CONCEPT: TRIPROTIC ACIDS AND BASES CALCULATIONS

pH of Weak Triprotic Species

- Utilize **only** _____ to calculate the pH of the acidic form of a weak triprotic acid.
  - □ Utilize **only** _____ to calculate the pH of the basic form of a weak triprotic acid.

EXAMPLE: Determine the pH of a 0.225 M phosphoric acid, H_3PO_4, solution. $K_{a1} = 7.5 \times 10^{-3}$, $K_{a2} = 6.2 \times 10^{-8}$ and $K_{a3} = 4.2 \times 10^{-13}$.

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

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

ICE Chart (Weak Triprotic Acid)

	H_3PO_4 (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

500 Approximation Method

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

$$\frac{[\ ]_0}{K} = \frac{0.225\ M}{7.5 \times 10^{-3}} =$$

$$7.5 \times 10^{-3} = \frac{[x^2]}{[0.225 - x]}$$

Quadratic Formula

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

CONCEPT: TRIPROTIC ACIDS AND BASES

PRACTICE: Determine the pH of 0.250 M sodium phosphate, Na_3PO_4. Phosphoric acid, H_3PO_4, contains $K_{a1} = 7.5 \times 10^{-3}$, $K_{a2} = 6.2 \times 10^{-8}$ and $K_{a3} = 4.2 \times 10^{-13}$.

PRACTICE: Determine the pOH of 0.450 M citric acid, $H_3C_6H_5O_7$. It possesses $K_{a1} = 7.4 \times 10^{-4}$, $K_{a2} = 1.7 \times 10^{-5}$ and $K_{a3} = 4.0 \times 10^{-7}$.