IX) Strong, Weak, Concentrated, Dilute

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The terms **strong** and **weak** differ from the terms **concentrated** and **dilute**.

What is a strong acid, and give an example.

- an acid that dissociates 100%. eg $HBr + H_2O \rightarrow Br^- + H_3O^+$ (100%.)

What is a weak acid, and give an example.

- an acid that dissociates <100%. eg. $HF + H_2O \rightleftharpoons F^- + H_3O^+$ (95% / ~5%.)
- an acid (more like 5%.)

What is a concentrated acid, and give an example.

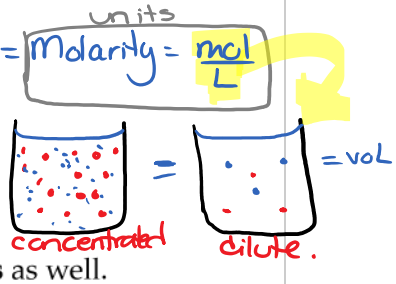
- an acid with a large/high concentration = Molarity = $\frac{mol}{L}$ (units)

eg. 3.0M HCl $\quad HCl \rightarrow H^+ + Cl^-$

What is a dilute acid, and give an example.

- an acid with a low/small concentration

eg. 0.0010M HCl



The terms *strong, weak, concentrated, and diluted* are used for **bases** as well.

6M KOH is concentrated and strong base.

0.0001M KOH is diluted and strong base.

6M CH_3COOH is concentrated and weak acid.

0.0001M CH_3COOH is dilute and weak acid.

Notice that a strong acid can be dilute, and a weak acid can be concentrated.

X) Leveling Effect

If you had a 1M solution of each strong acid, which would be the strongest (which would create the greatest $[H_3O^+]$)?

1 M of $HClO_4$
1 M of HBr
1 M of HNO_3

all the same 'strength' → all dissociate 100%.

Because they all dissociate 100% they will all create equal 1 M $[H_3O^+]$

eg. $HClO_4 + H_2O \rightarrow H_3O^+ + ClO_4^-$ (1.0M → 1.0M; 100% diss.)

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So what is the leveling effect? The idea that all strong acids are "level" in strength; as they all dissociate 100%.

So what is the leveling effect? The idea that all strong acids are "level" in strength; as they all dissociate 100%.
(the same is true for all strong bases)

What is the strongest acid that actually exists in water? H_3O^+, because all strong acids dissociate to produce it; and it is also the strongest of the weak acids.
strong acid → $H^+ + H_2O \Rightarrow H_3O^+_{(aq)}$

How does this compare with its position on the acid/base table?
H_3O^+ is at the top of the weak acids. That is why all weak acids will favor reactants (when H_3O^+ is a product, rvs rxn is favored)

What is the strongest base that actually exists in water?
- all strong bases dissociate 100% to create OH^-
- OH^- is strongest of weak bases, so all weak base equilibria will favor products.

Practice Questions:

1. Will the K_{eq} be greater or less than 1 for the following equilibrium? Why?

$HSO_4^- + NH_3 \Leftrightarrow SO_4^{2-} + NH_4^+$
A B B A

HSO_4^- is the stronger acid.

(weak acid side is always favored)

∴ products will be favored, $K_{eq} > 1$

2. Which acid has the higher $[H_3O^+]$ when reacting with water, HCN or CH_3COOH? Why?
CH_3COOH is the stronger, weak acid. ∴ it will dissociate more than HCN.
dissociate more = ↑ H^+ = ↑ $[H_3O^+]$

3. Will a reaction occur between NH_2^- and $C_2O_4^{2-}$? Explain why or why not.
NO. NH_2^- is a strong base and $C_2O_4^{2-}$ is a weak base
Both BASES ∴ no acid to donate a proton H^+ and cause a rxn.

4. Write an equation to show the reaction between NH_2^- and water and explain why products are favoured.

$NH_2^- + H_2O \rightarrow NH_3 + OH^-$
B A (dissociate 100%) A B

products are favored because NH_2^- + H_2O react FULLY (dissoc 100%)
∴ there are no reactants left over... all products.

Assignment 6: Hebden p. 125-126 #21-27, p. 133 #38-46

Quiz includes this