Annotated Bibliography of Studies on the Density and other Volumetric Properties for Major Components in Geothermal Waters 1928–74

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Contents

ANNOTATED BIBLIOGRAPHY OF STUDIES ON THE DENSITY AND OTHER VOLUMETRIC PROPERTIES FOR MAJOR COMPONENTS IN GEOTHERMAL WATERS, 1928–74

By R. W. Potter, II, D. R. Shaw, and J. L. Haas, Jr.

Introduction

This bibliography supplies an annotated list of references pertaining to the density of solutions of importance in geothermal exploration and energy production. The list has been restricted to those references containing data on aqueous solutions of the following salts:

HCl	H_2SO_4	$FeSO_4$	K_2CO_3
NaCl	$NaHSO_4$	H_2CO_3	NaOH
KCl	Na_2SO_4	$NaHCO_3$	KOH
$CaCl_2$	$KHSO_4$	Na_2CO_3	SiO_2[aq]
$FeCl_2$	K_2SO_4	$KHCO_3$	"sea water"

Other components in the geothermal waters are almost always minor. Examples are aluminum compounds, fluorides, and bisulfides. Densities of these solutions have been neglected because 1) data for these components at temperatures above 100°C are uniformly nonexistent, and 2) the salts are present in such minor quantities that they will have only a negligible effect on the overall physical properties of the geothermal water. The volumetric properties of "sea water" and its concentrates were included in the literature search. Sea water is similar to subsurface brines in that it is dominantly a NaCl brine. However, sea water contains significant concentrations of magnesium and only traces of calcium, whereas subsurface brines contain significant concentrations of calcium and only traces of magnesium. The difference in the composition will have a significant effect on the chemical properties of the brine, but only a minor effect on the physical properties such as density.

The period covered by this report is from 1928 to the present. Data available prior to 1928 were evaluated and the results are given in volume 3 of the International Critical Tables (National Research Council, 1928). The list contained here is as complete as a diligent search of literature and bibliographies would permit. With few noted exceptions, copies of all articles were used to prepare the annotation. The units of measurement cited in the annotation are those used in the reference. No conversion to the International System of Units (Page and Vigoureux, 1972) has been made because that work would require a substantial effort, delay publication, and impair the timeliness of this bibliography.

An evaluation of the quality of the data given in the cited references is beyond the scope of this report. The report is intended to supply the national geothermal effort with an immediate location of unevaluated data for use in preliminary calculations. The report will also serve as a basis for preparing tables of the densities of brines and for planning a future research effort on the physical and thermochemical properties of brines. In the section, Breakdown of bibliography by chemical species, however, we have noted those studies that contain data for temperatures at and greater than 100°C. Those studies containing data for pressures greater than ambient (that is for the vapor-absent pressure-temperature region) are also flagged separately.

The bibliography is a first step toward satisfying the needs of scientists and engineers as were expressed at the Conference on Thermodynamics and National Energy Problems (National Academy of Sciences, 1974) and as further amplified by the Ad Hoc Committee on Geothermal Chemistry (1974) convened by the U. S. Atomic Energy Commission. Support for this work has come exclusively from the U. S. Geological Survey's geothermal research program.

Experimental methods

The diverse types of experimental methods and techniques utilized to measure the density of a brine are discribed briefly below. This description is not intended to be a detailed or exhaustive treatise on how to measure density and specific volume, but rather generally to inform the reader of the meaning of various phrases that are used in the text of the annotations to describe how the particular set of experimental data was collected. Because the precision of the individual experimental technique varies widely, depending largely on the experimental configuration and the investigator, no attempt was made in this bibliography to specify the precision or accuracy of the sundry methods and techniques given below.

The pycnometer is perhaps the simplest and most commonly used method for directly measuring the density of a brine below 100°C. The basic principle of the method is to weigh a precisely known volume of brine at constant temperature. Knowing the volume and weight of that volume, the density or specific volume can be readily calculated. Examples in the bibliography of studies employing this technique are: Akerlof and Teare (1938), Taskoprulu (1956), and Choi and Bonner (1973).

Another commonly used series of methods to determine the density of brines is to immerse an object in the brine and measure either its loss of weight or the weight required to make the object just sink or float. This has been accomplished in numerous and ingeniously different ways. The most straightforward method is to take a sinker of precisely known density and weigh it while suspended in the brine. Another method is to place a float in the brine and add weights until the float sinks. An interesting and very useful variation of this method is to measure the amount of current required by an electromagnet to allow a magnetic float to remain suspended in the liquid and neither float to the surface nor sink to the bottom. Another method is to attach two identical floats to a differential balance and to immerse one in pure water and the other in the brine. By measuring the resulting difference in weight, the difference in the densities of the brine and the pure water can be calculated. The following studies in the bibliography have employed various float techniques: Bremner, Thompson, and Utterback (1938), Klotz and Eckart (1942), and Millero (1967).

Changes in the volume (density) of a brine with respect to a corresponding change in temperature or pressure or both are generally measured with a class of devices referred to as dilatometers. Basically, the change in volume is measured through the displacement of some medium such as a piston, or mercury from a constant temperature reference cell, or the brine itself by measuring the change in height of the brine in a tube. Examples of studies in the bibliography employing dilatometers are: Adams (1931), Wright (1940), and Ellis (1966).

At high temperature and pressure, the most common technique for obtaining densities of brines is by determining the filling temperature of an autoclave. This is accomplished by partially filling an autoclave at a reference temperature and ambient pressure. The autoclave is then heated while the pressure is monitored. There will be a sharp break in the p-t curve when the autoclave is filled with liquid. From this filling temperature, from the initial degree of filling and from the density of the brine at the reference temperature, the density of the solution at elevated pressure and temperature can be readily calculated. Examples of studies in the bibliography that used this method are: Lemmlein and Klevtsov (1961), and Mashovets and others (1973).

All objects vibrate at a natural resonance frequency that is dependant on the density of the object. By measuring the resonance frequency of a hollow metallic tube filled with a brine, the density of the brine can be readily determined. A study in the bibliography that employed this technique is by Fortier, Philip, and Desnoyers (1974).

The adiabatic compressibility is related to the velocity of sound in the brine, and thus the adiabatic compressibility of a brine is frequently determined by measuring the velocity of sound in the brine. Examples in the bibliography of such studies are: Baranowski and others (1957), and Auslander and Onitiu (1970).

The attenuation of gamma rays is related to the density of the medium through which they pass. Khaibullin and Borisov (1963) used this relation to measure the density of NaCl solutions at high pressure and temperature.

Nomenclature

Ambient pressure is the saturated vapor pressure of the solution at the specified temperature(s).

Apparent molal volume is equal to the total volume of the solution minus the volume of the solvent divided by the number of moles of the solute.

Compressibility is the change in volume per unit change in pressure.

Density is the mass per unit volume of a substance.

Limiting apparent molal volume is the apparent molal volume at infinite dilution.

Molal refers to the number of moles of the solute per 1000 grams of solvent.

Molar refers to the number of moles of the solute per liter of solution.

Normal refers to one equivalent weight of the solute per liter of solution.

Partial molal volume is the change in volume of a solution which would be brought about by the addition of one mole of solute to such a large amount of solution that the composition of the solution remains essentially unchanged.

Relative density is the ratio of the mass of a given volume of a substance to that of an equal volume of some arbitrary standard.

Relative volume is the ratio of the volume of a given mass of a substance to that of an equal mass of some arbitrary standard.

Specific gravity is the ratio of the mass of a given volume of a substance to that of an equal volume of water.

Specific volume is the volume per unit mass of a substance.

Breakdown of bibliography by chemical species

The following list gives a breakdown of the studies cited in the text by chemical species. The order of list is the same as given in the Introduction.

As an aid in identifying the maximum temperature considered in each of the studies, the following flags have been added in front of the reference:

Temperature	Flag
99°C or less	no flag
199°C or less	*
299°C or less	**
300°C or more	***

Those studies at pressures greater than ambient pressure (that is in the vapor-absent pressure-temperature region) are flagged with a plus sign (+).

Binary systems containing one salute are listed first. Three component systems are listed next.

1. Hydrochloric acid (HCl):

1. Accascina and Schaifo, 1962
5. Akerlof and Teare, 1938
18. Berecz, 1971
20. Bhimasenachar and Subrahmanyam, 1957b
29. Chapman and Newman, 1968
42. Dunn, 1966
***+ 50. Ellis and McFadden, 1968b
64. Garrett and Woodruff, 1951
66. Geffcken, 1931
81. Gucker, 1933b

82. Gucker, 1934a
94. Ingham, 1928
96. Isono and Tamamushi, 1967
116. Klochko and Kurbanov, 1954
+ 132. Lanman and Mair, 1934
136. Lengyel, 1963a
142. Lunden, 1943
*** 148. Maksimova, 1965
153. Mathieson and Conway, 1974
* 155. Mikhailov and Shutilov, 1956
164. Millero, Hoff, and Kahn, 1972b
**+ 165. Millero, 1972c
171. Owen and Brinkley, 1941
173. Owen and Brinkley, 1949
***+ 187. Rau and Narayanan Kutty, 1970
192. Redlich and Bigeleisen, 1942a
193. Redlich and Bigeleisen, 1942b
**+ 200. Samoilovich, 1970
219. Taskoprulu, 1956
240. Zen, 1957

2. Sodium chloride (NaCl):

+ 2. Adams, 1931
4. Adams, Yank, Christie, and Kruus, 1974
+ 8. Allam and Lee, 1966
13. Batuecus, 1946
15. Batuecas and Meijon, 1967b
***+ 17. Benson, Copeland, and Pearson, 1953
18. Berecz, 1971
+ 24. Brander, 1936
26. Bremer, Thompson and Utterback, 1938
29. Chapman and Newman, 1968
30. Choi and Bonner, 1973
31. Cholian, 1966
**+ 32. Chou, 1968
* 33. Cornec and Krombach, 1932
36. Desnoyers, Arel, Perron, and Jolicoeur, 1969
37. Devdariani, Kolobov, and Marenina, 1973
40. Duedall and Weyl, 1965
41. Duedall and Weyl, 1967
43. Dunn, 1968
***+ 45. Egorov and Ikornikova, 1973
*** 46. Ellis and Golding, 1963
**+ 47. Ellis, 1966
52. Epifanova and others, 1973
* 55. Fabus, Korosi, and Hug, 1966
* 56. Fabus and Korosi, 1967
* 57. Fabuss and Korosi, 1968

58. Fajans and Johnson, 1942
59. Falkenhagen and Bachem, 1935
60. Fortier, Philip and Desnoyers, 1974
61. Franks and Smith, 1967
62. Freyer, 1931
66. Geffcken, 1931
67. Geffcken, 1933a
68. Geffcken, Beckmann, and Kruis, 1933b
72. Gibson, 1934
+ 74. Gibson and Loeffler, 1941
80. Gucker, 1933a
81. Gucker, 1933b
82. Gucker, 1934a
84. Gucker, Chernik, and Roy-Chowdhury, 1966
*** 85. Haas, 1970
*** 86. Haas, 1971
87. Halasey, 1941
89. Helmy, Assaad, Naguib Hassan, and Sadek, 1968
***+ 93. Ikornikova and Egorov, 1968
94. Ingham, 1928
96. Isono and Tamamushi, 1967
98. Jain and Lark, 1970
101. Jones and Christian, 1937a
106. Kaulgud, 1965a
107. Kaulgud, 1965b
***+ 109. Khaibullin and Borisov, 1963
*** 110. Khaibullin and Borisov, 1966
*** 111. Khaibullin and Novikov, 1973
* 123. Korosi and Fabuss, 1968a
* 124. Korosi and Fabuss, 1968b
126. Kruis, 1936
129. Kuppers, 1974
130. Lamb and Lee, 1913
131. LaMer and Gronwall, 1927
+ 132. Lanman and Mair, 1934
133. Lee, 1966
***+ 135. Lemmlein and Klevtsov, 1961
136. Lengyel, 1963a
141. Lunden, 1941
146. Mahapatra and Ray, 1958
*** 148. Maksimova, 1965
149. Maksimova and Foterov, 1973
+ 150. Manucharov, Mikhailov, and Shutilov, 1964
153. Mathieson and Conway, 1974
154. Merkel, 1939
156. Mikhailov, Savina, and Feofanov, 1957
157. Mikhailov and Syrnikov, 1959
159. Mikhailov and Shutilov, 1964
160. Millero, 1967
161. Millero and Drost-Hansen, 1968

162. Millero, 1970
+ 163. Millero, Knox, and Emmet, 1972a
164. Millero, Hoff, and Kahn, 1972b
**+ 165. Millero, 1972c
170. Onitiu and Auslander, 1972
171. Owen and Brinkley, 1941
172. Owen, 1944
173. Owen and Brinkley, 1949
174. Owen and Kronick, 1961
175. Passynski, 1935
176. Passynski, 1938
***+ 182. Polyakov, 1965
183. Postnikov, 1970
184. Prang, 1938
186. Raqib, 1970
190. Redlich and Rosenfeld, 1931
191. Redlich, 1940
194. Redlich and Meyer, 1964
196. Rosen, 1959
*+ 197. Rowe and Chou, 1970
198. Salceanu, 1963
***+ 199. Samoilovich and Khetchikov, 1968
201. Satyavati, Jayarama Reddy, and Subrahmanyam, 1962
* 203. Scott, 1931
+ 204. Scott, Obenhaus, and Wilson, 1934a
+ 205. Scott and Wilson, 1934b
+ 206. Seifer and others, 1971
209. Shakhov, 1972
212. Simmons and Owen, 1957
214. Stankhanova and Vasilev, 1963
216. Szalay, 1934
219. Taskoprulu, 1956
222. Tikhomirova, 1957
* 223. Tribus and others, 1959
224. Tsujioka, 1957
* 226. Unterberg, 1964
***+ 227. Urusova, 1974
229. Vaslow, 1966
230. Vaslow, 1969
237. Wirth and LoSurdo, 1968
238. Wirth and Bangret, 1972
239. Wright, 1940
240. Zen, 1957

3. Potassium chloride (KCl):

+ 8. Allam and Lee, 1966
**+ 9. Androsov and Bagdasaryan, 1972
14. Batuecas and Varela, 1967a

*** 16. Bell, Helton, and Rogers, 1970
23. Branca and Carrelli, 1950
26. Bremer, Thompson and Utterback, 1938
28. Cantelo and Phifer, 1933
29. Chapman and Newman, 1968
30. Choi and Bonner, 1973
36. Desnoyers, Arel, Perron, and Jolicoeur, 1969
37. Devdariani, Kolobov, and Marenina, 1973
41. Duedall and Weyl, 1967
43. Dunn, 1968
**+ 47. Ellis, 1966
52. Epifanova and others, 1973
* 56. Fabus and Korosi, 1967
* 57. Fabuss and Korosi, 1968
58. Fajans and Johnson, 1942
61. Franks and Smith, 1967
62. Freyer, 1931
** 63. Galinker, Rodnyansky, Korobkov, and Lekakh, 1964
* 66. Geffcken, 1931
67. Geffcken, 1933a
69. Geffcken and Price, 1934
72. Gibson, 1934
+ 73. Gibson, 1935
80. Gucker, 1933a
81. Gucker, 1933b
82. Gucker, 1934a
84. Gucker, Chernik, and Roy-Chowdhury, 1966
87. Halasey, 1941
***+ 93. Ikornikova and Egorov, 1968
94. Ingham, 1928
96. Isono and Tamamushi, 1967
99. Jones and Talley, 1933a
100. Jones and Talley, 1933b
102. Jones and Ray, 1937b
104. Kaminsky, 1957
105. Kaputstinskii, Stakhanova, and Vasilev, 1960
106. Kaulgud, 1965a
107. Kaulgud, 1965b
*** 110. Khaibullin and Borisov, 1966
120. Kolosov, Novik, and Chuprakova, 1971
* 123. Korosi and Fabuss, 1968a
* 124. Korosi and Fabuss, 1968b
126. Kruis, 1936
129. Kuppers, 1974
130. Lamb and Lee, 1913
131. LaMer and Gronwall, 1927
+ 132. Lanman and Mair, 1934
134. Legrand and Paris, 1966
136. Lengyel, 1963a
140. Longsworth, 1935

141. Lunden, 1941
144. MacInnes, Dayhoff, and Ray, 1951
145. MacInnes and Dayhoff, 1952
*** 148. Maksimova, 1965
+ 150. Manucharov, Mikhailov, and Shutilov, 1964
153. Mathieson and Conway, 1974
154. Merkel, 1939
156. Mikhailov, Savina, and Feofanov, 1957
157. Mikhailov and Syrnikov, 1959
+ 159. Mikhailov and Shutilov, 1964
161. Millero and Drost-Hansen, 1968
**+ 165. Millero, 1972c
167. Millero and Knox, 1973b
170. Onitiu and Auslander, 1972
171. Owen and Brinkley, 1941
172. Owen, 1944
173. Owen and Brinkley, 1949
174. Owen and Kronick, 1961
176. Passynski, 1938
+ 178. Perman and Urry, 1929
***+ 182. Polyakov, 1965
183. Postnikov, 1970
184. Prang, 1938
186. Raqib, 1970
190. Redlich and Rosenfeld, 1931
191. Redlich, 1940
194. Redlich and Meyer, 1964
198. Salceanu, 1963
***+ 199. Samoilovich and Khetchikov, 1968
201. Satyavati, Jayarama Reddy, and Subrahmanyam, 1962
* 203. Scott, 1931
+ 204. Scott, Obenhaus, and Wilson, 1934a
+ 205. Scott and Wilson, 1934b
+ 206. Seifer and others, 1971
209. Shakhov, 1972
212. Simmons and Owen, 1957
213. Spedding, Pikal, and Ayers, 1966
216. Szalay, 1934
221. Thomas and Perman, 1934
222. Tikhomirova, 1957
224. Tsujioka, 1957
229. Vaslow, 1966
234. Wirth, 1937
239. Wright, 1940
240. Zen, 1957

4. Calcium chloride ($CaCl_2$):

11. Auslander and Onitiu, 1970

12. Baranowski, Jacob and Sarnowski, 1957
18. Berecz, 1971
* 22. Bogatykh and Evnovich, 1965
29. Chapman and Newman, 1968
39. Drucker, 1941
42. Dunn, 1966
***+ 48. Ellis, 1967
53. Ezrokhi, 1967a
** 63. Galinker, Rodnyansky, Korobkov, and Lekakh, 1964
67. Geffcken, 1933a
80. Gucker, 1933a
81. Gucker, 1933b
83. Gucker, 1934b
90. Hepburn, 1932
92. Hurtado, Mateo, Serna, and Vidal-Abarca, 1973
96. Isono and Tamamushi, 1967
117. Klochko, Taukesheva, and Bezhaev, 1959
122. Kononemko and Sashevskaya, 1974
133. Lee, 1966
140. Longsworth, 1935
143. Lyons and Riley, 1954
*** 148. Maksimova, 1965
\+ 150. Manucharov, Mikhailov, and Shutilov, 1964
157. Mikhailov and Syrnikov, 1959
\+ 159. Mikhailov and Shutilov, 1964
**+ 165. Millero, 1972c
\+ 178. Perman and Urry, 1929
179. Perron, Desnoyers, and Millero, 1974
180. Pesce, 1932
***+ 182. Polyakov, 1965
198. Salceanu, 1963
* 203. Scott, 1931
210. Shedlovsky and Brown, 1934
228. Vasilev, Fedyainov, Karapet'yants, and Karpachev, 1973
* 232. Voitko, Kcvaleva, and Tspalin, 1972
240. Zen, 1957

5. Ferrous chloride ($FeCl_2$):

120. Kolosov, Novik, and Chuprakova, 1971
134. Legrand and Paris, 1966
*** 148. Maksimova, 1965

6. Sulfuric acid (H_2SO_4):

18. Berecz, 1971
20. Bhimasenachar and Subrahmanyam, 1957b
29. Chapman and Newman, 1968

64. Garrett and Woodruff, 1951
71. Gibson, 1931
113. Khare, 1962b
118. Klotz and Eckert, 1942
139. Lindstrom and Wirth 1969
* 155. Mikhailov and Shutilov, 1956
165. Millero, 1972c
240. Zen, 1957

7. Sodium hydrogen sulfate ($NaHSO_4$):

139. Lindstrom and Wirth 1969
165. Millero, 1972c
171. Owen and Brinkley, 1941

8. Sodium sulfate (Na_2SO_4):

23. Branca and Carrelli, 1950
29. Chapman and Newman, 1968
42. Dunn, 1966
**+ 49. Ellis, 1968a
52. Epifanova and others, 1973
* 55. Fabus, Korosi, and Huq, 1966
* 56. Fabus and Korosi, 1967
* 57. Fabuss and Korosi, 1968
69. Geffcken and Price, 1934
70. Gibson, 1927
72. Gibson, 1934
78. Glass and Madgin, 1934
82. Gucker, 1934a
106. Kaulgud, 1965a
*** 111. Khaibullin and Novikov, 1973
* 123. Korosi and Fabuss, 1968a
* 124. Korosi and Fabuss, 1968b
133. Lee, 1966
140. Longsworth, 1935
*** 148. Maksimova, 1965
\+ 150. Manucharov, Mikhailov, and Shutilov, 1964
156. Mikhailov, Savina, and Feofanov, 1957
159. Mikhailov and Shutilov, 1964
**+ 165. Millero, 1972c
167. Millero and Knox, 1973b
171. Owen and Brinkley, 1941
171. Owen and Brinkley, 1941
177. Pearce and Eckstrom, 1937
***+ 182. Polyakov, 1965
183. Postnikov, 1970
184. Prang, 1938

13. Sodium hydrogen carbonate ($NaHCO_3$):

165. Millero, 1972c
****+ 182. Polyakov, 1965
183. Postnikov, 1970
211. Shilovskaya and Lenkova, 1974

14. Sodium carbonate (Na_2CO_3):

25. Brannland, 1958
59. Falkenhagen and Bachem, 1935
68. Geffcken, Beckmann, and Kruis, 1933b
69. Geffcken and Price, 1934
+ 73. Gibson, 1935
* 76. Ginzburg, Pikulina, and Litvin, 1964b
* 77. Ginzburg, 1965
130. Lamb and Lee, 1913
156. Mikhailov, Savina, and Feofanov, 1957
165. Millero, 1972c
180. Pesce, 1932
183. Postnikov, 1970
184. Prang, 1938
211. Shilovskaya and Lenkova, 1974
240. Zen, 1957

15. Potassium hydrogen carbonate ($KHCO_3$):

41. Duedall and Weyl, 1967
165. Millero, 1972c

16. Potassium carbonate (K_2CO_3):

** 63. Galinker, Rodnyansky, Korobkov, and Lekakh, 1964
* 75. Ginzburg, Pikulina, and Litvin, 1964a
* 77. Ginzburg, 1965
*** 148. Maksimova, 1965
165. Millero, 1972c
184. Prang, 1938
* 203. Scott, 1931
240. Zen, 1957

17. Sodium hydroxide (NaOH):

6. Akerlof and Kegeles, 1939
19. Bhimasenachar and Subrahmanyam, 1957a
21. Bodanszky and Kauzmann, 1962

29. Chapman and Newman, 1968
****+ 38. Dibrov, Mashovets, and Matveeva, 1964
81. Gucker, 1933b
91. Hepler, Stokes, and Stokes, 1965
119. Kobus, 1955
*** 125. Krey, 1972
*** 127. Krumgal'z and Mashovets, 1964
+ 132. Lanman and Mair, 1934
136. Lengyel, 1963a
*** 147. Maksimova and Yushkevich, 1963
* 158. Mikhailov and Fenjou, 1960
164. Millero, Hoff, and Kahn, 1972b
165. Millero, 1972c
169. Nicolai, Ernst, and Wegkamp, 1951
171. Owen and Brinkley, 1941
183. Postnikov, 1970
195. Riedl, 1972
215. Subrahmanyam, 1960
217. Tamas, 1963
218. Tamas, 1964
219. Taskoprulu, 1956
224. Tsujioka, 1957
240. Zen, 1957

18. Potassium hydroxide (KOH):

7. Akerlof and Bender, 1941
19. Bhimasenachar and Subrahmanyam, 1957a
29. Chapman and Newman, 1968
81. Gucker, 1933b
108. Kelley, Borza, and Harringer, 1965
+ 132. Lanman and Mair, 1934
136. Lengyel, 1963a
*** 151. Mashovets, Dibrov, Krumgal'z, and Matveeva, 1965
* 158. Mikhailov and Fenjou, 1960
165. Millero, 1972c
171. Owen and Brinkley, 1941
215. Subrahmanyam, 1960
217. Tamas, 1963
218. Tamas, 1964
* 220. Tham, Gubbins, and Walker, 1967
** 231. Vogel, Routsis, Kehrer, Landsman, and Tschinkel, 1967
240. Zen, 1957

19. "Silicic acid" (SiO_2[aq]):

No entries.

Bibliography

1. Accascina, Filippo, and Schaivo, Silvia, 1962, Ultrasonic behaviour of liquid systems. Ultrasonic velocity and adiabatic compressibility of aqueous solutions of mineral acids at different temperatures, in Symposium on Electrolytes, Trieste, 1959. Published in Electrolytes, Proceedings of an International Symposium, p. 301 - 308 (printed in 1962).

Experimental study on the adiabatic compressibility of HCl from 0 to 9 molar at ambient pressure from 15° to 60°C. Compressibility data were derived from the velocity cf sound in solutions. Adiabatic compressibility of the solutions and the partial molal compressibility and partial molal volume of H^2O in the solutions are given on a graph.

2. Adams, L. H., 1931, Equilibrium in binary systems under pressure. I. Experimental and thermodynamic investigations of the system, $NaCl-H_2O$, at 25°C: Am. Chem. Soc. Jour., v. 53, p. 3769 - 3813.

Experimental study of the compressibility of NaCl solutions (0 to 25 wt percent) at 25°C and 0 to 12 kb of pressure. Compressibility was measured by the piston-displacement method. Data are presented as tables of experimental and smoothed numbers.

3. Adams, L. H., 1932, Equilibrium in binary systems under pressure. II. The system K_2SO_4 - H_2O at 25°C: Am. Chem. Soc. Jour., v. 54, p. 2229 - 2243.

An experimental study of the compressibility and density of K_2SO_4 solutions (0 to 10 wt percent) at 25°C and from 0 to 10 kb. Density was measured only at ambient pressure. The compressibility was measured by the piston-displacement method and the density was measured with a pycnometer. Data are presented in tables as both experimental and smoothed numbers and graphically.

4. Adams, W. A., Yank, R., Christie, R. O., and Kruus, J., 1974, An automated apparatus for precision density measurements of liquids: Canadian Jour. Chem. Eng., v. 52, p. 121 - 124.

The densities of NaCl solutions, 0.026 to 0.502 molar, were measured at 25° and ambient pressure using a vibrating density meter. Data are presented in a table and are represented by the Redlich-Meyer equation. The appropriate constants are also given in a table. [Note: The authors have used 0.997075 g/cm³ as the density of water at 25° and 1 atm. This value is correct for the density of water in g/ml. The correct density is 0.997047 g/cm³.]

5. Akerlof, Gosta, and Teare, J. W., 1938, A note on the density of aqueous solutions of hydrochloric acid: Am. Chem. Soc. Jour., v. 60, p. 1226 - 1228.

Experimental study on the apparent molal volume and density of HCl solutions (0.56 to 16.81 molal) at ambient pressure and in the temperature range 0° to 80°C. Density data were derived from pycnometry. Experimental data are presented in tables, on graphs, and as empirical equations.

6. Akerlof, Gosta, and Kegeles, Gerson, 1939, The density of aqueous solutions of sodium hydroxide: Am. Chem. Soc. Jour., v. 61, p. 1027 - 1032.

Experimental study on the density and apparent molal volume of NaOH solutions (0.51 to 27.08 molal) at ambient pressure and in the temperature range 0° to 70°C. Density data were derived from pycnometry. Experimental data are contained in tables, on graphs, and represented as expirical equations.

7. Akerlof, Gosta, and Bender, Paul, 1941, The density of aqueous solutions of potassium hydroxide: Am. Chem. Soc. Jour., v. 63, p. 1085 - 1088.

Experimental study on the density and apparent molal volume of KOH solutions (0.36 to 17.82 molal) at the ambient pressure and in the temperature range 0° to 70°C. Density data were derived from pycnometry. Experimental data are given in tables, on a graph, and as empirical equations.

8. Allam, D. S. and Lee, W. H., 1966, Ultrasonic studies of electrolyte solutions. II. Compressibilities of electrolytes: Chem. Soc. (London) Jour., v. 1966A, p.

[Study of selective solutions by sound velocity and compressibility measurements]: Naturwissenschaften, v. 44, p. 30 - 31. In German.

Experimental study on the compressibility and density of $CaCl_2$ solutions (2.1, 4.2, and 4.9 molar) at ambient pressure and 25°C. Compressibility data were derived from velocity of sound measurements and densities from pycnometry. Experimental data are presented in graphical form.

13. Batuecus, T., 1946, [Partial molecular volumes at 0°, of water, sodium chloride, and potassium chloride in solutions of those halogens]: Anales de Fisica Quimica (Madrid), v. 42, p. 713 - 722. In Spanish.

Theoretical study on the apparent molal volume of NaCl and KCl solutions at 0°C and ambient pressure. Data were derived from earlier literature and given as smoothed values in tables.

14. Batuecas, T., and Varela, Concepcion, 1967a, [Experimental investigation on aqueous solutions of strong electrolytes. II. Densities, apparent molal volumes, and partial molal volumes of KCl, NaCl, and KBr at 25°C and concentrations in the interval 0.5 to 0.02 M]: Real Acad. Ciencias (Madrid) Rev., v. 61, p. 189 - 211. In Spanish.

Experimental study of the density of 0.02 to 0.5 molar KCl solutions at ambient pressure and 25°C. Densities were obtained from pycnometry. Experimental densities and the apparent and partial molal volumes are given in tables and by empirical equations.

15. Batuecas, T., and Meijon, Carmen, 1967b, [Experimental investigation on aqueous solutions of strong electrolytes. III. Densities, apparent molal volumes, and partial molal volumes at 25°C and concentrations in the interval 0.5 to 0.1 M of NaCl]: Real Acad. Ciencias (Madrid) Rev., v. 61, p. 563 - 571. In Spanish.

Experimental study of the densities of 0.1 to 0.5 molar NaCl solutions at 25°C and ambient pressure. Data were derived from pycnometry. Experimental data for densities apparent and partial molal volumes are given in tables and by empirical equations.

16. Bell, J. T., Helton, D. M. and Rogers, T. G., 1970, Densities of aqueous KCl and UO_2SO_4 from 25° to 374°: Jour. Chem. Eng. Data, v. 15, p. 44 - 46.

Experimental study on the density of aqueous KCl (0.1 to 1.0 molar) at ambient pressure from 25° to 370°C. Density data were obtained from dilatometry using X-ray absorption to measure fluid level. Experimental data are given in tabular and graphical form.

17. Benson, S. W., Copeland, C. S. and Pearson, D., 1953, Molal volumes and compressibilities of the system sodium chloride - water above the critical temperature of water: Jour. Chem. Phys., v. 21, p. 2208 - 2212.

Experimental study on the compressibility and on the apparent and partial molal volumes of the system NaCl - H_2O (0.2 to 6.74 wt percent NaCl) in the pressure range 232 to 300 bars and in the temperature range 380 to 400°C. Experimental data are given in tables, on graphs, and as empirical equations.

18. Berecz, E., 1971, [Structure of molal chloride - hydrochloric acid - water and metal sulfate - sulfuric acid - water type systems]: Teor. Rastvorov. v. 1971, p. 77 - 85. In Russian.

An experimental study of the viscosity of H_2SO_4, HCl, $CaCl_2$, and NaCl solutions from 10° to 50°C at ambient pressure. (Original unavialable. Data taken from Chem. Abs., 78:48058p, 1973.)

19. Bhimasenachar, J. and Subrahmanyam, S. V., 1957a, Compressibilities of sodium and potassium hydroxides: Nature, v. 179, p. 627 - 628.

Experimental study on the compressibility of NaOH and KOH solutions (0 to 8.0 molar) at ambient pressure and 25°C. Compressibility data were derived from optical diffraction. The data are presented graphically and as empirical equations.

20. Bhimasenachar, J., and Subrahmanyam, S. V., 1957b, Compressibilities of mineral acids: Acoustical Soc. Am. Jour., v. 29, p. 899-901.

Experimental study on the apparent molal compressibility of HCl from 0 to 5 molar and H_2SO_4 from 0 to 9 molar at ambient pressure and 27°C. Data are derived from the velocity of sound in the solutions. Results are given on a graph and as empirical equations.

21. Bodanszky, Agnes and Kauzmann, Walter, 1962, The apparent molal volume of sodium hydroxide at infinite dilution and the volume change accompanying the ionization of water: Jour. Phys. Chem., v. 66, p. 177 - 179.

Experimental and calculated study on the apparent molal volume of NaOH solutions (0.06 to 1.0 molar) at ambient pressure and 30°C. Apparent molal volume data were derived from dilatometry. Experimental data of the authors on NaOH and from other sources on KCl, NaCl, and HCl are given on a graph. An empirical equation was also used.

22. Bogatykh, S. A. and Evnovich, I. D., 1965, [Density of aqueous solutions of lithium chloride, lithium bromide, and calcium chloride]: Zh. Prikl. Khim., v. 38, p. 945 - 946. In Russian. English translation in Russian Jour. Applied Chem., v. 38, p. 932 - 933.

Experimental study on the density of $CaCl_2$ solutions in the concentration range 30 to 45 wt percent at ambient pressure and from 10° to 100°C. Density data were derived from areometry. Experimental data are presented in tables.

23. Branca, G., and Carrelli, A., 1950, [The compressibility of electrolyte solutions]: Il Nuovo Cimento, v. 7, p. 190 - 195. In Itallian.

Experimental study of the apparent molar compressibility of solutions of KCl at 3.60 and 1.80 mol/l, of Na_2SO_4 at 0.87 and 0.43 mol/l and of K_2SO_4 at 0.57 and 0.28 mol/l at ambient pressure and temperature. Data were derived from the measurement of the velocity of sound. Experimental results are given in a table and on a graph.

24. Brander, Einar, 1936, [Compressibility of aqueous solutions]: Fennica Sci. Soc. Commentationes

Phys.-Math., v. 9, p. 1 - 8. In German.

Calculated study on the compressibility of NaCl solutions in the pressure range 157 to 472 kg/cm² and in the temperature range 0° to 12°C. Smoothed data are presented in tables and as empirical equations.

25. Brannland, R., 1958, [Density and viscosity of sodium carbonate and sodium sulfide solutions]: Ost. Chem. Zeit., v. 59, p. 104 - 106. In German.

Experimental study of the density of Na_2CO_3 solutions from 0 to 2.5 molar at 20° and 50°C and ambient pressure. Data derived from pycnometry. Densities are presented in tables and on graphs.

26. Bremner, R. W., Thompson, T. G. and Utterback, C. L., 1938, Specific gravities of pure and mixed salt solutions in the temperature range of 0° to 25°: Am. Chem. Soc. Jour., v. 60, p. 2616 - 2618.

Experimental and calculated study on the specific gravity of NaCl, KCl, and $MgSO_4$ solutions and their mixtures at ambient pressure between 0° and 25°C. Specific gravity measurements were derived from weighing an immersed glass bulb. Although not all of the data are presented, some experimental data are given in tables and as empirical equations.

27. Bysova, E. A., 1963, [Aqueous solutions in the System K_2CO_3-K_2SO_4-KCl-H_2O at 0, 30, 50, and 70°]: Zh. Neorg. Khim., v. 8, p. 1950 - 1954. In Russian. English translation in Russian Jour. Inorg. Chem., v. 8, p. 1014 - 1017.

Specific gravity of saturated solutions in the system K_2CO_3-K_2SO_4-KCl-H_2O at 0°, 30°, 50°, and 70°C and ambient pressure. Data used are from previous studies of the same author. Experimental results are given in tables and on figures.

28. Cantelo, R. C. and Phifer, H. E., 1933, Partial molal volumes of cobalt sulfate and cadmium iodide: Am. Chem. Soc. Jour., v. 55, p. 1333 - 1338.

Calculated study on the partial molal volume of solutions of KCl from 0.27 to 2.30 molal at ambient pressure and 25°C. Calculated data are given as a smoothed table, as graphs, and as empirical equations.

29. Chapman, T. W., and Newman, John, 1968, A compilation of selected thermodynamic and transport properties of binary electrolytes in aqueous solutions: Univ. California (Berkeley), Lawrence Radiation Lab., Rept. No. UCRL-17767, 297 p.

A compilation of observed densities and other properties at ambient pressure between 0° and 70°C for the following sclutes: $CaCl_2$, HCl, H_2SO_4, KCl, KOH, K_2SO_4, NaCl, NaOH, and Na_2SO_4. Data are given in tables. Densities are taken without annotation from the literature.

30. Choi, Y. S. and Bonner, O. D., 1973, The partial molal volumes of some representative solutes in H_2O and D_2O: Zeit. Phys. Chem., Neue Folge, v. 87, p. 188 - 197.

Experimental study of apparent molal volumes based on density measurements of NaCl and KCl solutions from "0.0" to 1.0 molal at ambient pressure over the temperature range 0.19° to 76.68°C. Densities were measured by pycnometry. Data are presented as tables of apparent molal volumes.

31. Cholian, P. F., 1966, [Adiabatic compressubility of aqueous solutions of electrolytes]: Akust. Zhur., v. 12, p. 93 - 97. In Russian.

Experimental study on the adiabatic compressibility of NaCl and KCl solutions, 0 to 9 mol percent at ambient pressure and 20°C. Compressibilities were derived from measurements of the velocity of sound in the solutions. Experimental data are given graphically and in a table.

32. Chou., J. C.-S., 1968, Thermodynamic properties of aqueous sodium chloride solutions from 32° to 350°F: Okla. State Univ., Ph. D. Dissertation, 121 p.

Experimentally measured compressibilities of NaCl solutions from 0 to 25 wt percent between 250 and 5000 psig from 72° to 350°F. Compressibilities were derived from displacement of a calibrated piston. Experimental data are given in a table as a function of wt percent

NaCl, Celcius temperatures and pressures at 10, 100, 200, and 300 atm. An empirical function in temperature, pressure, and composition is derived from experimental data and the data of Fabuss (1965), and those in the International Critical Tables, v. 3, 1928. Some results are also given graphically.

33. Cornec, E. and Krombach, H., 1932, [Equilibrium between potassium chloride, sodium chloride, and water from -23 to 190°C]: Annales Chim., v. 18, p. 5 - 31. In French.

Experimental study on the volume of NaCl (0.75 to 3.56 molal) and KCl (0.26 to 2.43 molal) solutions at ambient pressure in the temperature range -23° to 190°C. Volume data were derived by filling an autoclave. Experimental data are given in tables and on graphs.

34. Couture, A. M., and Laidler, K. J., 1956, The partial molal volumes of ions in aqueous solutions. I. Dependence on charge and radius: Canadian Jour. Chem., v. 34, p. 1209 - 1216.

A theoretical discussion on the relation between molal volumes of ions to the Goldschmidt crystal radius and the ionic charge. Partial molal volumes and effective radii of monatomic cations and anions are derived for ambient pressure and 25°C. The source data are contained in the International Critical Tables, vol 3, of 1928 and in earlier compilations. The results are given on tables, graphs, and by empirical equations.

35. Couture, A. M., and Laidler, K. J., 1967, The partial molal volumes of ions in aqueous solutions. II. An empirical equation for oxy-anions: Canadian Jour. Chem., v. 35, p. 207 - 210.

A theoretical discussion on the relaticn of partial molal volumes of oxyanions to the Goldschmidt crystal radium and ionic charge. Partial molal volumes and effective radii of oxyanions are derived from density data given in the International Critical Tables, vol. 3, of 1928 at ambient pressure and 25°C. Data are given in a table, on a figure and by empirical equations.

36. Desnoyers, J. E., Arel, M., Perron, G., and Jolicoeur, C., 1969, Apparent molal volumes of alkali halide in

water at 25°. Influence of concentration dependence: Jour. Phys. Chem., v. 73, p. 3346 - 3351.

Experimental and calculated study on the apparent molal volume and density of 0.03 to 0.5 molar solutions of NaCl, NaF, KF and KCl at ambient pressure and 25°C. Density and apparent molal volume data were derived from the weight of a sinker in solution. Experimental and calculated data are presented in tables, on graphs, and as empirical equations.

37. Devdariani, A. K., Kolobov, N. P., and Marenina, K. N., 1973, [Ultrasonic study of the volumetric properties of aqueous solutions of some electrolytes]: Zhur. Fiz. Khim., v. 47, p. 3006 - 3009. In Russian.

Experimental study in which the partial molal volume of NaCl and KCl in aqueous solution was determined by sound velocity measurements. [Original text unavailable to authors. Data taken from Chem. Abs. 80:112984g, 1973.]

38. Dibrov, I. A., Mashovets, V. P, and Matveeva, R. R., 1964, [Density and compressibility of aqueous solutions of sodium hydroxide at high temperatures]: Zh. Prikl. Khim., v. 37, p. 29 - 36. In Russian. English translation in Russian Jour. Applied Chem., v. 37, p. 38 - 44.

Experimental study on the density and compressibility of 3 to 48 wt percent NaOH solution at pressures up to 1450 bars and from 0° to 350°C. Density data were calculated from electromagnetic float measurements. Experimental and smoothed data are given in tables, on graphs, and as empirical equations.

39. Drucker, Carl, 1941, [Study on partial specific volumes in binary and ternary solutions]: Arkiv Kemi, Mineral. Geol., v. 14A, p. 1-48. In German.

Experimental and calculated study on the partial specific volume of $CaCl_2$ - Na_2SO_4 solutions from 0.001 to 0.02 g $CaCl_2$ per g of 6.094 wt percent Na_2SO_4 and of $CaCl_2$ solutions from 0.002 to 0.02 g $CaCl_2$ per g of solution at ambient pressure and 25°C. Volume data were derived from pycnometry. Data were corrected for barometric pressure. Experimental data are presented in tables, on graphs, and as empirical equations.

40. Duedall, I. W., and Weyl, P. K., 1965, Apparatus for determining the partial equivalent volumes of salts in aqueous solutions: Rev. Sci. Instrum., v. 36, p. 528 - 531.

Experimental study on the partial molal volume of NaCl at ambient pressure and 0.8°C. Data were obtained from dilatometry. The equipment and procedure are described in detail. The limiting apparent molal volume of NaCl is 12.78 ml/mol. The partial molal volumes of some major salts in artificial sea water (3.013 wt percent solids) at 0.8°C are also given in a table.

41. Duedall, I. W. and Weyl, P. K., 1967, The partial equivalent volumes of salts in seawater: Limnol. Oceanog., v. 12, p. 52 - 59.

Experimental study on the partial molal volume of NaCl, KCl, Na_2SO_4, K_2SO_4, and $KHCO_3$ solutions of 30 to 40 per mill salinity at ambient pressure and from 0° to 25°C. Volume data were derived from dilatometry. Experimental data are presented in tables, on graphs, and as empirical equations.

42. Dunn, L. A., 1966, Apparent molal volumes of electrolytes. Part I. Some 1-1, 1-2, 2-1, 3-1 electrolytes in aqueous solutions at 25°C: Faraday Soc. Trans., v. 62, p. 2348 - 2354.

Experimental study on the density and apparent molal volumes of 0.001 to 1.0 molar solutions of Na_2SO_4, K_2SO_4, $CaCl_2$, and HCl at ambient pressure and 25°C. Limiting apparent molar volumes of the dissolved salts and of ionic species were calculated, using the volume of the aqueous chloride ion equal to 22.32 ml/mole. Density data were obtained from pycnometry and dilatometry. Experimental data are presented in graphical and tabular form.

43. Dunn, L. A., 1968, Apparent molal volumes of electrolytes, Part II. Some 1-1 electrolytes in aqueous solution at 25°C: Faraday Soc. Trans., v. 64, p. 1898 - 1903.

Experimental study on the apparent molal volume and density of 0.001 to 1.0 molal solutions of KCl and NaCl at ambient pressure and 25°C. Limiting apparent molar volumes of the dissolved salts and of ionic species were calculated. Density data were calculated from pycnometry and apparent molal volumes from dilatometry. Experimental data are given in tables, on graphs, and as empirical equations.

44. Eckart, C., 1958, Properties of water. II. The equation of state of water and sea water at low temperatures and pressures: Am. Jour. Sci., v. 256, p. 225 - 240.

Calculated study on the p-v-t properties of seawater (0 to 40 g/kg salinity) from 0 to 1000 atm of pressure and in a temperature range from 0° to 40°C. Smoothed data are given in tables, on graphs, and as empirical equations.

45. Egorov, V. M., and Ikornikova, N. Yu., 1973, [Partial molar volumes of aqueous chloride solutions at high temperatures and pressures]: Zap. Vses. Mineral. Obshchestva (Lenningrad), v. 102, p. 272 - 282. In Russian.

Theoretical study on the apparent molal volume of NaCl solutions from 1 to 6 molal at 500, 1000, and 1500 kg/cm^2 from 200° to 700°C. Data were taken from Ikornikova and Egorov (1968). Results are given in a table and on a graph.

46. Ellis, A. J. and Golding, R. M., 1963, The solubility of carbon dioxide above 100°C in water and sodium chloride solutions: Am. Jour. Sci., v. 261, p. 47 - 60.

An experimental and calculated study on the density of NaCl solutions from 0.5 to 3.0 molal in the pressure range 0 to 101.3 bars and at temperatures from 0° to 350°C. Data were obtained by a modified filling technique using a stainless steel vessel. Density data are presented in tabular and graphical form.

47. Ellis, A. J., 1966, Partial molal volumes of alkali chlorides in aqueous solutions to 200°C: Chem. Soc. (London) Jour., v. 1966A, p. 1579 - 1584.

Experimental study on the partial molal volume and density of NaCl and KCl solutions from 0.1 to 1.0 molal at 20 atm between 0° and 200°C. Partial molal volume and density data were calculated from a mercury displacement technique. Experimental data are given graphically, in tables, and as empirical equations.

48. Ellis, A. J., 1967, Partial molal volumes of $MgCl_2$, $CaCl_2$, $SrCl_2$, and $BaCl_2$ in aqueous solutions to 200°C: Chem. Soc. (London) Jour., v. 1967A, p. 660-664.

Experimental and calculated study on the density and partial molal volume of $CaCl_2$ solutions from 0.1 to 1.0 molal at 20 atm and from 25° to 200°C. Data were derived from a mercury displacement technique. Experimental data are presented in tables, on graphs, and as empirical equations.

49. Ellis, A. J., 1968a, Partial molal volumes in high temperature water. Part III. Halide and oxyanion salts: Chem. Soc. (London) Jour., v. 1968A, p. 1138 - 1143.

Experimental study on the density of K_2SO_4 (0.05 to 0.5 molal) and Na_2SO_4 solutions (0.05 to 1.0 molal) at a pressure of 20 atm and from 25° to 200°C. Limiting partial molar volumes of the dissolved salts and of the alkali and alkaline earth cations and of the sulfate ion were obtained by assuming a value for the chloride ion. Density data were derived from a mercury displacement technique. Experimental data are given in tables, graphically, and as empirical equations.

50. Ellis, A. J. and McFadden, I. M., 1968b, The partial molal volume of hydrochloric acid in high-temperature water: Chem. Communications., v. 287, p. 516 - 517.

Experimental study on the partial molal volume of HCl from 0.2 to 2.0 molal at 20 atm and at 25° to 200°C. Limiting partial molar volumes of the dissolved acid and of the hydrated protron were calculated from these results and those of previous studies. Volume data were derived by mercury displacement from a 25°C reference cell. The experimental data are presented in tabular and graphical form.

51. Ener, C. and Taskoprulu, N. S., 1954, Measurements of the velocity of ultrasound in sea water (Black Sea and

Sea of Marmara): Istanbul Univ. Fac. Sci. Rev., Ser. C., v. 19, p. 105 - 1-9.

Experimental study on the compressibility of sea salt solutions at ambient pressure and 20°C. Compressibility data were obtained from measurements of the velocity of sound. Experimental data are given in tables, on graphs, and as empirical equations.

52. Epifanova, S. S., Kaprina, Yu. D., Kaptsova, T. N., Korchemskaya, K. M., Krasilnikova, R. G., Likhacheva, O. A., Makarov, A. V., Makareva, T. S., Maksimova, M. P., and Fokeev, V. M., 1973, [Viscosity of salt solutions simulating natural solutions]: Izv. Vysch. Ucheb. Zaved. Geol. Razved., v. 16, p. 154 - 156. In Russian.

The densities of concentrated solutions of NaCl, KCl, and Na_2SO_4 were measured at varicus temperatures. (Original unavailable. Data taken from Chem. Abs., 79:108303w, 1973.)

53. Ezrokhi, L. L., 1967a, [Viscosity of solutions of calcium chloride]: Leningrad Vsesoiuznyi Nauchno-Issledovatel'skii Inst. Galurgii, Trudy, v. 52, p. 3 - 9. In Russian.

Experimental study of the viscosity and density of $CaCl_2$ solutions, 10 to 40 wt percent at ambient pressure and 25°, 40°, and 60°C. Densities were obtained from pycnometry. Experimental data are given in a table.

54. Ezrokhi, L. L., 1967b, [Density of complex solutions containing calcium chloride]: Leningrad Vsesoiuznyi Nauchno-Issledovatel'skii Inst. Galurgii, Trudy, v. 52, p. 10-19. In Russian.

Empirical study giving coefficients in an expression for the density of solutions in the system $CaCl_2$ - NaCl - Na_2SO_4 - KCl - K_2SO_4 - $MgCl_2$ - $MgSO_4$ at ambient pressure between 0° and 100°C. Constants are given in tabular form. Examples for the application are also given.

55. Fabuss, B. M., Korosi, Alexander, and Huq, Shamsul, 1966, Densities of binary and ternary aqueous solutions of NaCl, Na_2SO_4, and $MgSO_4$, of sea water and sea water concentrates: Jour. Chem. Eng. Data, v. 11, p. 324 - 331.

Experimental and calculated study on the density of NaCl (0.02 to 2.5 molal) and Na_2SO_4 (0.01 to 0.15 molal) solutions at ambient pressure in the temperature range 25° to 175°C. Experimental density data were derived from pycnometry and dilatometry. Experimental data are given in tables, on graphs, and as empirical equations.

56. Fabuss, B. M., and Korosi, Alexander, 1967, Thermodynamic properties of sea water and its concentrates: Desalination, v. 2, p. 271 - 278.

Calculated study on the density of NaCl, Na_2SO_4, and KCl solutions at ambient pressure and in the temperature range 25° to 175°C. Densities were obtained from pycnometry. Calculated data for sea water are presented as graphs and as empirical equations.

57. Fabuss, B. M., and Korosi, Alexander, 1968, Properties of sea water and solutions containing sodium chloride, potassium chloride, sodium sulfate, and magnesium sulfate: U.S. Off. Saline Water, Res. Develop. Progress Rept. No. 384, 133p.

A collection of tables giving the smoothed densities, vapor pressure, boiling point elevations, and other quantities at ambient pressure from 20° to 150°C and from 60° to 300°F for the following solutions from 0 molal up to the concentrations indicated: NaCl to 3.5 molal, KCl to 3.5 molal, Na_2SO_4 to 1.2 molal, KaCl-KCl to 3.5 total molality, NaCl-Na_2SO_4 to 3.4 total molality, and sea water to 13 wt percent solids. The tables are based on published, experimental research by the authors. Values are given in tables and on graphs. The empirical functions and their coefficients, which were used to generate the tables and graphs, are given.

58. Fajans, Kasimir and Johnson, Oliver, 1942, Apparent volumes of individual ions in aqueous solutions: Am. Chem. Soc. Jour., v. 64, p. 668 - 678.

Theoretical study on the apparent volume of NaCl and KCl from infinite dilution up at ambient pressure and at 25° to 55°C. Apparent volumes of common ions are given at 15° to 20°, at 25°, and at 35°C. The apparent volume was used to calculate the volume of ions. Smoothed data are given in tables and graphically.

59. Falkenhagen, H., and Bachem, Ch., 1935, [On the compressibility of strong electrolytes]: Zeit. Elektrochem., v. 41, p. 570 - 575. In German.

Experimental study on the apparent molal compressibility of NaCl and Na_2CO_3 solutions at ambient pressure and 25°C. Data were derived from the optical measurement of the wavelength of high frequency sound in solutions using a stroboscope and progressive waves. The dependence of the apparent molal compressibility with the square root of concentration is given in a table.

60. Fortier, Jean-Luc, Philip, P. R. and Desnoyers, J. E., 1974, Thermodynamic properties of alkali halides. III. Volumes and heat capacities of transfer from H_2O to D_2O at 25°C: Jour. Sol. Chem., v. 3, p. 523 - 538.

Experimental study on the density of NaCl, NaF, and KF solutions from 0.07 to 0.82 molal at ambient pressure and 25°C. Density data were derived from a vibrating densimeter. Experimental data are presented in tables and on graphs.

61. Franks, F. and Smith, H. T., 1967, Apparent molal volumes and expansibilities of electrolytes in dilute aqueous solutions: Faraday Soc. Trans., v. 63, p. 2586 - 2598.

Experimental study on the apparent molal volume of 0.002 to 1.0 molal solutions of NaCl and KCl at ambient pressure and at 5° and 25°C. Volume data were derived from magnetic float measurements. Limiting apparent molal volume data are 14.15 and 16.65 cm^3/mole for NaCl and 24.65 and 26.90 cm^3/mole at 5° and 25°, respectively. Experimental data are given in tables, on graphs, and as empirical equations.

62. Freyer, E. B., 1931, Sonic studies of the physical properties of liquids. II. The velocity of sound in solutions of certain alkali halides and their compressibilities: Am. Chem. Soc. Jour., v. 53, p. 1313 - 1320.

Experimental compressibilities of NaCl and KCl from 1 to 24 wt per cent at ambient pressure from 15° to 55°C. Compressibilities were derived from measurements of the velocity of sound. Data are presented as smoothed tables, graphs, and in empirical equations.

63. Galinker, I. S., Rodnyansky, I. M., Korobkov, V. I., and Lekakh, N. B., 1964, [Difference in the thermodynamic properties of water and electrolyte solutions depending on the temperature]: Ukrain'skyi Fizichnyi Zhur., v. 9, p. 401 - 405. In Russian.

Experimental study on the compressibility and expansivity of KCl (1 to 3 n), K_2CO_3 (1 to 6 n) and $CaCl_2$ (1 to 6 n) at ambient pressure and 25° and 230°C (n is the number of gram equivalents per 1000 g of H_2O). Experimental data are given in a table.

64. Garrett, A. B., and Woodruff, S. A., 1951, A study of several physical properties of electrolytes over the temperature range of 25°C to -73°C: Jour. Phys. Colloid Chem., v. 55, p. 477 - 490.

Experimental densities, viscosities, and specific conductivities for HCl (23.3, 24.8, and 27.6 wt percent) and H_2SO_4 (36 wt percent) at ambient pressure between 25° and -73°C. Densities were measured by pycnometry. Experimental data are given graphically. The listing of the experimental data is deposited in the Microfilm Library, Ohio State University, Columbus, Ohio.

65. Gastaldo, Charles, 1962, Determination of coefficients for thermodynamic equations for determining the properties of sea water, particularly vapor pressure: Univ. California (Los Angeles), Dept. Eng., Rept. 61-80, 149 p.

Empirical fitting of equations to experimental data for sea water concentrates given by Hara, Nakamura, and Higashi (1932) between 0 and 28 wt percent solids from 0° to 175°C at ambient pressure. Smoothed data for densities and partial molal volumes of H_2O for the sea water concentrates are given in tables and on graphs. The constants for the empirical equations are given in a table.

66. Geffcken, W., 1931, [On the apparent molal volumes of dissolved electrolytes]: Zeit. Phys. Chem., v. A 155, p. 1 - 28, In German.

Theoretical discussion where the validity of Masson's Rule is tested using published data for the alkali halides at ambient pressure and at the concentration and temperature ranges indicated: KF, 1.79 to 10.7 molar, 25°C KCl, 0.16 to 4.1 molar, 0° to 100°C NaCl, 0.25 to 5.3 molar, 25° to 45°C and HCl, 0.58 to 10.7 molar, 25°C. Densities and apparent molal volumes are given in tables and on graphs.

67. Geffcken, W., 1933a, [The apparent molal volume of dissolved electrolytes II. The pressure coefficient of apparent molal volumes]: Zeit. phys. Chem., v. A 167, p. 240 - 244. In German.

A theoretical discussion of the pressure coefficient of the apparent molal volumes. Constants for KCl, NaCl, and $CaCl_2$ at 25°C and ambient pressure are given in the text. They are derived from published data.

68. Geffcken, W., Beckmann, Ch., and Kruis, A., 1933b, [Molar refraction in dilute solutions. I. A differential method for precision measurement of the density]: Zeit. Phys. Chem., v. B20, p. 398 - 419. In German.

Theoretical study of the apparent molal volumes of NaCl and Na_2CO_3 at 25°C and ambient pressure. Apparent molal volume data are given in a table, on graphs, and by an empirical equation.

69. Geffcken, W., and Price, D., 1934, [Dependence of the apparent molal volume and apparent molal refraction in dilute solutions on concentration]: Zeit. phys. Chem., v. B 26, p. 81 - 99. In German.

Densities and apparent molal volumes of KCl (0 to 0.8 normal), Na_2SO_4 (0 to 1.8 normal), and Na_2CO_3 (0 to 2.6 normal) solutions at ambient pressure and 25°C. Data were derived from pycnometry. Results are given in tables and on graphs.

70. Gibson, R. E., 1927, The system sodium sulfate-water. I. The densities and specific volumes of aqueous solutions of sodium sulfate between 25 and 40° and the fictive volumes of sodium sulfate in solution. Jour. Phys. Chem., v. 31, p. 496 - 510.

Experimental and calculated study on the specific volume and density of 0 to 28 wt percent Na_2SO_4 solutions at ambient pressure and in the temperature range 25° to 40°C. Specific volume measurements were derived from dilatometry and densities from pycnometry. Experimental and smoothed data are given on tables, graphs, and by empirical equations.

71. Gibson, R. E., 1931, The fictive volumes of sodium sulfate in aqueous solutions of sulfuric acid and of iodine in aqueous solutions of potassium iodide: Jour. Phys. Chem., v. 35, p. 690-699.

Experimental and calculated study on the partial molal and specific volumes of Na_2SO_4 ranging in concentration from 0 to 30 wt percent in 5 and 10 wt percent H_2SO_4 at ambient pressure and 25°C. Volume data were derived from pycnometry. Experimental data are presented in tables, on graphs, and as empirical equations.

72. Gibson, R. E., 1934, A note on the computation of the partial volumes of the components of aqueous solutions: Jour. Phys. Chem., v. 38, p. 319 - 326.

Calculated study on the partial molal volumes of NaCl (0 to 25 wt per cent), KCl (0 to 0.29 g KCl per cm^3 of solution), and Na_2SO_4 (0 to 28 wt per cent) solutions at ambient pressure and 25°C. Partial molal volumes were calculated from data taken from other sources. Calculated values are presented as smoothed tables, graphs, and as empirical equations.

73. Gibson, R. E., 1935, The influence of the concentration and nature of the solute on the compressions of certain aqueous salts: Am. Chem. Soc. Jour., v. 57, p. 284 - 293.

Experimental and calculated study on the compressibility of KCl (5.9 to 25.5 wt per cent) and Na_2CO_3 (3.9 to 20.3 wt per cent) solutions in the pressure range of 1 to 1000 bars at 25°C. Compressibility data were derived from piezometer and pycnometer measurements. Data are presented as experimental and smoothed tables, graphs, and as empirical equations. Smoothed data for NaCl are also given.

74. Gibson, R. E., and Loeffler, O. H., 1941, Pressure - volume relations in solutions. IV. The apparent volumes and thermal expansibilities of sodium chloride and sodium bromide in aqueous solutions between 25° and 95°C: Am. Chem. Soc. Jour., v. 63, p. 443 - 449.

Experimental and calculated study on the apparent volumes of NaCl solutions from 5 to 25 wt percent at pressures from 1 to 1000 bars between 25° and 95°C. Apparent molal volume data were derived from dilatometry. Experimental and smoothed data are presented in tables, on graphs, and as empirical equations.

75. Ginzburg, D. M., Pikulina, N. S., and Litvin, V. P., 1964a, [Density of potassium carbonate solutions]: Zh. Prikl. Khim., v. 37, p. 2353 - 2357. In Russian. English translation in Russian Jour. Applied Chem., v. 37, p. 2327 - 2330.

Experimental and calculated study on the density and vapor pressure of K_2CO_3 solutions, 16 to 62 wt percent, at ambient pressure and from 25° to 130°C. Density data dere derived from pycnometry and vapor pressure data from the two-bulb method. Experimental data are presented in tables. Empirical equations are also given.

76. Ginzburg, D. M., Pikulina, N. S., and Litvin, V. P., 1964b, [Density of sodium carbonate solutions]: Zh. Prikl. Khim., v. 37, p. 2749 - 2750. In Russian. English translation in Russian Jour. Applied Chem., v. 37, p. 2710 - 2711.

Experimental and calculated study on the density of 16 to 30 wt percent Na_2CO_3 solutions at ambient pressure in the temperature range 35° to 110°C. Density data were derived from the two-bulb method. Experimental data are contained in tables and an empirical equation is given.

77. Ginzburg, D. M., 1965, [The density and vapor pressure of sodium and potassium carbonate solutions]: Zh. Prikl. Khim., v. 38, p. 55 - 58. In Russian. English translation in Russian Jour. Applied Chem., v. 38, p. 50 - 53.

Experimental and calculated study on the density of mixed solutions of K_2CO_3 (0.53 to 61.16 wt percent), Na_2CO_3 (0.37 to 25.9 wt percent) and K_2SO_4 (0.09 to 5.0 wt percent) at ambient pressure from 20° to 120°C. Density data were derived from the two-bulb weighing method. Experimental and calculated data are contained on tables and graphs. An empirical equation is also given.

78. Glass, H. M., and Madgin, W. M., 1934, Viscosities of aqueous solutions of electrolytes. Part I. Sodium sulfate solutions over the temperature range 25-40°: Chem. Soc. (London) Jour., v. 1934, p. 1124 - 1128.

An experimental study on the density of Na_2SO_4 solutions from 0.0005 to 0.072 molar at ambient pressure and 25°C. Densities were measured by pycnometry. Experimental data are given in tables.

79. Gleukauf, E., 1965, Molar volumes of ions: Faraday Soc. Trans., v. 61, p. 914 - 921.

Theoretical discussion of the molal volumes of solvated ions and the structure of water at 25°C and ambient pressure. Internally consistent limiting partial molal volumes of ions are calculated from cited experimental studies. Results are given in tables and on graphs.

80. Gucker, F. T., 1933a, The compressibility of solutions. I. The apparent molal compressibility of strong electrolytes: Am. Chem. Soc. Jour., v. 55, p. 2709 - 2118.

A calculated study on the apparent molal compressibility of 0 to 8.0 molal solutions of KCl, NaCl, and $CaCl_2$ at ambient pressure in the temperature range 0° to 80°C. Smoothed data are given in tables, on graphs, and as empirical equations.

81. Gucker, F. T., 1933b, The apparent molal heat capacity, volume, and compressibility of electrolytes: Chem. Rev., v. 13, p. 111 - 130.

Calculated study on the compressibility and apparent molal volume of HCl, KCl, NaCl, $CaCl_2$, KOH, and NaOH solutions at ambient pressure and 25°C. Data are given as constants, as empirical equations, in tables, and on graphs.

82. Gucker, F. T., 1934a, The apparent molal expansibility of electrolytes and the coefficient of expansibility (thermal expansion) as a function of concentration: Am. Chem. Soc. Jour., v. 56, p. 1017 - 1021.

Calculated study on the apparent molal volume of KCl, NaCl, Na_2SO_4, and HCl solutions at ambient pressure and in the temperature range 0° to 70°C. Smoothed data are given in tables, on graphs, and as empirical equations.

83. Gucker, F. T. Jr., 1934b, The calculated partial molal solute quantities as functions of volume concentration, with special reference to the apparent molal volume: Jour. Phys. Chem., v. 38, p. 307 - 317,

Calculated study on the apparent molal volume of $CaCl_2$ solutions at ambient pressure and 25°C. Data are treated by means of graphs and empirical equations.

84. Gucker, F. T. Jr., Chernik, C. L., and Roy-Chowdhury, Phanibusan, 1966, A frequency-modulated ultrasonic interferometer: Adiabatic compressibility of aqueous solutions of NaCl and KCl at 25°C: U. S. Natl. Acad. Sci. Proc., v. 55, p. 12 - 19.

Experimental study on the compressibility and density of NaCl (0.16 to 4.5 molar) and KCl (0.26 to 3.6 molar) solutions at ambient pressure and 25°C. Limiting partial molal volumes are obtained. Compressibility data were derived from measurements of the velocity of sound (equipment described) and density data from pycnometry. Experimental data are given in tabular and graphical form.

85. Haas, J. L. Jr., 1970, Equation for the density of vapor-saturated NaCl - H_2O solutions from 75° to 325°C: Am. Jour. Sci., v. 269, p. 490 -494.

Calculated study on the density of NaCl solutions from 0 to 8.0 molal at ambient pressure from 75° to 325°C. Smoothed data are presented as tables, on a graph, and as empirical equation.

86. Haas, J. L. Jr., 1971, The effect of salinity on the maximum thermal gradient of a hydrothermal system at hydrostatic pressure: Econ. Geol., v. 66, p. 940 - 946.

An empirical expression for the density of NaCl solutions from 0 wt percent to saturation at ambient pressure between 75° and 325°C. Smoothed data are given in tables.

87. Halasey, Sr. M. Eva, 1941, Partial molal volumes of potassium salts of the Hofmeister Series: Jour. Phys. Chem., v. 45, p. 1252 - 1263.

Experimental study on the partial molal volume and density of 0.005 to 0.5 molal KCl, NaCl, and K_2SO_4 solutions at ambient pressure and in the temperature range 5° to 30°C. Partial molal volume data were derived from dilatometry. Experimental data are given in tables, on graphs, and as empirical equations.

88. Hara, Ryosaburo Nakamura, Kazumoto and Higashi, Katsumi 1932, The specific gravity and the vapor pressure of concentrated sea water at 0° - 175°C: Tohoku Imperial Univ. Tech. Rept., v. 10, p. 433 - 452.

Experimental study on the specific gravity and vapor pressure of normal sea water and its concentrates up to halite (NaCl solid) saturation at ambient pressure from 0° to 175°C. Specific gravity was measured with a pycnometry at temperatures at and below 75°C and with a dilatometer above 75°C. Smoothed specific gravities are given on a table as a function of temperature and chloride concentration.

89. Helmy, A. K., Assaad, F. F., Naguib Hassan, M., and Sadek, H., 1968, Apparent and partial molal volumes of Na-Kaolin and NaCl in kaolin suspensions: Jour. Phys. Chem., v. 71, p. 2358 - 2361.

Experimental study on the density of NaCl solutions from 0.1 to 1.0 molal at ambient pressure and 30°C. Densities were derived from pycnometry. Experimental data are given in tables.

90. Hepburn, J. R. I., 1932, The vapor pressure of water over aqueous solutions of chlorides of the alkaline

earth metals. III. Correlation with other physical properties of the solutions: Chem. Soc. (London), v. 1932A, p. 575 - 582.

Calculated study attempting to correlate vapor pressure of $CaCl_2$ solutions to the specific gravity of the same from 0.1 to 1 molar at ambient pressure from 0° to 25°C. Results are negative.

91. Hepler, L. G., Stokes. J. M., and Stokes, R. H., 1965, Dilatometric measurements of apparent molal volumes of dilute aqueous electrolytes: Faraday Soc. Trans., v. 61, p. 20 - 29.

Experimental study on the density and apparent molal volumes of 0.001573 to 0.02445, 0.2735, and 0.8451 molar NaOH solutions at ambient pressure and 25°C. Density data were derived from pycnometry and apparent molal volume data from dilatometry. Experimental data are given in tabular and graphical form.

92. Hurtado, G. G., Mateo, P. L., Serna, A., and Vidal-Abarca, J. B., 1973, [Diffusion and viscosity in aqueous media. Behavior of calcium(II) and cerium(III) ions and their complexes with EDTA and DCTA (1,2-diaminocyclohexanetetraacetic acid)]: An. Quim., v. 69, p. 295 - 303. In Spanish.

The densities of $CaCl_2$ solutions from 10° to 35°C at ambient pressure were measured. (Original text unavailable. Data taken from Chem. Abs., 79:35259z, 1973.)

93. Ikornikova, N. Yu., and Egorov, V. M., 1968, [Experimental PTFC diagrams of aqueous solutions of lithium, sodium, potassium, and cesium chlorides]: in Lobachev, A. N., Editor, 1968, Gidrotermalni Sintez Krystallov: Moskow, Nauka Press. In Russian. English translation in Lobachev, A. N., editor, 1971, Hydrothermal synthesis of crystals: New York, Consultants Bureau, p. 34 - 51.

Experimental study of the specific volume of LiCl, NaCl, KCl, and CsCl solutions from 1.0 to 7.0 molal in the pressure range 200 to 2500 kgf/cm² from 150° to 700°C. The specific volumes were derived from recording the pressure at temperature for various percentages of filling of the steel pressure vessel at 20°C. Experimental data are presented in tables, on graphs, and as empirical equations.

94. Ingham, J. W., 1928, The apparent hydration of ions. Part I. The densities and viscosities of saturated solutions of sodium and potassium chlorides in hydrochloric acid: Am. Chem. Soc. Jour., v. 50, p. 1917 - 1930.

Experimental and calculated study on the density of NaCl (0.017 to 5.43 molar) and KCl (0.20 to 4.17 molar) solutions in HCl (13.41 to 0.46 molar) at ambient pressure and 25°C. Density measurements were derived from pycnometry. Experimental data are presented graphically and in tables. Empirical equations are also given.

95. Isdale, J. D. and Morris, R., 1972, Physical properties of sea water solutions: Density: Desalination, v. 10, p. 329 - 339.

The density of "synthetic" sea waters of the following salinities 63.12, 92.66, 121.04, and 148.45 g/kg were measured at ambient pressure between 70° and 180°C using a glass dilatometer. Experimental and smoothed data are given in tables, on figures, and by an empirical equation.

96. Isono, T., and Tamamushi, R., 1967, Relation between the viscosity B-coefficient and the molal volume of electrolytes in aqueous solutions: Electrochim. Acta, v. 12, p. 1479 - 1482.

Experimental study on the viscosity and density of HCl, NaCl, KCl, and $CaCl_2$ solutions at 5° and 25°C and ambient pressure. Densities were obtained from pycnometry. Limiting partial molal volumes for the unhydrated and hydrated solutes are given in a table.

97. Ivanova, F. I., 1972, [Regular variations in viscosity as a result of mixing of ideal liquids]: Sb. Aspirantsk. Rabot, Kazansk. Univ. Estetsv Nauk Kazan., v. 1962, p. 3 - 12. In Russian.

The densities of aqueous solutions of NaCl - KCl and NaCl - $CaCl_2$ were studied. [Original text unavailable to authors. Data taken from Chem. Abs. 60:13906e, 1964.]

98. Jain, D. V. S., and Lark, B. S., 1970, Apparent molal volume and expansibility of electrolytes: Indian Jour. Chem., v. 8, p. 1133 - 1134.

Density of NaCl solutions at 0.002 to 0.2 molar at ambient pressure and 25°, 30°, and 40°C with an accuracy of 1 ppm. [Original text unavailable to authors. Data taken from Chem. Abs., 74:91851, 1971.]

99. Jones, Ginnell, and Talley, S. K., 1933a, The viscosity of aqueous solutions as a function of the concentration: Am. Chem. Soc. Jour., v. 55, p. 624 - 642.

Experimental study on the density of 0.002 to 0.2 molar solutions of KCl at ambient pressure and 25°C. Density data were derived from pycnometry. Experimental data are given in tables.

100. Jones, Grinnell, and Talley, S. K., 1933b, The viscosity of aqueous solutions as a function of the concentration. II. Potassium brimide and potassium chloride: Amer. Chem. Soc. Jour., v. 55, p. 4124 - 4125.

An experimental study of the density of KCl solutions from 0.5 to 3 normal at ambient pressure and 25°C. Data were derived from pycnometry. Experimental data are reported as specific gravities in tables.

101. Jones, Grinnell, and Christian, S. M., 1937a, The viscosity of aqueous solutions of electrolytes as a function of concentration. V. Sodium chloride: Am. Chem. Soc. Jour., v. 59, p. 484 - 486.

Experimental study on the density and viscosity of 0.002 to 0.2 normal solutions of NaCl at ambient pressure and 0° and 25°C. Density data were derived from pycnometry. Experimental data are given in tables and as an empirical equation.

102. Jones, Grinnell, and Ray, W. A., 1937b, The surface tension of solutions of electrolytes as a function of the concentration. I. A differential method for measuring relative surface tension: Amer. Chem. Soc. Jour., v. 59, p. 187 - 198.

An experimental study in which the density of KCl (0.0001 to 3 normal) and K_2SO_4 (0.0002 to 1 normal) solutions were measured by pycnometry at 25°C and ambient pressure. Experimental data are listed in tables and are represented by empirical equations.

103. Jones, Grinnell, and Colvin, J. H., 1940, The viscosity of solutions of electrolytes as a function of the concentration. VII. Silver nitrate, potassium sulfate, and potassium chromate: Am. Chem. Soc. Jour., v. 62, p. 338 - 340.

Experimental study on the density and viscosity of 0.0005 to 0.5 molar solutions of K_2SO_4 at ambient pressure and 25°C. Density data were derived from pycnometry. Experimental and smoothed data are given in tables and as an empirical equations.

104. Kaminsky, Manfred, 1957, [Experimental investigation of the effect of concentration and temperature on the viscosity of strong electrolyte solutions. Part III. KCl, K_2SO_4, $MgCl_2$, $BeSO_4$, and $MgSO_4$ solutions]: Zeit. Phys. Chem., N.F., v. 12, p. 206 - 231. In German.

An experimental study on the density of KCl (0.001 to 0.5 molar) and K_2SO_4 (0.002 to 0.09 molar) solution at ambient pressure and at 12.5° and 42.5°C. Data were derived from pycnometry. Experimental data are given in tables.

105. Kaputstinskii, A. F., Stakhanova, M. S., and Vasilev, V. A., 1960, [Density and heat capacity for mixed aqueous solutions of the chlorides of lithium and potassium at 25°C]: Izv. Akad. Nauk SSSR., Otd. Khim. Nauk, v. 1960, p. 2082 - 2089. In Russian.

Experimental study on the density and partial molal volume of solutions of 0.49 to 4.5 molal KCl, 0.50 to 4.5 molal LiCl, and their 1:1 mixtures over a similar concentration range at ambient pressure and 25°C. Density data were derived from densimeter measurements.

Experimental data are given in tables, on graphs, and as empirical equations.

106. Kaulgud, M. V., 1965a, Velocity of sound in dilute electrolyte solutions: Z. Phys. Chem., N.F., v. 47, p. 24 - 41.

Experimental and calculated study on the compressibility of 0.0 to 0.0625 molar solutions of KCl, NaCl, and Na_2SO_4 at ambient pressure and 25°C. Compressibility data were derived from velocity of sound measurements. Experimental data are given in tables, on graphs, and as empirical equations.

107. Kaulgud, M. V., 1965b, [The measurement with a phase-comparison interferometer of very small changes of sound velocity in electrolyte solutions]: Acustica, v. 15, p. 377 - 382. In German.

Experimental study of the velocity of sound in NaCl and KCl solutions from 0 to 0.6 molar at ambient pressure and 25°C. The experimental method is described in detail. Velocities are given on a graph.

108. Kelley, W. R., Borza, P. F., and Harringer, R. D., 1965, Densities and viscosities of potassium hydroxide solutions at low temperatures: Jour. Chem. Eng. Data, v. 10, p. 233 - 234.

Experimental study on the density of KOH solutions from 1.99 to 17.11 molal at ambient pressure between -53.8° and 0°C. Density data were derived from pycnometry. Experimental data are given in tables.

109. Khaibullin, I. Kh., and Borisov, N. M., 1963, [Investigation of the density of a liquid phase system by the gamma radiation transmission method]: Teploenergetika, v. 10, p. 78 - 82. In Russian.

Density of 0.2 wt percent NaCl solution at 150 to 240 kg/cm² and 340° to 378°C, and of 6 wt percent NaCl solution at 1 to 400 kg/cm² and 101° to 437°C. Data are derived from gamma ray attenuation in the brine. Densities are given in tables and on figures.

110. Khaibullin, I. Kh., and Borisov, N. M., 1966, [Experimental investigations of the thermal properties of aqueous and gaseous solutions of sodium and potassium chloride in the presence of a vapor phase]: Akad. Nauk SSSR, Teplofiz. Vysokikh Temperatur, v. 4, p. 518 - 523. In Russian.

Experimental study on the density of 1 to 25 wt percent NaCl and of 1 to 20 wt percent KCl solutions at ambient pressure (given) between 100° and 440°C. Data were obtained from gamma ray transmissivity. Densities for the vapor and the liquid are given in tables along with the ambient pressure and the salt content of the vapor.

111. Khaibullin, I. Kh., and Novikov, B. E., 1973, [Thermodynamic study of aqueous and vapor solutions of sodium sulfate at high temperatures]: Akad. Nauk SSSR, Teplofiz. Vysokikh Temperatur, v. 11, p. 320 - 327. In Russian.

Experimental study on the density of Na_2SO_4 solutions from 0.5 to 30 wt percent and of NaCl solutions from 1 to 5 wt percent at ambient pressure (given) from 100° to 417°C. Data were obtained from gamma ray transmissivity. Densities of the gas and liquid phases are given in tables along with the ambient pressures.

112. Khare, P. L., 1962, Compressibilities of mixtures of electrolytes: Jour. Sci. Industr. Res. (New Delhi), v. 21B, p. 61 - 64.

Experimental study on the compressibility of Na_2SO_4 in 1 molar NaCl solution and of K_2SO_4 in 0.5 molar Na_2SO_4 solution at ambient pressure and 30°C. Densities were measured with a pycnometer and compressibilities were calculated from the velocity of sound in the solutions. Compressibilities are given on graphs and as constants.

113. Khare, P. L., 1962, Compressibility of dilute solutions of sulfuric acid: Faraday Soc. Trans., v. 58, p. 363 - 367.

Experimental study on the compressibility and apparent molal volume of 0.3 to 28.3 wt percent H_2SO_4 solutions at ambient pressure and 30°C. Compressibility data were derived from measurements of the velocity of sound and apparent molal volume data from pycnometry.

Experimental data are presented in tables, on graphs, and as an empirical equation.

114. Klarmann, Bodo, 1950, [Determination of the density of aqueous salt solutions]: Zeit. anal. Chem., v. 130, p. 186 - 192. In German.

The apparent consistency of the ratio of the density of two salt solutions taken at constant pressure temperature, and wt percent solute is discussed. Data used are from other sources at ambient pressure between 15° and 20°C.

115. Klevtsov, P. V., 1959, [Concerning the density of solutions in the system H_2O-NaCl-KCl]: Zapiski Vsesoyuz. Mineral. Obshchestva, v. 88, p. 93 - 96. In Russian.

Calculated densities of NaCl-KCl solutions of varying ratios and total weight percentages at ambient pressure between 50° and 200°C. Results are derived from data for NaCl and KCl at 80° and 150°C by using a described principle of additivity in the calculations of the specific volume of electrolyte solutions. Data are given in a table and on a figure.

116. Klochko, M. A., and Kurbanov, M. Sh., 1954, [Study of aqueous solutions of hydrogen chloride and perchloric acid by methods of physicochemical analysis]: Akad. Nauk SSSR, Sektor Fiz.-Khim. Anal. Izv., v. 24, p. 237 - 251. In Russian.

Densities of 5.9 to 44.9 wt percent (or 2.61 to 28.68 mole percent) HCl at ambient pressures between -30° and 25°C. Densities were derived from pycnometry. Experimental results are given in tables and on graphs along with experimentally measured conductances and viscosities.

117. Klochko, M. A., Taukesheva, S. M., and Bezhaev, M. S., 1959, [An investigation of the calcium chloride - water system by physicochemical analysis]: Uchenya Zapiski Dagestansk Gosudarst Univ., v. 5, p. 103 - 116. In Russian.

The density of $CaCl_2$ solutions from 2 wt percent to

saturation was measured at ambient pressure from 25° to 35°C. [Original text unavailable to authors. Data taken from Chem. Abs. 56:10990, 1962.]

118. Klotz, I. M., and Eckert, C. F., 1942, The apparent molal volumes of aqueous solutions of sulfuric acid at 25°C: Am. Chem. Soc. Jour., v. 64, p. 1878 - 1880.

Experimental study on the density and apparent molal volumes of H_2SO_4 solutions from 0.014 to 3.2 molar at ambient pressure and 25°C. The densities were obtained from the weight of a sinker in the solution. Molal volumes of $(H^+ + HSO_4^-)$ and $(2H^+ + SO_4^{2-})$ are derived from these data. Experimental data are presented in tabular form.

119. Kobus, G. I., 1955, [Electrical conductivity, viscosity, and density of highly concentrated solutions of sodium hydroxide]: Tr. Odessk. Gidrometeorol Inst., v. 1955, p. 113 - 127. In Russian.

The density of aqueous NaOH solutions from 1.0 to 28.7 normal were measured by pycnometry and dilatometry at ambient pressure from 25° to 80°C. [Original text unavailable to authors. Data taken from Chem. Abs. 52:17908b, 1958.]

120. Kolosov, A. S., Novik, V. Ph., and Chuprakova, T. V., 1971, [The system KCl - $FeCl_2$ - H_2O at 0°C]: Akad. Nauk SSSR, Sib. Otd., Ser. Khim. Nauk, Izv., v. 1971, p. 24 - 28. In Russian.

Experimental study of saturated solutions in the ternary system KCl - $FeCl_2$ - H_2O at 0°C and ambient pressure. Specific gravity of saturated solutions taken at 0°C were measured at 25°C and are given in a table.

121. Kondrat'ev, V. P., and Androsov, V. I., 1973, [Approximate equation of the temperature dependence of density of liquids]: Zhur. Fiz. Khim., v. 47, p. 2768 - 2770. In Russian.

An equation for the temperature dependence of the density of aqueous solutions is derived. Calculated results agree with experimental data. [Original test unavailable to authors. Data taken from Chem. Abs.

80:52447x, 1973.]

122. Kononemko, A. F., and Sashevskaya, Z. G., 1974, [Influence of temperature on density and viscosity of certain salt solutions]: Zhur. Prikl. Khim., v. 47, p. 211 - 212. In Russian. English translation is given in Jour. Applied Chem., v. 47, p. 208 - 209.

Experimental study of the density of a 28 wt percent $CaCl_2$ soluticn and of a 20 wt percent NaCl plus 0.5 wt percent Na_2CO_3 solution at ambient pressure between -20° and +20°C. Results were obtained from pycnometry. Experimental data are given in a table.

123. Korosi, Alexander, and Fabuss, B. M., 1968a, Viscosities of binary aqueous solutions of NaCl, KCl, Na_2SO_4, and $MgSO_4$ at concentrations and temperatures of interest in desalination processes: Jour. Chem. Eng. Data, v. 13, p. 548 - 552.

Experimental and calculated study on the density of KCl (0.1 to 3.5 molal), NaCl (0.1 to 3.5 molal), Na_2SO_4 (0.033 to 1.2 molal), and $MgSO_4$ (0.025 to 0.9 molal) solutions at pressure ranges from 1 to 200 psig and in the temperature range from 25° to 150°C. Densities were derived from pycnometry. Experimental data are presented in tables. An empirical equation is given.

124. Korosi, Alexander, and Fabuss, B. M., 1968b, Thermophysical properties of saline water: U.S. Off. Saline Water, Res. Develop. Progress Rept. No. 363, 53 p.

Experimental study on the density and viscosity of NaCl and KCl solutions between 0.1 and 3.5 molal, of Na_2SO_4 solutions between 0.03 and 1.2 molal, of NaCl-KCl solutions at ionic strengths between 0.7 and 3.6 molal, and of NaCl-Na_2SO_4 solutions at ionic strengths between 0.7 and 3.5 molal at ambient pressure from 25° to 150°C. The study also includes synthetic sea water at ionic strengths between 0.7 and 2.1 molal. Densities were obtained from pycnometry. Experimental data are given on tables. Constants for empirical functions are given on graphs and tables.

125. Krey, J., 1972, [Vapor pressure and density of the

system H_2O - NaOH]: Z. Phys. Chem. N.F., v. 81, p. 252 - 273. In German.

Experimental study on the density of 0.1 to 1.0 molal solutions of NaOH at ambient pressure and in the temperature range 0° to 350°C. Densities were derived from pressure vessel-filling measurements. Data are given in smoothed tables, graphically, as constants, and as empirical equations.

126. Kruis, A., 1936, [The depencence on concentration of the apparent molal volumes of a strong electrolyte]: Zeit. phys. Chem., v. B 34, p. 1 - 12. In German

Experimental determination of the density of NaCl (0.0026 to 0.74 molar) and KCl (0.040 to 3.72 molar) solutions at ambient pressure and 25°C. Data for NaCl were calculated from the weight of a sinker for KCl from dilatometry. Densities are given in tables. Apparent molal volumes are given in tables, on graphs, and as a function of the square root of molarity.

127. Krumgal'z, B. S. and Mashovets, V. P., 1964, [Density of concentrated solutions above 45 percent of NaOH and temperatures up to 400°C]: Zh. Prikl. Khim., v. 37, p. 2596 - 2600. In Russian. English translation in Russian Jour. Applied Chem., v. 37, p. 2563 - 2566.

Experimental study on the density of 46.16 to 90.73 wt percent solutions of NaOH at ambient pressure and from 150° to 400°C. Densities were derived from dilatometry. Experimental and smoothed data are given in tables, on graphs, and as empirical equations.

128. Kulkarni, A. G., 1969, Compressibility studies in mixed aqueous electrolytes: Indian Jour. Chem., v. 7, p. 333 - 335.

Among other binary systems, the compressibility of NaCl-KCl mixtures at total molarity of 1 and 3.5 were measured at ambient pressure and 25°C. Data are calculated from the measurement of the velocity of sound. Breaks in the slope of compressibility versus composition are absent at 1 molar but five are found at 3.5 molar. These are interpreted as changes in hydration. Only the ratios of KCl:NaCl for the breaks are given.

129. Kuppers, J. R., 1974, Partial molal expansibilities from the temperature of maximum density of aqueous solutions: Jour. Phys. Chem., v. 78, p. 1041 - 1042.

Calculated study on the expansivity of NaCl and KCl solutions at ambient pressure and 3.98°C. Tables of thermal coefficients are given and an empirical equation is used.

130. Lamb, A. B., and Lee, R. E., 1913, The density of certain dilute aqueous solutions by a new and precise method: Am. Chem. Soc. Jour., v. 35, p. 1666 - 1693.

Experimental study on the density of Na_2CO_3, NaCl, and KCl solutions at ambient pressure and 20°C. Density data were derived from magnetic float measurements. Experimental and smoothed data are presented on tables.

131. LaMer, V. K., and Gornwall, T. H., 1927, The partial molal volumes of water and salt in solutions of alkali halides: Jour. Phys. Chem., v. 31, p. 393 - 406.

Calculated study on the partial molal volume of NaCl and KCl solutions at ambient pressure from 0° to 50°C. Data are given in tables of constants and graphically. An empirical equation is also used.

132. Lanman, E. H., and Mair, B. J., 1934, The compressibility of aqueous solutions: Am. Chem. Soc. Jour., v. 56, p. 390 - 393.

Experimental study on the compressibility of NaCl, KCl, HCl, KOH, and NaOH solutions from 0.55 to 2.21 molal at pressures between 100 and 300 Mbars at 25°C. Compressibilities were derived from piezometry. Experimental data are given graphically and in tables.

133. Lee, Shiu, 1966, The apparent and partial molal volumes of electrolytes in water and in aqueous sodium chloride solutions: Ph. D. Thesis, Yale Univ., 141 p Univ. Microfilms, Ord. No. 66-4906 Abs. in Dissertation Abs., v. B27, p. 131.

Experimental and theoretical study of the density of solutions in binary, ternary, and higher order systems. The study includes experimental data at ambient pressure and 25°C for solutions of NaCl (0.15 to 3.4 molal), and of $CaCl_2$ (0.04 to 1.2 molal) and Na_2SO_4 (0.016 to 1.3 molal) in 0, 0.16, and 0.725 molal NaCl solutions. Data were obtained from pycnometry. Densities, apparent molal volumes and partial molal volumes are given in tables, on graphs, and as empirical equations.

134. Legrand, Michel, and Paris, R. A., 1966, [The systems: water, ferrous sulfate, potassium sulfate water, ferrous chloride, ferrous sulfate water, ferrous chloride, potassium chloride water, potassium chloride, potassium sulfate at 20°]: Soc. Chim. France Bull., v. 8, p. 2699 - 2701. In French.

Experimental study on the density of mixed solutions of $FeSO_4$-K_2SO_4, $FeSO_4$-$FeCl_2$, $FeCl_2$-KCl, and KCl-K_2SO_4 near saturation at ambient pressure and 20°C. Density data were derived from pycnometry. Experimental data are given in tables.

135. Lemmlein, G. G., and Klevstov, P. V., 1961, Relations among the principal thermodynamic parameters in a part of the system H_2O-NaCl: Geochemistry, v. 1961, p. 148 - 158.

Experimental study on the volume of NaCl-H_2O solutions at 5, 10, 20, and 30 wt percent NaCl from 250 to 1750 atm and from 150° to 500°C. Volume data are derived from pressure-temperature measurements for a given percent of fill of the pressure vessel at 20°C. Experimental data are given in tabular and graphical form.

136. Lengyel, Sandor, 1963a, [Studies on the sturcture of aqueous ionic solutions by analysis of the density against molality curves]: Magyar Kem. Foly., v. 69, p. 4 - 17. In Hungarian.

Theoretical study of the density of NaCl, KCl, HCl, NaOH, and KOH solutions from 2 to about 5 molar at ambient pressure and 0°, 25°, and 50°C. Constants for an empirical equation are given in tables.

137. Lengyel, Sandor, and Fezler, Gyula, 1963b, [Studies on the structure of aqueous solutions containing two electrolytes by density determinations]: Magyar Kem.

Foly., v. 69, p. 128 - 131. In Hungarian. English translation in Acad. Sci. Hungary, Acta Chim., v. 37, p. 319 - 327.

Experimental study on the density of NaCl solutions from 0.8 to 2.5 mclar in 2.0 molar KCl solutions at ambient pressure and 25°C. Densities were obtained from pycnometry. Relative densities are given in a table.

138. Likhoded, A. D., Zapol'skii, A. K., and Sazhin, V. S., 1973, [Investigation of the density and viscosity of aluminum and potassium sulfate solutions]: Khimicheskaya Tekhnologiya (Kharkov), v. 1973, p. 55 - 57. In Russian.

Experimental study of the density of K_2SO_4 solutions from 33.9 to 67.8 g/liter at ambient pressure from 85° to 95°C. Density was measured with a hydrometer. Experimental data are given in a table.

139. Lindstrom, R. E., and Wirth, H. E., 1969, Extimation of the bisulfate ion dissociation in solutions of sulfuric acid and sodium bisulfate: Jour. Phys. Chem., v. 73, p. 218 - 223.

Experimental study on the density of $NaHSO_4$ (0.001 to 4.0 molal) and H_2SO_4 (0.0012 to 2.33 molal) solutions at ambient pressure and 25°C. Experimental density measurements were derived from the weight of a sinker in solution. Experimental data are given in tabular form.

140. Longsworth, L. G., 1935, Transference numbers of aqueous solutions of some electrolytes at 25° by the moving boundary method: Am. Chem. Soc. Jour., v. 57, p. 1185 - 1191.

Smoothed partial molal volumes of $CaCl_2$, KCl, and Na_2SO_4 at ambient pressure and 25°C. Data for $CaCl_2$ are taken from the author's unpublished research (method is not stated) data for KCl and Na_2SO_4 are derived from the tabulations in volume 3 of the International Critical Tables, 1928. Partial molal volumes are given by equation only.

141. Lunden, Bertil, 1941, [The compressibility of mono-monovalent electrolyte solutions]: Svensk Kemisk

Tidshrift, v. 53, p. 86 - 96. In German.

Experimental study on the compressibility of NaCl and KCl solutions from 0.02 to 1 molar at ambient pressure and 20°C. Data are derived from the velocity of sound using densities taken from the literature. Experimental compressibilities and the limiting apparent molal compressibility are given in tables.

142. Lunden, Bertil, 1943, [The compressibility of electrolyte solutions]: Zeit. phys. Chem., v. 192, p. 345 - 378. In German.

Experimental compressibilities of 0.07 to 0.6 molar HCl at ambient pressure and 20°C. Compressibilities were calculated from the velocity of sound in the solutions. Results are given in tables and on graphs.

143. Lyons, P. A., and Riley, J. F., 1954, Diffusion coefficients for aqueous solutions of calcium chloride and cesium chloride at 25°: Amer. Chem. Soc. Jour., v. 76, p. 5126 - 5220.

An experimental study in which the density of $CaCl_2$ solutions from 0.095 to 2.0 molar were measured with a pycnometer at 25°C and ambient pressure. Experimental data are reported in a table.

144. MacInnes, D. A., Dayhoff, M. O., and Ray, B. R., 1951, A magnetic float method for determining the densities of solutions: Rev. Sci. Instruments, v. 22, p. 642 - 646.

Experimental study on the density of 0.2 to 4.5 wt percent KCl solutions at ambient pressure and 25°C. Densities were calculated from magnetic float measurements described in text. Experimental data are given graphically.

145. MacInnes, D. A., and Dayhoff, M. O., 1952, The partial molal volumes of potassium chloride, potassium and sodium iodides and of iodine in aqueous solutions at 25°: Am. Chem. Soc. Jour., v. 74, p. 1017 - 1020.

Experimental study on the partial molal volume of KCl (0.0086 to 0.60 molal) at ambient pressure and 25°C. Densities were derived from the measurements using the magnetic float technique. Experimental data are given in tables and as empirical equations.

146. Mahapatra, P. K., and Ray, B. C., 1958, On the variation of compressibility of water and electrolytic solutions with temperature: Indian Jour. Phys., v. 32, p. 439 - 442.

Experimental study on the compressibility of NaCl solutions (0.85, 1.7, and 3.4 normal) at ambient pressure and from 0° to 90°C. Compressibilities were calculated from velocity of sound measurements. Experimental data are given on graphs.

147. Maksimova, I. N., and Yushkevich, V. F., 1963, [Electrical conductivity of solutions of NaOH at elevated temperatures]: Zhur. Fiz. Khim., v. 37, p. 903 - 907. In Russian.

Calculated densities of NaOH solutions, 0.05 to 49 wt percent at ambient pressure from 20° to 300°C. Densities are given in a table and as an empirical expression.

148. Maksimova, I. N., 1965, [Density determinations of solutions]: Zh. Fiz. Khim., v. 39, p. 551 - 554. In Russian.

Calculated study to derive a generalized equation for the density of common inorganic compounds from 1 wt percent solute to near saturation at ambient pressure and between 20° and 300°C. The derived equation has been applied to binary solutions containing NaCl, KCl, HCl, $CaCl_2$, $FeCl_2$, K_2SO_4, Na_2SO_4, and K_2CO_3. Errors in calculation using given solute-dependent constants are about 0.1 to 0.3 percent between 20° and 140°C and about 1 to 6 percent at 200° to 300°C.

149. Maksimova, I. N., and Foterov, N. V., 1973, [Density of aqueous electrolyte solutions]: Ukr. Khim. Zhur., v. 39, p. 234 - 237. In Russian.

A theoretical study for calculating the volume of NaCl solutions based on the molecular volume of water and the molecular volume of the salt as calculated from the crystal radii. An empirical equation and tables of

smoothed numbers are given.

150. Manucharov, Yu. S., Mikhailov, I. G., and Shutilov, V. A., 1964, [The dependence of sound velocity and compressibility of electrolyte solutions on temperature and concentration at various hydrostatic pressures]: Leningrad Univ. Vestnik, Ser. Fiz. Khim., v. 1964, no. 3, p. 65 - 83. In Russian.

Experimental study of the compressibility and density between 20° and 80°C of the following solutions at the pressures indicated: $CaCl_2$, 0.56 and 1.02 mol/kg at 0 and 200 atm gauge Na_2SO_4, 0.07 to 0.71 mol/kg at 0 and 250 atm gauge NaCl, 0.17 to 2.64 mol/kg at 0 and 250 atm gauge and KCl, 0.13 to 2.36 mol/kg at 0, 200, and 300 atm gauge. Data were derived from measurments of the velocity of sound in solution. Experimental densities and compressibilities are given in tables.

151. Mashovets, V. P., Dibrov, I. A., Krumgal'z, B. S., and Matveeva, R. P., 1965, [Density of aqueous solutions of KOH at high temperatures in a wide range of concentrations]: Zh. Prikl. Khim., v. 38, p. 2344 - 2347. In Russian. English translation in Russian Jour. Applied Chem., v. 38, p. 2297 - 2299.

Experimental study on the density of 4.5 to 92.4 wt percent KOH solutions at ambient pressure in the temperature range 0° to 400°C. Densities were obtained by electromagnetically weighing a float in an autoclave. Experimental data are given in graphical and tabular form.

152. Mashovets, V. P., Puchkov, L. V., Smaev, V. N., Federov, M. K., and Federov, N. V., 1973, [Density, viscosity and electrical conductivity of sea water at temperatures up to 300-350°C]: Zh. Prikl. Khim., v. 46, p. 1865 - 1868. In Russian. English translation in Russian Jour. Applied Chem., v. 46, p. 1988 - 1990.

Experimental study on the density of 3.6 wt percent sea water solutions from ambient to 150 atm pressure in the temperature range 10° to 350°C. Densities were obtained from pycnometry up to 90°C and from pressure - temperature - degree of filling measurements above 90°C. Experimental data are given in tables for temperatures up to 275°C and 150 atm, on graphs for temperatures up

Data were derived from measurements of the velocity of sound in the solutions. Experimental compressibilities and densities are given in tables.

157. Mikhailov, I. G., and Syrnikov, Yu. P., 1959, [Temperature dependence of adiabatic compressibility of aqueous solutions of salts at low concentrations]: Stoenie i Fiz. Svoistva Veshchestva v Zhidkom Sostoyanii, Min. Vysshego i Srednego Spets. Obrazov. Ukr. SSR. Kievsk. Gos. Univ., Materialy 4-go (Chetvertogo) Soveshch., Kiev, 1959 (publ. 1962), p. 74 - 78. In Russian.

Experimental study of the adiabatic compressibility of 0.5 to 3 wt percent NaCl, KCl, and $CaCl_2$ solutions at ambient pressure between 58° and 74°C. Data were derived from the velocity of sound in solution. Results are given in the text and on graphs.

158. Mikhailov, I. G., and Fenjou, 1960, [Sound velocity and compressibility of aqueous solutions of LiOH, NaOH, and KOH]: Leningrad Univ. Vestnik, Ser. Fiz. Khim., v. 1960, no. 3, p. 22 - 35. In Russian.

Experimental study on the volumetric properties of NaOH (0.24 to 24.4 mol/kg) and KOH (0.15 to 16.7 mol/kg) at ambient pressure from 13° to 100°C. Data were obtained from measurments of the velocity of sound in solutions. Experimental compressibilities and densities are given in tables.

159. Mikhailov, I. G., and Shutilov, V. A., 1964, [Nonlinear accustical behavior of aqueous solutions of electrolytes]: Akust. Zhur., v. 10, p. 450 - 455. In Russian.

Experimental study on aqueous solutions of KCl (2.5 and 5 wt percent), $CaCl_2$ (4.1 and 11 wt percent), NaCl (1, 4, 10, and 14 wt percent). and Na_2SO_4 (1, 2, 6, and 10 wt percent). KCl and $CaCl_2$ solutions were studied at ambient and 200 atm above ambient pressure and at 30° and 80°C. NaCl and Na_2SO_4 solutions were studied at ambient pressure only at 20° and 80°C. Experimental velocities of sound and densities are given in a table and on graphs.

160. Millero, F. J., 1967, High precision magnetic float densimeter: Rev. Sci. Instruments, v. 38, p. 1441 - 1444.

An experimental study on the density of NaCl solutions from 0.02 to 0.31 molal at ambient pressure and 25°C. The densities were measured with a magnetic float densimeter which is described in detail. Partial molal volumes and the densities from which they were calculated are presented in tables.

161. Millero, F. J., and Drost-Hansen, W., 1968, Apparent molal volumes of aqueous monavalent salt solutions at various temperatures: Jour. Chem. Eng. Data, v. 13, p. 330 - 333.

An experimental study on the density and apparent molal volumes of NaCl (0.114 molal) and KCl (0.115 molal) solutions at ambient pressure between 20° and 40°C. The densities were measured with a magnetic float densimeter. Partial molal volumes were calculated from the densities and are presented in tables. Included also are empirical equations.

162. Millero, F. J., 1970, The apparent and partial molal volume of aqueous soldium chloride solutions at various temperatures: Jour. Phys. Chem., v. 74, p. 356 - 362.

Experimental study on the density of NaCl solutions from 0.010 to 0.964 molal at ambient pressure between 0° and 55°C. Density data were derived from a magnetic float densimeter. Experimental data are given in tables and on graphs.

163. Millero, F. J., Knox, J. H., and Emmet, R. I., 1972a, A high-precision, variable-pressure magnetic float densimeter: Jour. Soln. Chem., v. 1, p. 173 - 186.

Experimental study on the density and partial molal volume of NaCl solutions at 0.75 and 1.0 molal from 0 to 1.2 kb applied pressure and 25°C. Density data were derived from magnetic float densimeter measurements. Experimental and smoothed data are presented in tables.

164. Millero, F. J., Hoff, E. V., and Kahn, Larry, 1972b, The effect of pressure on the ionization of water at

[illegible]

25°C. Smoothed data are presented on tables, on graphs, and as empirical equations.

172. Owen, B. B., 1944. Some aspects of pressure upon the properties of liquids and solutions of electrolytes. Jour. Chem. Education, v. 21, p. 59 - 63.

Calculated study on the partial molal volume, compressibility, and density of KCl and NaCl solutions in the temperature range 0° to 85°C. Smoothed data are presented in tables, on graphs, and as empirical equations.

173. Owen, B. B., and Brinkley, S. R. Jr., 1949, Extrapolation of apparent molal properties of strong electrolytes: New York Acad. Sci. Annals, v. 51, p. 753 - 764.

Theoretical and calculated study on the apparent molal volume of HCl, NaCl, and KCl solutions at ambient pressure and 25°C. Data are presented as constants in tables, as empirical equations, and on graphs.

174. Owen, B. B., and Kronick, P. L., 1961, Standard partial molal compressibilities by ultrasonics. II. Sodium and potassium chlorides and bromides from 0° to 30°C: Jour. Phys. Chem., v. 65, p. 84 - 87.

Experimental and calculated study on the compressibility of 0 to 0.07 normal solutions of NaCl and KCl at ambient pressure from 0° to 30°C. The compressibilities were derived from measurements of the velocity of sound. Experimental data are presented in tables, on graphs, and as empirical equations.

175. Passynski, A., 1935, [The velocity of ultrasound in colloidal solutions]: Acta Physicochim U.R.S.S., v. 3, p. 779 - 782. In German.

Experimental study on the velocity of sound and density of NaCl solutions from 2.6 to 21.3 wt percent at ambient pressure and 20°C. Densities were measured with a pycnometer. Experimental data are given in a table.

176. Passynski, A., 1938, Compressibility and solvation of

solutions of electrolytes: Acta Physicochim. U.R.S.S., v. 8, p. 385 - 418.

Experimental and theoretical study of the compressibility of KCl (0.13 to 2.7 normal) and NaCl (0.17 to 3.6 normal) solutions at 20°C and ambient pressure. Compressibilities were obtained from the measurements of the velocity of sound in the solutions. Densities were obtained from pycnometry. Experimental data are given in tables.

177. Pearce, J. N., and Eckstrom, H. C., 1937, Vapor pressures and partial molal volumes of aqueous solutions of the alkali sulfates at 25°: Am. Chem. Soc. Jour., v. 59, p. 2689 - 2691.

Experimental study on the apparent and partial molal volume of 0 molal to saturated solutions of K_2SO_4 and Na_2SO_4 at 25°C and ambient pressure. Volume and density data were derived from pycnometry. Experimental data are presented in tables, on graphs, and as empirical equations.

178. Perman, E. P., and Urry, W. D., 1929, The compressibility of aqueous solutions: Royal Soc. (London) Proc., v. A126, p. 44 - 78.

Experimental study on the compressibility of KCl (2.5 to 22.1 wt percent) and $CaCl_2$ (7 to 50 wt percent) solutions at pressures from 1 to 200 atm and temperatures from 30° to 80°C. Experimental compressibilities were derived from piezometry. Data are presented in tables, on graphs, and as empirical equations.

179. Perron, Gerald, Desnoyers, J. E., and Millero, F. J., 1974, Apparent molal volumes and heat capacities of alkaline earth chlorides in water at 25°C: Canadian Jour. Chem., v. 52, p. 3738 - 3741.

Experimental densities and heat capacities of $CaCl_2$ solutions from 0.0125 to 0.33 molal at 25°C and ambient pressure. Densities were measured using a flowing densimeter. Experimental densities and apparent molal volumes are given in a table and on a figure. Constants for the Redlich-Meyer equation are also given in a table.

184. Prang, Willy, 1938, [The dependence of density and refractive index on the concentration of very dilute aqueous solutions of strong electrolytes. A differential method for the determination of small differences in density]: Annal Phys., 5th Ser., v. 31, p. 681 - 713. In German.

Experimental study on the density of 0.1 to 0.0007 normal solutions of NaCl, KCl, Na_2SO_4, Na_2CO_3, and K_2CO_3 at ambient pressure and 18°C. Experimental data are obtained by a differential float method. Experimental data are presented in tables, on graphs, and as empirical equations.

185. Ramanathan, VR., and Raman, N., 1969, Ultrasonic velocity and compressibility index in acid - base solutions: Defense Science Jour., v. 19, p. 149 - 152.

Experimental study on the compressibility and density of solutions from 0.5 to 4 normal in the system HCl - NaCl - NaOH - H_2O at 29°C and ambient pressure. Densities were measured by pycnometry and adiabatic compressibility data were calculated from the density data and measurements of the velocity of sound in the solutions. Experimental and smoothed data are given graphically.

186. Raqib, M. A., 1970, Apparent molar volumes of electrolytes in aqueous solution at very low concentrations: Sci. Ind. (Karachi), v. 7, p. 41 - 44.

Apparent molal volumes of NaCl and KCl solutions down to 10^{6} molar. Measurements were made with a newly developed, highly sensitive densimeter. [Original text unavailable to authors. Data taken from Chem. Abs., 74:16251, 1971.]

187. Rau, Hans, and Narayanan Kutty, T. R., 1970, [PVT-measurements of concentrated hydrochloric acid to 500°C and 1500 bars: Ber. Bunsen-Gesellschaft Phys. Chem., v. 76, p. 645 - 651. In German.

Experimental study on the apparent molal volume and density of 37 wt percent HCl solutions at pressures from 0 to 1500 bars and at temperatures from 0° to 500°C. Volume data were derived from dilatometry. Experimental data are presented in tabular and graphical form.

188. Ravich, M. I., and Borovaya, F. E., 1971a, [Experimental methods and results of determining the densities of aqueous solutions of potassium sulfate at 397°C in the 600 - 1500 kg/cm² pressure range]: Zhur. Neorg. Khim., v. 16, p. 1776 - 1781. In Russian.

Experimental study of the density of 5 to 35 wt percent K_2SO_4 solutions at 397°C between 600 and 1500 kg/cm². Data were obtained from dilatometry. Experimental specific volumes are given in a table. Specific volumes, compressibilities and the partial molal volumes of H_2O and K_2SO_4 are given on graphs.

189. Ravich, M. I., and Borovaya, F. E., 1971b, [Volume properties of potassium sulfate solutions at high pressures in the 300° - 500°C range]: Zhur. Neorg. Khim., v. 16, p. 3135 - 3141. In Russian.

Experimental study on the specific volume of K_2SO_4 solutions from 5 to 50 wt percent between 300 and 1500 kg/cm² at 300°C, between 850 and 1500 kg/cm² at 448°C, and between 1300 and 1500 kg/cm² at 500°C. Data are derived from dilatometry. Specific volumes are given in tables, on graphs, and as empirical equations. Compressibilities and the partial molal volumes of H_2O and K_2SO_4 are given on graphs.

190. Redlich, Otto, and Rosenfeld, P., 1931, [On the theory of molal volumes of aqueous electrolytes II.]: Zeit. Elektrochem., v. 37, p. 705 - 711. In German.

Theoretical discussion of the apparent and partial molal volumes of NaCl and KCl solutions at ambient pressure and 0°, 25°, and 50°C. Results are given in a table and on graphs.

191. Redlich, Otto, 1940, Molal volumes of solutes IV: Jour. Phys. Chem., v. 44, p. 619 - 629.

Calculated study on the apparent molal volume of 0 to 1 molar solutions of KCl and NaCl at ambient pressure and at temperatures from 0° to 50°C. Smoothed data are presented in tables, on graphs, and as empirical equations.

192. Redlich, Otto, and Bigeleisen, J., 1942a, Molal volumes

of solutes. VI. Potassium chlorate and hydrochloric acid: Am. Chem. Soc. Jour., v. 64, p. 758 - 760.

Experimental study on the molal volume and density of HCl solutions from 0.0034 to 1.88 molar at ambient pressure and at 25°C. Experimental volume and density data were derived from the weight of a sinker in the solution. Experimental data are presented in tables and as an empirical equation.

193. Redlich, Otto, and Bigeleisen, J., 1942b, Thermodynamic properties of electrolytes at infinite dilution: Chem. Rev., v. 30, p. 171 - 179.

Calculated and theoretical study on the apparent molal volume of 0.1 to 1.0 molal HCl solutions at ambient pressure and 25°C. Smoothed data are presented in tables, on graphs, and as empirical equations.

194. Redlich, Otto, and Meyer, D. M., 1964, The molal volumes of electrolytes: Chem. Rev., v. 64, p. 221 - 227.

Review study on the molal volume and density of NaCl (0.05 to 0.881 molar) and KCl (0.07 to 0.77 molar) solutions at ambient pressure in the temperature range 0° to 70°C. Smoothed data are presented in tables, on graphs, and as empirical equations.

195. Riedl, Istvan, 1972, Analysis of physiochemical characteristics and activation thermodynamical functions of the sodium hydroxide - water and sodium hydroxide - water - aluminum oxide systems: Nehezip Musz. Egyet, Miskolc, Idennyelva Kozlem, v. 32, p. 217 - 231.

An experimental study of the density of NaOH solutions as a function of temperature and composition at ambient pressure. (Original text unavailable. Data taken from Chem. Abs., 78:140501z, 1973.)

196. Rosen, J. S., 1959, Solutions under pressure: Jour. Chem. Phys., v. 30, p. 547 - 555.

Calculated study on the specific volume of NaCl and K_2SO_4 solutions at pressures from 0 to 10.13 kb at 25°C. Specific volume data are given in smoothed tables and an empirical equation is used.

197. Rowe, A. M. Jr., and Chou, J. C.-S., 1970, Pressure-volume-temperature-concentration relation of aqueous NaCl solutions: Jour. Chem. Eng. Data, v. 15, p. 61 - 66.

Experimental and calculated study on the compressibility of NaCl (0 tc 2.5 molar) solutions at pressures from 1 to 300 atm and at temperatures from 20° to 175°C. Compressibility data were derived from pvt measurements in stainless steel vessels. Smoothed data are given in tables, on graphs, and as empirical equations.

198. Salceanu, Constantin, 1963, [Speed of sound in equimolar aqueous solutions and in some organic liquids]: Acad. Sci. (Paris) Comptes rendus, v. 257, p. 1595 - 1598. In French.

Experimental compressibility of KCl, NaCl, and $CaCl_2$ solutions from 0.2 to 0.6 molal at ambient pressure and in the temperature range 20° to 22°C. Compressibility data were calculated from the measurements of the velocity of sound in the solutions. Experimental data are given as tables and as an empirical equation.

199. Samoilovich, I. A., and Khetchikov, L. N., 1968, [Relations among pressure, temperature, and density in aqueous solutions of sodium chloride and potassium chloride]: Akad. Nauk SSSR, Doklady, v. 180, p. 1450 - 1452. In Russian.

Relative volumes [v(20°C)/v(t)] for 6 and 12 wt percent NaCl and for 4 and 8 wt percent KCl solutions at ambient pressure (given) from 185° to 414°C. Relative volumes are obtained from breaks in the slope of plots of pressure against temperature for various percentages of filling of an autoclave at 20°C. Experimental data are given on a table. Pressure-temperature isochores are given graphically between 180° and 550°C and to 1500 kg/cm² for 6 wt percent NaCl and 8 wt percent KCl. The graph is contoured at 0.01 for relative volumes of 0.90 to 0.65.

200. Samoilovich, L. A., 1970, [Interrelations of pressure, temperature, filling factor, and concentration of

aqueous solutions of hydrochloric acid at high temperatures and pressures]: Tr. Vses. Nauch.-Issled. Inst. Sin. Miner. Syr'ya, v. 1970, p. 50 - 54. In Russian.

Relative volumes [v(20°C)/v(t)] for 3 and 6 normal HCl up to 300 atm and between 20° and 280°C. Relative volumes are obtained from breaks in the slope of plots of pressure against temperature for various percentages of filling of an autoclave at 20°C. [Original text unavailable to authors. Data taken from Chem. Abs., 76-37645, 1972.]

201. Satyavati, T., Jayarama Reddy, P., and Subrahmanyam, S. V., 1962, Ultrasonic studies in electrolytic mixtures-Complex ion formation: Japan Phys. Soc. Jour., v. 17, p. 1061 - 1064.

Experimental study on the adiabatic compressibility and density of 1.0 and 2.0 molar solutions of NaCl, KCl, and NaCl-KCl mixtures at ambient pressure and 25°C. Compressibility data were derived from velocity of sound measurements. Experimental data are given in graphical form.

202. Satyavati, A. V., 1968, Ultrasonic behaviour in simple and complex ternary systems of electrolytes: Acustica, v. 19, p. 350 - 354.

Experimental study of the compressibility of K_2SO_4 - Na_2SO_4 solutions of constant 0.5 molarity at ambient pressure and 31.5°C. Compressibilities were obtained from the velocity of sound in the solution densities were obtained from pycnometry. Experimental data are given on a graph only.

203. Scott, A. F., 1931, The apparent volumes of salts in solution. I. A test of the empirical rule of Masson: Jour. Phys. Chem., v. 35, p. 2315 - 2329.

Calculated study on the apparent volume of KCl (2.25 to 4.77 molar), NaCl (5.1 to 5.42 molar), K_2CO_3, and $CaCl_2$ solutions at ambient pressure in the temperature range from 0° to 100°C. Smoothed apparent volume data are given in tables and on a graph.

204. Scott, A. F., Obenhaus, V. M., and Wilson, R. W., 1934, The compressibility coefficients of solutions of eight alkali halides: Jour. Phys. Chem., v. 38, p. 931 - 940.

Experimental study on the compressibility and density of 2.86 to 24.82 wt percent NaCl solutions and of 7.44 to 26.52 wt percent KCl solutions at pressures from 100 to 300 Mb at 35°C. Compressibilities were derived from piezometry. Experimental data are given in tabular and graphical form.

205. Scott, A. F., and Wilson, R. W., 1934b, The apparent volumes of salts in solution and their compressibilities: Jour. Phys. Chem., v. 38, p. 951 - 977.

Calculated study on the apparent volume and compressibility of NaCl (0.49 to 5.0 molar) and KCl (1.03 to 4.17 molar) solutions at 200 atm and 35°C. Smoothed data are given in tables, on graphs, and as empirical equations.

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The density and compressibility of NaCl and KCl solutions were measured at 1200 bars at 20° and 45°C. Compressibility was determined from velocity of sound measurements. [Original text unavailable to authors. Data taken from Chem. Abs. 77:39475y, 1971.]

207. Sergeevich, V. I., and Zhuze, T. P., 1960, [The viscosity and density of formation waters and binary solutions of electrolytes at various temperatures and pressures]: Akad. Nauk SSSR, Inst. Geol. i. Razrabotki Goruckikh Iskopaemikh, Trudy, v. 2, p. 104 - 112. In Russian.

Experimental densities and viscosities of methane-saturated formation waters (analyses given) at 40°C from 50 to 300 atm. Densities were derived from the weight of a sinker. Densities are given in a table.

208. Sevzov, A. I., 1937, [Determination of the viscosity and density of caustic aqueous solutions]: Zh. Prikl. Khim., v. 10, p. 1500 - 1503. In Russian with abstract in French.

Experimental densities and viscosities of $NaOH+Na_2CO_3$ solutions (industrial solutions, approximate salt ratio 6:1) from 5.3 to 28.4 wt percent at ambient pressure over the temperature range 15° to 95°C. Densities were measured with a hydrometer. Results are given on a table, a graph, and as an empirical equation.

209. Shakhov, Yu. A., 1972, [Calculation of the density of aqueous salt solutions using digital computers]: Trudy Vses. Nauch.-Issled. Proekt. Inst. Galurgii, v. 1972, p. 227 - 234. In Russian.

A computer routine for calculating density as a function of composition based on a second degree polynomial equation is described. Calculated results for NaCl, KCl, Na_2SO_4, and K_2SO_4 agree well with experimental data. (Original text unavailable. Data taken from Chem. Abs., 80:100332e, 1974.)

210. Shedlovsky, Theodore, and Brown, A. S., 1934, The electrolytic conductivity of alkaline earth chlorides in water at 25°: Amer. Chem. Soc. Jour., v. 56, p. 1066 - 1071.

An experimental study in which the density of $CaCl_2$ solutions from 0.08 to 0.26 normal were measured with a pycnometer at 25°C and ambient pressure. Experimental data and data calculated from an empirical equation are given in tables.

211. Shilovskaya, M. E., and Lenkova, V. I., 1974, Determining the density and viscosity of concentrated solutions of certain salts in the 20 - 80°C temperature range: Teploenergetika, v. 21, no. 1, p. 93 - 94.

Experimental study on the density and viscosity of solutions of Na_2CO_3 (0.1 to 2.4 molar), $NaHCO_3$ (0.1 to 1.1 molar) and Na_2SO_4 (0.1 to 1.1 molar) at ambient pressure from 20° to 80°C. Densities were obtained from pycnometry. Results are given on graphs and as empirical equations.

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Calculated and experimental study on the compressibility of 0 to 0.07 normal solutions of KCl and NaCl at ambient pressure and 25°C. Compressibility data were calculated from measurements of the velocity of sound in the solutions. Experimental data are given in tables, on graphs, and as an empirical equation.

213. Spedding, F. H., Pikal, M. J., and Ayers, B. O., 1966, Apparent molal volumes of some aqueous rare earth chloride and nitrate solutions at 25°: Jour. Phys. Chem., v. 70, p. 2440 - 2449.

Experimental study on the specific gravity of 0.0073 to 0.41 molal KCl solutions at ambient pressure and 25°C. Specific gravity data were derived from magnetic float densimeter measurements. Data are presented in tables and as an empirical equation.

214. Stankhanova, M. S. and Vasilev, V. A., 1963, [Volumetric and heat capacity changes in aqueous salt solutions. I. The systems CsCl - LiCl - H_2O and CsCl - NaCl - H_2O]: Zhur. Fiz. Khim., v. 37, p. 1568 - 1573. In Russian.

Experimental study on the density of NaCl solutions from 0.5 to 4.5 molal at ambient pressure and 25°C. Data were derived from pycnometry. Relative densities are given in a table.

215. Subrahmanyam, S. V., 1960, Adiabatic compressibilities of electrolytic solutions: Jur. Sci. Industr. Res. (New Delhi), v. 19C, p. 333 - 336.

Experimental study on the compressibility of KOH and NaOH solutions from 0 to 5 molar at ambient pressure and 30°C. Data were measured with a piezometer. Experimental results are given graphically.

216. Szalay, A., 1934, [The compressibility of dilute electrolyte solutions]: Physik. Zeit., v. 35, p. 639 - 643. In German.

Experimental study on the compressibility of NaCl and KCl solutions from 0 to 0.2 molar at ambient pressure and at approximately 25° to 30°C. Compressibilities were derived from the velocity of sound. Results are given on a graph.

217. Tamas, Jozsef, 1963, [Density of aqueous solutions of some strong electrolytes]: Magyar Kemiai Folyoirat (Budapest), v. 69, p. 497 - 499. In Hungarian.

Refer to Tamas (1964) for the English language version of this report.

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Experimental study on the density of NaOH from 3.7 to 49 wt percent and KOH from 4.0 to 43 wt percent at ambient pressure and 25°C. Densities were obtained by pycnometry. Experimental data are given in a table and on figures.

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Experimental study on the compressibility of approximately 10.0 molar solutions of KCl, NaOH, and NaCl at ambient pressure and 26°C. Compressibilities were obtained from measurements of the velocity of sound and densities from pycnometry. Experimental data are given in tables and with empirical equations.

220. Tham, M. K., Gubbins, K. E., and Walker, R. D. Jr., 1967, Densities of potassium hydroxide solutions: Jour. Chem. Eng. Data, v. 12, p. 525 - 526.

Experimental study on the density of KOH solutions from 6.1 to 77.1 wt percent at ambient pressure and from 59.9° to 161.4°C. Density data were derived from a hydrostatic weighing method. Experimental data are given in tables.

221. Thomas, W. G., and Perman, E. P., 1934, The compressibility of aqueous solutions II. Royal Soc. (London) Proc., v. A146, p. 640 - 650.

Experimental study on the compressibility of 0.259 to 2.21 molal solutions of KCl at 0 to 100 atm and 30°C. Compressibility data were obtained from piezometry. Experimental data are given in tables, on graphs, and as empirical equations.

222. Tikhomirova, N. N., 1957, [Application of methods of physical chemical analysis in analytical chemistry]: Sbornik Nauch. Rabot., Leningrad Inst. Sovet. Torgovli, v. 1957, no. 11, p. 134 - 142. In Russian.

Experimental study on the density at ambient pressure of NaCl - KCl solutions at 25° and of KCl - K_2SO_4 solutions at 20°C. Densities as a function of composition from about 1 wt percent to near saturation are given in tables and on graphs.

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Compilations of partial molal volumes of NaCl and H_2O in NaCl solutions from 0 to 26 wt percent between 32° and 212°F at ambient pressure. Data are derived from a literature review. The references are not given. Volumes are given in tables and graphs with volumes in ft^3/lb-mol.

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A theoretical study on calculations of the density of a solution after diluting the solution with water. An empirical equation was derived from the data in the International Critical Tables (1928). Calculations are for solutions of NaCl, KCl, and NaOH at ambient pressure and 25°C. Smoothed data are presented in tables and on graphs.

225. Ukinashi, Hiroshi, 1959, [Physico-chemical properties of sodium silicate solutions. Part 7, The dependency of density and viscosity on the composition of sodium silicate solutions, and its relation to the molecular behavior in solutions]: Asahi Garasu Kenkyu Hokoku, v. 9, p. 137 - 161. In Japanese with English abstract.

Experimental study of the density of Na_2O - SiO_2 - H_2O solutions, water glass, from 5° to 60°C at ambient pressure. The ratio of SiO_2 to Na_2O in solution varied from 1 to 3.95. The concentration of Na_2O varied from 0.5 to 20.74 mole percent. Experimental densities are given in a table and on graphs. The thermal expansivity is shown graphically. Coefficients for an empirical expression are given on a table as a function of the mole ratio of SiO_2 to Na_2O and the function is plotted on all graphs.

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Compilation of density and other thermophysical data for NaCl from 0 wt percent to saturation between 30° and 300°F at ambient pressure. Data are derived indirectly from the International Critical Tables, v. 3 (1928). Smoothed densities are given in graphs in units of lb/ft^3.

227. Urusova, M. A., 1974, [Phase equilibria and thermodynamic characteristics of solutions in the systems NaCl - H_2O and NaOH - H_2O at 350 - 550°C[: Geokhimiya, v. 1974, p. 1360 - 1366. In Russian.

Experimental study on the density of NaCl solutions from 10 to 45 wt percent at pressures to 230 kg/cm^2 on the 350°C isotherm and to 600 kg/cm^2 on the 400° and 450°C isotherms. Densities were obtained from dilatometry. Experimental data are given on a graph only.

228. Vasilev, V. A., Fedyainov, N. V., Karapet'yants, M, K., and Karpachev, A. I., 1973, [Use of equations relating the specific heat capacity or density of electrolyte solutions tc concentration]: Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., v. 16, p. 689 - 693. In Russian.

An equation is presented for calculating the density of $CaCl_2$ solutions as a function of composition at 25°C. The equation fits the experimental data with a precision of 0.0002 g/ml. (Original text unavailable. Data taken from Chem. Abs., 79:84062p, 1973.)

229. Vaslow, Fred, 1966, The apparent molal volumes of alkali metal chlorides in aqueous solutions and evidence for salt-induced structure transitions: Jour. Phys. Chem., v. 76, p. 2286 - 2294.

Experimental study of the apparent molal volumes of NaCl and KCl from 0 to 3.5 molal at ambient pressure and 25°C. Volumes were measured using a differential hydrostatic balance. Apparent molal volumes are given in graphical and tabular form.

230. Vaslow, Fred, 1969, The apparent molal volumes of lithium and sodium halides. Critical-type transitions in aqueous solution: Jour. Phys. Chem., v. 73, p. 3745 - 3750.

Experimental study on the apparent molal volume of NaCl solutions from 0.05 to 3.5 molal at ambient pressure and 5°C. Experimental apparent molal volumes were calculated from measurements using a differential density balance. Data are presented in tabular form.

231. Vogel, W. M., Routsis, K. J., Kehrer, V. J., Landsman, D. A., and Tschinkel, J. G., 1967, Some physiochemical properties of the $KOH-H_2O$ system: Jour. Chem. Eng. Data, v. 12, p. 465 - 472.

Calculated and experimental study on the density of $KOH-H_2O$ solutions from 55 to 85 wt percent KOH at ambient pressure and from 120° to 250°C. Density data were derived from the float technique. Experimental data are presented in tables, on graphs, and as empirical equations.

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An experimental study of the density of $CaCl_2$ solutions from 22 to 49 mol percent at ambient pressure from 50° to 130°C. (Original text unavailable. Data taken from Chem. Abs., 78:164406g, 1973.)

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Experimental study on the density of 0 to nearly saturated solutions of NaCl-HCl-H_2O and KCl-HCl-H_2O at ambient pressure and the temperatures 0°, 25°, 35°, and 45°C. Density data were derived from pycnometry. Experimental data are given in tables and on graphs.

234. Wirth, H. E., 1937, The partial molal volumes of potassium chloride, potassium bromide, and potassium sulfate in sodium chloride solutions: Am. Chem. Soc. Jour., v. 59, p. 2549 - 2554.

Experimental and calculated study on the partial molal volume of KCl (0 to 0.638 molar) and K_2SO_4 (0 to 0.338 molar) contained in 0 to 0.97 molar NaCl solutions at ambient pressure and 25°C. Partial molal volumes and densities were calculated from the weight of a sinker in the solution. Experimental data are presented in tables, on graphs, and as empirical equations.

235. Wirth, H. E., 1940a, Apparent and partial molal volumes of sodium chloride and hydrochloric acid in mixed solutions: Am. Chem. Soc. Jour., v. 62, p. 1128 - 1134.

Experimental study on the apparent and partial molal volumes of mixed solutions of HCl and NaCl from 0.01 to 3.0 normal at ambient pressure and 25°C. Volume data were calculated from the weight of a sinker in the solutions. Experimental data are given in tables, on graphs, and as empirical equations.

236. Wirth, H. E., 1940b, The problem of the density of sea water: Jour. Marine Research, v. 3, p. 230 - 247.

Calculated study on the density of sea water, NaCl, KCl, K_2SO_4, and $CaCl_2$ at ambient pressure and 25°C. Smoothed data are given in tables, graphically, and as empirical equations.

237. Wirth, H. E., and LoSurdo, Antonio, 1968, Temperature dependence of volume changes on mixing electrolyte solutions: Jour. Chem. Eng. Data, v. 13, p. 226 - 231.

Experimental study on the volume and density of 4.0 molal NaCl and 1.33molal Na_2SO_4 solutions and their mixtures at ambient pressure between 5° and 45°C. Density and volume data were derived from dilatometry. Experimental data are presented in tables, on graphs, and as empirical equations.

238. Wirth, H. E., and Bangret, F. K., 1972, Apparent molal volumes of sodium chloride and magnesium chloride in aqueous solution: Jour. Phys. Chem., v. 76, p. 3488 - 3491.

Experimental study on the apparent molal volume of NaCl from 0 to 4 molal at ambient pressure and 25°C. Apparent molal volume data were derived from dilatometry and the sinker method. Experimental data are given in tables, graphically, and as empirical equations.

239. Wright, Robert, 1940, The relation between the coefficient of thermal expansion and structure of solutions: Chem. Soc. (London) Jour., v. 1940A, p. 870 - 873.

Experimental study on the coefficient of thermal expansion of NaCl (1 to 6 molal) and KCl (1 to 4 molal) at ambient pressure in the temperature range 25° to 78°C. Thermal expansion data were derived from the height of solution in a silica tube. Experimental data are given in tabular form.

240. Zen, E-an, 1957, Partial molal volumes of some salts in aqueous solutions: Geochim. Cosmochim. Acta, v. 12, p. 103 - 122.

Review paper on the partial molal volumes of KCl, NaCl, HCl, KOH, NaOH, $CaCl_2$, K_2CO_3, Na_2CO_3, K_2SO_4, Na_2SO_4, and H_2SO_4 at ambient pressure and 0° and 25°C. Data are given in tables.

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