

---

## Problem Set 13

### Problem 10.44

Following are data for  $G^E$  and  $H^E$  (both in J/mol) for equimolar mixtures of the same organic liquids. Use all of the data to estimate values of  $G^E$ ,  $H^E$ , and  $TS^E$  for the equimolar mixture at 25 °C.

At T = 10 °C,  $G^E = 544.0$  and  $H^E = 932.1$

At T = 30 °C,  $G^E = 513.2$  and  $H^E = 893.4$

At T = 50 °C,  $G^E = 494.2$  and  $H^E = 845.9$

### Problem 12.3

The pressure above a mixture of ethanol and ethyl acetate at 70 °C is measured to be 86 kPa. What are the possible compositions of the liquid and vapor phases?

### Problem 12.4

The pressure above a mixture of ethanol and ethyl acetate at 70 °C is measured to be 78 kPa. What are the possible compositions of the liquid and vapor phases?

### Problem 13.1

Assuming the validity of Raoult's Law, do the following calculations for the benzene(1)/toluene(2) system:

- (a) Given  $x_1=0.33$  and  $T=100$  °C, find  $y_1$  and P.
- (b) Given  $y_1=0.33$  and  $T=100$  °C, find  $x_1$  and P.
- (c) Given  $x_1=0.33$  and  $P=120$  kPa, find  $y_1$  and T.
- (d) Given  $y_1=0.33$  and  $P=120$  kPa, find  $x_1$  and T.

Report temperature in °C and pressure in kPa.

### Problem 13.6

Of the following liquid/vapor systems, which can be approximately modeled by Raoult's Law? For those which cannot, why? Table B.1 in Appendix B may be useful.

- (a) Benzene/toluene at 1 atm.

- (b) n-Hexane/n-heptane at 25 bar.
- (c) Hydrogen/propane at 200 K.
- (d) Isooctane/n-octane at 100 °C.
- (e) Water/n-decane at 1 bar.