

KARACHI EDU COACHING CENTER

Chapter 7: Electrochemistry

High-Detail Masterclass Notes for Class IX Chemistry (STBB Board)

Oxidation and Reduction Fundamentals

Core definitions of redox reactions based on electron transfer and oxidation state changes.

Oxidation Process

Loss of electrons: e.g., $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^{-}$

Addition of oxygen: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Removal of hydrogen: $\text{H}_2\text{S} + \text{Cl}_2 \rightarrow \text{S} + 2\text{HCl}$

Reduction Process

Gain of electrons: e.g., $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$

Removal of oxygen: $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$

Addition of hydrogen: $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

Rules for Assigning Oxidation Numbers

Standard criteria to determine the apparent charge on atoms in chemical species.

Free Elements

Oxidation number of uncombined elements is always zero (e.g., H_2 , Na, Cl_2).

Hydrogen & Oxygen

Hydrogen is usually +1 (except metal hydrides); Oxygen is usually -2 (except peroxides).

Neutral Compounds

The algebraic sum of all oxidation numbers in a neutral molecule equals zero.

Electrochemical Cells: Galvanic vs. Electrolytic

Conversion between chemical energy and electrical energy in systems.

Galvanic / Voltaic Cell

Energy conversion: Chemical to Electrical energy

Spontaneity: Spontaneous redox reaction ($\Delta G < 0$)

Example: Daniell cell, Dry cell battery

Electrolytic Cell

Energy conversion: Electrical to Chemical energy

Spontaneity: Non-spontaneous reaction driven by battery

Example: Down's cell, Electroplating setups

Process of Electrolysis & Industrial Application

Decomposition of electrolytes using electric current and ion migrations.

Electrode Reactions

Anode (Positive): Oxidation occurs here (loss of electrons, anions migrate).

Cathode (Negative): Reduction occurs here (gain of electrons, cations migrate).

Electroplating

Coating a thin layer of superior metal (e.g., silver, gold, chromium) onto a base metal object.

Object acts as cathode; coating metal acts as anode.

Metallic Corrosion and Its Prevention

Electrochemical degradation of metals and methods to protect structural infrastructure.

Rusting of Iron

Electrochemical reaction requiring moisture and oxygen. Fe is oxidized to hydrated iron(III) oxide.

Galvanizing

Coating iron or steel with a protective layer of molten zinc to prevent atmospheric contact.

Sacrificial Protection

Attaching a more reactive metal (like magnesium or zinc) that corrodes instead of the core iron structure.

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Chapter 7 Mastered Successfully

Master redox balancing, cell calculations, and corrosion prevention for your board examinations!

Prepared by Karachi Edu Academic Team