CONCEPT: PH OF WEAK BASES

Calculating Equilibrium Amount

● Recall, **Weak Bases** represent _____ electrolytes that only partially dissociate into aqueous ions.

□ They require the use of an **ICE (I_____, C_____, E_____) Chart** to calculate equilibrium amounts.

□ The units of an ICE Chart will be in _____ and use _____.

EXAMPLE: Calculate the hydroxide ion concentration of a 0.55 M KF solution at 25ºC. The acid dissociation constant of HF is 3.5×10^{-4}.

STEP 1: Setup an ICE Chart for the weak base that has it reacting with _____.

□ For **Ionic Bases**, _____ the neutral metal cation.

□ Use the Bronsted-Lowry definition to predict the products formed.

- Make sure that _____ is used in the presence of the weak base.

ICE Chart (Weak Base)

	F^- (aq)	+ _____ ( ) ⇌	_____ (aq)	+ _____ (aq)
I_____				
C_____				
E_____				

STEP 2: Using the **INITIAL ROW**, place the amount given for the **weak base**.

□ Place a ____ for any substance not given an initial amount.

STEP 3: We _____ reactants to _____ products.

□ Using the **CHANGE ROW**, place a _____ for the reactants and a _____ for the products.

STEP 4: 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**.

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

Quadratic Formula

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

CONCEPT: PH OF WEAK BASES

Calculating pH

- The pH or pOH of a weak base can be calculated once the **[**equilibrium**]** of _____ is found.
  - □ Determined by using the **EQUILIBRIUM ROW** of an ICE Chart.

EXAMPLE: What is the pH of a 0.12 M ethylamine, $C_2H_5NH_2$, solution? The K_b value of ethylamine is 5.6×10^{-4}.

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

ICE Chart (Weak Base)

	$C_2H_5NH_2$ (aq)	+	_____ ( )	⇌	_____ (aq)	+	_____ (aq)
I							
C							
E							

STEP 4: Using the **EQUILIBRIUM ROW**, setup the equilibrium constant expression 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**.

$$\frac{[\ ]_0}{K} = \frac{0.12\ M}{5.6 \times 10^{-4}} = \qquad 5.6 \times 10^{-4} = \frac{[x^2]}{[0.12 - x]}$$

Quadratic Formula

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

STEP 5: The ____ variable will equal **[ ]** and can be used to solve pOH.

pOH Formula

pH = –log[OH^-] = –log[ ] = _____

pH Formula

pH = –log[H_3O^+] = –log[ ] = _____

CONCEPT: PH OF WEAK BASES

Calculating Percent Ionization/Dissociation

● **Weak Bases** also represent _____ electrolytes that only partially ionize or dissociate into aqueous ions.

□ **Weak Bases** ionize < _____ □ **Strong Bases** ionize _____

Percent Ionization Formula

$$\% \text{ Ionization} = \frac{\text{_____}}{[A^-]_0} \times 100$$

EXAMPLE: Calculate the percent ionization when 73.2 g sodium hypoiodite, NaIO, are dissolved with 500 mL of solution. The K_a value of hypoiodous acid, HIO, is 2.3×10^{-11}.

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

ICE Chart (Weak Base)

	IO^- (aq)	+ _____ ( )	⇌ _____ (aq)	+ _____ (aq)
I	_____			
C	_____			
E	_____			

STEP 4: Using the **EQUILIBRIUM ROW**, setup the equilibrium constant expression 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**.

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

Quadratic Formula

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

STEP 5: Use the ____ variable to calculate the percent ionization or dissociation.

CONCEPT: PH OF WEAK BASES

PRACTICE: Determine the pH of a solution made by dissolving 6.1 g of sodium cyanide, NaCN, in enough water to make a 500.0 mL of solution. (MW of NaCN = 49.01 g/mol). The K_a value of HCN is 4.9×10^{-10}.

PRACTICE: An unknown weak base has an initial concentration of 0.750 M with a pH of 8.03. Calculate its equilibrium base constant.