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THERMODYNAMICS OF GEOTHERMAL BRINES I. THERMODYNAMIC PROPERTIES OF VAPOR-SATURATED NaCl (aq) SOLUTIONS FROM 0-300 °C

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THERMODYNAMICS OF GEOTHERMAL BRINES

I. THERMODYNAMIC PROPERTIES OF VAPOR-SATURATED NaCl (aq) SOLUTIONS FROM 0-300 °C

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THERMODYNAMICS OF GEOTHERMAL BRINES I.

THERMOYDNAMIC PROPERTIES OF VAPOR-SATURATED NaCℓ(aq) SOLUTIONS FROM 0-300°C

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ABSTRACT

Osmotic and activity coefficient data, enthalpy data, and heat capacity data on aqueous sodium chloride solutions from various sources have been fitted to a thirteen parameter equation. The equation reproduces the osmotic coefficient data to ±0.005 over the composition range 0-6M and temperature range 0-300°C, enthalpy data to ±5-10 cal/mole for compositions of 0-5M at temperatures from 25-100°C, and heat capacity data to ±0.5 cal/°K for compositions of 0-2M at temperatures from 25-200°C. Tabulated values of the total Gibbs energy, enthalpy, and heat capacity, plus partial molal and excess thermodynamic quantities of sodium chloride solutions for compositions of 0-6M at 25°C intervals from 0-300°C are given along with the same quantities in graphical form for compositions of 0-6M at temperatures of 100-350°C.

INTRODUCTION

Many geothermal systems of current interest as energy sources involve brines at elevated temperatures and pressures. Since the number of different brines encountered is large, detailed measurements on all of them becomes impractical. Consequently the ability to predict the properties of brines from theories or models based upon a few key electrolyte systems is essential to the technical development of geothermal resources. As a first step toward developing a compact set of equations capable of reproducing the thermodynamic properties of electrolyte solutions, we report preliminary work on modeling of vapor-saturated aqueous NaCℓ solutions. The equations reported here reproduce experimental Gibbs energy data in the form of osmotic and activity coefficients, enthalpy data in the form of heats of dilution and heats of solution, and heat capacity data.

BASIC EQUATIONS FOR DATA ANALYSIS

The Gibbs energy, G of a system is taken to be

$$G = H - TS \tag{1}$$

where H is the enthalpy, sometimes called the heat content of the system, T is the thermodynamic temperature, and S is the entropy of the system. The excess Gibbs energy, G^{EX}, of a system is the difference between the Gibbs energy of the real system and that of an ideal system. For a pure electrolyte MX, which completely dissociates into ν total ions (ν=2, for NaCℓ), the total excess Gibbs energy is

$$G^{EX} = n_w \, \nu m RT(1-\phi + \ln\gamma_\pm) \tag{2}$$

where n_w is the number of kg of solvent, m is the molality (moles of salt/kg-water), R is the gas constant (1.98726 cal/deg K-mole), T designates the temperature of the thermodynamic scale in °K, ϕ is the osmotic coefficient, and $\gamma_\pm$ is the mean molal activity coefficient.

Equation (2) may be rewritten as

$$G^{EX} = n_1 \bar{G}_1^{EX} + n_2 \bar{G}_2^{EX} \tag{3}$$

where n_1 and n_2 are the number of moles of solvent and solute respectively, and $\bar{G}_1^{EX}$ is the partial molal excess Gibbs energy of the solvent, and $\bar{G}_2^{EX}$ is the partial molal excess Gibbs energy of the solute.

The quantities $\bar{G}_1^{EX}$ and $\bar{G}_2^{EX}$ are related to ϕ and $\ln\gamma_\pm$ by

$$\bar{G}_1^{EX} = (\nu m/n_1)\, RT(1-\phi) \tag{4}$$

$$\bar{G}_2^{EX} = \nu RT \ln\gamma_\pm . \tag{5}$$

Equations relating the osmotic and activity coefficients to G^{EX} follow from the appropriate derivatives of equation (3), combined with equations (4) and (5)

$$(\phi-1) = -\frac{1000}{\nu m M_1 RT}\left(\frac{\partial G^{EX}}{\partial n_1}\right)_{T,P} \tag{6}$$

where M_1 is the molecular weight of the solvent

$$\ln\gamma_\pm = \frac{1}{\nu RT}\left(\frac{\partial G^{EX}}{\partial n_2}\right)_{T,P} \tag{7}$$

We now adopt the general form given by Pitzer [1-4] for G^{EX} which leads to the following

equations for ϕ and $\ln\gamma_\pm$ of a pure electrolyte, MX, containing ν_M and ν_M ions of charge Z_M and Z_X respectively,

$$\phi - 1 = -|Z_M Z_X| A_\phi \frac{I^{1/2}}{I+bI^{1/2}} + m \frac{2\nu_M\nu_X}{\nu}\left(\beta_{MX}^{(0)} + \beta_{MX}^{(1)} e^{-\alpha I^{1/2}}\right) + m^2 \frac{2(\nu_M\nu_X)^{3/2}}{\nu} C_{MX}^{\phi} \quad (8)$$

$$\ln\gamma_\pm = -|Z_M Z_X| A_\phi\left(\frac{I^{1/2}}{I+bI^{1/2}} + \frac{2}{b}\ln(1+bI^{1/2})\right) + m\frac{2\nu_M\nu_X}{\nu}\left(2\beta_{MX}^{(0)} + \frac{2\beta_{MX}^{(1)}}{\alpha^2 I}\left(1-(1+\alpha I^{1/2} - \frac{\alpha^2 I}{2}) e^{-\alpha I^{1/2}}\right)\right) + \frac{3m^2}{2}\left(2\frac{(\nu_M\nu_X)^{3/2}}{\nu} C_{MX}^{\phi}\right). \quad (9)$$

The quantity m is the molality, ν is $\nu_M + \nu_X$, I is the ionic strength,

$$\frac{1}{2}\sum_i m_i z_i^2,$$

and A_ϕ is the Debye-Hückel coefficient for the osmotic function given as

$$A_\phi = \frac{1}{3}\left(\frac{2\pi N_o \rho_w}{1000}\right)^{1/2}\left(\frac{e^2}{DkT}\right)^{3/2} = \frac{A_\gamma}{3} \quad (10)$$

where N_o is Avagadro's number (6.02251×10^{23} moles^{-1}), ρ_w is the density of the solvent in g/cm^3 and D the static dielectric constant of pure water, k is Boltzman constant (1.38054×10^{-16} ergs/°K), and e is the absolute electronic charge (4.80298 e.s.u.). The values of ν_M, ν_X, and ν for any 1-1 salt (e.g. NaCℓ) are 1,1 and 2 respectively so that the factor $\frac{2\nu_M\nu_X}{\nu}$ is unity.

The leading term in equations (8) and (9) accounts for long-range electrostatic interactions; the coefficients $\beta_{MX}^{(0)}$ and $\beta_{MX}^{(1)}$ account for various types of short-range interactions between M and X, and for indirect forces arising from the solvent; the third coefficient C_{MX}^{ϕ} is for triple ion interactions and is important only at high concentrations. The parameters b and α have the values 1.2 and 2.00 respectively for all 1-1 salts. For this study, b and α are taken as temperature independent. The quantities $\beta_{MX}^{(0)}$, $\beta_{MX}^{(1)}$, and C_{MX}^{ϕ} are adjusted for a given salt at fixed temperature by a least-square fit of osmotic and/or activity coefficient data.

Equations (8) and (9) are consistent with the standard states adopted for this study which are the pure solvent at the same temperature and pressure of the solution and for the solute the hypothetical state in which $\gamma_\pm$ approaches unity as the concentration becomes infinitely dilute, this to apply at every temperature and pressure.

Osmotic coefficients may be obtained from vapor-pressure lowering experiments, freezing point depression or boiling point elevation experiments or isopiestic measurements. Most activity coefficient data comes from electrochemical cell measurements.

The relative molal enthalpy, L, of an electrolyte solution is defined to be

$$L = H - H^\circ \quad (11)$$

where H is the total enthalpy of the solution and H° that of the solution in its standard state.

The quantity L is related to G^{EX} by the equation

$$L = G^{EX} - T\left(\frac{\partial G^{EX}}{\partial T}\right)_{P,m} \quad (12)$$

Equations (2) and (12) yield for L,

$$L = \nu m R T^2 \left(\frac{\partial\phi}{\partial T}\right)_{P,m} - \nu m R T^2 \left(\frac{\partial \ln\gamma_\pm}{\partial T}\right)_{P,m} \quad (13)$$

The apparent relative molal enthalpy, ϕ_L, is defined as

$$\phi_L = \frac{L - n_1\bar{L}_1^\circ}{n_2} = \frac{L}{n_2} \quad (14)$$

Taking the appropriate derivatives of equations (8) and (9) as prescribed by equations (13) and (14) one obtains for ϕ_L the result

$$\phi_L = \nu|Z_M Z_X| \frac{A_H}{3b}\ln(1+bI^{1/2}) - \nu R T^2 m B'^{(0)} - \frac{2\nu R T^2 m}{\alpha^2 I}\left(1-(1+\alpha I^{1/2}) e^{-\alpha I^{1/2}}\right)B'^{(1)} - \frac{\nu}{2} R T^2 m^2 C' \quad (15)$$

where we define

$$B'^{(0)} \equiv \frac{2\nu_M\nu_X}{\nu}\left(\frac{\partial\beta_{MX}^{(0)}}{\partial T}\right)_{P,m} \quad (16)$$

$$B'^{(1)} \equiv \frac{2\nu_M\nu_X}{\nu}\left(\frac{\partial\beta_{MX}^{(1)}}{\partial T}\right)_{P,m} \quad (17)$$

$$C' \equiv \frac{2(\nu_M\nu_X)^{3/2}}{\nu}\left(\frac{\partial C_{MX}^{\phi}}{\partial T}\right)_{P,m} \quad (18)$$

The quantity A_H is the Debye-Hückel enthalpy factor given as

$$A_H = -RT^2 A_\phi 9\left(\frac{1}{T} + \left(\frac{\partial \ln D}{\partial T}\right)_P + \frac{\alpha_w}{3}\right) \quad (19)$$

where $\alpha_w (= -\frac{1}{V}(\frac{\partial V}{\partial T})_P)$ is the coefficient of isobaric thermal expansion of pure water.

Enthalpy data on electrolytes is obtained as the heat effect from heat of dilution or heat of solution experiments. A heat of dilution experiment measures the heat effect upon taking n_2 moles of salt at concentration m_1, to a final concentration m_2. The heat effect is reported as $\Delta\bar{H}_D$ ($m_1 \rightarrow m_2$) in cal/mole and is related to ϕ_L as

$$\Delta\bar{H}_D(m_1 \to m_2) = {}^{\phi}L_2 - {}^{\phi}L_1. \quad (20)$$

The experimental values of $\Delta\bar{H}_D$ at a given temperature may be fitted with equation (15) according to the prescription given by equation (20) thus allowing values of $B'^{(0)}$, $B'^{(1)}$, and C' to be determined.

The heat of solution of a salt MX is taken as the heat effect for the reaction

$$n_2 MX(s) + n_1\ H_2O(\ell) = n_2 MX(aq, m). \quad (21)$$

The heat effect for reaction (21) is given as

$$\Delta H_s = n_1\bar{H}_1 + n_2\bar{H}_2 - n_1\bar{H}_1^\circ - n_2\bar{H}_2^\circ(s) \quad (22)$$

which may be rewritten as

$$\Delta H_s = n_1(\bar{H}_1 - \bar{H}_1^\circ) + n_2(\bar{H}_2 - H_2^\circ) + n_2(\bar{H}_2^\circ - \bar{H}_2^\circ(s))$$
$$= L + n_2(\bar{H}_2^\circ - \bar{H}_2^\circ(s))$$

As the concentration m approaches zero, we have

$$\lim_{m\to 0} \frac{\Delta H_s}{n_2} \to \Delta\bar{H}_s^\circ = (\bar{H}_2^\circ - \bar{H}_2^\circ(s)) \quad (23)$$

where $\bar{H}_s^\circ(=\Delta H_s^\circ/n_2)$ is the heat of solution per mole of salt at infinite dilution. At finite concentrations we therefore have

$$\Delta\bar{H}_s = \Delta\bar{H}_s^\circ + {}^{\phi}L. \quad (24)$$

The value of $\Delta\bar{H}_s^\circ$ at a given temperature may be found by fitting the experimental values of $\Delta\bar{H}_s$ to equation (15) and (24) treating $\Delta\bar{H}_s^\circ$ as an adjustable parameter.

From equations (11) and (12) we have

$$\left(\frac{\partial L}{\partial T}\right)_P = C_P - C_P^\circ = -T\left(\frac{\partial^2 G^{EX}}{\partial T^2}\right)_{P,m} \quad (25)$$

where C_P is the total heat capacity of the solution and C_P° is the total heat capacity of the solution in its standard state.

The total relative heat capacity, J, is defined as

$$J = C_P - C_P^\circ = C_P - (n_1\bar{C}_{P_1}^\circ + n_2\bar{C}_{P_2}^\circ) \quad (26)$$

where $\bar{C}_{P_2}^\circ$ is the partial molal heat capacity of the solute at infinite dilution (cal/deg K-mole) and $\bar{C}_{P_1}^\circ$ is the molal heat capacity of pure water (cal/deg K-mole water).

The apparent molal heat capacity, ${}^{\phi}C_P$, is defined to be

$${}^{\phi}C_P = \frac{C_P - n_1\bar{C}_{P_1}^\circ}{n_2} \quad (27)$$

From equations (27), (26), (25), and (14), we find that

$${}^{\phi}C_P - \bar{C}_{P_2}^\circ = (\partial{}^{\phi}L/\partial T)_{P,m} = -\frac{T}{n_2}\left(\frac{\partial^2 G^{EX}}{\partial T^2}\right)_{P,m} \quad (28)$$

Taking the temperature derivative of equation (15) yields

$${}^{\phi}C_P = \bar{C}_{P_2}^\circ + \nu|Z_M Z_X|\frac{A_J}{3b}\ln(1+bI^{1/2})$$
$$- \nu RT^2 m B''^{(0)}$$
$$- \frac{2\nu RT^2 m}{\alpha^2 I}\left(1-(1+\alpha I^{1/2})\ e^{-\alpha I^{1/2}}\right)B''^{(1)}$$
$$- \frac{\nu}{2}RT^2 m^2 C'' \quad (29)$$

where we define

$$B''^{(0)} = \frac{2\nu_M\nu_X}{\nu}\left(\left(\frac{\partial^2\beta_{MX}^{(0)}}{\partial T^2}\right)_{P,m} + \frac{2}{T}\left(\frac{\partial\beta_{MX}^{(0)}}{\partial T}\right)_{P,m}\right) \quad (30)$$

$$B''^{(1)} = \frac{2\nu_M\nu_X}{\nu}\left(\left(\frac{\partial^2\beta_{MX}^{(1)}}{\partial T^2}\right)_{P,m} + \frac{2}{T}\left(\frac{\partial\beta_{MX}^{(1)}}{\partial T}\right)_{P,m}\right) \quad (31)$$

$$C'' = \frac{2(\nu_M\nu_X)^{3/2}}{\nu}\left(\left(\frac{\partial^2 C_{MX}^{\phi}}{\partial T^2}\right)_{P,m} + \frac{2}{T}\left(\frac{\partial C_{MX}^{\phi}}{\partial T}\right)_{P,m}\right) \quad (32)$$

and

$$A_J = \left(\frac{\partial A_H}{\partial T}\right)_P. \quad (33)$$

Heat capacity data on electrolytes are obtained by direct measurements on the solution using a calorimeter. The resulting total heat capacities, C_P, are converted to ${}^{\phi}C_P$ values then the experimental values of ${}^{\phi}C_P$ may then be fitted to equation (29) treating $\bar{C}_{P_2}^\circ$ as an adjustable parameter. Values of $\bar{C}_{P_2}^\circ$ may also be obtained from heat of solution data according to

$$\left(\frac{\partial\Delta\bar{H}_s^\circ}{\partial T}\right)_P = \bar{C}_{P_2}^\circ - \bar{C}_{P_2}^\circ(s) \quad (34)$$

provided $\bar{C}_{P_2}^\circ(s)$, the heat capacity of the pure salt in the solid phase is known.

The details of computating the values for A^{ϕ}, A_H, and A_J used in this report are given in Appendix A.

Equations that describe the change in apparent molal volume of an electrolyte with concentration are given in Appendix B.

ANALYSIS OF NaCℓ(aq) DATA

The NaCℓ(aq) data analyzed in this report are listed in Table I.

TABLE 1

Data on Aqueous NaCℓ Solutions

Reference	Data Type	Method	T Range, °C	m
5	ϕ	fdp	0	0.002-1.0
6	ϕ	isop	0	.1-4.0
7	ϕ	isop	15	.1-4.0
8	$\gamma_{\pm}$	emf	15-45	.002- .1
9	$\gamma_{\pm}$	emf	15-50	.01-1.0
10	ϕ	vp	20-30	2.0-4.0
11	ϕ	vp	25-100	1.0-6.1
12	ϕ	bp	60-100	.05-1.0
13	ϕ	bp	60-100	1.0-4.0
14	ϕ	vp	125-250	.5-3.0
15	ϕ	vp	75-300	4.8-(6.4-10.4)
16	ϕ	vp	125-300	.1-3.5
17	$\Delta\bar{H}_S$	cal	0-100	.001-.03
18	$\Delta\bar{H}_S$	cal	100-200	.007-.04
19	$\Delta\bar{H}_D$	fcal	25-100	.04-5.0
20	$\Delta\bar{H}_D$	cal	40-80	.005-6.0
21	C_P	fcal	24.15	.001-2.0
22	C_P	fcal	25.0	.01-3.0
23	ϕC_P	cal	25.0	.04-2.3
24	C_P	cal	1.5-45	.01-3.0
25	C_P	cal	80-200	.35-2.1

Symbols: fpd, freezing point depression, isop, isopiestic; vp, vapor pressure lowering; bp, boiling point elevation; emf, electrochemical cell; cal, calorimeter; fcal, flow calorimeter.

The first column gives the reference number, the second column the type of data, osmotic coefficient, enthalpy, etc., the third column lists the experimental method, the fourth column lists the temperature range and the fifth column the concentration range. The freezing point depression data of Scatchard and Prentiss[5] were recalculated using a cryoscopic constant of 1.860 and the method outlined by Pitzer and Brewer[26]; the remaining osmotic and activity coefficient data were used as reported in the original literature. The experimental enthalpy data were used as reported. All heat capacity data were converted to a thermal calories (1th. cal ≡ 4.1840 abs. Joules) per deg K-mole base.

The concentration dependence of the data in Table I at any single experimental temperature may be reproduced by appropriate application of equations (8), (9), (15) and (29). The problem now reduces to finding suitable analytical forms to describe the temperature dependence of $\beta^{(0)}$, $\beta^{(1)}$, and C^{ϕ}.

We define

$$B^{(0)} \equiv \frac{2\nu_M\nu_X}{\nu}\beta^{(0)}_{MX}$$

$$B^{(1)} \equiv \frac{2\nu_M\nu_X}{\nu}\beta^{(1)}_{MX}$$

$$C \equiv \frac{2(\nu_M\nu_X)^{3/2}}{\nu}C^{\phi}_{MX}.$$

The following general forms were found to reproduce the entire array of data in Table I.

$$B^{(0)} = q_1 + q_2\left(\frac{1}{T} - \frac{1}{T_r}\right) q_3 \ln(T/T_r) + q_4(T-T_r) + q_5(T^2-T_r^2) \quad (35)$$

$$B^{(1)} = q_6 + q_9(T-T_r) + q_{10}(T^2-T_r^2) \quad (36)$$

$$C = q_{11} + q_{12}\left(\frac{1}{T} - \frac{1}{T_r}\right) + q_{13}\ln(T/T_r) + q_{14}(T-T_r) \quad (37)$$

The values of q_1, q_6, and q_{11} for NaCℓ at 25°C are given by Pitzer and Mayorga[2]. Various other analytical forms were tried, ranging from a simple power series in T, to a rather complicated form given by Gibbard et al.,[11] and all proved less satisfactory.

Using equation (29) to fit the heat capacity data at each single experimental temperature, the resulting $\bar{C}^{\circ}_{P_2}$ values were found to be reproduced by the equation

$$\bar{C}^{\circ}_{P_2} = \bar{C}^{\circ}_{P_s}(T) + q_{17} + 2q_{18}T + 3q_{19}T^2 \quad (38)$$

where $\bar{C}^{\circ}_{P_s}(T)$ is the heat capacity of the solid reported by Kelley[27]

$$\bar{C}_{P_2}(s) = 10.98 + 0.0039\ T;\ T \geq 298.15.$$

From equation (38), and (34), the temperature variation of $\Delta\bar{H}^{\circ}_s$ is

$$\Delta\bar{H}^{\circ}_s(T) = q_{16} + q_{17}T + q_{18}T^2 + q_{19}T^3. \qquad (39)$$

The q_i's in equations (35)-(39) are treated as temperature independent parameters.

The main difference in functional form between equations (15) and (29) compared to equations (8) and (9) is the factor νRT^2. Consequently to insure proper weighting of the enthalpy and heat capacity data in relation to the osmotic-activity coefficient data, the former were weighted as $(1.0/\nu RT^2)$. In addition, each data point, regardless of the temperature or type of data was weighted as unity for concentrations up to 4M, and as $(16/m^2)$ for concentrations greater than 4M.

The final assignment of the q_i's was done by a simultaneous fitting of the data array in Table III using a computer least-square analysis. The results are listed in Table II.

TABLE II

Fit Coefficients for Equations (35), (36), (37), and (39)

q_1	= 0.0765
q_2	= -777.03
q_3	= -4.4706
q_4	= 0.008946
q_5	= -3.3158×10^{-6}
q_6	= 0.2664
q_9	= 6.1608×10^{-5}
q_{10}	= 1.0715×10^{-6}
q_{11}	= 0.00127
q_{12}	= 33.317
q_{13}	= 0.09421
q_{14}	= 4.655×10^{-5}
q_{16}	= 41587.11
q_{17}	= -315.90
q_{18}	= 0.8514
q_{19}	= -8.3637×10^{-4}

The values of $B^{(0)}$, $B^{(1)}$, and C as computed from equations (35)-(37) are plotted against temperature in Figures 1, 2, and 3 respectively. Included for comparison are the values of $B^{(0)}_{ST}$, $B^{(1)}_{ST}$, and C_{ST}, which are the values of $B^{(0)}$, $B^{(1)}$, and

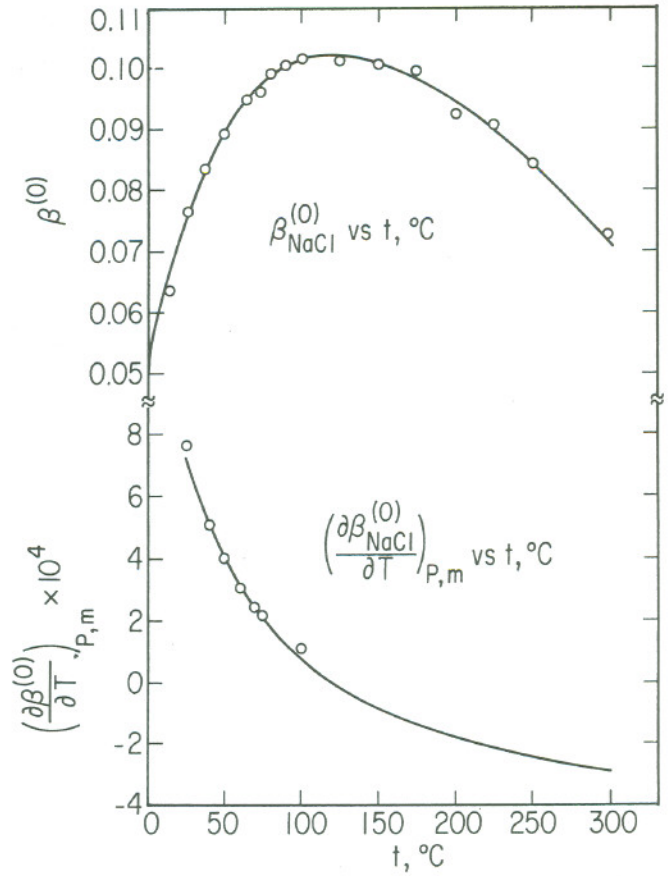

Figure 1.

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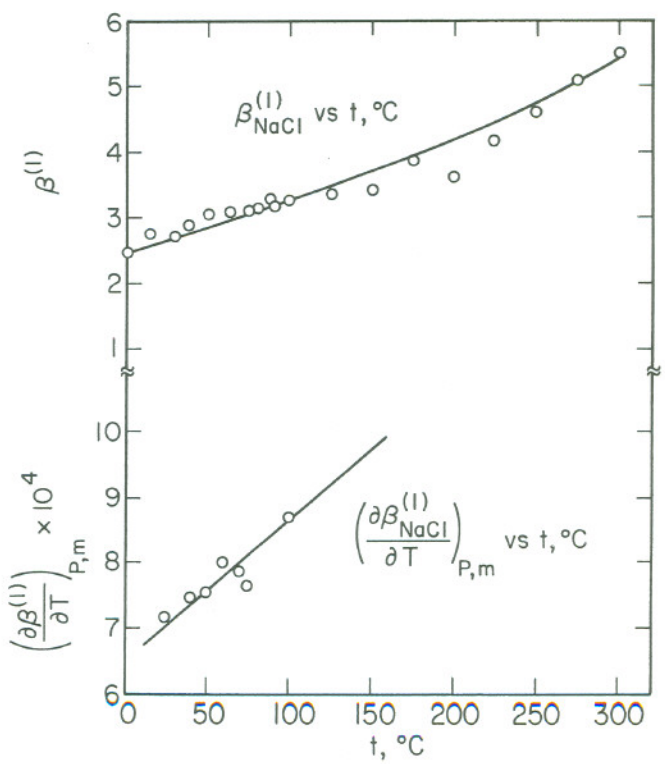

Figure 2.

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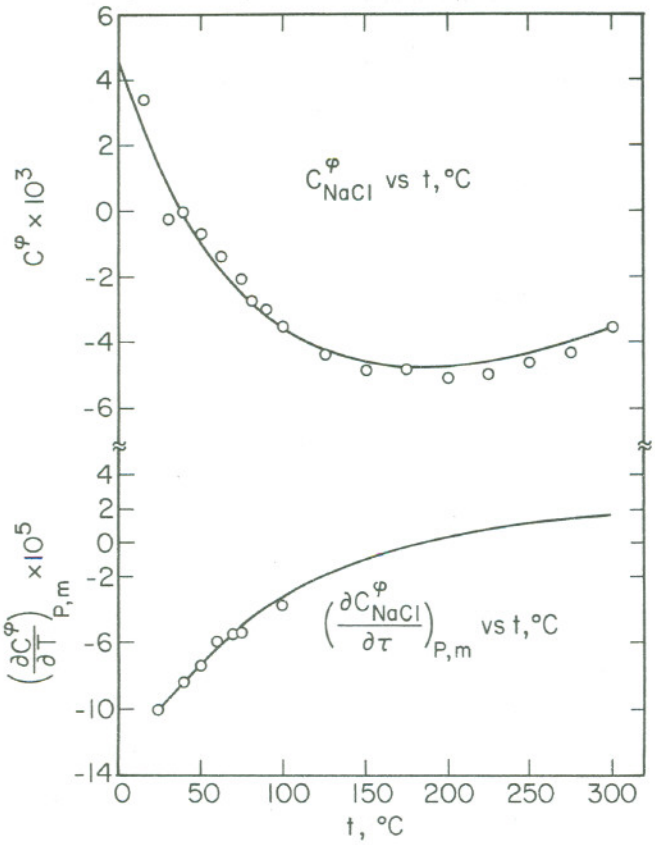

Figure 3. XBL 761-4

C obtained at each experimental temperature from the separate analysis of the osmotic-activity coefficient at that temperature using equations (8) and (9). In the lower half of Figures 1, 2, and 3 the curves for $B'^{(0)}$, $B'^{(1)}$, and C' obtained by taking the temperature derivative of equations (35)-(37) are plotted versus the temperature along with the corresponding values of $B'^{(0)}_{ST}$, $B'^{(1)}_{ST}$ and C'_{ST} obtained by appropriate application of equations (15) and (29).

The values of $B^{(0)}_{ST}$ and $B'^{(0)}_{ST}$ lie close to the smooth curve described by equation (35) and its temperature derivative.

Since the parameter $B^{(0)}$ takes into account the short-range interactions of like-like and like-unlike charge species, a strong ion association would lead to negative values of $B^{(0)}$. The values of $B^{(0)}$ at ≃ 250°C are comparable in magnitude and sign to those at room temperature which is consistent with conductance data[28] which shows no evidence for Na^+ and Cl^- ions to form a $[NaCl]^\circ$ species at temperatures below ≃ 280°C. The negative slope of the $B^{(0)}$ vs temperature curve (Figure 1) at temperatures above ≃ 150°C indicates, however, that at high enough temperatures ion association will eventually become significant.

Even though the parameter b is treated as a constant, Debye-Hückel theory indicates it is proportional to $(\rho_w/DT)^{1/2}$. Consequently, treating b as a constant forces the temperature variations of b to be taken up by $\beta^{(0)}$ and $\beta^{(1)}$. It is, therefore, worth noting that the values of $B^{(1)}_{ST}$ increase with temperature approximately as $(\rho_w/DT)^{1/2}$.

The temperature derivative of $(\rho_w/DT)^{1/2}$ increases with temperature which is the general trend of $B'^{(1)}_{ST}$. The scatter in the $B'^{(1)}_{ST}$ values arises from the data above 25°C being in disagreement with each other by some 5-20 cal/mole.

The number of parameters in equations (35-39) was determined by finding the appropriate number and type of temperature terms needed to reproduce the osmotic-activity coefficient data over the entire temperature range 0-300°C such that the standard deviation of fit at each single temperature from the composite fit was comparable with the fit at each single temperature by separate analysis of the data at that temperature. The above procedure was adopted in preference to specific sets of parameters for each type of data as the former yields a more compact set of equations involving fewer parameters and minimizes the chance of over fitting the data.

In Table III the standard deviation of fit, σ, for the data analyzed separately at each experimental temperature and the corresponding sigma from the composite fit are compared. Column one of Table III lists the number of data points used in the analysis at the temperature listed in column two over the concentration range listed in column three; column four lists the standard deviation of fit, σ_{ST}, for the data analyzed separately at the conditions listed in columns one through three, and column five lists the corresponding standard

TABLE III

Data and Results of Fit for Aqueous NaCℓ Solutions Osmotic and Activity Coefficient Data

No. Data Pts.	t, °C	m	σ_{ST}	σ
41	0	.002-4.0	.002	.003
32	15	.02-4.0	.002	.002
6	20	2.4-4.0	.002	.002
5	30	2.4-4.0	.001	.002
8	35	.002-1.0	.0002	.001
5	37.5	2.5-6.1	.0008	.003
8	45	.002-0.1	.0002	.0006
18	50	.02-6.1	.002	.002
5	62.5	2.5-6.1	.001	.001
14	75	1.0-6.5	.003	.003
18	80	0.05-4.0	.0006	.001
6	87.5	2.5-6.1	.001	.002
18	90	.05-4.0	.0006	.002
33	100	.05-6.1	.002	.002
15	125	.2-6.9	.007	.007
19	150	.1-7.2	.009	.009
13	175	.1-7.5	.005	.005
17	200	.1-7.9	.005	.007
15	225	.1-8.4	.010	.011
15	250	.1-8.9	.007	.009
13	275	.1-9.6	.006	.006
10	300	.1-10.4	.007	.010

TABLE III continued

Heat of Dilution Data

	No. Data Pts.	t, °C	m	$\sigma_{ST}^{(1)}$	$\sigma^{(1)}$
(a)	19	25	0.04-5.0	3.0	5.2
	23	50	0.04-5.0	0.9	2.2
	18	75	0.04-5.0	0.9	2.1
	18	100	0.04-5.0	1.6	9.0
(b)	42	40	0.005-6.1	2.7	2.7
	32	60	0.007-5.7	3.4	4.4
	32	70	0.007-5.7	4.8	4.9

(a) Reference 19.

(b) Reference 20.

Heat of Solution Data

No. Data Pts.	t, °C	m	$\sigma_{ST}^{(1)}$	$\sigma^{(1)}$
8	25	.001-.02	13.2	13.9
10	34.96	.0009-.02	17.9	16.1
4	45	.004-.02	2.6	13.0
4	64.86	.004-.02	4.3	7.2
4	75.01	.004-.02	1.0	4.0
4	84.98	.004-.02	4.1	3.3
4	95.18	.004-.02	10.9	40.8
7	114.25	.009-.04	38.6	62.5
5	149.9	.007-.01	26.4	79.7
5	199.5	.008-.03	42.7	19.0

(1) cal/mole.

Apparent Molal Heat Capacity Data

No. Data Pts.	t, °C	m	$\sigma_{ST}^{(2)}$	$\sigma^{(2)}$
13	24.15	.001-2.0	0.3	1.4
35	25	.01-3.0	0.4	1.6
16	35	.03-3.0	0.3	2.2
15	45	.03-2.5	0.3	1.8
5	80	.3-2.1	1.0	1.6
5	100	.3-2.1	0.3	1.2
5	120	.3-2.1	1.0	1.4
5	140	.3-2.1	0.5	0.8
5	160	.3-2.1	0.5	1.0
5	180	.3-2.1	0.5	1.6
5	200	.3-2.1	2.4	2.3

Heat of Solution at Infinite Dilution and Partial Molal Heat Capacity of the Solute at Infinite Dilution

t, °C	$\bar{H}^{\circ(1)}_{s_{ST}}$	$\bar{H}^{\circ(1)}_{s}$	t, °C	$\bar{C}^{\circ(2)}_{P_{2_{ST}}}$	$\bar{C}^{\circ(2)}_{P_2}$
25	918	918	24.15	-20.2	-19.3
34.96	614	617	25	-19.6	-19.1
45	338	328	35	-15.8	-17.3
64.86	-205	-216	45	-14.3	-15.1
75.01	-490	-491	80	-16.8	-15.1
84.98	-762	-765	100	-18.2	-17.4
95.18	-1114	-1055	120	-22.8	-21.8
114.25	-1757	-1642	140	-29.9	-28.1
149.9	-3096	-3003	160	-36.3	-36.4
199.5	-5823	-5833	180	-46.4	-46.8
			200	-61.3	-59.1

(2) cal/°K-mole.

deviation of fit, σ, obtained from the composite analysis. Also compared in Table III are the σ-values for $\Delta\bar{H}^{\circ}_{sST}$ and $\Delta\bar{H}^{\circ}_{s}$, and those for $\bar{C}_{P_{2_{ST}}}$ and $\bar{C}^{\circ}_{P_2}$. The total number of data points analyzed is 687.

In Figure 4, the experimental values of the osmotic coefficient and the smoothed curve generated from the composite fit are plotted against the molality for several isotherms. The smoothed curves generally pass within the experimental error for most of the data points. The over-all standard deviation of fit is ±0.005 for the osmotic-activity coefficient data over the temperature range 0-300°C.

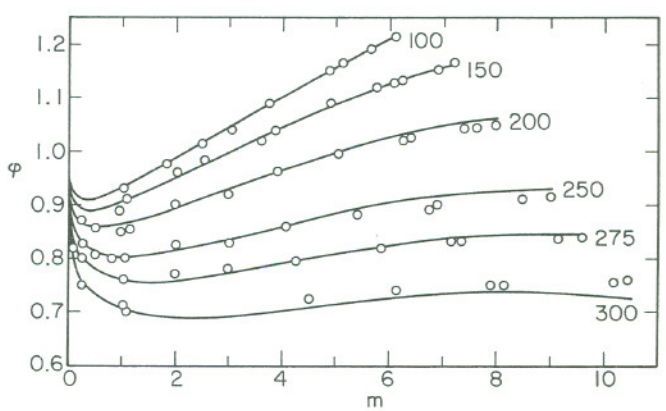

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Figure 4. Osmotic Coefficient for NaCℓ Solutions from 100 to 300°C.

The enthalpy data of Ensor and Anderson[20] at 50 and 80° C were not incorporated into the final array of data as analysis of the 50 and 80° C data gave σ_{ST} values of ±6 and ±8 cal/mole respectively, and the resulting values of $B'^{(0)}_{ST}$ and C'_{ST} inconsistent with the other data. The over-all fit for the heat of dilution data is ±4.9 cal/mole over the temperature range 25-100° C.

The values of $\bar{C}^{o}_{P_2}$ and those generated by equation (38) are $_{ST}$ plotted vs the temperature in Figure 5. Values of $\bar{C}^{o}_{P_2}$ below 25°C as determined by G. Perron et al.[24] are also plotted in Figure 5. The dashed curve represents the extrapolation of equation (38) to 0°C from 25°C.

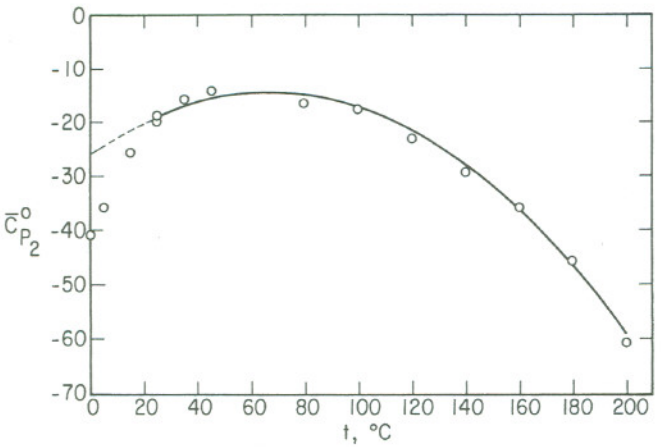

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Figure 5. Heat Capacity at Infinite Dilution for NaCℓ Solutions.

The dramatic change in $\bar{C}^{o}_{P_2}$ as the solution approaches 0°C has been attributed by Sen and Cobble[29] to structural changes in solution. The results presented in Figure 5 clearly indicate that the description of $\bar{C}^{o}_{P_2}$ over the entire temperature range will require a much more complicated temperature function, or an alternate functional form than that given by equation (38). Consequently we have not incorporated into the final data-array any heat capacity data or heat of solution data below 25°C and for this reason have not tabulated any of the heat capacity functions below 25°C. Models for describing the behavior of $\bar{C}^{o}_{P_2}$ over the entire temperature range are currently under study.

The over-all standard deviation of fit for the heat of solution data is ±40 cal/mole and the over fit to the apparent molal heat capacity is ± 1.8 cal/deg K-mole.

CALCULATED QUANTITIES

Knowledge of the parameters $B^{(0)}$, $B^{(1)}$, and C as a function of temperature allows the calculation of many thermodynamic quantities. The equations relating the calculated quantities to the analytical equations (8), (9), (15) and (29) are given below.

The partial molal Gibbs energy is related to the activity by the equation

$$\Delta\bar{G}_i = RT\ \ell n\ a_i \tag{40}$$

where $\bar{G}_i = \bar{G}_i - \bar{G}^{o}_i$. The activity of water in a pure electrolyte solution is given as

$$\ell n\ a_1 = -\frac{\nu m M_1}{1000}\phi \tag{41}$$

which yields

$$\Delta\bar{G}_1 = -\frac{\nu RTmM_1}{1000}\phi \tag{42}$$

and similarly for 1-1 electrolytes,

$$\Delta\bar{G}_2 = 2RT(\ell n\ m + \ell n\gamma_{\pm}). \tag{43}$$

The fundamental equations of thermodynamics yield

$$d\Delta\bar{G}_i = -\Delta\bar{S}_i\ dT + \Delta\bar{V}_i\ dP. \tag{44}$$

At constant pressure, the partial molal entropy is given from equation (35) as

$$\left(\frac{\partial\Delta\bar{G}_i}{\partial T}\right)_P = -\Delta\bar{S}_i. \tag{45}$$

Since the osmotic-activity coefficient data used in obtaining the analytical expression for $\Delta\bar{G}_i$ are referred to the vapor-liquid saturation curve of pure water, the derivative $(\partial\Delta\bar{G}_i/\partial T)$ is consequently along the vapor-liquid saturation curve. Along the saturation curve a change in temperature results in a pressure change even though the pressure is perfectly well defined by the equilibrium condition. Consequently the entropy is not given by equation (45) but rather

$$\left(\frac{\partial\Delta\bar{G}_i}{\partial T}\right)_{SAT} = -\Delta\bar{S}_i + \Delta\bar{V}_i\left(\frac{\partial P}{\partial T}\right)_{SAT} \tag{46}$$

where the symbol $\left(\frac{\partial\Delta\bar{G}_i}{\partial T}\right)_{SAT}$ means that the partial derivative is taken along the liquid-vapor saturation curve of NaCl(aq). The analogous meaning holds for $(\partial P/\partial T)_{SAT}$ where $(\partial P/\partial T)_{SAT}$ comes from an equation of state for pure water, i.e., steam tables, and $\Delta\bar{V}_i(=\bar{V}_i - \bar{V}^{o}_i)$ is the relative partial molal volume of the solvent or solute. The correction term $\Delta\bar{V}_i(\partial P/\partial T)_{SAT}$ was found by Lindsay and Liu[16] for temperatures under 300°C and concentrations up to 3m to be smaller than the uncertainty arising from experimental errors in the osmotic coefficients. The situation above 3m is uncertain. We have not applied the indicated corrections to any of the tabulated values in Appendix C but have included them explicitly in the equations below. Work is currently under way on analyzing the density data on NaCl solutions. Upon completion, the indicated corrections will be applied to the present results.

Not all the data used in this report refer to the vapor-liquid saturation curve. Under 100°C, the enthalpy data were taken at or referred to 1 standard atm, and as such are at constant pressure. The heat capacity data as taken from the literature had been corrected to constant pressure conditions by the original authors. The use of "mixed" data is unfortunate but unavoidable.

The Gibbs-Helmholtz equation yields for the relative partial molal enthalpy, $\bar{L}_i$, the expression,

$$\bar{L}_{i_{SAT}} = \bar{L}_i - T\Delta\bar{V}_i(\partial P/\partial T)_{SAT} \tag{47}$$

where $\bar{L}_i$ is given respectively for the solvent and solute as

$$\bar{L}_1 = -RT^2 \left(\frac{\partial \ln a_1}{\partial T}\right)_{P,m} = \frac{\nu m M_1}{1000} \left(\frac{\partial \phi}{\partial T}\right)_{P,m} \quad (48)$$

$$\bar{L}_2 = -\nu RT^2 \left(\frac{\partial \ln \gamma_\pm}{\partial T}\right)_{P,m} \quad (49)$$

where M_1 the molecular weight of water in grams (18.0153).

The temperature derivative of $\bar{L}_i$ yields the relative partial molal heat capacity, $\bar{J}_i$,

$$\bar{J}_i = \bar{C}_{P_i} - \bar{C}^\circ_{P_i} \quad (50)$$

where $\bar{C}_{P_i}$ is the partial molal heat capacity of the solvent or solute. The values of $\bar{C}_{i_{SAT}}$ and $\bar{C}_{P_i}$ are related by

$$\bar{C}_{i_{SAT}} = \bar{C}_{P_i} - T \left(\frac{\partial V_i}{\partial T}\right)_P \left(\frac{\partial P}{\partial T}\right)_{SAT} \quad (51)$$

The values of $\bar{C}^\circ_{P_2}$ as given by equation (39) need not be corrected via equation (51) as C_P values were used to determine $\bar{C}^\circ_{P_2}$. Tabulated values of $\Delta\bar{S}_1$, $\Delta\bar{S}_2$, $\bar{L}_1$, $\bar{L}_2$, ϕ_L, $\bar{J}_1$, $\bar{J}_2$, and C_P, are given in Appendix C and plotted versus the concentration for several isotherms in Appendix D.

EXCESS THERMODYNAMIC QUANTITIES

The excess thermodynamic functions are a measure of the departure of real systems from ideal systems and as such are an important aid in understanding physical phenomena.

We have adopted the excess functions defined by Freidman for unsymmetric electrolytes and as such are referenced to 1 kg of water. The excess functions are

a) For the solvent

$$G_1^{EX} = \nu m RT(1-\phi) \quad (52)$$

$$H_1^{EX} = (1000/M_1)\ \bar{L}_1 \quad (53)$$

$$S_1^{EX} = (H_1^{EX} - G_1^{EX})/T \quad (54)$$

$$C_{P_1}^{EX} = \frac{1000}{M_1}\bar{J}_1 \quad (55)$$

and

b) for the solute

$$G_2^{EX} = \nu m RT\ \ln \gamma_\pm \quad (56)$$

$$H_2^{EX} = m\ \bar{L}_2 \quad (57)$$

$$S_2^{EX} = (H_2^{EX} - G_2^{EX})/T \quad (58)$$

$$C_{P_2}^{EX} = m\ \bar{J}_2 \quad (59)$$

The partial molal excess functions for the solute may be computed by dividing equations (56) - (59) by m. Tabulated values of the excess functions are given in Appendix C with accompanying graphs for several isotherms in Appendix D.

c) Total Excess Functions

The total excess functions per 1000 gm of water is just the sum of the individual excess functions defined above, e.g.,

$$G^{EX} = G_1^{EX} + G_2^{EX}, \text{ etc.}$$

Values of the total excess functions G^{EX}, S^{EX}, H^{EX}, and C_P^{EX} are tabulated in Appendix C and presented graphically in Appendix D.

TOTAL GIBBS ENERGY, ENTHALPY, ENTROPY, AND HEAT CAPACITY OF NaCℓ(aq) SOLUTIONS

Technical utilization of solution thermodynamic data requires a knowledge of the total enthalpy and heat capacity of the system. We have tabulated in Appendix C values of several of the important quantities given below. For convenience the quantities are referred to their standard state at 25°C.

The total Gibbs energy of a pure salt solution at fixed temperature and composition is given as

$$G = n_1\bar{G}_1 - n_2\bar{G}_2. \quad (60)$$

Relative to a reference temperature, T_r, we have substituting from equations (42), and (43) into (60)

$$G(T,m) - G^\circ_{T_r} = (G^\circ_T - G^\circ_{T_r}) - \nu m RT\phi_{T,m} + \nu m RT \ln \gamma_{\pm T,m} \quad (61)$$

An expression for $(G^\circ_T - G^\circ_{T_r})$ is given below.

The total enthalpy of a salt solution relative to the reference state is

$$H(T,m) - H^\circ_{T_r} = (H^\circ_T - H^\circ_{T_r}) + m\ \phi_{L_T} \quad (62)$$

where ϕ_{L_T} is given by equation (15).

The total entropy relative to the reference state is

$$S(T,m) - S^\circ_{T_r} = (S^\circ_T - S^\circ_{T_r}) + \nu m R\phi_{T,m} - \nu m R \ln \gamma_{\pm T,m} + \frac{m\phi_{L_T}}{T} \quad (63)$$

The total heat capacity at constant pressure, C_P, is given by

$$C_P = C^\circ_P + m(\partial\phi_L/\partial T)_{P,M} \quad (64)$$

and C°_P is

$$C^\circ_P = n_1 C^\circ_{P_1} + n_2 C^\circ_{P_2} \quad (65)$$

where $\bar{C}^{\circ}_{P_1}$ is the heat capacity of pure water as determined by the equation of state of Keenan and Keyes,[30] and $\bar{C}^{\circ}_{P_2}$ is given by equation (38).

The values of $(S^{\circ}_T - S^{\circ}_{T_r})$ were obtained from

$$(S^{\circ}_T - S^{\circ}_{T_r}) = n_1(\bar{S}^{\circ}_{1_T} - \bar{S}^{\circ}_{1_{T_r}}) + n_2(\bar{S}^{\circ}_{2_T} - \bar{S}^{\circ}_{2_{T_r}})$$

where $(\bar{S}^{\circ}_{1_T} - \bar{S}^{\circ}_{1_{T_r}})$ is given by Keenan and Keyes[30] and $(\bar{S}^{\circ}_{2_T} - \bar{S}^{\circ}_{2_{T_r}})$ by

$$(S^{\circ}_{2_T} - S^{\circ}_{2_{T_r}}) = \int_{T_r}^{T} \frac{\bar{C}^{\circ}_{P_2}}{T}\, dT. \qquad (66)$$

The values of $(H^{\circ}_T - H^{\circ}_{T_r})$ were obtained from the relationship

$$(H^{\circ}_T - H^{\circ}_{T_r}) = n_1(H^{\circ}_{1_T} - H^{\circ}_{1_{T_r}}) + n(H^{\circ}_{2_T} - H^{\circ}_{2_{T_r}}) \qquad (67)$$

with $(\bar{H}^{\circ}_{1_T} - \bar{H}^{\circ}_{1_{T_r}})$ taken from Keenan and Keyes[30] and $(H^{\circ}_{2_T} - H^{\circ}_{2_{T_r}})$ from

$$(\bar{H}^{\circ}_{2_T} - \bar{H}^{\circ}_{2_{T_r}}) = \int_{T_r}^{T} \bar{C}^{\circ}_{P_2}\, dT. \qquad (68)$$

The quantity $(G^{\circ}_T - G^{\circ}_{T_r})$ requires the standard state values of the absolute entropy of the solvent and solute at the reference temperature. From the definition of G° we derive

$$(G^{\circ}_T - G^{\circ}_{T_r}) = (H^{\circ}_T - H^{\circ}_{T_r}) - T(S^{\circ}_T - S^{\circ}_{T_r}) + (T_r - T)(n_1\bar{S}^{\circ}_{1_{T_r}} + n_2\bar{S}^{\circ}_{2_{T_r}}) \qquad (69)$$

The values taken for the last term in equation (69) are

$$\bar{S}^{\circ}_{1_{298.15}} = 16.73 \text{ cal/deg-mole}$$

$$\bar{S}^{\circ}_{2_{298.15}} = 27.6 \text{ cal/deg-mole.}$$

The value of $\bar{S}^{\circ}_{1_{T_r}}$ is from Wagman[31] and that of $\bar{S}^{\circ}_2$ from Pitzer and Brewer[26].

The values of $(G_T - G_{T_r})$, $(H_T - H_{T_r})$, $(S_T - S_{T_r})$, and C_{P_1}, plus the total mass of solution in grams at a given composition, computed from

$$\text{MASS} = m\, M_2 + 1000 \qquad (70)$$

where M_2 is the molecular weight of NaCℓ (58.4428, C^{12} base) are tabulated in Appendix C with values of the thermal quantities presented graphically in Appendix D.

DISCUSSION OF RESULTS; OSMOTIC-ACTIVITY COEFFICIENT DATA

Smoothed values of the osmotic and activity coefficients are tabulated in Appendix C with a graphical presentation of the results for several isotherms given in Appendix D. The osmotic coefficients at high temperatures decrease rapidly with concentration falling away from the limiting scope then changing slowly from about 1 molal to saturation (≃10 molal at 300°C). The activity coefficients display a similar behavior and exhibit quite low values at high temperatures.

Gibbard *et al.*[11] using a 25 parameter equation combined enthalpy data at 25°C with osmotic data from various sources in tabulating the osmotic coefficient from 0-200°C. Our tabulated values of the osmotic coefficient generally agree within ±0.001 to ±0.002 with those tabulated by Gibbard for temperatures 0-100°C and from ±0.003 to ±0.005 for temperatures between 100 and 200°C. In their analysis, Gibbard *et al.*[11] selected from the data of Lindsay and Liu[15] only data between 1.0 m to 6.0 mol, whereas we have use of the entire composition range (≃.1-10 M). Consequently the differences between the two tabulations is not surprising. We agree to ≃ ±0.002 with the tabulated values of the osmotic coefficient given by Lindsay and Liu[16] over the composition range 0-4 M and the temperature range 75-250°C; above 250°C the agreement is within approximately ±0.001 to ±0.007 over the composition range 0-4 M.

ENTHALPY DATA

In addition to their experimental results, Messikomer and Wood[19] have tabulated values of ϕ_L from 25-100°C for compositions up to 5 M. Our tabulated values of ϕ_L given in Appendix C agree within 2 cal/mole with those of Messikomer and Wood at 25°C, vary from 20 cal/mole high at 5 M at 50°C to 5 cal/mole low at 1 M at 50°C, are 10 cal high at 75°C and about 10-75 cal/mole high at 100°C.

HEAT CAPACITY

The tabulated values of the total heat capacity agree within experimental error (±0.003 cal/g-deg) with those of Likke and Bromley[25] for the temperature interval 80-200°C and 0.2 to 2 M.

CALCULATED QUANTITIES

In the graphical presentation of results we have included isotherms at 325 and 350°C. The rapid increase in slope of the isotherms above 300°C for the total enthalpy and heat capacity of the system reflects the large increase in the corresponding Debye Hückel factors (see Appendix A). Though the 325-350° isotherms are probably qualitatively correct, quantitatively the situation is uncertain as the calculated values represent a 25-50° extrapolation beyond the limit of experimental data which is entirely osmotic coefficient data.

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APPENDIX A

DEBYE-HÜCKEL PARAMETERS

The parameters A_ϕ, A_H, A_J as given by the theory of Debye and Hückel depend only on the thermodynamic and electrostatic properties of water. The parameters for osmotic, enthalpy, and heat capacity functions are defined respectively to be

$$A_\phi = \frac{1}{3}\left(\frac{2\pi N_o \rho_w}{1000}\right)^{1/2}\left(\frac{e^2}{DkT}\right)^{3/2} = \frac{A_\gamma}{3} \qquad \text{(A-1)}$$

$$A_H = -RT^2\, A_\phi 9 \left(1/T + \left(\frac{\partial \ell n D}{\partial T}\right) + \frac{\alpha_w}{3}\right) \qquad \text{(A-2)}$$

$$A_J = \left(\frac{\partial A_H}{\partial T}\right)_P . \qquad \text{(A-3)}$$

The various symbols in equations (A-2)-(A-3) have been defined in the main body of the paper.

The thermodynamic properties of pure water, ρ_w, and its temperature derivatives, used in equations (A-1)-(A-4) were computed from the equation of state for liquid water given by Keenan and Keyes.[30] A detailed description of the equation may be found in the appendix of Keenan and Keyes[30] steam tables or from Helgeson and Kirkham.[32]

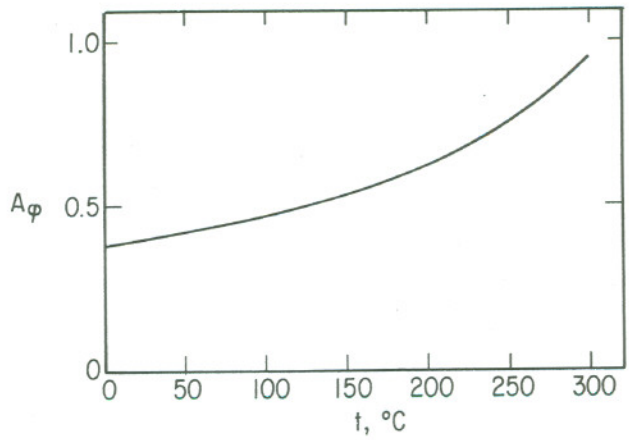
The electrostatic properties of pure water needed in equations (A-1)-(A-3) were obtained by fitting the data on the static dielectric constant of water given by Oshry[33], Owen et al.[34], and Heger[35] to a slightly modified version of an equation originally proposed by Helgeson and Kirkham.[32]

$$D = \sum_{i=0}^{4}\sum_{j=0}^{4-i} e_{ij}\, t^i\, \rho_w^j \qquad \text{(A-4)}$$

where t is the temperature in degrees centigrade and e_{ij} is an array of temperature and pressure independent fit coefficients given in Table A-I determined from a least-square analysis of the data.

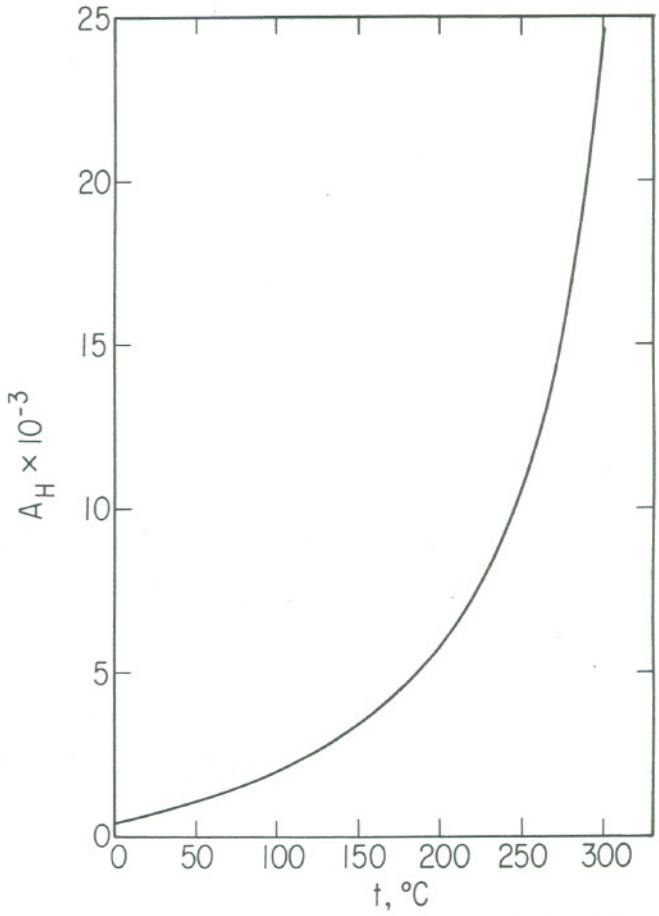
The data on the dielectric constant of water covers a much wider pressure interval than the Keenan-Keyes[30] equation of state which is limited to pressures up to 1 kilobar. Consequently, instead of using data on D only up to 1 kilobar we have used the entire array of data and weighted each data point up to 1 kilobar as unity and those above as (1.0/Pressure(kilobars)^2). We have found that a much better over-all fit resulted by assigning the value of 88.726 (D at 0°C as given by Owens et al.[34]) to e_{00}, and setting e_{03}, and e_{04} to zero.

Values of A^ϕ, A_H, A_J along the liquid-vapor saturation curve of water are tabulated in Table A-II and plotted in Figures A-1, A-2, and A-3.



XBL 761-8

Figure A-1. Debye-Hückel Osmotic Coefficient Constant versus Temperature.



XBL 761-2

Figure A-2. Debye-Hückel Enthalpy Constant versus Temperature.

Table A-I

Array of Fit Coefficients for Equation (A-4)

e_{ij}

i\j	0	1	2	3	4
0	88.287	-78.1110993	77.6526372	0	0
1	-0.67033927	0.443465512	-0.135474228	-0.334969862	
2	$1.99954913 \times 10^{-3}$	$-8.71140434 \times 10^{-4}$	$1.10849697 \times 10^{-4}$		
3	$-2.71567936 \times 10^{-6}$	$5.91444341 \times 10^{-7}$			
4	$1.40598463 \times 10^{-4}$				

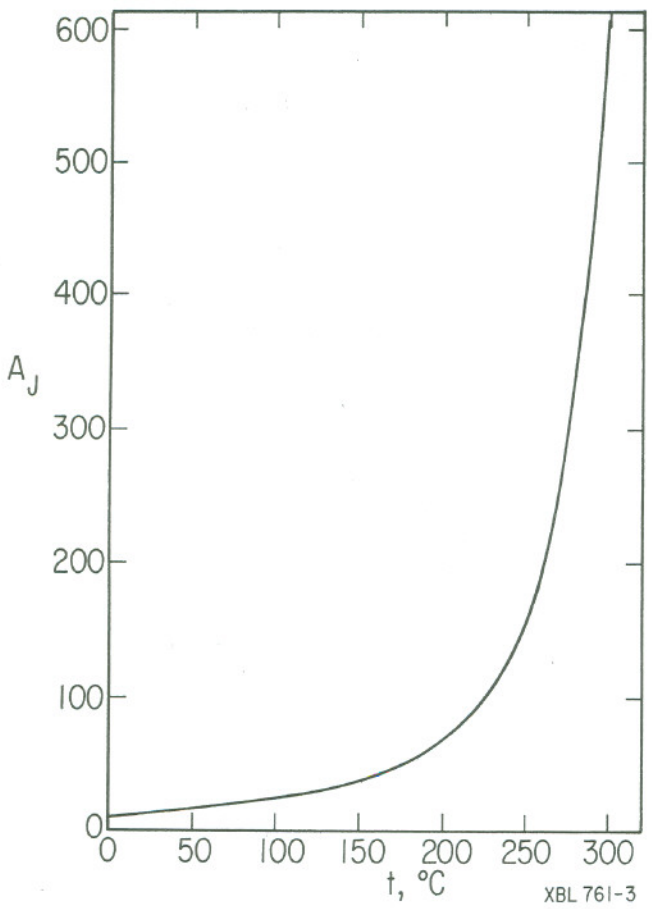


Figure A-3. Debye-Hückel Heat Capacity Constant versus Temperature.

Table A-II

Debye-Hückel Factors for the Osmotic Coefficient, Enthalpy, and Heat Capacity

t, °C	A	A_H	A_J
0	0.3770	411	9.6
10	0.3820	516	11.3
20	0.3878	635	12.3
30	0.3944	762	13.2
40	0.4017	899	14.2
50	0.4098	1,046	15.2
60	0.4185	1,203	16.3
70	0.4279	1,372	17.6
80	0.4380	1,555	19.0
90	0.4488	1,753	20.7
100	0.4603	1,969	22.5
110	0.4725	2,204	24.6
120	0.4855	2,461	26.9
130	0.4992	2.743	29.6
140	0.5137	3,053	32.6
150	0.5291	3,394	36.1
160	0.5454	3,773	40.1
170	0.5627	4,193	44.8
180	0.5810	4,664	50.4
190	0.6005	5,194	57.1
200	0.6212	5,796	65.4
220	0.6670	7,285	88.8
240	0.7200	9,336	127
260	0.7829	12,315	194
280	0.8596	16,935	323
300	0.9576	24,789	604
325	1.1323	45,943	1,779
350	1.4436	125,150	11,948

APPENDIX B

APPARENT MOLAR VOLUME EQUATIONS

The apparent molal volume, ϕ_V, of a solution is computed from the relationship

$$\phi_V = \frac{V - n_1 \bar{V}_1^\circ}{n_2}$$

or alternately by the relationship

$$\phi_V = \frac{1}{m}\left(\frac{1000 + mM_2}{\rho_s} - \frac{1000}{\rho_w}\right) \qquad \text{(B-2)}$$

where m is the molality, M_2 is the molecular weight of the solute, ρ_s and ρ_w are the density in g/cm^3 of the solution and pure water, respectively.

From basic thermodynamics the total volume of the solution, V, is related to the Gibbs energy of the solution by the relationship,

$$V = n_1 \left(\frac{\partial \bar{G}_1}{\partial P}\right)_T + n_2 \left(\frac{\partial \bar{G}_2}{\partial P}\right)_T \qquad \text{(B-3)}$$

which leads to

$$\phi_V = \bar{V}_2^\circ + \nu RT \left(\frac{\partial \ln \gamma_\pm}{\partial P}\right)_{T,m} - \nu RT \left(\frac{\partial \phi}{\partial P}\right)_{T,m} \qquad \text{(B-4)}$$

where R is the gas constant (83.14241 cm^3 bar/mole -°K) and $\bar{V}_2^\circ$ is the partial molal volume of the solute at infinite dilution.

Taking the pressure derivative of equations (8) and (9) and combining terms yields,

$$\begin{aligned}\phi_V = \bar{V}_2^\circ &+ \nu |z_M z_X| (A_V/3b) \ln(1+bI^{1/2}) \\ &+ \nu RTm\, B_V^{(0)} \\ &+ \frac{2\nu RTm}{\alpha^2 I}\left(1-(1+\alpha I^{1/2})\, e^{-\alpha I^{1/2}}\right) B_V^{(1)} \\ &+ \frac{\nu}{2} RT\, m^2\, C_V \end{aligned} \qquad \text{(B-5)}$$

where we define

$$B_V^{(0)} \equiv \frac{2\nu_M \nu_X}{\nu}\left(\frac{\partial \beta_{MX}^{(0)}}{\partial P}\right)_{T,m}$$

$$B_V^{(1)} \equiv \frac{2\nu_M \nu_X}{\nu}\left(\frac{\partial \beta_{MX}^{(1)}}{\partial P}\right)_{T,m}$$

$$C_V \equiv \frac{2(\nu_M \nu_X)^{3/2}}{\nu}\left(\frac{\partial C_{MX}^{\phi}}{\partial P}\right)_{T,m}$$

and A_V is given by

$$A_V = -6RT\left(\frac{\partial A_\phi}{\partial P}\right)_T . \qquad \text{(B-6)}$$

APPENDIX C

TABULATED THERMODYNAMIC QUANTITIES

The following quantities are tabulated from 0-300°C in 25°C intervals for concentrations of 0.05-6.0 m at each temperature with the exception of the heat capacity functions which are tabulated from 25-300°C. The terminology heat content on the table headings is synonymous with enthalpy.

The symbols on the tables have the following meaning and units (1 cal ≡ 4.1840 Joules), where T_r = 298.15°K.

	PAGE
HEAT-SOLN., $\bar{H}^\circ_s$, cal/mole	16
CP02(T) = $\bar{C}^\circ_{P_2}$, cal/°K-mole	16
CP01(T) = $\bar{C}^\circ_{P_1}$, cal/°K-mole of water	16
GO(T)-GO(TR) = $G^\circ_T - G^\circ_{T_r}$, cal	17
HO(T)-HO(TR) = $H^\circ_T - H^\circ_{T_r}$, cal	18
SO(T)-SO(TR) = $S^\circ_T - S^\circ_{T_r}$, cal/°K	19
G(T,M)-GO(TR) = $G(T,m) - G^\circ_{T_r}$, cal	20
H(T,M)-HO(TR) = $H(T,m) - H^\circ_{T_r}$, cal	21
S(T,M)-SO(TR) = $S(T,m) - S^\circ_{T_r}$, cal/°K	22
CP(T) = C_p, cal/°K	23
OSMOTIC COEFFICIENT = ϕ	24
ACTIVITY COEFFICIENT = $\gamma_\pm$	25
(L/M) = ϕL, cal/mole	26
L1 = $\bar{L}_1$, cal/mole of water	27
L2 = $\bar{L}_2$, cal/mole	28
S1-SO1 = $S_2 - S^\circ_2$, cal/°K-mole of water	29
S2-SO2 = $S_2 - S^\circ_2$, cal/°K-mole	30
J = J_1 cal/°K	31
J1 = $\bar{J}_1$, cal/°K-mole of water	32
J2 = $\bar{J}_2$, cal/°K-mole	33
GEX = G^{EX}, cal/Kg - H_2O	34
G1EX = G^{EX}_1, cal/Kg - H_2O	35
G2EX = G^{EX}_2, cal/Kg - H_2O	36
HEX = H^{EX}, cal/Kg - H_2O	37
H1EX = H^{EX}_1, cal/Kg - H_2O	38
H2EX = H^{EX}_2, cal/Kg - H_2O	39
STEX = S^{EX}, cal/°K - Kg H_2O	40
S1EX = S^{EX}_1, cal/°K - Kg H_2O	41
S2EX = S^{EX}_2, cal/°K - Kg H_2O	42
JEX = J^{EX}, cal/°K - Kg H_2O	43
J1EX = J^{EX}_1, cal/°K - Kg H_2O	44
J2EX = J^{EX}_2, cal/°K - Kg H_2O	45

MASS OF THE SOLUTION IN GRAMS FOR VARIOUS MOLALITIES

MOLALITY	WT(GM)
.05	1002.92
.10	1005.84
.20	1011.69
.30	1017.53
.40	1023.38
.50	1029.22
.60	1035.07
.70	1040.91
.80	1046.75
.90	1052.60
1.00	1058.44
1.20	1070.13
1.40	1081.82
1.60	1093.51
1.80	1105.20
2.00	1116.89
2.25	1131.50
2.50	1146.11
2.75	1160.72
3.00	1175.33
3.25	1189.94
3.50	1204.55
3.75	1219.16
4.00	1233.77
4.50	1262.99
5.00	1292.21
5.50	1321.44
6.00	1350.66

STANDARD STATE PROPERITIES OF NACL(AQ)

HSO(T)- CAL/MOLE
CPO1(T), CPO2(T)- CAL/DEG-MOLE

T(CENT)	HEAT-SOLN.	CPO2(T)	CPO1(T)
25.00	918.34	-19.11	18.01
50.00	188.57	-15.41	17.99
75.00	-490.46	-14.85	18.05
100.00	-1197.17	-17.43	18.15
125.00	-2009.95	-23.15	18.32
150.00	-3007.22	-32.00	18.57
175.00	-4267.39	-43.98	18.90
200.00	-5868.87	-59.11	19.35
225.00	-7890.08	-77.37	19.97
250.00	-10409.41	-98.76	20.89
275.00	-13505.28	-123.29	22.34
300.00	-17256.10	-150.96	24.78

STANDARD STATE VALUES OF G0(T)-G0(TR), CALS.

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	22142.490	0	-24238.311	-50404.427	-78359.932	-107985.335	-139175.879	-171838.284
.10	22178.129	0	-24271.912	-50470.108	-78456.337	-108110.985	-139328.941	-172016.383
.20	22249.408	0	-24339.113	-50601.471	-78649.148	-108362.285	-139635.067	-172372.581
.30	22320.687	0	-24406.315	-50732.834	-78841.958	-108613.585	-139941.192	-172728.779
.40	22391.966	0	-24473.516	-50864.197	-79034.769	-108864.886	-140247.317	-173084.977
.50	22463.245	0	-24540.718	-50995.559	-79227.579	-109116.186	-140553.442	-173441.175
.60	22534.524	0	-24607.919	-51126.922	-79420.390	-109367.486	-140859.567	-173797.373
.70	22605.802	0	-24675.120	-51258.285	-79613.200	-109618.786	-141165.692	-174153.570
.80	22677.081	0	-24742.322	-51389.648	-79806.011	-109870.086	-141471.817	-174509.768
.90	22748.360	0	-24809.523	-51521.011	-79998.821	-110121.386	-141777.942	-174865.966
1.00	22819.639	0	-24876.725	-51652.373	-80191.632	-110372.687	-142084.067	-175222.164
1.20	22962.197	0	-25011.127	-51915.099	-80577.253	-110875.287	-142696.317	-175934.560
1.40	23104.754	0	-25145.530	-52177.825	-80962.874	-111377.887	-143308.568	-176646.956
1.60	23247.312	0	-25279.933	-52440.550	-81348.495	-111880.488	-143920.818	-177359.352
1.80	23389.870	0	-25414.336	-52703.276	-81734.116	-112383.088	-144533.068	-178071.747
2.00	23532.428	0	-25548.739	-52966.002	-82119.737	-112885.689	-145145.318	-178784.143
2.25	23710.625	0	-25716.742	-53294.409	-82601.763	-113513.939	-145910.631	-179674.638
2.50	23888.822	0	-25884.746	-53622.816	-83083.789	-114142.189	-146675.944	-180565.133
2.75	24067.019	0	-26052.749	-53951.223	-83565.815	-114770.440	-147441.256	-181455.627
3.00	24245.216	0	-26220.753	-54279.630	-84047.841	-115398.690	-148206.569	-182346.122
3.25	24423.413	0	-26388.756	-54608.037	-84529.868	-116026.941	-148971.882	-183236.617
3.50	24601.611	0	-26556.760	-54936.444	-85011.894	-116655.191	-149737.194	-184127.112
3.75	24779.808	0	-26724.763	-55264.851	-85493.920	-117283.442	-150502.507	-185017.606
4.00	24958.005	0	-26892.767	-55593.258	-85975.946	-117911.692	-151267.820	-185908.101
4.50	25314.399	0	-27228.774	-56250.072	-86939.999	-119168.193	-152798.445	-187689.091
5.00	25670.794	0	-27564.781	-56906.887	-87904.051	-120424.694	-154329.071	-189470.080
5.50	26027.188	0	-27900.788	-57563.701	-88868.104	-121681.195	-155859.696	-191251.070
6.00	26383.582	0	-28236.795	-58220.515	-89832.156	-122937.696	-157390.322	-193032.059

STANDARD STATE VALUES OF G0(T)-G0(TR), CALS.

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	-205887.600	-241245.242	-277838.678	-315602.318	-354478.429			
.10	-206087.658	-241463.345	-278069.965	-315840.883	-354717.236			
.20	-206487.773	-241899.550	-278532.538	-316318.011	-355194.850			
.30	-206887.887	-242335.756	-278995.111	-316795.140	-355672.463			
.40	-207288.002	-242771.961	-279457.684	-317272.268	-356150.077			
.50	-207688.117	-243208.166	-279920.258	-317749.397	-356627.691			
.60	-208088.231	-243644.372	-280382.831	-318226.525	-357105.305			
.70	-208488.346	-244080.577	-280845.404	-318703.654	-357582.919			
.80	-208888.461	-244516.782	-281307.978	-319180.782	-358060.532			
.90	-209288.576	-244952.988	-281770.551	-319657.911	-358538.146			
1.00	-209688.690	-245389.193	-282233.124	-320135.039	-359015.760			
1.20	-210488.920	-246261.604	-283158.271	-321089.296	-359970.988			
1.40	-211289.149	-247134.014	-284083.417	-322043.553	-360926.215			
1.60	-212089.379	-248006.425	-285008.564	-322997.811	-361881.443			
1.80	-212889.608	-248878.835	-285933.710	-323952.068	-362836.671			
2.00	-213689.838	-249751.246	-286858.857	-324906.325	-363791.898			
2.25	-214690.124	-250841.759	-288015.290	-326099.146	-364985.933			
2.50	-215690.411	-251932.273	-289171.723	-327291.967	-366179.967			
2.75	-216690.698	-253022.786	-290328.156	-328484.789	-367374.002			
3.00	-217690.985	-254113.299	-291484.590	-329677.610	-368568.036			
3.25	-218691.272	-255203.813	-292641.023	-330870.431	-369762.071			
3.50	-219691.558	-256294.326	-293797.456	-332063.252	-370956.106			
3.75	-220691.845	-257384.839	-294953.889	-333256.074	-372150.140			
4.00	-221692.132	-258475.352	-296110.322	-334448.895	-373344.175			
4.50	-223692.706	-260656.379	-298423.189	-336834.538	-375732.244			
5.00	-225693.279	-262837.406	-300736.055	-339220.180	-378120.313			
5.50	-227693.853	-265018.432	-303048.922	-341605.823	-380508.382			
6.00	-229694.427	-267199.459	-305361.788	-343991.465	-382896.451			

STANDARD STATE VALUES OF H0(T)-H0(TR), CALS.

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-25045.788	0	24941.050	49923.231	75024.767	100321.219	125912.670	151910.796
.10	-25018.017	0	24919.801	49883.392	74965.076	100236.494	125793.808	151744.774
.20	-24962.475	0	24877.303	49803.713	74845.693	100067.043	125556.084	151412.730
.30	-24906.933	0	24834.804	49724.034	74726.310	99897.592	125318.359	151080.686
.40	-24851.391	0	24792.306	49644.355	74606.927	99728.141	125080.635	150748.642
.50	-24795.849	0	24749.808	49564.676	74487.545	99558.690	124842.911	150416.599
.60	-24740.307	0	24707.310	49484.997	74368.162	99389.240	124605.187	150084.555
.70	-24684.765	0	24664.811	49405.319	74248.779	99219.789	124367.463	149752.511
.80	-24629.223	0	24622.313	49325.640	74129.397	99050.338	124129.738	149420.467
.90	-24573.681	0	24579.815	49245.961	74010.014	98880.887	123892.014	149088.423
1.00	-24518.139	0	24537.316	49166.282	73890.631	98711.436	123654.290	148756.379
1.20	-24407.055	0	24452.320	49006.924	73651.866	98372.535	123178.842	148092.292
1.40	-24295.970	0	24367.323	48847.567	73413.101	98033.633	122703.393	147428.204
1.60	-24184.886	0	24282.327	48688.209	73174.335	97694.731	122227.945	146764.116
1.80	-24073.802	0	24197.330	48528.851	72935.570	97355.830	121752.496	146100.028
2.00	-23962.718	0	24112.334	48369.494	72696.804	97016.928	121277.048	145435.941
2.25	-23823.863	0	24006.088	48170.297	72398.348	96593.301	120682.737	144605.831
2.50	-23685.008	0	23899.843	47971.100	72099.891	96169.674	120088.427	143775.722
2.75	-23546.153	0	23793.597	47771.903	71801.434	95746.047	119494.116	142945.612
3.00	-23407.298	0	23687.351	47572.705	71502.978	95322.420	118899.806	142115.502
3.25	-23268.443	0	23581.106	47373.508	71204.521	94898.793	118305.495	141285.393
3.50	-23129.588	0	23474.860	47174.311	70906.064	94475.166	117711.185	140455.283
3.75	-22990.733	0	23368.614	46975.114	70607.607	94051.539	117116.874	139625.173
4.00	-22851.878	0	23262.369	46775.917	70309.151	93627.912	116522.564	138795.064
4.50	-22574.168	0	23049.877	46377.523	69712.237	92780.657	115333.942	137134.844
5.00	-22296.457	0	22837.386	45979.129	69115.324	91933.403	114145.321	135474.625
5.50	-22018.747	0	22624.895	45580.735	68518.410	91086.149	112956.700	133814.406
6.00	-21741.037	0	22412.403	45182.341	67921.497	90238.895	111768.079	132154.187

STANDARD STATE VALUES OF H0(T)-H0(TR), CALS.

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	178442.966	205685.116	233914.841	263582.523	295428.872			
.10	178212.841	205370.023	233489.996	263019.221	294694.487			
.20	177752.590	204739.838	232640.306	261892.617	293225.717			
.30	177292.339	204109.652	231790.616	260766.012	291756.947			
.40	176832.088	203479.466	230940.926	259639.407	290288.176			
.50	176371.838	202849.280	230091.236	258512.803	288819.406			
.60	175911.587	202219.094	229241.546	257386.198	287350.636			
.70	175451.336	201588.909	228391.856	256259.594	285881.866			
.80	174991.086	200958.723	227542.166	255132.989	284413.096			
.90	174530.835	200328.537	226692.476	254006.385	282944.326			
1.00	174070.584	199698.351	225842.786	252879.780	281475.555			
1.20	173150.083	198437.980	224143.405	250626.571	278538.015			
1.40	172229.581	197177.608	222444.025	248373.362	275600.475			
1.60	171309.080	195917.237	220744.645	246120.153	272662.934			
1.80	170388.578	194656.865	219045.265	243866.944	269725.394			
2.00	169468.077	193396.493	217345.885	241613.735	266787.854			
2.25	168317.450	191821.029	215221.660	238797.223	263115.928			
2.50	167166.823	190245.564	213097.434	235980.712	259444.003			
2.75	166016.197	188670.100	210973.209	233164.201	255772.078			
3.00	164865.570	187094.635	208848.984	230347.689	252100.152			
3.25	163714.943	185519.171	206724.759	227531.178	248428.227			
3.50	162564.316	183943.706	204600.534	224714.667	244756.301			
3.75	161413.689	182368.242	202476.308	221898.155	241084.376			
4.00	160263.063	180792.777	200352.083	219081.644	237412.451			
4.50	157961.809	177641.848	196103.633	213448.621	230068.600			
5.00	155660.555	174490.919	191855.183	207815.599	222724.749			
5.50	153359.302	171339.990	187606.732	202182.576	215380.898			
6.00	151058.048	168189.061	183358.282	196549.553	208037.047			

STANDARD STATE VALUES OF S0(T)-S0(TR), CALS/DEG K

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-87.737	0	80.323	154.767	224.350	289.879	352.060	411.496
.10	-87.640	0	80.255	154.643	224.171	289.635	351.734	411.061
.20	-87.445	0	80.118	154.395	223.813	289.147	351.080	410.191
.30	-87.250	0	79.981	154.147	223.455	288.660	350.426	409.322
.40	-87.055	0	79.844	153.899	223.097	288.172	349.773	408.452
.50	-86.860	0	79.707	153.651	222.739	287.684	349.119	407.582
.60	-86.665	0	79.570	153.403	222.381	287.197	348.465	406.712
.70	-86.470	0	79.432	153.155	222.023	286.709	347.812	405.842
.80	-86.275	0	79.295	152.907	221.665	286.221	347.158	404.972
.90	-86.080	0	79.158	152.659	221.307	285.734	346.504	404.102
1.00	-85.885	0	79.021	152.411	220.949	285.246	345.851	403.232
1.20	-85.495	0	78.747	151.915	220.233	284.271	344.543	401.492
1.40	-85.105	0	78.473	151.420	219.518	283.296	343.236	399.753
1.60	-84.715	0	78.199	150.924	218.802	282.320	341.929	398.013
1.80	-84.325	0	77.925	150.428	218.086	281.345	340.621	396.273
2.00	-83.935	0	77.650	149.932	217.370	280.370	339.314	394.533
2.25	-83.447	0	77.308	149.312	216.475	279.151	337.680	392.358
2.50	-82.960	0	76.965	148.692	215.580	277.932	336.046	390.184
2.75	-82.472	0	76.622	148.073	214.685	276.713	334.411	388.009
3.00	-81.985	0	76.280	147.453	213.790	275.494	332.777	385.834
3.25	-81.497	0	75.937	146.833	212.895	274.274	331.143	383.659
3.50	-81.010	0	75.594	146.213	212.000	273.055	329.509	381.485
3.75	-80.522	0	75.252	145.593	211.106	271.836	327.875	379.310
4.00	-80.035	0	74.909	144.973	210.211	270.617	326.241	377.135
4.50	-79.060	0	74.223	143.734	208.421	268.179	322.972	372.786
5.00	-78.085	0	73.538	142.494	206.631	265.741	319.704	368.436
5.50	-77.110	0	72.853	141.255	204.841	263.303	316.436	364.087
6.00	-76.135	0	72.167	140.015	203.051	260.865	313.167	359.737

STANDARD STATE VALUES OF S0(T)-S0(TR), CALS/DEG K

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000	------	------	------
.05	468.711	524.235	578.702	632.959	688.225			
.10	468.137	523.486	577.739	631.737	686.698			
.20	466.989	521.989	575.812	629.294	683.645			
.30	465.841	520.491	573.885	626.850	680.591			
.40	464.694	518.994	571.958	624.406	677.537			
.50	463.546	517.496	570.031	621.963	674.484			
.60	462.398	515.999	568.104	619.519	671.430			
.70	461.250	514.501	566.176	617.075	668.377			
.80	460.102	513.004	564.249	614.632	665.323			
.90	458.954	511.506	562.322	612.188	662.270			
1.00	457.806	510.009	560.395	609.745	659.216			
1.20	455.510	507.014	556.541	604.857	653.109			
1.40	453.214	504.019	552.687	599.970	647.002			
1.60	450.919	501.024	548.833	595.083	640.894			
1.80	448.623	498.029	544.979	590.195	634.787			
2.00	446.327	495.034	541.125	585.308	628.680			
2.25	443.457	491.290	536.308	579.199	621.046			
2.50	440.587	487.546	531.490	573.090	613.412			
2.75	437.718	483.802	526.673	566.981	605.778			
3.00	434.848	480.059	521.855	560.872	598.144			
3.25	431.978	476.315	517.038	554.763	590.511			
3.50	429.108	472.571	512.220	548.654	582.877			
3.75	426.238	468.827	507.403	542.545	575.243			
4.00	423.369	465.084	502.585	536.436	567.609			
4.50	417.629	457.596	492.950	524.217	552.341			
5.00	411.889	450.109	483.315	511.999	537.073			
5.50	406.150	442.621	473.680	499.781	521.805			
6.00	400.410	435.134	464.045	487.563	506.537			

TOTAL GIBBS ENERGY OF THE SOLUTION, G(T,M)-G0(TR), CALS.

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	22080.751	-67.612	-24311.982	-50484.355	-78446.336	-108078.461	-139276.012	-171945.766
.10	22049.998	-140.341	-24424.982	-50636.455	-78636.556	-108305.745	-139539.016	-172242.691
.20	21982.107	-292.602	-24658.476	-50949.109	-79026.684	-108771.525	-140078.086	-172851.834
.30	21909.040	-450.181	-24897.724	-51268.227	-79424.255	-109246.009	-140627.429	-173473.173
.40	21832.559	-611.111	-25140.510	-51591.300	-79826.416	-109725.944	-141183.323	-174102.434
.50	21753.585	-774.370	-25385.689	-51917.034	-80231.703	-110209.658	-141743.854	-174737.416
.60	21672.697	-939.320	-25632.550	-52244.632	-80639.208	-110696.120	-142307.842	-175376.762
.70	21590.299	-1105.520	-25880.606	-52573.547	-81048.316	-111184.628	-142874.482	-176019.544
.80	21506.692	-1272.646	-26129.499	-52903.380	-81458.577	-111674.670	-143443.188	-176665.087
.90	21422.113	-1440.444	-26378.953	-53233.824	-81869.645	-112165.855	-144013.512	-177312.874
1.00	21336.753	-1608.711	-26628.748	-53564.637	-82281.249	-112657.874	-144585.100	-177962.497
1.20	21164.310	-1946.009	-27128.668	-54226.610	-83105.216	-113643.453	-145730.970	-179265.982
1.40	20990.402	-2283.469	-27628.126	-54888.065	-83929.106	-114629.859	-146879.025	-180573.488
1.60	20815.836	-2620.281	-28126.276	-55548.093	-84751.918	-115615.964	-148027.575	-181883.522
1.80	20641.274	-2955.795	-28622.459	-56205.996	-85572.889	-116600.912	-149176.841	-183194.950
2.00	20467.275	-3289.478	-29116.140	-56861.219	-86391.420	-117584.036	-150324.860	-184506.883
2.25	20251.307	-3703.320	-29729.056	-57675.798	-87410.424	-118809.568	-151757.774	-186146.438
2.50	20037.810	-4112.840	-30336.662	-58484.773	-88424.114	-120030.592	-153187.474	-187784.574
2.75	19827.522	-4517.392	-30938.364	-59287.569	-89431.897	-121246.461	-154613.224	-189420.427
3.00	19621.104	-4916.414	-31533.665	-60083.717	-90433.301	-122456.667	-156034.447	-191053.316
3.25	19419.157	-5309.410	-32122.140	-60872.833	-91427.948	-123660.810	-157450.689	-192682.700
3.50	19222.238	-5695.936	-32703.422	-61654.597	-92415.538	-124858.577	-158861.596	-194308.155
3.75	19030.865	-6075.590	-33277.196	-62428.746	-93395.831	-126049.727	-160266.897	-195929.349
4.00	18845.524	-6448.007	-33843.182	-63195.061	-94368.641	-127234.077	-161666.386	-197546.029
4.50	18494.752	-7169.810	-34950.851	-64703.504	-96291.275	-129581.888	-164447.387	-200765.151
5.00	18173.346	-7858.943	-36024.802	-66178.853	-98182.707	-131901.422	-167203.960	-203964.636
5.50	17884.454	-8513.313	-37063.759	-67620.431	-100042.659	-134192.604	-169936.055	-207144.280
6.00	17631.015	-9131.060	-38066.713	-69027.862	-101871.194	-136455.757	-172644.074	-210304.393

TOTAL GIBBS ENERGY OF THE SOLUTION, G(T,M)-G0(TR), CALS.

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	-206002.846	-241368.786	-277971.241	-315744.958	-354632.838
.10	-206331.323	-241725.804	-278353.169	-316147.687	-355052.218
.20	-207006.256	-242461.096	-279142.351	-316983.710	-355928.651
.30	-207695.733	-243213.815	-279952.570	-317845.441	-356837.166
.40	-208394.823	-243978.244	-280777.139	-318724.951	-357768.148
.50	-209100.985	-244751.429	-281612.591	-319618.113	-358716.570
.60	-209812.649	-245531.538	-282456.772	-320522.357	-359679.293
.70	-210528.739	-246317.319	-283308.205	-321435.915	-360654.149
.80	-211248.473	-247107.855	-284165.808	-322357.489	-361639.542
.90	-211971.250	-247902.444	-285028.750	-323286.080	-362634.244
1.00	-212696.595	-248700.529	-285896.370	-324220.893	-363637.274
1.20	-214153.510	-250305.446	-287643.579	-326106.693	-365665.239
1.40	-215616.824	-251919.789	-289404.081	-328010.836	-367718.416
1.60	-217084.789	-253541.493	-291175.412	-329930.331	-369793.096
1.80	-218556.073	-255168.978	-292955.675	-331862.873	-371886.405
2.00	-220029.629	-256800.996	-294743.369	-333806.626	-373996.051
2.25	-221873.501	-258845.877	-296986.599	-336249.826	-376653.252
2.50	-223718.303	-260894.695	-299237.618	-338705.840	-379330.067
2.75	-225562.999	-262946.192	-301494.881	-341172.743	-382024.056
3.00	-227406.764	-264999.353	-303757.129	-343648.957	-384733.202
3.25	-229248.937	-267053.357	-306023.330	-346133.171	-387455.817
3.50	-231088.990	-269107.537	-308292.631	-348624.290	-390190.475
3.75	-232926.502	-271161.348	-310564.327	-351121.395	-392935.964
4.00	-234761.143	-273214.354	-312837.836	-353623.710	-395691.247
4.50	-238420.856	-277316.617	-317388.457	-358641.461	-401227.765
5.00	-242066.807	-281412.351	-321941.621	-363673.470	-406794.316
5.50	-245698.451	-285500.482	-326495.510	-368716.905	-412386.688
6.00	-249315.839	-289580.625	-331049.108	-373769.885	-418001.816

TOTAL ENTHALPY OF THE SOLUTION, H(T,M)-H0(TR), CALS.

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-25044.305	3.514	24946.950	49931.910	75036.780	100337.337	125933.951	151938.735
.10	-25015.426	8.313	24934.734	49905.952	74996.714	100279.254	125850.517	151819.448
.20	-24961.025	17.745	24913.497	49860.828	74927.417	100178.675	125705.044	151609.644
.30	-24911.896	25.352	24893.930	49820.997	74867.362	100091.872	125578.791	151425.892
.40	-24868.337	30.396	24874.763	49784.554	74813.870	100015.191	125466.860	151261.659
.50	-24830.416	32.570	24855.399	49750.560	74765.583	99946.754	125366.701	151113.523
.60	-24798.117	31.731	24835.509	49718.465	74721.682	99885.404	125276.733	150979.340
.70	-24771.385	27.821	24814.898	49687.914	74681.621	99830.358	125195.867	150857.624
.80	-24750.141	20.829	24793.448	49658.667	74645.014	99781.047	125123.306	150747.281
.90	-24734.292	10.772	24771.091	49630.557	74611.574	99737.041	125058.437	150647.463
1.00	-24723.740	-2.315	24747.789	49603.463	74581.082	99698.003	125000.775	150557.492
1.20	-24718.098	-37.367	24698.314	49552.006	74528.305	99633.795	124905.553	150404.953
1.40	-24732.328	-83.828	24645.088	49503.878	74485.703	99586.778	124835.173	150286.162
1.60	-24765.509	-141.106	24588.340	49458.906	74452.649	99555.791	124787.831	150198.505
1.80	-24816.694	-208.550	24528.401	49417.075	74428.742	99539.984	124762.143	150139.940
2.00	-24884.923	-285.468	24465.674	49378.480	74413.733	99538.721	124757.017	150108.821
2.25	-24992.696	-393.837	24384.044	49335.054	74407.286	99556.870	124778.191	150106.457
2.50	-25123.661	-514.425	24299.744	49297.420	74414.449	99596.301	124828.732	150142.647
2.75	-25275.887	-645.736	24213.816	49266.145	74435.286	99656.527	124907.532	150215.560
3.00	-25447.424	-786.241	24127.357	49241.879	74469.976	99737.219	125013.696	150323.651
3.25	-25636.314	-934.386	24041.506	49225.337	74518.789	99838.170	125146.496	150465.603
3.50	-25840.590	-1088.597	23957.438	49217.285	74582.065	99959.272	125305.337	150640.272
3.75	-26058.274	-1247.283	23876.354	49218.528	74660.206	100100.498	125489.732	150846.663
4.00	-26287.385	-1408.837	23799.481	49229.912	74753.663	100261.889	125699.283	151083.897
4.50	-26771.919	-1734.061	23663.377	49286.618	74988.521	100645.595	126192.631	151647.877
5.00	-27278.215	-2051.193	23559.302	49394.674	75290.971	101111.698	126783.517	152326.942
5.50	-27790.221	-2347.020	23497.650	49561.665	75665.774	101662.079	127470.847	153116.843
6.00	-28291.831	-2608.222	23488.982	49795.418	76118.021	102299.068	128254.115	154014.105

TOTAL ENTHALPY OF THE SOLUTION, H(T,M)-H0(TR), CALS.

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	178479.823	205734.601	233983.556	263683.305	295590.083
.10	178311.574	205502.839	233674.756	263290.671	295129.397
.20	178013.662	205091.797	233130.844	262614.548	294384.129
.30	177750.823	204728.526	232654.013	262037.696	293798.756
.40	177514.306	204401.088	232227.392	261534.909	293332.194
.50	177299.494	204103.143	231841.972	261092.655	292962.271
.60	177103.479	203830.678	231492.029	260702.303	292674.799
.70	176924.236	203580.895	231173.557	260357.799	292459.810
.80	176760.267	203351.709	230883.570	260054.626	292309.857
.90	176610.404	203141.499	230619.740	259789.262	292219.135
1.00	176473.713	202948.961	230380.194	259558.870	292182.968
1.20	176236.877	202612.752	229967.997	259193.993	292259.484
1.40	176044.877	202336.251	229637.164	258945.172	292515.055
1.60	175894.041	202114.306	229380.299	258801.262	292931.449
1.80	175781.477	201942.847	229191.565	258753.499	293494.390
2.00	175704.828	201818.548	229066.198	258794.754	294192.323
2.25	175656.546	201725.285	228992.576	258962.531	295240.103
2.50	175658.089	201696.791	229005.211	259250.426	296468.310
2.75	175706.741	201729.192	229098.571	259650.265	297863.928
3.00	175800.177	201819.156	229267.899	260155.048	299415.883
3.25	175936.375	201963.764	229509.034	260758.677	301114.593
3.50	176113.553	202160.432	229818.289	261455.769	302951.654
3.75	176330.122	202406.841	230192.356	262241.516	304919.604
4.00	176584.656	202700.894	230628.242	263111.576	307011.750
4.50	177202.565	203424.429	231674.749	265089.162	311544.939
5.00	177958.205	204317.447	232938.372	267360.561	316508.709
5.50	178843.861	205368.203	234402.267	269901.676	321866.827
6.00	179852.846	206566.345	236051.547	272691.304	327587.750

TOTAL ENTROPY OF SOLUTION, S(T,M)-S0(TR), CALS/DEG K

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-87.506	.239	80.570	155.021	224.614	290.153	352.347	411.798
.10	-87.161	.499	80.775	155.185	224.739	290.231	352.364	411.733
.20	-86.461	1.041	81.218	155.557	225.044	290.455	352.479	411.700
.30	-85.761	1.595	81.684	155.963	225.394	290.736	352.663	411.753
.40	-85.069	2.152	82.163	156.390	225.773	291.056	352.897	411.867
.50	-84.388	2.706	82.648	156.832	226.175	291.405	353.170	412.029
.60	-83.721	3.257	83.137	157.284	226.595	291.780	353.475	412.233
.70	-83.069	3.801	83.627	157.745	227.029	292.175	353.808	412.472
.80	-82.433	4.338	84.118	158.212	227.476	292.589	354.165	412.742
.90	-81.812	4.867	84.607	158.684	227.933	293.019	354.544	413.041
1.00	-81.209	5.388	85.094	159.160	228.400	293.464	354.943	413.366
1.20	-80.052	6.402	86.061	160.120	229.357	294.391	355.795	414.087
1.40	-78.962	7.378	87.015	161.089	230.341	295.364	356.712	414.892
1.60	-77.939	8.315	87.954	162.063	231.348	296.377	357.684	415.772
1.80	-76.982	9.214	88.877	163.040	232.375	297.424	358.708	416.720
2.00	-76.090	10.076	89.783	164.018	233.419	298.504	359.778	417.730
2.25	-75.062	11.100	90.894	165.243	234.745	299.895	361.176	419.074
2.50	-74.128	12.069	91.979	166.467	236.094	301.328	362.636	420.500
2.75	-73.284	12.986	93.041	167.692	237.464	302.800	364.154	422.004
3.00	-72.525	13.853	94.082	168.918	238.854	304.309	365.725	423.579
3.25	-71.846	14.674	95.104	170.146	240.263	305.854	367.347	425.222
3.50	-71.241	15.453	96.109	171.378	241.693	307.433	369.019	426.929
3.75	-70.706	16.194	97.100	172.614	243.142	309.047	370.737	428.698
4.00	-70.235	16.901	98.079	173.857	244.613	310.694	372.501	430.525
4.50	-69.461	18.232	100.018	176.371	247.621	314.088	376.163	434.348
5.00	-68.875	19.479	101.952	178.937	250.727	317.618	379.997	438.383
5.50	-68.429	20.682	103.909	181.575	253.942	321.289	384.001	442.622
6.00	-68.074	21.878	105.918	184.307	257.280	325.117	388.176	447.057

TOTAL ENTROPY OF SOLUTION, S(T,M)-S0(TR), CALS/DEG K

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	469.033	524.582	579.087	633.403	688.776			
.10	468.861	524.280	578.633	632.792	688.041			
.20	468.637	523.823	577.915	631.825	686.946			
.30	468.518	523.496	577.365	631.086	686.186			
.40	468.475	523.265	576.939	630.514	685.672			
.50	468.492	523.111	576.612	630.078	685.357			
.60	468.561	523.022	576.370	629.757	685.210			
.70	468.675	522.990	576.201	629.536	685.212			
.80	468.829	523.009	576.099	629.406	685.345			
.90	469.019	523.074	576.057	629.357	685.598			
1.00	469.242	523.181	576.071	629.383	685.961			
1.20	469.779	523.512	576.249	629.640	686.984			
1.40	470.424	523.981	576.608	630.143	688.364			
1.60	471.167	524.575	577.128	630.864	690.062			
1.80	471.997	525.282	577.796	631.785	692.048			
2.00	472.907	526.092	578.600	632.889	694.298			
2.25	474.150	527.240	579.780	634.505	697.451			
2.50	475.500	528.525	581.139	636.364	700.954			
2.75	476.950	529.938	582.664	638.447	704.778			
3.00	478.492	531.470	584.345	640.738	708.902			
3.25	480.121	533.113	586.170	643.224	713.306			
3.50	481.833	534.862	588.131	645.894	717.972			
3.75	483.622	536.709	590.221	648.736	722.885			
4.00	485.485	538.650	592.432	651.741	728.032			
4.50	489.422	542.797	597.196	658.209	738.979			
5.00	493.621	547.271	602.380	665.239	750.731			
5.50	498.064	552.047	607.948	672.782	763.215			
6.00	502.738	557.102	613.869	680.795	776.372			

TOTAL HEAT CAPACITY OF THE SOLUTION AT CONSTANT PRESSURE, CP(T), CALS/DEG K

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	998.803	997.721	1001.068	1006.857	1016.043	1029.375	1047.327	1071.348
.10	998.007	997.131	1000.535	1006.238	1015.198	1028.173	1045.650	1069.115
.20	996.547	996.088	999.620	1005.174	1013.718	1026.029	1042.636	1065.118
.30	995.225	995.186	998.855	1004.279	1012.436	1024.127	1039.935	1061.549
.40	994.024	994.403	998.212	1003.516	1011.307	1022.411	1037.471	1058.302
.50	992.931	993.725	997.677	1002.868	1010.308	1020.851	1035.203	1055.320
.60	991.940	993.144	997.238	1002.323	1009.424	1019.426	1033.105	1052.566
.70	991.046	992.655	996.890	1001.872	1008.644	1018.123	1031.158	1050.013
.80	990.245	992.254	996.627	1001.509	1007.960	1016.931	1029.349	1047.642
.90	989.533	991.935	996.445	1001.228	1007.365	1015.843	1027.667	1045.438
1.00	988.909	991.697	996.340	1001.026	1006.855	1014.851	1026.103	1043.388
1.20	987.911	991.452	996.349	1000.841	1006.070	1013.136	1023.298	1039.713
1.40	987.235	991.499	996.635	1000.932	1005.575	1011.747	1020.889	1036.551
1.60	986.867	991.824	997.180	1001.277	1005.348	1010.657	1018.838	1033.851
1.80	986.794	992.413	997.969	1001.860	1005.367	1009.842	1017.115	1031.574
2.00	987.005	993.255	998.990	1002.668	1005.618	1009.282	1015.695	1029.686
2.25	987.653	994.645	1000.573	1003.972	1006.233	1008.914	1014.314	1027.830
2.50	988.711	996.392	1002.480	1005.583	1007.159	1008.887	1013.336	1026.493
2.75	990.159	998.478	1004.689	1007.479	1008.374	1009.175	1012.731	1025.632
3.00	991.981	1000.886	1007.183	1009.642	1009.855	1009.753	1012.469	1025.213
3.25	994.161	1003.598	1009.944	1012.052	1011.583	1010.599	1012.525	1025.203
3.50	996.683	1006.599	1012.956	1014.692	1013.540	1011.692	1012.875	1025.576
3.75	999.531	1009.873	1016.203	1017.545	1015.707	1013.014	1013.498	1026.303
4.00	1002.689	1013.404	1019.669	1020.597	1018.068	1014.546	1014.372	1027.361
4.50	1009.881	1021.181	1027.200	1027.231	1023.307	1018.172	1016.801	1030.381
5.00	1018.141	1029.812	1035.431	1034.475	1029.133	1022.439	1020.019	1034.470
5.50	1027.357	1039.187	1044.251	1042.215	1035.429	1027.224	1023.892	1039.479
6.00	1037.417	1049.195	1053.550	1050.341	1042.084	1032.411	1028.300	1045.273

TOTAL HEAT CAPACITY OF THE SOLUTION AT CONSTANT PRESSURE, CP(T), CALS/DEG K

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000				
.05	1105.098	1155.628	1235.762	1372.031				
.10	1102.301	1152.427	1232.753	1371.269				
.20	1097.403	1147.152	1228.784	1374.156				
.30	1093.138	1142.902	1226.673	1381.030				
.40	1089.345	1139.412	1225.935	1390.841				
.50	1085.938	1136.539	1226.305	1403.015				
.60	1082.861	1134.192	1227.616	1417.184				
.70	1080.075	1132.305	1229.748	1433.088				
.80	1077.550	1130.831	1232.610	1450.533				
.90	1075.264	1129.731	1236.134	1469.368				
1.00	1073.198	1128.975	1240.264	1489.470				
1.20	1069.665	1128.399	1250.163	1533.091				
1.40	1066.855	1128.943	1262.016	1580.768				
1.60	1064.695	1130.488	1275.606	1632.030				
1.80	1063.125	1132.941	1290.764	1686.516				
2.00	1062.098	1136.226	1307.354	1743.934				
2.25	1061.518	1141.407	1329.937	1819.469				
2.50	1061.659	1147.688	1354.402	1898.831				
2.75	1062.465	1154.984	1380.600	1981.704				
3.00	1063.887	1163.222	1408.405	2067.825				
3.25	1065.883	1172.337	1437.707	2156.968				
3.50	1068.416	1182.276	1468.413	2248.938				
3.75	1071.452	1192.987	1500.440	2343.567				
4.00	1074.958	1204.426	1533.712	2440.703				
4.50	1083.272	1229.330	1603.737	2641.980				
5.00	1093.153	1256.703	1678.025	2851.851				
5.50	1104.419	1286.297	1756.190	3069.561				
6.00	1116.908	1317.897	1837.897	3294.469				

SMOOTHED VALUES OF THE OSMOTIC COEFFICIENT

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	.944	.943	.941	.938	.934	.929	.924	.917
.10	.932	.932	.930	.927	.922	.916	.908	.900
.20	.922	.923	.922	.918	.913	.905	.896	.885
.30	.917	.921	.920	.917	.911	.902	.892	.880
.40	.915	.920	.921	.917	.911	.902	.891	.877
.50	.914	.921	.923	.920	.913	.904	.892	.877
.60	.914	.923	.926	.923	.916	.906	.893	.878
.70	.915	.926	.929	.926	.920	.909	.896	.879
.80	.916	.929	.933	.931	.924	.913	.899	.881
.90	.918	.932	.937	.935	.928	.917	.902	.884
1.00	.920	.936	.942	.940	.932	.921	.906	.887
1.20	.925	.944	.951	.950	.942	.930	.913	.893
1.40	.932	.953	.962	.960	.952	.939	.922	.900
1.60	.939	.963	.972	.971	.963	.949	.930	.907
1.80	.947	.974	.984	.983	.974	.959	.940	.915
2.00	.956	.985	.996	.995	.985	.970	.949	.923
2.25	.968	.999	1.011	1.010	1.000	.983	.961	.934
2.50	.981	1.014	1.026	1.025	1.014	.996	.973	.945
2.75	.995	1.030	1.042	1.040	1.029	1.010	.985	.955
3.00	1.011	1.046	1.059	1.056	1.043	1.023	.997	.966
3.25	1.027	1.063	1.075	1.072	1.058	1.037	1.009	.977
3.50	1.044	1.080	1.092	1.088	1.073	1.050	1.021	.987
3.75	1.061	1.098	1.109	1.103	1.087	1.063	1.033	.998
4.00	1.080	1.116	1.126	1.119	1.101	1.076	1.044	1.008
4.50	1.119	1.153	1.160	1.150	1.129	1.101	1.067	1.028
5.00	1.162	1.192	1.195	1.181	1.157	1.125	1.088	1.046
5.50	1.207	1.232	1.230	1.212	1.183	1.148	1.107	1.063
6.00	1.255	1.274	1.265	1.242	1.208	1.169	1.126	1.078

SMOOTHED VALUES OF THE OSMOTIC COEFFICIENT

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	.909	.899	.887	.872	.852			
.10	.889	.877	.862	.842	.816			
.20	.872	.857	.837	.813	.780			
.30	.865	.847	.825	.797	.759			
.40	.861	.841	.817	.786	.744			
.50	.859	.838	.812	.779	.734			
.60	.859	.836	.809	.773	.726			
.70	.859	.836	.806	.769	.719			
.80	.861	.835	.805	.766	.714			
.90	.862	.836	.804	.763	.709			
1.00	.864	.837	.803	.761	.705			
1.20	.869	.839	.804	.759	.699			
1.40	.874	.843	.805	.758	.695			
1.60	.880	.847	.807	.758	.692			
1.80	.886	.852	.810	.759	.690			
2.00	.893	.857	.814	.760	.689			
2.25	.902	.864	.819	.763	.689			
2.50	.911	.872	.824	.766	.690			
2.75	.920	.879	.830	.770	.691			
3.00	.930	.887	.836	.774	.693			
3.25	.939	.895	.842	.778	.695			
3.50	.948	.902	.848	.782	.697			
3.75	.957	.910	.855	.787	.700			
4.00	.966	.918	.861	.792	.703			
4.50	.983	.932	.873	.801	.709			
5.00	.999	.946	.884	.810	.715			
5.50	1.014	.958	.895	.818	.721			
6.00	1.027	.970	.904	.825	.726			

SMOOTHED VALUES OF THE ACTIVITY COEFFICIENT

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	.824	.821	.814	.805	.794	.781	.766	.748
.10	.780	.777	.770	.759	.746	.730	.711	.690
.20	.734	.733	.725	.713	.698	.679	.656	.631
.30	.707	.708	.701	.689	.672	.651	.626	.598
.40	.688	.691	.686	.673	.655	.632	.606	.577
.50	.675	.680	.675	.662	.643	.620	.592	.561
.60	.664	.672	.668	.655	.635	.611	.582	.549
.70	.656	.666	.662	.650	.630	.604	.574	.539
.80	.650	.661	.659	.646	.625	.599	.568	.532
.90	.644	.658	.657	.644	.623	.595	.563	.526
1.00	.640	.656	.655	.643	.621	.593	.559	.521
1.20	.635	.654	.655	.643	.620	.590	.554	.514
1.40	.632	.655	.658	.645	.621	.589	.552	.509
1.60	.631	.658	.662	.649	.624	.591	.551	.507
1.80	.632	.662	.668	.655	.629	.594	.552	.505
2.00	.634	.668	.675	.662	.635	.598	.554	.505
2.25	.639	.677	.685	.672	.643	.604	.557	.506
2.50	.646	.688	.698	.684	.653	.611	.562	.508
2.75	.654	.700	.711	.696	.664	.620	.568	.511
3.00	.664	.714	.726	.710	.676	.629	.575	.515
3.25	.676	.729	.742	.725	.689	.639	.582	.519
3.50	.689	.746	.759	.741	.702	.650	.589	.524
3.75	.704	.764	.777	.758	.716	.661	.597	.529
4.00	.721	.783	.797	.775	.731	.672	.606	.535
4.50	.758	.826	.839	.813	.762	.697	.623	.547
5.00	.803	.874	.885	.853	.795	.722	.642	.559
5.50	.855	.929	.935	.896	.830	.748	.661	.572
6.00	.915	.989	.990	.942	.865	.775	.680	.584

SMOOTHED VALUES OF THE ACTIVITY COEFFICIENT

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	.728	.705	.679	.646	.604			
.10	.666	.639	.606	.568	.520			
.20	.603	.570	.533	.489	.436			
.30	.567	.532	.492	.445	.388			
.40	.543	.506	.463	.415	.357			
.50	.526	.486	.442	.392	.333			
.60	.512	.471	.426	.374	.314			
.70	.501	.459	.412	.360	.299			
.80	.493	.449	.401	.348	.286			
.90	.485	.441	.392	.337	.276			
1.00	.479	.434	.384	.328	.266			
1.20	.470	.422	.370	.313	.251			
1.40	.463	.413	.360	.302	.238			
1.60	.458	.407	.351	.292	.228			
1.80	.455	.401	.344	.284	.219			
2.00	.453	.397	.339	.277	.212			
2.25	.451	.394	.333	.270	.204			
2.50	.451	.391	.329	.265	.198			
2.75	.451	.389	.325	.260	.193			
3.00	.453	.388	.323	.256	.188			
3.25	.454	.388	.320	.252	.184			
3.50	.457	.388	.319	.249	.180			
3.75	.459	.388	.317	.247	.177			
4.00	.462	.389	.317	.244	.174			
4.50	.469	.392	.315	.241	.169			
5.00	.476	.394	.315	.238	.165			
5.50	.483	.398	.315	.236	.161			
6.00	.491	.401	.315	.234	.158			

TOTAL RELATIVE PARTIAL MOLAL HEAT CONTENT OF THE SOLUTION, (L/M), CALS/MOLE OF SALT

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	29.659	70.272	117.993	173.577	240.255	322.355	425.617	558.777
.10	25.909	83.130	149.334	225.607	316.389	427.606	567.094	746.743
.20	7.248	88.726	180.972	285.578	408.621	558.160	744.801	984.571
.30	-16.545	84.507	197.084	323.210	470.174	647.600	868.107	1150.685
.40	-42.365	75.991	206.142	350.497	517.356	717.626	965.561	1282.542
.50	-69.134	65.139	211.182	371.768	556.076	776.127	1047.581	1393.849
.60	-96.351	52.885	213.665	389.112	589.200	826.941	1119.244	1491.308
.70	-123.744	39.745	214.409	403.707	618.346	872.242	1183.435	1578.733
.80	-151.148	26.036	213.919	416.284	644.521	913.387	1241.959	1658.518
.90	-178.458	11.969	212.529	427.329	668.399	951.282	1296.026	1732.267
1.00	-205.602	-2.315	210.473	437.181	690.451	986.567	1346.485	1801.113
1.20	-259.203	-31.139	204.995	454.235	730.366	1051.050	1438.926	1927.218
1.40	-311.684	-59.877	198.404	468.794	766.144	1109.389	1522.700	2041.399
1.60	-362.889	-88.191	191.258	481.685	798.946	1163.162	1599.929	2146.493
1.80	-412.718	-115.861	183.928	493.457	829.540	1213.419	1672.026	2244.396
2.00	-461.103	-142.734	176.670	504.493	858.464	1260.897	1739.984	2336.440
2.25	-519.481	-175.039	167.980	517.670	892.861	1317.142	1820.202	2444.723
2.50	-575.461	-205.770	159.961	530.528	925.823	1370.651	1896.122	2546.770
2.75	-628.994	-234.813	152.807	543.361	957.764	1421.993	1968.515	2643.617
3.00	-680.042	-262.080	146.669	556.391	988.999	1471.600	2037.964	2736.050
3.25	-728.576	-287.503	141.662	569.794	1019.775	1519.808	2104.923	2824.680
3.50	-774.572	-311.028	137.879	583.707	1050.286	1566.887	2169.758	2909.997
3.75	-818.011	-332.609	135.397	598.244	1080.693	1613.056	2232.762	2992.397
4.00	-858.877	-352.209	134.278	613.499	1111.128	1658.494	2294.180	3072.208
4.50	-932.834	-385.347	136.333	646.466	1172.508	1747.764	2413.042	3225.118
5.00	-996.351	-410.239	144.383	683.109	1235.130	1835.659	2527.639	3370.463
5.50	-1049.359	-426.731	158.683	723.806	1299.521	1922.896	2638.936	3509.534
6.00	-1091.799	-434.704	179.430	768.846	1366.087	2010.029	2747.673	3643.320

TOTAL RELATIVE PARTIAL MOLAL HEAT CONTENT OF THE SOLUTION, (L/M), CALS/MOLE OF SALT

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	737.139	989.689	1374.290	2015.643	3224.219			
.10	987.332	1328.158	1847.600	2714.497	4349.103			
.20	1305.360	1759.795	2452.688	3609.655	5792.062			
.30	1528.278	2062.915	2877.990	4238.946	6806.031			
.40	1705.543	2304.055	3216.165	4738.754	7610.045			
.50	1855.313	2507.725	3501.472	5159.704	8285.729			
.60	1986.486	2685.973	3750.806	5526.840	8873.605			
.70	2104.143	2845.694	3973.859	5854.579	9397.063			
.80	2211.476	2991.232	4176.755	6152.046	9870.952			
.90	2310.633	3125.513	4363.628	6425.419	10305.343			
1.00	2403.129	3250.609	4537.409	6679.089	10707.413			
1.20	2572.329	3478.977	4853.826	7139.518	11434.557			
1.40	2725.211	3684.745	5137.956	7551.293	12081.843			
1.60	2865.601	3873.168	5397.284	7925.693	12667.822			
1.80	2996.055	4047.768	5636.833	8270.308	13204.998			
2.00	3118.375	4211.027	5860.156	8590.510	13702.235			
2.25	3261.820	4401.892	6120.407	8962.359	14277.411			
2.50	3396.506	4580.491	6363.111	9307.885	14809.723			
2.75	3523.834	4748.761	6591.041	9631.296	15306.127			
3.00	3644.869	4908.173	6806.305	9935.786	15771.910			
3.25	3760.441	5059.875	7010.546	10223.846	16211.190			
3.50	3871.210	5204.779	7205.073	10497.458	16627.244			
3.75	3977.715	5343.627	7390.946	10758.229	17022.728			
4.00	4080.398	5477.029	7569.040	11007.483	17399.825			
4.50	4275.723	5729.462	7904.693	11475.676	18105.853			
5.00	4459.530	5965.306	8216.638	11908.993	18756.792			
5.50	4633.556	6186.948	8508.279	12312.564	19361.078			
6.00	4799.133	6396.214	8782.211	12690.292	19925.117			

RELATIVE PARTIAL MOLAL HEAT CONTENT OF WATER, L1,CALS/MOLE H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-.001	-.018	-.039	-.062	-.089	-.122	-.163	-.215
.10	.024	-.027	-.084	-.146	-.219	-.305	-.412	-.550
.20	.159	.006	-.155	-.328	-.522	-.750	-1.028	-1.382
.30	.406	.111	-.192	-.509	-.859	-1.262	-1.749	-2.363
.40	.761	.285	-.194	-.686	-1.220	-1.828	-2.554	-3.462
.50	1.218	.525	-.162	-.858	-1.602	-2.441	-3.433	-4.665
.60	1.773	.828	-.098	-1.026	-2.006	-3.099	-4.382	-5.964
.70	2.420	1.189	-.005	-1.191	-2.430	-3.800	-5.395	-7.352
.80	3.156	1.605	.114	-1.354	-2.875	-4.542	-6.472	-8.826
.90	3.974	2.071	.256	-1.518	-3.341	-5.326	-7.609	-10.381
1.00	4.872	2.586	.420	-1.683	-3.830	-6.151	-8.806	-12.015
1.20	6.884	3.742	.798	-2.028	-4.878	-7.924	-11.372	-15.508
1.40	9.156	5.044	1.226	-2.404	-6.027	-9.860	-14.163	-19.290
1.60	11.652	6.462	1.681	-2.826	-7.285	-11.961	-17.172	-23.345
1.80	14.334	7.965	2.139	-3.313	-8.663	-14.232	-20.397	-27.663
2.00	17.167	9.525	2.578	-3.879	-10.171	-16.675	-23.834	-32.234
2.25	20.863	11.506	3.062	-4.728	-12.258	-19.980	-28.427	-38.293
2.50	24.665	13.468	3.430	-5.766	-14.589	-23.575	-33.349	-44.722
2.75	28.499	15.350	3.634	-7.030	-17.189	-27.472	-38.603	-51.513
3.00	32.295	17.093	3.625	-8.555	-20.085	-31.687	-44.190	-58.655
3.25	35.978	18.634	3.356	-10.380	-23.302	-36.233	-50.116	-66.144
3.50	39.477	19.914	2.775	-12.542	-26.867	-41.128	-56.386	-73.973
3.75	42.718	20.872	1.834	-15.081	-30.807	-46.388	-63.005	-82.139
4.00	45.628	21.444	.483	-18.034	-35.151	-52.029	-69.981	-90.638
4.50	50.162	21.191	-3.651	-25.342	-45.164	-64.532	-85.034	-108.627
5.00	52.490	18.659	-10.032	-34.783	-57.136	-78.783	-101.613	-127.928
5.50	52.025	13.352	-19.067	-46.677	-71.302	-94.937	-119.792	-148.539
6.00	48.174	4.772	-31.164	-61.345	-87.901	-113.150	-139.649	-170.461

RELATIVE PARTIAL MOLAL HEAT CONTENT OF WATER, L1,CALS/MOLE H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	-.286	-.386	-.539	-.795	-1.279			
.10	-.733	-.994	-1.391	-2.057	-3.313			
.20	-1.852	-2.517	-3.531	-5.225	-8.423			
.30	-3.174	-4.318	-6.057	-8.958	-14.424			
.40	-4.657	-6.334	-8.878	-13.111	-21.069			
.50	-6.278	-8.535	-11.948	-17.611	-28.233			
.60	-8.027	-10.902	-15.238	-22.413	-35.842			
.70	-9.893	-13.422	-18.728	-27.487	-43.844			
.80	-11.870	-16.085	-22.404	-32.810	-52.201			
.90	-13.952	-18.882	-26.254	-38.364	-60.882			
1.00	-16.135	-21.807	-30.267	-44.133	-69.863			
1.20	-20.787	-28.017	-38.751	-56.269	-88.649			
1.40	-25.799	-34.674	-47.797	-69.133	-108.428			
1.60	-31.147	-41.744	-57.360	-82.660	-129.100			
1.80	-36.812	-49.200	-67.398	-96.792	-150.581			
2.00	-42.777	-57.015	-77.877	-111.480	-172.801			
2.25	-50.634	-67.257	-91.547	-130.559	-201.525			
2.50	-58.913	-77.987	-105.803	-150.367	-231.208			
2.75	-67.590	-89.171	-120.595	-170.837	-261.758			
3.00	-76.646	-100.777	-135.878	-191.911	-293.095			
3.25	-86.064	-112.776	-151.612	-213.532	-325.145			
3.50	-95.828	-125.142	-167.758	-235.650	-357.840			
3.75	-105.923	-137.850	-184.281	-258.217	-391.117			
4.00	-116.337	-150.876	-201.146	-281.186	-424.915			
4.50	-138.069	-177.795	-235.775	-328.163	-493.856			
5.00	-160.936	-205.733	-271.404	-376.255	-564.240			
5.50	-184.859	-234.538	-307.803	-425.158	-635.676			
6.00	-209.767	-264.066	-344.759	-474.583	-707.795			

RELATIVE PARTIAL MOLAL HEAT CONTENT OF THE SOLUTE, L2, CALS/MOLE OF SALT

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	30.265	90.795	161.032	242.120	338.785	457.339	606.131	797.843
.10	12.505	98.356	195.932	306.904	437.733	597.001	796.014	1051.869
.20	-36.934	87.053	224.058	376.590	553.457	766.260	1030.179	1368.022
.30	-91.750	63.985	232.648	417.473	629.029	881.134	1191.777	1587.823
.40	-147.995	36.422	233.036	445.751	686.614	971.273	1320.006	1762.934
.50	-204.393	6.822	229.123	467.057	733.973	1047.118	1428.741	1911.740
.60	-260.385	-23.692	222.724	484.033	774.771	1113.622	1524.596	2043.032
.70	-315.681	-54.517	214.828	498.132	811.033	1173.537	1611.255	2161.731
.80	-370.117	-85.295	206.033	510.240	843.999	1228.552	1690.993	2270.884
.90	-423.589	-115.793	196.729	520.935	874.487	1279.786	1765.316	2372.511
1.00	-476.030	-145.853	187.184	530.622	903.063	1328.015	1835.274	2468.027
1.20	-577.648	-204.245	168.095	548.052	956.019	1417.577	1964.964	2644.592
1.40	-674.728	-259.871	149.805	564.103	1005.101	1500.316	2084.240	2806.218
1.60	-767.130	-312.367	132.952	579.741	1051.686	1578.132	2195.683	2956.399
1.80	-854.762	-361.494	117.959	595.610	1096.691	1652.292	2301.019	3097.470
2.00	-937.559	-407.082	105.124	612.162	1140.763	1723.693	2401.465	3231.080
2.25	-1034.181	-458.901	92.448	634.320	1195.261	1810.054	2521.495	3389.424
2.50	-1123.097	-504.807	83.812	658.560	1249.742	1894.090	2636.585	3539.758
2.75	-1204.248	-544.659	79.463	685.251	1304.729	1976.519	2747.706	3683.394
3.00	-1277.584	-578.343	79.591	714.679	1360.627	2057.895	2855.608	3821.339
3.25	-1343.067	-605.769	84.350	747.073	1417.756	2138.656	2960.882	3954.388
3.50	-1400.660	-626.861	93.866	782.619	1476.378	2219.159	3064.006	4083.180
3.75	-1450.334	-641.555	108.244	821.471	1536.707	2299.696	3165.372	4208.238
4.00	-1492.062	-649.796	127.572	863.759	1598.924	2380.511	3265.308	4330.000
4.50	-1551.589	-646.740	181.372	959.068	1729.613	2543.775	3461.954	4565.050
5.00	-1579.082	-617.383	255.761	1069.263	1869.432	2710.282	3655.715	4790.679
5.50	-1574.414	-561.485	351.118	1194.889	2019.132	2881.039	3847.925	5008.649
6.00	-1537.480	-478.852	467.742	1336.373	2179.297	3056.827	4039.617	5220.323

RELATIVE PARTIAL MOLAL HEAT CONTENT OF THE SOLUTE, L2, CALS/MOLE OF SALT

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	1054.642	1418.473	1973.004	2898.487	4643.613			
.10	1394.348	1879.675	2619.859	3856.046	6188.294			
.20	1819.279	2458.231	3432.559	5059.844	8129.891			
.30	2115.561	2861.786	3998.748	5896.504	9474.890			
.40	2351.736	3183.023	4448.213	6558.181	10533.748			
.50	2552.316	3455.261	4827.879	7114.776	11420.087			
.60	2729.074	3694.577	5160.497	7600.341	12189.530			
.70	2888.623	3910.036	5458.944	8034.232	12873.822			
.80	3035.070	4107.281	5731.265	8428.581	13492.927			
.90	3171.145	4290.080	5982.842	8791.530	14060.283			
1.00	3298.765	4461.079	6217.469	9128.829	14585.397			
1.20	3533.887	4774.948	6646.309	9742.337	15535.192			
1.40	3748.101	5059.514	7033.066	10292.354	16380.900			
1.60	3946.165	5321.385	7387.257	10793.390	17146.643			
1.80	4131.257	5564.984	7715.257	11255.167	17848.597			
2.00	4305.626	5793.432	8021.565	11684.550	18498.185			
2.25	4510.991	6061.136	8378.917	12183.296	19249.115			
2.50	4704.563	6312.056	8712.292	12646.529	19943.310			
2.75	4888.124	6548.658	9025.230	13079.625	20589.681			
3.00	5063.037	6772.826	9320.429	13486.675	21194.991			
3.25	5230.375	6986.038	9600.002	13870.871	21764.508			
3.50	5391.001	7189.479	9865.638	14234.761	22302.422			
3.75	5545.618	7384.116	10118.711	14580.412	22812.126			
4.00	5694.812	7570.751	10360.357	14909.529	23296.411			
4.50	5978.828	7922.597	10813.026	15523.631	24197.658			
5.00	6246.186	8249.289	11229.672	16086.057	25020.799			
5.50	6499.231	8554.009	11614.762	16603.446	25776.596			
6.00	6739.768	8839.195	11971.711	17080.850	26473.209			

RELATIVE PARTIAL MOLAL ENTROPY OF WATER, S1-S01, CALS/DEG K-MOLE H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	.003	.003	.003	.003	.003	.003	.003	.003
.10	.007	.007	.006	.006	.006	.006	.006	.005
.20	.014	.013	.013	.012	.012	.011	.010	.010
.30	.021	.020	.019	.018	.017	.016	.015	.014
.40	.029	.027	.026	.024	.023	.021	.019	.017
.50	.037	.035	.033	.030	.028	.026	.024	.021
.60	.046	.042	.039	.037	.034	.031	.028	.024
.70	.055	.050	.047	.043	.040	.036	.032	.028
.80	.064	.059	.054	.049	.045	.041	.036	.031
.90	.074	.067	.061	.056	.051	.046	.040	.034
1.00	.084	.076	.069	.062	.056	.050	.044	.037
1.20	.105	.094	.084	.076	.068	.060	.052	.042
1.40	.127	.112	.100	.089	.079	.069	.059	.047
1.60	.150	.132	.117	.103	.091	.079	.066	.052
1.80	.175	.152	.133	.117	.102	.088	.073	.056
2.00	.200	.173	.151	.131	.114	.097	.080	.060
2.25	.232	.200	.172	.149	.128	.108	.088	.065
2.50	.266	.227	.194	.167	.142	.119	.095	.069
2.75	.300	.254	.216	.185	.156	.130	.103	.073
3.00	.335	.282	.239	.202	.170	.140	.110	.077
3.25	.371	.310	.261	.220	.184	.150	.116	.080
3.50	.406	.337	.282	.237	.197	.160	.123	.082
3.75	.441	.365	.303	.253	.209	.169	.128	.085
4.00	.476	.392	.324	.269	.221	.177	.134	.086
4.50	.544	.443	.363	.298	.243	.193	.143	.089
5.00	.608	.489	.397	.323	.261	.205	.149	.089
5.50	.666	.530	.426	.343	.275	.214	.153	.087
6.00	.715	.563	.447	.357	.283	.218	.154	.083

RELATIVE PARTIAL MOLAL ENTROPY OF WATER, S1-S01, CALS/DEG K-MOLE H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	.003	.002	.002	.002	.001			
.10	.005	.004	.004	.002	.000			
.20	.009	.007	.005	.002	-.004			
.30	.012	.010	.006	.001	-.009			
.40	.015	.011	.006	-.001	-.015			
.50	.017	.013	.006	-.004	-.023			
.60	.020	.014	.006	-.008	-.031			
.70	.022	.015	.005	-.012	-.040			
.80	.024	.016	.003	-.016	-.050			
.90	.026	.016	.002	-.021	-.061			
1.00	.028	.016	-.000	-.026	-.071			
1.20	.031	.016	-.005	-.037	-.095			
1.40	.033	.015	-.011	-.050	-.120			
1.60	.035	.013	-.017	-.064	-.146			
1.80	.036	.011	-.024	-.079	-.174			
2.00	.037	.008	-.032	-.095	-.203			
2.25	.038	.004	-.043	-.115	-.241			
2.50	.039	-.001	-.055	-.137	-.280			
2.75	.038	-.006	-.067	-.160	-.321			
3.00	.038	-.012	-.080	-.184	-.363			
3.25	.037	-.018	-.094	-.209	-.406			
3.50	.035	-.025	-.108	-.234	-.450			
3.75	.033	-.032	-.123	-.260	-.494			
4.00	.031	-.040	-.138	-.286	-.540			
4.50	.025	-.057	-.169	-.341	-.633			
5.00	.018	-.074	-.202	-.396	-.728			
5.50	.009	-.093	-.236	-.453	-.825			
6.00	-.002	-.114	-.271	-.511	-.923			

RELATIVE PARTIAL MOLAL ENTROPY OF THE SOLUTE, S2-S02, CALS/DEG K-MOLE OF SALT

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	12.785	12.997	13.223	13.464	13.732	14.039	14.401	14.840
.10	10.183	10.484	10.798	11.128	11.491	11.903	12.387	12.973
.20	7.492	7.926	8.367	8.821	9.311	9.862	10.504	11.278
.30	5.829	6.374	6.917	7.468	8.054	8.707	9.462	10.369
.40	4.585	5.230	5.863	6.497	7.165	7.902	8.750	9.764
.50	3.571	4.310	5.026	5.735	6.474	7.286	8.214	9.320
.60	2.703	3.532	4.325	5.104	5.909	6.787	7.787	8.974
.70	1.937	2.852	3.719	4.563	5.430	6.369	7.434	8.695
.80	1.247	2.244	3.182	4.089	5.014	6.010	7.135	8.463
.90	.615	1.693	2.699	3.665	4.645	5.695	6.876	8.267
1.00	.030	1.186	2.258	3.282	4.314	5.415	6.649	8.098
1.20	-1.032	.276	1.475	2.608	3.739	4.934	6.266	7.822
1.40	-1.981	-.528	.792	2.026	3.249	4.532	5.952	7.606
1.60	-2.844	-1.251	.183	1.515	2.823	4.187	5.689	7.432
1.80	-3.639	-1.911	-.366	1.057	2.447	3.886	5.464	7.289
2.00	-4.376	-2.517	-.867	.644	2.110	3.620	5.269	7.169
2.25	-5.228	-3.212	-1.436	.179	1.734	3.328	5.058	7.046
2.50	-6.014	-3.847	-1.951	-.238	1.401	3.071	4.877	6.946
2.75	-6.742	-4.430	-2.420	-.614	1.104	2.845	4.721	6.864
3.00	-7.417	-4.967	-2.847	-.954	.837	2.644	4.585	6.797
3.25	-8.045	-5.461	-3.237	-1.262	.598	2.466	4.467	6.743
3.50	-8.628	-5.916	-3.593	-1.540	.384	2.309	4.364	6.699
3.75	-9.169	-6.334	-3.918	-1.792	.192	2.169	4.275	6.664
4.00	-9.670	-6.718	-4.213	-2.018	.021	2.047	4.199	6.638
4.50	-10.559	-7.387	-4.718	-2.400	-.263	1.848	4.081	6.609
5.00	-11.305	-7.934	-5.120	-2.694	-.475	1.704	4.004	6.605
5.50	-11.916	-8.365	-5.423	-2.908	-.622	1.613	3.965	6.624
6.00	-12.396	-8.685	-5.634	-3.044	-.706	1.569	3.960	6.665

RELATIVE PARTIAL MOLAL ENTROPY OF THE SOLUTE, S2-S02, CALS/DEG K-MOLE OF SALT

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	15.396	16.141	17.220	18.932	22.010			
.10	13.714	14.708	16.148	18.435	22.549			
.20	12.254	13.563	15.458	18.469	23.885			
.30	11.511	13.040	15.251	18.762	25.075			
.40	11.038	12.741	15.202	19.106	26.119			
.50	10.706	12.556	15.225	19.457	27.052			
.60	10.458	12.436	15.288	19.803	27.898			
.70	10.267	12.360	15.373	20.138	28.676			
.80	10.116	12.313	15.472	20.464	29.398			
.90	9.995	12.287	15.580	20.778	30.073			
1.00	9.895	12.277	15.694	21.082	30.708			
1.20	9.747	12.290	15.930	21.660	31.880			
1.40	9.644	12.332	16.171	22.203	32.945			
1.60	9.574	12.392	16.411	22.715	33.925			
1.80	9.526	12.464	16.647	23.199	34.833			
2.00	9.495	12.544	16.879	23.659	35.682			
2.25	9.474	12.651	17.160	24.202	36.670			
2.50	9.467	12.762	17.432	24.715	37.590			
2.75	9.472	12.875	17.694	25.199	38.452			
3.00	9.485	12.989	17.946	25.659	39.262			
3.25	9.504	13.103	18.189	26.096	40.026			
3.50	9.529	13.216	18.423	26.512	40.749			
3.75	9.559	13.328	18.649	26.909	41.436			
4.00	9.592	13.438	18.866	27.288	42.090			
4.50	9.668	13.653	19.278	27.999	43.308			
5.00	9.755	13.861	19.661	28.653	44.422			
5.50	9.850	14.062	20.019	29.256	45.446			
6.00	9.953	14.257	20.353	29.813	46.391			

TOTAL RELATIVE PARTIAL MOLAL HEAT CAPACITY OF THE SOLUTION, J, CALS/DEG K

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	.089	.102	.121	.147	.183	.234	.308	.425
.10	.248	.283	.331	.400	.496	.631	.830	1.148
.20	.699	.781	.901	1.079	1.331	1.687	2.214	3.061
.30	1.288	1.421	1.622	1.926	2.363	2.985	3.912	5.403
.40	1.998	2.178	2.464	2.907	3.548	4.468	5.846	8.067
.50	2.816	3.042	3.414	4.002	4.864	6.107	7.976	10.995
.60	3.736	4.002	4.461	5.200	6.294	7.882	10.276	14.151
.70	4.752	5.055	5.598	6.492	7.829	9.779	12.728	17.509
.80	5.862	6.195	6.821	7.872	9.459	11.787	15.317	21.049
.90	7.061	7.418	8.124	9.335	11.180	13.898	18.033	24.755
1.00	8.348	8.721	9.505	10.876	12.984	16.106	20.867	28.617
1.20	11.171	11.558	12.485	14.178	16.828	20.789	26.859	36.763
1.40	14.317	14.688	15.741	17.754	20.963	25.800	33.246	45.421
1.60	17.770	18.096	19.257	21.586	25.364	31.109	39.992	54.543
1.80	21.519	21.767	23.017	25.656	30.013	36.693	47.065	64.086
2.00	25.552	25.691	27.008	29.950	34.892	42.533	54.442	74.019
2.25	30.978	30.934	32.306	35.612	41.294	50.164	64.056	86.941
2.50	36.812	36.535	37.925	41.581	48.006	58.136	74.075	100.379
2.75	43.037	42.474	43.848	47.835	55.007	66.422	84.465	114.295
3.00	49.637	48.735	50.056	54.355	62.275	74.999	95.198	128.652
3.25	56.594	55.301	56.530	61.123	69.790	83.844	106.250	143.419
3.50	63.892	62.155	63.256	68.121	77.533	92.937	117.596	158.568
3.75	71.517	69.282	70.217	75.333	85.486	102.258	129.214	174.071
4.00	79.453	76.667	77.396	82.742	93.634	111.789	141.084	189.906
4.50	96.199	92.150	92.354	98.092	110.445	131.413	165.504	222.479
5.00	114.013	108.488	108.012	114.051	127.844	151.677	190.713	256.121
5.50	132.783	125.569	124.259	130.507	145.713	172.460	216.578	290.683
6.00	152.398	143.284	140.985	147.349	163.941	193.645	242.977	326.029

TOTAL RELATIVE PARTIAL MOLAL HEAT CAPACITY OF THE SOLUTION, J, CALS/DEG K

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000	------	------	------	------
.05	.630	1.020	1.851	3.978				
.10	1.702	2.758	5.007	10.764				
.20	4.540	7.359	13.368	28.747				
.30	8.012	12.985	23.586	50.718				
.40	11.956	19.371	35.177	75.625				
.50	16.285	26.375	47.877	102.895				
.60	20.945	33.903	61.517	132.160				
.70	25.895	41.893	75.977	163.161				
.80	31.107	50.295	91.169	195.702				
.90	36.557	59.071	107.023	229.633				
1.00	42.227	68.191	123.482	264.831				
1.20	54.168	87.367	158.040	338.645				
1.40	66.831	107.663	194.551	416.513				
1.60	80.143	128.960	232.800	497.968				
1.80	94.047	151.165	272.616	582.646				
2.00	108.493	174.202	313.865	670.256				
2.25	127.254	204.074	367.271	783.532				
2.50	146.736	235.046	422.560	900.635				
2.75	166.883	267.032	479.581	1021.248				
3.00	187.647	299.959	538.209	1145.110				
3.25	208.984	333.765	598.335	1271.993				
3.50	230.859	368.394	659.864	1401.704				
3.75	253.235	403.795	722.714	1534.073				
4.00	276.083	439.925	786.810	1668.950				
4.50	323.080	514.210	918.481	1945.708				
5.00	371.643	590.963	1054.416	2231.060				
5.50	421.592	669.937	1194.227	2524.250				
6.00	472.763	750.917	1337.581	2824.640				

RELATIVE PARTIAL MOLAL HEAT CAPACITY OF WATER, J1, CALS/DEG K-MOLE OF H2O

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	-.001	-.001	-.001	-.001	-.001	-.002	-.002	-.003
.10	-.002	-.002	-.003	-.003	-.004	-.005	-.006	-.009
.20	-.006	-.007	-.007	-.008	-.010	-.012	-.016	-.022
.30	-.012	-.012	-.013	-.015	-.018	-.022	-.028	-.039
.40	-.019	-.019	-.020	-.023	-.026	-.032	-.042	-.057
.50	-.028	-.027	-.029	-.031	-.036	-.044	-.056	-.076
.60	-.037	-.037	-.038	-.041	-.047	-.057	-.072	-.097
.70	-.049	-.047	-.048	-.052	-.059	-.070	-.089	-.120
.80	-.061	-.059	-.059	-.063	-.071	-.085	-.107	-.143
.90	-.074	-.071	-.071	-.075	-.084	-.100	-.125	-.168
1.00	-.089	-.085	-.084	-.088	-.098	-.116	-.145	-.193
1.20	-.122	-.115	-.112	-.117	-.129	-.150	-.186	-.247
1.40	-.158	-.148	-.144	-.148	-.161	-.186	-.230	-.304
1.60	-.199	-.184	-.178	-.181	-.196	-.225	-.276	-.363
1.80	-.243	-.224	-.214	-.216	-.232	-.266	-.324	-.425
2.00	-.291	-.266	-.253	-.253	-.270	-.308	-.374	-.489
2.25	-.355	-.322	-.304	-.302	-.320	-.362	-.439	-.572
2.50	-.424	-.382	-.357	-.353	-.371	-.418	-.505	-.657
2.75	-.496	-.444	-.413	-.405	-.424	-.475	-.572	-.743
3.00	-.572	-.509	-.470	-.458	-.477	-.533	-.641	-.831
3.25	-.650	-.576	-.528	-.511	-.530	-.591	-.709	-.920
3.50	-.732	-.644	-.587	-.565	-.583	-.649	-.778	-1.010
3.75	-.815	-.713	-.646	-.619	-.636	-.706	-.847	-1.099
4.00	-.899	-.783	-.705	-.672	-.688	-.762	-.914	-1.188
4.50	-1.072	-.923	-.821	-.774	-.787	-.870	-1.045	-1.364
5.00	-1.245	-1.059	-.931	-.869	-.877	-.968	-1.169	-1.534
5.50	-1.415	-1.189	-1.032	-.952	-.955	-1.055	-1.281	-1.694
6.00	-1.578	-1.309	-1.120	-1.020	-1.018	-1.127	-1.379	-1.843

RELATIVE PARTIAL MOLAL HEAT CAPACITY OF WATER, J1, CALS/DEG K-MOLE OF H2O

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000
.05	-.005	-.008	-.015	-.032
.10	-.013	-.021	-.038	-.083
.20	-.033	-.054	-.098	-.211
.30	-.057	-.092	-.167	-.360
.40	-.084	-.135	-.244	-.523
.50	-.112	-.180	-.326	-.697
.60	-.143	-.229	-.412	-.880
.70	-.175	-.280	-.503	-1.071
.80	-.208	-.333	-.596	-1.268
.90	-.243	-.387	-.693	-1.470
1.00	-.280	-.444	-.792	-1.678
1.20	-.355	-.562	-.998	-2.107
1.40	-.435	-.685	-1.213	-2.551
1.60	-.519	-.814	-1.435	-3.008
1.80	-.605	-.946	-1.664	-3.478
2.00	-.694	-1.083	-1.899	-3.957
2.25	-.809	-1.259	-2.200	-4.570
2.50	-.928	-1.439	-2.508	-5.196
2.75	-1.049	-1.624	-2.823	-5.834
3.00	-1.172	-1.812	-3.144	-6.481
3.25	-1.297	-2.003	-3.470	-7.139
3.50	-1.423	-2.196	-3.801	-7.805
3.75	-1.550	-2.392	-4.135	-8.478
4.00	-1.677	-2.590	-4.474	-9.159
4.50	-1.932	-2.988	-5.159	-10.539
5.00	-2.184	-3.388	-5.853	-11.941
5.50	-2.429	-3.787	-6.553	-13.359
6.00	-2.666	-4.181	-7.255	-14.790

RELATIVE PARTIAL MOLAL HEAT CAPACITY OF THE SOLUTE, J2, CALS/DEG K-MOLE OF SALT

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	2.632	3.002	3.519	4.261	5.293	6.735	8.860	12.255
.10	3.693	4.137	4.787	5.743	7.092	8.996	11.818	16.345
.20	5.246	5.744	6.521	7.713	9.435	11.900	15.584	21.524
.30	6.516	7.013	7.848	9.178	11.138	13.974	18.243	25.151
.40	7.650	8.121	8.981	10.403	12.536	15.654	20.374	28.035
.50	8.700	9.132	9.996	11.482	13.750	17.096	22.188	30.472
.60	9.691	10.075	10.932	12.463	14.840	18.377	23.786	32.605
.70	10.638	10.967	11.807	13.370	15.837	19.539	25.225	34.515
.80	11.550	11.819	12.635	14.220	16.763	20.610	26.543	36.254
.90	12.432	12.637	13.423	15.023	17.631	21.606	27.762	37.857
1.00	13.289	13.426	14.179	15.786	18.450	22.541	28.901	39.348
1.20	14.936	14.932	15.607	17.215	19.968	24.261	30.984	42.059
1.40	16.508	16.355	16.943	18.535	21.357	25.821	32.859	44.487
1.60	18.015	17.708	18.200	19.767	22.640	27.251	34.569	46.693
1.80	19.464	18.998	19.389	20.921	23.834	28.574	36.144	48.717
2.00	20.858	20.232	20.517	22.006	24.949	29.803	37.604	50.590
2.25	22.531	21.700	21.847	23.277	26.244	31.225	39.288	52.749
2.50	24.131	23.092	23.098	24.459	27.442	32.534	40.837	54.734
2.75	25.661	24.412	24.272	25.561	28.551	33.742	42.266	56.568
3.00	27.124	25.664	25.376	26.588	29.578	34.858	43.587	58.269
3.25	28.522	26.850	26.412	27.543	30.527	35.889	44.810	59.850
3.50	29.857	27.973	27.383	28.430	31.405	36.840	45.542	61.321
3.75	31.131	29.033	28.291	29.252	32.213	37.716	46.990	62.692
4.00	32.346	30.034	29.138	30.012	32.955	38.521	47.959	63.969
4.50	34.598	31.859	30.654	31.348	34.250	39.930	49.674	66.267
5.00	36.622	33.456	31.942	32.453	35.306	41.087	51.116	68.252
5.50	38.421	34.832	33.008	33.334	36.133	42.006	52.304	69.952
6.00	40.000	35.990	33.859	33.999	36.742	42.699	53.253	71.389

RELATIVE PARTIAL MOLAL HEAT CAPACITY OF THE SOLUTE, J2, CALS/DEG K-MOLE OF SALT

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000				
.05	18.173	29.441	53.453	114.924				
.10	24.249	39.313	71.422	153.621				
.20	31.920	51.748	94.015	202.197				
.30	37.259	60.361	109.601	235.593				
.40	41.479	67.132	121.795	261.624				
.50	45.022	72.786	131.933	283.182				
.60	48.105	77.683	140.673	301.697				
.70	50.853	82.027	148.393	317.991				
.80	53.344	85.946	155.330	332.584				
.90	55.629	89.528	161.647	345.827				
1.00	57.746	92.835	167.458	357.970				
1.20	61.579	98.793	177.878	379.652				
1.40	64.993	104.070	187.058	398.649				
1.60	68.083	108.825	195.288	415.601				
1.80	70.910	113.162	202.766	430.939				
2.00	73.520	117.156	209.630	444.965				
2.25	76.527	121.749	217.498	460.987				
2.50	79.292	125.968	224.712	475.624				
2.75	81.851	129.873	231.377	489.112				
3.00	84.229	133.507	237.575	501.628				
3.25	86.448	136.903	243.369	513.310				
3.50	88.523	140.091	248.810	524.266				
3.75	90.469	143.090	253.938	534.586				
4.00	92.295	145.919	258.786	544.341				
4.50	95.624	151.126	267.747	562.385				
5.00	98.569	155.804	275.865	578.773				
5.50	101.171	160.023	283.268	593.776				
6.00	103.463	163.834	290.049	607.600				

TOTAL EXCESS GIBBS ENERGY OF THE SOLUTION, GEX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-7.457	-8.362	-9.453	-10.742	-12.249	-14.003	-16.043	-18.422
.10	-19.567	-21.841	-24.633	-27.974	-31.909	-36.514	-41.893	-48.190
.20	-50.174	-55.601	-62.490	-70.893	-80.918	-92.749	-106.656	-123.017
.30	-85.955	-94.680	-106.100	-120.275	-137.369	-157.687	-181.692	-210.040
.40	-125.151	-137.110	-153.248	-173.612	-198.411	-228.076	-263.280	-304.985
.50	-166.840	-181.868	-202.788	-229.610	-262.577	-302.245	-349.504	-405.651
.60	-210.443	-228.318	-254.012	-287.472	-328.963	-379.161	-439.184	-510.681
.70	-255.556	-276.018	-306.430	-346.652	-396.952	-458.124	-531.517	-619.147
.80	-301.877	-324.643	-359.684	-406.749	-466.092	-538.620	-625.916	-730.374
.90	-349.171	-373.941	-413.500	-467.457	-536.041	-620.259	-721.933	-843.845
1.00	-397.246	-423.708	-467.657	-528.535	-606.525	-702.732	-819.214	-959.152
1.20	-495.118	-524.005	-576.301	-651.036	-748.253	-869.220	-1016.471	-1194.004
1.40	-594.457	-624.465	-684.483	-773.019	-889.903	-1036.534	-1215.912	-1432.878
1.60	-694.452	-724.276	-791.357	-893.576	-1030.476	-1203.548	-1416.248	-1674.281
1.80	-794.444	-822.790	-896.264	-1012.007	-1169.208	-1369.405	-1616.501	-1917.077
2.00	-893.872	-919.472	-998.669	-1127.759	-1305.499	-1533.437	-1815.906	-2160.378
2.25	-1016.628	-1037.063	-1122.490	-1267.998	-1471.704	-1735.105	-2063.053	-2464.142
2.50	-1136.911	-1150.332	-1241.001	-1402.634	-1632.595	-1932.265	-2306.985	-2766.489
2.75	-1253.986	-1258.633	-1353.608	-1531.091	-1787.579	-2124.269	-2546.968	-3066.552
3.00	-1367.192	-1361.405	-1459.814	-1652.900	-1936.183	-2310.611	-2782.423	-3363.650
3.25	-1475.926	-1458.150	-1559.194	-1767.676	-2078.031	-2490.890	-3012.898	-3657.244
3.50	-1579.632	-1548.425	-1651.381	-1875.101	-2212.821	-2664.793	-3238.038	-3946.909
3.75	-1677.792	-1631.828	-1736.059	-1974.910	-2340.316	-2832.079	-3457.572	-4232.313
4.00	-1769.921	-1707.994	-1812.951	-2066.886	-2460.326	-2992.564	-3671.294	-4513.204
4.50	-1934.267	-1837.296	-1942.429	-2226.650	-2677.361	-3292.647	-4080.760	-5060.745
5.00	-2069.247	-1933.928	-2038.191	-2353.321	-2863.195	-3564.452	-4465.799	-5588.650
5.50	-2171.713	-1995.795	-2098.958	-2446.220	-3017.548	-3807.906	-4826.359	-6096.714
6.00	-2238.726	-2021.041	-2123.722	-2504.973	-3140.485	-4023.330	-5162.843	-6585.247

TOTAL EXCESS GIBBS ENERGY OF THE SOLUTION, GEX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	-21.219	-24.548	-28.600	-33.708	-40.510			
.10	-55.610	-64.468	-75.277	-88.941	-107.182			
.20	-142.375	-165.564	-193.959	-229.972	-278.203			
.30	-243.682	-284.087	-333.678	-396.711	-481.304			
.40	-354.603	-414.321	-487.747	-581.230	-706.872			
.50	-472.596	-553.309	-652.698	-779.400	-949.881			
.60	-596.091	-699.222	-826.379	-988.652	-1207.190			
.70	-724.012	-850.807	-1007.312	-1207.218	-1476.633			
.80	-855.577	-1007.147	-1194.415	-1433.800	-1756.613			
.90	-990.184	-1167.540	-1386.856	-1667.399	-2045.902			
1.00	-1127.360	-1331.429	-1583.975	-1907.220	-2343.518			
1.20	-1407.937	-1667.954	-1990.184	-2403.037	-2960.656			
1.40	-1694.913	-2013.905	-2409.686	-2917.196	-3603.006			
1.60	-1986.539	-2367.217	-2840.016	-3446.708	-4266.859			
1.80	-2281.486	-2726.310	-3279.279	-3989.266	-4949.342			
2.00	-2578.703	-3089.936	-3725.972	-4543.035	-5648.161			
2.25	-2952.152	-3549.326	-4292.951	-5248.755	-6541.828			
2.50	-3326.532	-4012.654	-4867.720	-5967.290	-7455.109			
2.75	-3700.805	-4478.661	-5448.732	-6696.713	-8385.565			
3.00	-4074.147	-4946.332	-6034.729	-7435.447	-9331.177			
3.25	-4445.897	-5414.847	-6624.679	-8182.182	-10290.259			
3.50	-4815.527	-5883.536	-7217.729	-8935.822	-11261.383			
3.75	-5182.616	-6351.858	-7813.175	-9695.447	-12243.339			
4.00	-5546.834	-6819.373	-8410.433	-10460.283	-13235.088			
4.50	-6265.702	-7750.655	-9608.552	-12003.075	-15244.539			
5.00	-6970.807	-8675.409	-10809.215	-13560.124	-17284.022			
5.50	-7661.605	-9592.560	-12010.603	-15128.600	-19349.328			
6.00	-8338.147	-10501.723	-13211.699	-16706.621	-21437.388			

EXCESS PARTIAL GIBBS ENERGY OF WATER, G1EX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	3.030	3.353	3.765	4.270	4.873	5.587	6.427	7.417
.10	7.361	8.036	8.964	10.146	11.594	13.334	15.407	17.869
.20	17.045	18.168	20.026	22.597	25.894	29.967	34.908	40.859
.30	27.101	28.240	30.775	34.637	39.817	46.384	54.478	64.331
.40	37.086	37.782	40.706	45.709	52.743	61.878	73.304	87.342
.50	46.782	46.581	49.599	55.578	64.410	76.158	91.050	109.499
.60	56.046	54.502	57.322	64.110	74.678	89.065	107.532	130.584
.70	64.772	61.451	63.787	71.218	83.453	100.496	122.634	150.459
.80	72.867	67.348	68.924	76.834	90.668	110.380	136.272	169.025
.90	80.250	72.127	72.674	80.907	96.272	118.660	148.384	186.206
1.00	86.848	75.727	74.988	83.392	100.223	125.294	158.919	201.942
1.20	97.414	79.181	75.139	83.457	103.033	133.485	175.107	228.894
1.40	104.055	77.320	69.075	76.787	98.886	134.742	184.599	249.589
1.60	106.303	69.803	56.551	63.199	87.637	128.934	187.249	263.841
1.80	103.725	56.328	37.361	42.561	69.196	115.987	182.979	271.544
2.00	95.916	36.621	11.335	14.775	43.516	95.880	171.770	272.657
2.25	78.217	2.849	-31.024	-30.103	1.223	60.711	148.046	264.812
2.50	51.039	-41.484	-84.510	-86.309	-52.344	14.506	113.671	246.831
2.75	13.713	-96.770	-149.296	-153.852	-117.073	-42.543	68.875	218.943
3.00	-34.399	-163.369	-225.518	-232.691	-192.797	-110.184	13.955	181.458
3.25	-93.907	-241.606	-313.273	-322.746	-279.301	-188.112	-50.729	134.751
3.50	-165.400	-331.784	-412.631	-423.905	-376.337	-275.979	-124.770	79.253
3.75	-249.447	-434.183	-523.638	-536.026	-483.619	-373.401	-207.720	15.444
4.00	-346.604	-549.065	-646.317	-658.945	-600.838	-479.960	-299.093	-56.155
4.50	-582.392	-817.249	-926.703	-936.412	-863.729	-718.699	-505.019	-220.474
5.00	-876.958	-1138.158	-1253.665	-1254.625	-1162.111	-988.396	-738.132	-408.934
5.50	-1234.356	-1513.453	-1626.897	-1611.689	-1492.847	-1284.977	-993.706	-616.411
6.00	-1658.535	-1944.676	-2045.955	-2005.553	-1852.618	-1604.164	-1266.779	-837.515

EXCESS PARTIAL GIBBS ENERGY OF WATER, G1EX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	8.589	9.996	11.722	13.915	16.859
.10	20.808	24.355	28.731	34.320	41.860
.20	48.031	56.760	67.602	81.540	100.447
.30	76.299	90.950	109.234	132.826	164.923
.40	104.504	125.610	152.041	186.232	232.826
.50	132.177	160.175	195.330	240.887	303.034
.60	159.058	194.326	238.705	296.292	374.892
.70	184.978	227.855	281.906	352.113	447.960
.80	209.817	260.611	324.740	408.100	521.912
.90	233.480	292.475	367.056	464.061	596.492
1.00	255.892	323.352	408.733	519.835	671.488
1.20	296.729	381.844	489.774	630.312	822.052
1.40	331.954	435.594	567.215	738.677	972.467
1.60	361.314	484.257	640.584	844.291	1121.872
1.80	384.650	527.597	709.542	946.677	1269.607
2.00	401.882	565.468	773.853	1045.481	1415.164
2.25	414.814	605.010	847.487	1163.579	1593.471
2.50	418.265	635.892	913.499	1275.390	1767.253
2.75	412.426	658.234	971.901	1380.780	1936.178
3.00	397.582	672.258	1022.823	1479.751	2100.079
3.25	374.091	678.278	1066.496	1572.419	2258.922
3.50	342.377	676.675	1103.236	1659.000	2412.785
3.75	302.919	667.898	1133.426	1739.786	2561.839
4.00	256.240	652.445	1157.511	1815.140	2706.336
4.50	143.510	603.720	1189.394	1951.284	2982.981
5.00	9.069	535.273	1203.332	2071.348	3245.890
5.50	-141.796	452.331	1204.289	2179.838	3498.912
6.00	-303.499	360.464	1197.617	2281.698	3746.397

EXCESS GIBBS ENERGY OF THE SOLUTE, G2EX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-10.487	-11.715	-13.218	-15.012	-17.123	-19.590	-22.469	-25.839
.10	-26.928	-29.877	-33.597	-38.120	-43.504	-49.848	-57.300	-66.059
.20	-67.218	-73.770	-82.515	-93.490	-106.812	-122.716	-141.564	-163.876
.30	-113.057	-122.920	-136.875	-154.912	-177.186	-204.071	-236.170	-274.371
.40	-162.237	-174.892	-193.954	-219.321	-251.154	-289.955	-336.584	-392.327
.50	-213.622	-228.449	-252.387	-285.188	-326.988	-378.433	-440.553	-515.150
.60	-266.489	-282.820	-311.334	-351.582	-403.641	-468.226	-546.716	-641.264
.70	-320.327	-337.469	-370.217	-417.869	-480.405	-558.620	-654.151	-769.606
.80	-374.744	-391.991	-428.608	-483.583	-556.761	-649.000	-762.188	-899.399
.90	-429.422	-446.068	-486.174	-548.364	-632.313	-738.919	-870.317	-1030.051
1.00	-484.094	-499.435	-542.645	-611.927	-706.748	-828.026	-978.133	-1161.094
1.20	-592.533	-603.186	-651.440	-734.493	-851.286	-1002.705	-1191.578	-1422.898
1.40	-698.511	-701.784	-753.558	-849.806	-988.789	-1171.277	-1400.511	-1682.468
1.60	-800.755	-794.079	-847.908	-956.775	-1118.113	-1332.482	-1603.497	-1938.122
1.80	-898.169	-879.118	-933.625	-1054.568	-1238.404	-1485.392	-1799.480	-2188.621
2.00	-989.788	-956.093	-1010.004	-1142.533	-1349.015	-1629.317	-1987.676	-2433.035
2.25	-1094.845	-1039.912	-1091.466	-1237.895	-1472.927	-1795.816	-2211.099	-2728.954
2.50	-1187.950	-1108.848	-1156.491	-1316.325	-1580.251	-1946.771	-2420.657	-3013.319
2.75	-1267.699	-1161.863	-1204.312	-1377.239	-1670.505	-2081.726	-2615.843	-3285.495
3.00	-1332.793	-1198.036	-1234.297	-1420.210	-1743.386	-2200.427	-2796.379	-3545.108
3.25	-1382.019	-1216.544	-1245.921	-1444.930	-1798.729	-2302.777	-2962.169	-3791.995
3.50	-1414.233	-1216.641	-1238.750	-1451.196	-1836.485	-2388.813	-3113.268	-4026.162
3.75	-1428.345	-1197.646	-1212.421	-1438.884	-1856.696	-2458.678	-3249.852	-4247.757
4.00	-1423.317	-1158.930	-1166.633	-1407.941	-1859.488	-2512.604	-3372.201	-4457.049
4.50	-1351.874	-1020.047	-1015.726	-1290.238	-1813.632	-2573.948	-3575.741	-4840.271
5.00	-1192.289	-795.770	-784.526	-1098.696	-1701.084	-2576.056	-3727.666	-5179.716
5.50	-937.357	-482.342	-472.061	-834.531	-1524.701	-2522.929	-3832.653	-5480.303
6.00	-580.191	-76.365	-77.766	-499.419	-1287.868	-2419.166	-3896.065	-5747.732

EXCESS GIBBS ENERGY OF THE SOLUTE, G2EX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	-29.808	-34.544	-40.322	-47.624	-57.369
.10	-76.419	-88.823	-104.008	-123.261	-149.043
.20	-190.406	-222.324	-261.561	-311.512	-378.649
.30	-319.981	-375.037	-442.912	-529.538	-646.227
.40	-459.107	-539.931	-639.788	-767.461	-939.698
.50	-604.773	-713.484	-848.028	-1020.287	-1252.915
.60	-755.148	-893.548	-1065.084	-1284.944	-1582.082
.70	-908.990	-1078.662	-1289.218	-1559.331	-1924.593
.80	-1065.393	-1267.758	-1519.154	-1841.900	-2278.525
.90	-1223.664	-1460.015	-1753.912	-2131.460	-2642.393
1.00	-1383.252	-1654.781	-1992.708	-2427.055	-3015.006
1.20	-1704.666	-2049.798	-2479.958	-3033.349	-3782.708
1.40	-2026.866	-2449.499	-2976.901	-3655.873	-4575.473
1.60	-2347.853	-2851.474	-3480.600	-4290.999	-5388.731
1.80	-2666.136	-3253.907	-3988.821	-4935.943	-6218.949
2.00	-2980.585	-3655.404	-4499.825	-5588.517	-7063.324
2.25	-3366.966	-4154.337	-5140.438	-6412.334	-8135.299
2.50	-3744.796	-4648.547	-5781.219	-7242.680	-9222.362
2.75	-4113.231	-5136.895	-6420.633	-8077.493	-10321.743
3.00	-4471.728	-5618.591	-7057.552	-8915.198	-11431.256
3.25	-4819.988	-6093.124	-7691.175	-9754.601	-12549.180
3.50	-5157.904	-6560.211	-8320.965	-10594.821	-13674.168
3.75	-5485.535	-7019.756	-8946.601	-11435.233	-14805.178
4.00	-5803.075	-7471.818	-9567.945	-12275.422	-15941.424
4.50	-6409.212	-8354.375	-10797.947	-13954.359	-18227.520
5.00	-6979.876	-9210.682	-12012.547	-15631.472	-20529.912
5.50	-7519.809	-10044.891	-13214.891	-17308.438	-22848.240
6.00	-8034.649	-10862.188	-14409.316	-18988.319	-25183.785

TOTAL EXCESS ENTHALPY OF THE SOLUTION, HEX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	1.483	3.514	5.900	8.679	12.013	16.118	21.281	27.939
.10	2.591	8.313	14.933	22.561	31.639	42.761	56.709	74.674
.20	1.450	17.745	36.194	57.116	81.724	111.632	148.960	196.914
.30	-4.964	25.352	59.125	96.963	141.052	194.280	260.432	345.206
.40	-16.946	30.396	82.457	140.199	206.942	287.050	386.224	513.017
.50	-34.567	32.570	105.591	185.884	278.038	388.064	523.790	696.925
.60	-57.811	31.731	128.199	233.467	353.520	496.165	671.546	894.785
.70	-86.621	27.821	150.086	282.595	432.842	610.570	828.404	1105.113
.80	-120.918	20.829	171.135	333.028	515.617	730.709	993.567	1326.814
.90	-160.612	10.772	191.276	384.596	601.560	856.154	1166.423	1559.040
1.00	-205.602	-2.315	210.473	437.181	690.451	986.567	1346.485	1801.113
1.20	-311.043	-37.367	245.995	545.082	876.439	1261.260	1726.711	2312.662
1.40	-436.358	-83.828	277.765	656.311	1072.602	1553.145	2131.780	2857.958
1.60	-580.623	-141.106	306.013	770.696	1278.314	1861.060	2559.887	3434.389
1.80	-742.892	-208.550	331.070	888.223	1493.172	2184.155	3009.647	4039.912
2.00	-922.205	-285.468	353.341	1008.986	1716.928	2521.793	3479.969	4672.880
2.25	-1168.832	-393.837	377.956	1164.758	2008.938	2963.569	4095.454	5500.626
2.50	-1438.653	-514.425	399.901	1326.320	2314.558	3426.627	4740.306	6366.926
2.75	-1729.734	-645.736	420.219	1494.242	2633.851	3910.481	5413.416	7269.948
3.00	-2040.126	-786.241	440.006	1669.174	2966.998	4414.799	6113.891	8208.149
3.25	-2367.871	-934.386	460.401	1851.829	3314.268	4939.377	6841.001	9180.210
3.50	-2711.002	-1088.597	482.578	2042.973	3676.001	5484.136	7594.153	10184.989
3.75	-3067.542	-1247.283	507.739	2243.414	4052.599	6048.959	8372.858	11221.489
4.00	-3435.507	-1408.837	537.112	2453.995	4444.512	6633.977	9176.720	12288.834
4.50	-4197.752	-1734.061	613.500	2909.095	5276.284	7864.938	10858.689	14513.032
5.00	-4981.757	-2051.193	721.916	3415.545	6175.648	9178.294	12638.196	16852.317
5.50	-5771.474	-2347.020	872.755	3980.930	7147.364	10575.930	14514.147	19302.437
6.00	-6550.793	-2608.222	1076.579	4613.077	8196.524	12060.173	16486.036	21859.918

TOTAL EXCESS ENTHALPY OF THE SOLUTION, HEX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	36.857	49.484	68.714	100.782	161.211			
.10	98.733	132.816	184.760	271.450	434.910			
.20	261.072	351.959	490.538	721.931	1158.412			
.30	458.483	618.874	863.397	1271.684	2041.809			
.40	682.217	921.622	1286.466	1895.502	3044.018			
.50	927.656	1253.862	1750.736	2579.852	4142.864			
.60	1191.892	1611.584	2250.483	3316.104	5324.163			
.70	1472.900	1991.986	2781.702	4098.205	6577.944			
.80	1769.181	2392.986	3341.404	4921.637	7896.761			
.90	2079.569	2812.962	3927.265	5782.877	9274.809			
1.00	2403.129	3250.609	4537.409	6679.089	10707.413			
1.20	3086.794	4174.772	5824.592	8567.422	13721.469			
1.40	3815.296	5158.643	7193.139	10571.810	16914.581			
1.60	4584.962	6197.070	8635.654	12681.109	20268.515			
1.80	5392.899	7285.982	10146.300	14886.555	23768.996			
2.00	6236.751	8422.055	11720.313	17181.020	27404.469			
2.25	7339.096	9904.256	13770.917	20165.307	32124.175			
2.50	8491.265	11451.226	15907.777	23269.714	37024.307			
2.75	9690.544	13059.092	18125.362	26486.064	42091.850			
3.00	10934.608	14724.520	20418.915	29807.358	47315.730			
3.25	12221.432	16444.593	22784.275	33227.499	52686.366			
3.50	13549.236	18216.726	25217.755	36741.103	58195.353			
3.75	14916.432	20038.599	27716.048	40343.360	63835.228			
4.00	16321.593	21908.117	30276.159	44029.932	69599.299			
4.50	19240.755	25782.581	35571.117	51640.540	81476.340			
5.00	22297.649	29826.528	41083.189	59544.963	93783.961			
5.50	25484.559	34028.212	46795.535	67719.100	106485.929			
6.00	28794.798	38377.284	52693.265	76141.751	119550.703			

EXCESS PARTIAL HEAT CONTENT OF WATER, H1EX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-.030	-1.026	-2.152	-3.427	-4.927	-6.749	-9.026	-11.953
.10	1.340	-1.523	-4.660	-8.130	-12.134	-16.940	-22.892	-30.513
.20	8.836	.335	-8.617	-18.202	-28.967	-41.620	-57.076	-76.690
.30	22.561	6.157	-10.669	-28.279	-47.656	-70.060	-97.101	-131.141
.40	42.252	15.828	-10.758	-38.102	-67.703	-101.459	-141.778	-192.157
.50	67.630	29.159	-8.971	-47.645	-88.949	-135.496	-190.580	-258.945
.60	98.420	45.946	-5.435	-56.953	-111.343	-172.009	-243.211	-331.034
.70	134.356	65.983	-.293	-66.097	-134.881	-210.906	-299.474	-408.099
.80	175.175	89.065	6.309	-75.164	-159.582	-252.132	-359.227	-489.893
.90	220.618	114.985	14.220	-84.246	-185.479	-295.653	-422.361	-576.220
1.00	270.428	143.539	23.289	-93.440	-212.612	-341.448	-488.788	-666.914
1.20	382.134	207.728	44.281	-112.580	-270.784	-439.832	-631.246	-860.848
1.40	508.261	279.991	68.038	-133.433	-334.540	-547.297	-786.156	-1070.747
1.60	646.786	358.681	93.289	-156.890	-404.384	-663.951	-953.207	-1295.850
1.80	795.680	442.139	118.744	-183.874	-480.872	-789.972	-1132.187	-1535.534
2.00	952.913	528.697	143.093	-215.338	-564.597	-925.592	-1322.961	-1789.279
2.25	1158.075	638.690	169.948	-262.463	-680.398	-1109.053	-1577.911	-2125.578
2.50	1369.089	747.593	190.370	-320.080	-809.797	-1308.598	-1851.156	-2482.469
2.75	1581.947	852.076	201.696	-390.198	-954.154	-1524.946	-2142.775	-2859.386
3.00	1792.627	948.789	201.232	-474.864	-1114.883	-1758.884	-2452.933	-3255.869
3.25	1997.096	1034.364	186.262	-576.159	-1293.441	-2011.256	-2781.865	-3671.552
3.50	2191.309	1105.415	154.046	-696.194	-1491.322	-2282.950	-3129.869	-4106.141
3.75	2371.212	1158.546	101.825	-837.102	-1710.052	-2574.899	-3497.289	-4559.405
4.00	2532.742	1190.347	26.825	-1001.040	-1951.183	-2888.066	-3884.514	-5031.167
4.50	2784.400	1176.269	-202.674	-1406.712	-2506.973	-3582.048	-4720.105	-6029.692
5.00	2913.655	1035.723	-556.887	-1930.770	-3171.513	-4373.118	-5640.380	-7101.077
5.50	2887.804	741.145	-1058.392	-2590.958	-3957.863	-5269.787	-6649.441	-8245.135
6.00	2674.084	264.892	-1729.874	-3405.160	-4879.255	-6280.790	-7751.664	-9462.017

EXCESS PARTIAL HEAT CONTENT OF WATER, H1EX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	-15.875	-21.439	-29.936	-44.142	-70.970			
.10	-40.702	-55.152	-77.226	-114.155	-183.919			
.20	-102.784	-139.687	-195.974	-290.038	-467.566			
.30	-176.185	-239.661	-336.228	-497.267	-800.657			
.40	-258.477	-351.587	-492.819	-727.771	-1169.481			
.50	-348.501	-473.768	-663.204	-977.536	-1567.179			
.60	-445.552	-605.162	-845.815	-1244.100	-1989.555			
.70	-549.136	-745.039	-1039.559	-1525.757	-2433.731			
.80	-658.875	-892.839	-1243.608	-1821.228	-2897.580			
.90	-774.461	-1048.110	-1457.293	-2129.500	-3379.446			
1.00	-895.636	-1210.470	-1680.060	-2449.739	-3877.984			
1.20	-1153.870	-1555.165	-2150.979	-3123.382	-4920.762			
1.40	-1432.046	-1924.676	-2653.153	-3837.487	-6018.679			
1.60	-1728.902	-2317.147	-3183.958	-4588.316	-7166.114			
1.80	-2043.364	-2730.989	-3741.162	-5372.746	-8358.480			
2.00	-2374.501	-3164.808	-4322.818	-6188.080	-9591.901			
2.25	-2810.634	-3733.299	-5081.647	-7247.110	-11186.334			
2.50	-3270.143	-4328.914	-5872.953	-8346.609	-12833.968			
2.75	-3751.797	-4949.717	-6694.019	-9482.905	-14529.773			
3.00	-4254.504	-5593.957	-7542.372	-10652.666	-16269.244			
3.25	-4777.288	-6260.030	-8415.731	-11852.832	-18048.285			
3.50	-5319.266	-6946.451	-9311.977	-13080.561	-19863.124			
3.75	-5879.634	-7651.837	-10229.117	-14333.185	-21710.245			
4.00	-6457.654	-8374.885	-11165.267	-15608.183	-23586.346			
4.50	-7663.969	-9869.105	-13087.501	-18215.799	-27413.122			
5.00	-8933.279	-11419.920	-15065.170	-20885.324	-31320.035			
5.50	-10261.212	-13018.838	-17085.657	-23599.855	-35285.350			
6.00	-11643.810	-14657.884	-19136.999	-26343.351	-39288.550			

EXCESS HEAT CONTENT OF THE SOLUTE, H2EX, CALS/KG-H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	1.513	4.540	8.052	12.106	16.939	22.867	30.307	39.892
.10	1.250	9.836	19.593	30.690	43.773	59.700	79.601	105.187
.20	-7.387	17.411	44.812	75.318	110.691	153.252	206.036	273.604
.30	-27.525	19.195	69.794	125.242	188.709	264.340	357.533	476.347
.40	-59.198	14.569	93.214	178.300	274.645	388.509	528.002	705.174
.50	-102.197	3.411	114.562	233.529	366.987	523.559	714.371	955.870
.60	-156.231	-14.215	133.635	290.420	464.863	668.173	914.757	1225.819
.70	-220.977	-38.162	150.380	348.693	567.723	821.476	1127.879	1513.212
.80	-296.093	-68.236	164.827	408.192	675.200	982.842	1352.795	1816.707
.90	-381.230	-104.213	177.056	468.842	787.038	1151.807	1588.784	2135.260
1.00	-476.030	-145.853	187.184	530.622	903.063	1328.015	1835.274	2468.027
1.20	-693.177	-245.094	201.714	657.662	1147.222	1701.092	2357.957	3173.510
1.40	-944.619	-363.819	209.727	789.744	1407.142	2100.442	2917.936	3928.705
1.60	-1227.408	-499.787	212.724	927.586	1682.698	2525.011	3513.093	4730.239
1.80	-1538.572	-650.689	212.326	1072.097	1974.043	2974.126	4141.834	5575.446
2.00	-1875.118	-814.164	210.248	1224.324	2281.526	3447.386	4802.930	6462.160
2.25	-2326.907	-1032.527	208.007	1427.220	2689.336	4072.622	5673.365	7626.204
2.50	-2807.742	-1262.018	209.531	1646.400	3124.355	4735.226	6591.461	8849.395
2.75	-3311.681	-1497.812	218.523	1884.440	3588.005	5435.427	7556.191	10129.334
3.00	-3832.753	-1735.030	238.774	2144.038	4081.881	6173.684	8566.823	11464.018
3.25	-4364.968	-1968.750	274.139	2427.988	4607.708	6950.633	9622.867	12851.762
3.50	-4902.311	-2194.013	328.532	2739.167	5167.323	7767.056	10724.021	14291.130
3.75	-5438.754	-2405.830	405.915	3080.516	5762.651	8623.858	11870.147	15780.894
4.00	-5968.249	-2599.184	510.287	3455.035	6395.695	9522.043	13061.233	17320.001
4.50	-6982.152	-2910.330	816.174	4315.807	7783.257	11446.986	15578.794	20542.725
5.00	-7895.412	-3086.916	1278.803	5346.315	9347.161	13551.412	18278.576	23953.394
5.50	-8659.278	-3088.166	1931.147	6571.889	11105.226	15845.717	21163.588	27547.572
6.00	-9224.877	-2873.114	2806.453	8018.237	13075.780	18340.963	24237.699	31321.935

EXCESS HEAT CONTENT CF THE SOLUTE, H2EX, CALS/KG-H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	52.732	70.924	98.650	144.924	232.181			
.10	139.435	187.967	261.986	385.605	618.829			
.20	363.856	491.646	686.512	1011.969	1625.978			
.30	634.668	858.536	1199.624	1768.951	2842.467			
.40	940.695	1273.209	1779.285	2623.272	4213.499			
.50	1276.158	1727.630	2413.940	3557.388	5710.043			
.60	1637.444	2216.746	3096.298	4560.205	7313.718			
.70	2022.036	2737.025	3821.261	5623.962	9011.675			
.80	2428.056	3285.825	4585.012	6742.864	10794.342			
.90	2854.031	3861.072	5384.558	7912.377	12654.255			
1.00	3298.765	4461.079	6217.469	9128.829	14585.397			
1.20	4240.665	5729.937	7975.571	11690.804	18642.231			
1.40	5247.342	7083.319	9846.292	14409.296	22933.260			
1.60	6313.863	8514.217	11819.612	17269.425	27434.629			
1.80	7436.263	10016.971	13887.462	20259.300	32127.475			
2.00	8611.252	11586.863	16043.131	23369.100	36996.370			
2.25	10149.730	13637.556	18852.563	27412.417	43310.509			
2.50	11761.409	15780.140	21780.730	31616.323	49858.275			
2.75	13442.341	18008.809	24819.381	35968.969	56621.623			
3.00	15189.112	20318.477	27961.287	40460.024	63584.974			
3.25	16998.720	22704.623	31200.006	45080.331	70734.652			
3.50	18868.502	25163.177	34529.732	49821.664	78058.477			
3.75	20796.066	27690.436	37945.165	54676.545	85545.473			
4.00	22779.248	30283.002	41441.426	59638.115	93185.645			
4.50	26904.725	35651.686	48658.618	69856.339	108889.461			
5.00	31230.928	41246.447	56148.360	80430.287	125103.996			
5.50	35745.770	47047.050	63881.192	91318.955	141771.279			
6.00	40438.668	53035.168	71830.265	102485.102	158839.253			

TOTAL EXCESS ENTROPY OF SOLUTION,STEX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	.033	.040	.048	.056	.065	.076	.088	.103
.10	.081	.101	.122	.145	.170	.199	.233	.274
.20	.189	.246	.305	.368	.436	.513	.604	.714
.30	.297	.403	.511	.624	.746	.884	1.045	1.239
.40	.396	.562	.729	.901	1.086	1.294	1.535	1.825
.50	.484	.719	.954	1.193	1.449	1.734	2.064	2.460
.60	.559	.872	1.183	1.496	1.829	2.198	2.625	3.136
.70	.618	1.019	1.413	1.807	2.224	2.684	3.214	3.848
.80	.662	1.159	1.643	2.125	2.631	3.188	3.827	4.590
.90	.690	1.290	1.872	2.447	3.049	3.708	4.463	5.362
1.00	.702	1.413	2.098	2.774	3.476	4.243	5.118	6.159
1.20	.674	1.632	2.545	3.436	4.354	5.351	6.483	7.825
1.40	.579	1.813	2.978	4.106	5.259	6.504	7.911	9.575
1.60	.417	1.956	3.396	4.780	6.187	7.697	9.397	11.399
1.80	.189	2.060	3.798	5.458	7.135	8.925	10.933	13.292
2.00	-.104	2.126	4.184	6.137	8.100	10.185	12.515	15.248
2.25	-.557	2.157	4.643	6.988	9.328	11.801	14.554	17.773
2.50	-1.105	2.133	5.078	7.838	10.578	13.459	16.654	20.380
2.75	-1.742	2.056	5.489	8.690	11.849	15.157	18.812	23.065
3.00	-2.464	1.929	5.879	9.542	13.140	16.892	21.024	25.821
3.25	-3.265	1.757	6.250	10.396	14.451	18.662	23.287	28.645
3.50	-4.142	1.542	6.604	11.254	15.781	20.467	25.599	31.534
3.75	-5.088	1.290	6.944	12.116	17.132	22.306	27.958	34.484
4.00	-6.098	1.003	7.272	12.985	18.504	24.178	30.363	37.492
4.50	-8.287	.346	7.909	14.752	21.315	28.024	35.305	43.677
5.00	-10.663	-.393	8.541	16.570	24.223	32.005	40.421	50.075
5.50	-13.179	-1.178	9.196	18.461	27.241	36.127	45.706	56.676
6.00	-15.786	-1.969	9.903	20.445	30.382	40.396	51.161	63.472

TOTAL EXCESS ENTROPY OF SOLUTION,STEX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	.123	.149	.186	.245	.352
.10	.326	.396	.497	.657	.946
.20	.853	1.039	1.308	1.737	2.507
.30	1.484	1.813	2.288	3.044	4.402
.40	2.191	2.682	3.391	4.518	6.544
.50	2.959	3.628	4.594	6.128	8.886
.60	3.779	4.639	5.881	7.853	11.396
.70	4.643	5.707	7.243	9.679	14.053
.80	5.547	6.826	8.670	11.594	16.843
.90	6.488	7.991	10.158	13.592	19.752
1.00	7.462	9.198	11.701	15.664	22.771
1.20	9.500	11.729	14.938	20.014	29.106
1.40	11.646	14.398	18.356	24.608	35.798
1.60	13.889	17.192	21.936	29.422	42.808
1.80	16.220	20.099	25.663	34.436	50.106
2.00	18.631	23.109	29.526	39.632	57.668
2.25	21.750	27.007	34.529	46.363	67.462
2.50	24.977	31.043	39.712	53.338	77.605
2.75	28.303	35.206	45.062	60.536	88.070
3.00	31.721	39.488	50.566	67.943	98.834
3.25	35.226	43.881	56.215	75.544	109.878
3.50	38.814	48.380	62.000	83.329	121.184
3.75	42.479	52.977	67.914	91.287	132.738
4.00	46.219	57.668	73.949	99.407	144.525
4.50	53.908	67.316	86.361	116.106	168.753
5.00	61.859	77.290	99.192	133.367	193.785
5.50	70.054	87.566	112.408	151.141	219.550
6.00	78.480	98.121	125.977	169.385	245.988

EXCESS PARTIAL ENTROPY OF WATER, S1EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	-.011	-.015	-.018	-.022	-.026	-.031	-.037	-.043
.10	-.022	-.032	-.042	-.052	-.064	-.076	-.091	-.108
.20	-.030	-.060	-.089	-.117	-.147	-.180	-.217	-.262
.30	-.017	-.074	-.128	-.181	-.234	-.292	-.358	-.436
.40	.019	-.074	-.159	-.241	-.323	-.410	-.508	-.624
.50	.076	-.058	-.181	-.296	-.411	-.532	-.666	-.822
.60	.155	-.029	-.194	-.348	-.499	-.656	-.829	-1.030
.70	.255	.015	-.198	-.394	-.585	-.782	-.998	-1.246
.80	.375	.073	-.194	-.437	-.671	-.910	-1.171	-1.470
.90	.514	.144	-.181	-.474	-.755	-1.041	-1.349	-1.701
1.00	.672	.227	-.160	-.508	-.838	-1.172	-1.531	-1.939
1.20	1.042	.431	-.095	-.563	-1.002	-1.440	-1.906	-2.432
1.40	1.480	.680	-.003	-.604	-1.162	-1.713	-2.294	-2.946
1.60	1.979	.969	.114	-.632	-1.319	-1.991	-2.695	-3.480
1.80	2.533	1.294	.252	-.650	-1.474	-2.275	-3.108	-4.032
2.00	3.137	1.650	.408	-.661	-1.630	-2.566	-3.532	-4.601
2.25	3.953	2.133	.622	-.667	-1.827	-2.938	-4.079	-5.334
2.50	4.825	2.647	.851	-.671	-2.030	-3.323	-4.643	-6.090
2.75	5.741	3.182	1.086	-.679	-2.243	-3.723	-5.227	-6.869
3.00	6.689	3.730	1.321	-.696	-2.471	-4.141	-5.830	-7.670
3.25	7.655	4.280	1.546	-.728	-2.718	-4.579	-6.454	-8.493
3.50	8.628	4.820	1.754	-.782	-2.988	-5.041	-7.102	-9.339
3.75	9.594	5.342	1.936	-.865	-3.287	-5.529	-7.774	-10.208
4.00	10.541	5.834	2.083	-.983	-3.619	-6.048	-8.473	-11.101
4.50	12.326	6.686	2.241	-1.351	-4.404	-7.192	-9.961	-12.963
5.00	13.877	7.291	2.156	-1.942	-5.385	-8.501	-11.585	-14.933
5.50	15.091	7.562	1.759	-2.813	-6.606	-10.008	-13.366	-17.023
6.00	15.862	7.411	.978	-4.020	-8.111	-11.746	-15.325	-19.245

EXCESS PARTIAL ENTROPY OF WATER, S1EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000			
.05	-.052	-.063	-.080	-.106	-.153			
.10	-.130	-.160	-.203	-.271	-.394			
.20	-.319	-.394	-.504	-.678	-.991			
.30	-.534	-.664	-.851	-1.149	-1.685			
.40	-.767	-.958	-1.233	-1.667	-2.447			
.50	-1.016	-1.273	-1.641	-2.223	-3.263			
.60	-1.278	-1.605	-2.073	-2.810	-4.125			
.70	-1.552	-1.953	-2.526	-3.426	-5.028			
.80	-1.836	-2.315	-2.998	-4.067	-5.966			
.90	-2.130	-2.691	-3.487	-4.731	-6.937			
1.00	-2.434	-3.079	-3.993	-5.417	-7.938			
1.20	-3.066	-3.888	-5.048	-6.848	-10.020			
1.40	-3.728	-4.738	-6.156	-8.348	-12.198			
1.60	-4.418	-5.624	-7.311	-9.911	-14.460			
1.80	-5.132	-6.541	-8.508	-11.529	-16.799			
2.00	-5.868	-7.488	-9.742	-13.196	-19.205			
2.25	-6.817	-8.709	-11.334	-15.344	-22.297			
2.50	-7.795	-9.966	-12.972	-17.554	-25.475			
2.75	-8.801	-11.258	-14.653	-19.819	-28.729			
3.00	-9.832	-12.579	-16.372	-22.133	-32.050			
3.25	-10.887	-13.928	-18.125	-24.492	-35.431			
3.50	-11.966	-15.303	-19.909	-26.890	-38.866			
3.75	-13.067	-16.701	-21.719	-29.322	-42.349			
4.00	-14.190	-18.122	-23.555	-31.786	-45.874			
4.50	-16.501	-21.023	-27.290	-36.791	-53.033			
5.00	-18.900	-23.999	-31.097	-41.880	-60.309			
5.50	-21.387	-27.042	-34.961	-47.030	-67.669			
6.00	-23.968	-30.148	-38.870	-52.221	-75.085			

EXCESS ENTROPY OF THE SOLUTE, S2EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 0	25.000	50.000	75.000	100.000	125.000	150.000	175.000
.05	.044	.055	.066	.078	.091	.107	.125	.147
.10	.103	.133	.165	.198	.234	.275	.324	.382
.20	.219	.306	.394	.485	.583	.693	.821	.976
.30	.313	.477	.640	.805	.981	1.176	1.403	1.675
.40	.377	.635	.889	1.142	1.409	1.704	2.043	2.449
.50	.408	.778	1.136	1.490	1.860	2.265	2.729	3.282
.60	.404	.901	1.377	1.844	2.327	2.854	3.454	4.166
.70	.364	1.004	1.611	2.202	2.809	3.466	4.211	5.094
.80	.288	1.086	1.836	2.561	3.302	4.099	4.998	6.061
.90	.176	1.147	2.052	2.922	3.804	4.749	5.811	7.063
1.00	.030	1.186	2.258	3.282	4.314	5.415	6.649	8.098
1.20	-.368	1.201	2.640	3.999	5.356	6.791	8.388	10.256
1.40	-.901	1.134	2.981	4.709	6.421	8.217	10.205	12.521
1.60	-1.562	.987	3.282	5.412	7.506	9.689	12.092	14.880
1.80	-2.345	.766	3.546	6.108	8.609	11.201	14.041	17.325
2.00	-3.241	.476	3.776	6.798	9.729	12.751	16.048	19.849
2.25	-4.511	.025	4.021	7.655	11.154	14.739	18.633	23.106
2.50	-5.930	-.514	4.227	8.510	12.608	16.783	21.298	26.470
2.75	-7.483	-1.127	4.403	9.369	14.092	18.880	24.039	29.934
3.00	-9.152	-1.801	4.558	10.238	15.611	21.033	26.854	33.491
3.25	-10.921	-2.523	4.704	11.124	17.169	23.241	29.741	37.139
3.50	-12.770	-3.278	4.850	12.036	18.769	25.508	32.701	40.873
3.75	-14.682	-4.052	5.008	12.981	20.419	27.835	35.732	44.692
4.00	-16.639	-4.831	5.189	13.968	22.123	30.226	38.836	48.593
4.50	-20.612	-6.340	5.669	16.102	25.719	35.215	45.267	56.640
5.00	-24.540	-7.685	6.385	18.512	29.608	40.506	52.006	65.007
5.50	-28.270	-8.740	7.437	21.274	33.847	46.135	59.072	73.698
6.00	-31.648	-9.380	8.925	24.465	38.493	52.141	66.487	82.717

EXCESS ENTROPY OF THE SOLUTE, S2EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 200.000	225.000	250.000	275.000	300.000
.05	.174	.212	.266	.351	.505
.10	.456	.556	.700	.928	1.340
.20	1.171	1.433	1.812	2.414	3.498
.30	2.018	2.476	3.140	4.193	6.087
.40	2.958	3.640	4.624	6.186	8.991
.50	3.975	4.900	6.235	8.351	12.149
.60	5.057	6.244	7.954	10.663	15.521
.70	6.195	7.660	9.769	13.105	19.081
.80	7.383	9.141	11.668	15.661	22.809
.90	8.618	10.682	13.645	18.323	26.689
1.00	9.895	12.277	15.694	21.082	30.708
1.20	12.565	15.617	19.986	26.862	39.126
1.40	15.374	19.136	24.512	32.957	47.996
1.60	18.306	22.816	29.246	39.333	57.268
1.80	21.351	26.640	34.170	45.964	66.905
2.00	24.499	30.598	39.268	52.828	76.873
2.25	28.567	35.716	45.863	61.707	89.760
2.50	32.772	41.009	52.685	70.891	103.081
2.75	37.104	46.463	59.715	80.355	116.799
3.00	41.553	52.067	66.938	90.076	130.884
3.25	46.114	57.809	74.340	100.036	145.309
3.50	50.780	63.682	81.909	110.219	160.050
3.75	55.546	69.678	89.634	120.609	175.086
4.00	60.409	75.790	97.504	131.193	190.399
4.50	70.409	88.339	113.651	152.897	221.787
5.00	80.758	101.289	130.289	175.247	254.094
5.50	91.442	114.608	147.369	198.171	287.219
6.00	102.448	128.269	164.847	221.606	321.073

TOTAL EXCESS HEAT CAPACITY OF THE SOLUTION, JEX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	.089	.102	.121	.147	.183	.234	.308	.425
.10	.248	.283	.331	.400	.496	.631	.830	1.148
.20	.699	.781	.901	1.079	1.331	1.687	2.214	3.061
.30	1.288	1.421	1.622	1.926	2.363	2.985	3.912	5.403
.40	1.998	2.178	2.464	2.907	3.548	4.468	5.846	8.067
.50	2.816	3.042	3.414	4.002	4.864	6.107	7.976	10.995
.60	3.736	4.002	4.461	5.200	6.294	7.882	10.276	14.151
.70	4.752	5.055	5.598	6.492	7.829	9.779	12.728	17.509
.80	5.862	6.195	6.821	7.872	9.459	11.787	15.317	21.049
.90	7.061	7.418	8.124	9.335	11.180	13.898	18.033	24.755
1.00	8.348	8.721	9.505	10.876	12.984	16.106	20.867	28.617
1.20	11.171	11.558	12.485	14.178	16.828	20.789	26.859	36.763
1.40	14.317	14.688	15.741	17.754	20.963	25.800	33.246	45.421
1.60	17.770	18.096	19.257	21.586	25.364	31.109	39.992	54.543
1.80	21.519	21.767	23.017	25.656	30.013	36.693	47.065	64.086
2.00	25.552	25.691	27.008	29.950	34.892	42.533	54.442	74.019
2.25	30.978	30.934	32.306	35.612	41.294	50.164	64.056	86.941
2.50	36.812	36.535	37.925	41.581	48.006	58.136	74.075	100.379
2.75	43.037	42.474	43.848	47.835	55.007	66.422	84.465	114.295
3.00	49.637	48.735	50.056	54.355	62.275	74.999	95.198	128.652
3.25	56.594	55.301	56.530	61.123	69.790	83.844	106.250	143.419
3.50	63.892	62.155	63.256	68.121	77.533	92.937	117.596	158.568
3.75	71.517	69.282	70.217	75.333	85.486	102.258	129.214	174.071
4.00	79.453	76.667	77.396	82.742	93.634	111.789	141.084	189.906
4.50	96.199	92.150	92.354	98.092	110.445	131.413	165.504	222.479
5.00	114.013	108.488	108.012	114.051	127.844	151.677	190.713	256.121
5.50	132.783	125.569	124.259	130.507	145.713	172.460	216.578	290.683
6.00	152.398	143.284	140.985	147.349	163.941	193.645	242.977	326.029

TOTAL EXCESS HEAT CAPACITY OF THE SOLUTION, JEX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000
.05	.630	1.020	1.851	3.978
.10	1.702	2.758	5.007	10.764
.20	4.540	7.359	13.368	28.747
.30	8.012	12.985	23.586	50.718
.40	11.956	19.371	35.177	75.625
.50	16.285	26.375	47.877	102.895
.60	20.945	33.903	61.517	132.160
.70	25.895	41.893	75.977	163.161
.80	31.107	50.295	91.169	195.702
.90	36.557	59.071	107.023	229.633
1.00	42.227	68.191	123.482	264.831
1.20	54.168	87.367	158.040	338.645
1.40	66.831	107.663	194.551	416.513
1.60	80.143	128.960	232.800	497.968
1.80	94.047	151.165	272.616	582.646
2.00	108.493	174.202	313.865	670.256
2.25	127.254	204.074	367.271	783.532
2.50	146.736	235.046	422.560	900.635
2.75	166.883	267.032	479.581	1021.248
3.00	187.647	299.959	538.209	1145.110
3.25	208.984	333.765	598.335	1271.993
3.50	230.859	368.394	659.864	1401.704
3.75	253.235	403.795	722.714	1534.073
4.00	276.083	439.925	786.810	1668.950
4.50	323.080	514.210	918.481	1945.708
5.00	371.643	590.963	1054.416	2231.060
5.50	421.592	669.937	1194.227	2524.250
6.00	472.763	750.917	1337.581	2824.640

EXCESS PARTIAL HEAT CAPACITY OF WATER, J1EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	-.043	-.048	-.055	-.066	-.081	-.103	-.135	-.187
.10	-.121	-.131	-.148	-.174	-.213	-.268	-.352	-.486
.20	-.350	-.368	-.403	-.463	-.556	-.693	-.902	-1.243
.30	-.666	-.683	-.732	-.827	-.978	-1.207	-1.561	-2.142
.40	-1.062	-1.070	-1.128	-1.254	-1.466	-1.793	-2.304	-3.147
.50	-1.534	-1.524	-1.584	-1.739	-2.011	-2.440	-3.118	-4.240
.60	-2.079	-2.043	-2.098	-2.278	-2.610	-3.144	-3.995	-5.411
.70	-2.695	-2.622	-2.666	-2.867	-3.257	-3.898	-4.930	-6.651
.80	-3.378	-3.260	-3.287	-3.504	-3.951	-4.701	-5.917	-7.955
.90	-4.128	-3.955	-3.957	-4.186	-4.688	-5.547	-6.953	-9.316
1.00	-4.941	-4.705	-4.675	-4.911	-5.466	-6.435	-8.034	-10.731
1.20	-6.752	-6.360	-6.244	-6.480	-7.134	-8.324	-10.321	-13.709
1.40	-8.795	-8.209	-7.978	-8.195	-8.938	-10.349	-12.756	-16.861
1.60	-11.054	-10.237	-9.863	-10.041	-10.861	-12.493	-15.319	-20.166
1.80	-13.515	-12.430	-11.884	-12.001	-12.888	-14.739	-17.994	-23.604
2.00	-16.164	-14.773	-14.025	-14.063	-15.005	-17.074	-20.766	-27.160
2.25	-19.718	-17.891	-16.851	-16.761	-17.756	-20.093	-24.342	-31.744
2.50	-23.515	-21.196	-19.819	-19.568	-20.599	-23.200	-28.017	-36.455
2.75	-27.530	-24.660	-22.901	-22.459	-23.508	-26.369	-31.766	-41.267
3.00	-31.734	-28.257	-26.073	-25.409	-26.458	-29.575	-35.562	-46.154
3.25	-36.102	-31.962	-29.309	-28.392	-29.424	-32.794	-39.382	-51.092
3.50	-40.608	-35.749	-32.584	-31.386	-32.384	-36.003	-43.202	-56.055
3.75	-45.226	-39.593	-35.874	-34.364	-35.312	-39.178	-46.999	-61.022
4.00	-49.930	-43.469	-39.155	-37.304	-38.186	-42.296	-50.751	-65.970
4.50	-59.493	-51.217	-45.590	-42.975	-43.681	-48.273	-58.031	-75.722
5.00	-69.095	-58.795	-51.697	-48.212	-48.686	-53.757	-64.867	-85.138
5.50	-78.533	-66.006	-57.286	-52.829	-53.021	-58.573	-71.092	-94.055
6.00	-87.604	-72.656	-62.168	-56.645	-56.511	-62.551	-76.538	-102.308

EXCESS PARTIAL HEAT CAPACITY OF WATER, J1EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000				
.05	-.278	-.452	-.821	-1.768				
.10	-.723	-1.174	-2.135	-4.598				
.20	-1.844	-2.990	-5.436	-11.692				
.30	-3.166	-5.123	-9.295	-19.960				
.40	-4.636	-7.481	-13.541	-29.025				
.50	-6.226	-10.019	-18.090	-38.696				
.60	-7.918	-12.707	-22.887	-48.858				
.70	-9.702	-15.526	-27.897	-59.433				
.80	-11.568	-18.462	-33.095	-70.365				
.90	-13.509	-21.505	-38.460	-81.612				
1.00	-15.519	-24.644	-43.976	-93.140				
1.20	-19.728	-31.184	-55.415	-116.937				
1.40	-24.160	-38.035	-67.330	-141.595				
1.60	-28.789	-45.160	-79.661	-166.993				
1.80	-33.591	-52.527	-92.362	-193.043				
2.00	-38.548	-60.111	-105.394	-219.673				
2.25	-44.931	-69.861	-122.100	-253.688				
2.50	-51.494	-79.875	-139.219	-288.425				
2.75	-58.206	-90.119	-156.704	-323.809				
3.00	-65.041	-100.560	-174.515	-359.774				
3.25	-71.971	-111.171	-192.615	-396.263				
3.50	-78.973	-121.924	-210.971	-433.229				
3.75	-86.022	-132.792	-229.553	-470.626				
4.00	-93.096	-143.753	-248.333	-508.415				
4.50	-107.230	-165.857	-286.379	-585.027				
5.00	-121.203	-188.058	-324.911	-662.804				
5.50	-134.850	-210.188	-363.746	-741.517				
6.00	-148.013	-232.085	-402.714	-820.961				

EXCESS HEAT CAPACITY OF THE SOLUTE, J2EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 25.000	50.000	75.000	100.000	125.000	150.000	175.000	200.000
.05	.132	.150	.176	.213	.265	.337	.443	.613
.10	.369	.414	.479	.574	.709	.900	1.182	1.634
.20	1.049	1.149	1.304	1.543	1.887	2.380	3.117	4.305
.30	1.955	2.104	2.354	2.753	3.341	4.192	5.473	7.545
.40	3.060	3.249	3.592	4.161	5.014	6.261	8.150	11.214
.50	4.350	4.566	4.998	5.741	6.875	8.548	11.094	15.236
.60	5.815	6.045	6.559	7.478	8.904	11.026	14.271	19.563
.70	7.447	7.677	8.265	9.359	11.086	13.677	17.658	24.161
.80	9.240	9.455	10.108	11.376	13.410	16.488	21.234	29.004
.90	11.189	11.373	12.081	13.521	15.867	19.445	24.986	34.072
1.00	13.289	13.426	14.179	15.786	18.450	22.541	28.901	39.348
1.20	17.923	17.918	18.729	20.658	23.962	29.114	37.180	50.471
1.40	23.112	22.897	23.720	25.950	29.900	36.149	46.002	62.282
1.60	28.824	28.333	29.120	31.627	36.225	43.602	55.311	74.708
1.80	35.035	34.197	34.900	37.657	42.901	51.433	65.060	87.691
2.00	41.717	40.464	41.033	44.012	49.898	59.606	75.207	101.179
2.25	50.696	48.826	49.157	52.372	59.050	70.256	88.398	118.684
2.50	60.327	57.731	57.744	61.148	68.605	81.335	102.092	136.834
2.75	70.567	67.134	66.749	70.294	78.515	92.791	116.230	155.562
3.00	81.371	76.992	76.128	79.764	88.733	104.574	130.760	174.807
3.25	92.696	87.263	85.839	89.515	99.214	116.638	145.632	194.511
3.50	104.500	97.904	95.840	99.506	109.916	128.940	160.798	214.623
3.75	116.743	108.875	106.091	109.697	120.798	141.435	176.213	235.094
4.00	129.383	120.136	116.551	120.046	131.820	154.085	191.835	255.876
4.50	155.692	143.366	137.944	141.067	154.126	179.685	223.535	298.200
5.00	183.108	167.282	159.710	162.263	176.529	205.434	255.581	341.259
5.50	211.316	191.575	181.545	183.337	198.734	231.033	287.670	384.738
6.00	240.002	215.939	203.153	203.994	220.451	256.196	319.515	428.337

EXCESS HEAT CAPACITY OF THE SOLUTE, J2EX, CALS/DEG K-KG H2O

MOLALITY	T(CENT.) 225.000	250.000	275.000	300.000				
.05	.909	1.472	2.673	5.746				
.10	2.425	3.931	7.142	15.362				
.20	6.384	10.350	18.803	40.439				
.30	11.178	18.108	32.880	70.678				
.40	16.592	26.853	48.718	104.650				
.50	22.511	36.393	65.967	141.591				
.60	28.863	46.610	84.404	181.018				
.70	35.597	57.419	103.875	222.594				
.80	42.675	68.757	124.264	266.067				
.90	50.066	80.575	145.483	311.244				
1.00	57.746	92.835	167.458	357.970				
1.20	73.895	118.551	213.454	455.582				
1.40	90.991	145.698	261.881	558.108				
1.60	108.932	174.120	312.461	664.962				
1.80	127.638	203.692	364.978	775.689				
2.00	147.041	234.313	419.259	889.929				
2.25	172.186	273.934	489.371	1037.220				
2.50	198.230	314.920	561.779	1189.060				
2.75	225.090	357.150	636.285	1345.057				
3.00	252.687	400.520	712.724	1504.883				
3.25	280.956	444.936	790.950	1668.256				
3.50	309.831	490.317	870.836	1834.933				
3.75	339.257	536.587	952.267	2004.699				
4.00	369.179	583.677	1035.143	2177.365				
4.50	430.310	680.066	1204.860	2530.735				
5.00	492.846	779.020	1379.327	2893.864				
5.50	556.442	880.125	1557.974	3265.768				
6.00	620.775	983.003	1740.295	3645.600				

APPENDIX D

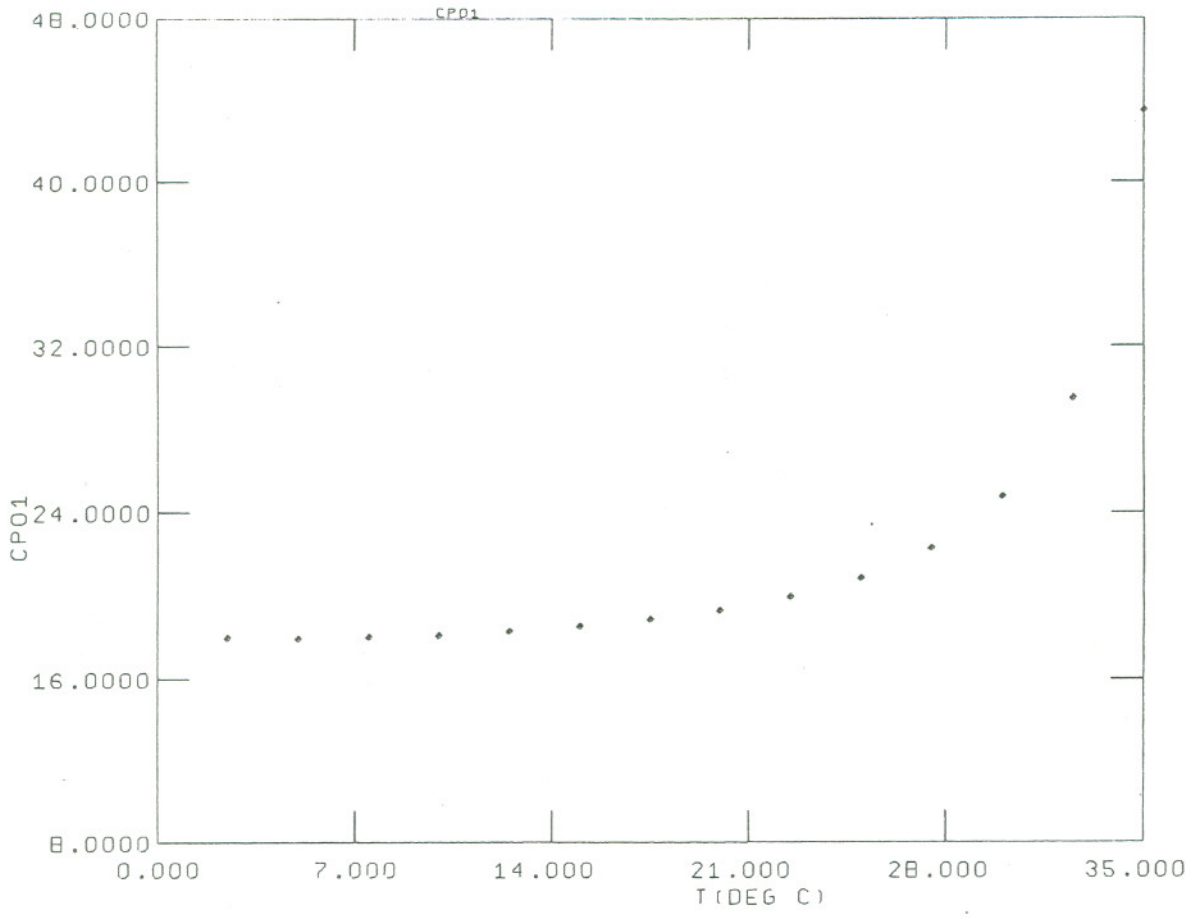
GRAPHICAL PLOTS OF THERMODYNAMIC QUANTITIES OF NaCl (aq) SOLUTIONS

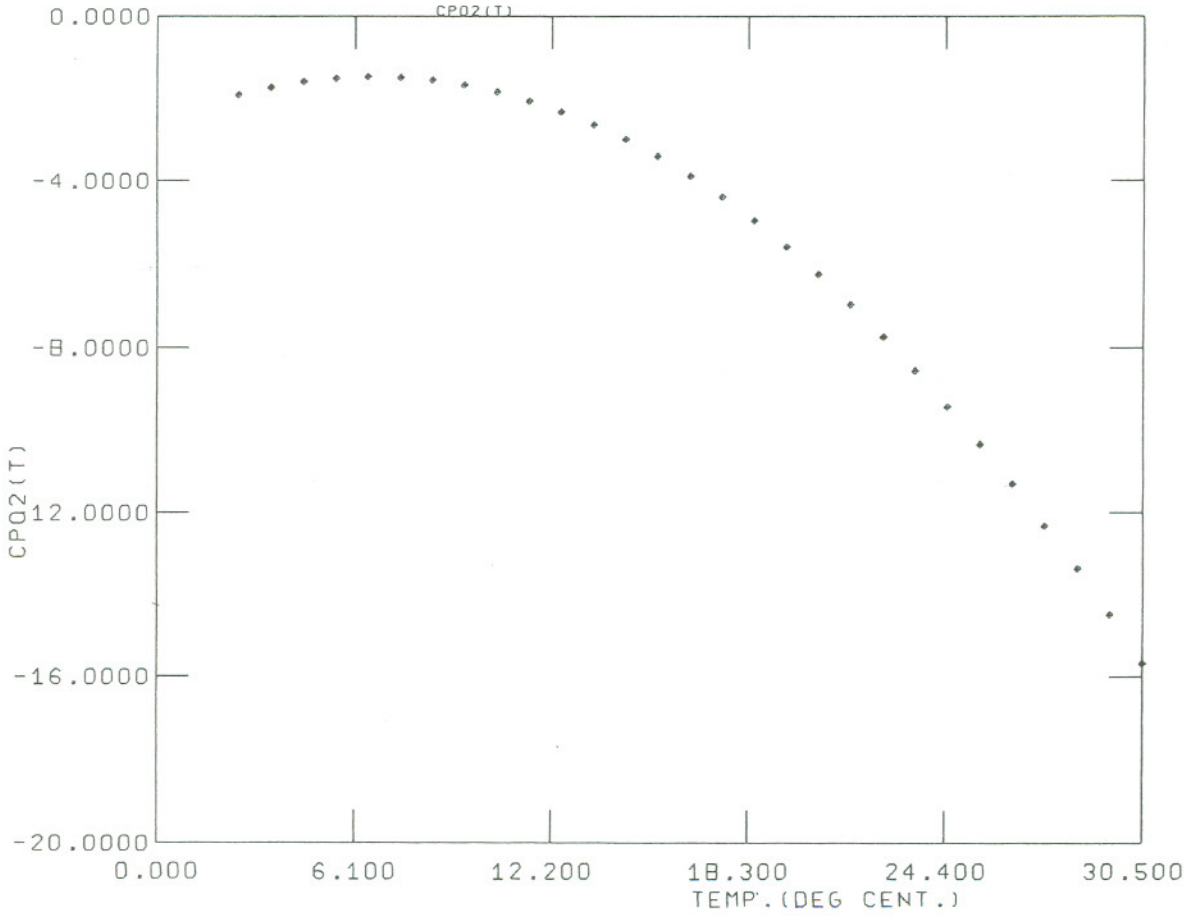
The quantities tabulated in Appendix C are presented in plots against the concentration for isotherms from 100-300°C at 50° intervals plus isotherms at 325 and 350°C. The terminology on the graphs and in Table D-I is identical to that listed in Appendix C for the tabulated quantities. For each entry in Table D-I, the first entry corresponds to the plotted values and the second to the scaling factor.

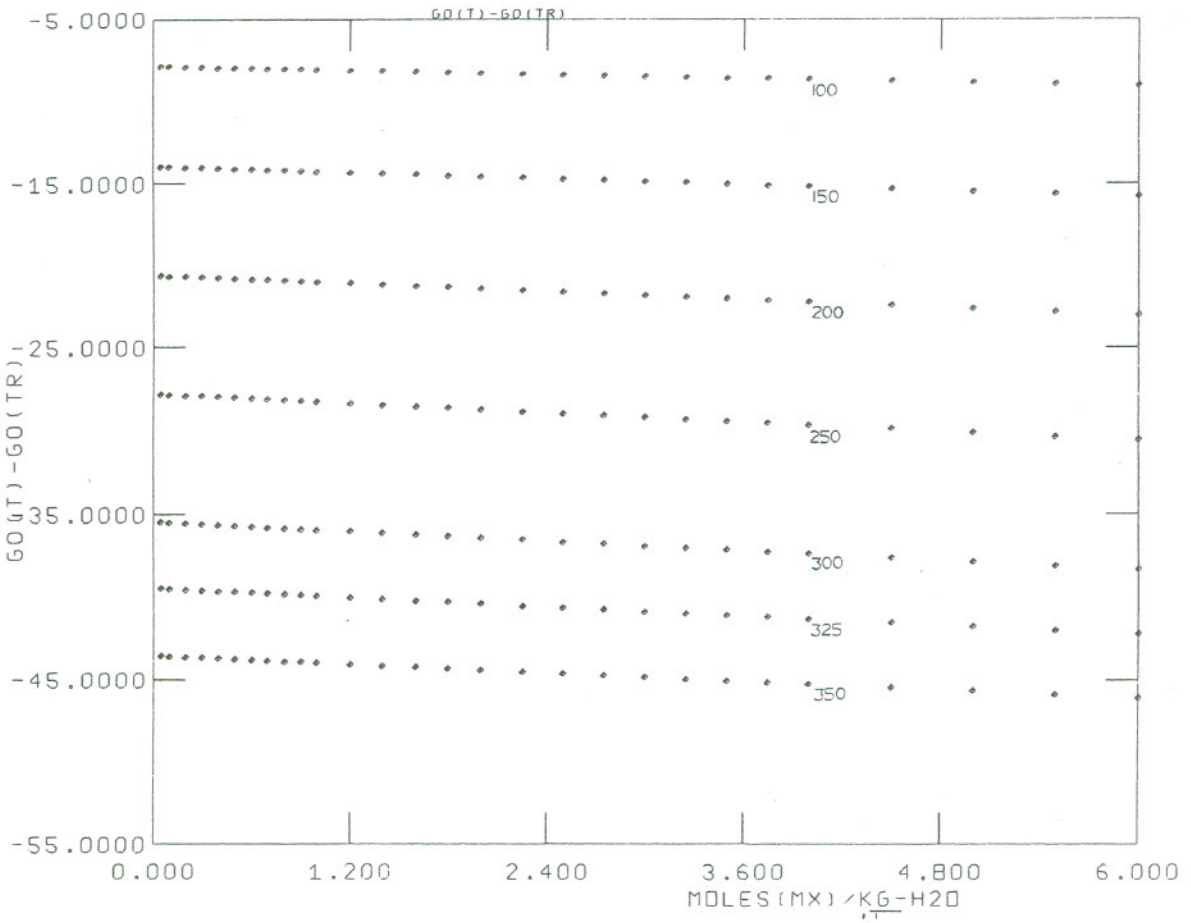
Table D-I

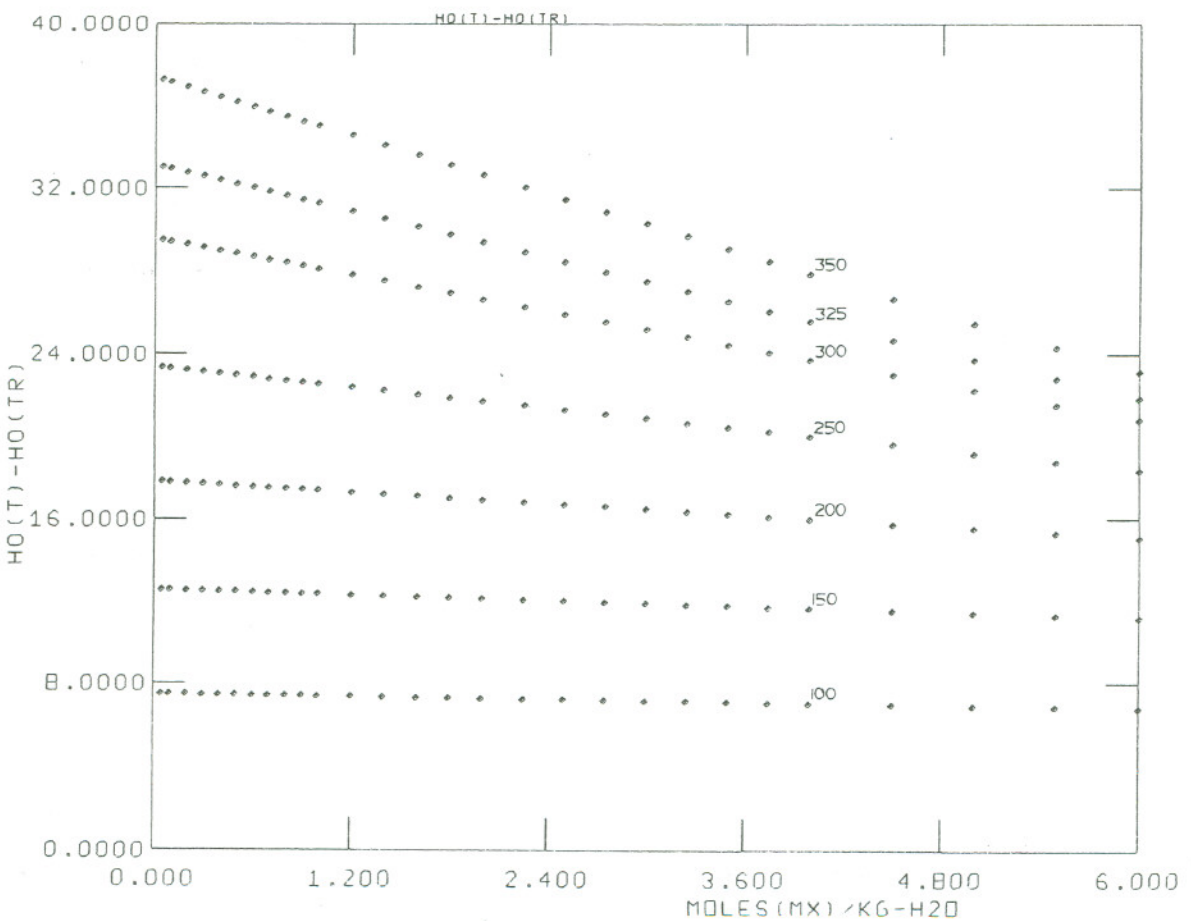
Scaling Factors for Plotted Quantities

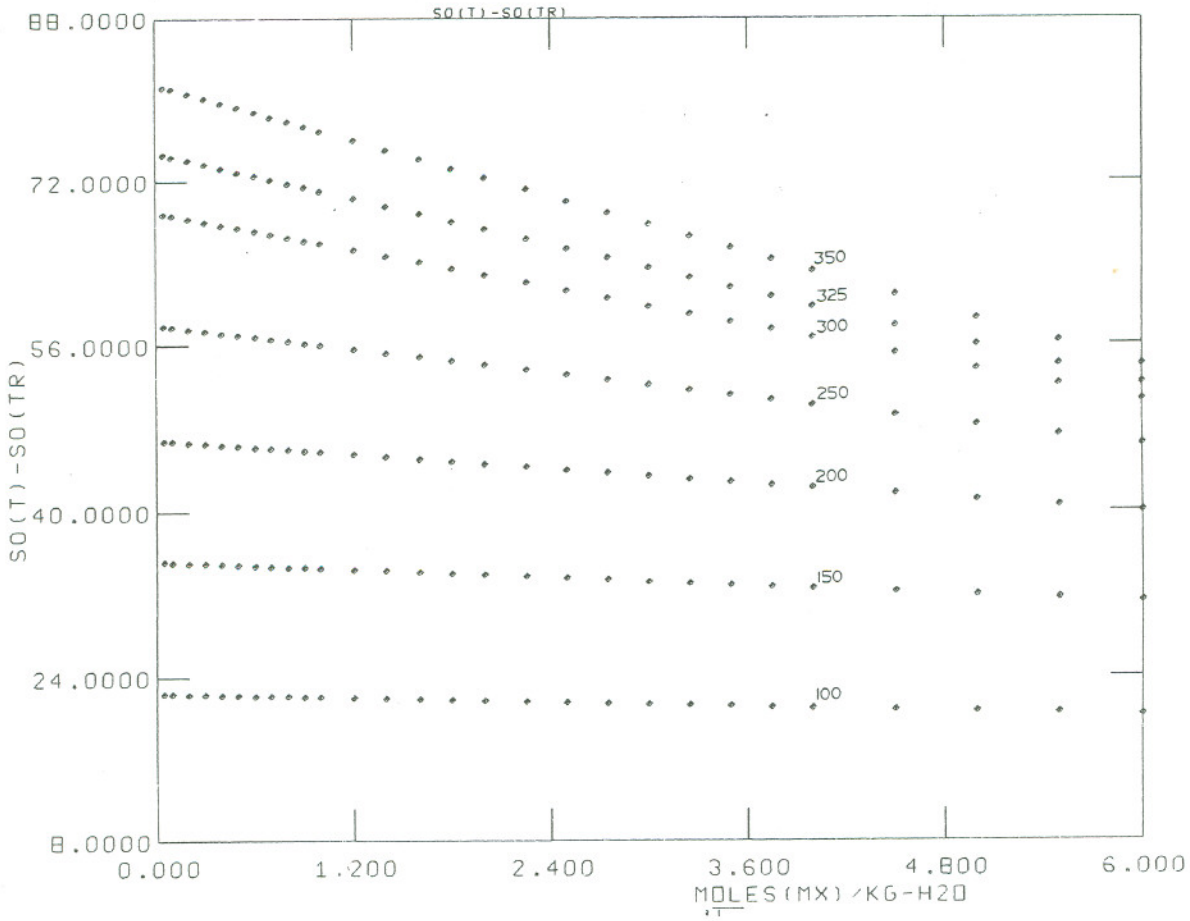
	PAGE
MOLES(NACL)/KGH20, 1	
T(DEG C), 10^{-1}	
CPO1, 1	47
CPO2, 10^{-1}	47
GO(T) - GO(TR), 10^{-5}	48
HO(T) - HO(TR), 10^{-3}	48
SO(T) - SO(TR), 10^{-1}	49
G(T,M) - GO(TR), 10^{-5}	49
H(T,M) - HO(TR), 10^{-4}	50
S(T,M) - SO(TR), 10^{-2}	50
CP(T), 10^{-2}	51
OSMOTIC, 1	51
GAMMA(NACL), 1	52
(L/M), 10^{-3}	52
L1, 10^{-2}	53
L2, 10^{-4}	53
S1 - SO1, 1	54
S2 - SO2, 10^{-1}	54
J, 10^{-3}	55
J1, 10^{-1}	55
J2, 10^{-3}	56
GEX, 10^{-3}	56
G1EX, 10^{-3}	57
G2EX, 10^{-3}	57
HEX, 10^{-4}	58
H1EX, 10^{-4}	58
H2EX, 10^{-4}	59
STEX, 10^{-2}	59
S1EX, 10^{-1}	60
S2EX, 10^{-2}	60
JEX, 10^{-3}	61
J1EX, 10^{-3}	61
J2EX, 10^{-3}	62

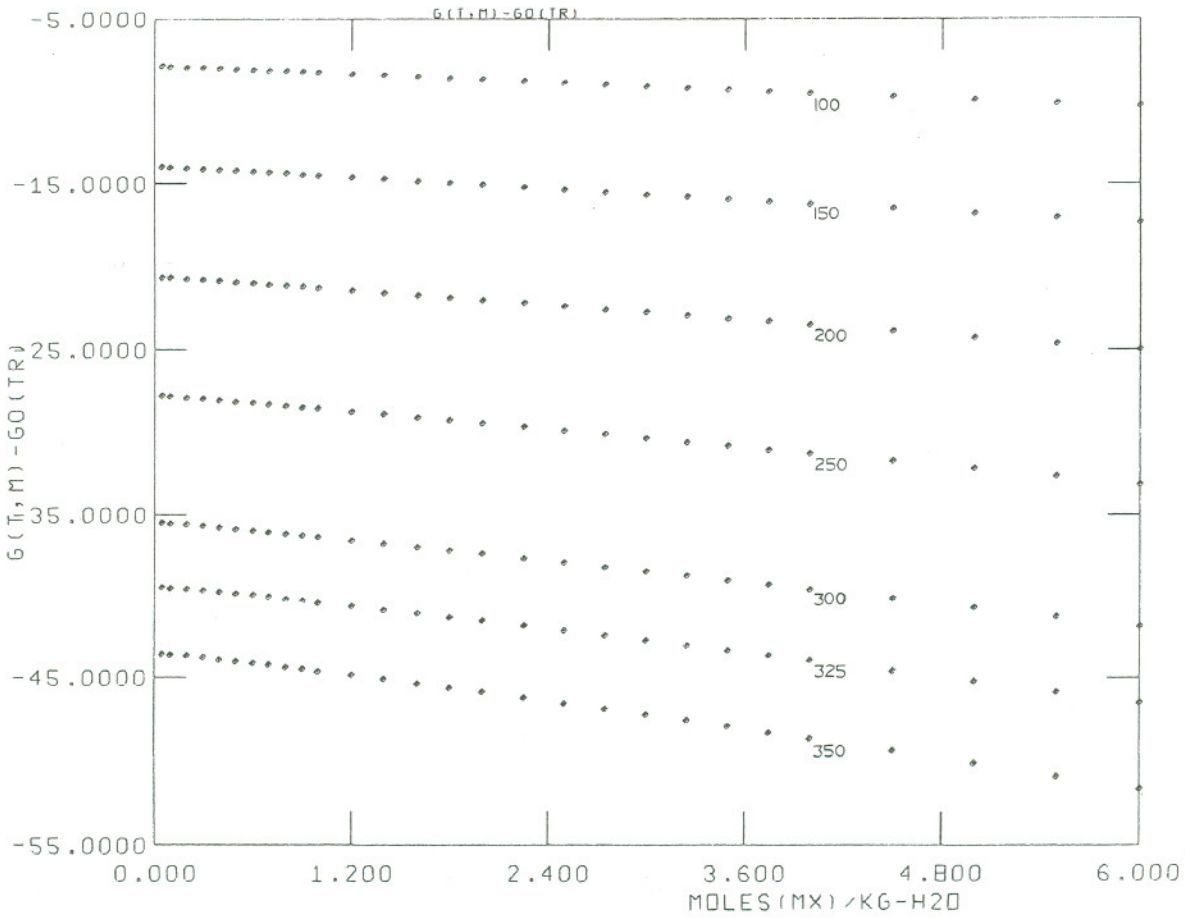

CPO1
48.0000
40.0000
32.0000
24.0000
16.0000
8.0000
CPO1
0.000
7.000
14.000
21.000
28.000
35.000
T(DEG C)

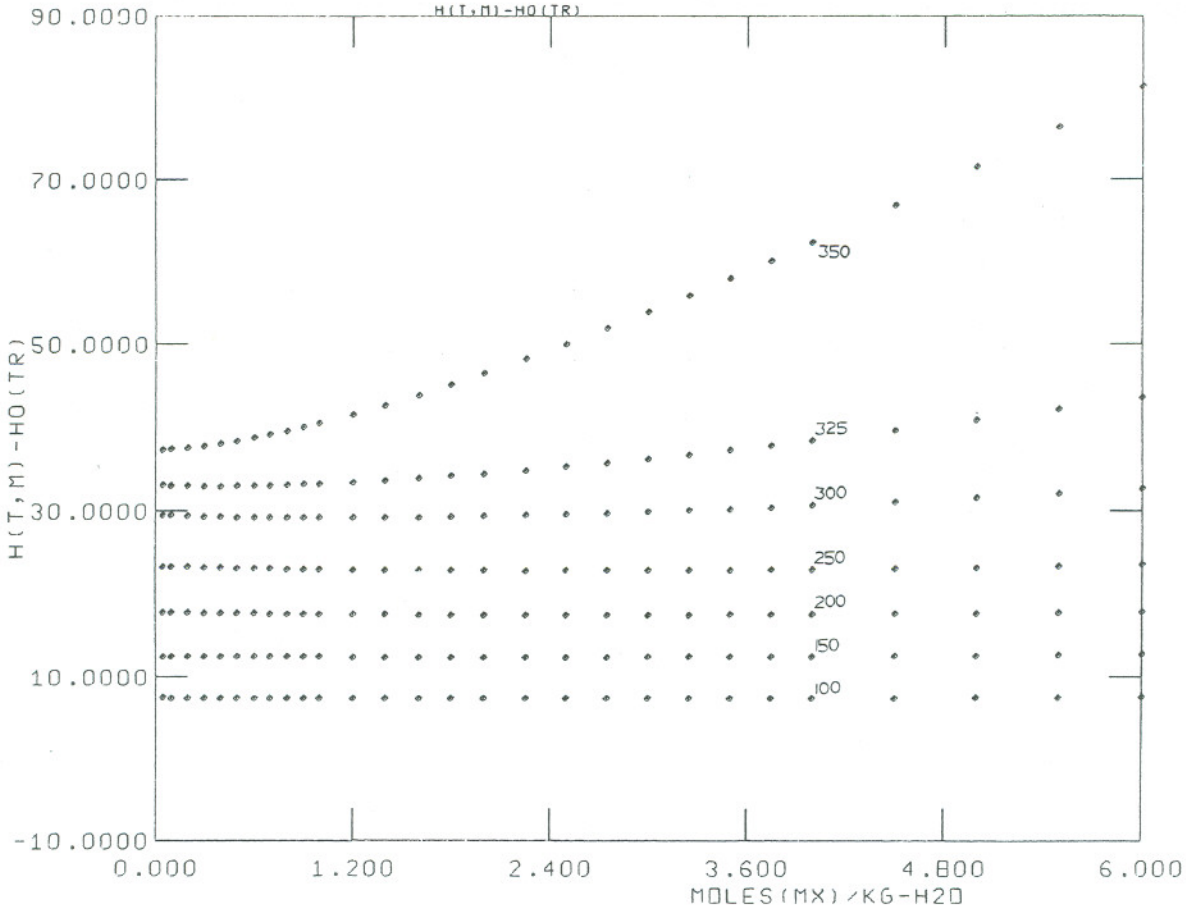

CPO2(T)
0.0000
-4.0000
-8.0000
-12.0000
-16.0000
-20.0000
CPO2(T)
0.000
6.100
12.200
18.300
24.400
30.500
TEMP.(DEG CENT.)

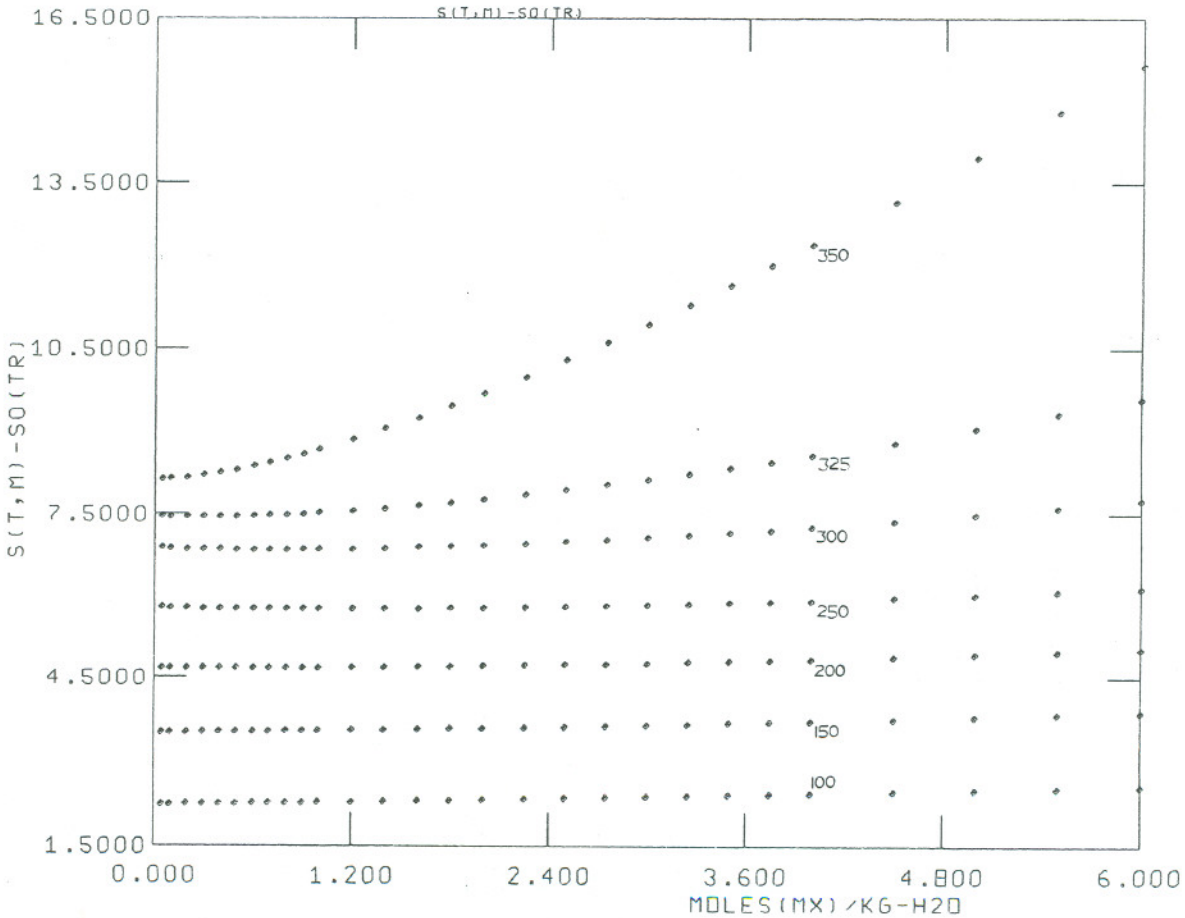

GO(T)-GO(TR)
-5.0000
-15.0000
-25.0000
-35.0000
-45.0000
-55.0000
GO(T)-GO(TR)
100
150
200
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

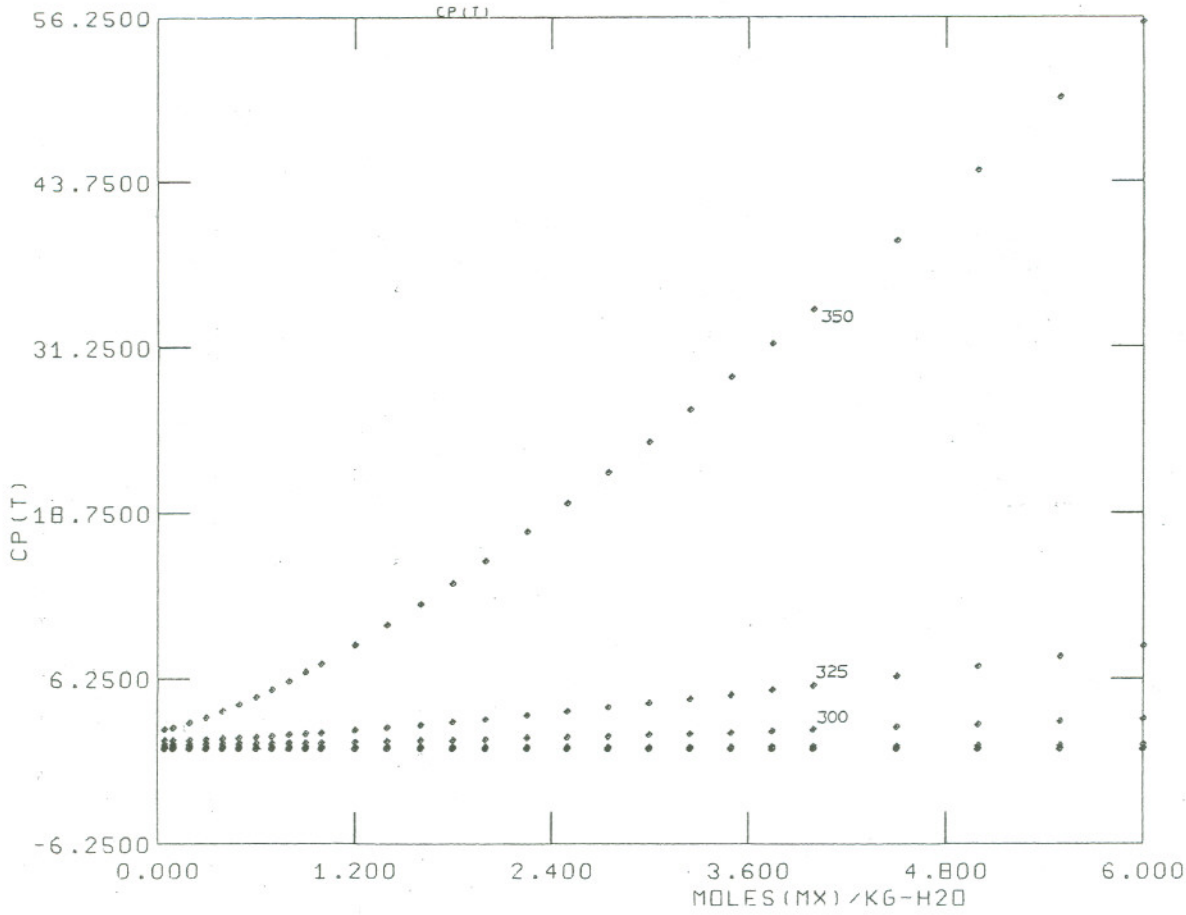

HO(T)-HO(TR)
40.0000
32.0000
24.0000
16.0000
8.0000
0.0000
HO(T)-HO(TR)
350
325
300
250
200
150
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

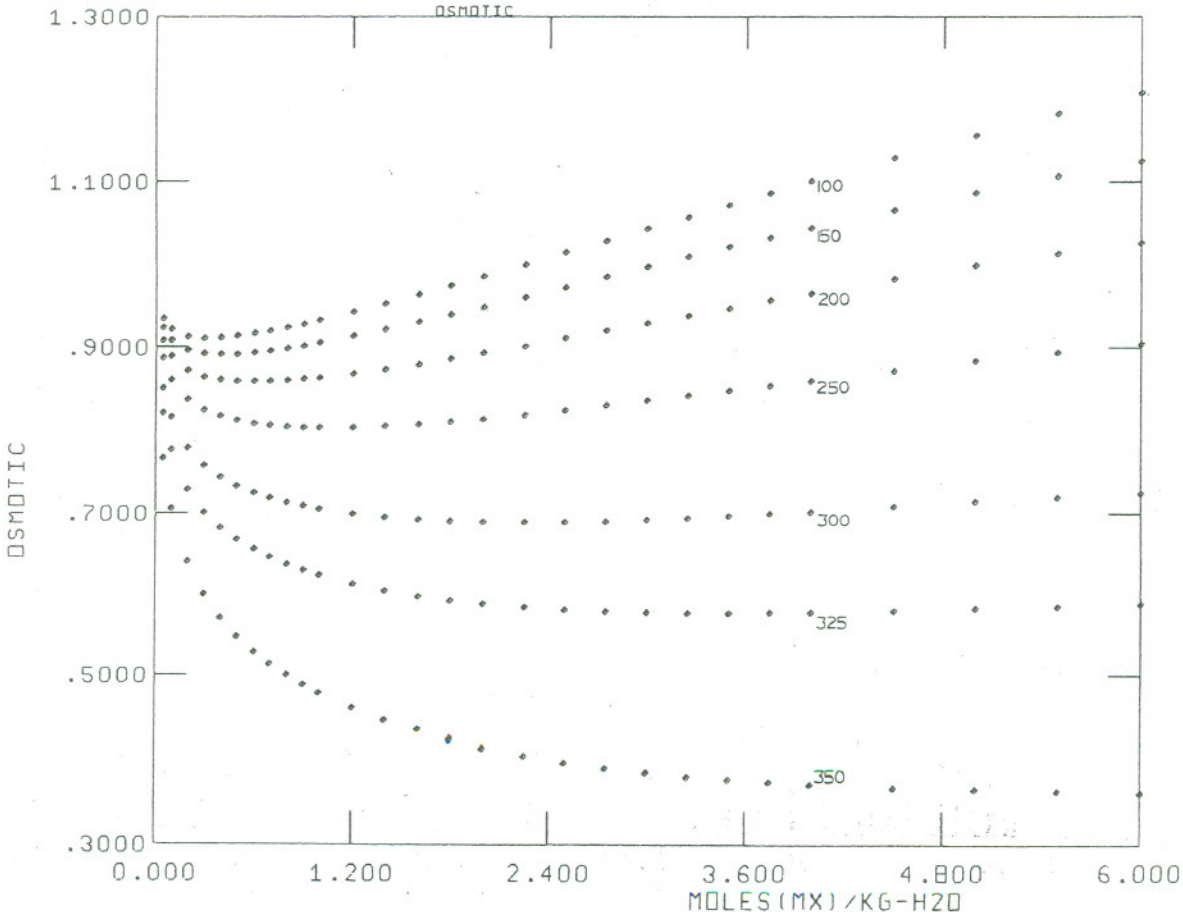

SO(T)-SO(TR)
88.0000
72.0000
56.0000
40.0000
24.0000
8.0000
SO(T)-SO(TR)
350
325
300
250
200
150
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

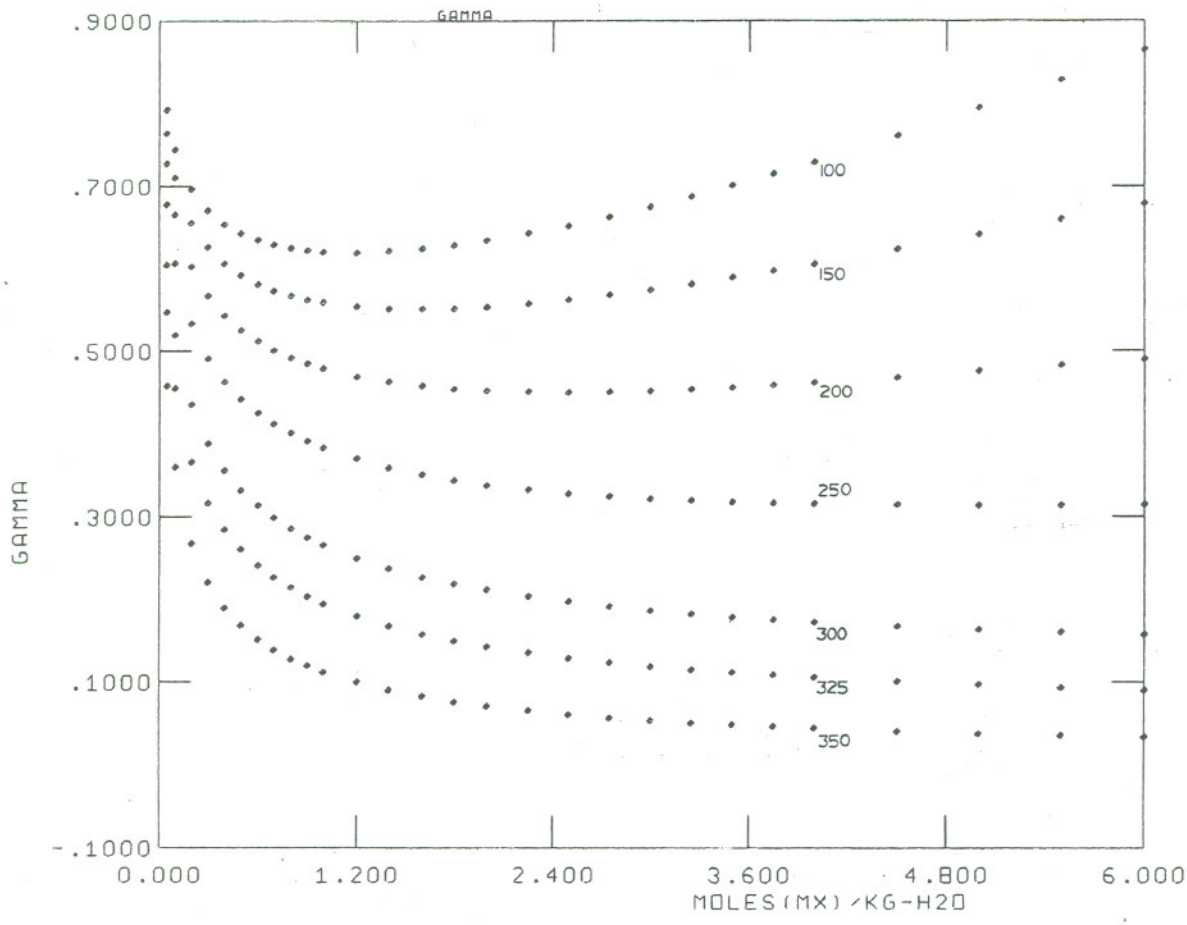

G(T,M)-GO(TR)
-5.0000
-15.0000
-25.0000
-35.0000
-45.0000
-55.0000
G(T,M)-GO(TR)
100
150
200
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

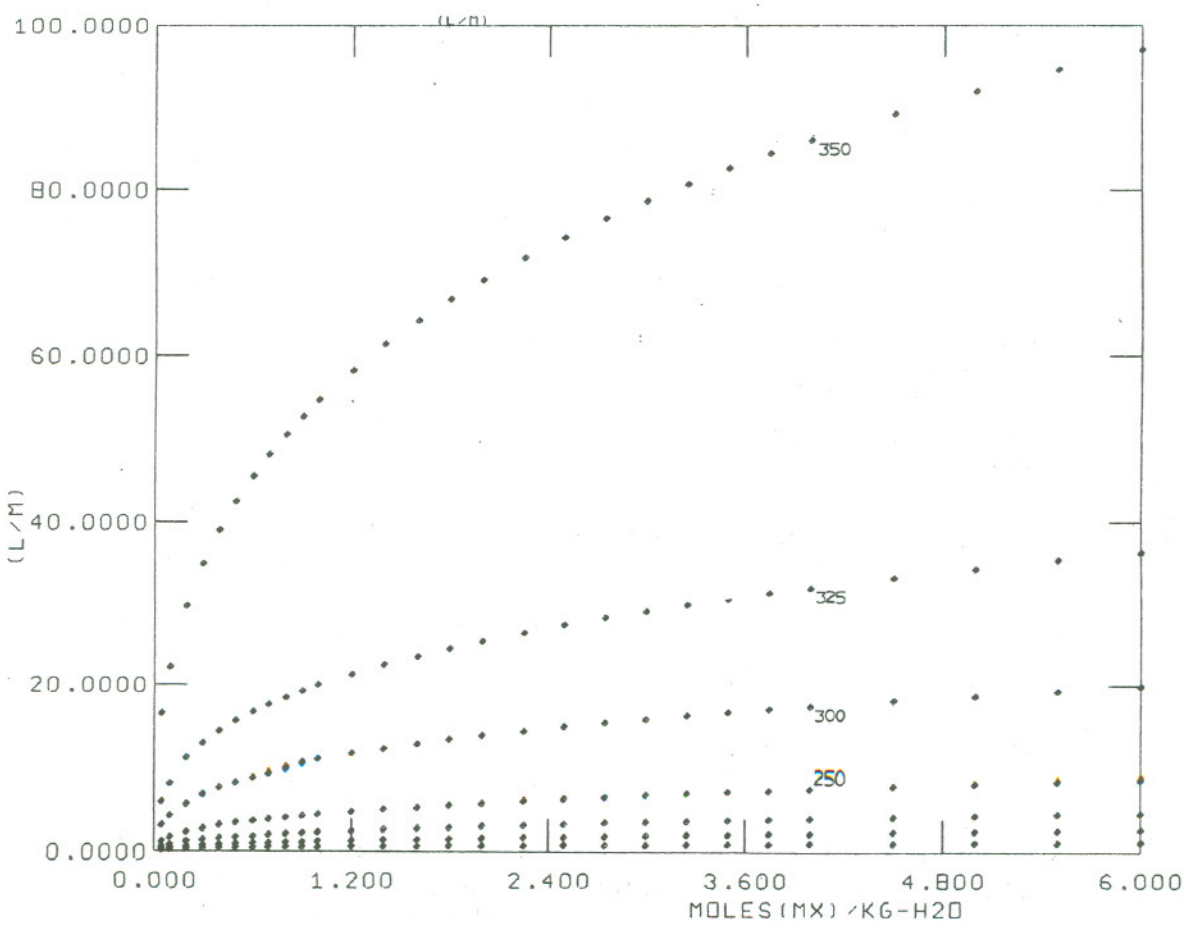

H(T,M)-HO(TR)
90.0000
70.0000
50.0000
30.0000
10.0000
-10.0000
H(T,M)-HO(TR)
350
325
300
250
200
150
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

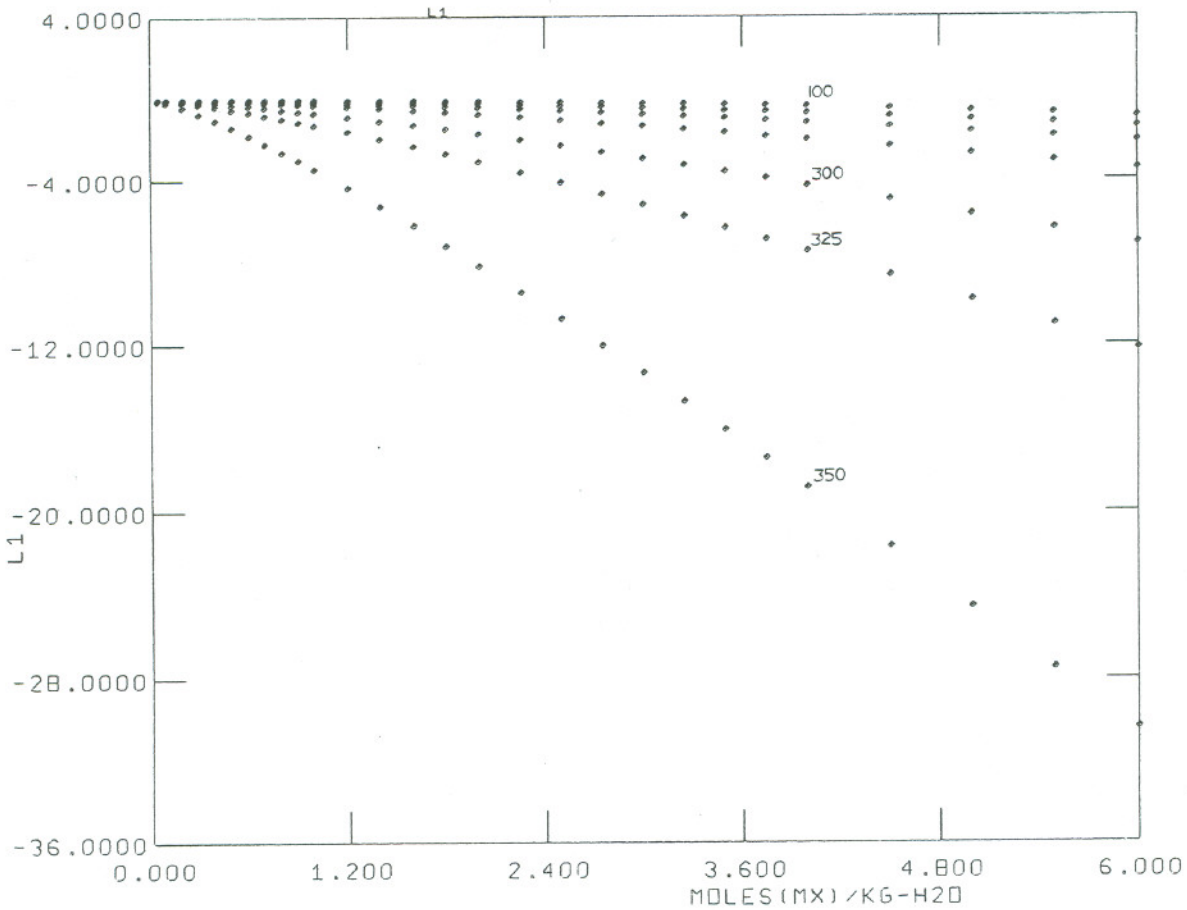

S(T,M)-SO(TR)
16.5000
13.5000
10.5000
7.5000
4.5000
1.5000
S(T,M)-SO(TR)
350
325
300
250
200
150
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

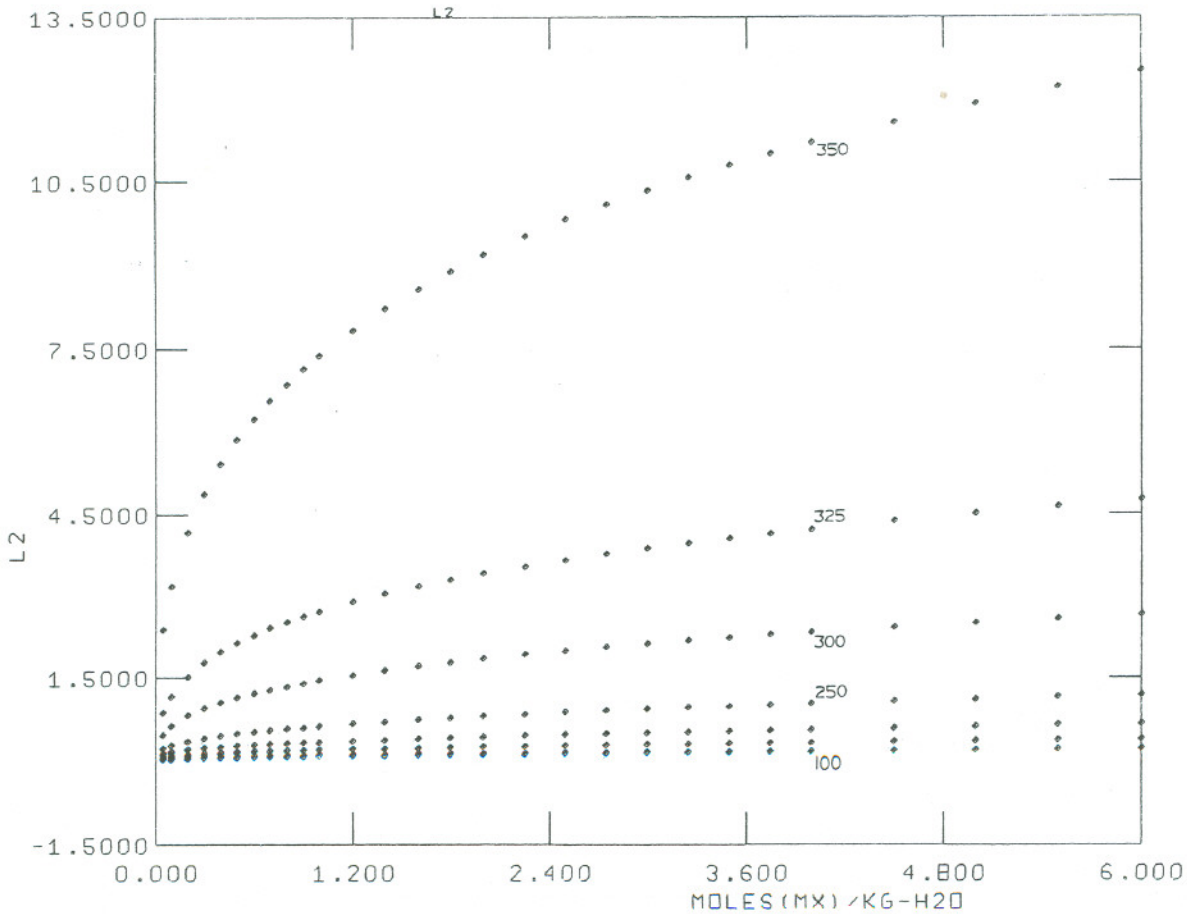

CP(T)
56.2500
43.7500
31.2500
18.7500
6.2500
-6.2500
CP(T)
350
325
300
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

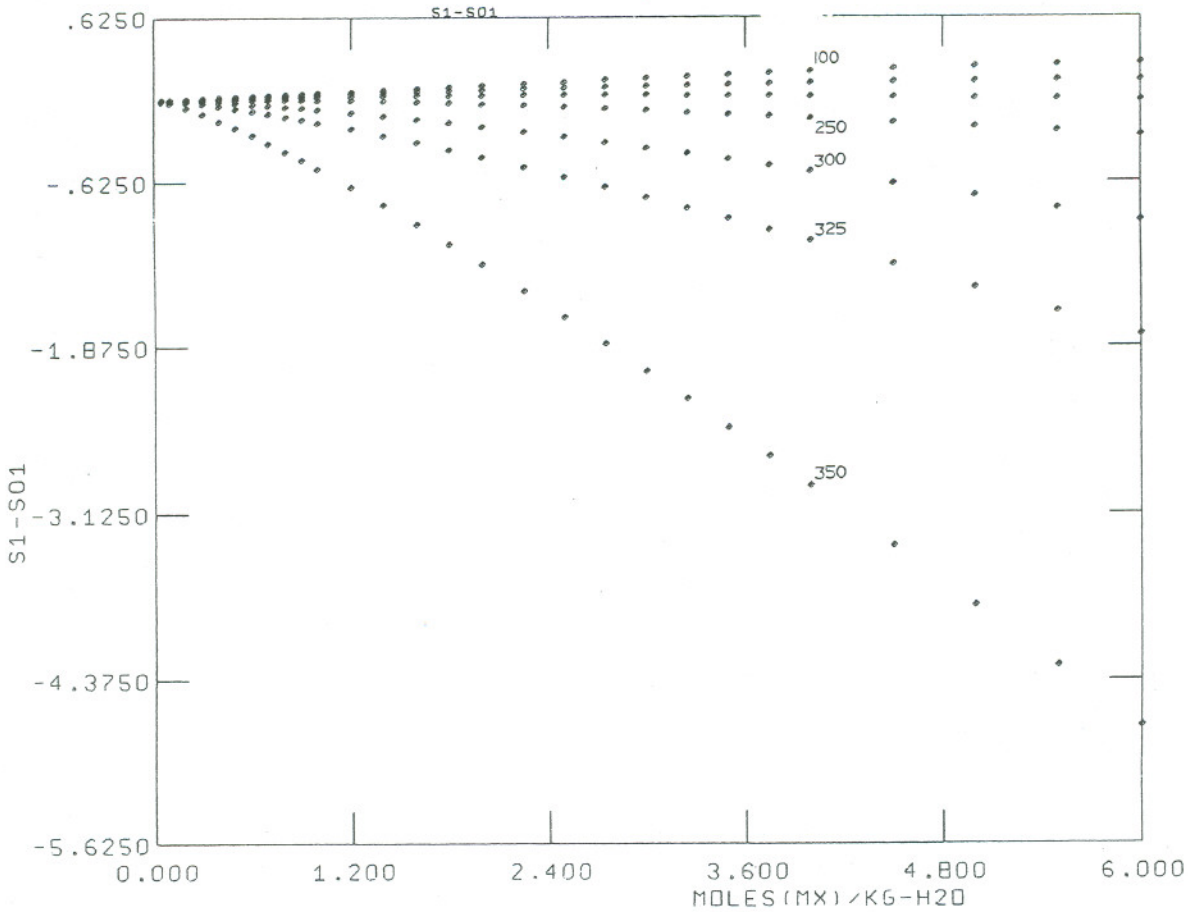

OSMOTIC
1.3000
1.1000
.9000
.7000
.5000
.3000
OSMOTIC
100
150
200
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

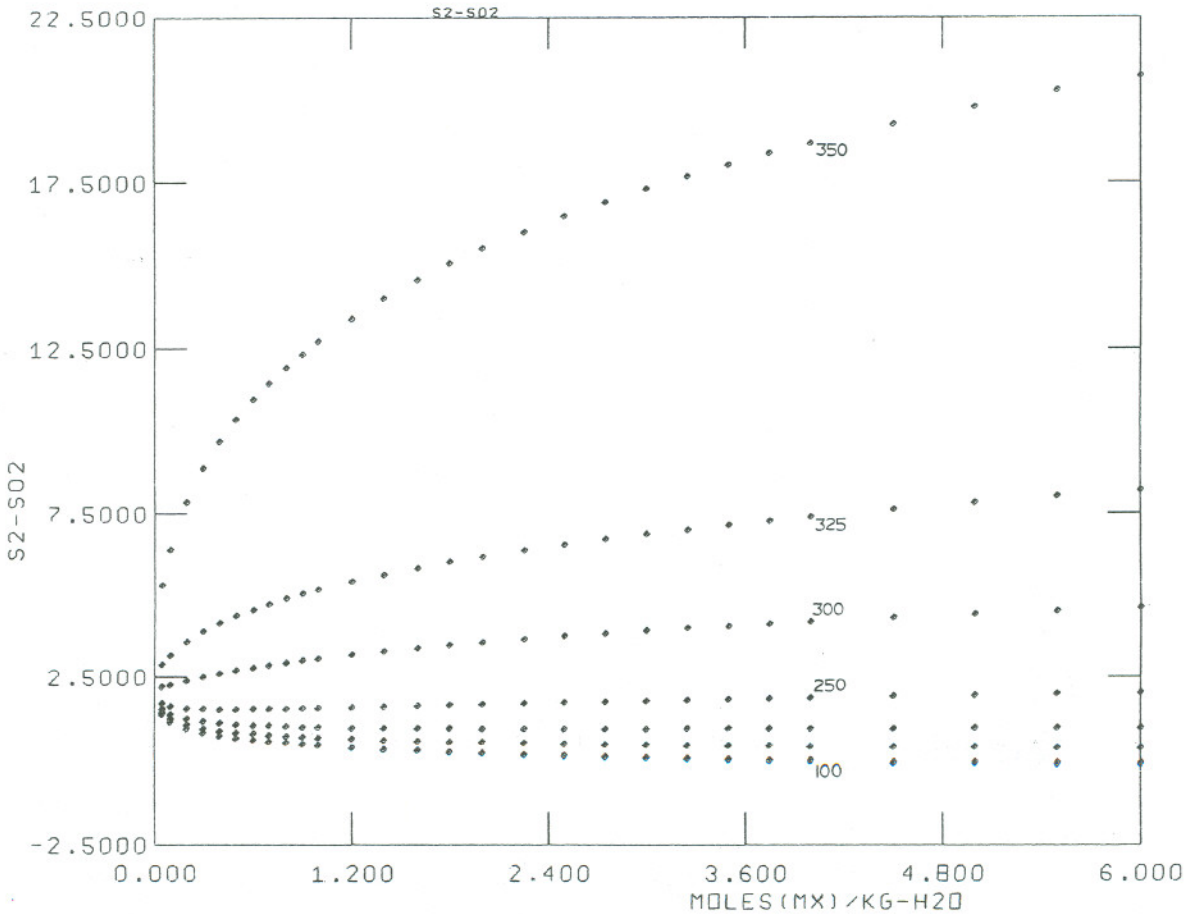

GAMMA
.9000
.7000
.5000
.3000
.1000
-.1000
GAMMA
100
150
200
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

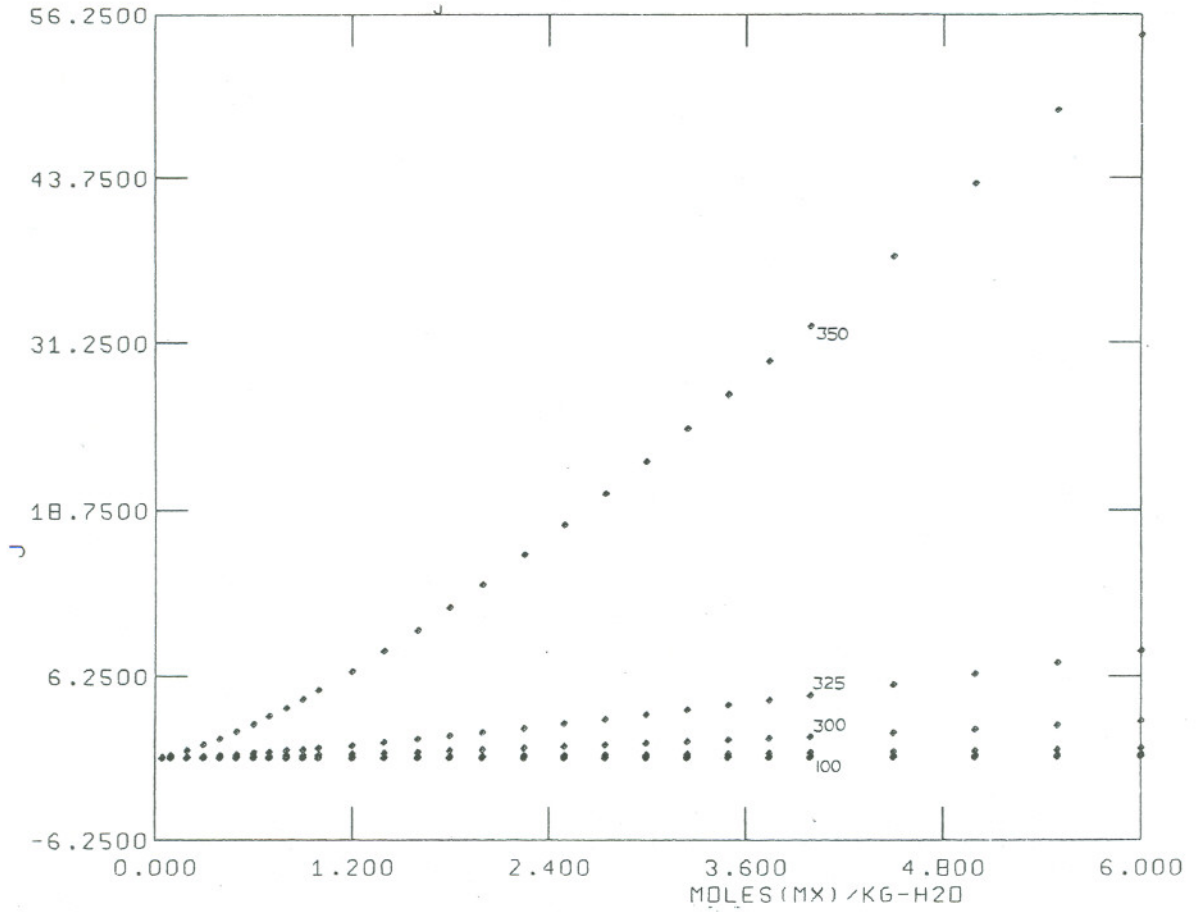

(L/M)
100.0000
80.0000
60.0000
40.0000
20.0000
0.0000
(L/M)
350
325
300
250
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

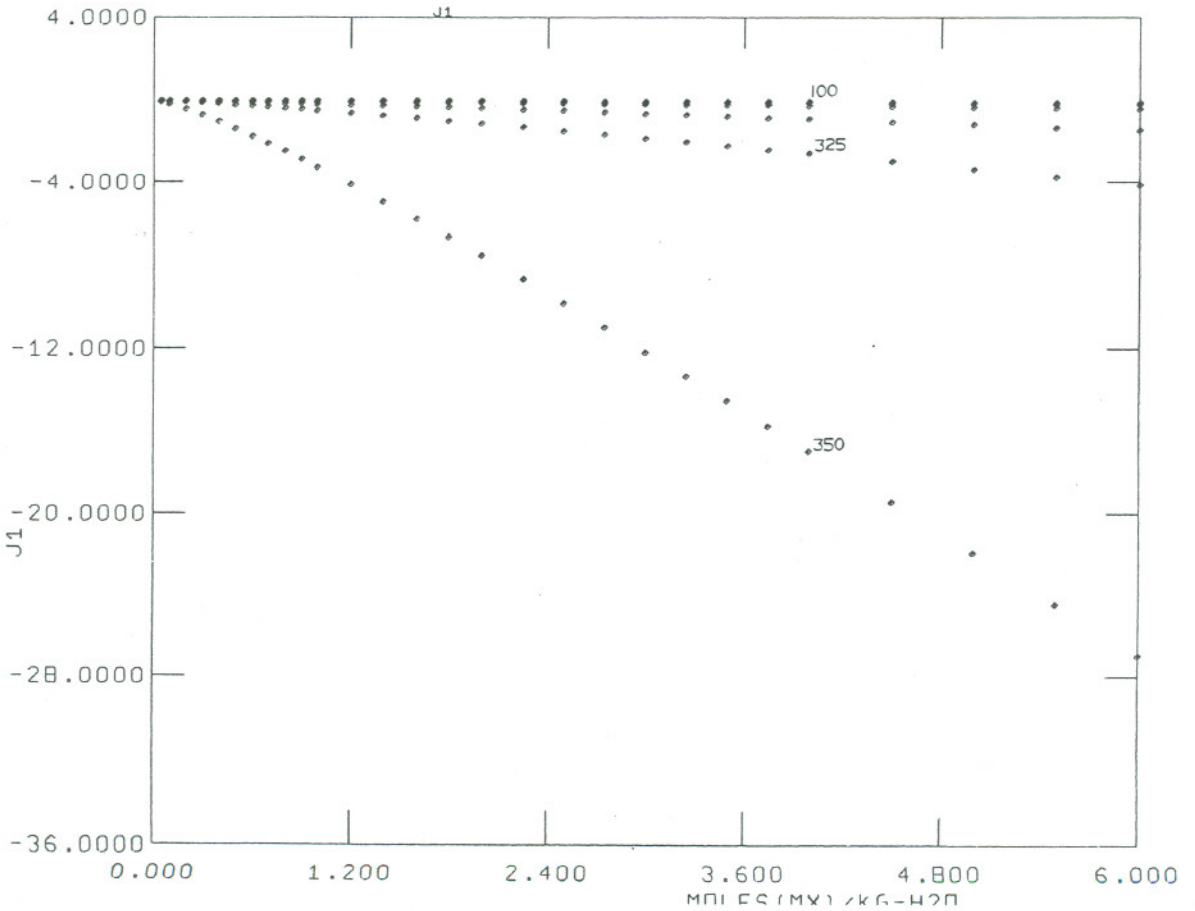

L1
4.0000
-4.0000
-12.0000
-20.0000
-28.0000
-36.0000
L1
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O
100
300
325
350

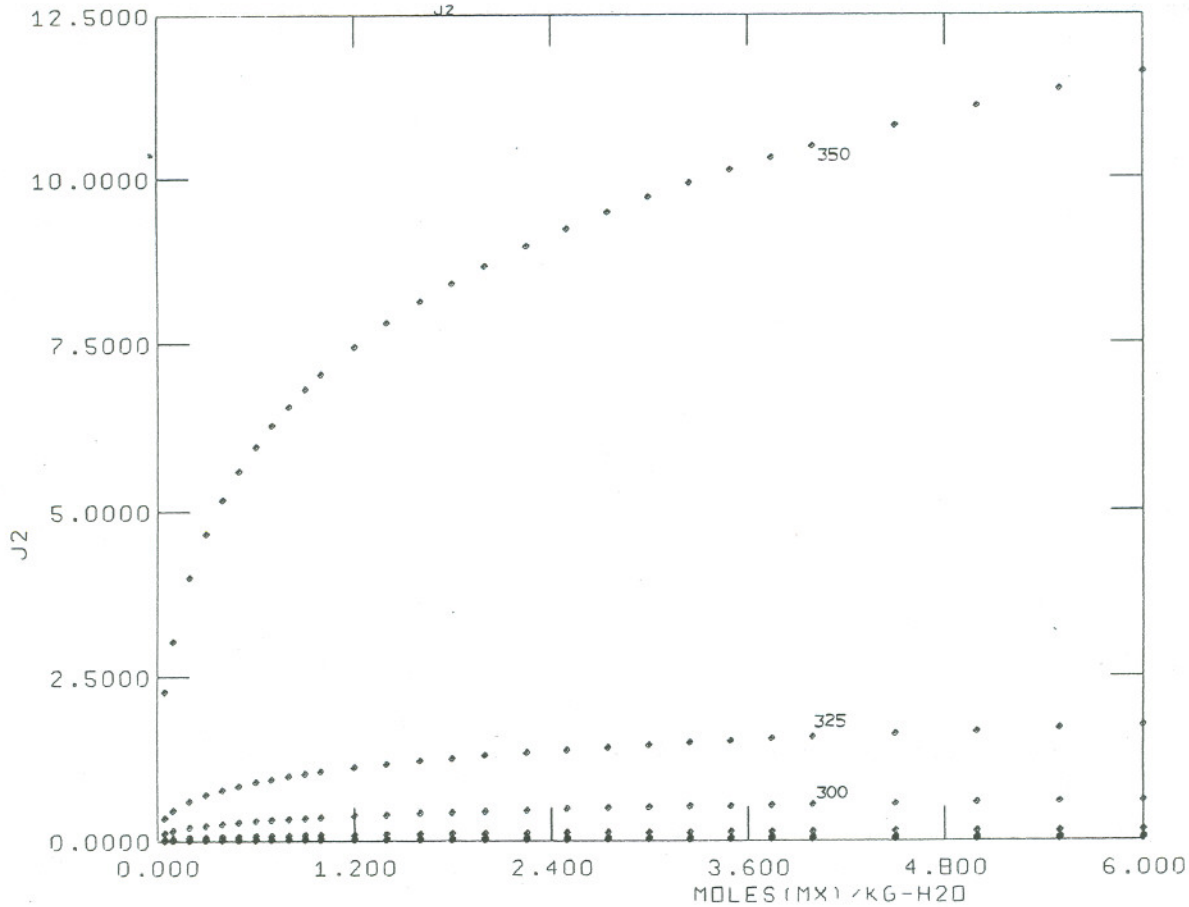

L2
13.5000
10.5000
7.5000
4.5000
1.5000
-1.5000
L2
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O
350
325
300
250
100

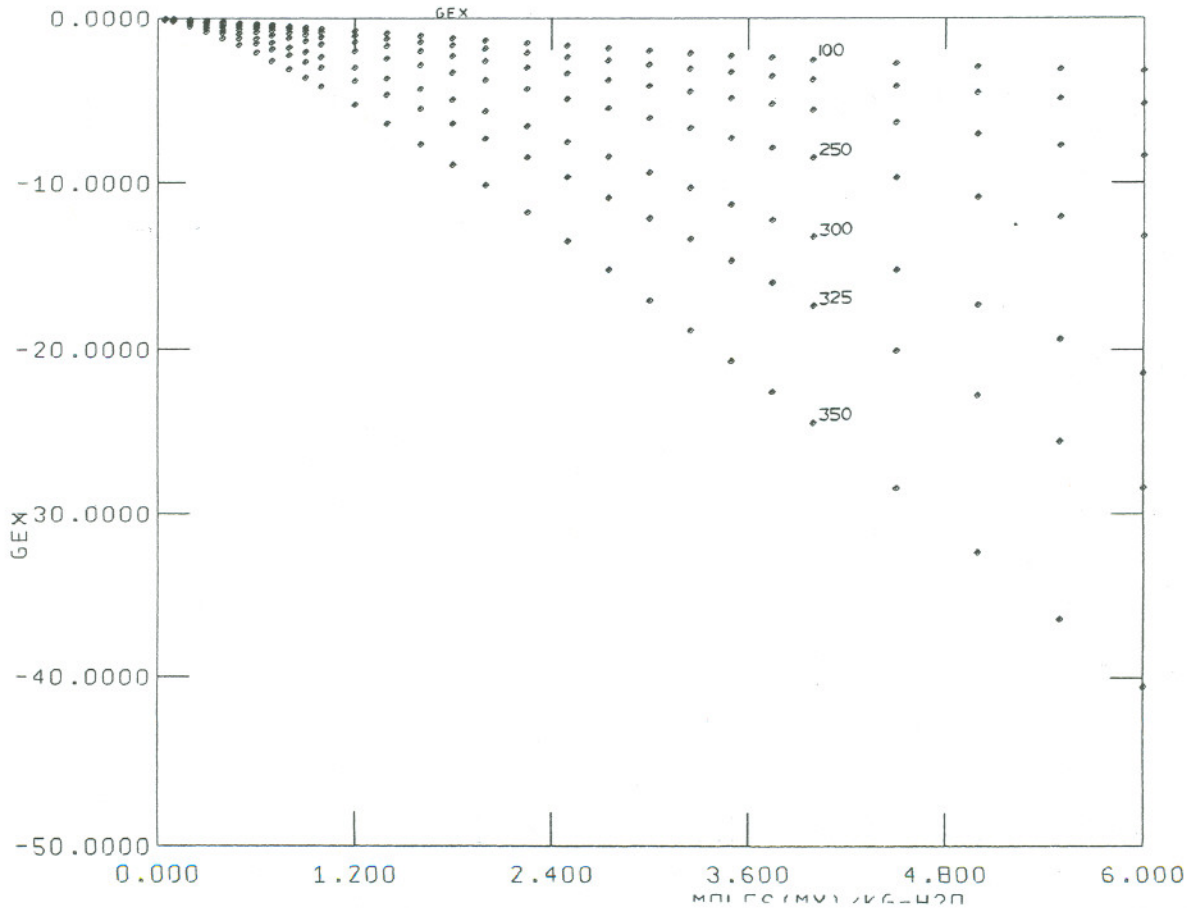

S1-S01
.6250
-.6250
-1.8750
-3.1250
-4.3750
-5.6250
S1-S01
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O
100
250
300
325
350

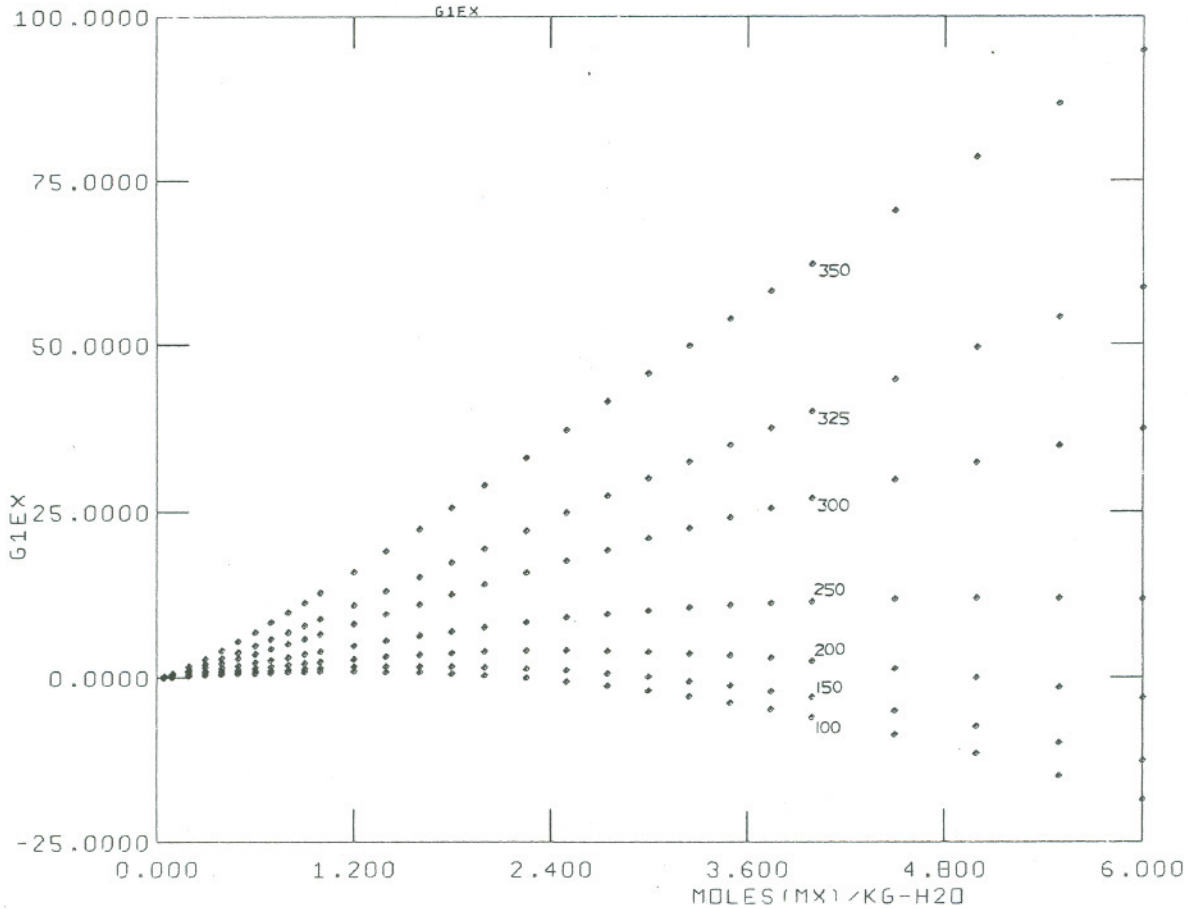

S2-S02
22.5000
17.5000
12.5000
7.5000
2.5000
-2.5000
S2-S02
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O
350
325
300
250
100

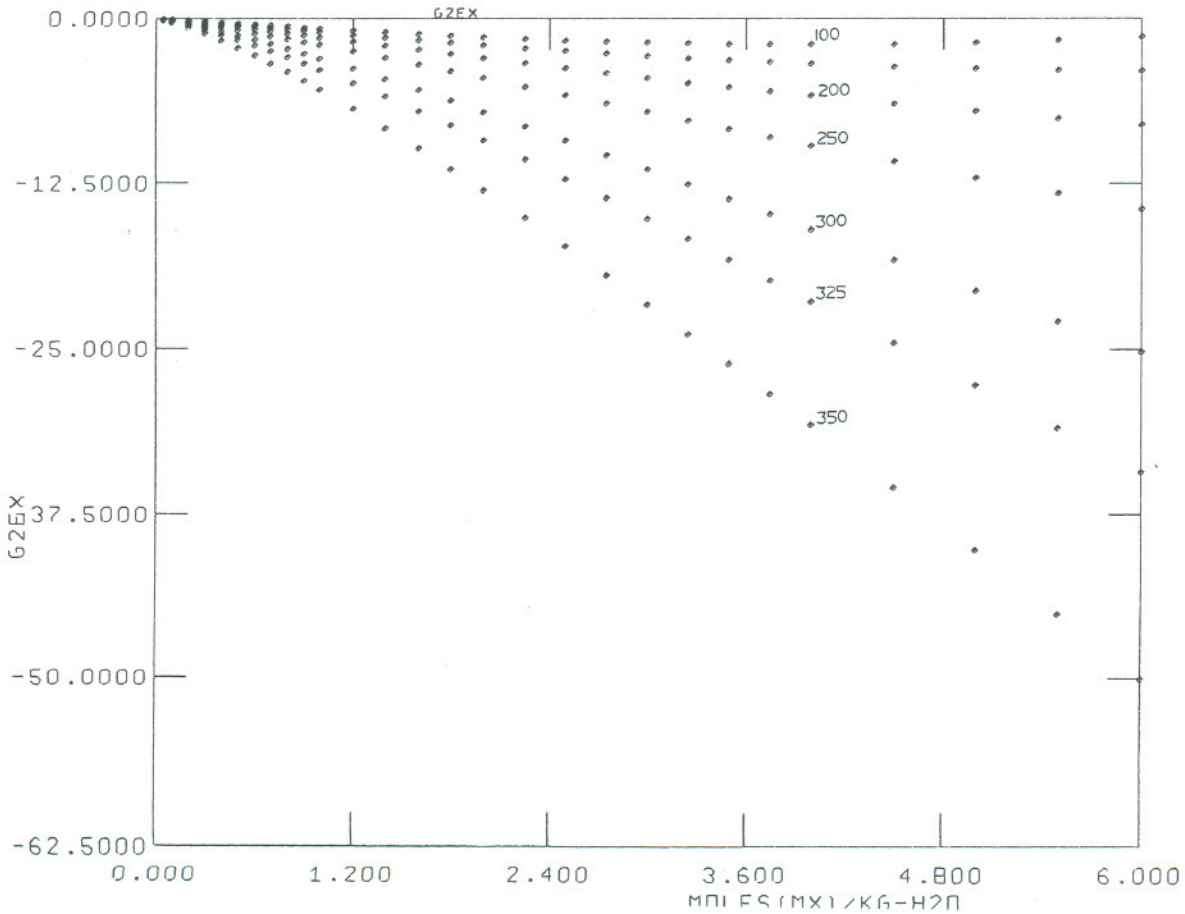

56.2500
43.7500
31.2500
18.7500
6.2500
-6.2500
J
350
325
300
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

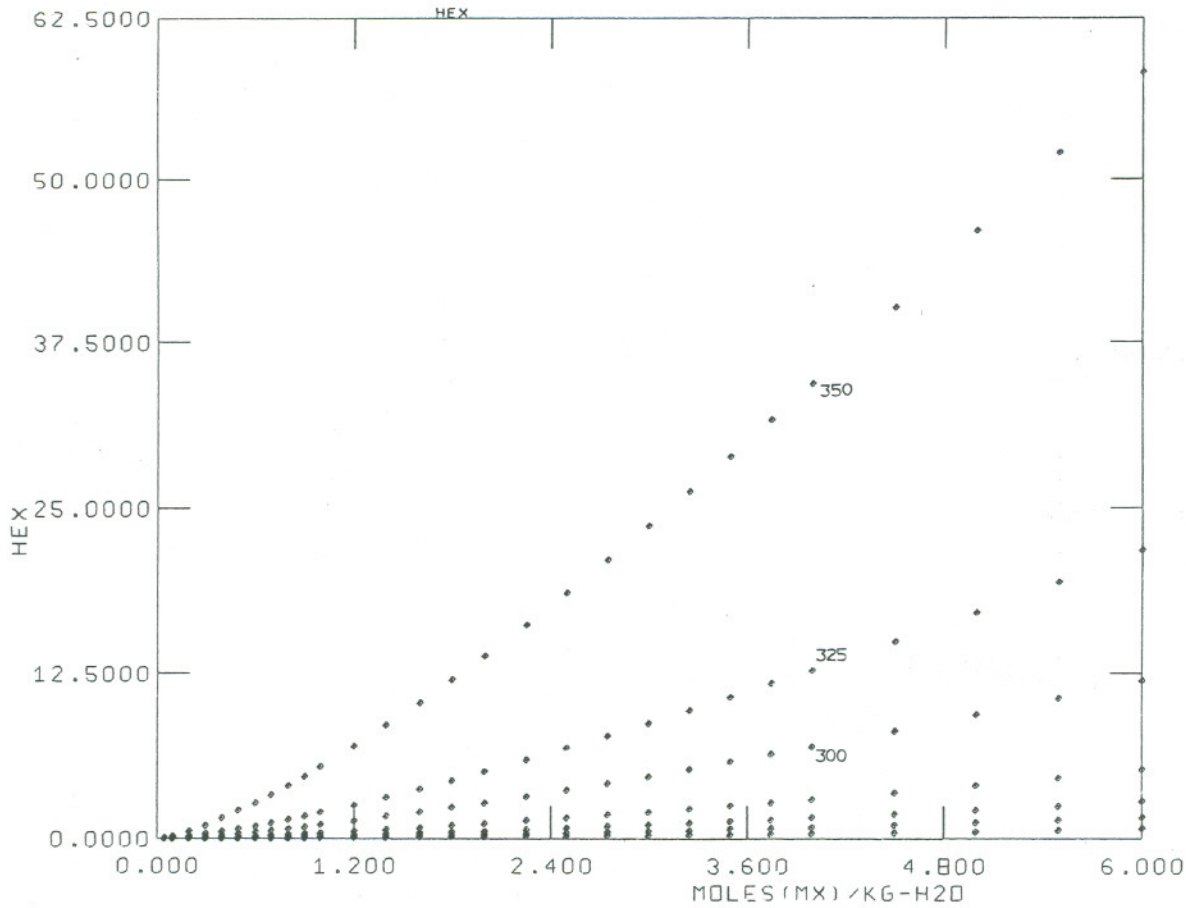

4.0000
-4.0000
-12.0000
-20.0000
-28.0000
-36.0000
J1
100
325
350
0.000
1.200
2.400
3.600
4.800
6.000

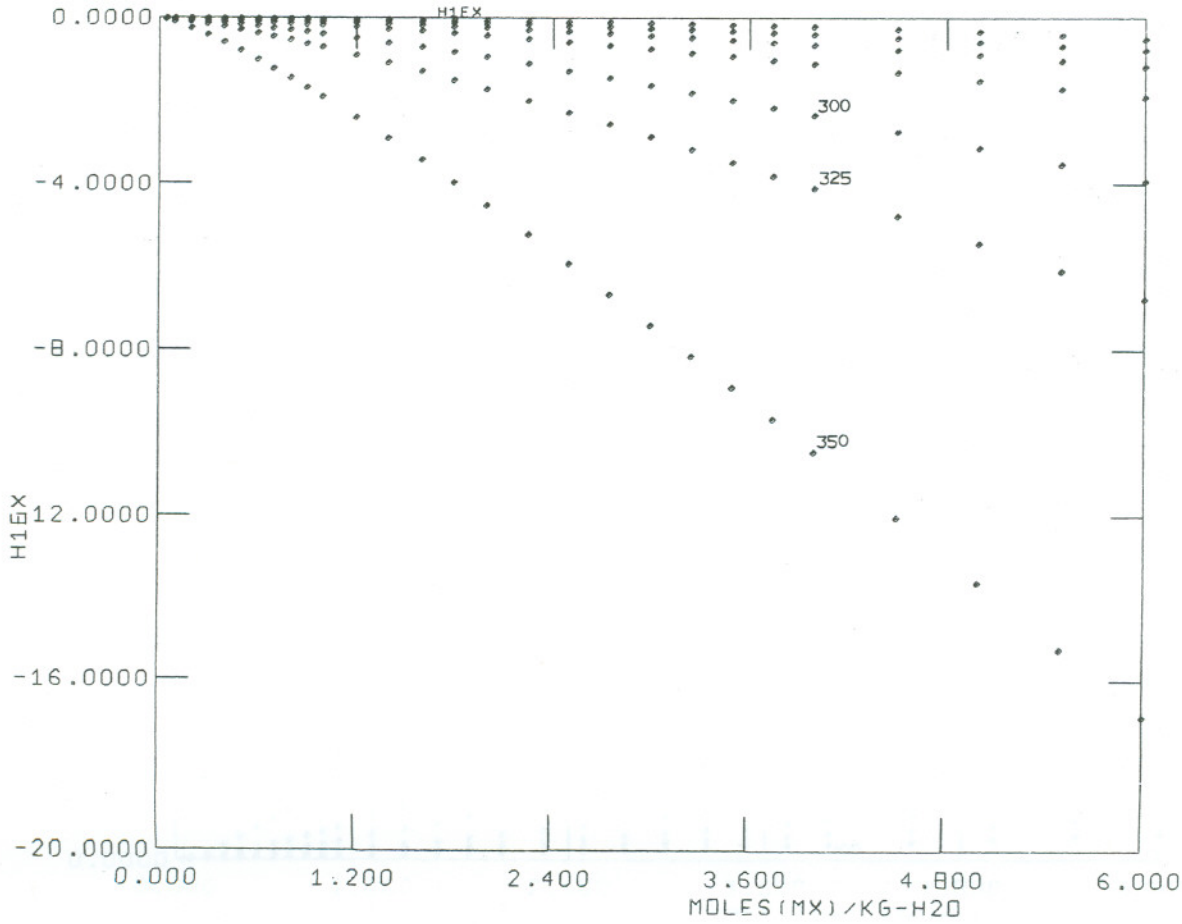

J2
12.5000
10.0000
7.5000
5.0000
2.5000
0.0000
J2
350
325
300
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

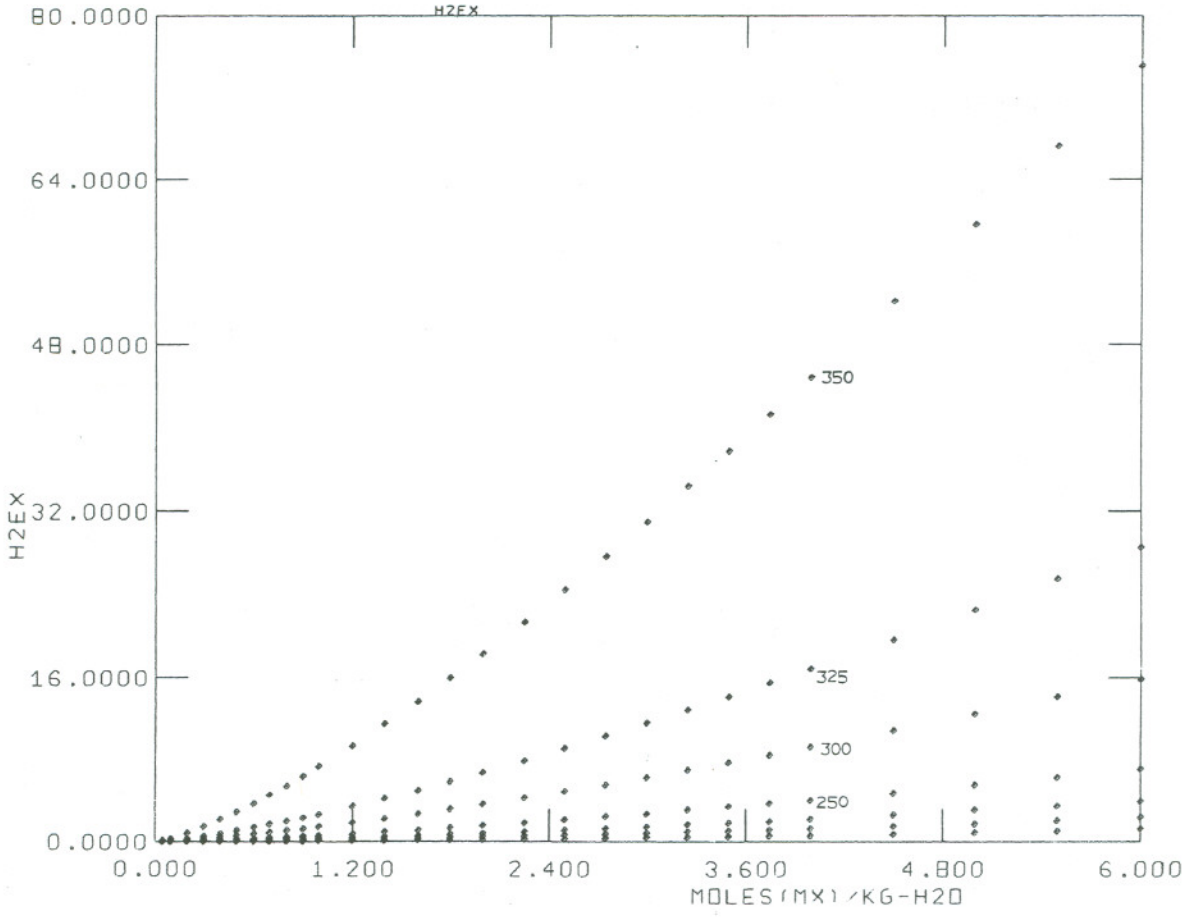

GEX
0.0000
-10.0000
-20.0000
-30.0000
-40.0000
-50.0000
GEX
100
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000

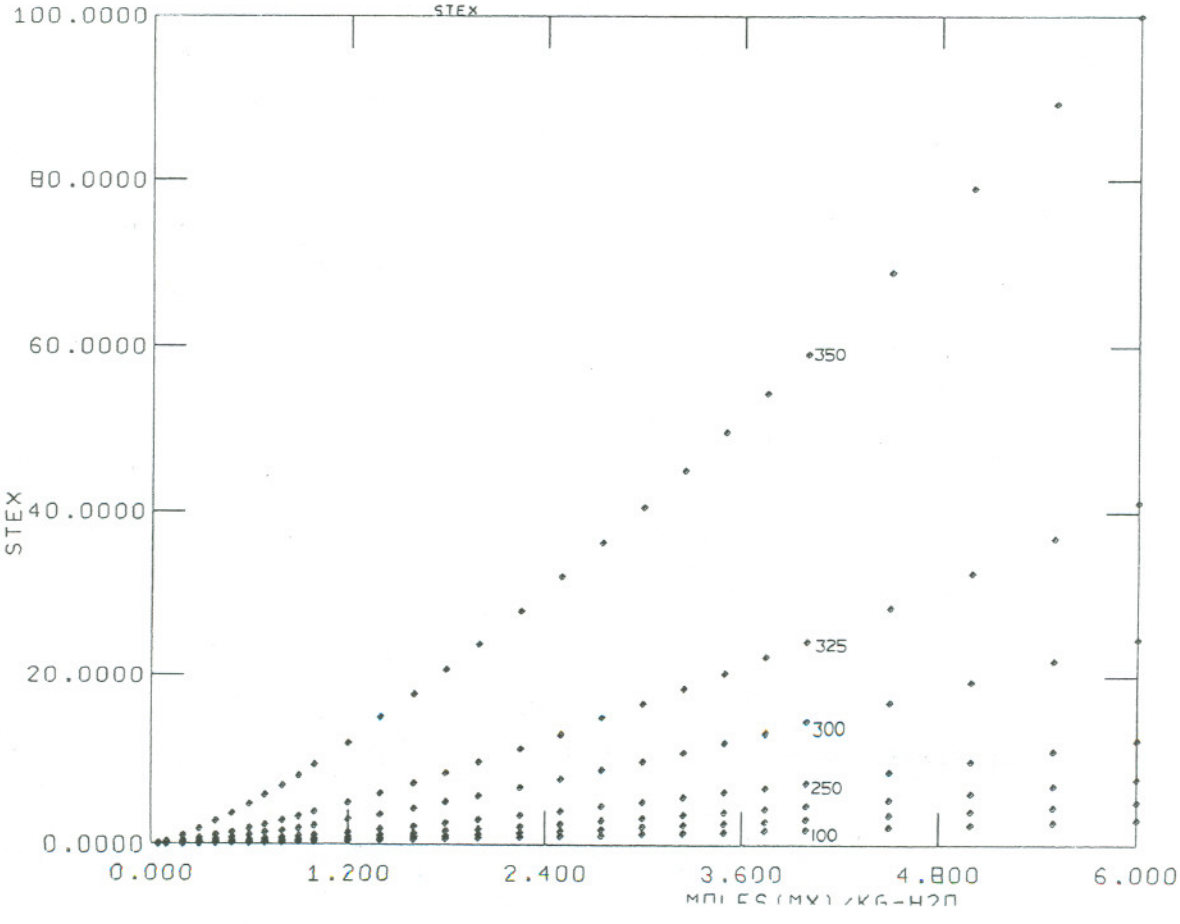

G1EX
100.0000
75.0000
50.0000
25.0000
0.0000
-25.0000
G1EX
350
325
300
250
200
150
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

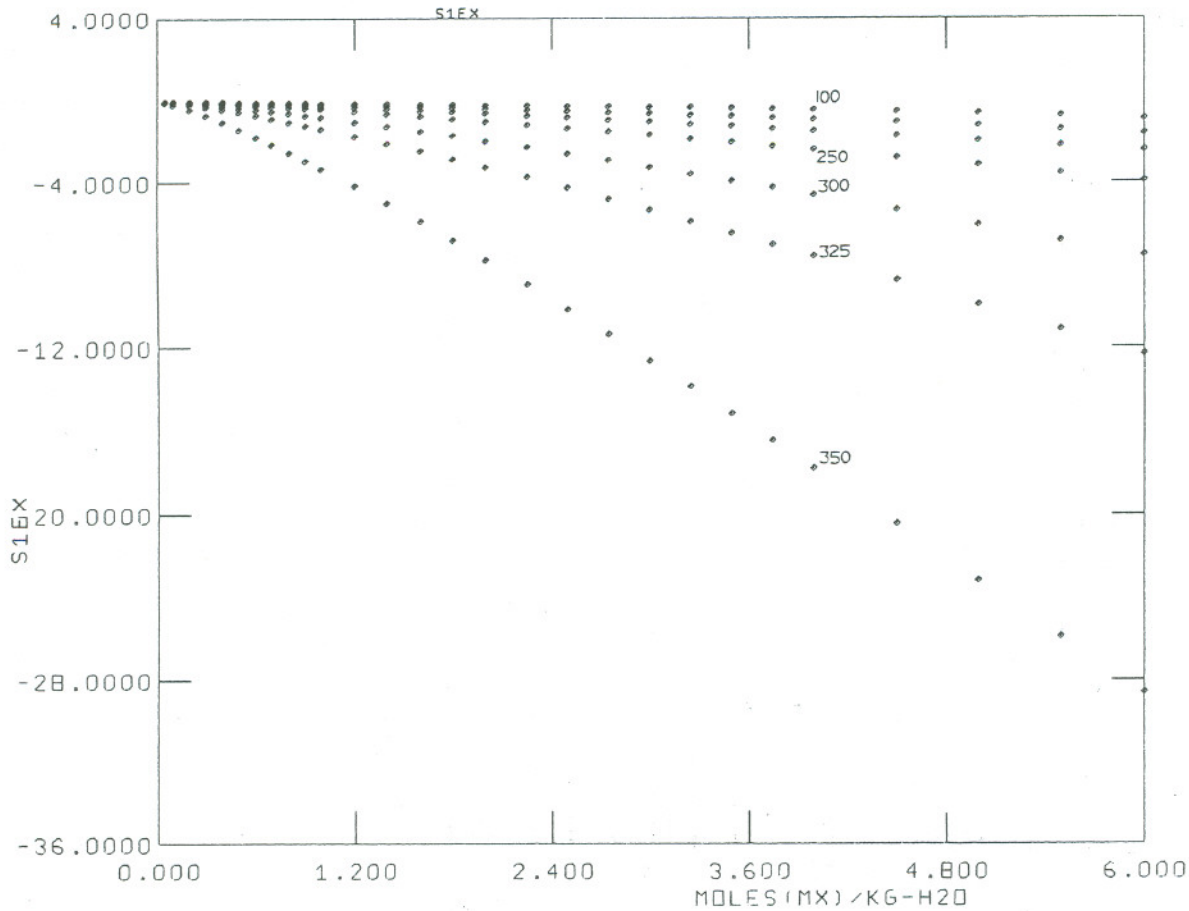

G2EX
0.0000
-12.5000
-25.0000
-37.5000
-50.0000
-62.5000
G2EX
100
200
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

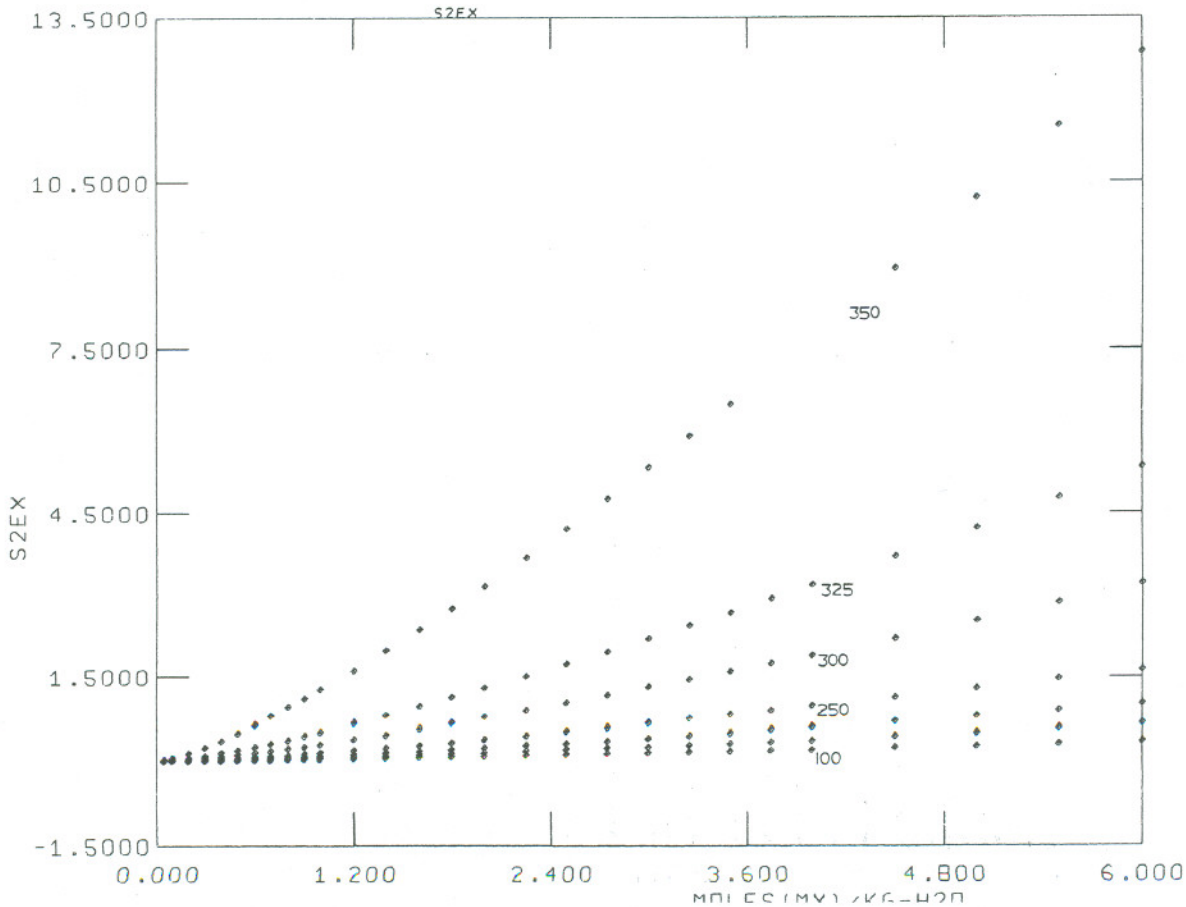

HEX
62.5000
50.0000
37.5000
25.0000
12.5000
0.0000
HEX
350
325
300
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

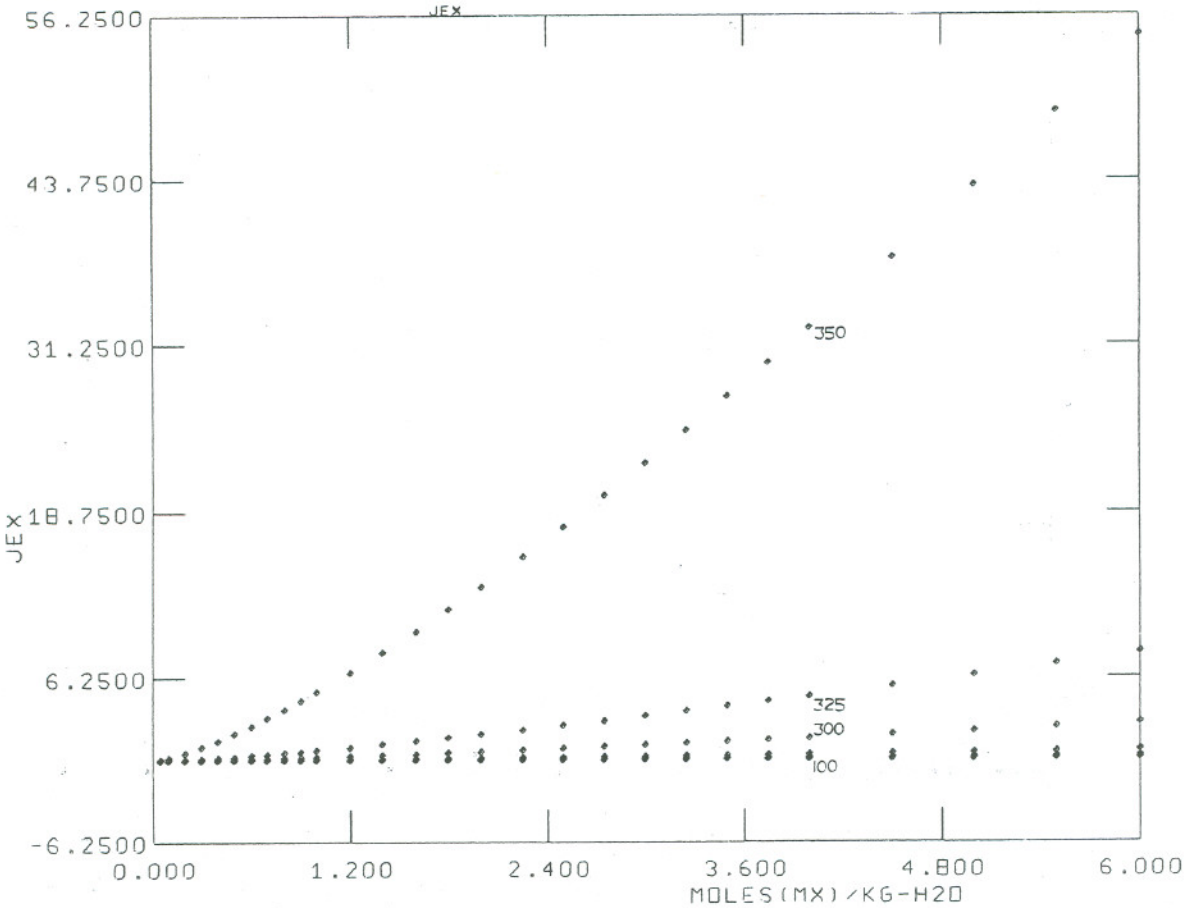

H1EX
0.0000
-4.0000
-8.0000
-12.0000
-16.0000
-20.0000
H1EX
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

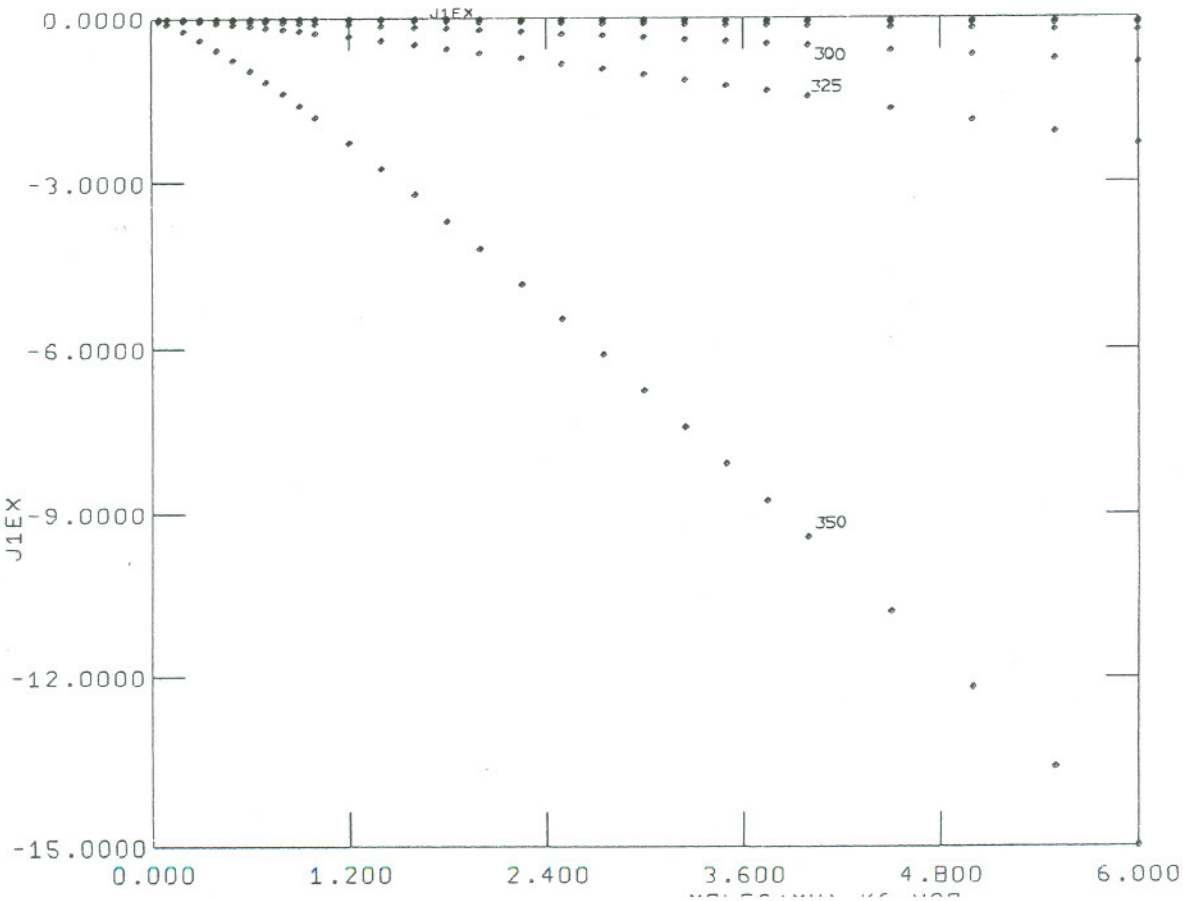

H2EX
80.0000
64.0000
48.0000
32.0000
16.0000
0.0000
H2EX
350
325
300
250
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

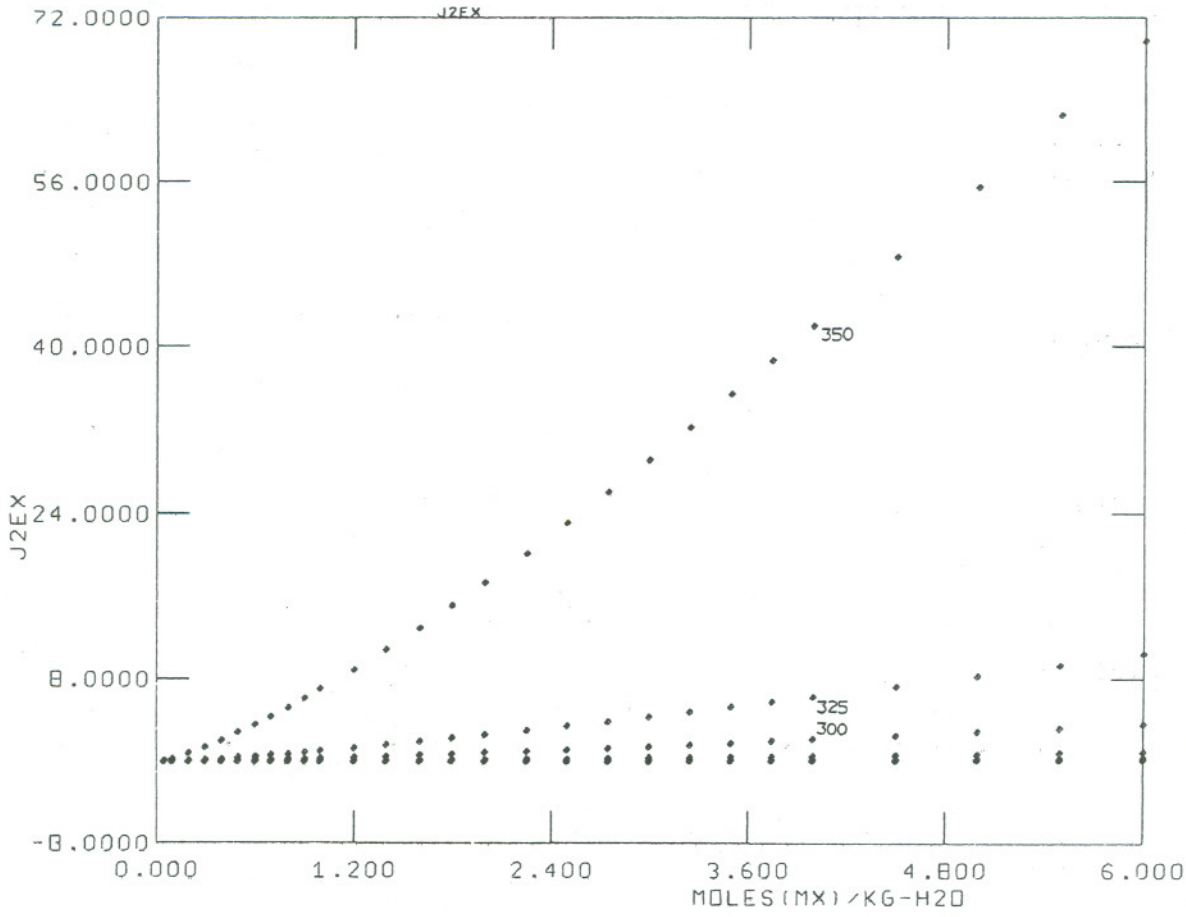

STEX
100.0000
80.0000
60.0000
40.0000
20.0000
0.0000
STEX
350
325
300
250
100
0.000
1.200
2.400
3.600
4.800
6.000


S1EX
4.0000
-4.0000
-12.0000
-20.0000
-28.0000
-36.0000
S1EX
100
250
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O


S2EX
13.5000
10.5000
7.5000
4.5000
1.5000
-1.5000
S2EX
350
325
300
250
100
0.000
1.200
2.400
3.600
4.800
6.000


JEX
56.2500
43.7500
31.2500
18.7500
6.2500
-6.2500
JEX
350
325
300
100
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O


J1EX
0.0000
-3.0000
-6.0000
-9.0000
-12.0000
-15.0000
J1EX
300
325
350
0.000
1.200
2.400
3.600
4.800
6.000


J2EX
72.0000
56.0000
40.0000
24.0000
8.0000
-8.0000
J2EX
350
325
300
0.000
1.200
2.400
3.600
4.800
6.000
MOLES(MX)/KG-H2O

0 0 0 0 4 4 0 3 7 3 0

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