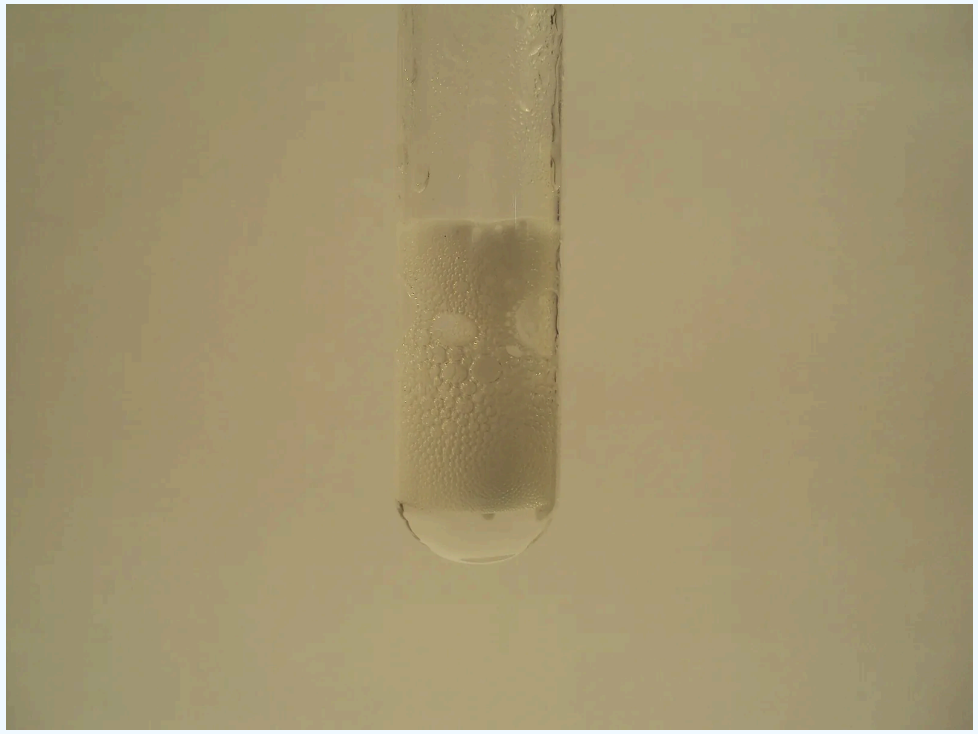
Chemistry 20

Unit C: Solutions and acid-base chemistry

Acid strength and polyprotic acids

Same concentration, different fizz

- At 0.10 mol·L^{-1}, hydrochloric acid ionizes completely and ethanoic acid ionizes only partly.
- The hydrochloric acid sample has the lower pH, the faster reaction with carbonate, and the higher conductivity.



Strength is the fraction ionized

- NaOH dissociates fully, while NH_3 ionizes only partly, so the strong base has more hydroxide and higher conductivity at equal concentration.
- After the strong-weak comparison, you will count how many protons HCl, H_2SO_4, H_3PO_4, NaOH, and carbonate can transfer.

Key terms

strong acid

An acid that ionizes completely in water, so the dissolved amount becomes hydronium and the anion. ($HCl(aq)$)

weak acid

An acid that ionizes only partly in water, so most of the molecules remain intact. ($CH_3COOH(aq)$)

polyprotic acid

An acid that can donate more than one proton, and does so in steps, with the first step more complete. (H_2SO_4)

Monoprotic and polyprotic acids

- Monoprotic HCl donates one proton, and monoprotic NaOH supplies one OH^-.
- Polyprotic H_2SO_4 and H_3PO_4 can donate more than one proton in steps, and CO_3^{2-} can accept more than one.

Mono- vs polyprotic

Monoprotic 

$HCl \longrightarrow H^+ + Cl^-$ (one H^+)

$NaOH \longrightarrow Na^+ + OH^-$ (base, one OH^-)

Polyprotic 

$H_2SO_4 \longrightarrow HSO_4^- \longrightarrow SO_4^{2-}$ (2 steps)

H_3PO_4: up to 3 H^+, one at a time

Polyprotic base: CO_3^{2-} can accept 2 H^+

Sulfuric acid in two steps

- H_2SO_4 donates a proton completely to form HSO_4^-, then HSO_4^- donates a second proton only partly.
- HCl donates one proton and stops, so hydrochloric acid is mono-protic.

Monoprotic and polyprotic bases

- NaOH supplies one OH^-, so it is a monoprotic base.
- CO_3^{2-} can accept more than one proton, so carbonate is a polyprotic base.

Retrieval of strength and proton count

- At 0.10 mol·L^{-1}, compare HCl and ethanoic acid on pH, carbonate rate, and conductivity.
- Classify H_3PO_4 and NaOH as polyprotic or monoprotic.

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