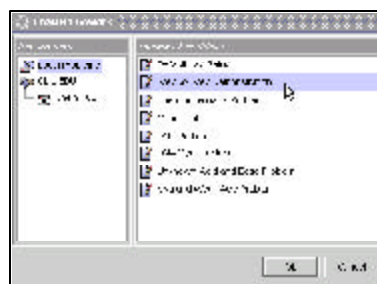
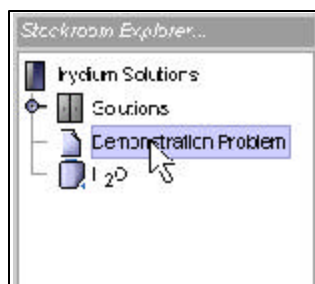


Virtual Lab Step-by-Step Demonstration

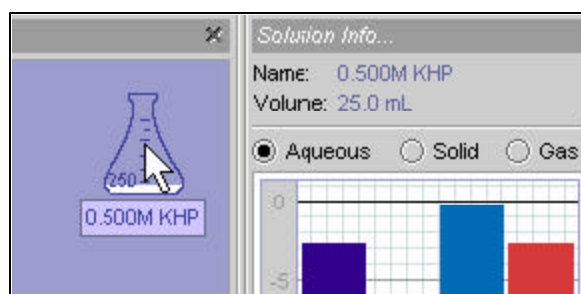
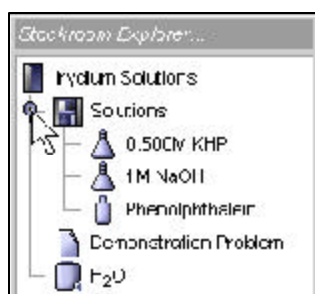
The purpose of this example is to illustrate concretely how to use the main features of the Virtual Lab in the context of a familiar type of problem: titration. In this problem, you will accurately determine the concentration of a solution of sodium hydroxide (NaOH) using a 0.500M potassium hydrogen phthalate (KHP) standard solution. Acid-base indicator phenolphthalein is added in its (colorless) acidic form to a precise volume sample of KHP. The base NaOH is slowly added to the sample of KHP. Once all the KHP has reacted with the base, the first excess drop of NaOH will cause the indicator to convert to its basic (pink) form. The exact concentration of the NaOH solution can then be calculated. To begin:

1. Open the Virtual Lab from the CD or in a web browser:
<http://ir.chem.cmu.edu/irProject/applets/virtuallab/>

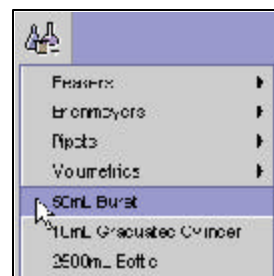
Under the lab's *File* menu, select *Load Homework*. In the *Local Problems* homework repository, select the sample problem and click OK. Double click on the problem description in the *Stockroom Explorer* window to open it in the lab.



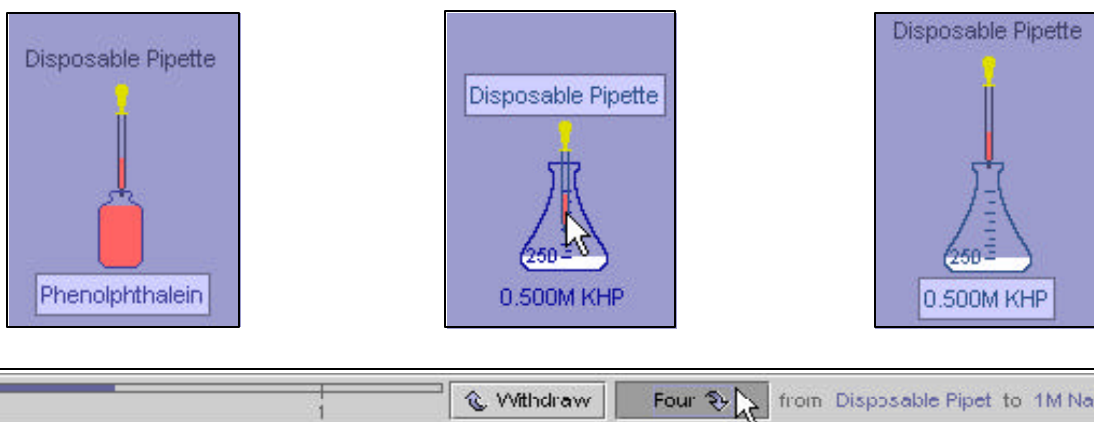
2. Retrieve the KHP, 1M NaOH solution, and the phenolphthalein from the stockroom. Double click on the *Solutions* cabinet to display the list of solutions. Double click on each solution to place it on the workbench. Note the volume of KHP, which can be found in the *Solution Info* window.



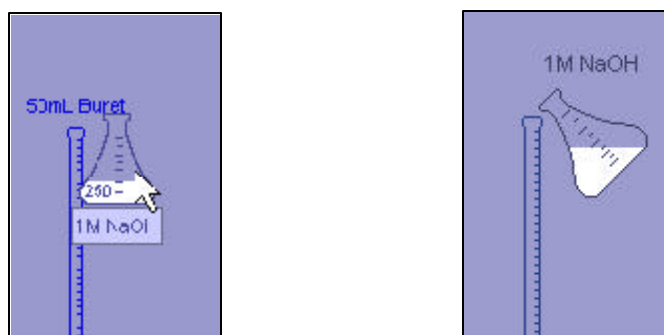
3. Retrieve a disposable pipette and a 50 mL buret. Click on the glassware button on the action bar to the left of the workbench. Click on the necessary glassware that appears on the drop-down menu.



4. Use a disposable pipette to add a small amount (~0.3 mL) of indicator to the KHP solution. Drag the pipette onto the indicator solution so the pieces of glassware overlap. When the pipette is above the indicator solution, briefly click the *Withdraw* button on the transfer bar. Then drag the pipette onto the KHP solution briefly click the *Pour* button on the transfer bar.



5. Fill the buret with NaOH solution. Drag the flask of NaOH onto the buret until the pieces of glassware overlap. When the flask is tilted above the buret, click and hold down the *Pour* button in the transfer bar. When you release the mouse button, the *Solution Info* window will allow you to infer how much has been transferred.



6. Titrate small volumes (~ 0.5 mL or less) of NaOH from the buret into the KHP until a slight color change occurs. Note the volume of NaOH used, which can be found in the *Solution Info* window.



You can check this by using Precise Transfer Mode instead of Realistic. Under the Tools menu, select Precise Transfer, and instead of clicking and holding the *Pour* button, type in 13.26 mL and click the *Pour* button once. The equivalence point occurs at 13.26 mL, and the concentration of NaOH is 0.9445 M. You should see a very light pink end point.

