Worksheet - Titration Problems

1. What is the M of NaOH if it takes 40.0 ml of NaOH to reach the equivalence point in a titration with 50.0 ml of 0.200 M HCl?

$(1)(.200)(50.0) = (1)(M)(40.0)$

$M = .250M$

OR

$NaOH + HCl \rightarrow NaCl + H_2O$

$(.200M)(.050L) \times \frac{1\,mol\,NaOH}{1\,mol\,HCl} = \frac{.01\,mol}{.040L} = .25M$

2. 50. ml of 0.30 M KOH are required to titrate 60. ml of H_2SO_4. What is the M of the H_2SO_4?

$(2)(M)(60.mL) = (1)(.30M)(50.mL)$

$M = .13M$

OR

$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$

$(.050mL)(.30M) \times \frac{1\,mol\,H_2SO_4}{2\,mol\,KOH} = \frac{.0075mol}{.060L} =$

$.13M$

3. 60.0 ml of 1.20 M NaOH are required to titrate 40.0 ml of HF. What is the M of the HF?

$(1)(M)(40.0mL) = (1)(1.20M)(60.0mL)$

$M = 1.80M$

4. What volume of 0.40 M NaOH would be required to titrate 100. ml of 0.25 M HCl?

$(1)(.25M)(100mL) = (1)(.40M)V$

$V = 63mL$

$NaOH + HCl \rightarrow NaCl + H_2O$

$(.100L)(.25M) \times \frac{1\,mol\,NaOH}{1\,mol\,HCl} = .025mol$

$.40M = \frac{.025mol}{XL}$

$X = .063L$ or $63mL$

5. 40.0 ml of 0.100M H_3PO_4 are required to titrate 150.0 ml of NaOH to the equivalence point. What is the M of the NaOH?

$(3)(.100M)(40.0mL) = (1)(M)(150.0mL)$

$M = .0800M$

6. 55 ml of 1.2 M $HC_2H_3O_2$ are used to titrate a sample of 0.67 M $Ba(OH)_2$. What is volume of the $Ba(OH)_2$ used?

$2HC_2H_3O_2 + Ba(OH)_2 \rightarrow Ba(C_2H_3O_2)_2 + 2H_2O$

$(1.2M)(.055L) \times \frac{1\text{mol } Ba(OH)_2}{2\text{mol } HC_2H_3O_2} = .033\text{mol}$

$.67M = \frac{.033\text{mol}}{x\ L}$

$x = .049L$ or $49mL$

$(1)(1.2M)(55mL) = (2)(.67M)(V)$

$V = 49mL$

7. 90.0 ml of 0.255 M $Ca(OH)_2$ are required to titrate 100.0 ml of HCl. What is M of the HCl?

$(1)(M)(100.0mL) = (2)(.255M)(90.0mL)$

$M = .459M$

8. 50.2 ml of 0.453M $Sr(OH)_2$ are required to titrate a .755 M H_2SO_4 sample. What is the volume of the H_2SO_4?

$(2)(.755M)(V) = (2)(.453M)(50.2mL)$

$V = 30.1mL$

9. Would it take more 0.10 M HCl or 0.10 M H_2SO_4 to neutralize 30. ml of NaOH? Prove it!

Give the NaOH some arbitrary molarity (I'm going to use 1M)

for HCl → $(1)(.1M)V = (1)(1)(30mL)$

for H_2SO_4 → $(2)(.1M)V = (1)(1)(30mL)$ ← you need only ½ as much H_2SO_4 as HCl to neutralize the base.

10. 30.3 ml of 0.305 M NaOH are required to titrate H_3PO_4 to the equivalence point. How many moles of H_3PO_4 are needed to reach the equivalence point?

$(.305M)(.0303L) = .00924$ moles NaOH used (OH^-)

Therefore: .00924 moles H^+ needed

$.00924\text{mol } H^+ \times \frac{1\text{mol } H_3PO_4}{3\text{moles } H^+} = .00308 \text{ moles } H_3PO_4$