- This is a simulation of a vapor-liquid equilibrium measurement apparatus, and in this lab you will use it to determine the Margules parameters of a binary mixture of two imaginary compounds. For more information on Margules equation, click the "Details" button, where there is an explanation of the Margules Equation and its relevancy to vapor-liquid equilibrium.

- On the right side of the canvas is the vapor-liquid equilibrium measurement apparatus, which consists of a boiling flask at the bottom filled with 10 milliliters of the liquid mixture, a red heater on the outside of the boiling flask, a vapor condensate collection chamber filled with glass beads, and a complete condenser to condense any vapor that did not condense in the collection chamber. Below the complete condenser is a chamber with a sampling port to collect samples of the vapor condensate to determine the vapor mole fraction. The condensate then flows down this tube back to the boiling flask, creating a closed system. The complete condenser is open to the atmosphere, which allows the pressure inside the vessel to be one atmosphere. For more information on the design of this apparatus, you can click the "About" button where there is a link to the patent for this vapor-liquid eqilibrium measurement apparatus.

- On the left side of the canvas is the information about the two components used in this experiment. The molecular weight, density, and Antoine constants are random values generated when the page loads, so each time you visit this web page you will have different values for molecular weight, density, and Antoine constants. This means that if you refresh the page, you will have to start the lab over again, so take this into account while doing this lab.

- You are given 100 milliliters of component A and 100 milliliters of component B. The amount you have remaining is displayed in blue. In the boiling flask is 10 milliliters of the mixture, and the volume of component A and B are shown here in blue. To change the volume of component A and B in the flask, adjust the slider at the top of the page labelled "volume of component A in boiling flask". Notice that if we raise the value of the slider to 7, it lowers the volume of component B to 3 milliliters to satisfy the condition of there being 10 milliliters of liquid in the boiling flask.

- When you click "collect sample", an animation will display a test tube collecting vapor condensate, then after a couple seconds, the vapor mole fraction will appear in this grey box. In order to determine the liquid mole fraction, you will need to calculate it using the volumes of A and B in the boiling flask, as well as the molecular weights and densities of components A and B. The equations necessary to calculate liquid mole fraction are available by clicking the "details" button.

- We recommend that you choose a range of liquid mole fractions between 0 and 1, and calculate the volume of component A in the boiling flask for each liquid mole fraction. For example, a liquid mole fraction of 0.2 might result in a volume of 2.5 milliliters of component A. Keep in mind that you cannot take any more measurements after you run out of liquid, so keep track of the volume of liquid required for each measurement and plan your measurements such that you use as close to 100 milliliters of both liquids as possible.

- After you have used up 100 milliliters of each liquid on measurements, you can download your measurements by pressing "download measurements" above the canvas. After some formatting, the spreadsheet will look something like this, with the molecular weights and densities of each component at the top, then the Antoine's Equation constants below that, the pressure below that, and the measurement data below that, which displays the volumes of components A and B in the boiling flask, the vapor mole fraction yA, and the temperature in celsius.

- I’ll now bring up a more complete spreadsheet where I have already determined the Margules Equation parameters. Using the measurement data, you will need to calculate the liquid mole fractions of components A and B for each measurement, the saturation pressures of components A and B for each measurement, and the activity coefficients of components A and B for each measurement. You can then use equations [3] and [4] from the details along with Excel's "solver" tool to determine the Margules Equation parameters and their 95% confidence intervals.

- Once you have determined the Margules Equation parameters and their 95% confidence intervals, you can return to the laboratory web page to submit your answers. Click the red "submit answers" button, where you will be prompted to enter the Margules Equation parameters, the 95% confidence intervals, and the names of the people in your group. Once every input box is filled, you can press "view results" to see the correct Margules Equation parameters. You can take a screenshot of this page and turn it in to your instructor along with your calculations and supplemental material such as a lab report. If your answer submission does not match up with the correct Margules Equation parameters, you can always press "reset exercise" to start the lab over again with new, randomized properties, and hopefully correct any mistakes you made the first time.

- If you are having difficulty with any part of the lab, click the "details" button to see the relevant equations, then download example spreadsheets referenced at the bottom of the details section, and watch any screencasts referenced at the bottom of the details section.

- That's all you need to know to get started on this virtual laboratory, so good luck on your assignment, and hopefully you'll learn a thing or two. That's all, goodbye.