

5. Redox reactions

Oxidation is always accompanied by reduction.

Oxidation: Loss of electron(s) by any species

Reduction: Gain of electron(s) by any species

Oxidising agent (oxidant): Acceptor of electron(s)

Reducing agent (reductant): Donor of electron(s)

Differences between oxidation and reduction

Oxidation	Reduction
It is addition of oxygen	It is removal of oxygen
It is removal of hydrogen	It is addition of hydrogen
It is addition of an electronegative atom/ion	It is removal of an electronegative atom/ion
It is removal of electropositive atom/ion	It is addition of electropositive atom/ion
There is an increase in positive valency	There is a decrease in positive valency
There is a decrease in negative valency	There is an increase in negative valency
Loss of electrons occur	Gain of electrons occur

Oxidation number:

It denotes the oxidation state of an element in a compound.

Rules for the calculation of oxidation state of an element are as follows:

- The oxidation number of the element in the free or the uncombined state is zero.
- For the ions composed of only one atom, the oxidation number is equal to the charge on the ion.
- The algebraic sum of the oxidation number of all the atoms in a compound must be zero.
- For polyatomic ions, the algebraic sum of the oxidation number of all the atoms in a compound must be equal to the charge on the ion.

Balancing of redox reaction:

- Oxidation number method: It is based on the change in the oxidation number of reducing agent and the oxidising agent.
- Half-reaction method (Ion-electron method): The two half-equations are balanced separately and then added together to give a balanced equation.

Redox reactions and electrode processes:

- Redox couple → Oxidised and reduced form of a substance together taking part in an oxidation or reduction half reaction
- Electrode potential → Potential associated with each electrode
- Standard electrode potential → When concentration of each species is unity, pressure is 1 atm, and temperature is 298 K

The standard electrode potential E^0 of hydrogen electrode is 0.00 Volts.

The redox couple with a negative E^0 is a stronger reducing agent than the H^+/H_2 couple.

The redox couple with a positive E^0 is a weaker reducing agent than the H^+/H_2 couple.

Daniell Cell:

