PRAYAS

JEE 2026

PHYSICAL CHEMISTRY

REDOX REACTION

Lecture –05

FAISAL RAZAQ

Topics to be covered

A Law of Equivalence

TELEGRAM GROUP BY FAISAL SIR

LIST OF IONS

Cl^-	chloride	$C_2O_4^{2-}$	oxalate
Br^-	bromide	NO_3^-	nitrate
F^-	fluoride	N^{3-}	nitride
I^-	iodide	NO_2^-	nitrite
CO_3^{2-}	carbonate	ClO_4^-	perchlorate
CN^-	cyanide	ClO_3^-	chlorate
NC^-	isocyanide	ClO_2^-	chlorite
SO_4^{2-}	sulphate	ClO^-	hypochlorite
SO_3^{2-}	sulphite	CrO_4^{2-}	chromate
$S_2O_3^{2-}$	thiosulphate	$Cr_2O_7^{2-}$	dichromate
S^{2-}	sulphide	MnO_4^-	permanganate
P^{3-}	phosphide	PO_4^{3-}	phosphate

$A + (NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + H_2O + \cdots$

NH_4^+

$x + 4 = +1$

$x = -3$

$Cr_2O_7^{2-}$

$2x - 14 = -2$

$x = +6$

Behaviour of A —

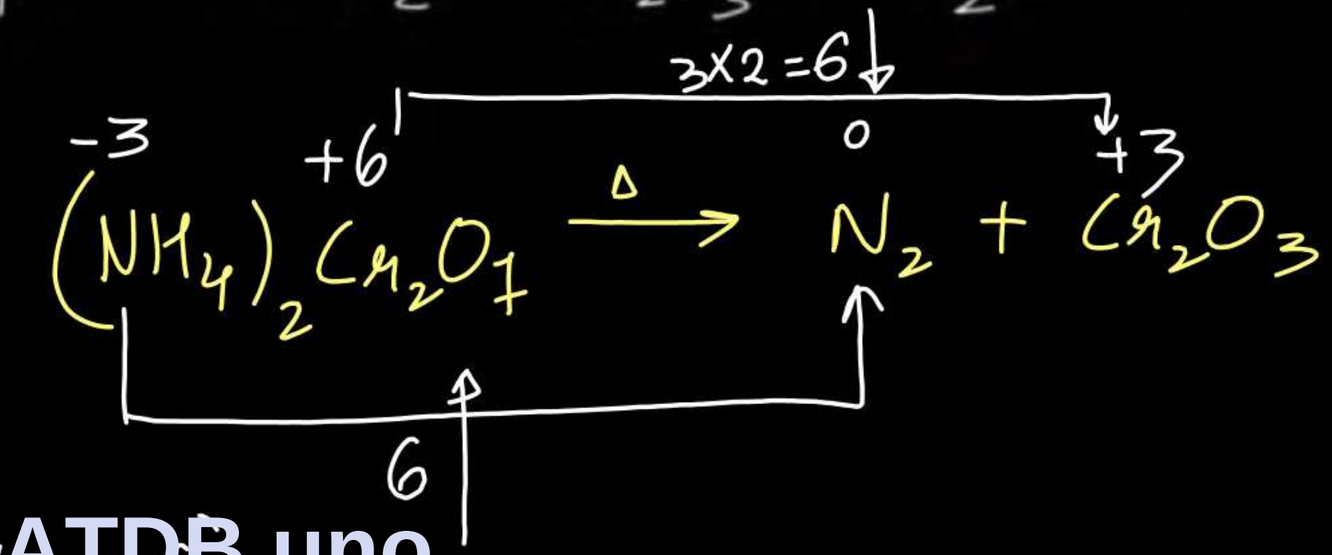
i) O.A

ii) R.A

iii) Both

iv) None

v) Mujhe kya pata



Question

learn (Hypo Solution)

$$I_2^0 + 2Na_2\overset{2}{S_2}O_3 \longrightarrow 2Na\overset{-1}{I} + Na_2S_4O_6$$

$2 + 4x - 12 = 0$

$x = 2.5$

$= \frac{10}{4} = 2.5$

$\frac{M_{I_2}}{2} = E_1 = E_2$ (2 ; $0.5 \times 2 = 1$)

Find out E_1 and E_2 in terms of M_1 and M_2.

$$\frac{M_{Na_2S_2O_3}}{1}$$

n-Factor Calculation in a Disproportionation Reaction

A redox reaction in which a same element present in a particular compound in a definite O.S is oxidised as well as reduced.

One of the reactant in a disproportionation reaction always contain an element that can exist in an atleast three oxidation state.

Some example of disproportionation Rxn

i) $H_2O_2 \longrightarrow H_2O + O_2$

ii) $X_2 + \bar{O}H_{(dil)} \longrightarrow X^- + X\bar{O}$

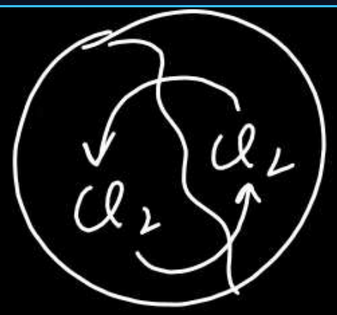
iii) $X_2 + \bar{O}H_{(conc)} \longrightarrow X^- + XO_3^-$

iv) $S_8 + \bar{O}H \longrightarrow S^{2-} + S_2O_3^{2-} + H_2O$

v) $KClO_3 \longrightarrow KClO_4 + KCl$

$Cl_2 \longrightarrow Cl^- + ClO_3^-$

0 → -1 (red, ②) ; 0 → +5 (oxⁿ, 10)



$$\frac{1}{n_{net}} = \frac{1}{2} + \frac{1}{10}$$

Jugaad!

$$E_{net} = E_1 + E_2$$

$$\frac{M}{n_{net}} = \frac{M}{n_1} + \frac{M}{n_2}$$

$$\boxed{\frac{1}{n_{net}} = \frac{1}{n_1} + \frac{1}{n_2}}$$

$$\boxed{n_{net} = \frac{5}{3}}$$

Question: find out the eq. wt of Cl_2 in this disproportionation reaction.

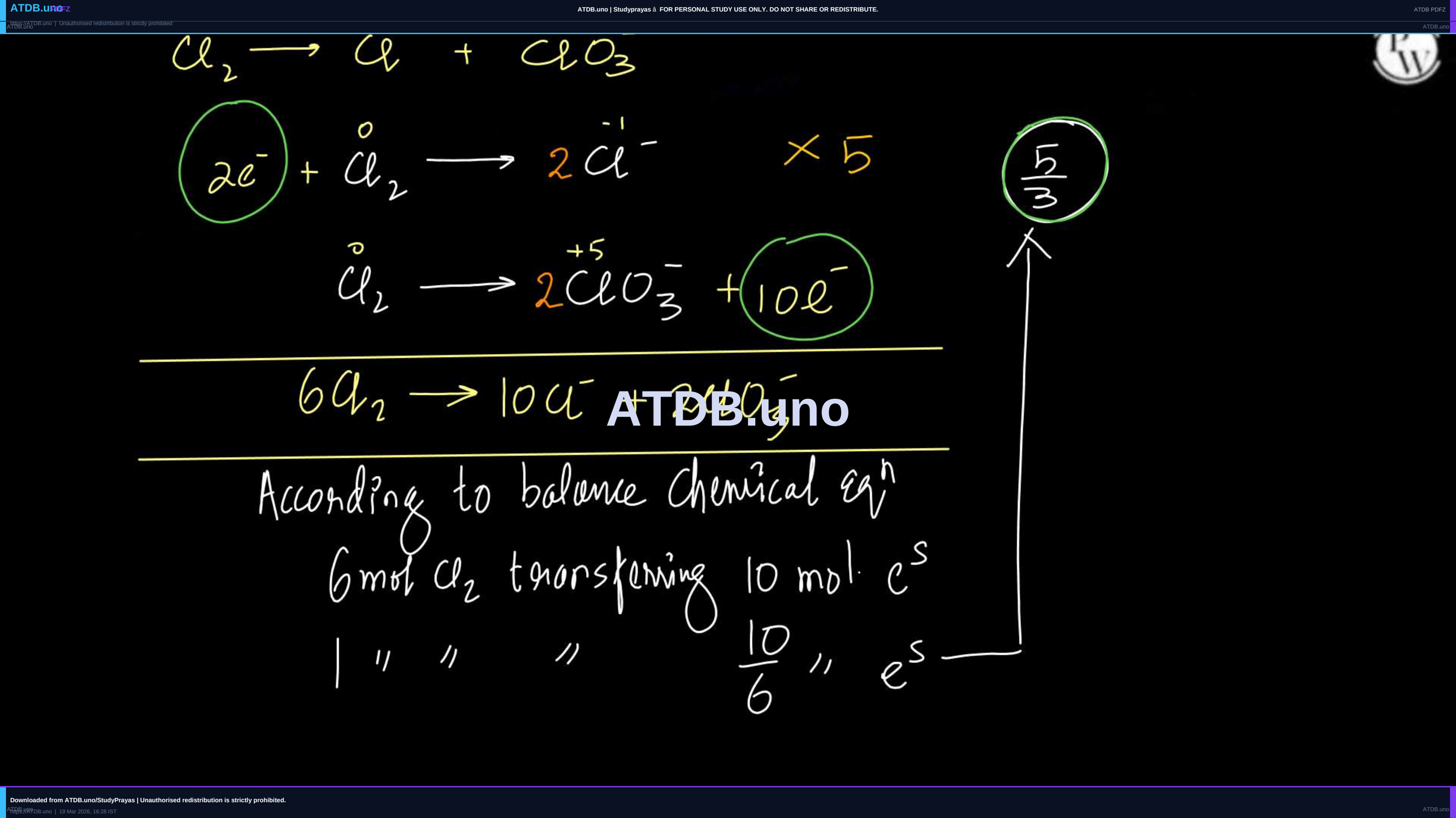
$$E_{net} = \frac{M}{n_{net}} = \frac{71}{5/3} = \frac{71 \times 3}{5}$$

K.B.q

* C_2 as an OA, n-Factor = 2

* C_2 as RA, n-Factor = 10

* Overall n-Factor = $\frac{5}{3}$



Question

Imp

$$n\text{-Factor} = \frac{3+5}{2} = 4$$

Question

Imp

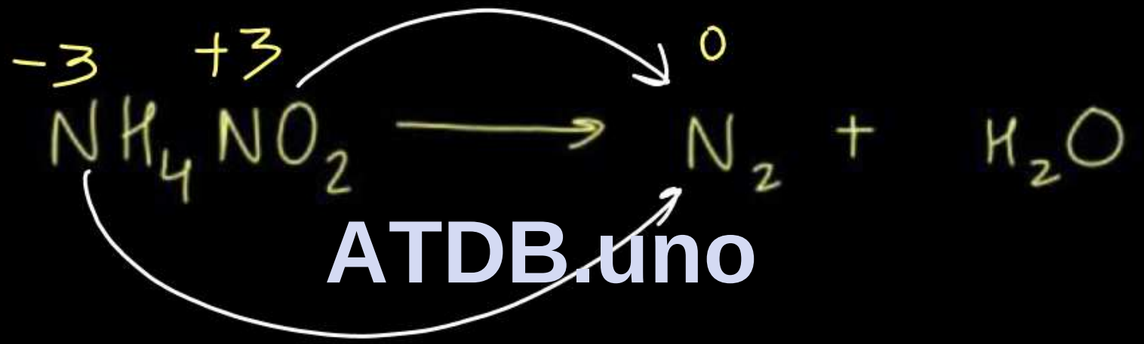
$$n\text{-Factor} = \frac{5}{2}$$

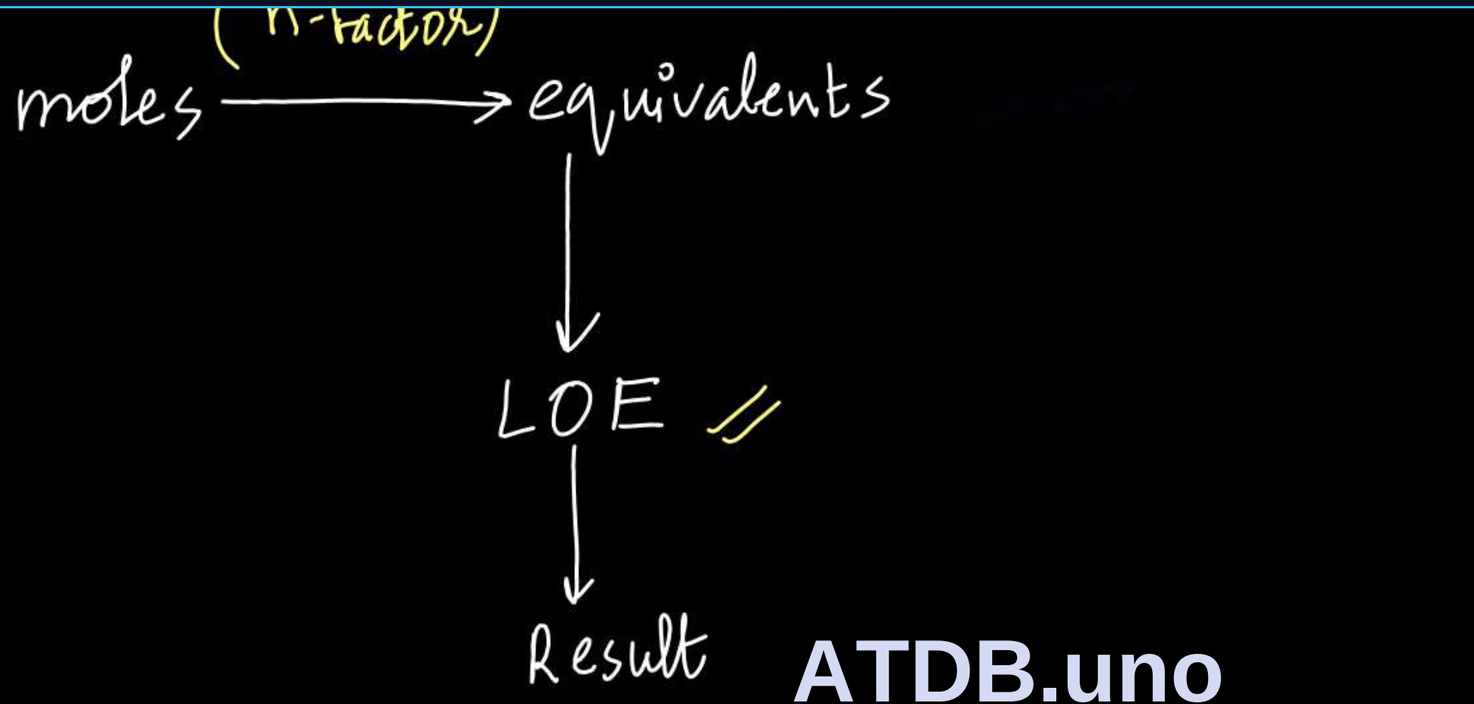
Comproportionation Reaction

A class of redox reaction in which element from two different oxidation state gets converted into single O.S.

NH_4^+

NO_2^-





Important

* Equivalents = moles × n-factor

* Equivalents = $\frac{\text{wt of substance}}{\text{equivalent wt}}$ $\left[\text{eq wt} = \frac{\text{Mol. wt}}{n}\right]$

* Equivalents = Normality × Vol of solution in lt.

$$\left[\text{Normality} = \frac{\text{Eq of solute}}{\text{Vol. of soln in lt.}}\right]$$

$$\frac{M \times V = \text{moles}}{N \times V = \text{equivalents}}$$

$$\frac{M}{N} = \frac{\text{moles}}{\text{equivalents}} = \frac{\cancel{\text{moles}}}{\cancel{\text{moles}} \times n\text{-factor}}$$

$$\boxed{N = M \times n\text{-factor}}$$

* Equivalents = moles × n-factor

* Equivalents = $\frac{\text{given mass}}{\text{Eq. mass}}$

* Equivalent mass = $\frac{\text{Mol. wt.}}{\text{n-factor}}$

* Eq = normality × volume
= N × V
= n-factor × molarity × vol.

* Normality = $\frac{\text{no. of equivalents of solute}}{\text{volume of solution in lt.}}$

$$\text{Normality} = \frac{\text{no. of eq. of solute}}{\text{vol. of soln in lt}}$$

$$= \text{n-factor} \times \left(\frac{\text{moles of solute}}{\text{vol. of soln in lt.}} \right)$$

$$\text{Normality} = \text{n-factor} \times \text{Molarity}$$

no. of equivalents of solute : Normality x vol. of soln in lt.

Law of Equivalence

Jo bhidte hain unke baraban hote hain!

$$\underset{n=x}{yA} + \underset{n=y}{xB} \longrightarrow C$$

According to LOE —(i) Eq. of A = Eq. of B = Eq of C

—(ii) If the n-factor ratio of A and B is x : y then their molar ratio will be y : x.

A + B + C ⟶

acid base acid

According to LOE

Eq of A = Eq. of B = Eq of C ✗

Eq of A + Eq of C = Eq of B ✓

A + B + C →

OA OA RA

According to LOE

Eq of A + Eq of B = Eq of C

Question How many moles of $KMnO_4$ are required to completely oxidise 2 moles of SnC_2O_4 in acidic medium?

$5 - 4$

$1 - 4/5$

$2 - \frac{4 \times 2}{5} = 8/5$ mol.

$$4\,KMnO_4 \ (n=5) + 5\,SnC_2O_4 \xrightarrow{H^+} CO_2 + Mn^{+2} + Sn^{+4}$$

(+7 in $KMnO_4$; +2 +3 in SnC_2O_4; +4 in CO_2)

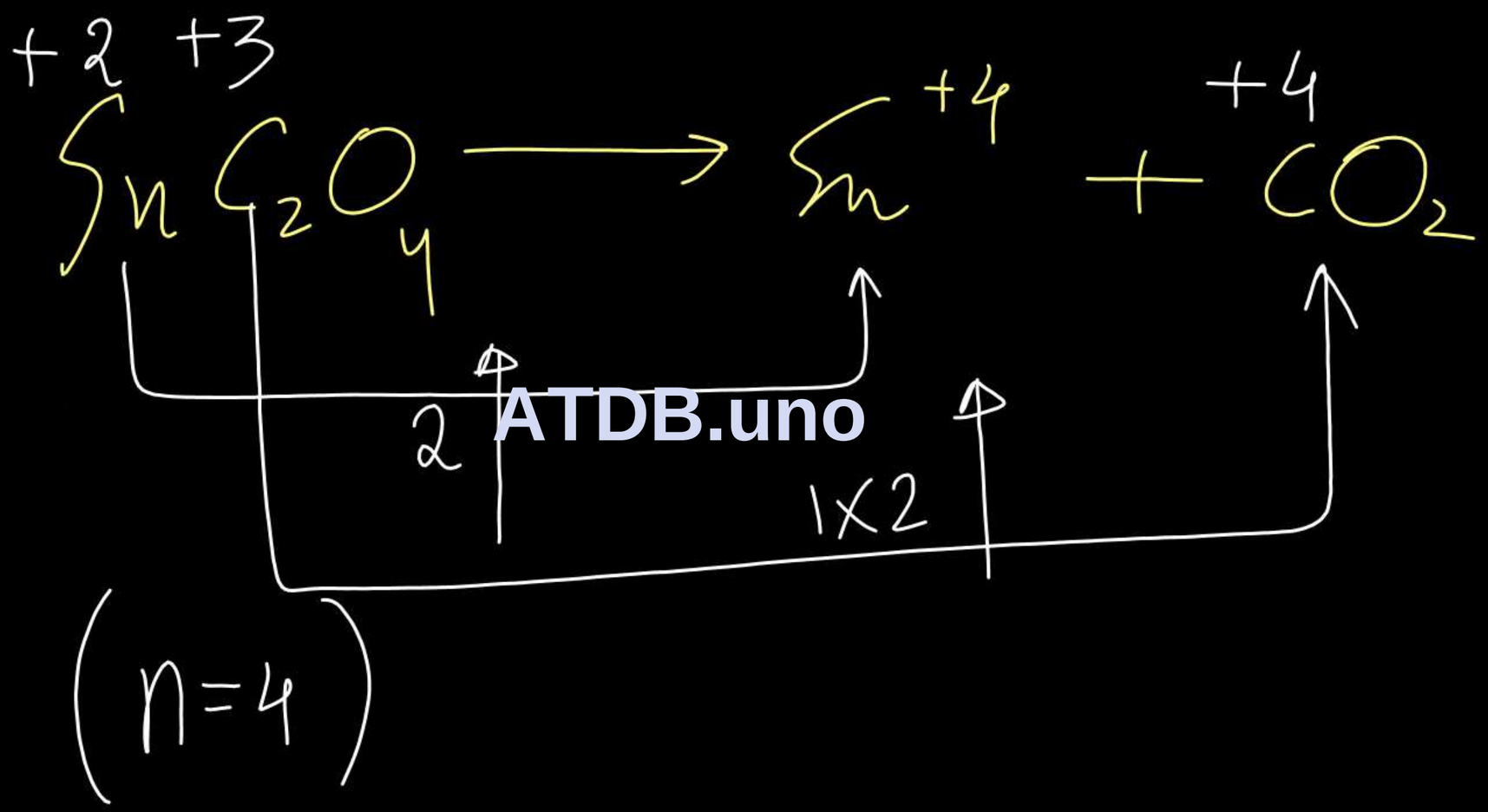
$8/5$ ✓

$\div 5$

2 mol ✓

$\times 4$

8 eq ← 8 eq

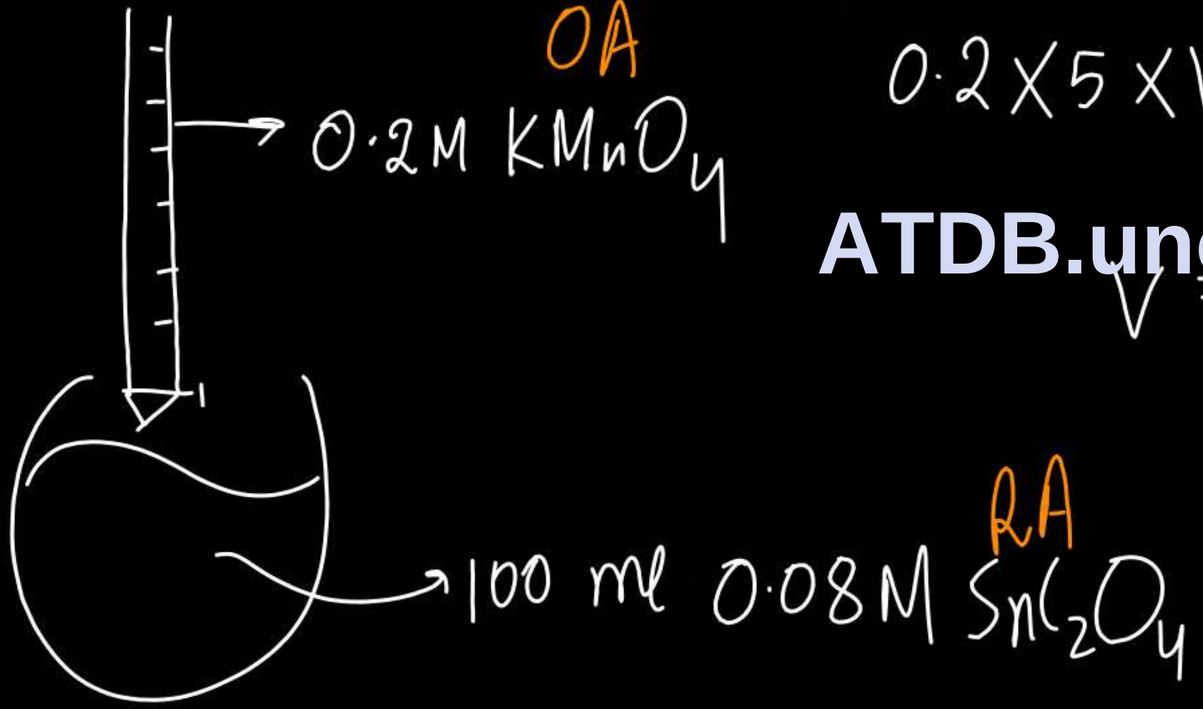


\# find out the volume of 0·2 M $KMnO_4$ consumed to completely oxidised 100 ml 0·08 M SnC_2O_4 soln in acidic medium.

m·Eq of $KMnO_4$ = m·Eq of SnC_2O_4

$0.2 \times 5 \times V = 0.08 \times 4 \times 100$ (LOE)

$V = \frac{0.08 \times 4 \times 100}{0.2 \times 5} = 32$ ml.



$$Eq = Normality \times vol.$$

$$Eq. = Molarity \times n\text{-}factor \times vol.$$

ATDB.uno

Question Find out the moles of FeC_2O_4 consumed during its complete oxidation by 2 mol of $KMnO_4$ in acidic medium.