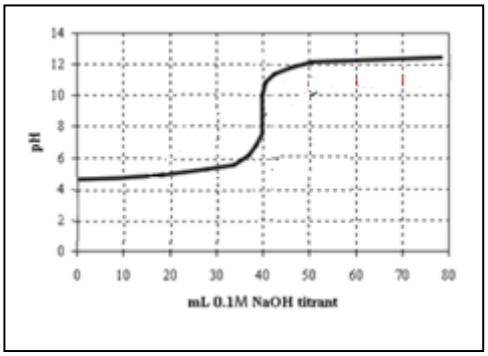
Lesson 3b – dilution before titration and indicators.

A monoprotic acid solution, whose concentration is unknown, is titrated with a 0.100 M NaOH solution. The Ph curve for this titration is shown on the right.
A 20.00 mL aliquot is taken from the original bottle of this monoprotic acid and placed in a 200 mL volumetric flask and made to the mark using distilled water.
A 25.00 mL was transferred from the volumetric flask to a 100mL conical flask and titrated to the end point. An average titre of 40.00 mL was obtained



a) Write the balanced overall equation for the reaction taking place in the conical flask between the weak monoprotic(HA) acid and the NaOH.
$HA(aq) + NaOH(aq) \rightarrow NaA(aq) + H_2O(l)$

b) Find the mol of the NaOH in the average titre

=> mol of NaOH = C X V = 0.100 mol/L X 0.0400 L = 4.00×10^{-3} mol

c) Find the mol of the monoprotic acid in the conical flask.

Mol of HA = mol of NaOH = 4.00×10^{-3} mol

d) Find the mol of the monoprotic acid in the volumetric flask.

$(200/25.00) \times 4.00 \times 10^{-3}$ mol = 3.20×10^{-2} mol

e) Find the concentration in mol/L in the original undiluted sample of the monoprotic acid
Since all the mol of acid in the volumetric flask came from 20.00 mL of the original acid solution then the concetration of acid in the original solution is
=> 3.20×10^{-2} mol / 0.0200 L = 1.6 M

f) Is the monportic acid a weak or strong acid? Explain.

Judging by the shape of the pH curve and the starting pH of around 4.4 it is a weak acid

Name of indicator	pH range
methyl orange	3.1-4.4
methyl red	4.4-6.2
bromothymol blue	6.0-7.6
phenolphthalein	8.3-10.0

g) What is an ideal indicator to use in this titration? Justify your reasoning. *Since the end point and equivalence point lie on the vertical part of the curve the most likely indicator that will change colour as close to the equivalence point as possible is phenophthalein.*

h) The chemist decided to use methyl red as the indicator. How does this choice of indicator impact the average titre? *The indicator will change colour almost immediately the titration starts and will ultimately result in a very low average titre.*

Unpack the information by drawing a flow diagram.

20.00mL original sample

200mL volumetric flask

25.00mL aliquot is taken

An average titre of 40.00 mL of a 0.100 M NaOH.

Concentration of acid in original sample
= 3.2 X 10^{-2} mol / 0.0200 = 1.6M

Mol of HA in the 200 mL volumetric flask
= (200 /25) X 4.00 X 10^{-3} mol
= 3.2 X 10^{-2} mol

Mol of HA in the 25 mL aliquot
= 4.00 X 10^{-3} mol

Mol of NaOH 4.00 X 10^{-3} mol