pH and Concentration Name

Intro

Today you will be exploring the relationship between concentration and pH. pH is a measure of a solution's acidity. The range of pH is from 0 to 14, with a pH of 7.0 determining neutrality.

Procedure

First we will make a set of solutions of various hydrogen ion concentration. We will be using hydrochloric acid. The process described below is called serial dilution.

Serial Dilutions:

1) Set up a test tube rack with 5 clean and dry test tubes. Also fill a medium sized beaker with distilled water for pippette rinsing.
2) Place 10.0 ml of 1.0 M HCl in one test tube.
3) Then, with a pippette measure out 1.0 ml from the first test tube into your graduated cylinder, dilute this to 10.0 ml with distilled water, and place the new 10.0 ml solution in the next test tube. Rinse out your pippette, squeezing it several times to remove as much water as possible. Then use it to stir the new solution.
4) Rinse the graduated cylinder and remove as much water as possible without towel drying.
5) Repeat the above process with the solution you just made: take 1.0 ml of the new solution, dilute it to 10.0 ml and place the new 10.0 ml solution in the next test tube. Rinse pippette and stir. Rinse the graduated cylinder and shake dry.
6) Repeat until all test tubes are filled with more and more dilute solutions.

pH Testing:

1) Remove the pH probe from its storage bottle by just pulling it out, and place the bottle somewhere where it won't be knocked over.
2) Put the probe in the most dilute solution (least concentrated) first and, after about a minute, record the pH.
3) Remove the pH probe and shake off any extra water. Then place the probe in the next most dilute solution and wait about a minute before recording the pH. Gently moving the pH probe up and down will help to speed up the equilibration process.
4) Repeat until you have measured all of the solutions.
5) Immediately rinse the pH probe in distilled water and place it back into its storage bottle.

Questions:

1) The following is a balanced equation for how each acid will ionize when dissolved:

$HCl_{(g)}$ -----> $H^+_{(aq)}$ + $Cl^-_{(aq)}$

$H_3PO_{4(l)}$ ------> 3 $H^+_{(aq)}$ + $PO_4^{-3}{}_{(aq)}$

If you dissolve one mole of HCl how many moles of H^+ ions will you get?

If you dissolve one mole of H_3PO_4 how many moles of H^+ ions will you get?

If the concentration of an HCl solution is 1.0 M, what would be the concentration of H^+ ions?

If the concentration of an H_3PO_4 solution is 1.0 M, what would be the concentration of H^+ ions?

2) Fill in the table below: $[H^+]$ = hydrogen ion concentration (M). (round the pH value to one significant digit)

Test Tube	Acid Conc. (M)	[H+]	pH
1			
2			
3			
4			
5			

3) What is the relationship between hydrogen ion concentration and pH? (You might try writing the $[H^+]$ in scientific notation)

4) How many times more concentrated is a solution that is one pH value lower than another? What about two pH values lower?

5) For question 3, does it matter whether the pH difference is from 4 to 3 or from 2 to 1?