

YOUR NAME: _____

I. 50 points

A. 30 points

Using the data in the table below for the binary system Acetone (1), Cyclohexane (2) at 308.15 K, compute γ_1, γ_2 (activity coefficients), and the function G^E/RTx_1x_2 and enter the numbers directly in the data table.

P (kPa)	x_1	x_2	y_1	y_2	γ_1	γ_2	$G^E/(RTx_1x_2)$
19.625	0.000	1.000	0.000	1.000	----		----
37.877	0.098	0.902	0.482	0.518			
45.476	0.198	0.802	0.601	0.399			
49.489	0.387	0.613	0.665	0.335			
50.969	0.598	0.402	0.709	0.291			
50.196	0.895	0.105	0.841	0.159			
45.863	1.000	0.000	1.000	0.000		----	----

B. 5 points

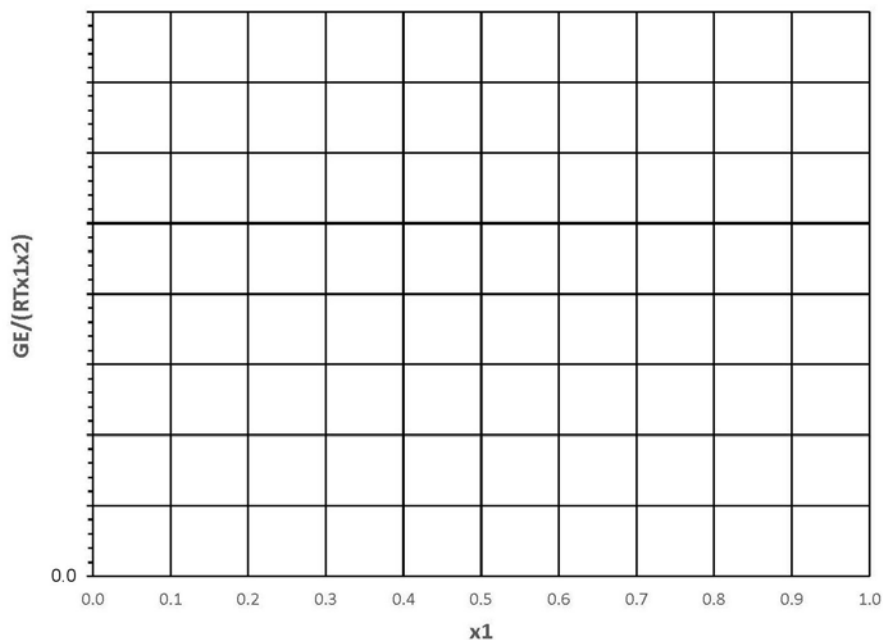
Plot the values of $G^E/(RTx_1x_2)$ on the graph below. Be sure to include the axis scale numbers for the vertical axis.

C. 15 points

Of the three below, which activity coefficient correlation do you think would model this set of data best? Check off your answer. Briefly explain why you chose the one you did.

☐ Regular Solution☐ Margules 3-suffix☐ Van Laar

Why? _____



II. 50 points

The Berthelot equation of state can be written:

$$P(v - b) = RT \quad \text{where } b \text{ is a constant which can be computed as } b = \frac{RT_c}{8P_c}$$

in terms of total moles, this equation can be written:

$$V = \frac{n_T RT}{P} + n_T b \quad \text{where } n_T \text{ is total moles, and } V \text{ is total volume (of course)}$$

Using the Berthelot equation of state, find:

A. 20 points

An expression for the fugacity coefficient of a pure gas

B. 20 points

An expression for the fugacity coefficient of component (1) in a binary gas mixture using the mixing rule:

$$b = y_1 b_1 + y_2 b_2 \quad \text{or:} \quad n_T b = n_1 b_1 + n_2 b_2$$

C. 10 points

Find the fugacity of ethane in a 30 mole% /70 mole% ethane (1)/propane(2) mixture at 40 bar and 400K using the result from part B.