REDOX REACTION (SUMMARY)

1. Redox reactions are those reactions in which oxidation and reduction takes place simultaneously

2. Classical view of redox reactions
   - Oxidation is addition of oxygen / electronegative element to a substance or removal of hydrogen / electropositive element from a substance
   - Reduction is removal of oxygen / electronegative element from a substance or addition of hydrogen / electropositive element to a substance

3. Redox reactions in terms of Electron transfer
   - Oxidation is defined as loss of electrons by any species
   - Reduction is defined as gain of electrons by any species

4. In oxidation reactions there is loss of electrons or increase in positive charge or decrease in negative charge

5. In reduction reactions there is gain of electrons or decrease in positive charge or increase in negative charge

6. Oxidising agents are species which gain one or more electrons and get reduced themselves

7. Reducing agents are the species which lose one or more electrons and gets oxidized themselves

8. Oxidation number denotes the oxidation state of an element in a compound ascertained according to a set of rules. These rules are formulated on the basis that electron in a covalent bond belongs entirely to the more electronegative element.

9. Rules for assigning oxidation number to an atom

- Oxidation number of Hydrogen is always +1 (except in hydrides, it is -1).
- Oxidation number of oxygen in most of compounds is -2. In peroxides it is (-1). In superoxides, it is (-1/2). In OF_2 oxidation number of oxygen is +2.In O_2F_2 oxidation number of oxygen is +1
- Oxidation number of Fluorine is -1 in all its compounds
- For neutral molecules sum of oxidation number of all atoms is equal to zero
- In the free or elementary state, the oxidation number of an atom is always zero. This is irrespective of its allotropic form
- For ions composed of only one atom, the oxidation number is equal t the charge on the ion
- The algebraic sum of the oxidation number of all the atoms in a compound must be zero
- For ions the sum of oxidation number is equal to the charge on the ion
- In a polyatomic ion, the algebraic sum of all the oxidation numbers of atoms of the ion must be equal to the charge on the ion

10. Oxidation state and oxidation number are often used interchangeably

11. According to Stock notation the oxidation number is expressed by putting a Roman numeral representing the oxidation number in parenthesis after the symbol of the metal in the molecular formula

Balancing of redox reactions:

Oxidation Number Method:

Write the net ionic equation for the reaction of potassium dichromate(VI), $K_2Cr_2O_7$ with sodium sulphite,Na2SO3, in an acid solution to give chromium(III) ion and the sulphate ion.

Step 1: The skeletal ionic equation is:

$$Cr_2O_7^{2-}(aq) + SO_3^{2-}(aq) \rightarrow Cr^{3+}(aq) + SO_4^{2-}(aq)$$

Step 2: Assign oxidation numbers forCr and S

$$\overset{+6\ -2}{Cr_2O_7^{2-}}(aq) + \overset{+4\ -2}{SO_3^{2-}}(aq) \rightarrow \overset{+3}{Cr^{3+}}(aq) + \overset{+6\ -2}{SO_4^{2-}}(aq)$$

Step 3: Calculate the increase anddecrease of oxidation number, and make them equal:

$$\overset{+6\ -2}{Cr_2O_7^{2-}}(aq) + 3\overset{+4\ -2}{SO_3^{2-}}(aq) \rightarrow 2\overset{+3}{Cr^{3+}}(aq) + 3\overset{+6\ -2}{SO_4^{2-}}(aq)$$

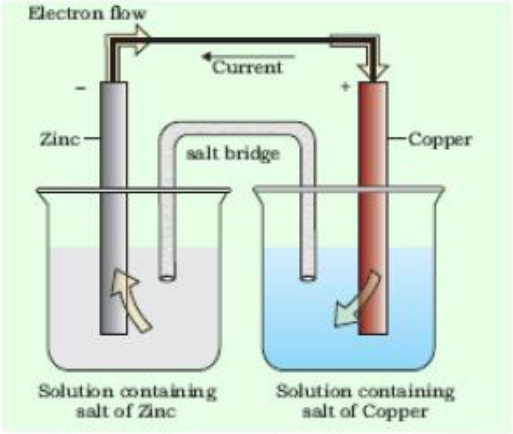
Step 4: Balance the charge by adding H^+as the reaction occurs in theacidic medium,

$$Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq)\ \ 8H^+ \rightarrow 2Cr^{3+}(aq) + 3SO_4^{2-}(aq)$$

Step 5: Balance the oxygen atom by adding water molecule.

$$Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq)\ \ 8H^+ \rightarrow 2Cr^{3+}(aq) + 3SO_4^{2-}(aq) + 4H_2O(l)$$

- Electrochemical cells are the devices which are used to get electric current by using chemical reaction.



Daniell cell having electrodes of zinc and copper dipping in the solutions of their respective salts.

$Zn_{(s)} + Cu^{2+}_{(aq)} \dashrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

The potential associated with eachelectrode is known as **electrode potential**. Ifthe concentration of each species taking partin the electrode reaction is unity (if any gasappears in the electrode reaction, it is confinedto 1 atmospheric pressure) and further thereaction is carried out at 298K, then thepotential of each electrode is said to be the**Standard Electrode Potential**.

- SHE is used to measure electrode potential and its standard electrode potential is taken as 0.00 V.