13. During a titration, a 25.00 mL sample of 0.40 M NaOH requires 20.00 mL of $H_2C_2O_4$ solution to reach the equivalence point. What is the concentration of the acid?

25.00 mL
0.40 M NaOH

B A
$NaOH + H_2C_2O_4 \rightleftharpoons NaHC_2O_4 + H_2O$

(assuming monoprotic rxn)

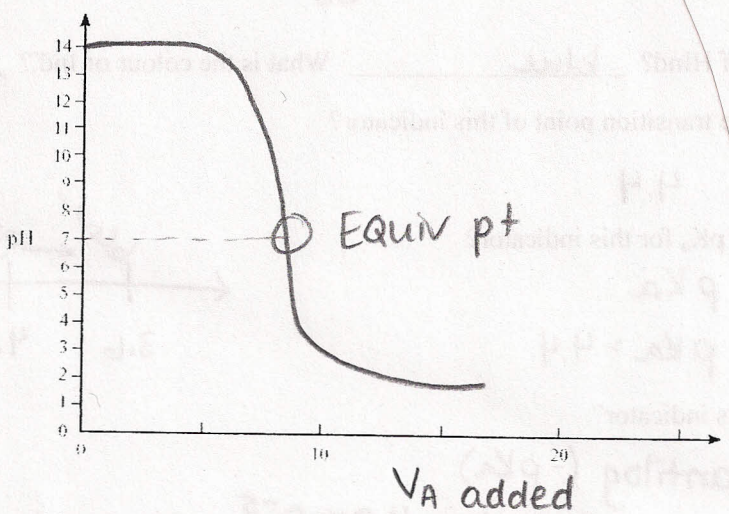
@ EQ PT: moles acid = moles base

moles NaOH = (0.40 M)(0.025 L)
= 0.01 mol
= moles $H_2C_2O_4$ acid

$[H_2C_2O_4] = \frac{0.01\ mol}{0.020\ L} = 0.50\ M$

14. a) Draw the titration curve you would expect would result from the following titration: 0.10 M HNO_3 (SA) with 25.0 mL of 0.10 M NaOH (SB). Get the shape and the important points (pH at beginning, equivalence point, end).

SA - SB Titration



b) Name an indicator which would be suitable for this titration.

bromothymol blue

c) As you pass through the Equivalence (Stoichiometric) point in this titration, the colour of your indicator would change from yellow to green (to blue)

15. A vinegar solution is reported to be 6.0% pure. If a 10.0 mL sample of the vinegar solution (density 1.0 g/mL) is titrated against 0.500 M NaOH to the equivalence point, what volume of base will be required?

$$\%\ \text{comp} = \frac{\text{mass solute}}{\text{mass solution}} \times 100\%$$

mass solution = D × V
= (1.0 g/mL)(10.0 mL)
= 10 g

mass solute = (mass sol'n)(% comp/100)
= (10.0 g)(0.06)
= 0.6 g CH_3COOH

moles CH_3COOH = $\frac{0.6\ g}{60\ g/mol}$ = 0.1 moles CH_3COOH

@EQPT, moles A = moles B
0.1 moles NaOH
V = moles/molarity = $\frac{0.1\ mol\ NaOH}{0.500\ M}$ = 0.20 L NaOH added

16. State whether the following compounds will act as acids (A) or bases (B) when added to water.

a) ClO_2 A
b) CO_2 A
c) SrO B
d) Cs_2O B
e) Cr_2O_3 amphoteric
f) BaO B

metal oxides → basic
nonmetal oxides → acidic