Chemistry 230
Problem Set # 12 -- Answers

1. This is a slight modification of Problem 9.41 in Levine.

   (c) $\mu^\circ_{chl,l} - \mu^\circ_{chl,v} = RT \ln (K_i/P^\circ) = -214.0$ J/mol.

   (d) $\gamma_{eth} = P_{eth}/(x_{eth} P^*_{eth}) = 1.0010$; $\gamma_{chl} = P_{chl}/(x_{chl} K_{eth}) = 1.005$. Using the Gibbs-Duhem equation, we can show that these results are physically inconsistent: In Convention II (which we are using here), if one g is > 1.0, the other must be < 1.0. See, *e.g.*, Fig. 10.4 on p. 265.

2. This is Problem 9.60 in Levine.

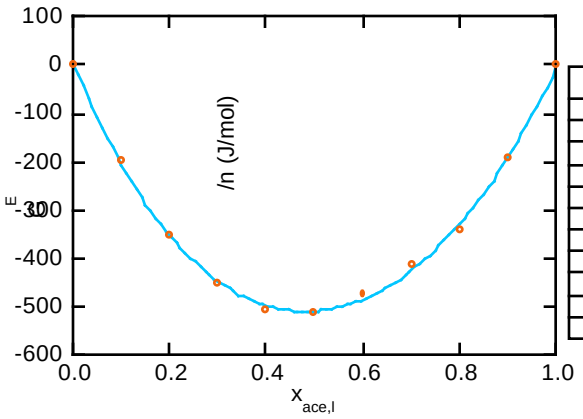
3. This is a straightforward variation on the example worked out in the text (pp. 262-266) for the same system at 35.2˚C.

   (a) (i) $\mu_i - \mu_i^* = RT \ln a_i = RT \ln (\gamma_i x_i) = RT \ln (P_i/P_i^*) = -1.121$ kJ/mol (ace); $= -4.233$ kJ/mol (chl)

   (ii) $\Delta G_{mix} = \sum n_i (\mu_i - \mu_i^*) = n \sum x_i (\mu_i - \mu_i^*) = -4.81$ kJ

   (iii) $\Delta G_{mix,id} = nRT \sum x_i \ln x_i = -3.84$ kJ

4. $G^E \equiv G - G^{id} = \Delta G_{mix} - \Delta G_{mix,id} = RT \sum n_i \ln \gamma_{I,i}$ $\quad G^E/n = RT \sum x_i \ln \gamma_{I,i}$.



$x_{ace,l}$	$\gamma_{I,ace}$	$\gamma_{I,chl}$	$\gamma_{II,chl}$	G^E/n (J/mol)
0.000	0.51800	1.0000	2.5690	0.0000
0.100	0.57426	0.98071	2.5194	-196.13
0.200	0.63897	0.94959	2.4395	-351.86
0.300	0.70358	0.91534	2.3515	-449.77
0.400	0.76667	0.87115	2.2380	-507.94
0.500	0.84297	0.81017	2.0813	-512.28
0.600	0.91088	0.74148	1.9048	-471.94
0.700	0.94113	0.68983	1.7722	-413.41
0.800	0.98162	0.57006	1.4645	-341.89
0.900	0.99869	0.49750	1.2781	-190.74
1.000	1.0000	0.38926	1.0000	0.0000