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Similarly, the feed pump and reboiler pump were calibrated to determine the actual flow rates of a particular setting. Also, the reboiler level on labview was calibrated to an actual level. Next, a known solution was prepared in the reboiler. The temperature that the solution boiled and the temperature of the distillate were measured to determine the composition. Then, a batch distillation was conducted for a prepared solution. A model was constructed to compare the theoretical temperatures and volumes of the reboiler and distillate to those recorded experimentally. Finally, a distillation was performed based on a given set of instructions. The distillation was conducted at various feed settings. The material balances of the methanol and water were performed for each setting. Background and Theory Distillation refers to the separation of chemicals by their differences in boiling temperatures. The distillation column used in this experiment separates a mixture of methanol and water. The process of distilling could be performed in two ways, batch distillation or continuous distillation. In batch distillation a solution of methanol and water is prepared in the reboiler. As the solution is heated, the vapor formed is richer in methanol, the component with the lower boiling point. The vapor travels up the column where it is all condensed by cooling water and collected as distillate. In batch distillation, no reflux occurs. The second type of distillation is continuous distillation. In this process, a continuous flow of the solution is pumped into the column. As in batch distillation, the vapors of the heated solution travel up the column to the condenser. However in continuous distillation, some of the condensed liquid is returned to the still where it is brought into contact with the vapors. This reflux of the condensed liquid produces a purer product. A diagram of the distillation column is shown below. Figure 1 Diagram of Distillation Column Figure 1b Distillation Column Diagram For continuous distillation the molar flow rates of methanol and water along with the total molar flow rate must balance. The following equations represent the overall material balance of the column. The mole fractions xF, xD, and xB are the fractions of the lighter components. The reflux ratio, RD, relates the amount of distillate that returns to the column [3] Procedure In the first experiment, the reboiler pump was set to values of 2 0. The time required to fill a measured volume was determined to find the flow rate produced by the pump. This procedure was repeated several times, producing an average flow rate. Similarly, the feed pump was calibrated using the same procedure. The reboiler, feed, reflux, and tray temperatures were calibrated by comparing the temperatures displayed in labview to the actual temperatures. By converting mol percent to volume percent, an 18 mole percent methanol solution is produced when 2 L of water are added for every 1 L of methanol. A batch distillation was performed for this solution. The reboiler temperature was measured when the solution began to boil and the distillate temperature was measured when the first amount of distillate formed. The following week, a batch distillation was performed with the prepared solution in the reboiler. As the distillate was produced, the distillate volume was measured as a function of time. When the collection beaker reached 1 L, it filled to capacity. To continue the experiment, the heater was shut off and the beaker was drained to mL. Then heating continued and more distillate was collected. In the last experiment, a distillation was performed based on a set of instructions. The distillation was conducted with a current of 14 amps, a distillation temperature of C, a display rate of 60, and a file data rate of 1. The distillation was stopped when the distillate temperature reached C. The distillation restarted with a feed of 1 0. This run lasted 30 minutes. Midway through the distillation, it was noticed that the distillate pump failed to pump the fluid through the line. This cause of this failure was that the line was nearly vertical at the pump outlet. Thus, the pump pressure was not adequate to force the fluid upward. This was corrected by lowering the line slightly. After 30 minutes, the feed was increased to 3 0. During the experiment, it was observed that the heaters in the reboiler were not fully submerged. To solve this problem, the reboiler pump was shut off. The time was After 70 minutes into the distillation, the feed was increased to 4 0. The distillation concluded at During the course of the experiment, the labeled reboiler line remained dry. Modeling In the third

experiment a model was constructed based on the Rayleigh equation and the Van Laar model. First, the Van Laar model was used to find the x, y, and T data for the methanol water system. The following diagrams are the x vs y and x, y vs T diagrams. The spreadsheet used to calculate these values and plot the graphs is shown in Appendix A. An Excel spreadsheet was constructed to compare the model to experimental results. The van Laar model was used to calculate Temperature for each value of x. Then using the equations described above, graphs of the reboiler temperature, reboiler volume, and distillate volume were developed as a function of time. The spreadsheet used to implement the model is shown in the appendix. Results The results of the Batch distillation are shown below. Figure 4 Batch Distillation Distillate began to collect after the column ran for about 42 minutes. After that time, the reboiler and distillate temperatures began to increase at a slower rate. The drop in the distillate temperature around 68 minutes into the distillation occurred when the heater was shut off and the distillate pump was started to drain the collection beaker. The following graph shows the temperature of the reboiler as a function of time and a comparison to the model. In the graphs that follow, the time that the first distillate is formed is zero. The graphs were plotted to model the distillation up to the time the heat was shut off. The model could not accurately predict changes in the temperatures and volumes that occurred when the distillation was restarted. The graph below is a comparison of the reboiler volume to the model as a function of time. Figure 6 Reboiler Volumes Figure 7 is the distillate volume as a function of time compared to the results predicted by the model. Continuous Distillation Using the calibration graphs developed for the feed pump, each feed setting was converted to a flow rate as shown in table1 below.

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The financial records contain information for United States Glass Company factories in the states of Ohio and Pennsylvania with the latter receiving a great amount of coverage. No restrictions exist on the use of this collection and duplication is permitted for research purposes. This collections was processed and the register was completed by Frederick Honneffer in March , with revisions completed by Marilyn Levinson, Curator of Manuscripts in June, Agency History The United States Glass Company of Pittsburgh, Pennsylvania, confronted at the turn of the century by crises in the glass industry; labor unrest, foreign competition, and increasing dependency upon gas rather than coal for manufacturing purposes, began a major reorganization. On July 1, , the company merged between thirteen and eighteen fully operational glass companies located in Pennsylvania, West Virginia and Ohio. From to the early s, various glass factories within this merger either ceased operations or left, while others were added, resulting in the number of factories under the USGC merger to fluctuate between nine and twelve. For example, during the s, a Gas City, Indiana plant was added to the merger as well as a tank operation at Glassport, Pennsylvania. The Glassport Land Company was formed on October 4, , after the USGC purchased approximately acres of land along the Monongahela River, intending eventually to concentrate all of its factories at this location. The Glassport Land Company was responsible for the sale of property belonging to the USGC but not used by them for manufacturing purposes. Through the s and s, the company added decorating shops and sales offices; the latter located throughout the United States as well as Mexico, Cuba, Australia and England. USGC, however, was operating at a loss each year and finally applied for a mortgage loan from the Reconstruction Finance Corporation in July Beatty to move his glassworks from Steubenville to Tiffin. The Tiffin glassworks was noted for its complete lines of lead blown glassware, stemware, tumblers and tableware of every description. In business began to diminish and by the company went bankrupt. Two years later, in June , the glassworks became the property of the Continental Can Company and was officially named the Tiffin Glass Company. Upon becoming a division of the Interpace Corporation in January , the Franciscan Ware line was added while continuing to manufacture pressed glass, sandwich glass, white milk glass, and, of course, stemware. Williams, who was plant engineer at Tiffin, Ohio. Encompassing both commercial and artistic product records sketches, mold drawings, glass rubbings , the collection gives a balanced picture of the creative and business aspects of the company. The variety of reports included in the collection range from the typical annual reports and stockholders reports, to monthly chemical inventories, expense and production reports, income tax returns, manufacturing census reports, lists by factory of employees salaries including detailed personal statistical information in sheets for , and mold inventories. While the correspondence component of the collection is weak, consisting primarily of the affairs of the Mexico City sales office much of it in Spanish , this material provides a detailed representation of the difficulties of conducting business at the outset of World War I. Problems encountered included material shortages, shipping problems, and difficulties with inferior goods being shipped to Mexico. Wartime restrictions on manufactured goods sent to foreign countries particularly the Enemy Trading List, Bulletin 1, Oct. The Tiffin Glass Company collection contains financial records including general, distribution, production, sales, and stock ledgers dating from approximately until , balance sheets, audit reports, comparative and condensed statements, expense and productions reports, inventories, and corporate income tax returns. This variety of records details the amount and type of glassware produced at specific factories, manpower required, and quantity of glassware sold. The factory appraisal schedules give detailed listings of the values of physical plants and their contents such as land, steam, sewage, gas and water lines, factory and storage buildings, warehouses, stables, tools, molds, furnishings, recapitulations and depreciations. The products of the Tiffin Glass Company are represented in the form of glassware rubbing notebooks and tissue rubbing sheets representing over patterns , penciled glassware sketches, blueprints of glassware and technical drawings with specific measurements, glassware promotional sketches and drawings, cutting and etching designs, glass manufacturing machinery drawings and blueprints including plans for a plate etching

machine, a spinning machine, cutting machine, a machine press, a stemware fluting machine and a stempress , design drawings and blueprints of various pieces of glassware with dimensions in preparation of designing molds, and technical drawings and blueprints of glassware molds. The collection also includes a small number of photographs which show the step-by-step production of Tiffin stemware. Encompassing approximately 80 linear feet of material with over volumes and spanning over 70 years of the history of the Tiffin Glass Company and the United States Glass Company, this collection is particularly strong in the financial view of the company in the first third of the 20th Century, with detailed ledgers from through Financial records from the late period of the Company are noticeably absent.

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