One observes similar behavior in the other thermodynamic functions. The heat capacity has a particularly interesting property. The thermodynamic energy is given by

$$E = \frac{3}{2} \frac{kTV}{\Lambda^3} g_{5/2}(\lambda) \tag{10–69}$$

which becomes

$$\begin{aligned} \frac{E}{N} &= \frac{3}{2} \frac{kTv}{\Lambda^3} g_{5/2}(\lambda) \qquad T > T_0 \\ &= \frac{3}{2} \frac{kTv}{\Lambda^3} g_{5/2}(1) \qquad T < T_0 \end{aligned} \tag{10–70}$$

We differentiate these with respect to T at constant N and V, we get (see Problem 10–19)

$$\begin{aligned} \frac{C_V}{Nk} &= \frac{15}{4} \frac{v}{\Lambda^3} g_{5/2}(\lambda) - \frac{9}{4} \frac{g_{3/2}(\lambda)}{g_{1/2}(\lambda)} \qquad T > T_0 \\ &= \frac{15}{4} \frac{v}{\Lambda^3} g_{5/2}(1) \qquad T < T_0 \end{aligned} \tag{10–71}$$

Again, λ must be determined numerically from Eq. (10–50), and the result of this is shown in Fig. 10–8(a), where C_V is plotted against T. There is no discontinuity in C_V at T_0, but there is a discontinuity in the slope there.

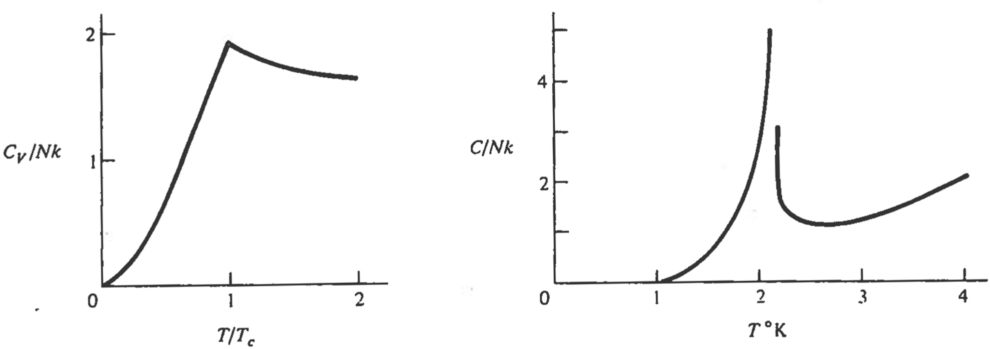

Figure 10–8. **(a) The heat capacity of an ideal Bose-Einstein gas and (b) the experimental heat capacity of liquid helium under its saturated vapor.**