Mixing Strong Acids & Bases

25.0 mL
0.250 M HCl

pH = ?
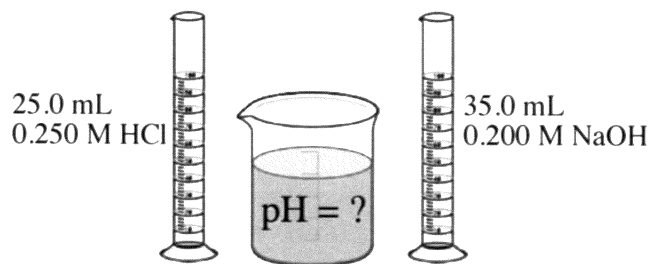
35.0 mL
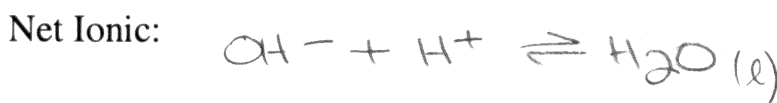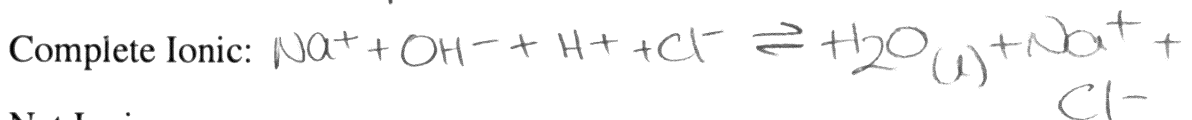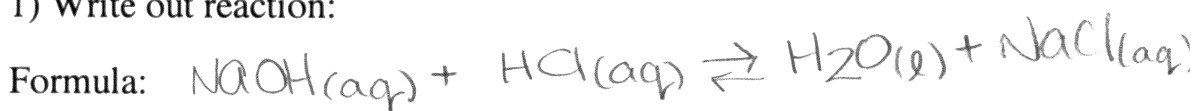0.200 M NaOH

What is the pH that results when 25.0 mL of
0.250 M HCl is mixed with 35.0 mL of 0.200 M
NaOH?

1) Write out reaction:

Formula: $NaOH_{(aq)} + HCl_{(aq)} \rightleftharpoons H_2O_{(\ell)} + NaCl_{(aq)}$

Complete Ionic: $Na^+ + OH^- + H^+ + Cl^- \rightleftharpoons H_2O_{(\ell)} + Na^+ + Cl^-$

Net Ionic: $OH^- + H^+ \rightleftharpoons H_2O_{(\ell)}$

2) Mixing two solutions ⟹ this is a DILUTION!

Find $[H_3O^+]$ and $[OH^-]$

$$[H_3O^+] = [HCl] = \frac{(0.250M)(25mL)}{60mL} = 0.1041\overline{6}M$$

$$[OH^-] = [NaOH] = \frac{(.200m)(35mL)}{60mL} = 0.11\overline{6}M$$

3) Determine how acidic or basic solution is by
finding EXCESS H_3O^+ or OH^-

excess = 0.117 - 0.104 M
OH^-
= 0.013M $[OH^-]$

4) Determine pH.

pOH = 1.89

pH = 12.11

How many moles of HCl(g) must be added to 40.0 mL of 0.180 M NaOH to produce a solution that has a pH = 12.500? Assume that there is no change in volume when the HCl is added.

$$pH = 12.500$$

$$pOH = 1.500$$

new $[OH^-] = $ antilog -1.500

$$= 0.03162 M$$

$$\Delta OH = 0.180M - 0.03162M$$

$$= 0.148 M$$

$$\overset{\Delta}{[OH^-]} = [H_3O^+]^{added} = 0.148M$$

$$moles\ HCl = \left(0.148\frac{mol}{L}\right)\left(\frac{1}{0.0400L}\right)$$

$$= 0.005936 mol$$

$$5.94 \times 10^{-3} mol$$