8.2 Properties of Acids / Bases

acids → $H^+(aq)$

bases → neutralize acids to produce H_2O

include:
- metal oxides / hydroxides
- ammonia
- soluble carbonates (Na_2CO_3 / K_2CO_3)
- hydrogencarbonates ($NaHCO_3$ / $KHCO_3$)

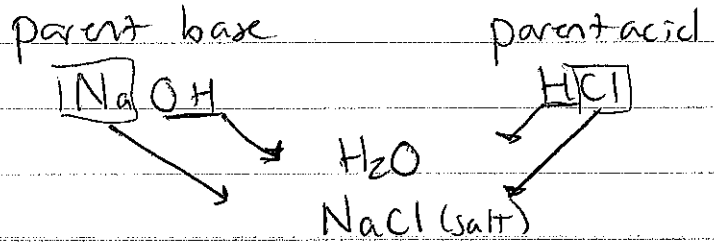
soluble bases (alkalis) → when dissolved in H_2O → release OH^-

ex: $K_2O(s) + H_2O(l) \rightarrow 2K^+ + 2OH^-$

$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$

Fig 8.2

Reactions:



1) Acid + metal → salt + hydrogen

$2HCl(aq) + Zn(s) \rightarrow ZnCl_2(aq) + H_2(g)$

net ionic equation + spectator ions

$2H^+ + \cancel{2Cl^-} + Zn(s) \rightarrow Zn^{2+} + \cancel{2Cl^-} + H_2(g)$

net rxn: $2H^+(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + H_2(g)$

★ why acids have corrosive properties

reactivity ranges w/ metals: alkalis → explosive

transition → less to none

2) Acid + Base → salt + H_2O

neutralization rxn:

$HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

net ionic:

$H^+_{(aq)} + \cancel{Cl^-_{(aq)}} + \cancel{Na^+_{(aq)}} + OH^-_{(aq)} \rightarrow \cancel{Na^+_{(aq)}} + \cancel{Cl^-_{(aq)}} + H_2O_{(l)}$

$\therefore H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

enthalpy of neutralization: ΔH_{neut} occurs when acid & base react to form 1 mole H_2O

SA + SB → $\Delta H = -57\ kJ\ mol^{-1}$

use: add weak bases (lime / antacids) to neutralize acids (acidic soil / acid indigestion)

3) Acid + carbonate → salt + H_2O + CO_2

$2HCl_{(aq)} + CaCO_{3(s)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

net ionic:

$2H^+_{(aq)} + \cancel{2Cl^-_{(aq)}} + \cancel{Ca^{2+}_{(aq)}} + CO_3^{2-}_{(aq)} \rightarrow \cancel{Ca^{2+}_{(aq)}} + \cancel{2Cl^-_{(aq)}} + H_2O_{(l)} + CO_{2(g)}$

$2H^+_{(aq)} + CO_3^{2-}_{(aq)} \rightarrow H_2O_{(l)} + CO_{2(g)}$

• effervescence: rxn of acids where (g) is being released

Distinguished using indicators

acid / base indicators: change colors (reversibly) according to $[H^+]$ in soln → pH determination

ex: litmus ~~red~~ acid (pink) base (blue) does not distinguish strenght

(section 22 → list of indicators)

• Many are derived from natural substances
• universal indicator: mixed of several indicators ∴ change color many times → measure pH ($[H^+]$)

A/b titrations → neutralization rxns

used to calc exact conc of acid / base

Add 1 known (std) soln to another → carefully measured → equivalence pt. → pt. of neutralization

~~ideal~~ indicator → choosen to change at appropriate pH