Unit 3 starts Today! September 30th

- CK3 on Oct 23rd
- acid/base reaction chemistry
- Oxidation-reduction rxns

Tuesday Oct 1 → Expt 6

Acid Nomenclature

$HCl(aq)$* hydrochloric acid

*not to be confused w $HCl(aq)$ a covalent-molecular called hydrogen chloride

$HClO(aq)$ hypochlorous acid

$HClO_2(aq)$ chlorous acid

$HClO_3(aq)$ chloric acid

$HClO_4(aq)$ perchloric acid

$HNO_3(aq)$ nitric acid

$HNO_2(aq)$ nitrous acid

$H_2SO_4(aq)$ sulfuric acid

$H_2SO_3(aq)$ sulfurous acid

$H_3PO_4(aq)$ phosphonic acid

$H_3PO_3(aq)$ phosphorous acid

Associated anions

Cl^- chloride

ClO^- hypochlorite

ClO_2^- chlorite

ClO_3^- chlorate

ClO_4^- perchlorate

NO_3^- nitrate

NO_2^- nitrite

6 strong acids

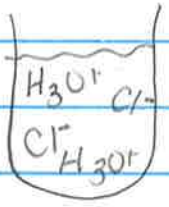
$HCl(aq) + H_2O(l) \xrightarrow{100\%} H_3O^+(aq) + Cl^-(aq)$ (hydronium ion)

$HBr(aq)$

$HI(aq)$

$HNO_3(aq)$

$HClO_4(aq)$



strong acids are all strong electrolytes

$H_2SO_4(aq) + H_2O \xrightarrow{100\%} H_3O^+(aq) + HSO_4^-(aq)$

weak acids:

$HF(aq) + H_2O \underset{99+\%}{\overset{<1\%}{\rightleftharpoons}} H_3O^+(aq) + F^-(aq)$

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*weak electrolytes $HC_2H_3O_2(aq)$

Bases → forms a ionic hydroxide, OH^- in solution

Strong Bases

$LiOH(aq) \xrightarrow{100\%} Li^+(aq) + OH^-(aq)$

$NaOH(aq)$

$KOH(aq)$

sparingly soluble:

$Ca(OH)_2(aq) \xrightarrow{100\%} Ca^{2+}(aq) + 2OH^-(aq)$ strong electrolyte

→ $Sr(OH)_2$

$Ba(OH)_2$

Weak Bases

$NH_3(aq) + H_2O \underset{>99\%}{\overset{<1\%}{\rightleftharpoons}} OH^-(aq) + NH_4^+(aq)$

Acid Base Reactions (arrow goes → 100% to the right)

*strong acid + strong base → ~~←~~ ~~⇌~~

$HCl(aq) + NaOH(aq) \longrightarrow H_2O + NaCl(aq)$

H_3O^+ Cl^- Na^+ OH^- $\longrightarrow 2H_2O(\ell) + Na^+(aq) + Cl^-(aq)$

$H_3O^+(aq) + OH^-(aq) \longrightarrow 2H_2O(\ell)$

*weak acid + strong base

$HC_2H_3O_2(aq) + LiOH(aq) \xrightarrow{100\%} H_2O(\ell) + LiC_2H_3O_2(aq)$

weak acid — strong base

ionic $HC_2H_3O_2(aq)$ $Li^+(aq)$ $OH^-(aq) \longrightarrow Li^+(aq)$ $C_2H_3O_2^-(aq)$

net ionic $HC_2H_3O_2(aq) + OH^-(aq) \longrightarrow H_2O(\ell) + C_2H_3O_2^-(aq)$

LEO says GER
↳ loss of e⁻ is oxidation ↳ gain of e⁻ is reduction

Oxidation & Reduction

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loses 3e⁻ per Al — OXIDATION

$3Cu^{2+}(aq) + 2Al(s) \longrightarrow 3Cu(s) + 2Al^{3+}(aq)$

gains 2e⁻ per Cu — REDUCTION

*scale up to least common multiple!

Balance electrons lost w/ electrons gained

362 mL 0.100 M Cu^{2+} → what mass of Al(s) is required?
→ what mass of Cu(s) is produced?
→ what is the $[Al^{3+}]$ after the rxn?
[n = M·V]
→ given we used 4.95 g Al, what is the LR?

* what was oxidized and what was reduced?

$2MnO_4^-(aq) + 5SO_3^{2-}(aq) \longrightarrow 2Mn^{2+}(aq) + 5SO_4^{2-}(aq)$

Mn: +7, −2 → +2 ; S: +4, −2 → +6, −2

2e⁻ OX — oxidized

reduced — ↳ 5e⁻ reduction

- sulfite got oxidized
- permanganate got reduced

* Rules for assigning oxidation numbers.

1. All neutral elements have oxidation numbers = 0
   ↳ Al, Cu, Fe, Na, Cl_2, Br_2, O_2
2. Simple ions with one element/atom have oxidation numbers = charge.

$3Cu^{2+} + 2Al \longrightarrow 3Cu + 2Al^{3+}$

OX# +2 0 0 +3

3. In polyatomic ions and neutral compounds, oxygen is usually (−2) and hydrogen is usually (+1)
   ↳ Group I is usually +1, II .... +2, etc.
   ↳ $6Li + N_2 \longrightarrow Li_3N$ (0, 0, +1, −3)
4. The sum of the oxidation numbers = charge on the ion or = 0 for neutral compounds