e) Calculate the activity coefficient of carbon dioxide in the liquid at 50% mole fraction.
f) Does this system obey Raoult's law at 290 K?

P (bar)	x_1	y_1	ϕ_1^L	ϕ_1^V	ϕ_2^L	ϕ_2^V	Z^V	Z^L
0.5	0	0.000	128.211	1.009	0.979	0.979	0.979	0.003
30.1	0.5	0.978	1.645	0.841	0.021	0.481	0.799	0.116
34.8	0.6	0.980		0.817	0.021		0.761	0.125
42.5			0.955	0.777	0.026	0.329	0.692	0.134
53.5	1	1.000	0.716	0.716	0.052	0.221	0.578	0.147

Problem 12.27: Use the UNIFAC equation to do the following calculations for the system methanol(1)-acetic acid(2):
a) Calculate the *Pxy* graph for this system at 80 °C.
b) Do you expect the volume of the system to expand or to contract upon mixing the pure components?
c) Calculate the fugacity of methanol in ~~solution~~ mixture with acetic acid at $x_{\text{MeOH}} = 0.8$, 80 °C, 0.4 bar.
d) Repeat the previous calculation at the bubble pressure of the solution instead of 0.4 bar.
e) Calculate the chemical potential of methanol in ~~solution~~ mixture with acetic acid at $x_{\text{MeOH}} = 0.8$, 80 °C, 0.4 bar. The reference state is the pure liquid at 80 °C, 0.4 bar. How is your answer affected by the fact that methanol is in the *vapor* phase at 80 °C, 0.4 bar?
f) Repeat the previous part if the reference state is the pure liquid at saturation at 80 °C.
Additional data: The saturation pressures of methanol and acetic acid at 80 °C are 1.81 and 0.2763 bar, respectively.

Problem 12.28: Use the UNIFAC equation to do the following calculations for the system methanol(1)-acetic acid(2):
a) Calculate the bubble pressure of a solution that contains 80% (by mole) methanol at 80 °C.
b) Do you expect the volume of the system to expand or to contract upon mixing the pure components?
c) Calculate the fugacity of methanol in solution with acetic acid at $x_{\text{BMeOH}} = 0.8$, 80 °C, 0.4 bar.
d) Repeat the previous calculation at the bubble pressure of the solution instead of 0.4 bar.

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