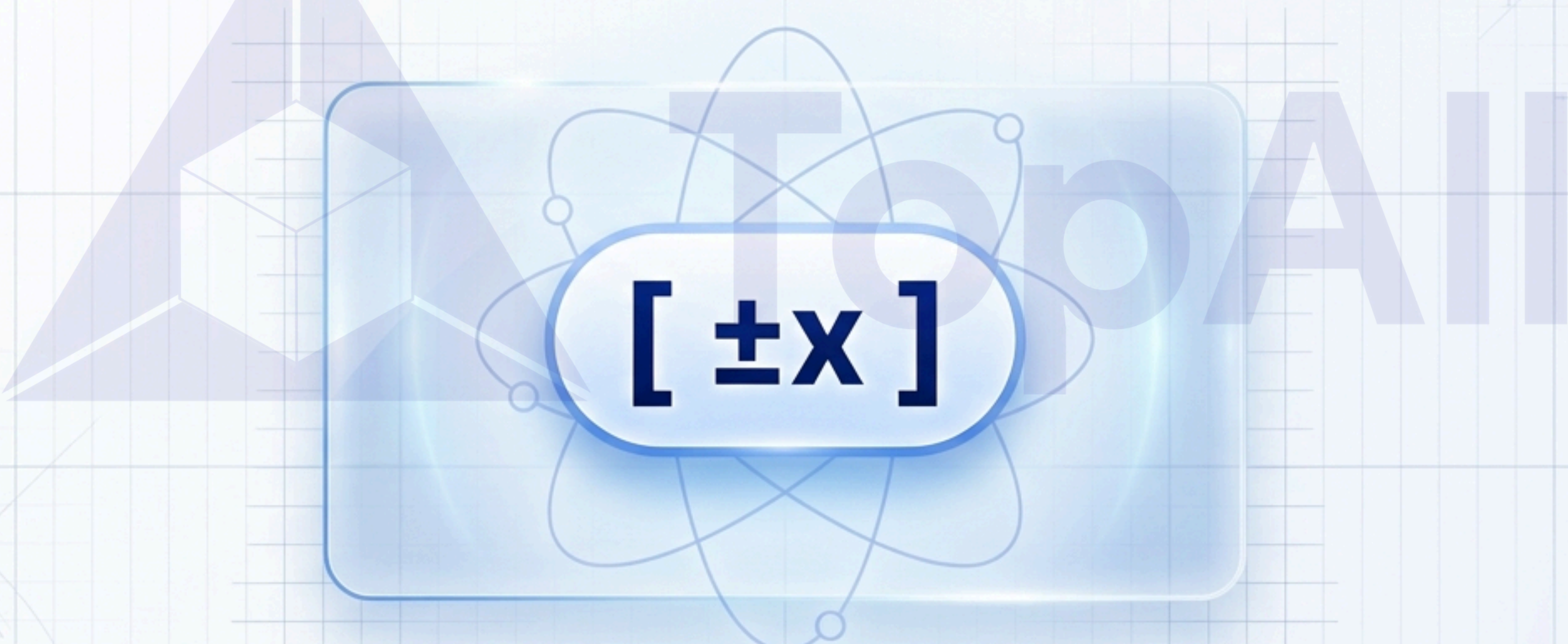


6 Rules to Master Oxidation Numbers

The JEE Chemistry Blueprint



[±x]

Distilled for High-Yield Application in Redox Stoichiometry.

Rule 1: The Absolute Constant (Free Elements)



In elements, in the free or uncombined state, every atom bears an oxidation number of zero.

Monoatomic

Na

Mg

Al

Diatomic

H₂

O₂

Cl₂

Polyatomic

O₃

P₄

S₈

[0]

Key Takeaway: If an element is bonded only to itself, its oxidation state is zero. No exceptions.

Rule 2: The Charge is the Number

For monatomic ions, the oxidation number equals the charge on the ion.

Group 1 (Alkali Metals): Na^+ , K^+ , Li^+

[+1]

Group 2 (Alkaline Earth): Mg^{2+} , Ca^{2+} , Ba^{2+}

[+2]

Group 13 (Aluminium): Al^{3+}

[+3]

Simple Anions: Cl^- , O^{2-}

[-1]

[-2]



Note: Alkali metals, alkaline earth metals, and Aluminium have highly predictable, fixed positive oxidation states in all their compounds.



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Rule 3: The Chameleon (Oxygen)

Oxygen is mostly -2 , but shifts drastically based on specific linkages and bonding partners.

Tier 1: Safe	Standard Oxides		$[-2]$
	Examples: MgO , H_2O		

 Tier 2: JEE Trap Alert	O-O Linkages (Peroxides & Superoxides)		
	Peroxides	$[-1]$	Examples: H_2O_2 , Na_2O_2
	Superoxides	$[-\frac{1}{2}]$	Examples: KO_2 , RbO_2

Tier 3: High Danger	Bonded to Fluorine	
	Fluorine forces Oxygen to be positive.	
	In OF_2	$[+2]$
	In O_2F_2	$[+1]$

Rule 4: The Dichotomy (Hydrogen)

Hydrogen's oxidation number depends entirely on the electronegativity of its partner.

Bonded to Non-Metals

[+1]

Standard Examples:

HCl, H₂O, CH₄

Bonded to Metals (Binary Hydrides)

[-1]

Trap Examples:

LiH, NaH, CaH₂



Metals are more electropositive, forcing Hydrogen to accept the electron.

Rule 5: The Dictator & The Followers (Halogens)



Fluorine (F)



ALWAYS -1 in all its compounds.
It is the most electronegative element.

Other Halogens (Cl, Br, I)

Usually as Halide ions

[-1]

NaCl, KBr

Combined with Oxygen
(Oxoacids/Oxoanions)

[Positive Numbers]

Highly electronegative Oxygen forces
Cl, Br, and I into positive states.

Rule 6: The Mathematical Engine (Summation)



The algebraic sum of all atoms equals the net charge of the molecule or ion.

Visual Equation Breakdown: Carbonate Ion



1. (The Formula) $1 \times (\text{Carbon O.N.}) + 3 \times (\text{Oxygen O.N.}) = -2$

2. (Applying Rule 3) $[x] + [3 \times (-2)] = -2$

3. (Solving) $x - 6 = -2$

4. (Result) Carbon = **[+4]**

Key Takeaway: For neutral compounds, set the sum to 0. For polyatomic ions, set the sum to the ion's charge.

Exam Snapshot: The Exceptions Matrix

Synthesizing the most heavily tested edge-cases in JEE Advanced.

Molecule	Novice Assumption	Actual O.N.	The Trap Explained
Hydrogen Peroxide (H_2O_2)	Assumes O is $[-2]$	Actual O is $[-1]$	Contains an O-O peroxide linkage.
Potassium Superoxide (KO_2)	Assumes O is $[-2]$	Actual O is $[-\frac{1}{2}]$	Alkali metal K is strictly $[+1]$, forcing O to fraction.
Oxygen Difluoride (OF_2)	Assumes O is $[-2]$	Actual O is $[+2]$	Fluorine is the only element more electronegative than Oxygen.
Calcium Hydride (CaH_2)	Assumes H is $[+1]$	Actual H is $[-1]$	Binary metal hydride; Ca is strictly $[+2]$.

Mastering these structural exceptions is the key to unlocking complex redox stoichiometry.



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