tester light for each solution. After testing, rinse the tester probes with distilled water. Remove any excess moisture with a paper towel.

4. Place 18 drops of distilled water in each of six wells in your 24-well plate. Add 2 drops of 1.0 M HCl to the first well to make a total of 20 drops of solution. Mix the contents of this well thoroughly by picking the contents up in a pipet and returning them to the well.

5. Repeat this procedure by taking 2 drops of the previous dilution and placing it in the next well containing 18 drops of water. Return any unused solution in the pipet to the well from which it was taken. Mix the new solution with a new pipet. (You now have 1.0 M HCl in the well from Procedure step 2, 0.10 M HCl in the first dilution well, and 0.010 M HCl in the second dilution.)

6. Continue diluting in this manner until you have six successive dilutions. The $[H_3O^+]$ should now range from 1.0 M to 1.0×10^{-6} M. Write the concentrations in the first column of your data table.

7. Using the conductivity tester, test the cells containing HCl in order from most concentrated to least concentrated. Note the brightness of the tester bulb, and compare it with the brightness of the bulb when it was placed in the acetic acid solution. (Retest the acetic acid well any time for comparison.) After each test, rinse the tester probes with distilled water, and use a paper towel to remove any excess moisture. When the brightness produced by one of the HCl solutions is about the same as that produced by the acetic acid, you can infer that the two solutions have about the same hydronium ion concentration and that the pH of the HCl solution is equal to the pH of the acetic acid. If the glow from the bulb is too faint to see, turn off the lights or build a light shield around your conductivity tester bulb.

8. Record the results of your observations by noting which HCl concentration causes the intensity of the bulb to most closely match that of the bulb when it is in acetic acid. (Hint: If the conductivity of no single HCl concentration matches that of the acetic acid, then estimate the value between the two concentrations that match the best.)

CLEANUP AND DISPOSAL

9. Clean your lab station. Clean all equipment, and return it to its proper place. Dispose of chemicals and solutions in containers designated by your teacher. Do not pour any chemicals down the drain or throw anything in the trash unless your teacher directs you to do so. Wash your hands thoroughly after all work is finished and before you leave the lab.

ANALYSIS AND INTERPRETATION

1. **Resolving Discrepancies:** How did the conductivity of the 1.0 M HCl solution compare with that of the 1.0 M CH_3COOH solution? Why do you think this was so?

2. **Organizing Data:** What is the H_3O^+ concentration of the HCl solution that most closely matched the conductivity of the acetic acid?

3. **Drawing Conclusions:** What was the H_3O^+ concentration of the 1.0 M CH_3COOH solution? Why?

CONCLUSIONS

1. **Applying Models:** The acid ionization expression for CH_3COOH is the following:

$$K_a = \frac{[H_3O^+][CH_3COO^-]}{[CH_3COOH]}$$

Use your answer to Analysis and Interpretation item 3 to calculate K_a for the acetic acid solution.

2. **Applying Models:** Explain how it is possible for solutions of HCl and CH_3COOH to show the same conductivity but have different concentrations.

EXTENSIONS

1. **Evaluating Methods:** Compare the K_a value that you calculated with the value found on page 606 of your text. Calculate the percent error for this experiment.

2. **Predicting Outcomes:** Lactic acid ($HOOCCHOHCH_3$) has a K_a of 1.4×10^{-4}. Predict whether a solution of lactic acid would cause the conductivity tester to glow brighter or dimmer than a solution of acetic acid with the same concentration. How noticeable would the difference be?