IV.10 - Relative Strengths of Acids and Bases

- If we mix solutions containing H_2CO_3 and SO_3^{2-}, the SO_3^{2-} can only act as a base (since it has no protons) and we find:

$$H_2CO_3 + SO_3^{2-} \rightleftharpoons HCO_3^- + HSO_3^-$$

In Chemistry 12 we will only study the transfer of ONE proton. We will not deal with two-proton transfers such as:

$$H_2CO_3 + SO_3^{2-} \rightleftharpoons CO_3^{-2} + H_2SO_3$$

- Consider what happens when we mix CO_3^{-2} and $H_2PO_4^-$:

$$CO_3^{-2} + H_2PO_4^- \rightleftharpoons HCO_3^- + HPO_4^{-2}$$

We have set up a "proton competition" in solution.

  - There are two acids in equilibrium, $H_2PO_4^-$ and HCO_3^-, each trying to donate a proton.
  - There are two bases in equilibrium, CO_3^{-2} and HPO_4^{-2}, each trying to accept a proton.

- The stronger of the two acids involved will be more successful in donating a proton than the weaker.
- From the Acid-Base Table we see that $H_2PO_4^-$ ($K_a = 6.2 \times 10^{-8}$) is a stronger acid than HCO_3^- ($K_a = 5.6 \times 10^{-11}$).
- As a result, $H_2PO_4^-$ has a greater tendency to donate a proton than does HCO_3^-. Therefore, there will be MORE PRODUCTS than reactants ("products are favoured")

******In a Bronsted-Lowry acid-base equilibrium, the side of the equilibrium that has the WEAKER ACID will be favoured******

Try this….

When HS^- and HCO_3^- are mixed, does the resulting equilibrium favour the reactants or products?

Examples:

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Consider the following equilibria:

$$HTe^- + HSe^- \rightleftarrows H_2Te + Se^{2-}$$

$$HTe^- + Se^{2-} \rightleftarrows HSe^- + Te^{2-}$$

Reactants are favoured in both equilibria. The order of acids from strongest to weakest is

A. HTe^-, HSe^-, H_2Te
B. HSe^-, H_2Te, HTe^-
C. H_2Te, HTe^-, HSe^-
D. H_2Te, HSe^-, HTe^-

*****Do Hebden Questions #38 - 46, pg 133*****