CONCEPT: STRONG BASE-STRONG ACID TITRATIONS

Whenever we had a **STRONG ACID** or **STRONG BASE** we **never** use an _____ CHART.

Now, whenever you titrate two **STRONG** species you can use an _____ CHART with the units in moles.

The following can be used as the roadmap for determining the pH for a Strong Acid-Strong Base Titration.

Equivalence Volume (V_e)

Calculate the equivalence volume, V_e, in order to determine the volume of titrant required to reach the equivalence point.

□ The titration of 150.0 mL of 0.100 M NaOH with 0.050 M HNO_3

Before any Strong Acid is added

Before any of the strong acid titrant is added we only have a strong base initially.

□ The titration of 150.0 mL of 0.100 M NaOH with 0.00 mL of 0.050 M HNO_3

$$0.100\ M\ NaOH \rightarrow \underset{0.100\ M}{Na^+(aq)} + \underset{0.100\ M}{OH^-(aq)} \quad pOH = -\log[OH^-] = -\log[0.100] = 1.0 \quad \therefore \quad pH = 14 - 1 = 13$$

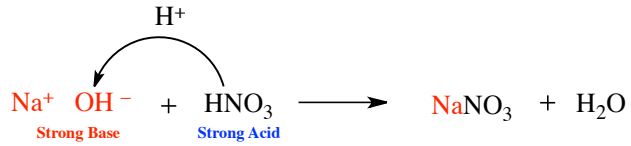
Before Equivalence Point

Once our acid and base begin to mix we use an ICF Chart to determine the pH.

□ The titration of 150.0 mL of 0.100 M NaOH with 120.00 mL of 0.050 M HNO_3

moles = Liters × Molarity

	$NaOH$ (Strong Base)	+ HNO_3 (Strong Acid)	→ $NaNO_3$	+ H_2O
Initial	0.015 moles	0.006 moles	0.000 moles	
Change				
Final				



Before the Equivalence Point

- **Strong Base** will be present at the end.

$$[SB] = \frac{\text{moles left}}{\text{Total Liters}} \quad \therefore \quad pOH = -\log[SB]$$

CONCEPT: STRONG BASE-STRONG ACID TITRATIONS

At Equivalence Point

At the equivalence point of a strong base–strong acid titration the solution is _____ and pH = _____.

□ The titration of 150.0 mL of 0.100 M NaOH with 300.00 mL of 0.050 M HNO_3

	$NaOH$ (Strong Base)	+	HNO_3 (Strong Acid)	→	$NaNO_3$	+	H_2O
Initial	0.015 moles		0.015 moles		0.000 moles		
Change							
Final							

At the Equivalence Point

- **Conjugate Base** will be present at the end.

After Equivalence Point

After the equivalence point of a strong base–strong acid titration we will have excess strong acid remaining.

□ The titration of 150.0 mL of 0.100 M NaOH with 310.00 mL of 0.050 M HNO_3

	$NaOH$ (Strong Base)	+	HNO_3 (Strong Acid)	→	$NaNO_3$	+	H_2O
Initial	0.015 moles		0.0155 moles		0.000 moles		
Change							
Final							

After the Equivalence Point

- **Strong Acid** will be present at the end.

$$[SA] = \frac{\text{moles left}}{\text{Total Liters}} \quad \therefore \quad pH = -\log[SA]$$

CONCEPT: STRONG BASE-STRONG ACID TITRATIONS CALCULATIONS

EXAMPLE: Calculate the pH of the solution resulting from the titration of 150.0 mL of 0.20 M NaOH with 80.0 mL of 0.15 M HBr.

PRACTICE: Calculate the pH of the solution resulting from the titration of 100.0 mL of 0.30 M LiH with 150.0 mL of 0.40 M HI.

CONCEPT: STRONG ACID-STRONG BASE TITRATIONS

The following can be used as the roadmap for determining the pH for a Strong Base-Strong Acid Titration.

Equivalence Volume (V_e)

Calculate the equivalence volume, V_e, in order to determine the volume of titrant required to reach the equivalence point.

□ The titration of 120.0 mL of 0.250 M HCl with 0.200 M KOH

Before any Strong Base is added

Before any of the strong base titrant is added we only have a strong acid initially.

□ The titration of 120.0 mL of 0.250 M HCl with 0.00 mL of 0.200 M KOH

$$0.250\ \text{M HCl} \rightarrow \underset{0.250\ \text{M}}{H^+(aq)} + \underset{0.250\ \text{M}}{Cl^-(aq)} \quad \vdots \quad pH = -\log[H^+] = -\log[0.250] = 0.602$$

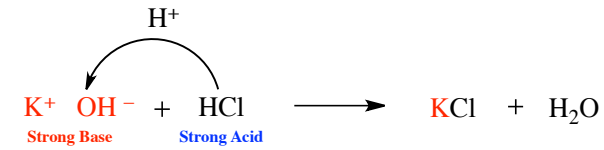
Before Equivalence Point

Once our acid and base begin to mix we use an ICF Chart to determine the pH.

□ The titration of 120.0 mL of 0.250 M HCl with 100.00 mL of 0.200 M KOH

moles = Liters × Molarity

	KOH (Strong Base)	+ HCl (Strong Acid)	→ KCl	+ H_2O
Initial	0.020 moles	0.030 moles	0.000 moles	
Change				
Final				



Before the Equivalence Point

- **Strong Acid** will be present at the end.

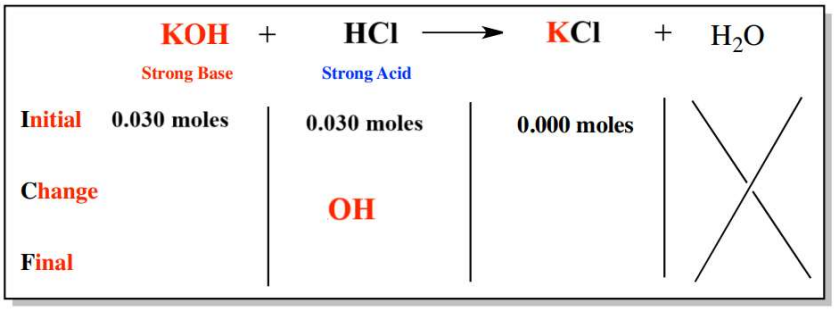
$$[SA] = \frac{\text{moles left}}{\text{Total Liters}} \quad \therefore \quad pH = -\log[SA]$$

CONCEPT: STRONG ACID-STRONG BASE TITRATIONS

At Equivalence Point

At the equivalence point of a strong base–strong acid titration the solution is _____ and pH = _____.

□ The titration of 120.0 mL of 0.250 M HCl with 150.00 mL of 0.200 M KOH.



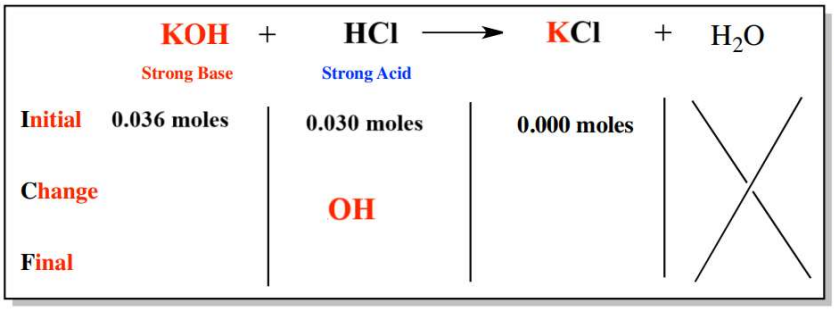
At the Equivalence Point

- **Conjugate Base** will be present at the end.

After Equivalence Point

After the equivalence point of a strong base–strong acid titration we will have excess strong base remaining.

□ The titration of 120.0 mL of 0.250 M HCl with 180.00 mL of 0.200 M KOH.



After the Equivalence Point

- **Strong Base** will be present at the end.

$$[\mathrm{SB}] = \frac{\text{moles left}}{\text{Total Liters}} \quad \therefore \ \mathrm{pOH} = -\log[\mathrm{SB}]$$

PRACTICE: STRONG ACID-STRONG BASE TITRATIONS CALCULATIONS 1

EXAMPLE 1: Calculate the pH of the solution resulting from the titration of 50.0 mL of 0.10 M HI with 20.0 mL of 0.30 M NaOH.

EXAMPLE 2: Calculate the pH of the solution resulting from the titration of 90.0 mL of 0.40 M $HClO_3$ with 50.0 mL of 0.50 M KOH.