Instead of tabulating the vapor pressure of the solution of lithium chloride it is preferable to tabulate the dew-point of air in equilibrium with lithium chloride, since it is easy to interpolate between values of the dew-point and not so easy to interpolate accurately between values of vapor pressure. The values for dew-point may be converted to vapor

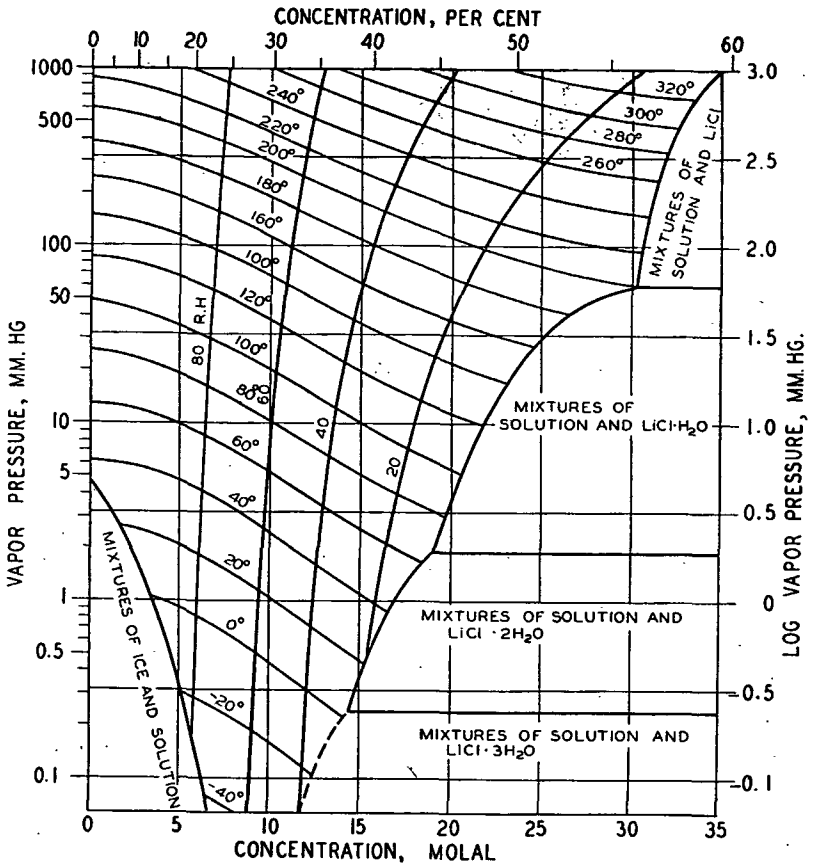

FIG. 2. TEMPERATURE—PRESSURE—CONCENTRATIONS FOR LITHIUM CHLORIDE

pressures, relative humidity, and wet-bulb of air in equilibrium by means of the usual psychrometric chart or formula.

In Tables 7, 8, 9 and 10 the unit of concentration is the *mol*. A 'M' molal solution is defined as a solution containing $M \times 42.37$ grains of anhydrous lithium chloride per 1000 grains of water. The formula connecting concentration in mols with weight in per cent is equivalent to: $[100 \times M \times 42.37] \div [1000 + (M \times 42.37)]$.

PROBLEMS IN PRACTICE

1 ● What is the heat content above −40 F of 2.5 lb of ammonia when under a pressure of 92.9 lb per square inch gage and a temperature of 160 F?

First determine the condition of the ammonia at the stated temperature and pressure. Do this by finding the absolute pressure which in this case is 92.9 lb gage plus 14.7 or 107.6 lb per square inch absolute. From Table 1 note that the saturation temperature at this pressure is 60 F. Therefore, the ammonia is superheated 100 F, and the total heat per pound can be read directly from the Table as 689.9 Btu. In the 2.5 lb of ammonia there are 2.5 × 689.9, or 1724.75 Btu.

2 ● What volume is necessary to accommodate 0.27 lb of saturated F_{12} vapor when compressed to 99.6 lb gage?

The absolute pressure is 99.6 plus 14.7 or 114.3 lb. In Table 3 find that one pound of F_{12} vapor saturated occupies 0.368 cu ft. Then the 0.27 lb would occupy 0.27 × 0.368, or 0.099 cu ft.

3 ● How much heat would be removed from air passing over a coil through which 2 lb of methyl chloride per minute is forced? The coil is under a gage pressure of 64 lb per square inch and the liquid refrigerant is completely vaporized in passing through the coil.

Find that the absolute pressure is 64 plus 14.7 or 78.7 lb per sq in. From Table 4 note that the saturation temperature at this pressure is 75 F (nearly) and that the heat content per pound of the vapor is 207.8 Btu. Also that the heat content of the liquid is 42.2 Btu per pound. Subtract 42.2 from 207.8 and 165.6 Btu per pound is the heat necessary to change the liquid refrigerant to a vapor (latent heat). As the heat to accomplish this change comes from the air around the coil, the heat removed from the air is 165.6 Btu per pound of methyl chloride evaporated in the coil. When the refrigerant is circulated at 2 lb per minute, 2 × 165.6, or 331.2 Btu per minute are removed from the air, or refrigerating effect is produced at the rate of 331.2 ÷ 200, or 1.65 tons.

4 ● Calculate 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.

From Table 8 the concentration of a solution of density 1.270 at 100 F is 18.0 *M*. From Table 7 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, the absolute humidity is 42.00 grains per pound dry air, and the wet-bulb is 65.8 F. The relative humidity is 14.0 per cent.

5 ● Calculate the boiling point, and freezing point of 18 M lithium chloride solutions.

From Table 10, boiling point (standard) is 285.8 F, freezing point is 58.1 F. The salt precipitated on cooling to this temperature has the composition $LiCl{\cdot}2H_2O$.

6 ● Calculate the heat of vaporization of 1 lb of water from a large amount of lithium chloride solution at the boiling point.

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 10 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.

7 ● 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 is 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