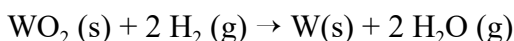


Your Name: _____

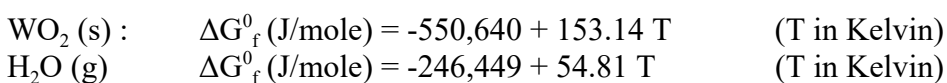
answer questions and turn back in with your solution. Attach further work as needed.

I. 30 points

It is proposed to clean the oxide layer off of tungsten wire by heating it in hydrogen gas at 1 bar of pressure at 800°K. The reaction would be:



You can use the following free energies for your calculations:



based upon the elements in their standard states at 1 bar pressure.

A) 10 points

Can this process work? ☐ **Yes** ☐ **No**

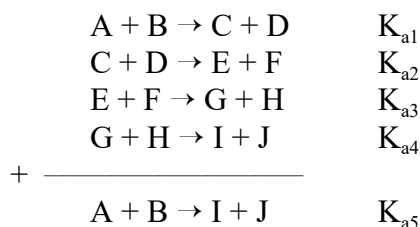
B) 20 points

What is the maximum water vapor partial pressure that can exist in the hydrogen for it to work?

_____ **bar**

II. 10 points

Suppose we have a series of reactions that add to an overall reaction:



A) 5 points

How is K_{a5} related to the other K_a 's?

_____ (write your answer here).

B) 5 points

How many independent reactions are there? _____ **Independent Reactions**

II. 30 points

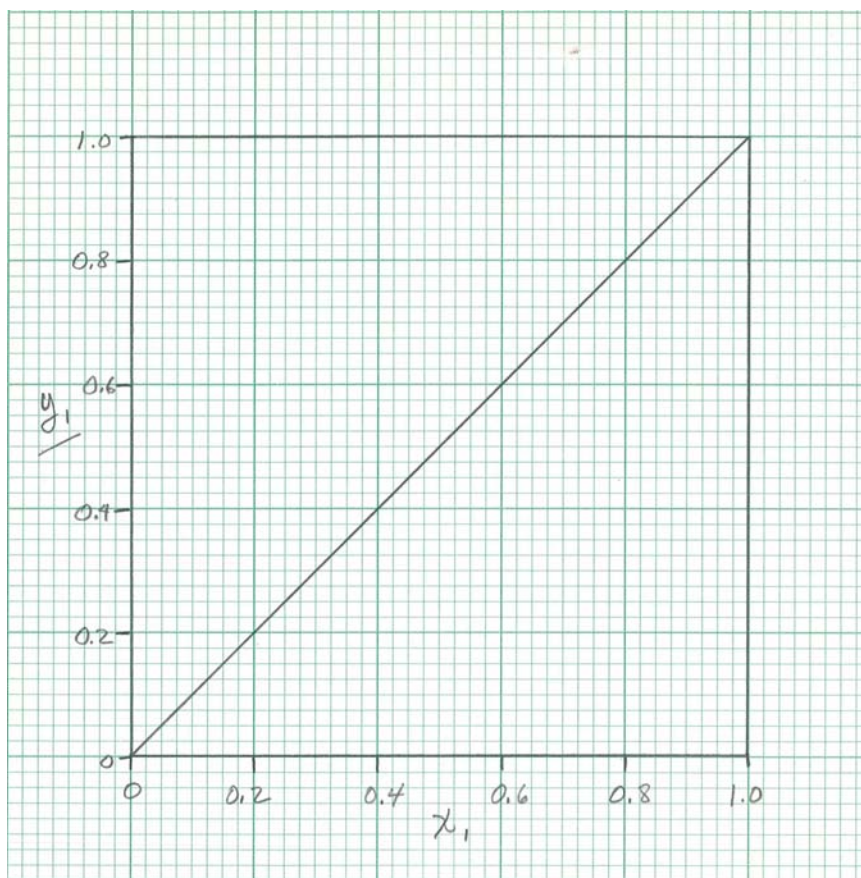
For the system n-hexane (1)/ methyl ethyl ketone (2) at 60°C, Van Laar constants are $A = 1.1347$, $B = 1.2677$ for the Van Laar equations in this form:

$$\ln(\gamma_1) = \frac{A}{\left(1 + \frac{Ax_1}{Bx_2}\right)^2} \quad \ln(\gamma_2) = \frac{B}{\left(1 + \frac{Bx_2}{Ax_1}\right)^2}$$

A)

A) 10 points

For this system, plot y_1 vs x_1 below. Provide enough data points so you can determine if there is an azeotrope.



B) 10 points

Estimate the composition of the azeotrope: _____

C) 10 points

What is the pressure of the azeotrope? _____ **kPa**

You may assume the vapor above the liquid is an ideal gas.

III. 30 points

Find the fugacity of the individual components in a chloroform (1)/dichloromethane (2) mixture at 400°C and 80 bar. The composition of the mixture is 60 mole% (1)/ 40 mole% (2). Use good practice in evaluating the fugacities, and note your assumptions. Poor assumptions will result in less than 100% credit.

$f_1 =$ _____ bar

$f_2 =$ _____ bar