HELLENIC REPUBLIC
UNIVERSITY OF CRETE

Academic English

Section 1: Introduction to Acids and Bases

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Characteristic of Acids

- React with metals to give hydronium ions H+

  $HCl\ (aq) + Mg \longrightarrow MgCl\ (aq) + H_2(g)$
- Taste sour (e.g. citrus fruit)
- React with indicators to turn litmus paper red
- pH values less than 7
- React with C to give carbon dioxide gas
- React with sulfites to produce sulfur dioxide gas
- React with sulfides to produce hydrogen sulfide
- Neutralize bases to produce water and salt

Characteristics of Bases

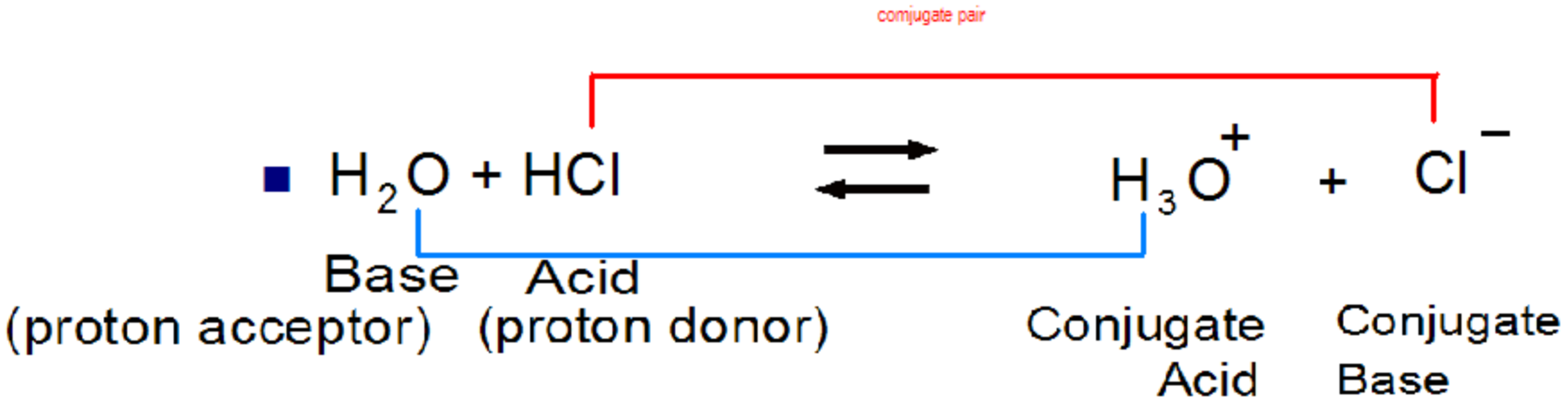
- Feel slippery in aqueous state
  - React with fat ⟶ soap (saponification)
- Taste bitter (e.g. Ionic water)
- pH values greater than 7
- Neutralize acids to produce water and salt

Arrhenius Definition

- Acids ionize in aqueous solutions and produce hydrogen ions, thus increase the concentration of protons in this solution
  - $HNO_3 \longrightarrow H^+(aq) + NO_3^-(aq)$
- Bases ionize and produce hydroxide ions thus increasing the concentration of OH in the solutions
  - $KOH \longrightarrow K^+ + OH^-$

Bronsted-Lowry Definition

- Acids are proton donors
  - monoprotic
  - diprotic
  - aprotic
- Bases are proton acceptors

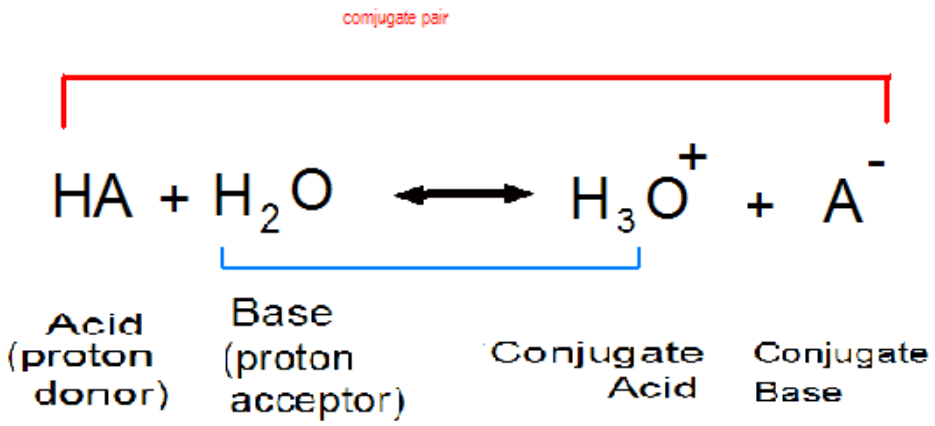


Conjugate pairs

- When both forward and backward reaction involve hydrogen transfer
- An acid will always have a conjugate base
- A base will always have a conjugate acid
- The stronger the acid the weaker the conjugate base
- The stronger the base the weaker the conjugate acid

Acid strength

- The strength of an acid refers to its ability or tendency to lose a proton (H+). (it's not the same as concentration)
- A strong acid is one that completely ionizes (dissociates) in a solution.
- E.g. in water, one mole of a strong acid HA dissolves yielding one mole of H+ (as hydronium ion H3O+) and one mole of the conjugate base, A−.
- Generic formula:



Strong Acids

- hydrochloric **acid** (HCl)
- hydroiodic **acid** (HI)
- hydrobromic **acid** (HBr)

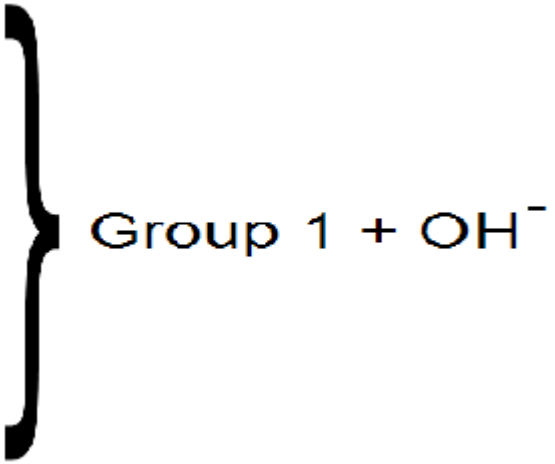
- perchloric **acid** (HClO4)
- nitric **acid** (HNO3)
- sulfuric **acid** (H2SO4)

NB. FOR OXOACIDS

- The greater the number of oxygen atoms the stronger the acid

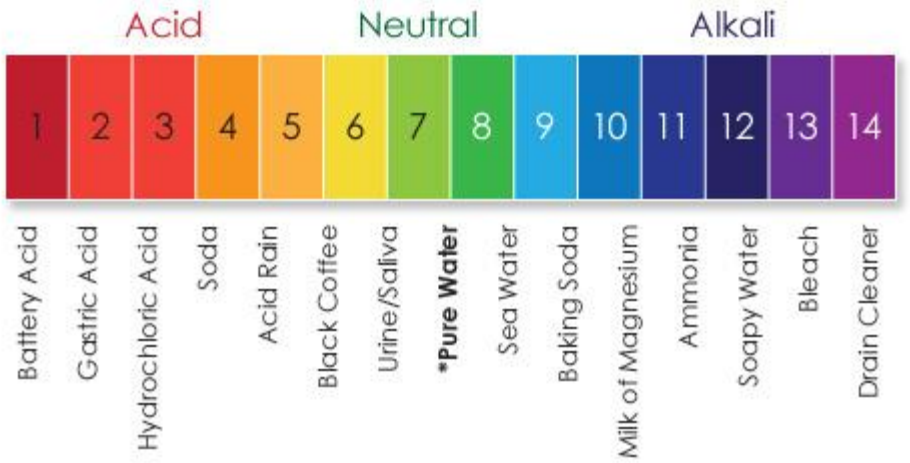
Strong Bases

- LiOH lithium hydroxide
- NaOH sodium hydroxide
- KOH potassium hydroxide
- RbOH rubidium hydroxide
- CsOH cesium hydroxide
- Ca(OH)2 calcium hydroxide
- Ba(OH)2 barium hydroxide
- Sr(OH)2 strontium hydroxide



pH scale

- Simplified method for stating the concentration of an acid or base
- The lower the pH values the stronger the acid



Acid base Titration

- Volumetric technique
- To find the concentration of an acid by slowly adding a known concentration of a base (or vice versa) by measuring the amount of “titrant” it takes to neutralize the acid (or base).

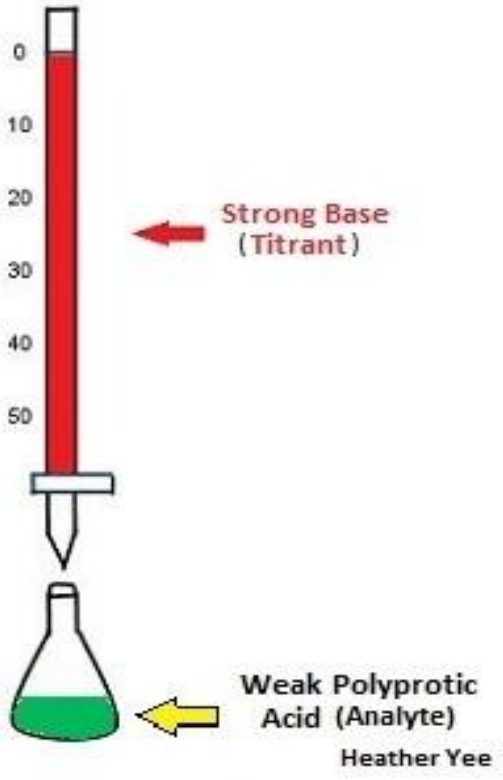


Figure 2. Setup of a Titration. Like any other titration, this case includes both an analyte and titrant. The weak polyprotic acid, or the analyte (in green), is titrated with the strong base, or the titrant (in red). Image created by Heather Yee.

References

- Meyers, R. (2003). *The Basics of Chemistry*. Greenwood Press. p. 156.
- H. L. Finston and A. C. Rychtman, (1983) A New View of Current Acid-Base Theories, John Wiley & Sons, New York, p. 140–146.

End of Section

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