Redox In Daily Life

- Photosynthesis
- Extraction of metals
- Combustion process
- Electrochemical cells

OXIDATION

Classical Theory

Addition of oxygen or removal of hydrogen from a substance.

$$C + O_2 \rightarrow CO_2 + \text{Heat}$$

Modern Theory

1) Oxidation is loss of electrons.
2) They are considered as reducing agents.
3) Lower oxidation number.

REDUCTION

Classical Theory

Removal of oxygen or addition of hydrogen from a substance.

$$H_2 + S \rightarrow H_2S$$

Modern Theory

1) Reduction is gain of electrons.
2) They are considered as oxidising agents.
3) Increases Oxidation Number.

Oxidation Number

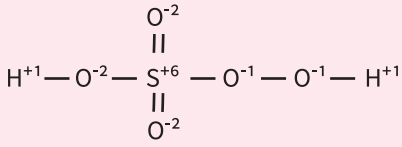
It indicates the number of electron gained or lost by a particular atom.

Rules for Arranging Oxidation Number

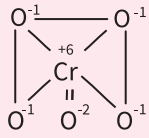
a) Oxidation Number in elemental state is always O.
b) Oxidation Number of monoatomic ions is equal to charge on ion
c) Oxidation Number of oxygen in most of the compound is -2.
d) Oxidation Number of hydrogen is +1, except when it is bonded to metals in binary compounds.
e) Halogens have an oxidation number of -1, when they occur as halide ions in their compounds.
f) Algebraic sum of oxidation number of all the atoms in a neutral compounds must be zero.

Oxidation Numbers by Structure

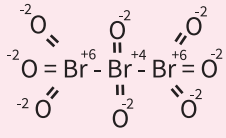
a) Caro's acid (H_2SO_5)



b) Chromium (VI) peroxide



c) (Br_3O_8)



7. REDOX REACTIONS

TYPES OF REDOX REACTIONS

Combination Reaction	Two reactants combine to form single product. $H_{2(g)} + O_{2\,(g)} \rightarrow H_2O_{(l)}$
Decomposition Reaction	Breakdown of a compound into two or more compounds. $CaCO_{3\,(s)} \rightarrow CaO_{(s)} + CO_{2\,(g)}$
Displacement Reaction	An ion/atom in a compound, is replaced by an ion/atom of another elements. $CuSO_{4\,(aq)} + Zn_{(s)} \rightarrow ZnSO_{4\,(aq)} + Cu$
Disproportionation	An element in one oxidation state is simultaneously oxidised and reduced. $2H_2O_{2\,(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

BALANCING REDOX REACTION

1. OXIDATION NUMBER METHOD

STEPS

1. Write the correct formula of the reaction
2. Identify atoms undergoing change in oxidation number
3. Calculate increase or decrease in oxidation number per atom for entire ion or molecule. If unequal, multiply by suitable number to make equal.
4. Add H^+/OH^- ion to make total ionic charges of reactants and product equal
5. Equalize H^+ on two sides by adding water.

2. HALF REACTION METHOD

STEPS

1. Seperate equation into two half reaction.
2. Balance atoms other than O and H
3. For reaction occuring in acidic medium, add H_2O to balance O atoms and H^+ to balance H atoms.
4. Balance charges by adding e^- to one side of the half reaction.
5. Add two half reactions and cancel the electron on each side.

CALCULATION OF n - FACTOR

n - factor of oxidising agent/reducing agent
= Change in oxidation number per molecule

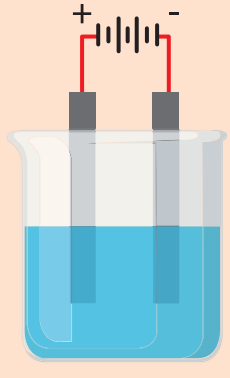
$+7\ MnO_4^{4-}$ — Change = 5 × 1 → $+7\ Mn^{2+}$ $(n_f = 5)$

$+3\ C_2O_4^{2-}$ — Change = 1 × 2 → $+4\ CO_2$ $(n_f = 2)$

ELECTRO-CHEMICAL SERIES

A series of electrode potentials on half cells arranged in order of their increasing standard oxidation potentials or in the decreasing order of their standard reduction potential.

APPLICATION



Study of electrode processes and cells

GALVANIC CELL