Neutralization / Titration

One definition of **acids** and **bases** says ...
Acids = H^+ donors
Bases = OH^- donors

Neutralization ...
when an acid and a base react to form a salt and water (neutral pH)

Example: $HCl + NaOH \rightarrow NaCl + HOH$
Acid + Base → Salt + Water

Solve each of the following:

(1) In the above reaction between HCl and NaOH, if 34.2 mL of 3.00 M HCl neutralizes 24.8 mL of NaOH, what is the molarity of the base?

$M = \frac{mol}{L}$

$1\,HCl + 1\,NaOH \rightarrow NaCl + H_2O$

3.00 M ? 34.2 mL 24.8 mL

$$\frac{3.00\ mol\ HCl}{L} \left| \frac{34.2\ mL}{} \right| \frac{1\ mol\ NaOH}{1\ mol\ HCl} \left| \frac{}{24.8\ mL} \right. = 4.14\ \frac{mol}{L}\ \text{or}\ M\ NaOH$$

(2) Using the same reaction again, if 67.3 mL of 6.00 M HCl reacts with 81.4 mL of 4.25 M NaOH, how many grams of $NaCl_{(s)}$ form?

$$\frac{6.00\ mol\ HCl}{L} \left| 67.3\ mL \right| \frac{1\ L}{1000\ mL} \left| \frac{1\ mol\ NaCl}{1\ mol\ HCl} \right| \frac{58.5\ g}{mol} = 23.6\ g\ NaCl$$

$$\frac{4.25\ mol\ NaOH}{L} \left| 81.4\ mL \right| \frac{1\ L}{1000\ mL} \left| \frac{1\ mol\ NaCl}{1\ mol\ NaOH} \right| \frac{58.5\ g}{mol} = 20.2\ g\ NaCl$$

smallest amount

(3) What volume of 0.100 M HCl is needed to neutralize 25.0 mL of a 0.350 M NaOH solution?

$M = \frac{mol}{L}$

$HCl + NaOH \rightarrow NaCl + H_2O$

.100	.350 M
V = ?	25.0 mL

$M = \frac{mol}{L}$

$$.350 \frac{mol\ NaOH}{L} \left| 25.0\ mL \right| \frac{1\ L}{1{,}000\ mL} \left| \frac{1\ mol\ HCl}{1\ mol\ NaOH} \right| \frac{L}{.100\ mol}$$

$\times 1000$

.0875 L or 87.5 mL

SHORT CUT! (Because HCl : NaOH is 1 : 1)

$$M_1 \cdot 350\ M \left| 25.0\ mL \right| U_1$$

$$.100\ M \left| M_2 \right.$$

= 87.5 mL of .100 M HCl

Be careful using this!