Chemistry 236 -- Quiz 8

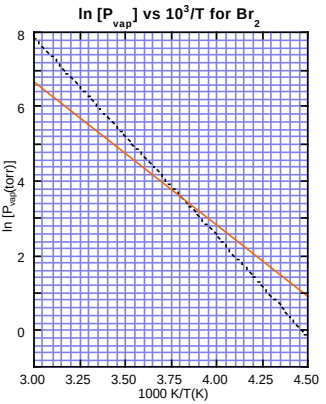
Lab Day ___

October 24 2007 — Phase Equilibria: The Triple Point

Pledge and signature:

Note: If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

1. (8) Consider the accompanying figure, for vapor equilibrium with both the solid and liquid phases of Br_2. Using this figure, determine (a) the triple point T and P; (b) the normal boiling point T; and (c) $\Delta H_{m,vap}$. You should obtain Ts within ~1%, Ps to 5%, and ΔH_m to 2%.



(a) 262 K, 35 Torr

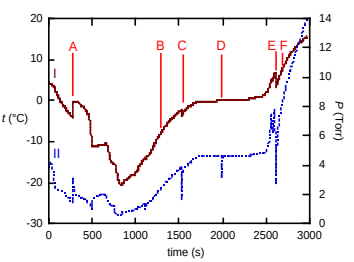
(b) P = 760 Torr T = 333 K

(c) 32 kJ/mol

2. (2) Bob and Carol record sublimation and vapor P data for a substance near its triple point and obtain ΔH_{sub} = 35.1 kJ/mol and ΔH_{vap} = 29.1 kJ/mol. Ted and Alice do the same experiment on the same substance and obtain ΔH_{sub} = 31.5 kJ/mol and ΔH_{vap} = 36.2 kJ/mol. Which of these sets of results must certainly be wrong, at least in part; and how do you know this?

ΔH_{sub} must exceed ΔH_{vap}, so Ted and Alice have a problem.

3. (4) The accompanying figure shows typical data for our TP experiment. Identify (a) the t and P curves, (b) a region where three phases are present in equilibrium, (c) a region of good sublimation vapor P data, and (d) a region of good vapor/liquid data. [Give letters for (b-d).]



(a) I — t and II — P

(b) D (c) B (d) F

4. (2) On going from the Clapeyron equation, $\frac{dP}{dT} = \frac{\Delta S}{\Delta V}$, to the integrated Clausius-Clapeyron equation (which you used in 1c above), which of the following did we employ?

a. $\Delta S = T\,\Delta H$ b. $d(1/T) = T^{-2}\,dT$ c. $\ln P^2 = -2 \ln (1/P)$ d. ΔH_m = constant

e. T_0 = triple point T f. none of these g. more than one of these