Physics 301

Homework due 27 November 2024

1) (a) Stowe problem 23-4; (b) The phase-equilibrium curve for helium is such that the substance remains liquid down to absolute zero at atmospheric pressure but becomes solid at pressures greater than atmospheric. Use what you know about the Clausius-Clapeyron Equation and the Third Law to predict what the slope of the solid-liquid phase-equilibrium curve is at absolute zero.

2) Stowe problem 23-5.

3) In class we showed that the Gibbs Free Energy of a non-diffusive system in equilibrium is at a minimum. Use a similar line of reasoning to show that, for a non-diffusive equilibrated system whose volume is held fixed, the Helmholtz Free Energy is at a minimum.

4) The vapor pressure p of solid ammonia is given, in millimeters of mercury, by $\ln(p) = 23.003 - 3754/T$. The vapor pressure of liquid ammonia is given by $\ln(p) = 19.49 - 3063/T$. In both cases, T is the absolute temperature and ln is the natural log. Use this to find:

(a) what is the temperature of the triple point of ammonia?

(b) what is the latent heat of sublimation of ammonia at the triple point?

(c) what is the latent heat of vaporization of ammonia at the triple point?

(d) what is the latent heat of melting of ammonia at the triple point?

5) Stowe problem 24-9.