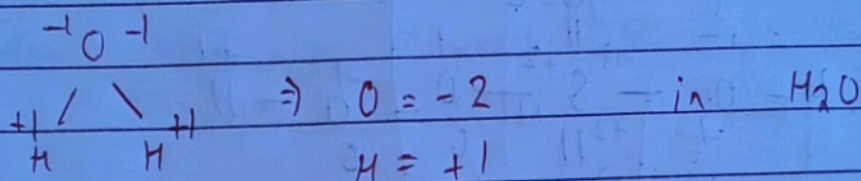
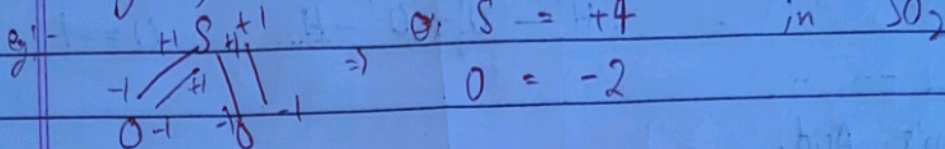


Redox Rxⁿ

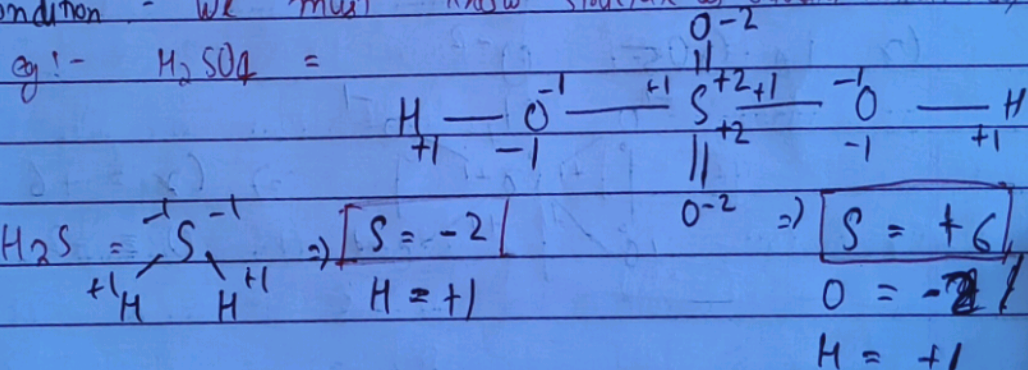
Oxidation state / Oxidation Number :- formal charge on an atom in a specie.

finding by structure

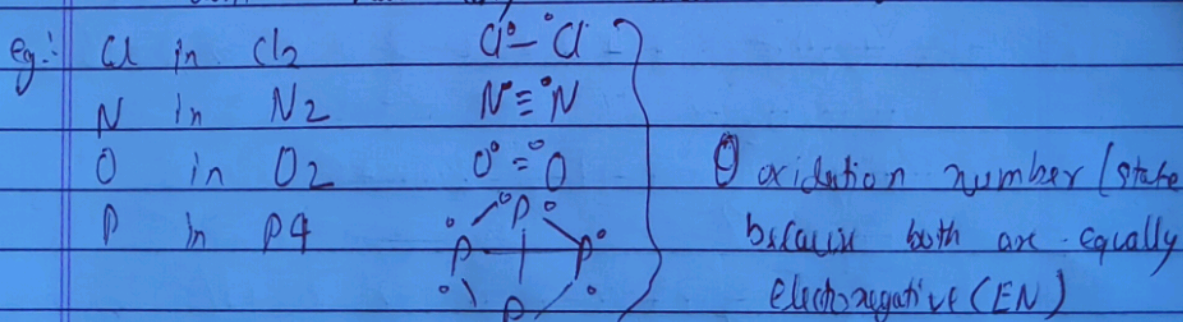


In a Covalent Bond, Assign -1 to more EN atom & +1 to lesser EN atom

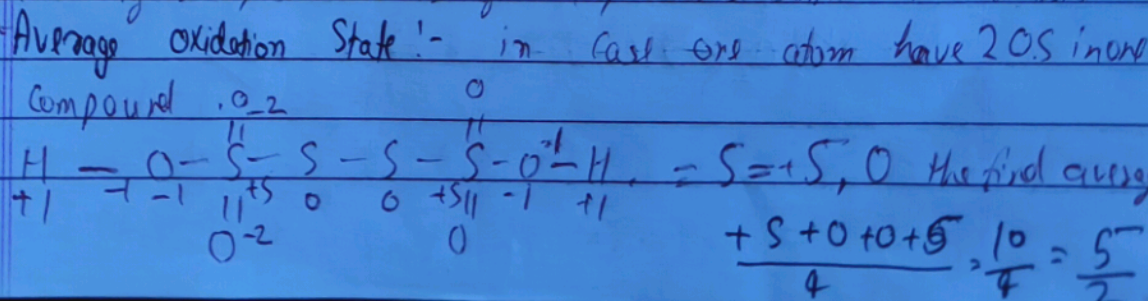
Condition :- We must know structure as oxidation number may vary



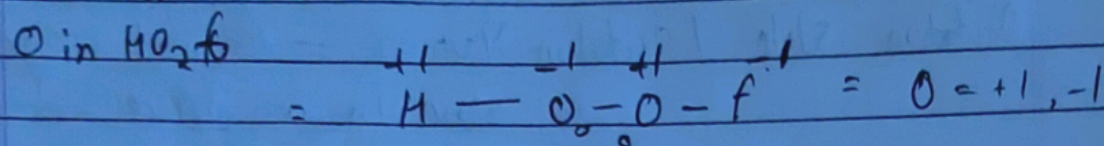
Self bond case :- when atom form bond with itself it don't have any oxidation number



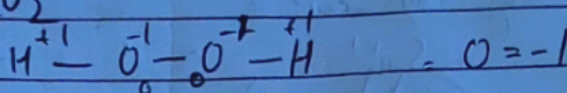
as long as any of 2 OS is given they should be chosen in exam instd.



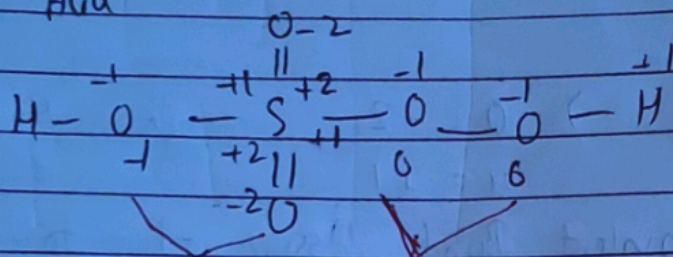
Rare case :-



Peroxide linkage = H_2O_2

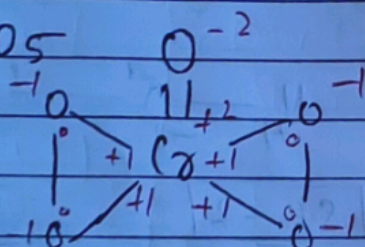


Caro's Acid



$\text{S} = +6, \text{O} = +2, \text{O} = -1, \text{H} = +1$

Cr in CrO_5



$\Rightarrow \text{Cr} = +6$
 $\text{O} = -2, -1$

Using formula to find O.S. :-

Rules to follow :-

- 1) O.S. of Alkaline Metal ($\text{Li, Na, K, Rb, Cs, Fr}$) $+1$
- 2) " " " " Earth Metal ($\text{Be, Mg, Ca, Sr, Ba, Ra}$) $+2$
- 3) " " of F is -1 always
- 4) Any atom in elemental state has $\text{O.S.} = 0$
eg- Cl in Cl_2 , Br in Br_2 , I in I_2 , S in S_8 etc.
- 5) O.S. of O
 - -2 (Oxy. case)
 - -1 (peroxide)
 - $+1$ (H_2O_2)
 - -1 (Superoxides eg KO_2)
- 6) Generally, halogens have O.S. of -1 (Cl, F, I, Br etc.)

Formula :-

Sum of O.S. of all atoms in a species = Total Charge on species

eg:- O in H_2O , H in $\text{H}_2\text{O} = 2x - 2 = 0 \Rightarrow x = +1$

$x + 2 = 0 \Rightarrow x = -2$

C in CO_2

$x - 4 = 0 \Rightarrow x = +4$

S in SO_3

$x - 6 = 0 \Rightarrow x = +6$

S in H_2S

$x + 2 = 0 \Rightarrow x = -2$

N in NO_3^-

$x - 6 = -1 \Rightarrow x = +5$

Cl in ClO_4^-

$x - 8 = -1 \Rightarrow x = +7$

Exception cases of formula :-

- S in H_2SO_4

$$x = \frac{5}{2}$$

- Fe in FeO , Fe_2O_3

$$x = +2 \quad x = +3$$

Fe_3O_4

$$x = \frac{+8}{3}$$

- Pb in Pb_3O_4

$$x = \frac{8}{3}$$

- Br in Br_3O_8

$$x = \frac{16}{3}$$

□ - formula gives average O.S. in these cases

1 peroxide

(peroxide O = -1)

- S in H_2SO_5

$$x = +8$$

More the max O.S.

(maybe due to some atom elemental state like O-O)

- N in HNO_4

↓ peroxide

$$x = +7$$

Note: Max O.S. ever = +7

- Cr in CrO_5

2 peroxide

$$x = +10$$

Max O.S. = Group No - 10

N} +5

S} +6

Cl} +7

Br}

P}

15

16

17

On such cases assume 1 peroxide linkage

eg- H_2SO_5

$$x + 2 + (-6) - 2 = 0 \Rightarrow x = +6$$

$H_2SO_3O_2 \rightarrow$

O₃ O₂

HNO_4

$$x + 1 - 4 - 2 = 0 \Rightarrow x = +5$$

$HNO_2O_2 \rightarrow$

CrO_5

$$x + (-6) - 2 = 0 \Rightarrow x = +8 \text{ (max } \downarrow \text{ O.S. = +7)}$$

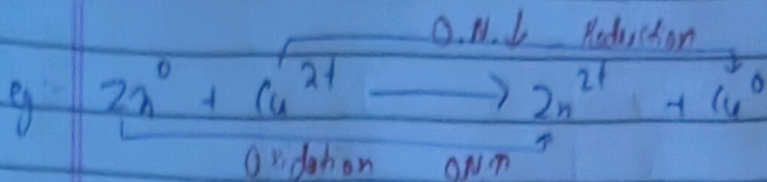
$CrO_3O_2 \rightarrow$

Still wrong

$CrO_4O_2 \rightarrow$

$$x - 2 - 2 - 2 = 0 \Rightarrow x = +6$$

Redox Rn - Oxidation + Reduction simultaneously



Half in - Reaction with explicitly show involvement of electron

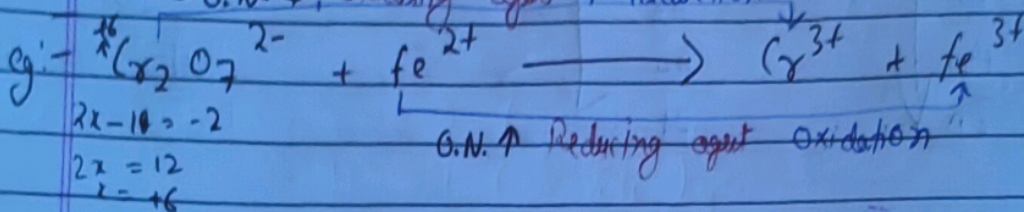
Oxidation :- Half Rn that involve loss of e^- by any species

Reduction: " " " " " gain " " " " "

Oxidising agent :- Acceptor of electron

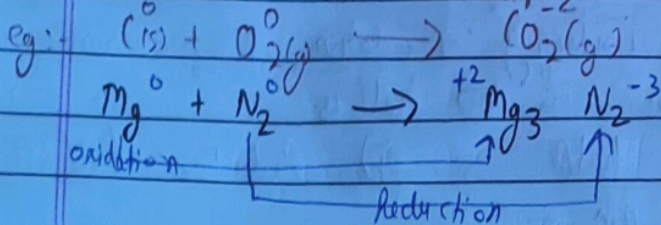
Reducing agent :- Donor of electron

O.N. ↓, Oxidising agent, Reduction

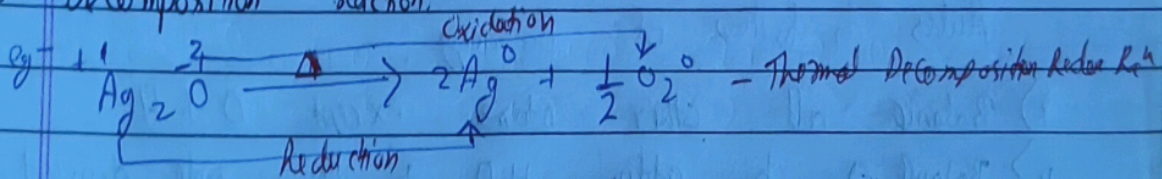


Types of Redox Rxn :-

① Combination Rxn :-



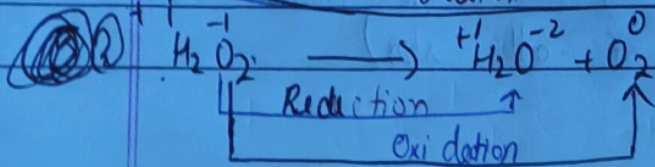
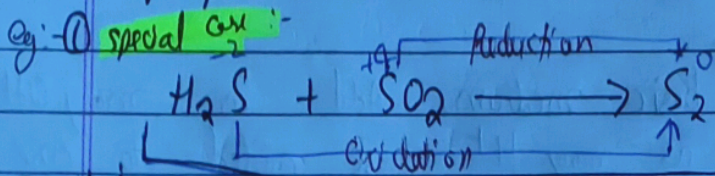
② Decomposition reaction:-



② Displacement rxn - (Metal/non metal displacement)



④ Disproportionation rxn:- Simultaneous Oxidation and Reduction of same element.



Comproportionation

Redox Rxn - A type in which both oxidation and Reduction happen in same product.

Standard Reduction Potential Series

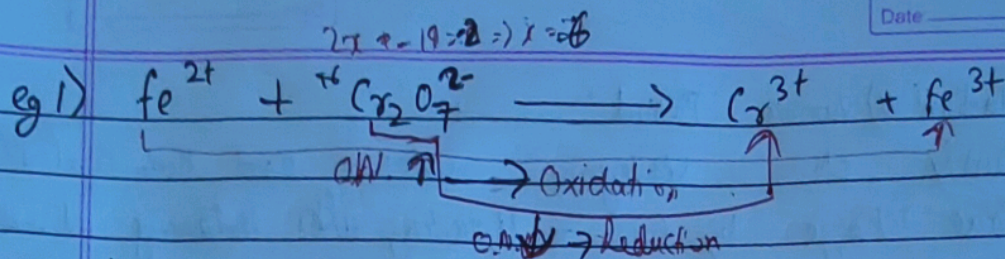
Tendency ↑ To get Oxidised ↓ better Reducing agent	Li K Ba Sr Ca Na Mg Al Mn Zn	Reducing Agent	Cr Fe Co Ni Pb H Hg Ag Au Pt	I ₂ Br ₂ Cl ₂ F ₂	High Reduction Potential (↑) ↓ Tendency to get reduced (↑) ↓ better Oxidising agent
---	---	-------------------	---	--	--

Half Rxⁿ Method:-

- (1) Write the given equation in Ionic form.
- (2) Identify elements undergoing Oxidation & Reduction.
- (3) Break the equation in two halves :-
i) Oxidation half ii) Reduction half
- (4) Balance the half Rxⁿ :-

Rules to follow of Balancing :-

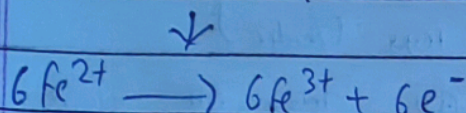
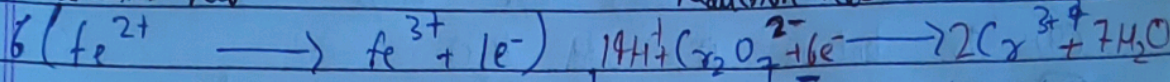
- i) Balance all other atoms except O & H
- ii) Balance O by adding H₂O to the side deficient in O.
- iii) Balance H by adding H⁺ ions.
- iv) Balance charge by adding e⁻.
- 5) Add Both halves such that e⁻ in two halves get cancelled.
- 6) In case of basic medium, Add as many OH⁻ to both sides as many H⁺ were added to one side. (in the end of all steps)



- break halves

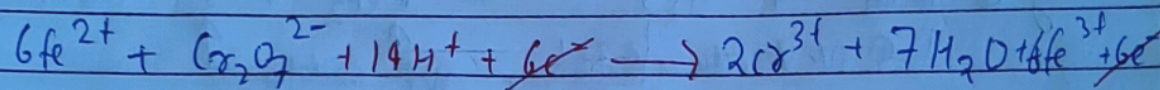
Oxidation half

Reduction half

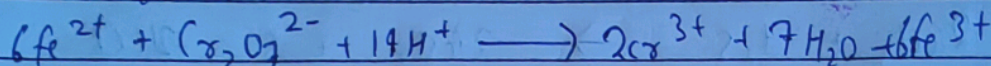


To balance / cancel e^-
multiply 6 to Oxidation
half.

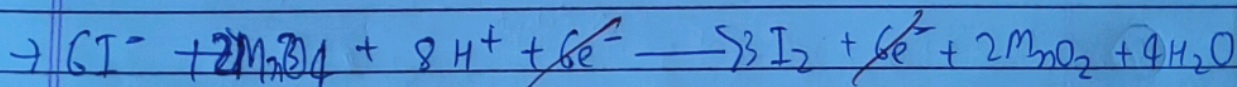
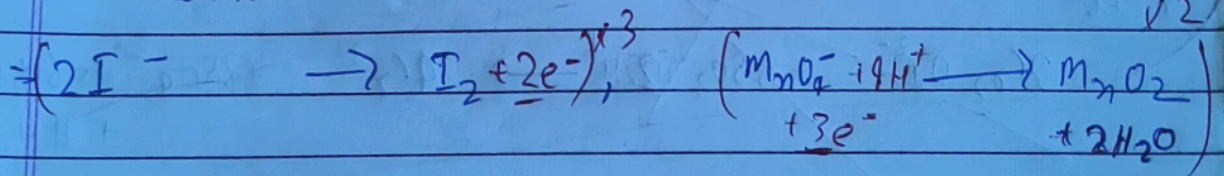
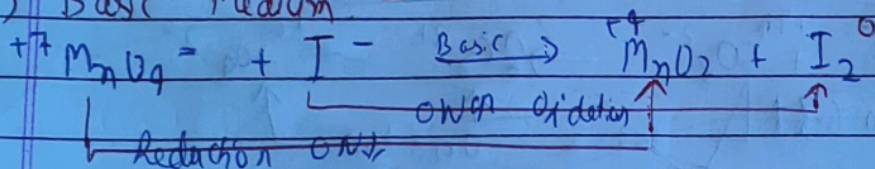
Adding both halves:-



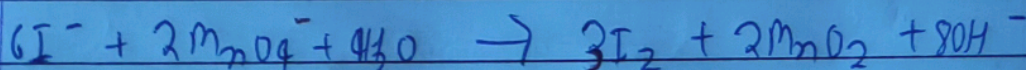
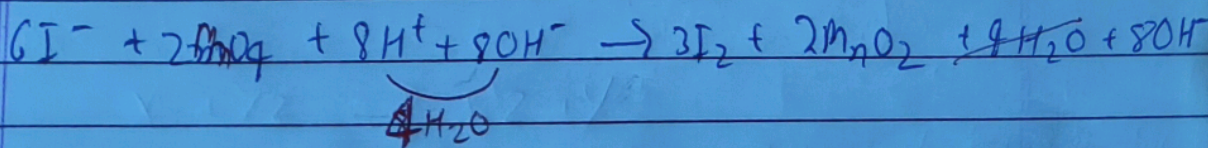
Final answer :-



eg 2) Basic Medium -



since its basic add SOH^- to both sides



Oxidation (or) Number Method :-

- ① Identify atoms undergoing oxidation and Reduction (O.N. change)
- ② Balance charge by cross multiplication, after balancing atoms undergoing oxidation & reduction
- ③ Balance all other atoms except O & H
- ④ To balance O, add H_2O
- ⑤ To balance H, add H^+ ions (Acidic)
- ⑥ For basic medium add as many OH^- ions on both sides as no. of H^+ ions on one side

