<u>**CONCEPT:**</u> PH OF WEAK ACIDS

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

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

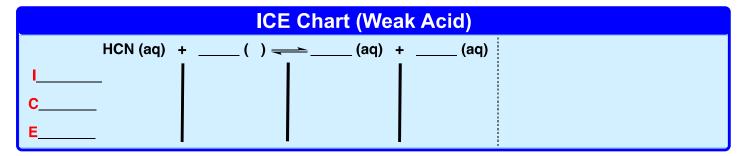   □ The units of an ICE Chart will be in _____ and use _____.

EXAMPLE: Calculate the hydronium ion concentration for 0.30 M HCN. The acid dissociation constant, K_a, for HCN is 4.9 x 10^{-10}.

<u>**Calculating Equilibrium Amount**</u>

STEP 0: Use the following steps when asked to determine the [_____] of any compound in your equation.

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

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

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

ICE Chart (Weak Acid)

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

I_____

C_____

E_____

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

    □ 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

_____ Approximation Method	_____ Formula
When the ratio of [ ]$_0$ to K is _____ 500 you can ignore the _____. $$\frac{[\ ]_0}{K} = \frac{0.30\ M}{4.9 \times 10^{-10}} =$$ $$4.9 \times 10^{-10} = \frac{[x^2]}{[0.30 - x]}$$	$$\frac{-\quad \pm \sqrt{\quad -\quad}}{2a}$$

<u>**CONCEPT:**</u> PH OF WEAK ACIDS

<u>**Calculating pH**</u>

● The pH or pOH of a weak acid can be calculated once the **[equilibrium]** of _____ is found.

               □ Determined by using the **EQUILIBRIUM ROW** of an ICE Chart.
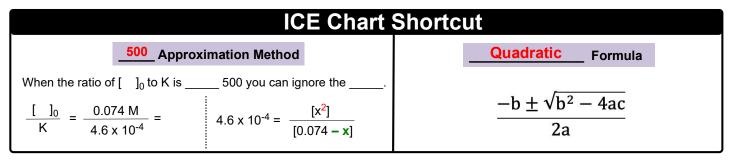

EXAMPLE: What is the pH of a 0.074 M nitrous acid, HNO_2, solution? The K_a value for the compound is 4.6 x 10^{-4}.

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

ICE Chart (Weak Acid)

HNO_2 (aq) + _____ ( ) $\rightleftharpoons$ _____ (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**	**_Quadratic_** Formula
When the ratio of [ ]$_0$ to K is _____ 500 you can ignore the _____. $\dfrac{[\ ]_0}{K} = \dfrac{0.074\ M}{4.6\ x\ 10^{-4}} = $ $\Big\vert$ $4.6\ x\ 10^{-4} = \dfrac{[x^2]}{[0.074 - x]}$	$\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

STEP 5: The _____ variable will equal **[   ]** and can be used to solve pH. Add H3O+ too purple box

pH Formula

$$pH = -\log[\ \mathbf{H_3O^+}\ ] = -\log[\quad] = \underline{\quad\quad}$$
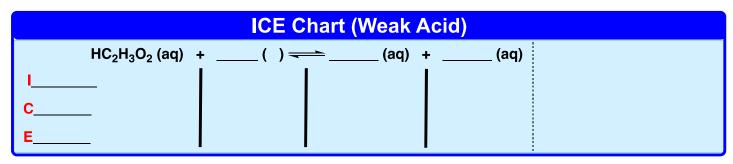
<u>**CONCEPT:**</u> PH OF WEAK ACIDS

<u>**Calculating Percent Ionization/Dissociation**</u>

● The _____ of a weak acid that can become ionized when placed in an aqueous solution.
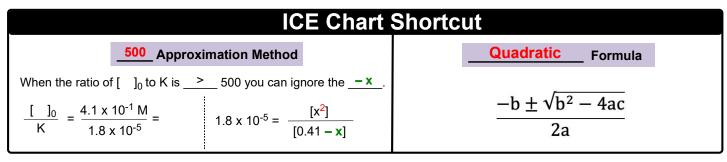
　□ **Weak Acids** ionize < _____   □ **Strong Acids** ionize _____

Percent Ionization Formula
% Ionization = $\dfrac{}{[HA]_0}$ x 100

EXAMPLE: Calculate the percent dissociation of 4.10 x 10^{-1} M acetic acid, $HC_2H_3O_2$. The K_a value is 1.8 x 10^{-5}.

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

ICE Chart (Weak Acid)
$HC_2H_3O_2$ **(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	____Quadratic____ Formula
When the ratio of [ ]$_0$ to K is __>__ 500 you can ignore the __− x__.	
$\dfrac{[\ ]_0}{K} = \dfrac{4.1 \times 10^{-1}\ M}{1.8 \times 10^{-5}} =$　　$1.8 \times 10^{-5} = \dfrac{[x^2]}{[0.41\ \textbf{− x}]}$	$\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

STEP 5: Use the _____ variable to calculate the percent ionization/dissociation.

<u>**CONCEPT:**</u> <u>PH OF WEAK ACIDS</u>

PRACTICE: Calculate the [H$^+$] of a 0.50 M solution of methylammonium bromide, CH_3NH_3Br. The K_b of methylamine, CH_3NH_2, is given as 4.4 x 10^{-4}.

PRACTICE: An unknown weak acid has an initial concentration of 0.55 M. What is the pH of the solution if the weak acid also has a pKa of 5.79?