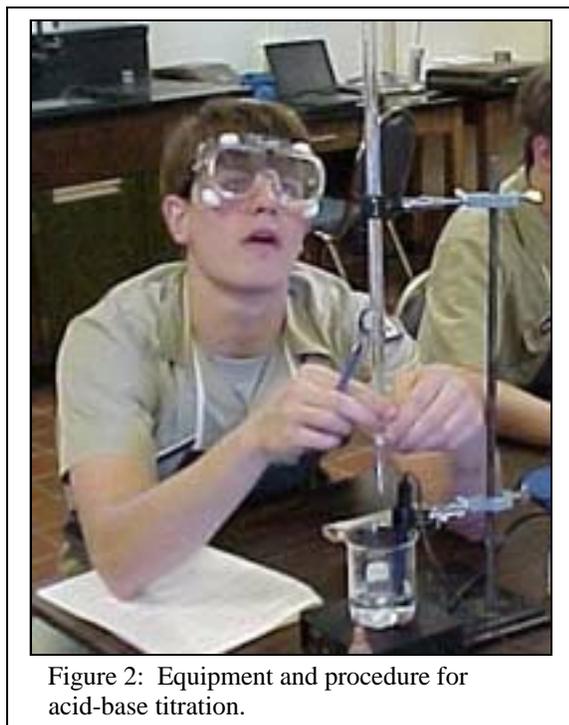
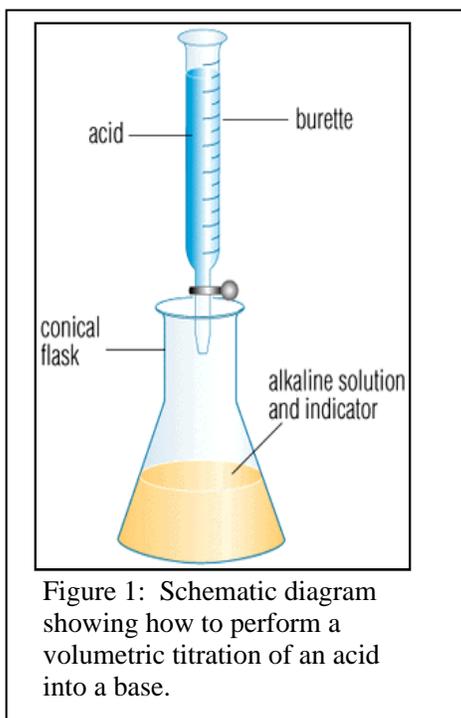




## ICE - Inverse functions



***If you have taken an introductory chemistry class, you will have performed a titration (see Figure 1<sup>1</sup>), although perhaps not with the awestruck expression of the individual featured in Figure 2<sup>2</sup>.***

***An electronic pH meter may be used to measure the acidity of the solution as you perform the titration. You can then plot a graph showing the pH as a function of amount of solution added using the burette. Figure 3<sup>3</sup> shows such a graph. This kind of graph is often called a "titration curve" in chemistry.***

***In this ICE you will examine the results of performing a titration. In the particular titration that you will examine, the acid (hydrochloric acid, HCl) is in the conical flask and the base (sodium hydroxide, NaOH) is dispensed from the burette.***

<sup>1</sup> Image source: <http://ebooks.whsmithonline.uk.co/>

<sup>2</sup> Image source: <http://www.jesuitnola.org/>

<sup>3</sup> Image source: <http://www.chem.vt.edu/>

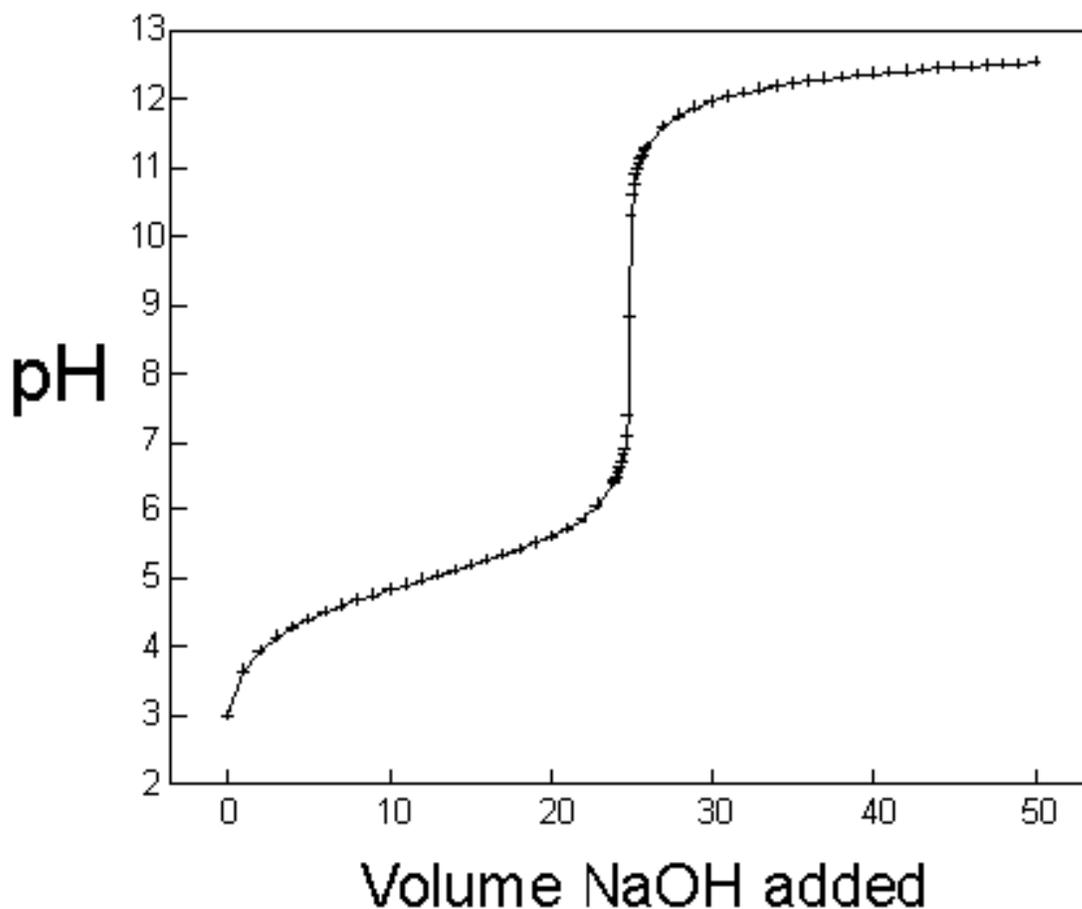


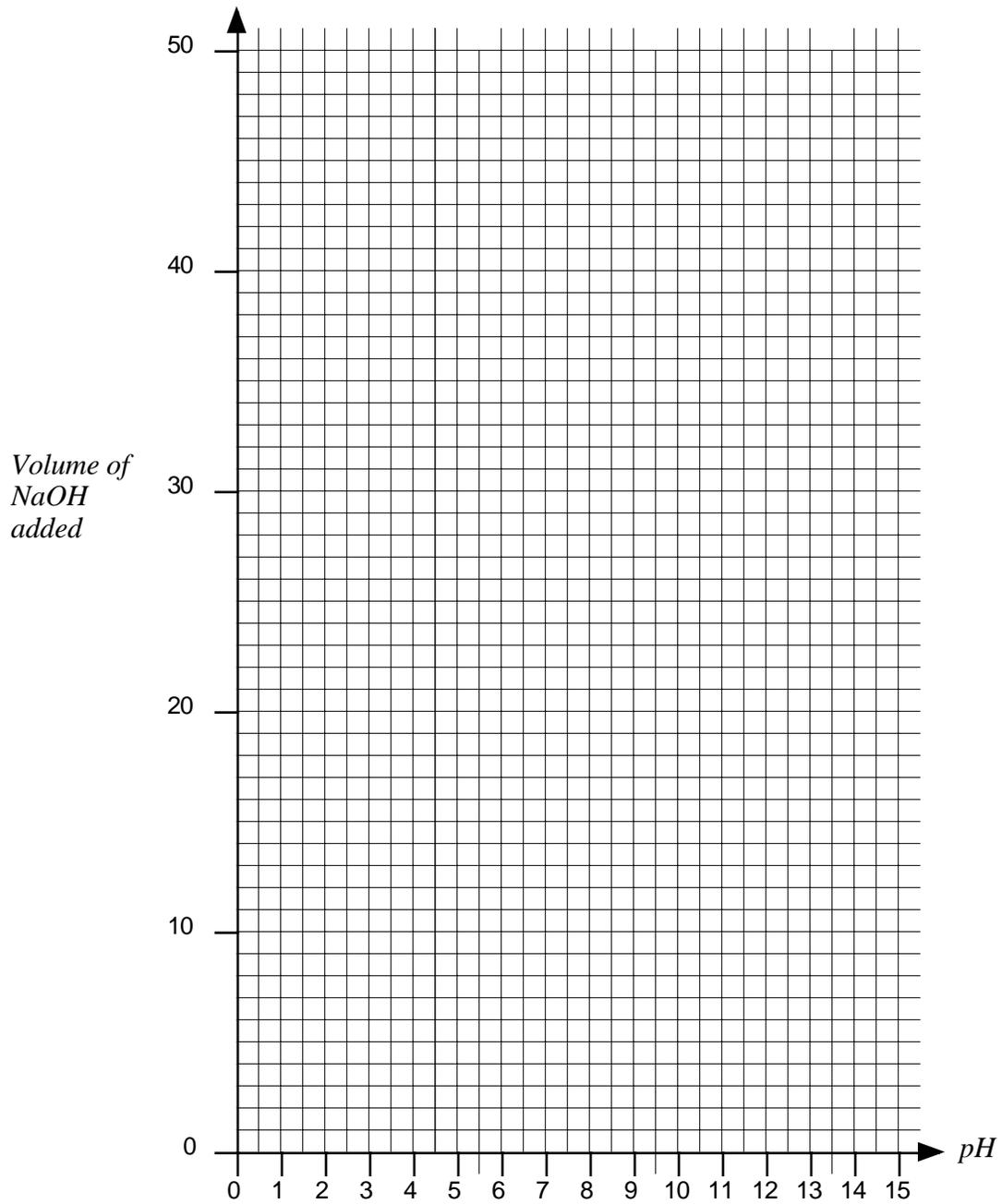
Figure 3: Titration curve for a titration in which the conical flask contained hydrochloric acid and the burette contained sodium hydroxide.

- Use the graph shown in Figure 3 to complete the tables given below.

Volume of NaOH	0	2	10	22	25
pH					

pH	3	4	5	6	7
Volume of NaOH					

- Use the axes provided to plot a graph that has the pH on the horizontal axis and the volume of NaOH added on the vertical axis.



- How does the shape of the graph that you have just drawn related to the shape of the graph shown in Figure 3?

***One of the truly classic undergraduate chemistry labs is the determination of the quantity of alcohol (ethanol) in wine via a titration.***

***The first step in the lab is to make up a solution of ethanol ( $C_2H_5OH$ ) with a known concentration in order to calibrate your equipment and reagents. The instructions in a typical lab manual is as follows:***

Pour precisely one (1) liter of distilled water into a flask. Add the required amount of 100%  $C_2H_5OH$  to the flask. Cap the flask and shake vigorously.

***• Let 'C' represent the concentration of the ethanol solution and 'V' the volume of ethanol added. What is the relationship between 'C' and 'V'?***

***• During this lab, one of the questions that students raise is:***

“Isn't this the wrong way around? I mean, wouldn't you know what concentration you wanted and have to figure out how much ethanol to add?”

***In mathematical terms, what is being described?***

***• Is this idea feasible? What would the relationship between 'V' and 'C' be?***