sup>+</sup>		20.6					20.3					
112,100	H <sub>2</sub> O <sub>2</sub>	Cl <sup>-</sup>	(22.1) <sup>s</sup>						(21.4)					
112,107		NO <sub>2</sub> <sup>-</sup>	(20.2) <sup>s</sup>						(20.0)					
112,107		NO <sub>3</sub> <sup>-</sup>	(19.2) <sup>s</sup>						(21.3)					
112		HSO <sub>4</sub> <sup>-</sup>	(15.9) <sup>s</sup>						(17.3)					
252	PH <sub>3</sub>	PH <sub>4</sub> <sup>+</sup>	11.5	9.2	7.3	6.5	5.5		25.9	22.3	18.4	15.0	13.2	
252		P <sub>2</sub> H <sub>5</sub> <sup>+</sup>	9						20					
252		P <sub>3</sub> H <sub>6</sub> <sup>+</sup>	10.8						34					
93		H <sub>3</sub> O <sup>+</sup>	(34.5)						---					
41,98	PF <sub>3</sub>	F <sup>-</sup>	(40.2)						(23.5)					
311,4		Cl <sup>-</sup>	(15.5)						(21.0)					
322	AlF <sub>3</sub>	F <sup>-</sup>	117.2 114	48.8 <sup>*</sup> 56					---	---				
321														
320	ScF <sub>3</sub>	Na <sup>+</sup>	33						---	---				
321		F <sup>-</sup>	112						---	---				
319	K <sub>2</sub> SO <sub>4</sub>	K <sup>+</sup>	38						---	---				
41,98	SF <sub>4</sub>	F <sup>-</sup>	(43.8)						(25.6)					
41,98	COF <sub>2</sub>	F <sup>-</sup>	(42.6)						(29.0)					
41,98	SOF <sub>2</sub>	F <sup>-</sup>	(37.4)						(24.1)					
41,98	SO <sub>2</sub> F <sub>2</sub>	F <sup>-</sup>	(35.8)						(27.5)					
253	CeI <sub>3</sub>	I <sup>-</sup>	67						28					
259	CCl <sub>4</sub>	Cl <sup>-</sup>	14.2						27.8					
314,98	SiF <sub>4</sub>	F <sup>-</sup>	---						---					

Neut.	Ion	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)						Method	Comments
		1	2	3	4	5	6		
HNO <sub>2</sub>	NO <sub>2</sub> <sup>-</sup>	---	---	---	---	---	---	HPMS HPS	<sup>s</sup> NO <sub>2</sub> <sup>-</sup> -SO <sub>2</sub>
HNO <sub>3</sub>	NO <sub>3</sub> <sup>-</sup>	>14.5	11.7	7.4				298	HPMS
		---	9.0	5.9	3.2	1.9	2.4	298	FA
		---	---	6.9				298	HPMS
								298	FA
	Br <sup>-</sup>	(>13.4)	(11.1)*					367,*298	FA
	Na <sup>+</sup>	14.6						298	FA
H <sub>2</sub> O <sub>2</sub>	Cl <sup>-</sup>	(15.7)						298	FA
	NO <sub>2</sub> <sup>-</sup>	(14.2)						298	FA
	NO <sub>3</sub> <sup>-</sup>	(12.9)						298	FA
	HSO <sub>4</sub> <sup>-</sup>	(10.7)						298	FA
PH <sub>3</sub>	PH <sub>4</sub> <sup>+</sup>	3.7	2.5	1.8	1.7	1.6		298	DTMS
	P <sub>2</sub> H <sub>5</sub> <sup>+</sup>	4.3	3.66	3.33				298	DTMS
	P <sub>3</sub> H <sub>6</sub> <sup>+</sup>	3.5	3.27					298	DTMS
	H <sub>3</sub> O <sup>+</sup>	---						---	ICR
									bracketed ( $\pm 2$ kcal) by HCN and HCOOH (Refs. 88,117)
PF <sub>3</sub>	F <sup>-</sup>	(32.6) <sup>s</sup>						298	ICR
	Cl <sup>-</sup>	(9.2) <sup>s</sup>						298	ICR
AlF <sub>3</sub>	F <sup>-</sup>	---	---				1100,850	MS	Knudsen cell
		---	---				---	MS	Knudsen cell
ScF <sub>3</sub>	Na <sup>+</sup>	---						MS	Knudsen cell
	F <sup>-</sup>	---						MS	Knudsen cell
K <sub>2</sub> SO <sub>4</sub>	K <sup>+</sup>	---					1200	MS	Knudsen cell
SF <sub>4</sub>	F <sup>-</sup>	(36.2) <sup>s</sup>					298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
COF <sub>2</sub>	F <sup>-</sup>	(33.9) <sup>s</sup>					298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
SOF <sub>2</sub>	F <sup>-</sup>	(30.2) <sup>s</sup>					298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
SO <sub>2</sub> F <sub>2</sub>	F <sup>-</sup>	(27.6) <sup>s</sup>					298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
CeI <sub>3</sub>	I <sup>-</sup>	39					1000	MS	Heated collision chamber
CCl <sub>4</sub>	Cl <sup>-</sup>	5.9					298	HPMS	
SiF <sub>4</sub>	F <sup>-</sup>	(51)					298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O

Table 8. Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH° <sub>0,1</sub>	-ΔS° <sub>0,1</sub>	-ΔG° <sub>0,1(T)</sub>				
295,4	CHFCl <sub>2</sub>	CHFCl <sub>2</sub>	Cl <sup>-</sup>	(17.6)	[23.1]	(10.7)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
295,4	CHF <sub>2</sub> Cl	CHF <sub>2</sub> Cl	Cl <sup>-</sup>	(17.2)	[23.0]	(10.3)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
41,98	CHF <sub>3</sub>	CHF <sub>3</sub>	F <sup>-</sup>	(27.1)	[24.1]	(19.6)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O	
295,4			Cl <sup>-</sup>	(16.7)	[22.9]	(9.8)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
254 295,4	CHCl <sub>3</sub>	CHCl <sub>3</sub>	Cl <sup>-</sup>	15.2 19.1	14.8 24.3	10.8 11.0	298 298	HPMS NMR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
295,4				(18.1)	[23.2]	(11.2)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
40,28	CH <sub>2</sub> O	formaldehyde	Li <sup>+</sup>	(36.0)	[26]	(28.2)	298	ICR	s Li <sup>+</sup> -H <sub>2</sub> O	
85,70 115,70 115,70 88,70 116,70 315,70			H <sub>3</sub> O <sup>+</sup>	(32.9) (32.0) — — (32.2)	(21.6) (21.7) (25.5) (25.2) (23.8)	(26.4) (25.5) (25.3) (25.1)	298 298 298 299 298	HPMS FA ICR FA ICR	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O	
85,70 115,70 115,70			H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O	(22.8) (18.9)	(24.3) (18.4)	(15.6) (13.1) (12.7)	298 298 299	HPMS FA FA	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O-H <sub>2</sub> O s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O-H <sub>2</sub> O	
85,70 115,70 115,70 166,70			H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O	(20.9) (16.4)	(28.1) (23.2)	(12.5) (9.5) (9.3)	298 298 298	HPMS FA FA	c H <sub>2</sub> O/H <sub>2</sub> CO s H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O-H <sub>2</sub> O s H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O-H <sub>2</sub> O	
85,70			H <sub>3</sub> O <sup>+</sup> -3H <sub>2</sub> O	(16.3)	(24.0)	(9.2)	298	HPMS	c H <sub>2</sub> O/H <sub>2</sub> CO	
85,72			H <sub>3</sub> O <sup>+</sup> -4H <sub>2</sub> O	(14.7)	(23.2)	(7.8)	298	HPMS	c H <sub>2</sub> O/H <sub>2</sub> CO	
85,72			H <sub>3</sub> O <sup>+</sup> -5H <sub>2</sub> O	(12.6)	(19.0)	(6.9)	298	HPMS	c H <sub>2</sub> O/H <sub>2</sub> CO	
85,72			H <sub>3</sub> O <sup>+</sup> -6H <sub>2</sub> O	(11.9)	(18.6)	(6.3)	298	HPMS	c H <sub>2</sub> O/H <sub>2</sub> CO	
243,147			H <sub>2</sub> CN <sup>+</sup>	—	—	(21.8)	298	FA	s H <sub>2</sub> CN <sup>+</sup> -HCN	
115,70 315,70,19			H <sub>2</sub> COH <sup>+</sup>	(27.6) (27.7)	(24.6) (26.5)	(20.3) (19.8)	298 298	FA ICR	c H <sub>2</sub> O/H <sub>2</sub> CO(s) c H <sub>2</sub> O/H <sub>2</sub> CO(s)	
117	CH <sub>2</sub> O <sub>2</sub>	formic acid	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	19.0	24.2	11.8	298	HPMS		
299,131,19			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	(32.0)	[27.7]	(23.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>2</sub> ) <sub>2</sub> O	
41,98			F <sup>-</sup>	(45.3)	[24.2]	(38.1)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O	
255 254 256 295,4			Cl <sup>-</sup>	27.4 37.2 — (25.6)	24.5 39.6 25.4 [24.1]	20.1 — — (18.4)	300 298 — 298	HPMS NMR HPMS ICR	cf. Table 9 s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
296			I <sup>-</sup>	18.9	20.7	12.7	300	HPMS		
256			HCOO <sup>-</sup>	—	—	—	—	—	cf. Table 9	
39,28	CH <sub>2</sub> F <sub>2</sub>	CH <sub>2</sub> F <sub>2</sub>	Li <sup>+</sup>	(26.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
39,28	CH <sub>2</sub> Cl <sub>2</sub>	CH <sub>2</sub> Cl <sub>2</sub>	Li <sup>+</sup>	(29)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
259 295,4			Cl <sup>-</sup>	15.5 (15.8)	22.0 (22.1)	8.9 (9.2)	298 298	HPMS ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
117	CH <sub>3</sub> NO	HCONH <sub>2</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	30.0	30.0	21.1	298	HPMS		
39,28	CH <sub>3</sub> NO	CH <sub>3</sub> NO <sub>2</sub>	Li <sup>+</sup>	(39.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	20.5	23.0	13.6	298	HPMS		
126			valineH <sup>+</sup>	19.8	27.8	12.6	300	HPMS		
126			prolineH <sup>+</sup>	17.5	21.6	11.0	300	HPMS		
118			anilineH <sup>+</sup>	(14.0)	[17]	8.2	343	HPMS		
118			1-CH <sub>3</sub> -naphthalene <sup>+</sup>	11.6	24	4.4	298	HPMS		
39,28	CH <sub>3</sub> F	CH <sub>3</sub> F	Li <sup>+</sup>	(31)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	11.8	23.3	4.9	298	HPMS		
295,4			Cl <sup>-</sup>	(11.5)	[20.3]	(5.4)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
39,28	CH <sub>3</sub> Cl	CH <sub>3</sub> Cl	Li <sup>+</sup>	(25)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
257			CH <sub>2</sub> Cl <sup>+</sup>	6.9	-3.5	7.9	298	HPMS	cf. Table 9	
257			CH <sub>3</sub> <sup>+</sup>	—	—	—	—	HPMS	cf. Table 9	

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^0$	(cal/K mol) $-\Delta S_{0,1}^0$	(kcal/mol) $-\Delta G_{0,1}^0(T)$	(K)	T	Method	Remarks
257	CH <sub>3</sub> Cl	CH <sub>3</sub> Cl (conc'd)	CH <sub>4</sub> Cl <sup>+</sup>	---	---	---	---	298	HPMS	cf. Table 9
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	10.7	20.6	4.6		298	HPMS	
258			C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	30.7	30.7	21.6		298	HPMS	
258			(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	22.9	44.5	9.6		298	HPMS	
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	6.5	17.9	1.2		298	HPMS	
259 295,4			Cl <sup>-</sup>	8.6 (12.2)	15.3 [20.5]	4.1 (6.2)		298 298	HPMS ICR	<sup>s</sup> Cl <sup>-</sup> -C <sub>4</sub> H <sub>9</sub> OH <sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
117	CH <sub>3</sub> Br	CH <sub>3</sub> Br	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	11.2	21.0	4.9		298	HPMS	
293			Cl <sup>-</sup>	10.9	12.8	7.1		298	HPMS	
293			Br <sup>-</sup>	9.2	14.0	5.0		298	HPMS	
118	CH <sub>3</sub> I	CH <sub>3</sub> I	aniline <sup>+</sup>	(9.3)	[17]	4.3		299	HPMS	
293			Cl <sup>-</sup>	9.8	7.3	7.6		298	HPMS	
293			I <sup>-</sup>	9.0	16.4	4.1		298	HPMS	
314,98	CH <sub>2</sub> SiF <sub>3</sub>	CH <sub>2</sub> SiF <sub>3</sub>	F <sup>-</sup>	---	---	(43.0)		298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
217	CH <sub>4</sub>	methane	Na <sup>+</sup>	7.2	14.1	3.0		298	HPMS	
260			H <sub>3</sub> O <sup>+</sup>	8.0	20.4	1.9		300	HPMS	cf. Table 9
145			NH <sub>4</sub> <sup>+</sup>	3.59	15.5	-1.06		300	HPMS	
145			H <sub>3</sub> O <sup>+</sup>	3.87	18.1	-1.55		300	HPMS	
145			CF <sub>3</sub> <sup>+</sup>	4.55	18.8	-1.08		300	HPMS	
91,19			CH <sub>3</sub> <sup>+</sup>	(39.8)	---	---		298	---	cΔH <sub>f</sub> 's + PA's
261 262			CH <sub>5</sub> <sup>+</sup>	7.4 4.14	20.8 12.4	1.2 0.45		298 298	HPMS HPMS	cf. Table 9 cf. Table 9
262			C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	2.39	8.6	-0.16		298	HPMS	
263				6.6	23.4	-0.4		298	HPMS	
57			(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	3.4	20	-2.6		298	HPMS	
40,28	CH <sub>4</sub> O	methanol	Li <sup>+</sup>	(38.1)	[26.2]	(30.3)		298	ICR	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O
91,19			NO <sup>+</sup>	(30.2)	---	---		298	---	cΔH <sub>f</sub> 's + PA's
118,19			H <sub>3</sub> O <sup>+</sup>	(40.8)	(24.0)	(33.6)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O; cf. Table 9
118,70,19			H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O	(30.2)	(28.6)	(21.6)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O; cf. Table 9
118,70,19			H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O	(25.5)	(32.8)	(15.6)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O; cf. Table 9
118,70,19			H <sub>3</sub> O <sup>+</sup> -3H <sub>2</sub> O	(19.6)	(28.8)	(10.9)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O; cf. Table 9
118,72,19			H <sub>3</sub> O <sup>+</sup> -4H <sub>2</sub> O	(16.0)	(24.4)	(8.7)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O; cf. Table 9
118,72,19			H <sub>3</sub> O <sup>+</sup> -5H <sub>2</sub> O	(14.0)	(22.2)	(7.3)		300	HPMS	cCH <sub>3</sub> OH/H <sub>2</sub> O
299,131,19			HCOH <sub>2</sub> <sup>+</sup>	(35.1)	[25.6]	(27.5)		298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
131 299,131,19			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	33.1 (33.7)	30.5 [28.5]	24.0 (25.2)		298 298	HPMS ICR	cf. Table 9 <sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	19.0	24.2	11.8		298	HPMS	
299,131,19			CH <sub>3</sub> CHOH <sup>+</sup>	(30.3)	[26.9]	(22.3)		298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(29.6)	[26.6]	(21.7)		298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
122			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	26.3	27.1	18.2		300	HPMS	cf. Table 9
122			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	18.1	30.6	9.0		300	HPMS	cf. Table 9
122,131			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -2(CH <sub>3</sub> ) <sub>2</sub> O	---	---	(6.8)		300	HPMS	c (CH <sub>3</sub> ) <sub>2</sub> O/CH <sub>3</sub> OH
118			CH <sub>3</sub> CH <sup>+</sup> -OCH <sub>3</sub>	13.1	21.4	6.7		298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	32.6	39	15.8	52%	HPMS		
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	9.8	23.2	2.9		298	HPMS	cf. Table 9
301			C <sub>8</sub> H <sub>17</sub> O <sub>4</sub> <sup>+</sup>	19.5	34.0	9.4		298	HPMS	12-crown-4etherH <sup>+</sup>
301			C <sub>10</sub> H <sub>21</sub> O <sub>5</sub> <sup>+</sup>	20.0	28.0	11.7		298	HPMS	15-crown-5etherH <sup>+</sup>

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)			(K)	Method	Remarks
				$-\Delta H_{0,1}^{\circ}$	$-\Delta S_{0,1}^{\circ}$	$-\Delta G_{0,1}^{\circ}(T)$			
301	CH <sub>4</sub> O	methanol (cont'd)	C <sub>2</sub> H <sub>25</sub> O <sub>6</sub> <sup>+</sup>	20.0	29.5	11.2	298	HPMS	18-crown-6etherH <sup>+</sup>
41,98			F <sup>-</sup>	(29.6)	[22.6]	(22.8)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
264,265			Cl <sup>-</sup>	—	—	(9.4)	298	ICR	s Cl <sup>-</sup> -CH <sub>3</sub> CN
266				14.2	14.8	9.8	298	HPMS	cf. Table 9
295,4				(16.8)	[22.9]	(9.9)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
330				17.4	24.1	10.2	298	HPMS	cf. Table 9
296			I <sup>-</sup>	11.3	17.8	6.0	300	HPMS	
266			O <sub>2</sub> <sup>-</sup>	19.1	21.9	12.5	298	HPMS	cf. Table 9
302,11,132			OH <sup>-</sup>	—	—	(25)	296	HPMS	s OH <sup>-</sup> /CH <sub>3</sub> O <sup>-</sup> ; cf. Table 9
132,104			OH <sup>-</sup> -H <sub>2</sub> O	—	—	(14.5)	296	FA	s OH <sup>-</sup> -H <sub>2</sub> O-H <sub>2</sub> O
132,103			OH <sup>-</sup> -2H <sub>2</sub> O	—	—	(9.6)	296	FA	s OH <sup>-</sup> -2H <sub>2</sub> O-H <sub>2</sub> O
302			CH <sub>3</sub> O <sup>-</sup>	21.8	21.8	15.3	298	HPMS	
268,302,11			C <sub>2</sub> H <sub>5</sub> O <sup>-</sup>	—	—	(13.4)	298	ICR	c CH <sub>3</sub> O <sup>-</sup> -CH <sub>2</sub> OH/C <sub>2</sub> H <sub>5</sub> OH(s)
267,302,11				—	—	(13.4)	296	FA	c CH <sub>3</sub> O <sup>-</sup> -CH <sub>2</sub> OH/C <sub>2</sub> H <sub>5</sub> OH(s)
303,302				(20.2)	[22]	(13.6)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>2</sub> OH
303,302			n-C <sub>3</sub> H <sub>7</sub> O <sup>-</sup>	(19.8)	[22]	(13.2)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> *CH <sub>3</sub> OH
303,302			t-C <sub>4</sub> H <sub>9</sub> O <sup>-</sup>	(18.9)	[22]	(12.3)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> *CH <sub>3</sub> OH
303,302			t-C <sub>5</sub> H <sub>11</sub> O <sup>-</sup>	(18.6)	[22]	(12.0)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> *CH <sub>3</sub> OH
303,302			C <sub>6</sub> H <sub>11</sub> S <sub>2</sub> <sup>-</sup>	(14.8)	[22]	(8.2)	298	ICR	s,5(CH <sub>3</sub> ) <sub>2</sub> -1,3-dithianide
303,302			C <sub>6</sub> H <sub>5</sub> C≡C <sup>-</sup>	(13.3)	[22]	(7.7)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
93	CH <sub>4</sub> S	CH <sub>3</sub> SH	H <sub>3</sub> O <sup>+</sup>	(34.5)	—	—	—	I <sup>OK</sup>	bracketed ± 2 kcal by HCOOH (Refs. 88,117)
118			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	14.5	24.7	7.1	298	HPMS	
118			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup> -CH <sub>3</sub> CN	9.9	20.0	3.9	298	HPMS	
118			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup> -2CH <sub>3</sub> CN	(7.8)	[20]	2.4	269	HPMS	
41,98			F <sup>-</sup>	(34.2)	[23.2]	(27.3)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
40,28	CH <sub>5</sub> N	CH <sub>3</sub> NH <sub>2</sub>	Li <sup>+</sup>	(41.1)	[26]	(33.3)	298	ICR	s Li <sup>+</sup> -H <sub>2</sub> O
134,61			K <sup>+</sup>	(19.1)	(21.8)	(12.7)	298	HPMS	s K <sup>+</sup> -H <sub>2</sub> O
144			NH <sub>4</sub> <sup>+</sup>	(32)	[26]	(17.9)	550	HPMS	from proton transfer
144			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	21.7	23.6	8.7	550	HPMS	cf. Table 9
63			(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	22.4	29.2	6.3	550	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(42.1)	[30.7]	(26.0)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	8.7	17.4	3.5	298	HPMS	
129			C <sub>6</sub> H <sub>12</sub> NO <sub>3</sub> <sup>+</sup>	28.6	19.9	22.7	298	HPMS	N-acetylalanine methyl esterH <sup>+</sup>
314,98	C <sub>2</sub> OF <sub>4</sub>	CF <sub>3</sub> COF	F <sup>-</sup>	—	—	(37.2)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
299,70	C <sub>2</sub> HO <sub>2</sub> F <sub>3</sub>	CF <sub>3</sub> COOH	H <sub>3</sub> O <sup>+</sup>	(30.8)	[24.7]	(23.4)	298	ICR	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O
299,70,19			CF <sub>3</sub> C(OH) <sub>2</sub> <sup>+</sup>	(29.3)	[28.5]	(20.8)	298	ICR	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O
41,98	C <sub>2</sub> HF <sub>3</sub>	F <sub>2</sub> C=CHF	F <sup>-</sup>	(26.3)	[25.6]	(18.7)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
41,98	C <sub>2</sub> HF <sub>5</sub>	CF <sub>3</sub> CHF <sub>2</sub>	F <sup>-</sup>	(30.4)	[26.6]	(22.5)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(16.6)	[23.3]	(11.6)	298	I <sup>OK</sup>	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
269	C <sub>2</sub> H <sub>2</sub>	acetylene	C <sub>2</sub> H <sub>2</sub> <sup>+</sup>	22.6	—	—	—	PI	
41,98	C <sub>2</sub> H <sub>2</sub> O	H <sub>2</sub> C=CO	F <sup>-</sup>	(35.3)	[26.5]	(27.4)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
41,98	C <sub>2</sub> H <sub>2</sub> OF <sub>4</sub>	(CHF <sub>2</sub> ) <sub>2</sub> O	F <sup>-</sup>	(36.0)	[27.2]	(27.9)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
39,28	C <sub>2</sub> H <sub>3</sub> N	CH <sub>3</sub> CN	Li <sup>+</sup>	(43)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
61			Na <sup>+</sup>	—	—	—	—	HPMS	cf. Table 9
61			K <sup>+</sup>	24.4	21.5	18.0	298	HPMS	cf. Table 9

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH <sub>0,1</sub> <sup>o</sup>	-ΔS <sub>0,1</sub> <sup>o</sup>	-ΔU <sub>0,1</sub> <sup>o</sup> (T)				
61	C <sub>2</sub> H <sub>3</sub> N	CH <sub>3</sub> CN (cont'd)	Rb <sup>+</sup>	20.7	18.1	15.3	298	HPMS	cf. Table 9	
61			Cs <sup>+</sup>	19.2	18.6	13.7	298	HPMS	cf. Table 9	
118			NH <sub>4</sub> <sup>+</sup>	27.6	24.2	20.4	298	HPMS	cf. Table 9	
118,19			H <sub>3</sub> O <sup>+</sup>	(46.7)	(29.3)	(37.9)	300	HPMS	c H <sub>2</sub> O/CH <sub>3</sub> CN; cf. Table 9	
118,70			H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(32.6)	(30.1)	(23.6)	300	HPMS	c H <sub>2</sub> O/CH <sub>3</sub> CN; cf. Table 9	
118,70			H <sub>3</sub> O <sup>+</sup> •2H <sub>2</sub> O	(28.7)	(33.2)	(18.8)	300	HPMS	c H <sub>2</sub> O/CH <sub>3</sub> CN; cf. Table 9	
118,70			H <sub>3</sub> O <sup>+</sup> •3H <sub>2</sub> O	(22.4)	(27.7)	(14.1)	300	HPMS	c CH <sub>3</sub> CN/H <sub>2</sub> O; cf. Table 9	
118,72			H <sub>3</sub> O <sup>+</sup> •4H <sub>2</sub> O	(20.1)	(27.7)	(11.9)	300	HPMS	c CH <sub>3</sub> CN/H <sub>2</sub> O; cf. Table 9	
118,72			H <sub>3</sub> O <sup>+</sup> •5H <sub>2</sub> O	(18.6)	(28.2)	(10.2)	300	HPMS	c CH <sub>3</sub> CN/H <sub>2</sub> O; cf. Table 9	
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	24.5	25.8	16.8	298	HPMS	cf. Table 9	
118			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup> •CH <sub>3</sub> SH	(19.9)	(21.1)	(13.6)	298	HPMS	c CH <sub>3</sub> CN/CH <sub>3</sub> SH	
147			CH <sub>3</sub> CNH <sup>+</sup>	30.2	29	21.6	298	HPMS	cf. Table 9	
270			CH <sub>3</sub> NHCOH <sup>+</sup>	---	---	(16.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270,131			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	---	---	(23.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
270			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	---	---	(20.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			C <sub>2</sub> H <sub>5</sub> OCOH <sup>+</sup>	---	---	(21.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> ) <sub>2</sub> (CH <sub>3</sub> O)COH <sup>+</sup>	---	---	(20.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	---	---	(23.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(37.5)	[31.4]	(21.0)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	
270			(c-C <sub>3</sub> H <sub>5</sub> )CNR <sup>+</sup>	---	---	(20.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			cyclobutanoneH <sup>+</sup>	---	---	(22.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> ) <sub>2</sub> (c-C <sub>3</sub> H <sub>5</sub> )COH <sup>+</sup>	---	---	(17.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			c-C <sub>4</sub> H <sub>9</sub> OH <sup>+</sup>	---	---	(20.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> ) <sub>2</sub> (C <sub>2</sub> H <sub>5</sub> O)COH <sup>+</sup>	---	---	(18.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> O)(c-C <sub>3</sub> H <sub>5</sub> )COH <sup>+</sup>	---	---	(17.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			1,4-dioxane H <sup>+</sup>	---	---	(22.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	---	---	(19.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			cyclopentanoneH <sup>+</sup>	---	---	(20.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			2-C <sub>3</sub> H <sub>7</sub> -c-C <sub>4</sub> H <sub>7</sub> OH <sup>+</sup>	---	---	(19.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			c-C <sub>5</sub> H <sub>10</sub> OH <sup>+</sup>	---	---	(20.3)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> (C <sub>3</sub> H <sub>7</sub> )OH <sup>+</sup>	---	---	(18.4)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
118			aniline <sup>+</sup>	17.2	17.0	11.6	323	HPMS		
270			cyclohexanoneH <sup>+</sup>	---	---	(19.4)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			2,2-(CH <sub>3</sub> ) <sub>2</sub> -c-C <sub>4</sub> H <sub>6</sub> OH <sup>+</sup>	---	---	(18.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> )(t-C <sub>4</sub> H <sub>9</sub> )COH <sup>+</sup>	---	---	(18.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	---	---	(18.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	---	---	(17.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			C <sub>6</sub> H <sub>5</sub> CHOH <sup>+</sup>	---	---	(18.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(c-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	---	---	(14.3)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> COH <sup>+</sup>	---	---	(16.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> )(C <sub>6</sub> H <sub>5</sub> )COH <sup>+</sup>	---	---	(16.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> )(C <sub>6</sub> H <sub>5</sub> )COH <sup>+</sup>	---	---	(16.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			(CH <sub>3</sub> )(c-C <sub>6</sub> H <sub>11</sub> )COH <sup>+</sup>	---	---	(18.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
270			p-(CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	---	---	(15.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -CH <sub>3</sub> CN	
118			1-CH <sub>3</sub> -naphthalene <sup>+</sup>	(12.0)	[24]	4.6	303	HPMS		
265			F <sup>-</sup>	16.0	13.4	12.0	298	HPMS	cf. Table 9	

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^{\circ}$	(cal/K mol) $-\Delta S_{0,1}^{\circ}$	(kcal/mol) $-\Delta G_{0,1}^{\circ}(T)$	(K) T	Method	Remarks
265 295,4 330	C <sub>2</sub> H <sub>3</sub> N	CH <sub>3</sub> CN (cont'd)	Cl <sup>-</sup>	13.4 (15.8) 13.6	14.3 [21.4]	9.2 (9.4) 8.9	298 298 298	HPMS ICR HPMS	cf. Table 9 s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH cf. Table 9
265			Br <sup>-</sup>	12.9	16.5	8.0	298	HPMS	cf. Table 9
265			I <sup>-</sup>	11.9	18.2	6.4	298	HPMS	cf. Table 9
266			O <sub>2</sub> <sup>-</sup>	16.4	17.4	11.2	298	HPMS	cf. Table 9
267			CH <sub>3</sub> C(O)CH <sub>2</sub> <sup>-</sup>	---	---	9.4	295	FA	
299,70	C <sub>2</sub> H <sub>3</sub> OF <sub>3</sub>	CF <sub>3</sub> CH <sub>2</sub> OH	H <sub>3</sub> O <sup>+</sup>	(33.0)	[24.6]	(25.7)	298	ICR	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	19.1	28.5	10.6	298	HPMS	
299,70,19			CF <sub>3</sub> CH <sub>2</sub> OH <sub>2</sub> <sup>+</sup>	(23.2)	[28.9]	(31.8)	298	ICR	s H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O
41,98			F <sup>-</sup>	(37.8)	[26.5]	(29.9)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(24.0)	[25]	(16.5)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
311,98	C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> Cl	ClCOOCH <sub>3</sub>	Cl <sup>-</sup>	(14.1)	[21.0]	(7.8)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
41,98	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>	CF <sub>2</sub> HCH <sub>2</sub> F	F <sup>-</sup>	(26.5)	[25.9]	(18.8)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(18.9)	[25]	(11.4)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
325	C <sub>2</sub> H <sub>4</sub>	ethylene	NH <sub>4</sub> <sup>+</sup>	(10)	[20]	3.7	294	HPMS	
271			C <sub>2</sub> H <sub>4</sub> <sup>+</sup>	15.8	---	---	---	PI	
272			C <sub>2</sub> H <sub>4</sub> <sup>+</sup>	18.2	---	---	---	PI	cf. Table 9
272			C <sub>3</sub> H <sub>5</sub> <sup>+</sup>	16.7	---	---	---	PI	
272			C <sub>4</sub> H <sub>7</sub> <sup>+</sup>	8.7	---	---	---	PI	
41,98	C <sub>2</sub> H <sub>4</sub> NF <sub>3</sub>	CF <sub>3</sub> CH <sub>2</sub> NH <sub>2</sub>	F <sup>-</sup>	(28.1)	(26.0)	(20.3)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(18.0)	[24]	(10.8)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
39,28	C <sub>2</sub> H <sub>4</sub> O	CH <sub>3</sub> CHO (acetaldehyde)	Li <sup>+</sup>	(41.3)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; value given in Ref. 93
273			NO <sup>+</sup>	(35.9)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
299,131,19			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	(34.7)	[27.5]	(26.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			CH <sub>3</sub> CH <sub>2</sub> OH <sup>+</sup>	(31.9)	[28.9]	(23.3)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			CH <sub>3</sub> C(OH) <sub>2</sub> <sup>+</sup>	(29.0)	[26.2]	(21.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(31.2)	[26.9]	(23.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
295,4			Cl <sup>-</sup>	(14.4)	[21.7]	(7.9)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
117	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	CH <sub>3</sub> COOH (acetic acid)	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	22.0	24.3	14.8	298	HPMS	
299,131,19			CH <sub>3</sub> CHOH <sup>+</sup>	(32.5)	[27.7]	(24.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			CH <sub>3</sub> C(OH) <sub>2</sub> <sup>+</sup>	(29.5)	[27.9]	(21.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(31.4)	[27.6]	(23.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131			(CH <sub>3</sub> ) <sub>2</sub> DH <sup>+</sup>	(29.3)	[28.4]	(20.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
129			(N(CH <sub>3</sub> ) <sub>2</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	18.4	24.7	11.0	298	HPMS	
129			C <sub>8</sub> H <sub>12</sub> NO <sub>3</sub> <sup>+</sup>	18.1	27.2	10.0	298	HPMS	N-acetylalanino methyl esterH <sup>+</sup>
117			(c-C <sub>3</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	22.4	34.9	12.0	298	HPMS	
41,98			F <sup>-</sup>	(44.1)	[25.6]	(36.5)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
254 295,4			Cl <sup>-</sup>	21.6 (23.9)	19.3 [24.0]	15.8 (16.7)	298 298	HPMS ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
296			I <sup>-</sup>	16.9	21.3	10.5	300	HPMS	
39,28	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	HCOOCH <sub>3</sub>	Li <sup>+</sup>	(41.5)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(21.4)	[24]	10.3	459	HPMS	
295,4	C <sub>2</sub> H <sub>4</sub> F <sub>2</sub>	CH <sub>3</sub> CF <sub>2</sub> H	Cl <sup>-</sup>	(14.9)	[22.7]	(8.1)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	$-\Delta H_{0,1}^0$ (kcal/mol)	$-\Delta S_{0,1}^0$ (cal/K mol)	$-\Delta G_{0,1}^0(T)$ (kcal/mol)	T (K)	Method	Remarks
274	C <sub>2</sub> H <sub>5</sub> NO <sub>2</sub>	glycine	glycineH <sup>+</sup>	31	33	21.2	298	HPMS	
275,221	C <sub>2</sub> H <sub>5</sub> NO <sub>3</sub>	C <sub>2</sub> H <sub>5</sub> ONO <sub>2</sub>	NO <sub>2</sub> <sup>-</sup>	(20.9)	(35.3)	(10.4)	298	HPMS	<sup>s</sup> NO <sub>2</sub> <sup>-</sup> -SO <sub>2</sub> ; cf. Table 9
248			NO <sub>2</sub> <sup>-</sup> -SO <sub>2</sub>	7.4	10.4	4.2	298	HPMS	
275			NO <sub>3</sub> <sup>-</sup>	17.2	32.2	7.6	298	HPMS	cf. Table 9
41,98	C <sub>2</sub> H <sub>5</sub> OF	CH <sub>2</sub> FCH <sub>2</sub> OH	F <sup>-</sup>	(34.8)	[26.3]	(27.0)	298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(20.5)	[25]	(13.0)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
295,4	C <sub>2</sub> H <sub>5</sub> OC <sub>1</sub>	CH <sub>2</sub> ClCH <sub>2</sub> OH	Cl <sup>-</sup>	(21.5)	[25]	(14.0)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
39,28	C <sub>2</sub> H <sub>5</sub> F	C <sub>2</sub> H <sub>5</sub> F	Li <sup>+</sup>	(33.5)	---	---	---	ICR	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O; from Figure
276	C <sub>2</sub> H <sub>5</sub> Cl	C <sub>2</sub> H <sub>5</sub> Cl	C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9
294	C <sub>2</sub> H <sub>5</sub> Br	C <sub>2</sub> H <sub>5</sub> Br	Br <sup>-</sup>	11.6	19.2	5.9	298	HPMS	
277	C <sub>2</sub> H <sub>6</sub>	ethane	C <sub>2</sub> H <sub>4</sub> <sup>+</sup>	15.3	21	9.0	298	HPMS	
91,19	C <sub>2</sub> H <sub>6</sub> O	C <sub>2</sub> H <sub>5</sub> OH (ethanol)	NO <sup>+</sup>	(35.2)	---	---	298	---	<sup>c</sup> ΔH <sub>f</sub> 's + PA's
299,131,19			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	(36.0)	[27.5]	(27.8)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(21.3)	[25]	8.9	496	HPMS	
114			C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	(54)	---	---	298	---	<sup>c</sup> ΔH <sub>f</sub> 's + PA's
299,131,19			CH <sub>3</sub> CHOH <sup>+</sup>	(32.9)	[30.6]	(23.8)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			CH <sub>3</sub> C(OH) <sub>2</sub> <sup>+</sup>	(29.5)	[26.0]	(21.7)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(32.0)	[28.5]	(23.5)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131,19				(32.2)	[28.5]	(23.7)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(34.8)	[32.2]	(17.9)	525	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
299,131,19			n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(30.5)	[28.6]	(22.0)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131,19			i-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(30.7)	[28.2]	(22.3)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			n-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(30.2)	[28.6]	(21.7)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
41,48			F <sup>-</sup>	(31.5)	(24.9)	(24.1)	298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
278,264			Cl <sup>-</sup>	---	---	(9.95)	295	ICR	<sup>s</sup> Cl <sup>-</sup> -CH <sub>3</sub> OH
295,4				(17.3)	[23.1]	(10.4)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
296			I <sup>-</sup>	12.1	18.9	6.4	300	HPMS	
267;268,302			CH <sub>3</sub> O <sup>-</sup>	---	---	(16.5)	298	FA, ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
267,302,11			C <sub>2</sub> H <sub>5</sub> O <sup>-</sup>	---	---	(13.9)	296	FA	<sup>c</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH/C <sub>2</sub> H <sub>5</sub> OH(s)
268,302,11				---	---	(13.8)	298	ICR	<sup>c</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH/C <sub>2</sub> H <sub>5</sub> OH(s)
303,302				(20.6)	[22]	(14.0)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			n-C <sub>3</sub> H <sub>7</sub> O <sup>-</sup>	(20.3)	[22]	(13.7)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			t-C <sub>4</sub> H <sub>9</sub> O <sup>-</sup>	(19.5)	[22]	(12.9)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			t-C <sub>5</sub> H <sub>11</sub> O <sup>-</sup>	(19.2)	[22]	(12.6)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
40,28	C <sub>2</sub> H <sub>6</sub> O	(CH <sub>3</sub> ) <sub>2</sub> O	Li <sup>+</sup>	(39.5)	[27.5]	(31.3)	298	ICR	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O
134			K <sup>+</sup>	20.8	24.8	13.4	298	HPMS	
279				22.2	26.8	14.2	298	HPMS	
122,19			H <sub>3</sub> O <sup>+</sup>	(48.2)	(27.7)	(39.9)	300	HPMS	<sup>c</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -H <sub>2</sub> O + ΔPA
122,70				(45.4)	(24.5)	(37.9)	300	HPMS	<sup>c</sup> H <sub>2</sub> O/(CH <sub>3</sub> ) <sub>2</sub> O(s); cf. Table 9
122,70			H <sub>3</sub> O <sup>+</sup> -H <sub>2</sub> O	(29.1)	(26.5)	(21.1)	300	HPMS	<sup>c</sup> H <sub>2</sub> O/(CH <sub>3</sub> ) <sub>2</sub> O(s); cf. Table 9
122,70			H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O	(23.4)	(30.2)	(14.3)	300	HPMS	<sup>s</sup> H <sub>3</sub> O <sup>+</sup> -2H <sub>2</sub> O-H <sub>2</sub> O; cf. Table 9
122			H <sub>3</sub> O <sup>+</sup> -3H <sub>2</sub> O	(17.9)	(28.4)	(9.3)	300	HPMS	<sup>s</sup> H <sub>2</sub> O <sup>+</sup> -3H <sub>2</sub> O-H <sub>2</sub> O
122			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	35.0	24.7	27.6	300	HPMS	cf. Table 9
122			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> -CH <sub>3</sub> OH	21.9	25.2	14.4	300	HPMS	cf. Table 9
122			CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> -2CH <sub>3</sub> OH	17.2	28.6	8.7	300	HPMS	cf. Table 9

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^0$	(cal/K mol) $-\Delta S_{0,1}^0$	(kcal/mol) $-\Delta G_{0,1}^0(T)$	(K) T	Method	Remarks
122	C <sub>2</sub> H <sub>6</sub> O	(CH <sub>3</sub> ) <sub>2</sub> O (cont'd)	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> •3CH <sub>3</sub> OH	15.3	31.5	5.9	300	HPMS	
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	21.5	29.3	12.8	298	HPMS	
299,131,19			CH <sub>3</sub> C(OH) <sub>2</sub> <sup>+</sup>	(31.1)	[26.0]	(23.4)	298	ICR	s(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	29.5	27.0	21.5	298	HPMS	
131				30.7	29.6	21.9	300	HPMS	cf. Table 9
299,131,19			(HCOOC <sub>2</sub> H <sub>5</sub> )H <sup>+</sup>	(30.2)	[28.8]	(21.6)	298	ICR	s(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
324			(CH <sub>3</sub> ) <sub>2</sub> OCH <sub>3</sub> <sup>+</sup>	13.0	28.4	4.5	298	HPMS	
299,131,19			n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(31.9)	[28.6]	(23.4)	298	ICR	s(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131,19			i-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(31.9)	[28.2]	(23.5)	298	ICR	s(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			1,4-dioxaneH <sup>+</sup>	(29.9)	[29.1]	(21.2)	298	ICR	s(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
318	C <sub>2</sub> H <sub>6</sub> OS	(CH <sub>3</sub> ) <sub>2</sub> SO	K <sup>+</sup>	35	31	25	300	HPMS	cf. Table 9
280			(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup>	(30.8)	(22.9)	(24.0)	298	HPMS	s(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> CO; cf. Table 9
280			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(41.1)	(29.6)	(32.3)	298	HPMS	s(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> CO
317			Cl <sup>-</sup>	18.6	20.4	12.5	300	HPMS	cf. Table 9
317			Br <sup>-</sup>	17.3	21.4	10.9	300	HPMS	cf. Table 9
317			I <sup>-</sup>	15.7	21.7	9.2	300	HPMS	cf. Table 9
39,28	C <sub>2</sub> H <sub>6</sub> S	(CH <sub>3</sub> ) <sub>2</sub> S	Li <sup>+</sup>	(32.8)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O (value given in Ref. 93)
118	C <sub>2</sub> H <sub>6</sub> S	C <sub>2</sub> H <sub>5</sub> SH	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	15.5	21.8	9.0	298	HPMS	
40,28	C <sub>2</sub> H <sub>7</sub> N	(CH <sub>3</sub> ) <sub>2</sub> NH	Li <sup>+</sup>	(42.2)	[27]	(34.1)	298	ICR	s Li <sup>+</sup> -H <sub>2</sub> O
134			K <sup>+</sup>	19.5	21.4	13.1	298	HPMS	
144			NH <sub>4</sub> <sup>+</sup>	(38.9)	[28.2]	(23.4)	550	HPMS	from proton transfer
144			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(27.5)	(24.9)	(13.8)	550	HPMS	from proton transfer
144			(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	20.8	25.7	6.6	550	HPMS	
144			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	20.5	28.5	4.8	550	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(44.2)	[30.3]	(28.3)	525	HPMS	s(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
281	C <sub>2</sub> H <sub>7</sub> N	C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub>	C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(44.1)	[31.8]	(27.4)	525	HPMS	s(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
279	C <sub>2</sub> H <sub>8</sub> N <sub>2</sub>	H <sub>2</sub> NCH <sub>2</sub> CH <sub>2</sub> NH <sub>2</sub>	K <sup>+</sup>	25.7	22.3	19.0	298	HPMS	cf. Table 9
282			H <sub>2</sub> NCH <sub>2</sub> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9
41,98	C <sub>3</sub> F <sub>5</sub> N	C <sub>2</sub> F <sub>5</sub> CN	F <sup>-</sup>	(30.1)	[22.8]	(23.3)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
311,4	C <sub>3</sub> HOF <sub>5</sub>	(CF <sub>2</sub> H)(CF <sub>3</sub> )CO	Cl <sup>-</sup>	(23.4)	[23.9]	(16.3)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
295,4	C <sub>3</sub> H <sub>2</sub> OF <sub>6</sub>	(CF <sub>3</sub> ) <sub>2</sub> HCOH	Cl <sup>-</sup>	(>26.5)	[25]	(>19)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
39,28	C <sub>3</sub> H <sub>4</sub>	CH <sub>3</sub> C≡CH	Li <sup>+</sup>	(28.5)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
41,98	C <sub>3</sub> H <sub>5</sub> OF	CH <sub>2</sub> F(c-C <sub>2</sub> H <sub>3</sub> O)	F <sup>-</sup>	(25.5)	[23.7]	(18.4)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
39,28	C <sub>3</sub> H <sub>6</sub>	CH <sub>3</sub> CH=CH <sub>2</sub>	Li <sup>+</sup>	(23)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
39,28	C <sub>3</sub> H <sub>6</sub> O	(CH <sub>3</sub> ) <sub>2</sub> CO (acetone)	Li <sup>+</sup>	(44.5)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
318			K <sup>+</sup>	26	24	19	300	HPMS	cf. Table 9
273			NO <sup>+</sup>	(41.0)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	24.0	23.2	17.1	298	HPMS	
283			CH <sub>3</sub> CO <sup>+</sup>	12.5	---	---	---	PI	

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^{\circ}$	(cal/K mol) $-\Delta S_{0,1}^{\circ}$	(kcal/mol) $-\Delta G_{0,1}^{\circ}(T)$	(K) T	Method	Remarks
280	C <sub>3</sub> H <sub>6</sub> O	(CH <sub>3</sub> ) <sub>2</sub> CO (acetone) (cont'd)	(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup>	24.1	24.5	16.8	298	HPMS	
283			(CH <sub>3</sub> ) <sub>2</sub> CO <sup>+</sup>	>12.4	—	—	—	PI	
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(31.5) 30.1	[30.9] 30.4	(22.3) 21.0	298 298	ICR HPMS	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
280 329				—	—	—	—	HPMS	cf. Table 9
299,131,19			(CH <sub>3</sub> COOCH <sub>3</sub> )H <sup>+</sup>	(30.0)	[29.0]	(21.4)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			c-C <sub>6</sub> H <sub>8</sub> OH <sup>+</sup>	(31.0)	[30.6]	(21.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> )(C <sub>2</sub> H <sub>5</sub> )COH <sup>+</sup>	(29.4)	[29.1]	(20.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			1,4-dioxaneH <sup>+</sup>	(32.6)	[29.4]	(23.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	(29.3)	[29.2]	(20.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	(28.5)	[29.0]	(19.9)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(37.4)	[30.9]	(21.2)	298	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	14.6	24.7	7.2	298	HPMS	cf. Table 9
324			N(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> <sup>+</sup>	12.4	26.7	4.4	298	HPMS	
255			Cl <sup>-</sup>	13.7	19.6	7.9	300	HPMS	
295,4				(14.1)	[19.6]	(8.2)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
284,104			OH <sup>-</sup> +H <sub>2</sub> O	—	—	(15.0)	295	FA	s OH <sup>-</sup> +H <sub>2</sub> O-H <sub>2</sub> O
267			CH <sub>3</sub> C(O)CH <sub>2</sub> <sup>-</sup>	—	—	8.3	295	FA	
273	C <sub>3</sub> H <sub>6</sub> O	C <sub>2</sub> H <sub>5</sub> CHO	NO <sup>+</sup>	(38.1)	—	—	—	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
118	C <sub>3</sub> H <sub>6</sub> O	CH <sub>2</sub> =CHOCH <sub>3</sub>	(CH <sub>2</sub> =CHOCH <sub>3</sub> )H <sup>+</sup>	—	—	<6.8	520	HPMS	
295,4	C <sub>3</sub> H <sub>6</sub> OF <sub>2</sub>	(CH <sub>2</sub> F) <sub>2</sub> HCOH	Cl <sup>-</sup>	(23.6)	[25]	(16.1)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
39,28	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	CH <sub>3</sub> COOCH <sub>3</sub>	Li <sup>+</sup>	(43.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
273			NO <sup>+</sup>	(39.8)	—	—	—	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(31.4)	[29.9]	(22.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> COOCH <sub>3</sub> )H <sup>+</sup>	(29.7)	[30.9]	(20.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O + ΔPA
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	23.5	24.8	16.1	298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(38.4)	[32.6]	(21.3)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
299,131	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	HCOC <sub>2</sub> H <sub>5</sub>	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	(31.2)	[28.8]	(22.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> C(OH) <sub>2</sub> <sup>+</sup>	(30.0)	[30.9]	(20.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			1,4-dioxaneH <sup>+</sup>	(30.5)	[29.9]	(21.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
296	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	C <sub>2</sub> H <sub>5</sub> COOH	I <sup>-</sup>	16.6	20.4	10.5	300	HPMS	
129	C <sub>3</sub> H <sub>7</sub> NO	CH <sub>3</sub> CONHCH <sub>3</sub>	(CH <sub>3</sub> CONHCH <sub>3</sub> )H <sup>+</sup>	29.8	23.6	22.8	298	HPMS	
39,28	C <sub>3</sub> H <sub>7</sub> NO	(CH <sub>3</sub> ) <sub>2</sub> NCHO	Li <sup>+</sup>	(50)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
318			K <sup>+</sup>	31	26	23	300	HPMS	cf. Table 9
39,28	C <sub>3</sub> H <sub>7</sub> F	(CH <sub>3</sub> ) <sub>2</sub> CHF	Li <sup>+</sup>	(35.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
39,28	C <sub>3</sub> H <sub>7</sub> Cl	(CH <sub>3</sub> ) <sub>2</sub> CHCl	Li <sup>+</sup>	(30)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
294	C <sub>3</sub> H <sub>7</sub> Br	n-C <sub>3</sub> H <sub>7</sub> Br	Br <sup>-</sup>	11.6	19.8	5.7	298	HPMS	
39,28	C <sub>3</sub> H <sub>7</sub> Br	(CH <sub>3</sub> ) <sub>2</sub> CHBr	Li <sup>+</sup>	(30.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
294			Br <sup>-</sup>	12.2	19.9	6.3	298	HPMS	
39,28	C <sub>3</sub> H <sub>7</sub> I	(CH <sub>3</sub> ) <sub>2</sub> CHI	Li <sup>+</sup>	(29.5)	—	—	—	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
316,131,19	C <sub>3</sub> H <sub>8</sub> O	i-C <sub>3</sub> H <sub>7</sub> OH	C <sub>2</sub> H <sub>5</sub> OH <sup>+</sup>	(33.6)	[27.2]	(25.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	(31.0)	[28.2]	(22.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH° <sub>0,1</sub>	-ΔS° <sub>0,1</sub>	-ΔG° <sub>0,1(T)</sub>				
316,131,19	C <sub>3</sub> H <sub>8</sub> O	i-C <sub>3</sub> H <sub>7</sub> OH (cont'd)	i-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(31.9)	[29.6]	(23.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
316,131,19			t-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(30.5)	[28.2]	(22.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
316,131,19			s-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(32.0)	[27.5]	(23.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
41,98			F <sup>-</sup>	(32.3)	[25.6]	(24.7)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O	
295,4			Cl <sup>-</sup>	(17.6)	[23.2]	(10.7)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
296			I <sup>-</sup>	12.2	19.1	6.5	300	HPMS		
117	C <sub>3</sub> H <sub>8</sub> O	n-C <sub>3</sub> H <sub>7</sub> OH	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	22.0	25.6	14.4	298	HPMS		
299,131			(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	(30.3)	[28.4]	(21.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(32.8)	[27.4]	(24.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
299,131,19 329			n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(31.6)	[30.2]	(22.6)	298	ICR HPMS	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O cf. Table 9	
299,131,19			n-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(31.7)	[29.2]	(23.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(35.5)	[32]	(18.7)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	
41,98			F <sup>-</sup>	(32.3)	[25.4]	(24.7)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O	
295,4			Cl <sup>-</sup>	(17.7)	[23.2]	(10.8)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
303,302	C <sub>3</sub> H <sub>8</sub> O	n-C <sub>3</sub> H <sub>7</sub> OH (cont'd)	H <sub>2</sub> O=C(CH <sub>3</sub> )O <sup>-</sup>	(14.5)	{22}	(7.9)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH	
303,302			n-C <sub>3</sub> H <sub>7</sub> O <sup>-</sup>	(21.0)	{22}	(14.4)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH	
303,302			t-C <sub>4</sub> H <sub>9</sub> O <sup>-</sup>	(20.2)	{22}	(13.6)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH	
303,302			t-C <sub>5</sub> H <sub>11</sub> O <sup>-</sup>	(19.8)	{22}	(13.2)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH	
303,302			C <sub>6</sub> H <sub>5</sub> C≡C <sup>-</sup>	(15.4)	{22}	(8.8)	298	ICR	s CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH	
118	C <sub>3</sub> H <sub>8</sub> S	n-C <sub>3</sub> H <sub>7</sub> SH	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	17.5	24.9	10.1	298	HPMS		
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(34.2)	[32.2]	(17.3)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	
324	C <sub>3</sub> H <sub>8</sub> S	C <sub>2</sub> H <sub>5</sub> SCH <sub>3</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(19.8)	[25]	11.3	438	HPMS		
40,28	C <sub>3</sub> H <sub>9</sub> N	(CH <sub>3</sub> ) <sub>3</sub> N	Li <sup>+</sup>	(42.1)	[28]	(33.7)	298	ICR	s Li <sup>+</sup> -H <sub>2</sub> O	
134,61			K <sup>+</sup>	(20.0)	(23.4)	(13.0)	298	HPMS	s K <sup>+</sup> -H <sub>2</sub> O	
144			(CH <sub>3</sub> ) <sub>2</sub> NH <sub>2</sub> <sup>+</sup>	23.3	25.3	9.4	550	HPMS		
144			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	22.5	32.0	4.9	550	HPMS		
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	9.9	20.6	3.8	298	HPMS		
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(45.6)	[32]	(28.8)	525	HPMS	s (CH <sub>2</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	
134	C <sub>3</sub> H <sub>9</sub> N	n-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	K <sup>+</sup>	21.8	25.5	14.2	298	HPMS		
281			n-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9	
281	C <sub>3</sub> H <sub>9</sub> N	i-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	i-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9	
282	C <sub>3</sub> H <sub>10</sub> N	1,2(NH <sub>2</sub> ) <sub>2</sub> C <sub>3</sub> H <sub>6</sub>	(1,2(NH <sub>2</sub> ) <sub>2</sub> C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9	
282	C <sub>3</sub> H <sub>10</sub> N	1,3(NH <sub>2</sub> ) <sub>2</sub> C <sub>3</sub> H <sub>6</sub>	(1,3(NH <sub>2</sub> ) <sub>2</sub> C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	---	---	HPMS	cf. Table 9	
129	C <sub>4</sub> H <sub>4</sub> N <sub>2</sub>	pyrimidine	C <sub>5</sub> H <sub>10</sub> NO <sub>3</sub> <sup>+</sup>	28.6	26.7	20.6	298	HPMS	N-acetylglycine methyl esterH <sup>+</sup>	
118	C <sub>4</sub> H <sub>4</sub> O	furan	furan H <sup>+</sup>	22.5	40.7	10.4	298	HPMS		
295,4	C <sub>4</sub> H <sub>4</sub> OF <sub>6</sub>	(CF <sub>3</sub> ) <sub>2</sub> CH <sub>3</sub> COH	Cl <sup>-</sup>	(>26.5)	[25]	(>19)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
325	C <sub>4</sub> H <sub>5</sub> N	pyrrole	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	18.6	21.0	12.3	298	HPMS		
41,98			F <sup>-</sup>	(34.2)	[25.5]	(26.6)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O	
255			Cl <sup>-</sup>	---	---	11.6	421	HPMS		

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^{\circ}$	(cal/K mol) $-\Delta S_{0,1}^{\circ}$	(kcal/mol) $-\Delta G_{0,1}^{\circ}(T)$	(K) T	Method	Remarks
285	C <sub>4</sub> H <sub>5</sub> N <sub>3</sub> O	cytosine	cytosine H <sup>+</sup>	38.3	37	27.3	298	HPMS	
117	C <sub>4</sub> H <sub>5</sub> O <sub>2</sub> F <sub>3</sub>	CF <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(21.4)	[26]	9.4	450	HPMS	
118	C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	CH <sub>3</sub> COOCH=CH <sub>2</sub>	(CH <sub>3</sub> COOCH=CH <sub>2</sub> )H <sup>+</sup>	(27.3)	[34.5]	10.4	492	HPMS	
117	C <sub>4</sub> H <sub>7</sub> N	n-C <sub>3</sub> H <sub>7</sub> CN	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(28.1)	[28]	10.0	581	HPMS	
39,28	C <sub>4</sub> H <sub>8</sub>	(CH <sub>3</sub> ) <sub>2</sub> C=CH <sub>2</sub>	Li <sup>+</sup>	(28)	---	---	---	ICR	s Li <sup>+</sup> -H <sub>2</sub> O; from Figure
273	C <sub>4</sub> H <sub>8</sub> O	(CH <sub>3</sub> ) <sub>2</sub> C <sub>2</sub> H <sub>5</sub> )CO	NO <sup>+</sup>	(42.2)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(25.2)	[25]	11.4	553	HPMS	
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(32.7)	[29.8]	(23.8)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> (C <sub>2</sub> H <sub>5</sub> )COH <sup>+</sup>	(30.4)	[30.9]	(21.2)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	(29.5)	[29.4]	(20.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(39.3)	[32.8]	(22.1)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
295,4			Cl <sup>-</sup>	(14.0)	[21.0]	(8.5)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
117 299,131,19	C <sub>4</sub> H <sub>8</sub> O	c-C <sub>4</sub> H <sub>8</sub> O (tetrahydrofuran)	c-C <sub>4</sub> H <sub>8</sub> OH <sup>+</sup>	32.6 (32.5)	32.2 [32.2]	23.0 (22.9)	298 298	HPMS ICR	tetrahydrofuranH <sup>+</sup> s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(33.4)	[29.9]	(24.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	(30.1)	[29.4]	(21.3)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	(30.4)	[29.5]	(21.6)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
273	C <sub>4</sub> H <sub>8</sub> O	n-C <sub>3</sub> H <sub>7</sub> CHO	NO <sup>+</sup>	(39.2)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
299,131	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4 dioxane	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	(31.7)	[28.9]	(23.1)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(30.0)	[30.2]	(21.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			1,4 dioxaneH <sup>+</sup>	(30.9)	[31.5]	(21.5)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(HCOOC <sub>2</sub> H <sub>5</sub> )H <sup>+</sup>	(30.9)	[29.7]	(22.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
273	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	CH <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub>	NO <sup>+</sup>	(41.5)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
118			(CH <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub> )H <sup>+</sup>	30.0	34.5	19.7	298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(40.2)	[33]	(22.9)	525	HPMS	s (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
296	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	i-C <sub>3</sub> H <sub>7</sub> COOH	I <sup>-</sup>	16.7	20.5	10.6	300	HPMS	
318	C <sub>4</sub> H <sub>9</sub> NO	(N(CH <sub>3</sub> ) <sub>2</sub> )(CH <sub>3</sub> )CO	K <sup>+</sup>	31	23	24	300	HPMS	cf. Table 9
129			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	27.2	24.1	20.0	298	HPMS	
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	18.0	21.6	11.6	298	HPMS	
129			(N(CH <sub>3</sub> ) <sub>2</sub> )(CH <sub>3</sub> )COH <sup>+</sup>	31.3	27.4	23.1	298	HPMS	
41,98	C <sub>4</sub> H <sub>9</sub> F	(CH <sub>3</sub> ) <sub>3</sub> CF	F <sup>-</sup>	(22.3)	[23.6]	(15.3)	298	ICR	s F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(13.3)	[20.8]	(7.1)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
295,4	C <sub>4</sub> H <sub>9</sub> Cl	(CH <sub>3</sub> ) <sub>3</sub> COCl	Cl <sup>-</sup>	(14.3)	[21.2]	(8.0)	298	ICR	s Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
294	C <sub>4</sub> H <sub>9</sub> Br	(CH <sub>3</sub> ) <sub>3</sub> CBr	Br <sup>-</sup>	12.4	19.3	6.7	298	HPMS	
294	C <sub>4</sub> H <sub>9</sub> Br	(CH <sub>3</sub> ) <sub>2</sub> CHCH <sub>2</sub> Br	Br <sup>-</sup>	12.9	21.8	6.4	298	HPMS	
134	C <sub>4</sub> H <sub>10</sub> O	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> O	K <sup>+</sup>	22.3	24.7	14.9	298	HPMS	
273			NO <sup>+</sup>	(41.3)	---	---	---	ICR	s NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
286			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	22.0	25.0	14.6	298	HPMS	
286			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	19.5	29.4	10.7	298	HPMS	
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(32.9)	[29.7]	(24.0)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			c-C <sub>4</sub> H <sub>8</sub> OH <sup>+</sup>	(31.9)	[30.9]	(22.7)	298	ICR	s (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH° <sub>0,1</sub>	-ΔS° <sub>0,1</sub>	-ΔH° <sub>0,1(T)</sub>					
117 299,131,19	C <sub>4</sub> H <sub>10</sub> O	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> O (cont'd)	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	29.8 (30.3)	33.2 (30.9)	19.9 (21.1)		298	298	HPMS ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	(29.5)	[29.5]	(20.7)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	(29.3)	[30.0]	(20.4)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH	(26.0)	[30.8]	(16.8)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
286			pyridine H <sup>+</sup>	22.5	32.9	12.7		298		HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	21.9	31.9	12.4		298		HPMS	
117	C <sub>4</sub> H <sub>10</sub> O	n-C <sub>4</sub> H <sub>9</sub> OH	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(23.5)	[26]	10.6		495		HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(36.5)	[32.4]	(19.5)		525		HPMS	<sup>a</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
299,131,19			n-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(31.5)	[30.9]	(22.3)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(33.1)	[27.7]	(24.8)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(31.3)	[29.2]	(22.6)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
41,98			F <sup>-</sup>	(32.2)	(25.9)	(24.5)		298		ICR	<sup>a</sup> F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(17.6)	[23.2]	(10.7)		298		ICR	<sup>a</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
316,131,19	C <sub>4</sub> H <sub>10</sub> O	s-C <sub>4</sub> H <sub>9</sub> OH	i-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(32.8)	[28.2]	(24.4)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131,19			s-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(32.6)	[28.2]	(24.6)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117	C <sub>4</sub> H <sub>10</sub> O	t-C <sub>4</sub> H <sub>9</sub> OH	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(22.9)	[26]	10.0		495		HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(36.6)	[32.4]	(19.6)		525		HPMS	<sup>a</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
316,131,19			i-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	(33.0)	[28.2]	(24.6)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
316,131,19			t-C <sub>4</sub> H <sub>9</sub> OH <sub>2</sub> <sup>+</sup>	(31.6)	[29.6]	(22.8)		298		ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
41,98			F <sup>-</sup>	(33.3)	(26.1)	(25.5)		298		ICR	<sup>a</sup> F <sup>-</sup> -H <sub>2</sub> O
4 254			Cl <sup>-</sup>	19.2 14.2	27 10.3	11.1 11.1		298		HPMS HPMS	
296			I <sup>-</sup>	12.1	18.7	6.5		300		HPMS	
303,302			t-C <sub>4</sub> H <sub>9</sub> O <sup>-</sup>	(20.4)	[22]	(13.8)		298		ICR	<sup>a</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			c-C <sub>5</sub> H <sub>11</sub> O <sup>-</sup>	(20.3)	[22]	(13.7)		298		ICR	<sup>a</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
217	C <sub>4</sub> H <sub>10</sub> O <sub>2</sub>	CH <sub>3</sub> O(CH <sub>2</sub> ) <sub>2</sub> OCH <sub>3</sub>	Na <sup>+</sup>	47.2	34.6	36.9		298		HPMS	cf. Table 9
279			K <sup>+</sup>	30.8	26.8	22.8		298		HPMS	
286			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	30.1	30.1	21.1		298		HPMS	
286			(CH <sub>3</sub> ) <sub>2</sub> NH <sup>+</sup>	26.7	34.8	16.3		298		HPMS	
286			pyridine H <sup>+</sup>	25.4	31.4	16.0		298		HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	29.4	35.5	18.8		298		HPMS	
30	C <sub>4</sub> H <sub>11</sub> N	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> NH	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(46.4)	[33]	(29.1)		525		HPMS	<sup>a</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
117	C <sub>5</sub> H <sub>4</sub> NF	2-F-pyridine	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NH <sup>+</sup>	20.8	31.0	11.6		298		HPMS	
19,28	C <sub>5</sub> H <sub>5</sub> N	pyridine	Li <sup>+</sup>	(44)	---	---	---	---		ICR	<sup>a</sup> Li <sup>+</sup> -H <sub>2</sub> O; from Figure
134			K <sup>+</sup>	20.7	18.6	15.2		298		HPMS	
63			Ag <sup>+</sup>	---	---	---	---	---		HPMS	cf. Table 9
63 285 125			pyridine H <sup>+</sup>	26.3 23.7 24.6	32.1 28 28.2	16.7 15.4 16.2		298 298 298		HPMS HPMS HPMS	cf. Table 9
117			(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NH <sup>+</sup>	(20.4)	[28]	9.0		408		HPMS	
285	C <sub>5</sub> H <sub>5</sub> N <sub>5</sub>	adenine	adenine H <sup>+</sup>	30.3	39	21.7		298		HPMS	
255	C <sub>5</sub> H <sub>6</sub>	cyclopentadiene	Cl <sup>-</sup>	---	---	<2.5		300		HPMS	

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^{\circ}$	(cal/K mol) $-\Delta S_{0,1}^{\circ}$	(kcal/mol) $-\Delta G_{0,1}^{\circ}(T)$	(K) T	Method	Remarks
285	C <sub>5</sub> H <sub>6</sub> N <sub>2</sub> O <sub>2</sub>	thymine	thymineH <sup>+</sup>	30.1	37	19.1	298	HPMS	
255	C <sub>5</sub> H <sub>8</sub>	1,4-pentadiene	Cl <sup>-</sup>	---	---	3.7	300	HPMS	
274 126	C <sub>5</sub> H <sub>8</sub> NO <sub>2</sub>	proline	prolineH <sup>+</sup>	29 20	32 ---	19.5 ---	298 ---	HPMS HPMS	
126			valineH <sup>+</sup>	23.4	---	---	---	HPMS	
255	C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	(CH <sub>3</sub> CO) <sub>2</sub> CH <sub>2</sub> (acetylacetone)	Cl <sup>-</sup>	---	---	11.0	421	HPMS	
129	C <sub>5</sub> H <sub>9</sub> NO <sub>3</sub>	CH <sub>3</sub> C(O)NHCH <sub>2</sub> COOCH <sub>3</sub>	pyrimidinedeH <sup>+</sup>	34.5	38.4	23.1	298	HPMS	N-acetylglycine methyl ester
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	20.1	29.4	11.3	298	HPMS	
41,98	C <sub>5</sub> H <sub>10</sub> O	(CH <sub>3</sub> ) <sub>3</sub> CCHO	F <sup>-</sup>	(24.6)	[26.2]	(16.8)	298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O
295,4			Cl <sup>-</sup>	(15.0)	[21.9]	(8.4)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
273	C <sub>5</sub> H <sub>10</sub> O	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> CO	NO <sup>+</sup>	(42.9)	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> COH <sup>+</sup>	(30.2)	[31.2]	(20.9)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(31.1)	[29.9]	(22.2)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	(33.4)	[30.1]	(24.4)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	(30.8)	[29.7]	(22.0)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19			c-C <sub>4</sub> H <sub>8</sub> OH <sup>+</sup>	(32.6)	[31.0]	(23.4)	298	ICR	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(25.9)	[26]	11.8	549	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(39.5)	[31.6]	(22.9)	525	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
295,4			Cl <sup>-</sup>	(14.1)	[19.6]	(8.2)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
117	C <sub>5</sub> H <sub>10</sub> O	c-C <sub>5</sub> H <sub>10</sub> O <sup>+</sup>	c-C <sub>5</sub> H <sub>10</sub> O <sup>+</sup>	32.6	32.2	23.0	298	HPMS	
296	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	t-C <sub>4</sub> H <sub>9</sub> COOH	I <sup>-</sup>	15.4	21.7	8.9	300	HPMS	
117	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	HCOOn-C <sub>4</sub> H <sub>9</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	(24.5)	[26]	12.5	461	HPMS	
117	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	CH <sub>3</sub> COO <sup>-</sup> -C <sub>3</sub> H <sub>7</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	30.0	35.2	19.5	298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(41.8)	[33.5]	(24.2)	525	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
273	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	CH <sub>3</sub> COO <sup>-</sup> -C <sub>3</sub> H <sub>7</sub>	NO <sup>+</sup>	(42.0)	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(40.2)	[32.8]	(23.0)	---	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
126	C <sub>5</sub> H <sub>11</sub> NO <sub>2</sub>	valine	prolineH <sup>+</sup>	21.0	---	---	---	HPMS	
126			valineH <sup>+</sup>	20.7	---	---	---	HPMS	
294	C <sub>5</sub> H <sub>11</sub> Br	t-C <sub>5</sub> H <sub>11</sub> Br	Br <sup>-</sup>	14.4	25.2	6.9	298	HPMS	
303,302	C <sub>5</sub> H <sub>12</sub> O	t-C <sub>5</sub> H <sub>11</sub> OH	t-C <sub>5</sub> H <sub>11</sub> O <sup>-</sup>	(21.5)	[22]	(14.9)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			t-C <sub>4</sub> H <sub>9</sub> CH(CH <sub>3</sub> )O <sup>-</sup>	(21.3)	[22]	(14.7)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
303,302			C <sub>6</sub> H <sub>5</sub> EC <sup>-</sup>	(17.1)	[22]	(10.5)	298	ICR	<sup>s</sup> CH <sub>3</sub> O <sup>-</sup> -CH <sub>3</sub> OH
286	C <sub>5</sub> H <sub>12</sub> O <sub>2</sub>	CH <sub>3</sub> O(CH <sub>2</sub> ) <sub>3</sub> OCH <sub>3</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	31.2	32.0	21.7	298	HPMS	
286			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	25.5	33.1	15.6	298	HPMS	
286	C <sub>5</sub> H <sub>12</sub> O <sub>2</sub>	CH <sub>3</sub> O(CH <sub>2</sub> ) <sub>3</sub> OCH <sub>3</sub>	2-F-pyridineH <sup>+</sup>	26.2	31.6	16.8	298	HPMS	
286			pyridineH <sup>+</sup>	26.5	35.8	15.8	298	HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	28.4	35.0	18.0	298	HPMS	

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) -ΔH <sub>0,1</sub> <sup>o</sup>	(cal/K mol) -ΔS <sub>0,1</sub> <sup>o</sup>	(kcal/mol) -ΔC <sub>0,1</sub> <sup>o</sup> (T)	(K) T	Method	Remarks
241	C <sub>6</sub> F <sub>6</sub>	C <sub>6</sub> F <sub>6</sub>	benzene <sup>+</sup>	(12.1)	[27]	4.0	300	HPMS	
118			aniline <sup>+</sup>	(11.0)	[25]	3.5	298	HPMS	
241	C <sub>6</sub> HF <sub>5</sub>	C <sub>6</sub> HF <sub>5</sub>	benzene <sup>+</sup>	(11.2)	[27]	3.1	300	HPMS	
241	C <sub>6</sub> H <sub>2</sub> F <sub>4</sub>	1,2,3,5-C <sub>6</sub> H <sub>2</sub> F <sub>4</sub>	benzene <sup>+</sup>	(11.2)	[27]	3.1	300	HPMS	
241	C <sub>6</sub> H <sub>2</sub> F <sub>4</sub>	1,2,4,5-C <sub>6</sub> H <sub>2</sub> F <sub>4</sub>	benzene <sup>+</sup>	12.0	27	3.9	300	HPMS	
241	C <sub>6</sub> H <sub>3</sub> F <sub>3</sub>	1,3,5-C <sub>6</sub> H <sub>3</sub> F <sub>3</sub>	benzene <sup>+</sup>	12.4	28	3.9	300	HPMS	
241	C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	1,2-C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	benzene <sup>+</sup>	(15.2)	[27]	6.3	330	HPMS	
295,4			Cl <sup>-</sup>	(14.3)	[21.6]	(7.8)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
241	C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	1,3-C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	benzene <sup>+</sup>	13.9	26	6.2	300	HPMS	
241			1,3-C <sub>6</sub> H <sub>4</sub> F <sub>2</sub> <sup>+</sup>	(13.2)	[27]	5.2	298	HPMS	
255 295,4			Cl <sup>-</sup>	(14.6)	[22.6]	7.7 (7.8)	300 298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
325	C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	1,4-C <sub>6</sub> H <sub>4</sub> F <sub>2</sub>	NH <sub>4</sub> <sup>+</sup>	(13)	[20]	5.1	395	HPMS	
295,4			Cl <sup>-</sup>	(13.8)	[21.6]	(7.3)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
273	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	NO <sup>+</sup>	(39.3)	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
118			aniline <sup>+</sup>	(19.5)	[27]	10.7	324	HPMS	
118			1-CH <sub>3</sub> -naphthalene <sup>+</sup>	13.2	27	5.2	298	HPMS	
255			Cl <sup>-</sup>	---	---	7.1	300	HPMS	
287,255	C <sub>6</sub> H <sub>5</sub> OF	p-F-phenol	Cl <sup>-</sup>	(26.9)	(25.3)	(19.3)	300	HPMS	<sup>s</sup> Cl <sup>-</sup> -phenol
287,255	C <sub>6</sub> H <sub>5</sub> OCl	p-Cl-phenol	Cl <sup>-</sup>	(28.9)	(26.3)	(21.0)	300	HPMS	<sup>s</sup> Cl <sup>-</sup> -phenol
273	C <sub>6</sub> H <sub>5</sub> F	C <sub>6</sub> H <sub>5</sub> F	NO <sup>+</sup>	(37.8)	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
325			NH <sub>4</sub> <sup>+</sup>	14.4	18.0	9.0	298	HPMS	
241			C <sub>6</sub> H <sub>5</sub> F <sup>+</sup>	(14.1)	[27]	5.3	356	HPMS	
241			benzene <sup>+</sup>	17.0	30	8.1	300	HPMS	
118			aniline <sup>+</sup>	11.8	26.7	3.8	298	HPMS	
255			Cl <sup>-</sup>	---	---	5.9	300	HPMS	
273	C <sub>6</sub> H <sub>5</sub> Cl	C <sub>6</sub> H <sub>5</sub> Cl	NO <sup>+</sup>	(38.5)	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
118			aniline <sup>+</sup>	(12.0)	[27]	4.0	297	HPMS	
241			mesitylene <sup>+</sup>	(11.4)	[27]	2.9	300	HPMS	
255 295,4			Cl <sup>-</sup>	(13.6)	[22.4]	6.5 (6.9)	300 298	HPMS ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
118	C <sub>6</sub> H <sub>5</sub> Br	C <sub>6</sub> H <sub>5</sub> Br	aniline <sup>+</sup>	(14.1)	[27]	5.3	325	HPMS	
255			Cl <sup>-</sup>	---	---	6.8	298	HPMS	
118	C <sub>6</sub> H <sub>5</sub> I	C <sub>6</sub> H <sub>5</sub> I	aniline <sup>+</sup>	(13.6)	[27]	4.8	324	HPMS	
255			Cl <sup>-</sup>	---	---	7.2	300	HPMS	
40,28	C <sub>6</sub> H <sub>6</sub>	benzene	Li <sup>+</sup>	(37.9)	[27.5]	(29.7)	298	ICR	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O
97			K <sup>+</sup>	19.2	24.6	11.9	298	HPMS	cf. Table 9
97,60			K <sup>+</sup> +H <sub>2</sub> O	(16.8)	(27.1)	(8.7)	298	HPMS	<sup>s</sup> K <sup>+</sup> +H <sub>2</sub> O-H <sub>2</sub> O; cf. Table 9
97,60			K <sup>+</sup> +2H <sub>2</sub> O	(13.4)	(24.3)	(6.1)	298	HPMS	<sup>s</sup> K <sup>+</sup> +2H <sub>2</sub> O-H <sub>2</sub> O; cf. Table 9
97,60			K <sup>+</sup> +3H <sub>2</sub> O	(12.6)	(27.6)	(3.7)	298	HPMS	<sup>s</sup> K <sup>+</sup> +3H <sub>2</sub> O-H <sub>2</sub> O

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH° <sub>0,1</sub>	-ΔS° <sub>0,1</sub>	-ΔG° <sub>0,1(T)</sub>				
273	C <sub>6</sub> H <sub>6</sub>	benzene (cont'd)	NO <sup>+</sup>	(41.1)	---	---	---	---	ICR	<sup>s</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
325			NH <sub>4</sub> <sup>+</sup>	19.3	23.3	12.4	298	HPMS	cf. Table 9	
325			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	18.8	25.1	11.3	298	HPMS		
288			C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	(46.5)	(31.5)	(37)	298	---	c ΔH <sub>f</sub> 's + PA's	
325			C <sub>2</sub> H <sub>5</sub> OH <sub>2</sub> <sup>+</sup>	(21)	[25]	8.7	491	HPMS		
289			C <sub>3</sub> H <sub>3</sub> <sup>+</sup>	9.0	9	6	300	HPMS		
288			(CH <sub>3</sub> ) <sub>2</sub> CH <sup>+</sup>	(33.8)	(34)	(23.7)	298	---	c ΔH <sub>f</sub> 's + PA's	
325			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	15.9	27.7	7.6	298	HPMS		
289			c-C <sub>4</sub> H <sub>4</sub> S <sup>+</sup>	13	23	7	300	HPMS	thiophene <sup>+</sup>	
288			(CH <sub>3</sub> ) <sub>3</sub> C <sup>+</sup>	22	49	7.4	298	HPMS		
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	(9.4)	[20]	3.5	296	HPMS		
241			C <sub>6</sub> H <sub>5</sub> Cl <sup>+</sup>	14.0	26	6.2	300	HPMS		
289			benzene <sup>+</sup>	15	23	8	300	HPMS		
241			benzeneH <sup>+</sup>	17.0	27	8.9	300	HPMS		
241			benzeneH <sup>+</sup>	11.0	24	3.0	300	HPMS		
118			aniline <sup>+</sup>	113.2	26.3	5.3	298	HPMS		
241			toluene <sup>+</sup>	12.4	26	4.6	300	HPMS		
118			C <sub>6</sub> H <sub>5</sub> NHCH <sub>3</sub> <sup>+</sup>	(12.2)	[26]	4.5	298	HPMS		
118			C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(9.8)	[26]	2.0	298	HPMS		
241			mesitylene <sup>+</sup>	10.6	26	2.8	300	HPMS		
118			p-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(9.8)	[22]	2.6	329	HPMS		
118			p-CH <sub>3</sub> -naphthalene <sup>+</sup>	8.9	24	1.7	298	HPMS		
97			Cl <sup>-</sup>	(10.4)	[22]	3.8	300	HPMS		
295, 4				(9.9)	[17.1]	(4.8)	298	ICR	<sup>s</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH	
331				9.5	19.9	3.6	298	HPMS		
41, 98	C <sub>6</sub> H <sub>6</sub> O	phenol	F <sup>-</sup>	(41.4)	[26.3]	(33.5)	298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O	
254			Cl <sup>-</sup>	19.4	15.5	14.8	298	HPMS		
4				27.4	25	20.0	298	HPMS		
255				25.0	26.0	17.2	300	HPMS		
125	C <sub>6</sub> H <sub>7</sub> N	2-CH <sub>3</sub> -pyridine	2-CH <sub>3</sub> -pyridineH <sup>+</sup>	23.0	27.8	14.7	298	HPMS		
134	C <sub>6</sub> H <sub>7</sub> N	aniline	K <sup>+</sup>	22.8	23.7	15.8	298	HPMS		
118			aniline <sup>+</sup>	17.4	24.6	9.5	322	HPMS		
118			C <sub>6</sub> H <sub>5</sub> NHCH <sub>3</sub> <sup>+</sup>	17.4	28.2	9.0	298	HPMS		
118			C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(14.5)	[27]	6.5	298	HPMS		
118			p-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(13.5)	[27]	5.9	283	HPMS		
41, 98			F <sup>-</sup>	(31.2)	[26.2]	(23.4)	298	ICR	<sup>s</sup> F <sup>-</sup> -H <sub>2</sub> O	
325	C <sub>6</sub> H <sub>10</sub>	cyclohexene	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	11.6	16.9	6.6	298	HPMS		
129	C <sub>6</sub> H <sub>11</sub> NO <sub>3</sub>	CH <sub>3</sub> C(O)NHCH <sub>2</sub> -(CH <sub>3</sub> )COOCH <sub>3</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	40.1	35.1	29.6	298	HPMS	N-acetylaalanine methyl ester	
129			(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	29.7	27.6	21.5	298	HPMS		
129			C <sub>6</sub> H <sub>12</sub> NO <sub>3</sub> <sup>+</sup>	30.1	31.5	20.7	298	HPMS		
39, 28	C <sub>6</sub> H <sub>12</sub>	cyclohexane	Li <sup>+</sup>	(24)	---	---	---	ICR	<sup>s</sup> Li <sup>+</sup> -H <sub>2</sub> O; from Figure	
325			NH <sub>4</sub> <sup>+</sup>	(<9)	[20]	<2.8	317	HPMS		
241			benzene <sup>+</sup>	(11.2)	[27]	3.2	295	HPMS		
117	C <sub>6</sub> H <sub>12</sub> O	c-C <sub>6</sub> H <sub>12</sub> O	c-C <sub>6</sub> H <sub>12</sub> OH <sup>+</sup>	33.2	34.7	22.9	298	HPMS		
117	C <sub>6</sub> H <sub>12</sub> O	(n-C <sub>3</sub> H <sub>7</sub> )(C <sub>2</sub> H <sub>5</sub> )CO	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	27.0	27.0	19.0	298	HPMS		
300	C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	CH <sub>3</sub> COO(n-C <sub>4</sub> H <sub>9</sub> )	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(41.7)	[33.5]	(24.1)	525	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	
300	C <sub>6</sub> H <sub>14</sub> O	n-C <sub>6</sub> H <sub>13</sub> OH	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(37.5)	[33.3]	(20.0)	525	HPMS	<sup>s</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH	

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				$-\Delta H_{0,1}^{\circ}$	$-\Delta S_{0,1}^{\circ}$	$-\Delta G_{0,1}^{\circ}(T)$				
117 299,131,19	C <sub>6</sub> H <sub>14</sub> O	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> O	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	24.0 (31.4)	26.7 [29.9]	16.0 (22.5)	298	298	HPMS ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117			pyridineH <sup>+</sup>	(23.5)	[31]	8.0	500		HPMS	
117			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	25.4	31.2	16.1	298		HPMS	
117 299,131,19			(n-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup>	30.2 (29.9)	37.4 [31.9]	19.1 (20.4)	298 298	298	HPMS ICR	<sup>a</sup> (CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
117 299,131,19	C <sub>6</sub> H <sub>14</sub> O	(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> O	(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> OH <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> OH <sup>+</sup>	27.0 (26.6)	39.1 [32.6]	15.3 (16.9)	298 298	298	HPMS ICR	<sup>a</sup> (CH <sub>3</sub> )OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
299,131,19				(31.3)	[29.8]	(22.4)	298	298	ICR	<sup>a</sup> (CH <sub>3</sub> )OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
303,302	C <sub>6</sub> H <sub>14</sub> O	t-C <sub>4</sub> H <sub>9</sub> CH(CH <sub>3</sub> )OH	t-C <sub>4</sub> H <sub>9</sub> CH(CH <sub>3</sub> )O <sup>-</sup> C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> O <sup>-</sup>	(21.4) (21.6)	[22] [22]	(14.8) (15.0)	298	298	ICR	<sup>a</sup> (CH <sub>3</sub> )OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
303,302							298	298	ICR	<sup>a</sup> (CH <sub>3</sub> )OH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> O
286	C <sub>6</sub> H <sub>14</sub> O <sub>3</sub>	CH <sub>3</sub> (OCH <sub>2</sub> CH <sub>2</sub> ) <sub>2</sub> O <sup>-</sup>	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	32.8	40.0	20.9	298		HPMS	
286			1,2-diazineH <sup>+</sup>	32.4	36.1	21.6	298		HPMS	
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	20.6	28.7	12.0	298		HPMS	
286			2-F-pyridineH <sup>+</sup>	34.7	38.6	23.2	298		HPMS	
286			pyridineH <sup>+</sup>	31.5	36.3	20.6	298		HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	39.7	44.6	26.4	298		HPMS	
125	C <sub>6</sub> H <sub>15</sub> N	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> N	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NH <sup>+</sup>	23.8	41.0	11.6	298		HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(45.7)	[33.9]	(27.9)	525		HPMS	<sup>a</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
311,4	C <sub>6</sub> H <sub>15</sub> B	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> B	Cl <sup>-</sup>	(23.8)	[22]	(17.2)	298	298	ICR	<sup>a</sup> Cl <sup>-</sup> -t-C <sub>4</sub> H <sub>9</sub> OH
273	C <sub>7</sub> H <sub>5</sub> N	C <sub>6</sub> H <sub>5</sub> CN	NO <sup>+</sup>	(41.1)	—	—	—	—	ICR	<sup>a</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
117			CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	29.4	31.2	20.1	298		HPMS	
118			aniline <sup>+</sup>	(21.8)	[27]	12.3	338		HPMS	
118			1-CH <sub>3</sub> -naphthalene <sup>+</sup>	(15.4)	[27]	6.9	301		HPMS	
287,255 287,255	C <sub>7</sub> H <sub>5</sub> NO	p-CNphenol	Cl <sup>-</sup>	(33.6) (34.6)	(26) (28)	(25.8) (26.2)	300 300	HPMS HPMS		<sup>a</sup> Cl <sup>-</sup> -p-F phenol <sup>a</sup> Cl <sup>-</sup> -p-Cl phenol
273	C <sub>7</sub> H <sub>5</sub> F <sub>3</sub>	C <sub>6</sub> H <sub>5</sub> CF <sub>3</sub>	NO <sup>+</sup>	(35)	—	—	—	—	ICR	<sup>a</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
118			aniline <sup>+</sup>	(12.1)	[27]	4.0	300		HPMS	
273	C <sub>7</sub> H <sub>6</sub> O	C <sub>6</sub> H <sub>5</sub> CHO	NO <sup>+</sup>	(43.7)	—	—	—	—	ICR	<sup>a</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
255	C <sub>7</sub> H <sub>7</sub> NO <sub>2</sub>	p-NO <sub>2</sub> toluene	Cl <sup>-</sup>	—	—	7.5	300		HPMS	
41,98	C <sub>7</sub> H <sub>7</sub> F	C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> F	F <sup>-</sup>	(24.4)	[26.6]	(16.5)	298	298	ICR	<sup>a</sup> F <sup>-</sup> -H <sub>2</sub> O
273	C <sub>7</sub> H <sub>8</sub>	toluene	NO <sup>+</sup>	(44.2)	—	—	—	—	ICR	<sup>a</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	9.5	20.3	3.5	298		HPMS	
118			aniline <sup>+</sup>	14.0	26.8	5.5	320		HPMS	
241			toluene <sup>+</sup>	16.0	29	7.3	300		HPMS	
241			mesitylene <sup>+</sup>	12.0	27	4.0	300		HPMS	
255			Cl <sup>-</sup>	—	—	4.0	300		HPMS	
302 303,302	C <sub>7</sub> H <sub>8</sub> O	C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> OH	C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> O <sup>-</sup>	23.8 (22.3)	23.2 [22]	16.9 (15.7)	298 298	298	HPMS ICR	<sup>a</sup> CH <sub>3</sub> O <sup>-</sup> CH <sub>3</sub> OH
287,255	C <sub>7</sub> H <sub>8</sub> O	p-CH <sub>3</sub> phenol (p-cresol)	Cl <sup>-</sup>	(24.6)	(26.7)	(16.6)	300		HPMS	<sup>a</sup> Cl <sup>-</sup> -phenol
303,302			C <sub>6</sub> H <sub>5</sub> C≡C <sup>-</sup>	(19.5)	[22]	(14.9)	298	298	ICR	<sup>a</sup> CH <sub>3</sub> O <sup>-</sup> CH <sub>3</sub> OH
118	C <sub>7</sub> H <sub>8</sub> O	C <sub>6</sub> H <sub>5</sub> OCH <sub>3</sub> (anisole)	aniline <sup>+</sup>	(16.8)	[27]	7.6	346		HPMS	

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Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol)	(cal/K mol)	(kcal/mol)	(K)	T	Method	Remarks
				-ΔH° <sub>0,1</sub>	-ΔS° <sub>0,1</sub>	-ΔG° <sub>0,1</sub> (T)				
255	C <sub>7</sub> H <sub>8</sub> O	C <sub>6</sub> H <sub>5</sub> OCH <sub>3</sub> (anisole) (cont'd)	Cl <sup>-</sup>	---	---	7.3	300		HPMS	
125	C <sub>7</sub> H <sub>9</sub> N	2,6-(CH <sub>3</sub> ) <sub>2</sub> -pyridine	2,6-(CH <sub>3</sub> ) <sub>2</sub> -pyridineH <sup>+</sup>	23.3	33.2	13.4	298		HPMS	
118	C <sub>7</sub> H <sub>9</sub>	C <sub>6</sub> H <sub>5</sub> NHCH <sub>3</sub>	C <sub>6</sub> H <sub>5</sub> NHCH <sub>3</sub> <sup>+</sup>	(12.3)	[26]	4.6	298		HPMS	
273	C <sub>7</sub> H <sub>14</sub> O	(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> CO	NO <sup>+</sup>	(44.6)	---	---	---		ICR	<sup>a</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
74	C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	CH <sub>3</sub> COO-t-C <sub>5</sub> H <sub>11</sub> (t-amyl acetate)	t-amyl acetateH <sup>+</sup>	9.1	-2	9.8	300		HPMS	
255	C <sub>8</sub> H <sub>8</sub> O	(CH <sub>3</sub> )(C <sub>6</sub> H <sub>5</sub> )CO (acetophenone)	Cl <sup>-</sup>	---	---	7.1	421		HPMS	
273	C <sub>8</sub> H <sub>10</sub>	C <sub>6</sub> H <sub>5</sub> C <sub>2</sub> H <sub>5</sub>	NO <sup>+</sup>	(44.5)	---	---	---		ICR	<sup>b</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
255			Cl <sup>-</sup>	---	---	5.0	300		HPMS	
118	C <sub>8</sub> H <sub>10</sub>	p-xylene	aniline <sup>+</sup>	(14.5)	[27]	5.8	322		HPMS	
241		p-xylene <sup>+</sup>		15.6	32	5.9	300		HPMS	
241		mesitylene <sup>+</sup>		14.9	28	6.6	300		HPMS	
255			Cl <sup>-</sup>	---	---	3.9	300		HPMS	
241	C <sub>8</sub> H <sub>10</sub>	m-xylene	mesitylene <sup>+</sup>	(14.3)	[27]	6.2	300		HPMS	
255			Cl <sup>-</sup>	---	---	4.4	300		HPMS	
300	C <sub>8</sub> H <sub>10</sub>	o-xylene	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(29.9)	[31.8]	(13.2)	525		HPMS	<sup>b</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
125	C <sub>8</sub> H <sub>11</sub> N	2-i-C <sub>3</sub> H <sub>7</sub> pyridine	2-i-C <sub>3</sub> H <sub>7</sub> pyridineH <sup>+</sup>	23.0	32.7	13.3	298		HPMS	
118	C <sub>8</sub> H <sub>11</sub> N	C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub>	C <sub>6</sub> H <sub>5</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(10.0)	[26]	2.2	298		HPMS	
117	C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-C <sub>4</sub> H <sub>9</sub> COOnC <sub>3</sub> H <sub>7</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	30.0	34.8	19.6	298		HPMS	
286	C <sub>8</sub> H <sub>16</sub> O <sub>4</sub>	12-crown-4-ether (cont'd)	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	35.8	41.5	23.4	298		HPMS	
286		1,2-diazineH <sup>+</sup>		37.0	40.8	24.8	298		HPMS	
286		pyridineH <sup>+</sup>		36.1	40.0	24.2	298		HPMS	
286		c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>		37.2	34.8	26.8	298		HPMS	
286	C <sub>8</sub> H <sub>18</sub> O	(n-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> O	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	25.0	28.0	16.6	298		HPMS	
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	(12.9)	[25]	4.6	330		HPMS	
117			(n-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> OH <sup>+</sup>	30.5	38.7	19.0	298		HPMS	
286	C <sub>8</sub> H <sub>18</sub> O <sub>4</sub>	CH <sub>3</sub> (OCH <sub>2</sub> CH <sub>2</sub> ) <sub>3</sub> OCH <sub>3</sub>	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	34.6	40.0	22.7	298		HPMS	
286			1,2-diazineH <sup>+</sup>	37.0	41.4	24.7	298		HPMS	
324			N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	24.2	33.8	14.1	298		HPMS	
286			pyridineH <sup>+</sup>	34.7	38.3	23.3	298		HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	43.3	43.8	30.2	298		HPMS	
300	C <sub>8</sub> H <sub>19</sub> N	(n-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> NH	(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(48.8)	[33.7]	(31.1)	525		HPMS	<sup>b</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
255	C <sub>9</sub> H <sub>10</sub>	(CH <sub>3</sub> )(C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> )CO (phenylacetone)	Cl <sup>-</sup>	---	---	8.3	421		HPMS	
74	C <sub>9</sub> H <sub>10</sub> O <sub>2</sub>	CH <sub>3</sub> COOCH <sub>2</sub> C <sub>6</sub> H <sub>5</sub> (benzyl acetate)	C <sub>3</sub> H <sub>3</sub> <sup>+</sup>	10	-7	~10	300		HPMS	
74			benzyl acetateH <sup>+</sup>	5.4	-14	9.7	300		HPMS	
273	C <sub>9</sub> H <sub>12</sub>	i-C <sub>3</sub> H <sub>7</sub> C <sub>6</sub> H <sub>5</sub> (cumene)	NO <sup>+</sup>	(45.1)	---	---	---		ICR	<sup>b</sup> NO <sup>+</sup> -C <sub>2</sub> H <sub>5</sub> OH
255			Cl <sup>-</sup>	---	---	5.5	300		HPMS	
273	C <sub>9</sub> H <sub>12</sub>	n-C <sub>3</sub> H <sub>7</sub> C <sub>6</sub> H <sub>5</sub>	NO <sup>+</sup>	(45.1)	---	---	---		ICR	<sup>b</sup> NO <sup>+</sup> -C <sub>6</sub> H <sub>5</sub> OH
255			Cl <sup>-</sup>	---	---	5.0	300		HPMS	

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^0$	(cal/K mol) $-\Delta S_{0,1}^0$	(kcal/mol) $-\Delta C_{0,1}^0(T)$	(K) T	Method	Remarks
325	C <sub>9</sub> H <sub>12</sub>	mesitylene	NH <sub>4</sub> <sup>+</sup>	21.8	21.2	15.5	298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(32.0)	[31.8]	(15.3)	525	HPMS	<sup>a</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
118			aniline <sup>+</sup>	15.3	25.6	7.7	298	HPMS	
241			mesitylene <sup>+</sup>	17.2	30	8.0	300	HPMS	
290			mesitylenen <sup>+</sup>	(12.4)	[28]	4.6	272	HPMS	
118		1-CH <sub>3</sub> -naphthalene	1-CH <sub>3</sub> -naphthalene <sup>+</sup>	(13.0)	[27]	5.0	296	HPMS	
255			Cl <sup>-</sup>	---	---	4.5	300	HPMS	
125	C <sub>9</sub> H <sub>13</sub> N	2-t-C <sub>4</sub> H <sub>9</sub> -pyridine	2-t-C <sub>4</sub> H <sub>9</sub> -pyridineH <sup>+</sup>	23.0	39.4	11.3	298	HPMS	
125	C <sub>9</sub> H <sub>13</sub> N	2,6(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> -pyridine	2,6-(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> -pyridineH <sup>+</sup>	22.8	37.4	11.7	298	HPMS	
118	C <sub>9</sub> H <sub>13</sub> N	p-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> N(CH <sub>3</sub> ) <sub>2</sub>	p-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> N(CH <sub>3</sub> ) <sub>2</sub> <sup>+</sup>	(16.2)	[24]	8.3	329	HPMS	
125	C <sub>9</sub> H <sub>21</sub> N	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> N	(n-C <sub>3</sub> H <sub>7</sub> ) <sub>3</sub> NH <sup>+</sup>	---	---	7.4	293	HPMS	
118	C <sub>10</sub> H <sub>7</sub> Br	1-Br-naphthalene	aniline <sup>+</sup>	15.7	28.9	7.0	298	HPMS	
118	C <sub>10</sub> H <sub>8</sub>	naphthalene	aniline <sup>+</sup>	(15.7)	[26]	7.3	324	HPMS	
290			naphthalene <sup>+</sup>	17.8	29	9.2	298	HPMS	
290			naphthalene H <sup>+</sup>	14.1	30	5.2	298	HPMS	
290			biphenylene <sup>+</sup>	(12.6)	[28]	5.1	298	HPMS	
290			biphenylene H <sup>+</sup>	(13.9)	[28]	6.4	298	HPMS	
118	C <sub>10</sub> H <sub>8</sub>	azulene	aniline <sup>+</sup>	(14.3)	[27]	5.8	315	HPMS	
118	C <sub>10</sub> H <sub>14</sub>	n-C <sub>4</sub> H <sub>9</sub> C <sub>6</sub> H <sub>5</sub>	aniline <sup>+</sup>	(14.6)	[27]	5.5	330	HPMS	
118	C <sub>10</sub> H <sub>20</sub> O <sub>5</sub>	15-crown-5-ether	(CH <sub>2</sub> ) <sub>3</sub> NH <sup>+</sup>	34.9	35.6	24.3	298	HPMS	
286			pyridine H <sup>+</sup>	41.0	42.6	28.3	298	HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	42.3	36.5	31.4	298	HPMS	
118	C <sub>11</sub> H <sub>10</sub>	1-CH <sub>3</sub> -naphthalene	aniline <sup>+</sup>	15.8	25.1	8.4	298	HPMS	
118			1-CH <sub>3</sub> -naphthalene <sup>+</sup>	(17.9)	[27]	9.9	296	HPMS	
125	C <sub>11</sub> H <sub>17</sub> N	2,6-(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> -pyridine	2,6-(i-C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub> -pyridineH <sup>+</sup>	23.6	48.4	9.2	298	HPMS	
290	C <sub>12</sub> H <sub>8</sub>	biphenylene	azulene <sup>+</sup>	(15.9)	[28]	7.2	309	HPMS	
290			biphenylene <sup>+</sup>	16.0	29	7.3	300	HPMS	
290			biphenyleneH <sup>+</sup>	(13.6)	[28]	5.9	277	HPMS	
118	C <sub>12</sub> H <sub>8</sub>	acenaphthylene	aniline <sup>+</sup>	(17.5)	[27]	8.7	325	HPMS	
118	C <sub>12</sub> H <sub>10</sub>	acenaphthene	aniline <sup>+</sup>	18.3	28.6	9.0	325	HPMS	
290			biphenylene <sup>+</sup>	(14.2)	[28]	6.3	283	HPMS	
290			acenaphthene	(17.0)	[28]	8.1	283	HPMS	
290			acenaphthenell <sup>+</sup>	(14.8)	[28]	5.6	330	HPMS	
290	C <sub>12</sub> H <sub>10</sub>	biphenyl	azulene <sup>+</sup>	(13.5)	[28]	5.2	297	HPMS	
290			biphenylene <sup>+</sup>	(13.4)	[28]	5.5	279	HPMS	
118	C <sub>12</sub> H <sub>18</sub>	C <sub>6</sub> (CH <sub>3</sub> ) <sub>6</sub>	aniline <sup>+</sup>	17.1	24.1	9.3	325	HPMS	
286	C <sub>12</sub> H <sub>24</sub> O <sub>6</sub>	18-crown-6-ether	(CH <sub>3</sub> ) <sub>3</sub> NH <sup>+</sup>	(41)	[40]	18	569	HPMS	
286			1,2-diazineH <sup>+</sup>	(42)	[44]	16	600	HPMS	

Table 8. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.

Reference	Neutral Formula	Compound	Ion	(kcal/mol) $-\Delta H_{0,1}^{\circ}$	(cal/K mol) $-\Delta S_{0,1}^{\circ}$	(kcal/mol) $-\Delta G_{0,1}^{\circ}(T)$	(K) T	Method	Remarks
286	C <sub>12</sub> H <sub>24</sub> O <sub>6</sub>	18-crown-6-ether (cont'd)	pyridineH <sup>+</sup>	(40)	[44]	16	550	HPMS	
286			c-C <sub>6</sub> H <sub>11</sub> NH <sub>3</sub> <sup>+</sup>	(46)	[38]	23	670	HPMS	
117	C <sub>12</sub> H <sub>26</sub> O	(n-C <sub>6</sub> H <sub>13</sub> ) <sub>2</sub> O	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	27.2	31.4	17.8	298	HPMS	
117			(n-C <sub>6</sub> H <sub>13</sub> ) <sub>2</sub> OH <sup>+</sup>	29	36	18.3	298	HPMS	
125	C <sub>12</sub> H <sub>27</sub> N	(n-C <sub>4</sub> H <sub>9</sub> ) <sub>3</sub> N	(n-C <sub>4</sub> H <sub>9</sub> ) <sub>3</sub> NH <sup>+</sup>	24.4	56.5	7.6	298	HPMS	
300			(CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup>	(48.0)	[34.3]	(30.0)	525	HPMS	<sup>a</sup> (CH <sub>3</sub> ) <sub>3</sub> Sn <sup>+</sup> -CH <sub>3</sub> OH
290	C <sub>13</sub> H <sub>10</sub>	fluorene	azulene <sup>+</sup>	(14.6)	[28]	6.0	307	HPMS	
290			biphenylene <sup>+</sup>	(13.3)	[28]	5.4	283	HPMS	
290	C <sub>13</sub> H <sub>10</sub>	fluorene	fluorene <sup>+</sup>	(16.5)	[28]	7.2	331	HPMS	
290	C <sub>13</sub> H <sub>12</sub>	(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> CH <sub>2</sub>	fluoreneH <sup>+</sup>	(14.4)	[28]	6.1	298	HPMS	
255			Cl <sup>-</sup>	---	---	7.4	300	HPMS	
125	C <sub>13</sub> H <sub>21</sub> N	2,6-(t-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> -pyridine	2,6-(t-C <sub>4</sub> H <sub>9</sub> ) <sub>2</sub> -pyridineH <sup>+</sup>	---	---	<4.5	313	HPMS	
290	C <sub>14</sub> H <sub>10</sub>	anthracene	anthracene <sup>+</sup>	16.4	26	8.7	298	HPMS	
290			anthraceneH <sup>+</sup>	(16.0)	[28]	6.1	352	HPMS	
290	C <sub>14</sub> H <sub>10</sub>	phenanthrene	phenanthrene <sup>+</sup>	(17.8)	[28]	6.8	320	HPMS	
290			phenanthreneH <sup>+</sup>	(15.7)	[28]	6.7	320	HPMS	
290	C <sub>14</sub> H <sub>18</sub>	octhacene	octhacene <sup>+</sup>	(16.5)	[28]	7.8	304	HPMS	
290			octhaceneH <sup>+</sup>	(14.2)	[28]	6.1	298	HPMS	
290	C <sub>16</sub> H <sub>10</sub>	pyrene	pyrene <sup>+</sup>	(19.1)	[28]	8.2	390	HPMS	
290			pyreneH <sup>+</sup>	16.5	29	7.9	298	HPMS	
290	C <sub>18</sub> H <sub>12</sub>	chrysene	chrysene <sup>+</sup>	(18.2)	[28]	6.3	418	HPMS	
290			chryseneH <sup>+</sup>	(17.8)	[28]	5.6	418	HPMS	
255	C <sub>19</sub> H <sub>16</sub>	(C <sub>6</sub> H <sub>5</sub> ) <sub>3</sub> CH	Cl <sup>-</sup>	---	---	4.1	300	HPMS	
290	C <sub>20</sub> H <sub>12</sub>	perylene	perylene <sup>+</sup>	(19.7)	[28]	8.3	406	HPMS	
290			perylene H <sup>+</sup>	(19.1)	[28]	7.2	424	HPMS	
290	C <sub>22</sub> H <sub>12</sub>	1,12-benzoperylene <sup>+</sup>	1,12-benzoperylene <sup>+</sup>	21.6	27	13.6	298	HPMS	
290			1,12-benzoperyleneH <sup>+</sup>	(21.4)	[28]	10.6	385	HPMS	
290	C <sub>24</sub> H <sub>12</sub>	coronene	coronene <sup>+</sup>	(23.8)	[28]	10.4	476	HPMS	

Table 9. Thermodynamic quantities for the association of organic compounds to gaseous ions. The higher order clustering reactions.

Ref.	Neutral	Ion	$-\Delta H_{n-1,n}^0$ (kcal/mol)							$-\Delta S_{n-1,n}^0$ (cal/K mol)						
			1	2	3	4	5	6	7	1	2	3	4	5	6	7
256	HCOOH	Cl <sup>-</sup>	---	34.1	22.2	14.1	10.1			---	55	35	20	11.5		
256		HC <sub>2</sub> O <sup>-</sup>	---	26.1	20.0	14.2	10.1			---	34	30	21.5	12		
257	CH <sub>3</sub> Cl	CH <sub>2</sub> Cl <sup>+</sup>	6.9	5.7						-3.5	8					
257		CH <sub>3</sub> <sup>+</sup>	---	6.0	5.1					---	15	14				
257		CH <sub>4</sub> Cl <sup>+</sup>	---	4.2						---	2					
260	CH <sub>4</sub>	H <sub>3</sub> O <sup>+</sup>	8.0	3.4						20.4	8.1					
261		CH <sub>5</sub> <sup>+</sup>	7.4	5.9	4.1	3.9				20.8	24.4	26.1	26.6			
262			4.1	1.5						12.4	7.2					
118,(131)	CH <sub>3</sub> OH	H <sub>3</sub> O <sup>+</sup>	(40.8)c(22.9)	16.4	(13.5)	(11.4)c				(24.0) [25]	26.5	[28]	(25.5)			
118		H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(30.2)c	18.0	---	---				(28.6)	26.3					
118		H <sub>3</sub> O <sup>+</sup> •2H <sub>2</sub> O	(25.5)c(14.4)c	---	---					(32.8) (23.4)	---	---				
118		H <sub>3</sub> O <sup>+</sup> •3H <sub>2</sub> O	(19.6)c(13.2)c	---						(28.8) (23.6)	---					
118		H <sub>3</sub> O <sup>+</sup> •4H <sub>2</sub> O	(16.0)c(13.5)c							(24.4) [26.6]						
131		CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	33.1	26.3	16.1	13.5	12.5	11.9	12.0	30.5	28.2	28.9	28.7	31.1	32.9	35.7
117		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	19.0							24.2						
122		(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	26.3	18.8	15.9	13.7				27.1	28.9	31.2	30.8			
122		(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> • (CH <sub>3</sub> ) <sub>2</sub> O	18.1	15.1	12.2					30.6	30.6	26.5				
324		N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	9.8	9.2						23.2	24.0					
266		Cl <sup>-</sup>	14.2	13.0	12.3	11.2	10.5			14.8	19.4	23.6	26.4	25.5		
330			17.4	14.1	11.8					24.1	24.2	22.9				
266		O <sub>2</sub> <sup>-</sup>	19.1	15.5	13.5					21.9	24.8	27.9				
132,104,302		OH <sup>-</sup>	---	---						---	---					
63	CH <sub>3</sub> NH <sub>2</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	---	19.2	17.0					---	39.9	41.6				
61	CH <sub>3</sub> CN	Na <sup>+</sup>	---	24.4	20.6	14.9	12.7			---	22.7	27.5	27.9	41.2		
61		K <sup>+</sup>	24.4	20.6	18.2	13.6	11.5			21.5	24.2	28.3	27.5	33.7		
61		Rb <sup>+</sup>	20.7	17.7	15.7	12.5	11.1			18.1	20.9	24.8	25.7	32.5		
61		Cs <sup>+</sup>	19.2	16.7	14.3	12.1	10.9			18.6	21.6	24.0	27.0	32.9		
118		NH <sub>4</sub> <sup>+</sup>	27.6	21.2	14.2	11.7				24.2	25.4	19.5	22.2			
118		H <sub>3</sub> O <sup>+</sup>	(46.7)c	23.4	20.6					(29.3) 24.7	27.3					
118		H <sub>3</sub> O <sup>+</sup> •H <sub>2</sub> O	(32.6)c(21.2)c(15.0)c							(30.1)(24.8) [24.1]						
118		H <sub>3</sub> O <sup>+</sup> •2H <sub>2</sub> O	(28.7)c(15.9)c							(33.2)(22.3)						
118		H <sub>3</sub> O <sup>+</sup> •3H <sub>2</sub> O	(22.4)c(14.4)							(27.7)[22]						
85		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	24.5	17.9	13.4					25.8	21.8	21.0				
147		CH <sub>3</sub> CNH <sup>+</sup>	30.2	9.3						29	19					
265		F <sup>-</sup>	16.0	12.9	11.7	10.4	5.3			13.4	14.8	17.9	19.6	7.4		
265		Cl <sup>-</sup>	13.4	12.2	10.6	6.2				14.3	18.9	20.1	10.8			
330			13.6	11.9	11.6	11.3	10.9	10.4		15.7	17.2	22.6	26.6	30.4		
265		Br <sup>-</sup>	12.9	11.8	10.0	5.5				16.5	20.4	21.7	10.9			
265		I <sup>-</sup>	11.9	10.5	9.3					18.2	20.8	22.1				
266		O <sub>2</sub> <sup>-</sup>	16.4	14.2	11.9	9.5				17.4	22.0	24.7	22.4			

Neutral	Ion	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)							T(K)	Method	Comments
		1	2	3	4	5	6	7			
HCOOH	Cl <sup>-</sup>	---	17.7	11.8	8.1	6.7			298	HPMS	cf. Table 8
	HCOO <sup>-</sup>	---	16	11	7.8	6.5			298	HPMS	
CH <sub>3</sub> Cl	CH <sub>2</sub> Cl <sup>+</sup>	7.9	3.3						298	HPMS	
	CH <sub>3</sub> <sup>+</sup>	---	1.5	0.9					298	HPMS	
	CH <sub>4</sub> Cl <sup>+</sup>	---	3.6						298	HPMS	
CH <sub>4</sub>	H <sub>3</sub> O <sup>+</sup>	1.9	1.2						300	HPMS	
	CH <sub>3</sub> <sup>+</sup>	1.2	-1.4	-3.7	-4.1				298	HPMS	
		0.45	-0.69						298	HPMS	
CH <sub>3</sub> OH	H <sub>3</sub> O <sup>+</sup>	(33.6)	11.6*	8.4	-0.2*	(3.8)			300,*452	HPMS	cH <sub>2</sub> O/CH <sub>3</sub> OH
	H <sub>3</sub> O <sup>+</sup> *H <sub>2</sub> O	(21.6)	10.1	(2.3)*(-0.5)*					300,*452	HPMS	cH <sub>2</sub> O/CH <sub>3</sub> OH
	H <sub>3</sub> O <sup>+</sup> *2H <sub>2</sub> O	(15.6)	(7.4)	(1.6)*(-1.4)*					300,*452	HPMS	cH <sub>2</sub> O/CH <sub>3</sub> OH
	H <sub>3</sub> O <sup>+</sup> *3H <sub>2</sub> O	(10.9)	(6.1)	(1.2)*					300,*452	HPMS	cH <sub>2</sub> O/CH <sub>3</sub> OH
	H <sub>3</sub> O <sup>+</sup> *4H <sub>2</sub> O	(8.7)	(6.3)*						300,*269	HPMS	cH <sub>2</sub> O/CH <sub>3</sub> OH
	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	24.0	12.9	7.5	4.9	3.2	2.1	1.4	298	HPMS	
	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	11.8							298	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	18.2	10.2	6.6	4.5				300	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup> *	9.0	6.0	4.3					300	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> O										
	N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	2.9	2.0						298	HPMS	
	Cl <sup>-</sup>	9.8	7.2	5.2	3.3	2.9			298	HPMS	
		10.2	6.9	5.0					298	HPMS	cf. Table 8
	O <sub>2</sub> <sup>-</sup>	12.5	8.1	5.2					298	HPMS	
	OH <sup>-</sup>	(25) <sup>b</sup> (10.3) <sup>c</sup>							296	FA	cOH <sup>-</sup> -H <sub>2</sub> O/CH <sub>3</sub> OH(s)
CH <sub>3</sub> NH <sub>2</sub>	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	---	7.3	4.7					298	HPMS	cf. Table 8
CH <sub>3</sub> CN	Na <sup>+</sup>	---	17.6	12.3	6.6	0.4			298	HPMS	
	K <sup>+</sup>	18.0	13.4	9.8	5.4	1.4			298	HPMS	
	Rb <sup>+</sup>	15.3	11.4	8.3	4.8	1.4			298	HPMS	
	Cs <sup>+</sup>	13.7	10.2	7.2	4.0	1.1			298	HPMS	
	NH <sub>4</sub> <sup>+</sup>	20.4	13.6	8.4	5.1				298	HPMS	
	H <sub>3</sub> O <sup>+</sup>	(37.9)	16.0	12.4					300	HPMS	cCH <sub>3</sub> CN/H <sub>2</sub> O
	H <sub>3</sub> O <sup>+</sup> *H <sub>2</sub> O	(23.6)(13.7)	(7.5)*						300,*316	HPMS	cCH <sub>3</sub> CN/H <sub>2</sub> O
	H <sub>3</sub> O <sup>+</sup> *2H <sub>2</sub> O	(18.8)	(9.1)						300	HPMS	cCH <sub>3</sub> CN/H <sub>2</sub> O
	H <sub>3</sub> O <sup>+</sup> *3H <sub>2</sub> O	(14.1)	7.4*						300,*318	HPMS	cCH <sub>3</sub> CN/H <sub>2</sub> O
	CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>	16.8	11.4	7.1					298	HPMS	
	CH <sub>3</sub> CNH <sup>+</sup>	21.6	3.6						298	HPMS	
	F <sup>-</sup>	12.0	8.5	6.4	4.5	3.1			298	HPMS	
	Cl <sup>-</sup>	9.2	6.6	4.6	3.0				298	HPMS	
		8.9	6.8	4.9	3.0	2.0	1.3		298	HPMS	cf. Table 8
	Br <sup>-</sup>	8.0	5.8	3.6	2.2				298	HPMS	
	I <sup>-</sup>	6.4	4.3	2.7					298	HPMS	
	O <sub>2</sub> <sup>-</sup>	11.2	7.7	4.5	2.8				298	HPMS	

Table 9. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.  
The higher order clustering reactions.

Ref.*	Neutral	Ion	$-\Delta H_{n-1,n}^{\circ}$ (kcal/mol)							$-\Delta S_{n-1,n}^{\circ}$ (cal/K mol)						
			1	2	3	4	5	6	7	1	2	3	4	5	6	7
272	C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>4</sub> <sup>+</sup>	18.2	4.2						---	---					
275,(221)	C <sub>2</sub> H <sub>5</sub> ONO <sub>2</sub>	NO <sub>2</sub> <sup>-</sup>	(20.9) <sup>s</sup>	8.5	7.3					(35.3)	12.8	14.1				
275		NO <sub>3</sub> <sup>-</sup>	17.2	7.2						32.2	8.7					
276	C <sub>2</sub> H <sub>5</sub> Cl	C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	---	5.2	4.8					---	8.7	7.7				
122	(CH <sub>3</sub> ) <sub>2</sub> O	H <sub>3</sub> O <sup>+</sup>	(45.4) <sup>c</sup>	18.5	16.8					(24.5)	26.3	26.6				
122		H <sub>3</sub> O <sup>+</sup> ·H <sub>2</sub> O	(29.1) <sup>c</sup>	16.4	15.8					(26.5)	22.8	36.5				
122,(70)	(CH <sub>3</sub> ) <sub>2</sub> O	H <sub>3</sub> O <sup>+</sup> ·2H <sub>2</sub> O	(23.4) <sup>s</sup>	16.9						(30.2)	32.9					
122		CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	35.0	20.2	---					24.7	29.8	---				
122		CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> ·CH <sub>3</sub> OH	21.9	16.6						25.2	31.8					
122		CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> ·2CH <sub>3</sub> OH	17.2	12.5						28.6	25.6					
131		(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	30.7	10.1						29.6	27.9					
318	(CH <sub>3</sub> ) <sub>2</sub> SO	K <sup>+</sup>	35	29	20	16	15.8	15.5		31	34	28	30	37	40	
280		(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup>	(30.8) <sup>s</sup>	21.3						(22.9)	10.9					
317		Cl <sup>-</sup>	18.6	16.0	14.9	14.6	13.8			20.4	23.8	29.8	37.2	40.2		
317		Br <sup>-</sup>	17.3	14.5	13.6					21.4	22.4	27.5				
317		I <sup>-</sup>	15.7	12.8	11.6					21.7	22.0	25.1				
281	C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub>	C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup>	---	19.5	17.3					---	41.6	42.6				
279	H <sub>2</sub> NCH <sub>2</sub> <sup>-</sup> CH <sub>2</sub> NH <sub>2</sub>	K <sup>+</sup>	25.7	22.2	12.9					22.3	32.0	26.3				
282		H <sub>2</sub> NCH <sub>2</sub> <sup>-</sup> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	---	---	17.5					---	---	46.7				
318	(CH <sub>3</sub> ) <sub>2</sub> CO	K <sup>+</sup>	26	21	16					24	26	24				
329		(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	---	12.2	8.5					---	23.0	17.0				
324		N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	14.6	13.0	(11.7)					24.7	29.2	[25]				
318	(CH <sub>3</sub> ) <sub>2</sub> NCHO	K <sup>+</sup>	31	21	15	13				26	20	18	24			
329	n-C <sub>3</sub> H <sub>7</sub> OH	n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	---	18.9	14.2	11.7				---	23.0	23.8	23.0			
281	n-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	n-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	19.5	17.1					---	41.6	42.3				
281	i-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	19.8	16.2					---	42.6	39.3				
282	1,2(NH <sub>2</sub> ) <sub>2</sub> <sup>-</sup> C <sub>3</sub> H <sub>6</sub>	(1,2(NH <sub>2</sub> ) <sub>2</sub> <sup>-</sup> C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	19.5					---	---	54.7				
282	1,3(NH <sub>2</sub> ) <sub>2</sub> <sup>-</sup> C <sub>3</sub> H <sub>6</sub>	(1,3(NH <sub>2</sub> ) <sub>2</sub> <sup>-</sup> C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	19.7					---	---	57.0				
318	(N(CH <sub>3</sub> ) <sub>2</sub> ) <sub>2</sub> <sup>-</sup> (CH <sub>3</sub> ) <sub>6</sub> O	K <sup>+</sup>	31	24	18					23	24	24				
217	CH <sub>3</sub> O(CH <sub>2</sub> ) <sub>2</sub> <sup>-</sup> OCH <sub>3</sub>	Na <sup>+</sup>	47.2	35.1	23.2					34.6	40.5	42.2				
63	c-C <sub>5</sub> H <sub>5</sub> N	Ag <sup>+</sup>	---	---	16.7	17.9				---	---	28.0	40.3			
63	c-C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup>	26.3	12.6	13.6					32.1	29.7	37.9					

Neutral	Ion	$-\Delta G_{n-1,n}^{\circ}(T)$ (kcal/mol)							T(K)	Method	Comments
		1	2	3	4	5	6	7			
C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>4</sub> <sup>+</sup>	---	---						---	PI	cf. Table 8
C <sub>2</sub> H <sub>5</sub> ONO <sub>2</sub>	NO <sub>2</sub> <sup>-</sup>	(10.4)	4.7	3.1					298	HPMS	sNO <sub>2</sub> <sup>-</sup> -SO <sub>2</sub>
	NO <sub>3</sub> <sup>-</sup>		7.6	4.6					298	HPMS	
C <sub>2</sub> H <sub>5</sub> Cl	C <sub>2</sub> H <sub>5</sub> <sup>+</sup>	---	2.6	2.5					298	HPMS	
(CH <sub>3</sub> ) <sub>2</sub> O	H <sub>3</sub> O <sup>+</sup>	(37.9)	10.7	8.9					300	HPMS	cH <sub>2</sub> O/(CH <sub>3</sub> ) <sub>2</sub> O(s); cf. Table 8
	H <sub>3</sub> O <sup>+</sup> *H <sub>2</sub> O	(21.1)	9.6	4.9					300	HPMS	cH <sub>2</sub> O/(CH <sub>3</sub> ) <sub>2</sub> O(s)
(CH <sub>3</sub> ) <sub>2</sub> O	H <sub>3</sub> O <sup>+</sup> *H <sub>2</sub> O	(14.3)	7.1						300	HPMS	sH <sub>3</sub> O <sup>+</sup> *H <sub>2</sub> O-H <sub>2</sub> O
	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup>	27.6	11.3	(-0.3)s					300	HPMS	sH <sup>+</sup> CH <sub>3</sub> OH*2(CH <sub>3</sub> ) <sub>2</sub> O-CH <sub>3</sub> OH
	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> *	14.4	7.1						300	HPMS	
	CH <sub>3</sub> OH <sub>2</sub> <sup>+</sup> *	8.7	4.8						300	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> OH <sup>+</sup>	21.9	1.9						300	HPMS	cf. Table 8
(CH <sub>3</sub> ) <sub>2</sub> SO	K <sup>+</sup>	25	19	11	7	5	3		300	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup>	(24.0)	18.1						298	HPMS	s(CH <sub>3</sub> ) <sub>2</sub> SOH <sup>+</sup> -(CH <sub>3</sub> ) <sub>2</sub> CO
	Cl <sup>-</sup>	12.5	8.9	6.0	3.5	1.8			300	HPMS	
	Br <sup>-</sup>	10.9	7.8	5.3					300	HPMS	
	I <sup>-</sup>	9.2	6.2	4.1					300	HPMS	
C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub>	C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup>	---	7.1	4.6					298	HPMS	
H <sub>2</sub> NCH <sub>2</sub> <sup>-</sup> CH <sub>2</sub> NH <sub>2</sub>	K <sup>+</sup>	19.0	12.7	5.1					298	HPMS	
	H <sub>2</sub> NCH <sub>2</sub> <sup>-</sup> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	---	---	3.6					298	HPMS	
(CH <sub>3</sub> ) <sub>2</sub> CO	K <sup>+</sup>	19	13	9					300	HPMS	
	(CH <sub>3</sub> ) <sub>2</sub> COH <sup>+</sup>	---	5.3	3.4					298	HPMS	cf. Table 8
	N(CH <sub>3</sub> ) <sub>4</sub> <sup>+</sup>	7.7	4.8	4.7					281	HPMS	
(CH <sub>3</sub> ) <sub>2</sub> NCHO	K <sup>+</sup>	23	15	9.6	5.8				300	HPMS	
n-C <sub>3</sub> H <sub>7</sub> OH	n-C <sub>3</sub> H <sub>7</sub> OH <sub>2</sub> <sup>+</sup>	---	12.0	7.1	4.8				298	HPMS	cf. Table 8
n-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	n-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	7.1	4.5					298	HPMS	
i-C <sub>3</sub> H <sub>7</sub> NH <sub>2</sub>	i-C <sub>3</sub> H <sub>7</sub> NH <sub>3</sub> <sup>+</sup>	---	7.1	4.5					298	HPMS	
1,2(NH <sub>2</sub> ) <sub>2</sub> - C <sub>3</sub> H <sub>6</sub>	(1,2(NH <sub>2</sub> ) <sub>2</sub> - C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	3.2					298	HPMS	
1,3(NH <sub>2</sub> ) <sub>2</sub> - C <sub>3</sub> H <sub>6</sub>	(1,3(NH <sub>2</sub> ) <sub>2</sub> - C <sub>3</sub> H <sub>6</sub> )H <sup>+</sup>	---	---	2.7					298	HPMS	
(N(CH <sub>3</sub> ) <sub>2</sub> ) (CH <sub>3</sub> )CO	K <sup>+</sup>	24	16.5	11					300	HPMS	
CH <sub>3</sub> O(CH <sub>2</sub> ) <sub>2</sub> OCH <sub>3</sub>	Na <sup>+</sup>	36.9	23.0	10.6					298	HPMS	
c-C <sub>5</sub> H <sub>5</sub> N	Ag <sup>+</sup>	---	---	8.4	5.9				298	HPMS	pyridine
c-C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup>		16.7	3.7	2.3					298	HPMS	cf. Table 8

Table 9. (continued) Thermodynamic quantities for the association of organic compounds to gaseous ions.  
The higher order clustering reactions.

Ref.	Neutral	Ion	$-\Delta H_{n-1,n}^{\circ}$ (kcal/mol)							$-\Delta S_{n-1,n}^{\circ}$ (cal/K mol)						
			1	2	3	4	5	6	7	1	2	3	4	5	6	7
97	C <sub>6</sub> H <sub>6</sub>	K <sup>+</sup>	19.2	18.8	14.5	12.6				24.6	33.9	32.7	41.4			
97,60		K <sup>+</sup> •H <sub>2</sub> O	(16.8) <sup>b</sup>	(14.4) <sup>c</sup>						(27.1)	(30.1)					
97,60		K <sup>+</sup> •2H <sub>2</sub> O	(13.4) <sup>b</sup>	(12.8) <sup>c</sup>						(24.3)	(33.7)					
118		NH <sub>4</sub> <sup>+</sup>	19.3	17.0	14.2					23.3	30.5	32.8				

		$-\Delta G_{n-1,n}^0(T)$ (kcal/mol)							Method	Comments	
Neutral	Ion	1	2	3	4	5	6	7			
$C_6H_6$	$K^+$	11.9	8.8	4.7	0.3				298	HPMS	benzene
	$K^+ \cdot H_2O$	(8.7)	(5.4)						298	HPMS	$sK^+ \cdot H_2O - H_2O$ ; $cH_2O/C_6H_6(s)$
	$K^+ \cdot 2H_2O$	(6.1)	(2.7)						298	HPMS	$sK^+ \cdot 2H_2O - H_2O$ ; $cH_2O/C_6H_6(s)$
	$NH_4^+$	12.4	7.9	4.4					298	HPMS	

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