Arrhenius Theory

Acid

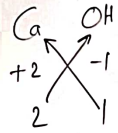
① HCl (hydrochloric acid) $\xrightarrow[\text{dissociation}]{\text{Water}} \boxed{H^+} + Cl^-$

② H_2SO_4 (Sulfuric acid) $\xrightarrow[\text{dissociation}]{\text{Water}} \boxed{2H^+} + SO_4^{2-}$

Bases.

① $NaOH$ (Sodium hydroxide) $\xrightarrow[\text{dissociation}]{\text{Water}} Na^+ + \boxed{OH^-}$

② $Ca(OH)_2$ (Calcium hydroxide) $\xrightarrow[\text{dissociation}]{\text{Water}} Ca^{2+} + \boxed{2OH^-}$



Concentration of acid and base.

Solution

Solute

Solvent.

Molarity (M)

$$\text{Molarity} = \frac{\text{No. of moles of solute}}{\text{Volume of solution.}}$$

= mol per litre

↓

Molar

Solute.			Quantity of solute		Vol. of solution	Conc. of solution.	
A	B	C	D	$E = \frac{D}{C}$	F	$G = \frac{D}{F}$	$H = \frac{E}{F}$
Name	Mol. formula	Mol.	Gram (g)	Mole (mol)	Litre (L)	Gram/Litre (g/L)	Molarity (mol/L)
Sodium chloride	NaCl	58.5 u	117 g	2 mol.	2 L	58.5 g/L	1 mol/L.
Sodium hydroxide	NaOH	40 u	60 g	1.5 mol	2 L	30 g/L	0.75 mol/L
				$\frac{117}{58.5} = \frac{1170}{585}$		$\frac{117}{2}$	$= \frac{2}{2} =$
						$\frac{60}{2}$	$\frac{1.5}{2}$

$$58.5$$
$$2\overline{)117}$$
$$-10$$
$$17$$
$$-16$$
$$10$$
$$-10$$
$$0$$

$$NaCl = (1 \times 23) + (1 \times 35.5)$$
$$= 23 + 35.5$$
$$= 58.5 \text{ u.}$$

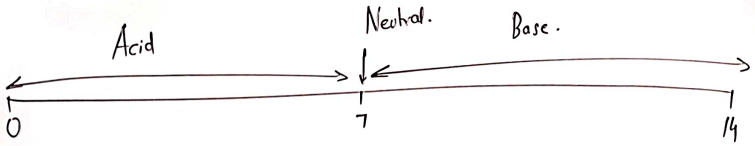
$$NaOH = (1 \times 23) + (1 \times 16) + (1 \times 1)$$
$$= 23 + 16 + 1$$
$$= 40$$

$$\text{No. of moles} = \frac{\text{Mass}}{\text{Mol. mass}}$$

$$1.5 = \frac{\text{Mass}}{40}$$

$$\text{Mass} = 40 \times 1.5$$
$$= 15 \times 4$$
$$= 60$$

pH of solution.



Acid = Red litmus to blue.

Base = Blue litmus turns red.

Reaction of acid and base.

1] Neutralization Reaction

Base → Salt + Water

① $HCl + NaOH \longrightarrow NaCl + H_2O$

Sodium chloride

$H^+ \; Cl^- + Na^+ \; OH^- \longrightarrow NaCl + H_2O$

H_2O

$H^+ \quad OH^-$

② $HNO_3 + KOH \longrightarrow KNO_3 + H_2O$

nitric acid — potassium hydroxide — potassium nitrate — water

$H^+ \; NO_3^- \quad K^+ \; OH^- \longrightarrow K^+ \; NO_3^- + H^+ \; OH^-$

2) Reaction of acid with metals

Metal + Dilute Acid → Salt + Hydrogen

① $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

Mg^{2+} H^+ Cl^-

② $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

$Zn^{2+} + 2H^+ \; SO_4^{2-} \longrightarrow Zn^{2+} \; SO_4^{2-} + 2H^+$

Mg Cl
+2 -1
2 1

day

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3] Reaction of acids with oxides of metal

Metal oxide + Dilute Acid → Salt + Water

① $CaO + 2HCl \longrightarrow CaCl_2 + H_2O$

$Ca^{2+}\ O^{2-} + H^+\ Cl^- \longrightarrow Ca^{2+}\ Cl^- + H^+\ OH^-$

Ca Cl
+2 -1
2 1

② $MgO + 2HCl \longrightarrow MgCl_2 + H_2O$

$Mg^{2+}\ O^{2-}\ \ 2H^+\ 2Cl^- \longrightarrow Mg^{2+}\ 2Cl^- + H^+\ OH^-$

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4] Reaction of bases with oxides of non metal

Non Metal oxide + base → Salt + Water

④ ④

① $CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$

Na CO_3
+1 -2
1 2

② $CO_2 + 2KOH \longrightarrow K_2CO_3 + H_2O$

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5] Reaction of acids with Carbonate of metals

Carbonate salt of metal + dilute acid ⟶ another salt of metal + $CO_2 + H_2O$

① $Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$

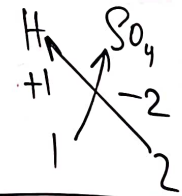
$2Na^+ \; CO_3^{2-} + 2H^+ \; 2Cl^- \longrightarrow 2Na^+ \; 2Cl^- + CO_2 + H^+ \; OH^-$

② $Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + CO_2 + H_2O$

$2Na^+ \; CO_3^{2-} + 2H^+ \; SO_4^{2-} \longrightarrow 2Na^+ \; SO_4^{2-} + CO_2 + H^+ \; OH^-$

Carbonate
↓
CO_3^{2-}

Bicarbonate
HCO_3^-



① Metal
② Non metal
③ Oxygen
④ Hydrogen.

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6) Reaction of acids with bicarbonate metals

Bicarbonate salt of metal + dilute acid ⟶ another salt of metal + $CO_2 + H_2O$

① $NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

$Na^+ HCO_3^- + H^+ Cl^- \longrightarrow Na^+ Cl^- + CO_2 + H^+ OH^-$

② $KHCO_3 + HNO_3 \longrightarrow KNO_3 + CO_2 + H_2O$

nitric acid

potassium nitrate

$K^+ HCO_3^- + H^+ NO_3^- \longrightarrow CO_2 + H^+ OH^-$

Carbonate

CO_3^{2-}

Bicarbonate

HCO_3^-

① Metal
② Non metal
③ Oxygen
④ Hydrogen.

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Salts.

Types of Salt

- Acidic
- Neutral
- Basic.

Acid	Base	Salt
Strong	Strong	Neutral.
Strong	Weak	Acidic
Weak	Strong	Basic
Weak	Weak.	Neutral.

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Water of Crystallisation.

$$CuSO_4 \cdot 5H_2O \xrightarrow{\text{Heat}} CuSO_4 + 5H_2O$$

(Blue) (White)

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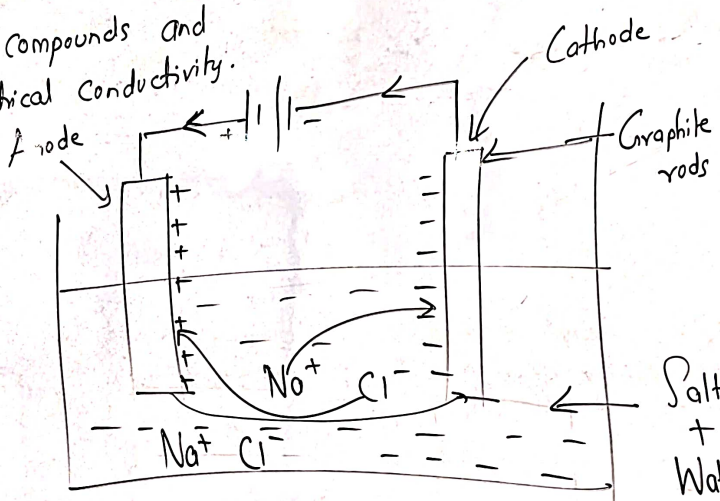
Ionic compounds and electrical conductivity.



Na^+ = Cathode
(Cation)

Cl^- = Anode
(Anion)