Solution Stoichiometry

300 mL of 0.2 M KOH is poured into a beaker of 500mL of 0.1 M HCl.

Write the equation, determine the limiting reactant.
Determine the concentration of each ion after the reaction.

Write the equation. Make an ISE table.

neutralization reaction

$1\,KOH_{(aq)} + 1\,HCl_{(aq)} \rightarrow HOH_{(l)} + KCl_{(aq)}$ (HCl: LR)

	KOH	HCl	HOH	KCl
I	0.06	0.05		
C	-0.05	-0.05	+0.05	+0.05
E	0.01 + excess OH^-	0	0.05 not ion(l)	0.05 K^+ Cl^-

Determine moles of reactants and limiting reactant. Fill out ISE.

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

KOH: $0.2M = \frac{X\ mol}{0.3}$

$X = 0.06\ mol$

HCl: $0.1M = \frac{X\ mol}{0.5L}$

$X = 0.05\ mol$

$1000mL = 1L$

$300mL \left| \frac{1L}{1000mL} \right. = 0.3L$

Determine the ions still in solution after the reaction.

$KOH \longrightarrow K^+ + OH^-$

0.01 0.01 0.01

$KCl \longrightarrow K^+ + Cl^-$

0.05 0.05 0.05

Determine the molarity of the ions in solution after the reaction.

300mL
500mL
800mL

$800mL \left| \frac{L}{1000mL} \right. = 0.8L$

K^+: 0.01 + 0.05 = 0.06 mol

$M = \frac{0.06\ mol}{0.8L} = 0.075M\ K^+$

OH^-: $\frac{0.01\ mol}{0.8L} = 0.0125M\ OH^-$

Cl^-: $M = \frac{0.05\ mol}{0.8L} = 0.0625M\ Cl^-$

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Write the equation, determine the limiting reactant.
Determine the concentration of each ion after the reaction.

Write the equation. Make an ISE table.

	$KOH(aq)$ +	$HCl(aq)$	⟶	$HOH(l)$	+	$KCl(aq)$
I	0.06 mol	0.05 mol				
S	0.05 mol	0.05 mol		0.05 mol		0.05 mol
E	0.01 mol excess	0		0.05 mol		0.05 mol

Determine moles of reactants and limiting reactant. Fill out ISE.

KOH

$0.2\ M = \frac{x\ mol}{0.3L}$

x= 0.06 mol KOH

HCl

$0.1\ M = \frac{x\ mol}{0.5L}$

x= 0.05 mol HCl

HCl is the limiting reactant

Determine the ions still in solution after the reaction.

(excess) $KOH \rightarrow K^{+1} + OH^{-1}$
0.01 mol 0.01 0.01

aq. product: $KCl \rightarrow K^{+1} + Cl^{-1}$
0.05 mol 0.05 0.05

Determine the molarity of the ions in solution after the reaction.

final volume:
300mL
+500mL
800mL

K^{+1}

$\frac{0.01+0.05\ mol}{0.8L} = 0.075M$

OH^{-1}

$\frac{0.01mol}{0.8L} = 0.0125M$

Cl^{-1}

$\frac{0.05mol}{0.8L} = 0.0625M$

① Equivalence
all reactant gone / no excess

Ag^+ NO_3^- Na^+ Cl^-

② $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$

S -0.002 $-0.002\,mol$ $+0.002$ $+0.002$

$.020\,mL$ $0.1M$

③ $M = \frac{mol}{L}$ $0.1M = \frac{X\,mol}{0.020\,L}$

$X = 0.002\,mol\ AgNO_3$

④ $0.002\,mol\ AgNO_3 \rightarrow$ need $0.002\,mol$ NaCl

$0.05M = \frac{0.002\,mol}{X}$

$\frac{0.05}{0.05}X = \frac{0.002}{0.05}$

$X = 0.04$

$NaCl$
$0.002\,mol$

$0.04\,L \mid \frac{1000\,mL}{1\,L} = 40\,mL$

$= 0.04\,L\ NaCl$
$40\,mL$

Na^{+1} NO_3^{-1}

$AgCl_{(s)}$

$40\,mL$
$20\,mL$
$60\,mL$

$\frac{0.002\,mol}{0.06\,L}$

$60mL \mid \frac{1\,L}{1000\,mL} = 0.06\,L$

⑤ $= 0.033M\ Na^+$

$0.033M\ Cl^-$

(a.) LR

$NaOH_{(aq)} + HCN_{(aq)} \rightarrow HOH_{(l)} + NaCN_{(aq)}$

I	0.664	0.665		
	-0.664	-0.664	+0.664	+0.864
E	0	0.001 excess	0.004	0.004

(b.) $0.2M = \frac{x\ mol}{0.02L}$

$x = 0.004\ mol\ NaOH$

$0.1M = \frac{x\ mol}{0.05L}$

$x = 0.005\ mol\ HCN$

(c.) no solid (creating $HOH_{(l)}$)

(d.) 0

20 mL of 0.5M Na_2SO_4 reacts with completely with 25 mL of $Ca(NO_3)_2$

What is the molarity of the $Ca(NO_3)_2$?