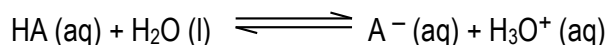


### CONCEPT: $K_a$ AND $K_b$

As you might already realize, there are relatively few strong acids. The great majority of acids are weak acids.

Consider a weak monoprotic acid, HA, and its ionization in water:



The equilibrium expression for this ionization would be:

$$K_a = \frac{\text{Products}}{\text{Reactants}} =$$

Where  $K_a$  represents the \_\_\_\_\_ and it measures the strength of weak acids.

When looking at weak bases we don't use  $K_a$ , but instead \_\_\_\_\_, which represents the \_\_\_\_\_.

- The relationship between  $K_a$  and  $K_b$  can be expressed with the following equation:

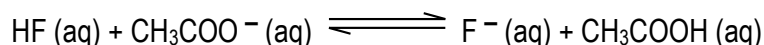
$$K_w = K_a \cdot K_b$$

In general, the \_\_\_\_\_ the  $K_a$  the stronger the acid and the \_\_\_\_\_ the concentration of  $\text{H}^+$ .

In general, the \_\_\_\_\_ the  $\text{p}K_a$  the stronger the acid and the \_\_\_\_\_ the concentration of  $\text{H}^+$ .

**PRACTICE:** If the  $K_b$  of  $\text{NH}_3$  is  $1.76 \times 10^{-5}$ , determine the acid dissociation constant of its conjugate acid.

**EXAMPLE:** Knowing that HF has a higher  $K_a$  value than  $\text{CH}_3\text{COOH}$ , determine, if possible, in which direction the following equilibrium lies.



- a) Equilibrium lies to the left
- b) Equilibrium lies to the right
- c) Equilibrium is equal and balanced
- d) Not enough information given

**CONCEPT:  $K_a$  AND  $K_b$**

**PRACTICE:** Which Bronsted-Lowry base has the greatest concentration of hydroxide ions?

- a)  $C_2H_8N_2$  ( $K_b = 8.3 \times 10^{-5}$ )
- b)  $C_5H_5N$  ( $K_b = 1.7 \times 10^{-9}$ )
- c)  $(CH_3)_3N$  ( $K_b = 1.0 \times 10^{-6}$ )
- d)  $C_3H_7NH_2$  ( $K_b = 3.5 \times 10^{-4}$ )
- e)  $C_6H_5NH_2$  ( $K_b = 3.9 \times 10^{-10}$ )

**PRACTICE:** Which Bronsted-Lowry acid has the weakest conjugate base?

- a)  $HCNO$  ( $K_a = 2.0 \times 10^{-4}$ )
- b)  $HF$  ( $K_a = 3.5 \times 10^{-4}$ )
- c)  $HN_3$  ( $K_a = 2.5 \times 10^{-5}$ )
- d)  $H_2CO_3$  ( $K_a = 4.3 \times 10^{-7}$ )