TABLE 1. PROPERTIES OF LITHIUM CHLORIDE SOLUTIONS

Concentration Pound Mols (42.4 Lb) LiCl per 1000 Lb Water	Concentration Per Cent by Weight	Specific Gravity at 100 F	Viscosity (Millipoise) 80 F	Viscosity (Millipoise) 180 F	Partial Heat of Mixing at 0 F, Btu per Lb	Temp. Coeff. of Partial Heat of Mixing Btu per Lb per F	Specific Heat at 70 F	Boiling Point F at (760 mm Hg)	Freezing Point, F
0	0.0	1.000	8.61	3.48	0.00	0.000	0.998	212.0	32.0
2	7.8	1.037	11.19	4.56	2.04	−0.014	0.901	215.8	16.3
4	14.5	1.076	14.42	6.01	7.24	−0.036	0.831	221.5	− 5.8
6	20.2	1.111	18.62	7.78	16.70	−0.069	0.778	228.9	−34.2
8	25.3	1.143	24.32	10.00	31.90	−0.109	0.739	238.1	−69.0
10	29.7	1.172	32.28	12.91	51.10	−0.143	0.710	248.4	−90.0
12	33.7	1.199	43.45	16.56	75.70	−0.160	0.687	258.8	−40.0
14	37.4	1.225	60.26	21.28	90.80	−0.167	0.666	268.9	1.0
16	40.4	1.248	82.04	27.10	124.80	−0.176	0.647	277.9	36.5
18	43.3	1.270	113.80	35.48	145.00	−0.186	0.631	285.8	58.1
20	46.0	1.291		46.45	162.00	−0.194		293.2	86.4
22	48.4			60.67	171.00	−0.200		300.2	133.0
24	50.3			84.33	177.00	−0.200		307.0	156.0
26	52.4				182.00	−0.210		313.0	180.0
28	54.3				191.00	−0.210		318.0	190.0
30	56.1				194.00	−0.210		323.0	195.0
32	57.5				198.00	−0.220		328.0	280.0

TABLE 2. DEW-POINT OF AIR IN EQUILIBRIUM WITH LITHIUM CHLORIDE SOLUTIONS
CONCENTRATION IN POUND MOLS (42.4 LB) LITHIUM CHLORIDE PER 1000 LB WATER

Dew-Point at Zero Conc.	Concentration of Lithium Chloride 2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0
320	315.2	308.7	299.9	290.2	279.7	269.4	259.6	251.5	244.1	236.5	230.0	223.8	218.6	214.5	210.3
300	295.4	289.1	280.5	270.9	260.6	250.5	240.8	232.6	225.4	218.0	211.8	205.8	200.8	196.9	192.8
280	275.6	269.5	261.1	251.7	241.5	231.6	222.2	214.0	206.7	199.7	193.5	187.8	183.2	179.3	175.2
260	255.8	250.0	241.9	232.6	222.7	212.8	203.5	195.5	188.4	181.7	175.4	170.0	165.6	162.0	158.4
240	236.0	230.4	222.5	213.5	203.8	194.2	185.0	177.1	170.0	163.6	157.5	152.2	148.3	144.6	140.5
220	216.2	210.8	203.2	194.4	184.9	175.5	166.4	158.6	151.6	145.3	139.6	134.6	130.7	127.3	124.2
200	196.4	191.2	183.9	175.4	166.1	156.7	148.0	140.3	133.5	127.3	121.9	117.0	113.3	110.1	
180	176.6	171.6	164.7	156.4	147.3	138.1	129.6	122.1	115.5	109.4	104.2	99.6	96.0		
160	156.8	152.1	145.4	137.4	128.6	119.7	111.3	103.9	97.4	91.6	86.6	82.2			
140	137.0	132.6	126.1	118.4	109.9	101.3	93.1	85.9	79.5	73.8	69.0				
120	117.2	113.0	106.8	99.4	91.1	82.7	74.7	67.8	61.5	56.0					
110	107.3	103.2	97.2	89.9	81.9	73.5	65.6	58.8	52.6	47.1					
100	97.4	93.4	87.5	80.5	72.7	64.4	56.6	49.8	43.7	38.2					
90	87.5	83.6	77.9	71.0	63.3	55.2	47.6	40.8	34.8	29.3					
80	77.6	73.8	68.4	61.6	54.0	46.1	38.5	31.8	25.9	20.6					
70	67.7	64.0	58.7	52.2	44.8	37.0	29.5	22.9	17.2	12.0					
60	57.8	54.3	49.1	42.7	35.5	27.9	20.5	14.0	8.3						
40	38.0	34.7	29.9	23.9	16.9	9.6	2.4	−3.9							
20		15.1	10.7	5.0	−1.7	−8.7	−15.4								
0		−4.5	−8.6	−13.9	−20.2	−27.0	−33.3								

TABLE 3. DENSITY OF LITHIUM CHLORIDE SOLUTIONS

Concentration Pound Mols (42.4 lb) LiCl per 1000 lb Water	Temperature Deg F 0	50	100	150	200	250	300
0							
2		1.045	1.037	1.026	1.012		
4	1.090	1.085	1.076	1.064	1.052		
6	1.124	1.119	1.111	1.100	1.087		
8	1.156	1.150	1.143	1.132	1.122		
10	1.188	1.181	1.172	1.162	1.152	1.142	
12	1.217	1.209	1.199	1.188	1.178	1.168	
14	1.242	1.235	1.225	1.214	1.203	1.192	
16		1.257	1.248	1.236	1.226	1.215	
18		1.279	1.270	1.259	1.248	1.237	
20			1.291	1.280	1.279	1.568	
22				1.310	1.289	1.278	1.267
24				1.317	1.307	1.296	1.286
26					1.313	1.312	1.302
28					1.338	1.327	1.318
30						1.34	1.33
32							1.35

Example 1. Determine the dew-point, wet-bulb, relative humidity and absolute humidity of air in equilibrium at 100 F with pure lithium chloride solution of density 1.270.

Solution. From Table 1 the concentration of a solution of density 1.270 at 100 F is 18.0 *M*. From Fig. 2 the dew-point of 18 *M* lithium chloride at 100 F is 43.7 F. From Table 6, Chapter 1, the partial pressure of water over the solution is 0.2858 in. of Hg, and the absolute humidity is 42.00 grains per pound dry air. From the psychrometric chart, the wet-bulb is 66.3 F, and the relative humidity is 15 per cent.

Example 2. Determine the boiling point, and freezing point of 18 *M* lithium chloride solutions.

Solution. From Table 1, boiling point (standard) is 285.8 F, freezing point is 58.1 F.

Example 3. Calculate the heat of vaporization of 1 lb of water from a large amount of 18 *M* lithium chloride solution at the boiling point.

Solution. The heat of boiling is equal to the heat of mixing plus the heat of boiling pure water at the same temperature. The heat of mixing from Table 1 at 18 *M* and 285.8 F is 145 − (0.186 × 285.8) = 92 Btu per pound. The heat of vaporization of water from steam tables at 285.8 F is 920 Btu per pound. Therefore the heat of vaporization of water from the solution is 920 + 92 = 1012 Btu per pound.

Example 4. One thousand pounds of air per minute at 100 F dry-bulb with a dew-point of 70 F and a relative humidity of 39 per cent are passed over 18 *M* lithium chloride solution. The rate of flow of the solution is 200 gpm and the entering temperature is 80 F. The air leaves the absorber at 85 F dry-bulb and dew-point of 35 F. Calculate (*a*) the heat to be removed from the lithium chloride solution to maintain these conditions, and (*b*) the temperature rise of the solution in passing through the absorber.

Solution. (*a*) The enthalpy of the entering air at 100 F dry-bulb and 39 per cent relative humidity = $h_a + \mu h_{as}$ = 24.00 + (0.39 × 47.40) = 42.49 Btu per pound (Table 6, Chapter 1).

The relative humidity of the air leaving at 85 F dry-bulb and 35 F dew-point is 16.7 per cent (psychrometric chart). Enthalpy of leaving air = 20.39 + (0.167 × 28.85) = 25.21 Btu per pound (Table 6, Chapter 1).

Heat to be extracted from air = 1000 (42.49 − 25.21) = 17,280 Btu per minute. Heat of mixing = 145 − (0.186 × 80) = 130 Btu per pound of moisture removed. From Table 6, Chapter 1, the moisture removal per pound of air = 0.01574 − 0.00426 = 0.01148 lb. Heat of mixing for 1000 lb of air = 1000 × 0.01148 × 130 = 1492 Btu. Total heat extraction = 17,280 + 1492 = 18,772 Btu per minute.

(*b*) The weight of solution circulated is 200 × 1.27 (Table 1) × 8.33 = 2116 lb per minute. Its heat capacity = 2116 × 0.631 (Table 1) = 1335 Btu per minute per degree Fahrenheit. The temperature rise = 18,772 ÷ 1335 = 14.1 F.