Reaction of Acids and Bases with Metals

Acids react with metals to form salt and hydrogen

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

(metal + acid $\longrightarrow$ salt + hydrogen)

$Zn(s) + 2HNO_3(dil) \rightarrow Zn(NO_3)_2(aq) + H_2(g)$

$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

$Zn(s) + CH_3COOH(aq) \rightarrow (CH_3COO)_2Zn(aq) + H_2(g)$

When a base reacts with a metal, hydrogen gas is evolved and a salt is formed which has a negative ion composed of the metal and oxygen.

eg: $Zn + NaOH \longrightarrow Na_2ZnO_2 + H_2$

metal base sodium zincate

$CaCl_2$ Ca^{2+} Cl^- $AlCl_3$ Al^{3+} Cl^-

$AB \rightarrow$

$A_xB_y \rightarrow A^{y+} \; B^{x-}$ A_xB_y $Na_2(ZnO_2)_1$ anion

cation anion $(Na^+)\boxed{ZnO_2^{2-}}$

6-1

Li

Na

K

Rb

Cs

$(Na^{2+} \; Na^{3+})$ X $Na_2(ZnO_2)_1$

However such reactions are not possible with all metals

Be Sn Ga Al Zn Pb

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Reaction of Metal carbonates and metal hydrogencarbonates with acid

Metal carbonates / Metal hydrogen carbonate + acid

$\longrightarrow$ salt + CO_2 + H_2O

eg:

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

Test for carbon dioxide:

On passing CO_2 through lime water, it turns milky

$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$

Lime water — white ppt.

Passing excess of CO_2 through it, milkiness dissapears

$CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2(aq)$

(soluble in water)

Reaction of acids and bases with each other

Acids and bases react with each other to form salt and water. This reaction is known as neutralisation reaction.

acid + base $\longrightarrow$ salt + water

eg: $NaOH + HCl \rightarrow NaCl + H_2O$

Reaction of acids with metallic oxides

Metal oxide + acid $\rightarrow$ salt + water.

eg: $CuO + 2HCl \rightarrow CuCl_2 + H_2O$

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copper (II) oxide — copper (II) chloride (Blue - green)

Since metallic oxides react with acids to give salt and water, similar to the reaction of a base with an acid, metallic oxides are said to be basic oxides.

Reaction of non-metallic oxides with Base

Base + non metallic oxide → salt + water.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

$Ca(OH)_2 + H_2CO_3 \rightarrow CaCO_3 + 2H_2O$

base — acid — salt

Since non-metallic oxides react with bases to give salt and water, similar to reaction of an acid with a base, non-metallic oxides are said to be acidic.