ARJUNA

JEE AIR 2024

Physical Chemistry

Redox Reaction

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Lecture No.- 01

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(GC Sir)

Topics to be Covered

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- Topic ✓ Oxidation and reduction
- Topic ✓ Oxidant and Reductant
- Topic ✓ Redox Reaction

Topic : Redox Reaction

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Reduction + Oxidation

$X^0 \longrightarrow X^+ + 1e^-$

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Oxidation:

loss of e^- or increases in oxidation number or addition of oxygen or more EN element or removal of hydrogen (classical concept)

Example:

$Na(s) \rightarrow Na^+ + 1e^-$ Oxidation

$O^{-2} \longrightarrow \frac{1}{2}O_2 + 2e^-$ Oxidation

$Mg + \frac{1}{2}O_2 \longrightarrow MgO$ Redox

Charge per atom: +2 −2

Charge per atom

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Reduction :

Gain of e^- or decreases in oxidation number or addition of hydrogen or less EN (classical concept)

Example:

$$O_2 + 4e^- \rightarrow 2O^{-2} \quad \text{Reduction}$$

$$Cl_2 + 2e^- \rightarrow 2Cl^{-1} \quad \text{Reduction}$$

} Half Reaction

$$H_2 + Cl_2 \rightarrow HCl \quad \text{Redox}$$

Oxidation, Reduction

Topic : Oxidant And Reductant

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Substance which oxidise other substance get reduce itself

(Oxidising Agent)

Substance which reduce other substance get oxidise itself

(Reducing Agent)

Topic : Redox Reaction

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(Types of Redox Reaction)

ATDB.uno

Redox reaction → reduction and oxidation both process takes place in the reaction (Simultaneously)

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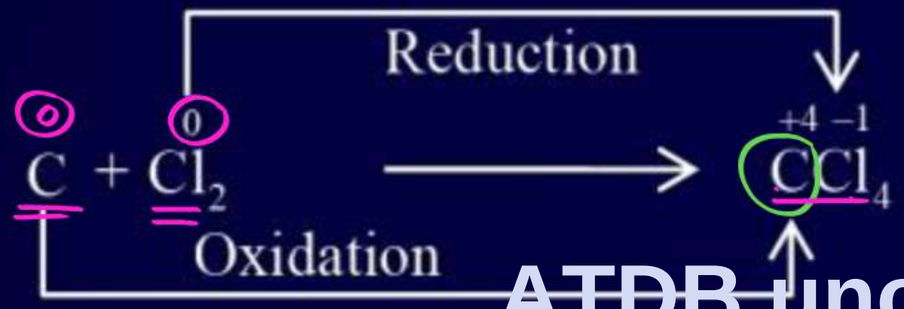
Example:



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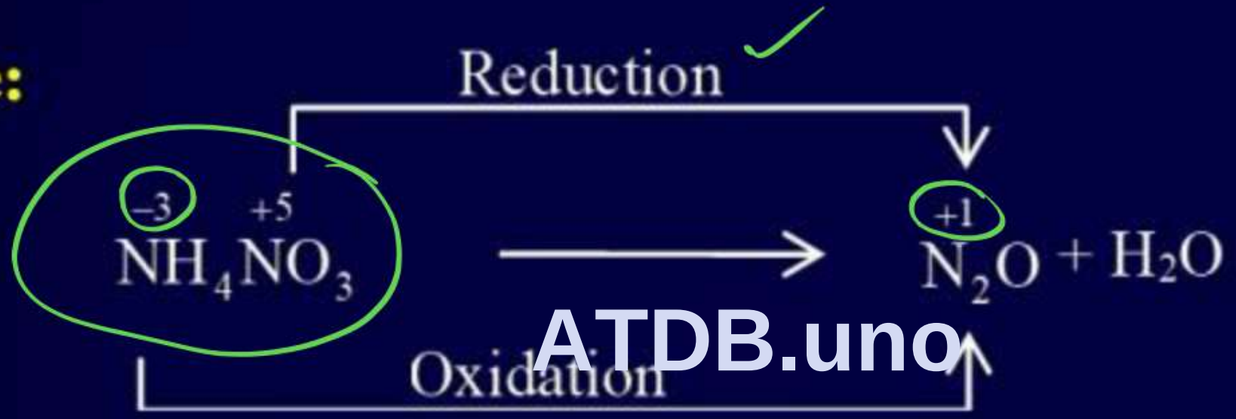
(a) Intramolecular redox Reaction :→ Reduction and oxidation takes place within a molecule

Example:



e.g. NH_4^+ NO_3^-

−3 +4 +5 −2×3

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(b) Intermolecular Redox Reaction :→ Reduction and oxidation takes place in different molecules.

Example:

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Some other type of reaction.

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Combination redox Reaction:

Small element combine and form large molecule.

Intermolecular Redox Reaction.

Thermal decomposition redox Reaction:

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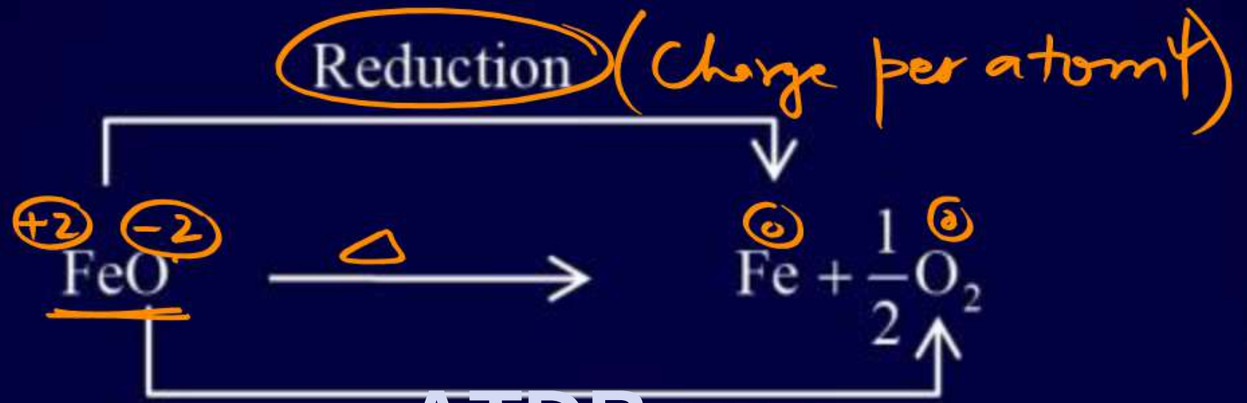

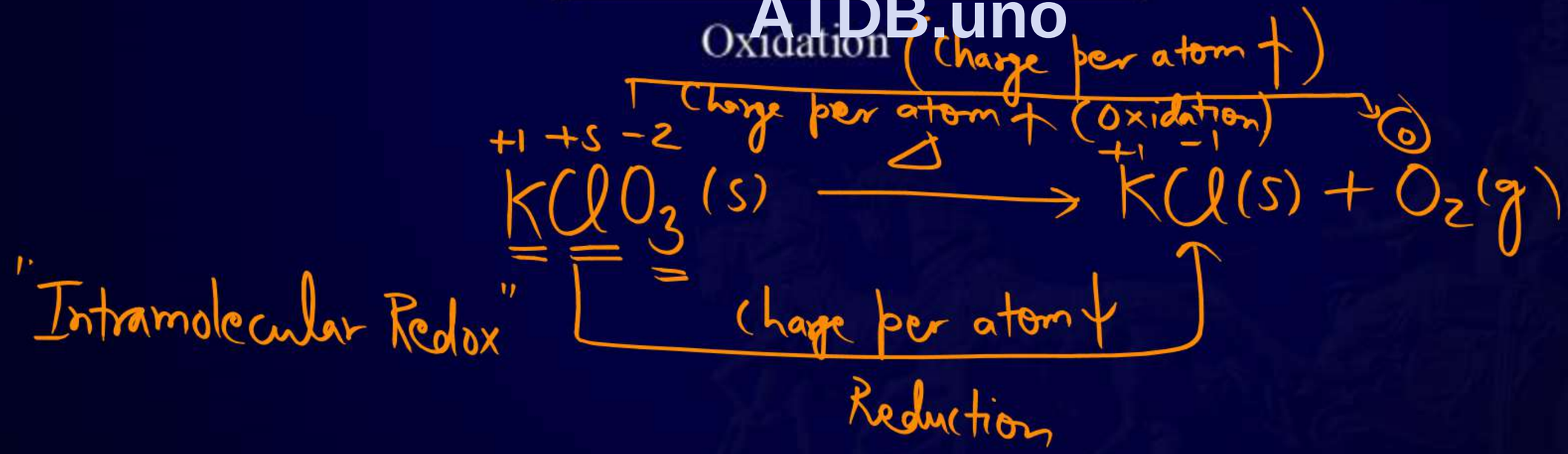

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(1) Metal displacement reaction:

Metal ion displaced by more electropositive metal from their salt solution.

$$\overset{0}{Zn}(s) + \overset{+2}{Cu}SO_4(aq) \longrightarrow \overset{+2}{Zn}SO_4(aq) + \overset{0}{Cu}(s)$$

Oxidation

Reduction

Intermolecular redox Reaction

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(2) Non – metal displacement reaction:

Non-metal displaced by more electropositive metal or more electronegative non-metal

$$Na(s) + H_2O \longrightarrow Na_2O + H_2(g) \uparrow$$

$$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2 \quad (g) \uparrow$$

$$F_2 + H_2O \longrightarrow HF + O_2(g) \uparrow$$

F is more electro negative than O

Intermolecular Redox reaction

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(f) Disproportion reaction:

Redox reaction in which an element from same oxidation state is converted into different oxidation state is called disproportionation reaction when non-metal reacts with strong alkali reaction shows disproportionation reaction.

(i) $\overset{0}{P_4(s)} + \underset{+1\ -2\ +1}{NaOH\,(aq)} \xrightarrow[\text{Of } CO_2]{\text{Inert atmp}} \overset{-3}{PH_3} + \underset{+1\quad +1\quad -1}{NaH_2PO_2}$

Reduction

Oxidation

(ii) $Cl_2 \xrightarrow{\text{Basic}} Cl^- + ClO_3^-$

$H_2PO_2^-$

$2(+1) + x + 2(-2) = -1$

$x = +1$

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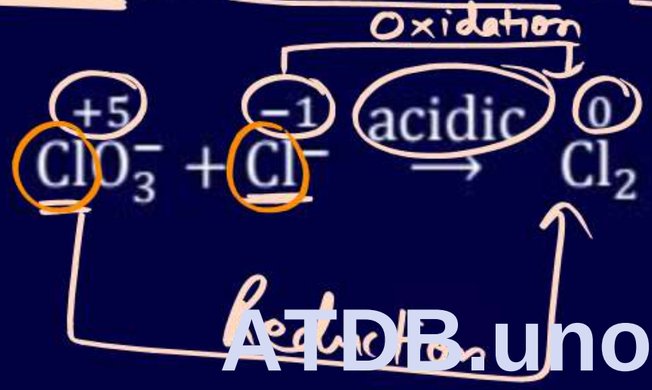
(g) Comproportionation Reaction:

Reverse of disproportionation Reaction, Redox Reaction in which different oxidation state of an element is converted into same Oxidation state.



Question

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#Q. Assuming no change in volume, calculate the minimum mass of NaCl necessary to dissolve 0.010 mol AgCl in 100 L solution.
$[K_f(AgCl_2^-) = 3 \times 10^5, K_{sp} = (AgCl) = 1\times10^{-10}]$

Soln.

$$NaCl(aq) \longrightarrow Na^+(aq) + Cl^-(aq)$$

$$AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq), \quad K_{sp} = 1\times10^{-10}$$

Moles of Ag in AgCl = Moles of Ag in $AgCl_2^-$

$$Ag^+(aq) + 2Cl^-(aq) \rightleftharpoons AgCl_2^-(aq), \quad K_f = 3\times10^5$$

$$AgCl(s) + Cl^-(aq) \rightleftharpoons AgCl_2^-(aq), \quad K_f \times K_{sp} = \frac{[AgCl_2^-(aq)]}{[Cl^-(aq)]}$$