CONCEPT: TITRATIONS: WEAK BASE–STRONG ACID

- This type of titration has the _____ as the titrate and the _____ as the titrant.
  - □ Recall, when a weak species reacts with a strong species use an **ICF (I_____, C_____, F_____) Chart**.

Before the Equivalence Point

- In this part of the titration the moles of weak base is _____ the moles of strong acid.
  - □ As the Strong Acid neutralizes the Weak Base, some _____ is formed.

EXAMPLE: Calculate the pH of the solution resulting from the titration between 25.0 mL of a 0.100 M $HClO_3$ and 50.0 mL of a 0.100 M NH_3. (K_b of NH_3 is 1.75×10^{-5}).

Use **STEPS 1 to 3** to setup the ICF Chart.

ICF Chart (Weak Base-Strong Acid)

	_____ (aq)	+ _____ (aq)	⇌ _____ ( )	+ _____ ( )
I				
C				
F				

STEP 4: The Henderson-Hasselbalch Equation is used for a _____ to find the pH of a solution.

- □ Using the **FINAL ROW**, use the moles of the _____ and _____ to find the pH.

Henderson-Hasselbalch Equation

$$pH = pKa + \log \frac{[CB]}{[WA]}$$

CONCEPT: TITRATIONS: WEAK BASE–STRONG ACID

PRACTICE: Calculate the pH of the solution resulting from the mixing of 75.0 mL of 0.100 M $NaC_2H_3O_2$ and 75.0 mL of 0.30 M $HC_2H_3O_2$ with 0.0040 moles of HBr.

PRACTICE: In order to create a buffer 7.321 g of potassium lactate is mix with 550.0 mL of 0.328 M lactic acid, $HC_3H_5O_3$. What is the pH of the buffer solution after the addition of 300.0 mL of 0.100 M hydrobromic acid, HBr? The Ka of $HC_3H_5O_3$ is 1.4×10^{-4}.

CONCEPT: TITRATIONS: WEAK BASE–STRONG ACID

At the Equivalence Point

- In this part of the titration the moles of weak acid is _____ the moles of strong base.
  - □ The weak base and strong acid have been _____ and only the weak acid (conjugate acid) remains.

EXAMPLE: Calculate the pH of the solution resulting from the titration between 25.0 mL of a 0.100 M $HClO_3$ and 50.0 mL of a 0.050 M NH_3. (K_b of NH_3 is 1.75×10^{-5}).

Use **STEPS 1 to 3** to setup the ICF Chart.

ICF Chart (Weak Base-Strong Acid)

_____ (aq) + _____ (aq) ⇌ _____ ( ) + _____ ( )

I_____

C_____

F_____

STEP 4: Using the **FINAL ROW**, determine the concentration of the weak acid (conjugate acid).

- □ Divide its final _____ by the total volume used in the chemical reaction.

STEP 5: If all that is left is a weak species then set up an ICE Chart that has it reacting with _____.

ICE Chart (Weak Acid)

NH_4^+ (aq) + _____ ( ) ⇌ _____ (aq) + _____ (aq)

I_____

C_____

E_____

STEP 6: Using the **EQUILIBRIUM ROW**, setup the equilibrium constant expression with _____ and solve for ____.

- □ Check if a shortcut can be utilized to avoid the _____ formula.

ICE Chart Shortcut

500 Approximation Method

When the ratio of [ ]$_0$ to K is **>** 500 you can ignore the **– x**.

$K_w = K_a \times K_b \Rightarrow$ $\frac{[\ ]_0}{K}$ = _____ = $\frac{\text{_____}}{[\ \ - x]} = \frac{[x^2]}{[\ \ - x]}$

Quadratic Formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

STEP 7: The ____ variable will equal **[ ]** and can be used to solve pH.

pH Formula

pH = –log[H_3O^+] = –log[ ] = _____

CONCEPT: TITRATIONS: WEAK BASE–STRONG ACID

PRACTICE: Consider the titration of 100.0 mL of 0.100 M CH_3NH_2 with 0.250 M HNO_3 at the equivalence point. What would be the pH of the solution at the equivalence point? The K_b of CH_3NH_2 is 4.4×10^{-4}.

CONCEPT: TITRATIONS: WEAK BASE–STRONG ACID

After the Equivalence Point

- In this part of the titration the moles of weak base is _____ the moles of strong acid.
  - □ There will be _____ strong acid remaining after it has neutralized the weak base.

EXAMPLE: Calculate the pH of the solution resulting from the titration between 125.0 mL of a 0.100 M $HClO_3$ and 50.0 mL of a 0.050 M NH_3. (K_b of NH_3 is 1.75×10^{-5}).

Use **STEPS 1 to 3** to setup the ICF Chart.

ICF Chart (Weak Base-Strong Acid)

	_____ (aq)	+ _____ (aq)	⇌ _____ ( )	+ _____ ( )
I				
C				
F				

STEP 4: Using the **FINAL ROW**, determine the concentration of the strong acid.

- □ Divide its final _____ by the total volume used in the chemical reaction.

STEP 5: Recall, the concentration of the strong acid will be equal to _____.

pH & pOH Formulas

$pH + pOH = 14$

$pH = -\log [H^+]$

$[H^+] = 10^{-pH}$

$pOH = -\log [OH^-]$

$[OH^-] = 10^{-pOH}$

PRACTICE: A solution contains 100.0 mL of 0.550 M sodium nitrite, $NaNO_2$. Find the pH after the addition of 180.0 mL of 0.400 M $HClO_4$. The Ka of HNO_2 is 4.6×10^{-4}.