4.10 Relative Strengths

Using Stronger Acid to predict direction:

In a B.L. equilibrium there is an acid & a base on both sides, How do you know which direction the reaction proceeds? (which side is favoured?)
Especially, if both reactants are amphiprotic?

Which way will the reaction proceed?

$$\underset{\text{Base}}{CO_3^{2-}} + \underset{\text{Acid}}{H_2PO_4^-} \rightleftharpoons \underset{\text{Acid}}{HCO_3^-} + \underset{\text{Base}}{HPO_4^{2-}}$$

Both acids; ($H_2PO_4^-$ & HCO_3^-) can donate a proton ... which way will reaction proceed?

1. Look up Ka values
   Ka $H_2PO_4^-$ =
   ka HCO_3^- :

Summary: in B-L eq. the side with the weaker acid is favoured.

* Shift AWAY from the stronger Acid! *

Example #1 Predict whether reactants or products will be favoured, when HCN reacts with HCO_3^-

$$HCN + HCO_3^- \rightleftharpoons$$

1. Write eqn:

2. Look up Ka's of both acids; determine which acid is stronger

3. Direction is Away from stronger acid.
   (- Larger Ka means it ionizes more; more H^+ ions to react with base)

Example #2: What happens when HCO_3^- & HS^- are mixed together?

Beware !! Both are amphiprotic & can be found on both sides of table

1. Start by looking for both HCO_3^- & HS^- on acid side:

2. Try looking for both on base side:

3. Write Eqn:

4. Now, look up both acids in your equilibrium equation
   - Go to table a 2nd time, when both are amphiprotic ↘ First step & Last step

5. Away from stronger acid

Example #3 ... on own or at start of next class

Predict whether reactants or products will be favoured: * Beware !! Both Amphiprotic !!

$HSO_4^- + HC_2O_4^- \rightleftharpoons$

Do. Pg. 133 # 35-46