VLAB (Virtual Lab)

LAB MANUAL

STUDENT'S COPY

Department of Chemistry, BITS Pilani, Pilani Campus

PREFACE

This manual is designed primarily to serve as an instructional book for students, technical staff and instructors to assist in performing and understanding the experiments through VLAB (Virtual Lab) in Chemistry. Even in an online mode of study, it is important that the students do experiments in the VLAB to understand the theories they have studied in the lectures and in their textbook. An attempt has been made to identify concepts that are of particular interest or challenge to students and can be better understood through laboratory work. This will help students to learn about chemistry, using virtual laboratory equipment and data interpretation and presentation. The manual contains four experiments.

In conclusion, we view this manual as one of continual modification and improvement. We encourage discussing ideas for improvements and suggestions for new experiments. For any new specific experiment, HOD or instructor may be contacted. This manual is the culmination of efforts of the faculty members and students of Department of Chemistry, BITS Pilani, Pilani Campus.

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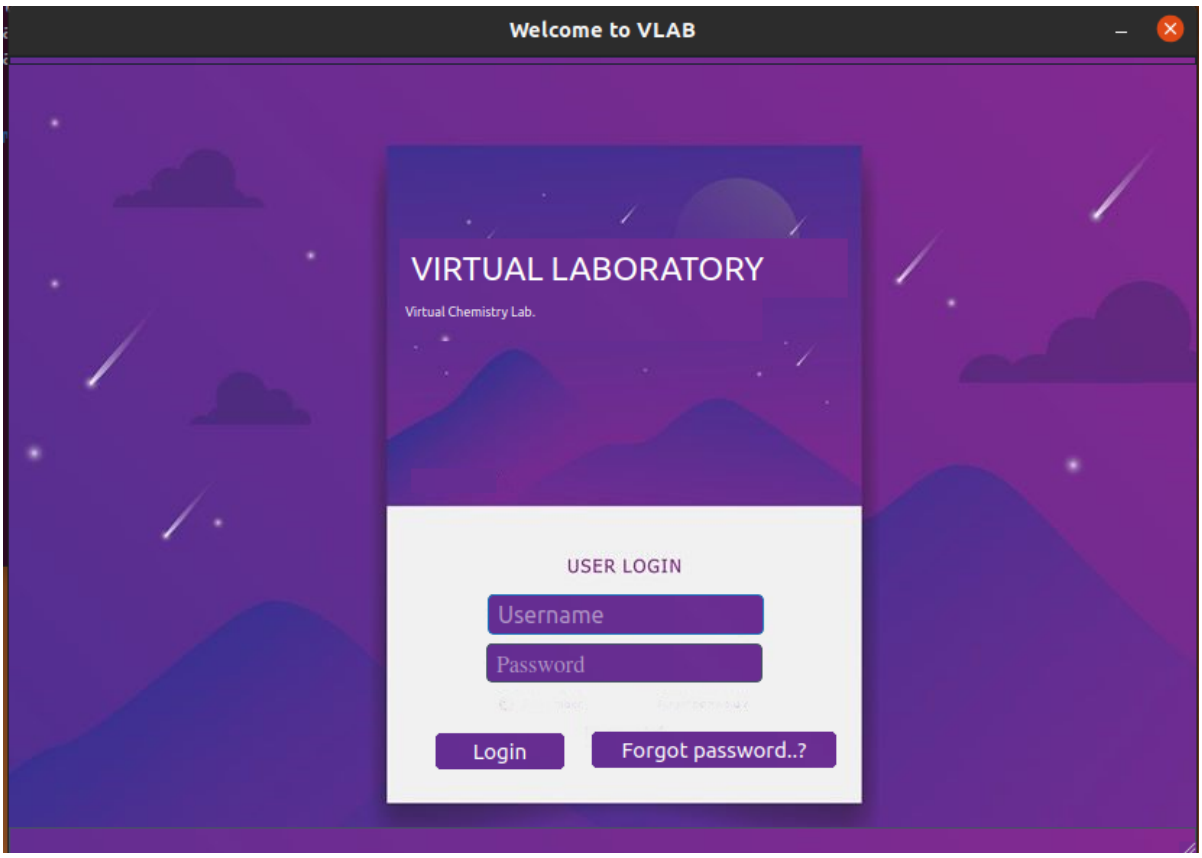
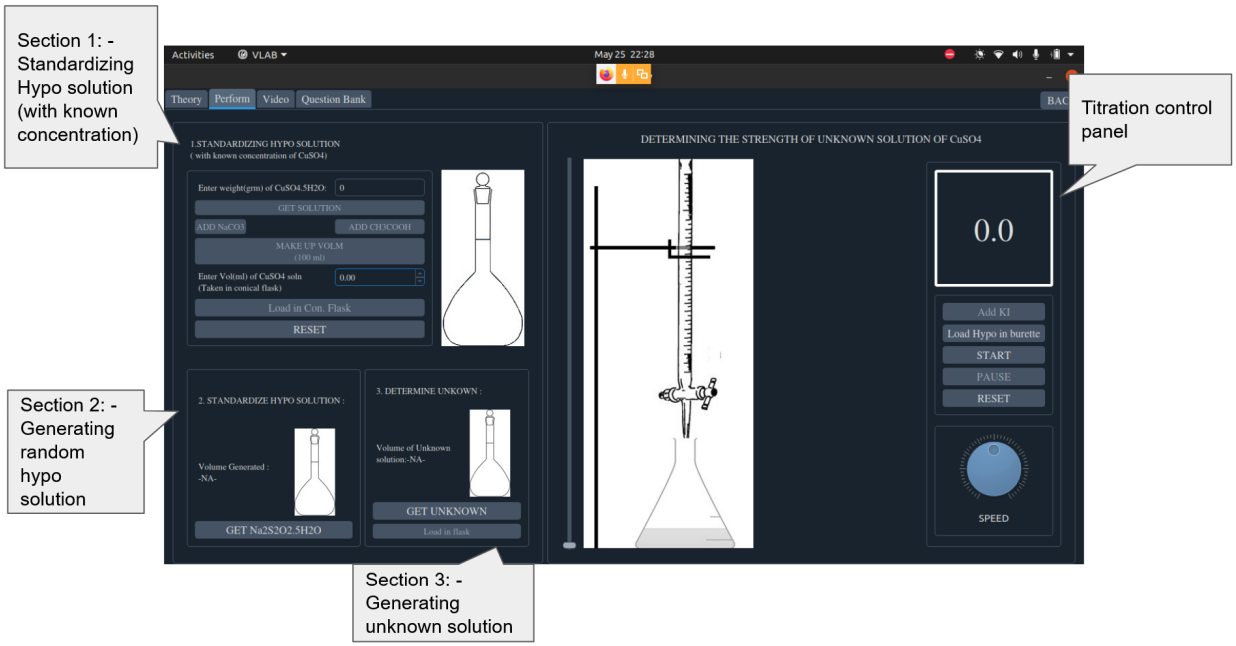
Login instructions

Log in using your username (BITS ID) and password. If you do not remember the password, click on the “Forget Password” button.

NOTE: - Perform the experiments and the submissions in one session only. Do not close the application in between, otherwise all the system generated data will be lost and you will have to perform your experiment again.



Experiment-1: - Estimation of Copper by Iodometry



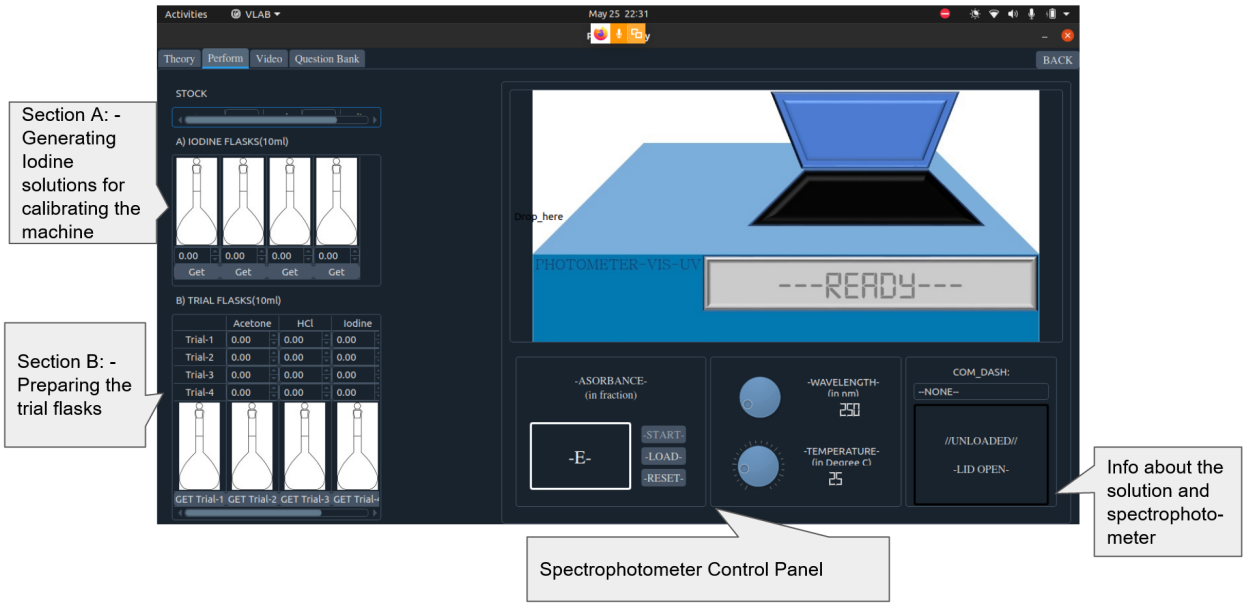
Steps: -

1. Select the “Perform” tab on the upper left corner.
2. Inside the Section 1 “Standardizing HYPO solution” section, insert the weight of $CuSO_4.5H_2O$ in grams. Then click on “Get solution” or press enter.
3. Click on Add $NaCO_3$ and Add CH_3COOH. Then click on “Makeup VOLM”. This will make the volume up to 100 ml.
4. Enter volume of CuSO4 in ml. Click on “Load in Con. Flask” to load the volume of CuSO4 solution mentioned in the tab to the conical flask for titration.
5. To generate the solution to be kept in the burette, press “GET $Na_2S_2O_2.5H_2O$” in section 2 which generates a random hypo solution.
6. Press “Load Hypo in burette” in the Titration control panel. Click on “Add KI” to add the indicator. If you forget to add the indicator, it will not start.
7. Press “Start” to start the titration. You can adjust the speed by adjusting the knob available at the lower right corner.
8. Click on “Pause” immediately when the colour of the solution changes. Note the reading displayed on the upper right panel. The reading gives the volume (in ml) of solution that has been titrated against the solution in the flask.

Determining strength of unknown solution

9. Click on “Get Unknown” in the 3rd section to get a solution with random strength and random volume. Note down the volume that appears in the 3rd tab. Click on “Load in Flask” to load the solution into the conical flask.
10. Repeat the process of titration as mentioned above. Note down the volume (in ml) of solution that has been titrated against the solution in the flask.
11. Click on “Back” on the upper left corner. Click on the “Exp 1” tab in the lower left section. Fill up the readings that you have noted and calculated and then click on the “Submit” button to submit it to the instructors for evaluation. You should receive a message prompt after submission.

Experiment-2: - Kinetics of Iodination of Acetone



Steps: -

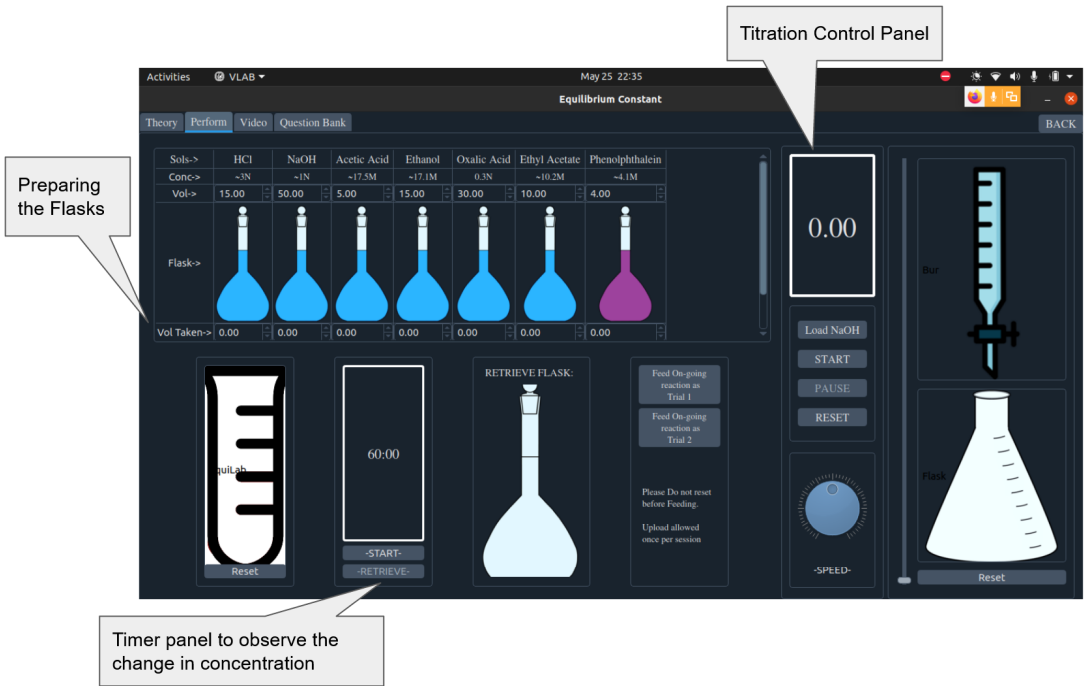
1. Select the “Perform” tab on the upper left corner.
2. On the upper left tab, fill up the values of strength (N - Normality) of the stock solutions (Acetone, HCl and Iodine).
3. Next step is to calibrate the machine. For that we will generate the Iodine solutions. Inside section A, enter the amount of volume (ml) of stock solution that you will take up in the 10 ml flask. Click on the Get button, to fill the remaining amount with water.
4. Drag and drop the flasks into the spectrophotometer on the right side. The solution that you have kept in the machine can be seen in the lower right tab as well. Click on the “Load” button in the Spectrophotometer Control Panel to load the solution into the machine. Set the wavelength (in nm) using the knob, that is appropriate for the calibration with iodine solution.
5. Click on the “Start” button to start the absorbance. The absorbance value is shown in the box at the lower middle part of the application. Click on “Unload” to unload the solution.
6. Now repeat the same process for all the flasks which we had prepared for calibration.
7. Now in the trial flasks inside Section B, insert the volume (in ml) of stock solutions of Acetone, HCl and Iodine to be used inside the flask. Click on “Get Trial” to fill the remaining amount with water.

8. Repeat the process of dragging and dropping flasks and operating the machine and note down the absorbance value as mentioned in the above steps.

   Note: - As soon as you click on "Get Trial" the reaction starts, and it is the responsibility of the user to note down the decreasing value of absorbance with time.)

9. Upload your hand-drawn plots and hand-written data points in Google Drive.
10. Click on "Back" on the upper left corner. Click on the "Exp 2" tab in the lower left section. Fill up the readings that you have noted and calculated and then click on the "Submit" button to submit it to the instructors for evaluation. You should receive a message prompt after submission.

Experiment-3: - Determination of Concentration Equilibrium Constant (K_c)



Steps: -

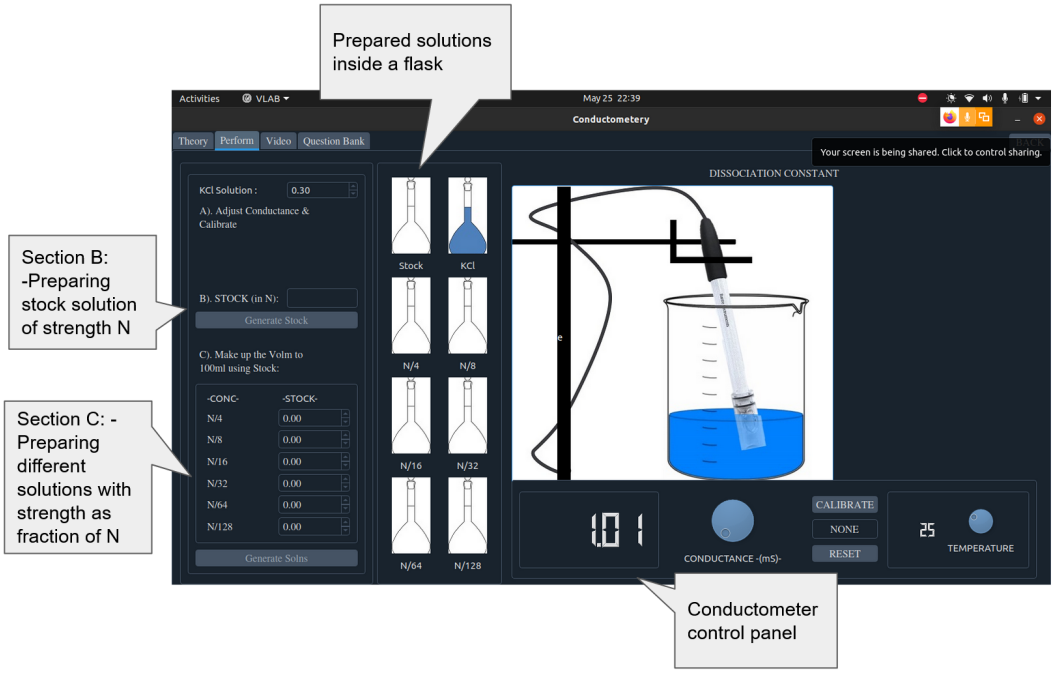
1. Select the “Perform” tab on the upper left corner.
2. In the upper left section, set the “Vol Taken” (in ml) for each of the solutions and then drag and drop the flasks to the test tube on the lower left side. Refer to the theory to know which solutions to be included to make the equilibrium test tube.
3. After preparing the test tube with an equilibrium solution, click on the “Start” button beside the test tube inside the Timer Panel. If you do not receive any error, the timer starts immediately.
4. There is an option button to feed the ongoing reaction as trails. This will save the ongoing reaction as trial-1 submitted by the user. Similarly trial-2 can be fed and saved by the user by clicking on the corresponding button. The user needs to perform at least two trials and feed the same.

5. Once the timer reaches zero (or even in between the timer), the solution mixture with composition at that time is retrieved into the retrieve flask by clicking on “Retrieve” in the Timer panel. This flask will ideally contain a mixture of HCL and acetic acid. This can be then further analyzed by dragging and dropping the flask to the flask in the titration area.
6. To start the titration, drag and drop the NaOH flask into the burette to load NaOH inside the burette. Add the indicator (Phenolphthalein) into the conical flask. Click on “Start”. When the color inside the flask changes, pause the process and note down the Volume(in ml) used.

   Note: - If the solution inside your burette finishes before reaching the titration point, and you want to refill your burette with NaOH, you can either press on “Load NaOH” on the Titration Control Panel” or you can drag and drop the NaOH flask.

7. The given solution concentrations of HCL, NaOH, Acetic acid are not standardized. The user can use the titration section on the right to find their exact concentrations. To drag and drop a flask, first fill the volume taken (last row in the upper left section) below the flask with the amount of volume you want to take and then drag and drop it in the burette or the titration flask. Titration can be done as mentioned in step 6.
8. The user may take one acid in the flask or combination of more for titration.
9. Click on “Back” on the upper left corner. Click on the “Exp 3” tab in the lower left section. Fill up the readings that you have noted and calculated and then click on the “Submit” button to submit it to the instructors for evaluation. You should receive a message prompt after submission.

Experiment-4: - Dissociation Constant of a weak electrolyte by Conductometry



Steps: -

1. Select the “Perform” tab on the upper left corner.
2. You have some random KCl solution with random conductance in the flask shown in the middle section. Drag and Drop the KCl flask to the conductometer. Using the knob on the COnductometer Control panel, calibrate the conductance value to 12.88. Click on “Calibrate” to calibrate the conductometer.
3. Now in section B on the left side of the screen, insert the strength (in N – Normal) of acetic acid stock solution. Click on the “Generate Stock” to generate the stock solution.

4. In section C, the left side of the table represents the strength of the stock solution we need in fraction of the strength of the original stock solution. On the right side, enter the volume of stock solution (already prepared) you will take, and fill the remaining with water to meet the required strength of solution. Click on “Generate solutions” to generate all the solutions.
5. Now drag and drop each solution to the conductometer and note the conductance values against the concentration values.
6. Upload the hand-drawn plot of the conductance vs concentration on Google Drive.
7. Click on “Back” on the upper left corner. Click on the “Exp 2” tab in the lower left section. Fill up the readings that you have noted and calculated and then click on the “Submit” button to submit it to the instructors for evaluation. You should receive a message prompt after submission.