Name: ______________________________ Block: ____________

IV. Acids & Bases (part 3)

IV.14-15 Calculations involving K_a and K_b *(Used for the WEAK A & B)*

You will be able to:

- Given the Ka, Kb, and initial concentration, calculate any of the following: $[H_3O^+]$, [OH-], pH, pOH
- Calculate the value of Ka or Kb given the pH and initial concentration
- Calculate the initial concentration of an acid or base, given the appropriate Ka, Kb, pH, or pOH values

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Remember: *WEAK acids/bases do not ionize completely.*

- The ___________________________________, the _________________________ is produced.

Therefore, a lower _____ means a _________________ acid.

There are 3 TYPES of calculations involving Ka and Kb for weak acids and bases.
The following examples are interchangeable for **ACIDS** and **BASES**.

Calculations involving weak bases are similar to calculations involving weak acids, with 2 changes:

- ____
- ____

Q TYPE 1: Given [WA] and K_a, **find $[H_3O^+]$ (or pH)**

Example 22: What is the pH of a 0.500 M solution of benzoic acid (C_6H_5COOH)?

Step 1: Look up the Ka on the B-L table	
Step 2: Write out ionization equilibrium with an ICE table.	
Step 3: Write Ka expression & substitute values.	
Step 4: State assumption. **Assumption can ONLY be made if percent dissociation is less than 5%.** Show calc for percent dissociation.	
Step 5: Assumption	

reduces equation. Solve for x ($[H_3O^+]$).	
Step 6: Convert to pH. (Ka limits to 2 SD's.)	

Q TYPE 2: Given [WA]/[WB] and $[H_3O^+]$/[OH-] (or pH/pOH), **find K_a or K_b**

Example 23: At a certain temp, a 0.20 M solution of K_2SO_3 has a pH of 10.25. Calculate the Kb of SO_3^{2-} at this temp.

Step 1: Write out dissociation equation of salt. Identify the weak base.	
Step 2: Calculate [OH-] from pH (pH → pOH → $[OH^-]$)	
Step 3: Write hydrolysis equation and an ICE table. (It is called *hydrolysis* this time because SO_3^{2-} is an ion.)	
Step 4: Write the Kb expression and substitute the values from the [E]'s in our ICE table	
Step 5: Solve for Kb to correct SD's	

Q TYPE 3: Given $[H_3O^+]$ (or pH) and K_a, **find [WA]**

Example 24: Find the concentration of HCOOH needed to form a solution with pH = 2.69.

Step 1: Convert pH to $[H_3O^+]$ **This is the $[H_3O^+]$ at equilibrium.**	
Step 2: Write out ionization equilibrium with an ICE table. *Calc change in concentrations using molar ratios.*	
Step 3: Write Ka	

expression & substitute values. Find Ka for HCOOH on the acid table.	
Step 4: Solve for [WA] with correct SD's	

In written response questions, you will have to show your exact calculations! You may state assumption if you can prove that the base/acid is less than 5% ionized.

SHORTCUT FOR MULTIPLE CHOICE ONLY:

Example 22: The pH of 2.0 M acetic acid is...

Step 1: Use MC shortcut option to calc $[H_3O^+]$ (see Ex. 16 in ABpt2)	
Step 2: Look up Ka value in table. Solve for $[H_3O^+]$	
Step 3: Calculate pH. Select best answer	

Do Hebden set 29: Ka calcs -p. 152 #77-80, 83
Kb calcs – p. 153 #85-87, 91