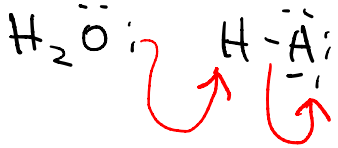
Quiz #3 - Kinetics

- Reaction coordinate diagram
  - ΔH_{rxn}, Ea, transition state, # of steps
- Rate-limiting step
  - Relationship between RLS + rate law
  - Relationship between RLS + stoichiometry and rate law
- Rate law
  - Form: $R = k[\ ]\ldots$
  - Rate
    - definition
    - relating rates in terms of reactants and products
    - Arrhenius expression
      - activation energy
      - temperature
      - "the graph" (energy distribution)
- Experimentally determining the rate law
  - Method of initial rates
  - Integrated rate laws (graphs)

Acid-Base

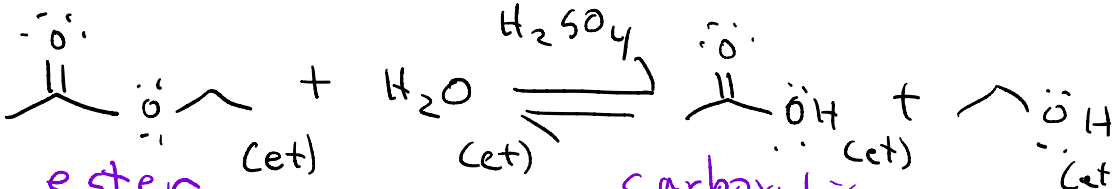
H_3O^+ – hydronium

$HA_{(aq)} \rightleftharpoons H^+_{(aq)} + A^-_{(aq)}$



$$K = \frac{[H_3O^+][A^-]}{[H_2O][HA]} = K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

In water, the H^+ ion is solvated (kept in solution) by more than one water molecule, so the ion H_3O^+ is used more as a convention.



ester

carboxylic acid

$$K = \frac{[\text{ester}][\text{ethanol}]}{[\text{carboxylic acid}][H_2O]}$$

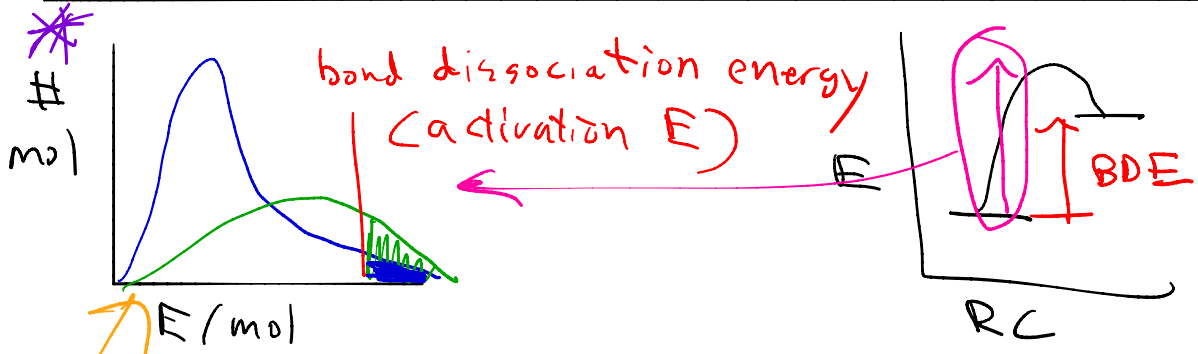
Since ethanol is the solvent, water's concentration is included.

neutral : $[H^+] = [OH^-]$ (just like pure water)

Defining neutral as pH = 7 is only true at exactly one temperature. For example, the pH of water at 0°C is 7.47.

Whether a substance is an acid or base is not necessarily dependend on pH.

This is neutral water.



$H_2O_{(l)} \rightleftarrows [H^+]_{aq} + [OH^-]_{aq}$

$K_w = [H^+][OH^-]$ $\quad [H^+] = [OH^-]$ neutral

$K_w = [H^+]^2$

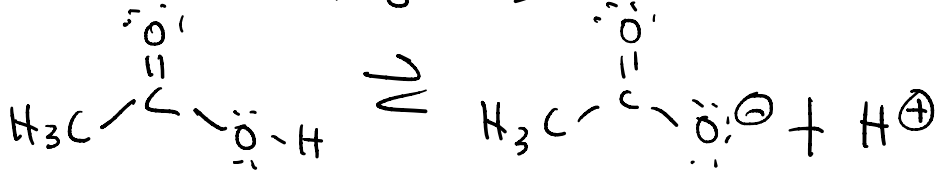
K_w @ 25°C $= 1.0 \times 10^{-7} \rightarrow$ pH = 7

K_w @ 0°C $< 1.0 \times 10^{-7}$ $\quad [H^+] \downarrow$ pH ↑

Water is still neutral!!

$DØ11!$DØ
command try not defined

Acid-base conjugates



acid — conjugate base

conjugate acid — base

An acid base conjugate pair is a pair of substances that differ only by an H^+ ion.

The strengths of an acid and its conjugate base are inversely proportional.

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monoprotic – a substance that has one dissociable H^+ example: HNO_3

diprotic → two reactive H^+ → H_2SO_4

triprotic → three reactive H^+ → H_3PO_4

polyprotic → more than one H^+