

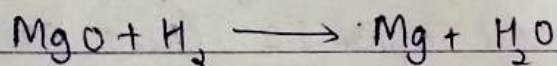
REDOX REACTION

↓
Reduction

↑
oxidation

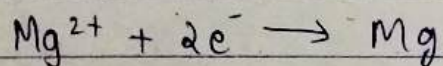
⊗ Reduction

I. Addition of Hydrogen

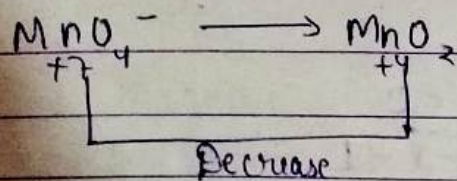


II. Removal of oxygen

III. Gain of e^-

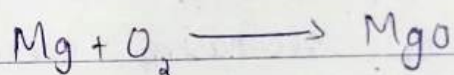


IV. Decrease in oxidation no.



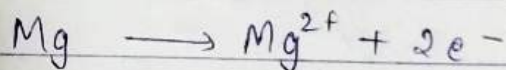
⊗ Oxidation

I. Addition of oxygen

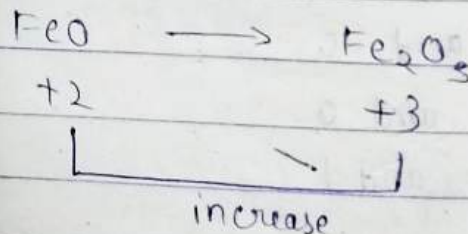


II. Removal of Hydrogen

III. Loss of e^-



IV. Increase in oxidation no.



1. Alkali Metal

$$\text{ON} = +1 \text{ (always)}$$

II. Alkaline earth metal = +2 (always)

III. Zn, Cd, Hg = +2 (always)

IV. Oxygen = -2 Mostly

V. Halogen $\Rightarrow$ F, Cl, Br, I = -1 Normally
F = always -1

VI. Hydrogen

H	$\begin{cases} +1 \rightarrow \text{non-metal} = +1 \\ -1 \rightarrow \text{metal} = -1 \end{cases}$
	HCl NaH

VII. Self Bonding

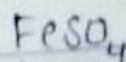
O ₂	Fe	Cu	
F ₂	Na	Zn	= 0
N ₂	Br ₂		
O ₃	I ₂		

VIII. group oxidation no.

$$\text{SO}_4 = -2$$

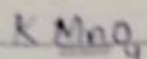
$$\text{NO}_3 = -1$$

$$\text{NH}_4 = +1$$



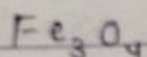
$$x - 2 = 0$$

$$\boxed{x = +2}$$



$$+1 + x - 2 \times 4 = 0$$

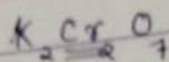
$$\boxed{x = +7}$$



$$3x - 2 \times 4 = 0$$

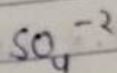
$$3x = 8$$

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



$$+1 \times 2 + 2x - 2 \times 7 = 0$$

$$\boxed{x = +6}$$

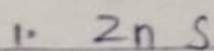


$$x - 2 \times 4 = -2$$

$$x - 8 = -2$$

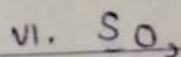
$$\boxed{x = +6}$$

Questions



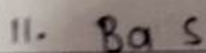
$$+2 + x = 0$$

$$\boxed{x = -2}$$



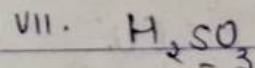
$$x + 2 \times 2 = 0$$

$$\boxed{x = +4}$$



$$+2 + x = 0$$

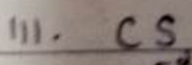
$$x = -2$$



$$+1 \times 2 + x - 2 \times 3 = 0$$

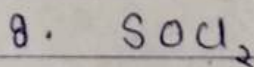
$$+2 + x - 6 = 0$$

$$\boxed{x = +4}$$



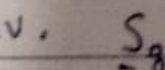
$$+4 + 2x = 0$$

$$x = -\frac{4}{2} = -2$$



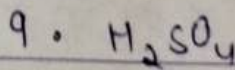
$$x - 2 - 1 \times 2 = 0$$

$$\boxed{x = +4}$$



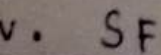
$$-x = 0$$

$$\boxed{x = 0}$$



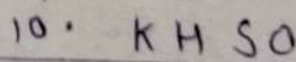
$$+1 \times 2 + x - 2 \times 4 = 0$$

$$\boxed{x = +6}$$



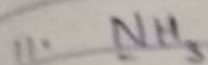
$$+2 + x = 0$$

$$\boxed{x = -2}$$



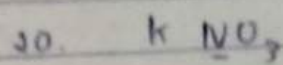
$$+1 + 1 + x - 2 \times 4 = 0$$

$$\boxed{x = +6}$$



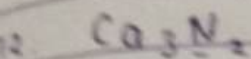
$$x + 1 \times 3 = 0$$

$$x = -3$$



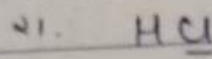
$$+1 + x - 2 \times 3 = 0$$

$$x = 5$$



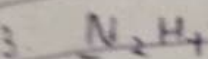
$$+2 \times 3 + 2x = 0$$

$$x = -\frac{6}{2} = -3$$



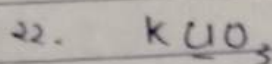
$$+1 + x = 0$$

$$x = -1$$



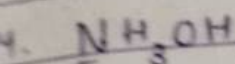
$$2x + 1 \times 4 = 0$$

$$x = -2$$



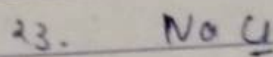
$$+1 + x - 2 \times 3 = 0$$

$$x = 5$$



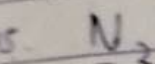
$$x + 1 \times 3 - 2 + 1 = 0$$

$$x = -2$$



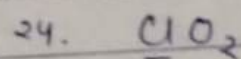
$$+1 + x = 0$$

$$x = -1$$



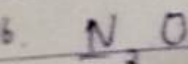
$$2x = 0$$

$$x = 0$$



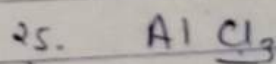
$$x - 2 \times 2 = 0$$

$$x = 4$$



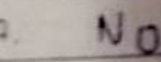
$$2x - 2 = 0$$

$$x = 1$$



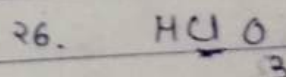
$$+3 + 3x = 0$$

$$x = -1$$



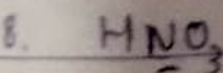
$$x - 2 = 0$$

$$x = +2$$



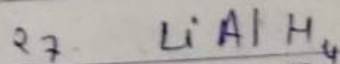
$$+1 + x - 2 \times 3 = 0$$

$$x = 5$$



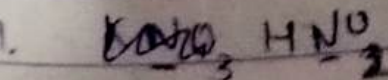
$$+1 + x - 2 \times 3 = 0$$

$$x = 5$$



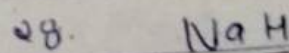
$$+1 + 3 + 4x = 0$$

$$x = -1$$



$$+1 + x - 2 \times 2 = 0$$

$$x = 3$$



$$+1 + x = 0$$

$$x = -1$$

$$29. \quad \underline{\text{P}_4} \quad 4x = 0 \\ \boxed{x = 0}$$

$$38. \quad \underline{\text{H}_2\text{O}} \quad +1 \times 2 + 2x = 0 \\ \boxed{x = -1}$$

$$30. \quad \underline{\text{PH}_3} \quad x + 1 \times 3 = 0 \\ \boxed{x = -3}$$

$$39. \quad \underline{\text{KO}_2} \quad +1 + 2 \times x = 0 \\ \boxed{x = -\frac{1}{2}}$$

$$31. \quad \underline{\text{H}_3\text{PO}_2} \quad +1 \times 3 + x - 2 \times 2 = 0 \\ \boxed{x = 1}$$

$$40. \quad \underline{\text{H}_2\text{O}} \quad +1 \times 2 + x = 0 \\ \boxed{x = -2}$$

$$32. \quad \underline{\text{KH}_2\text{PO}_2} \quad +1 + 1 \times 2 + x - 2 \times 2 = 0 \\ \boxed{x = 1}$$

$$41. \quad \underline{\text{KO}_3} \quad +1 + 3x = 0 \\ \boxed{x = -\frac{1}{3}}$$

$$33. \quad \underline{\text{P}_2\text{O}_3} \quad 2x - 2 \times 3 = 0 \\ \boxed{x = 3}$$

$$42. \quad \underline{\text{O}_3} \quad \boxed{x = 0}$$

$$34. \quad \underline{\text{H}_3\text{PO}_5} \quad +1 \times 3 + x - 2 \times 5 = 0 \\ \boxed{x = 7}$$

$$43. \quad \underline{\text{O}_2\text{F}_2} \quad -2x - 1 \times 2 = 0 \\ \boxed{x = -1}$$

$$35. \quad \underline{\text{Ca}(\text{PO}_4)_2} \quad +2 + 2 \times 4 = 0 \\ \boxed{x = -7}$$

$$44. \quad \underline{\text{OF}_2} \quad x - 1 \times 2 = 0 \\ \boxed{x = 2}$$

$$36. \quad \underline{\text{SO}_2} \quad +2 + 2x = 0 \\ \boxed{x = -1}$$

$$45. \quad \underline{\text{CH}_4} \quad x + 1 \times 4 = 0 \\ \boxed{x = -4}$$

$$37. \quad \underline{\text{Na}_2\text{O}} \quad +2 + 2x = 0 \\ \boxed{x = -1}$$

$$46. \quad \underline{\text{C}_2\text{H}_6} \quad 2x + 1 \times 6 = 0 \\ \boxed{x = -3}$$

47. CH_3Cl $x + 1 \times 3 - 1 = 0$
 $\boxed{x = -2}$

56. CCl_4 $x - 1 \times 4 = 0$
 $\boxed{x = 4}$

48. Diamond ~~graphite~~
 $x = 0$

57. Na_2CO_3 $+1 \times 2 + x - 2 \times 3 = 0$
 $\boxed{x = 4}$

49. graphite
 $x = 0$

58. CrCl_3 $x + 1 \times 3 = 0$
 $\boxed{x = -3}$

50. $\text{C}_6\text{H}_{12}\text{O}_6$ $6x + 1 \times 12 - 2 \times 6 = 0$
 $\boxed{x = 0}$

59. $\text{Cr}(\text{SO}_4)_3$ $x - 2 \times 3 = 0$
 $\boxed{x = 6}$

51. CO $x - 2 = 0$
 $\boxed{x = 2}$

60. K_2CrO_4 $+1 \times 2 + x - 2 \times 4 = 0$
 $\boxed{x = 6}$

52. HCN $+1 + x - 3 = 0$
 $\boxed{x = 2}$

61. K_2MnO_4 $+1 \times 2 + x - 2 \times 4 = 0$
 $\boxed{x = 6}$

53. CHCl_3 $x + 1 - 1 \times 3 = 0$
 $\boxed{x = 2}$

62. MnO $x - 2 = 0$
 $\boxed{x = 2}$

54. CO_2 $x - 2 \times 2 = 0$
 $\boxed{x = 4}$

63. $\text{Mn}(\text{OH})_4$ $x - 1 \times 4 = 0$
 $\boxed{x = 4}$

55. H_2CO_3 $+1 \times 2 + x - 2 \times 3 = 0$
 $\boxed{x = 4}$

64. Mn_3O_4 $3x - 2 \times 4 = 0$
 $x = \frac{8}{3}$

$$65. \text{MnO}_4^- \quad x - 2 \times 4 = -1 \\ x = -1 + 8 \\ \boxed{x = 7}$$

$$66. \text{KMnO}_4 \quad +1 + x - 2 \times 4 = 0 \\ \boxed{x = 7}$$

$$67. \text{K}_2\text{MnO}_4 \quad +1 \times 2 + x - 2 \times 4 = 0 \\ \boxed{x = 5}$$

$$68. \text{SiH}_4 \quad x + 1 \times 4 = 0 \\ \boxed{x = -4}$$

$$69. \text{Mg}_2\text{Si} \quad +2 \times 2 + x = 0 \\ \boxed{x = 4}$$

$$70. \text{SiO}_2 \quad x - 2 \times 2 = 0 \\ \boxed{x = 4}$$

$$71. \text{SiO}_2 \quad x - 1 \times 2 = 0 \\ \boxed{x = 2}$$

$$72. \text{Fe}_3\text{O}_4 \quad 3x + 2 \times 4 = 0 \\ x = \frac{8}{3}$$

$$\text{FeO} \quad x + 2 = 0 \\ \boxed{x = -2}$$

$$74. \text{FeSO}_4 \quad x - 2 = 0 \\ \boxed{x = 2}$$

$$75. \text{Fe}_2\text{O}_3 \quad 2x - 2 \times 3 = 0 \\ \boxed{x = 3}$$

$$76. \text{H}_4\text{I}_2\text{O}_8 \quad -1 \times 4 + x - 2 \times 8 = 0 \\ x = 16 - 4 \\ \boxed{x = 12}$$

$$77. \text{KIO}_3 \quad +1 + x - 2 \times 3 = 0 \\ \boxed{x = 5}$$

$$78. \text{OsO}_4 \quad x - 2 \times 4 = 0 \\ \boxed{x = 8}$$

$$79. \text{XeO}_3 \quad x - 2 \times 3 = 0 \\ \boxed{x = 6}$$

$$80. \text{XeF}_6 \quad x - 1 \times 6 = 0 \\ \boxed{x = 6}$$

$$81. \text{Cr}_2\text{O}_7^{2-} \quad 2x - 2 \times 7 = -2 \\ 2x = -2 + 14 \\ \boxed{x = 6}$$

$$82. \text{C}_2\text{O}_4^{2-} \quad 2x - 2 \times 4 = -2 \\ \boxed{x = 3}$$

$$83. \quad \underline{\text{S}} \text{O}_4^{2-} \quad 2x - 2 \times 4 = -2 \quad 92. \quad \underline{\text{Cu}}\text{S} \quad x - 2 = 0$$

$$2x = -2 + 8 \quad x = 2$$

$$x = 3$$

$$84. \quad \underline{\text{Mn}} \text{O}_4^{2-} \quad 2x - 2 \times 4 = -2 \quad 93. \quad \underline{\text{Mg}}_3 \text{N}_2 \quad 3x - 3 \times 2 = 0$$

$$2x = -2 + 8 \quad x = 2$$

$$x = 3$$

$$85. \quad \text{H} \underline{\text{Au}} \text{Cl}_4 \quad +1 + x - 1 \times 4 = 0 \quad 94. \quad \underline{\text{V}}_2 \text{O}_5 \quad 2x + 8 = 0$$

$$x = 3 \quad x = -4$$

$$86. \quad \underline{\text{Ti}}_2 \text{O} \quad 2x - 2 = 0 \quad 95. \quad \underline{\text{V}}_2 \text{O}_3 \quad 2x - 2 \times 3 = 0$$

$$x = 1 \quad x = 3$$

$$87. \quad \underline{\text{Fe}} \text{O} \quad x - 2 = 0 \quad 96. \quad \underline{\text{Ti}} \text{Cl}_4 \quad x - 1 \times 4 = 0$$

$$x = 2 \quad x = 4$$

$$88. \quad \underline{\text{Cu}} \text{I} \quad x - 1 = 0 \quad 97. \quad \underline{\text{HClO}}_3 \quad +1 + x - 2 \times 3 = 0$$

$$x = 1 \quad x = 3$$

$$89. \quad \underline{\text{Cu}} \quad x = 0 \quad 98. \quad \underline{\text{Pb}} (\text{NO}_3)_2 \quad x - 1 \times 2 = 0$$

$$x = 2$$

$$90. \quad \underline{\text{Au}} \text{O} \quad x - 2 = 0 \quad 99. \quad \underline{\text{N}}_2 \text{O}_5 \quad 2x - 2 \times 5 = 0$$

$$x = 2 \quad x = 5$$

$$100. \quad \underline{\text{N}}_2 \text{O}_3 \quad 2x - 2 \times 3 = 0$$

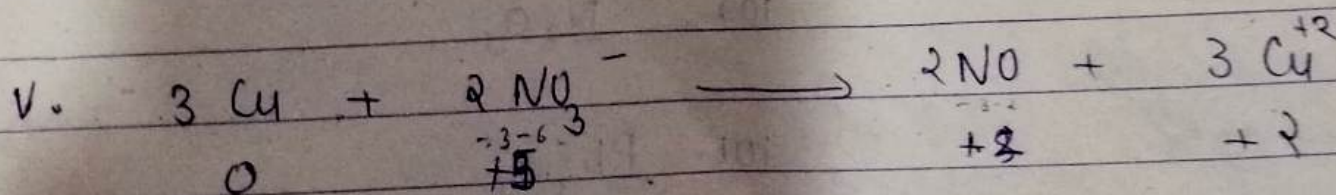
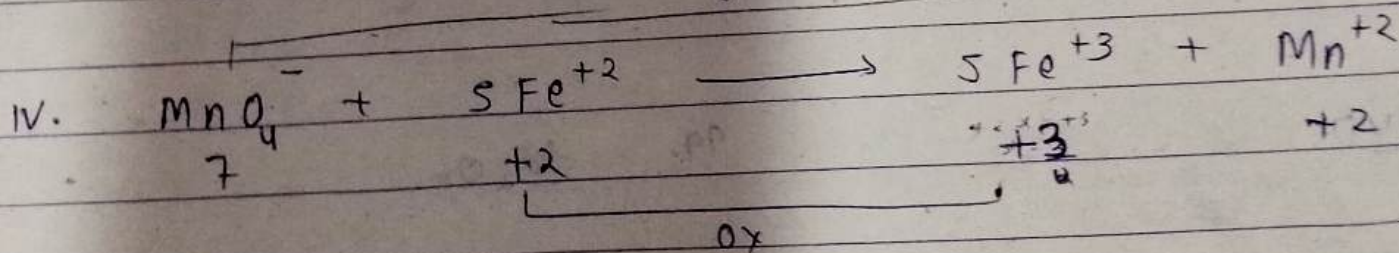
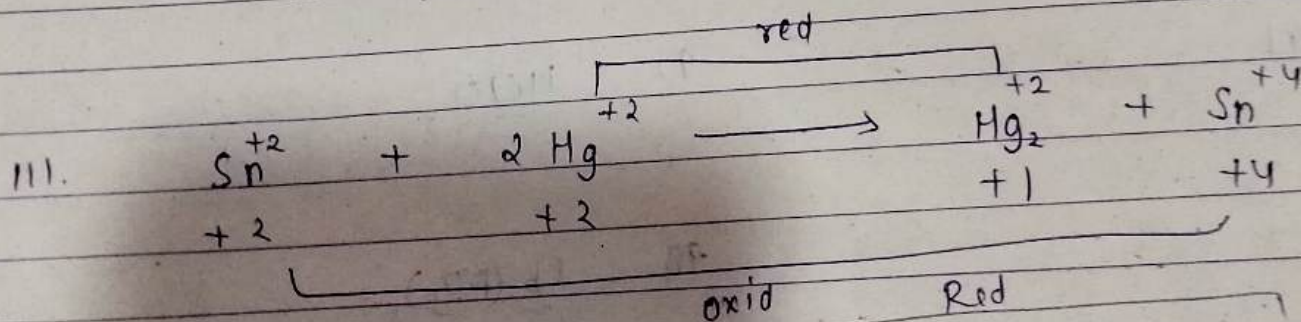
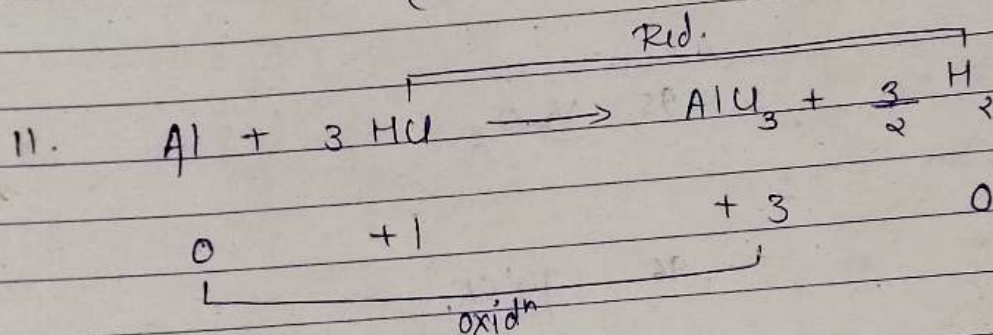
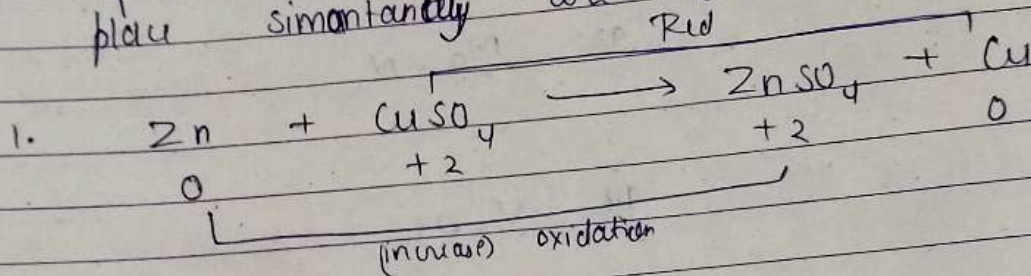
$$x = 3$$

$$91. \quad \underline{\text{Cu}} \text{SO}_4 \quad x - 2 = 0 \quad 101. \quad \underline{\text{Pb}}_3 \text{O}_4 \quad 3x - 2 \times 4 = 0$$

$$x = 2 \quad x = \frac{8}{3}$$

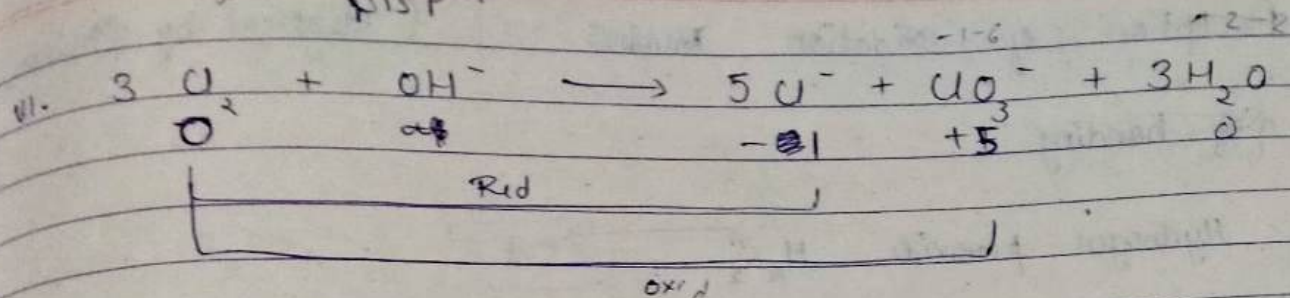
⊛ Redox Reaction

A reaction in which oxidation and reduction take place simultaneously are called Redox reaction



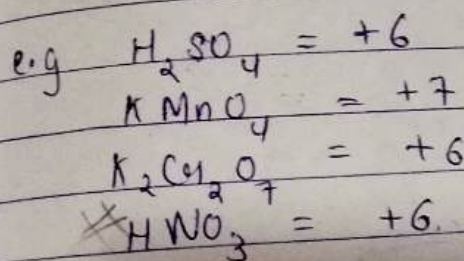
2Mn⁰
x=0

Disproportionation



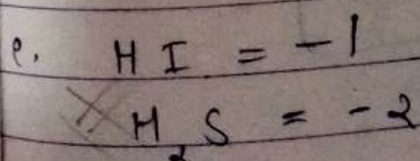
⊗ Oxidising agent

- A reagent can oxidise other and reduce itself.
- A reagent which are in there higher oxidising state act as oxidising agent.



⊗ Reducing Agent.

- A reagent which reduce other and oxidise itself
- A reagent which are in there low oxidised state act as Reducing agent



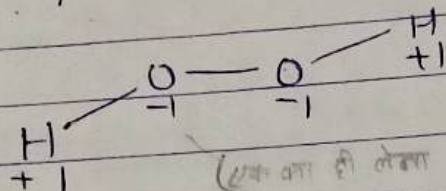
Paradox

* Exception of oxidation Number

(identical by structure)

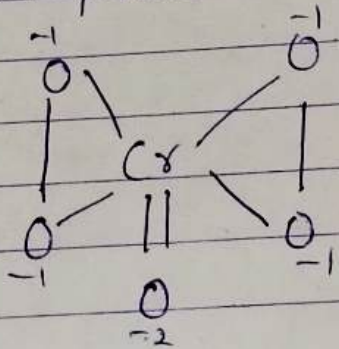
self bonding

eg. i. Hydrogen peroxide $H_2O_2 \rightarrow -1$

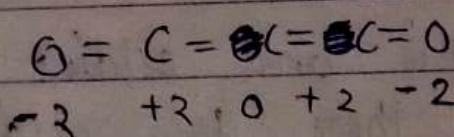


(एक-एक ही होता है kyuki self bonding)

eg. ii. Chromium pentoxide CrO_5 $[Cr = +10] \times$

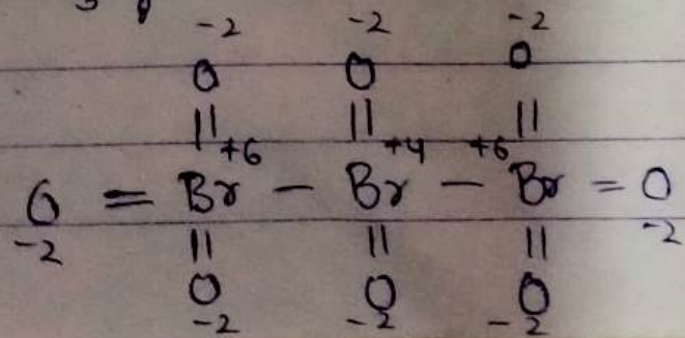


eg. iii. Carbon suboxide C_3O_2 $[Cr = +\frac{4}{3}] \times$

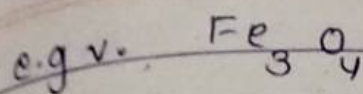


eg. iv. Br_3O_9 Tribromo octaoxide

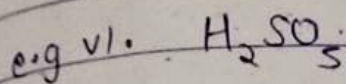
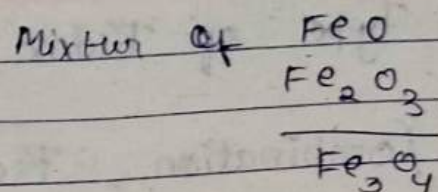
$[Br = \frac{16}{3}] \times$



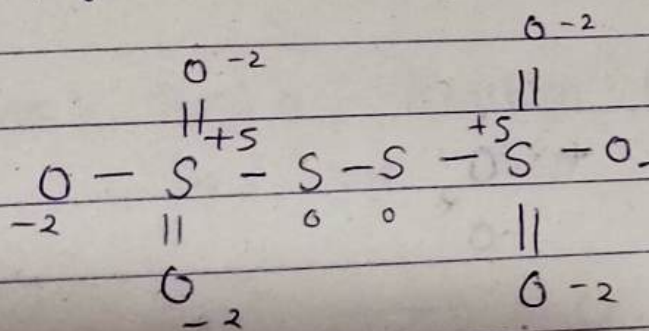
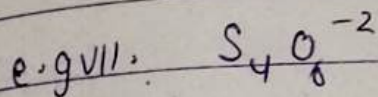
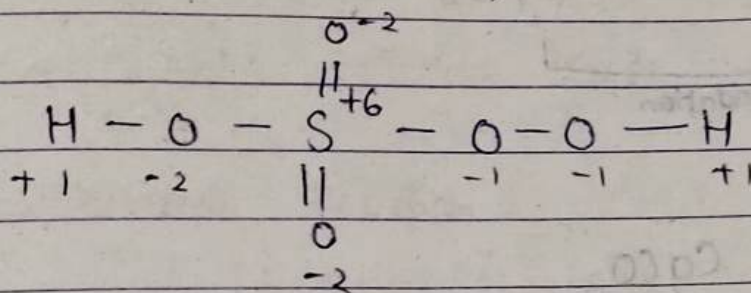
Br = 0



$$\boxed{\text{Fe} = \frac{8}{3}} \times$$

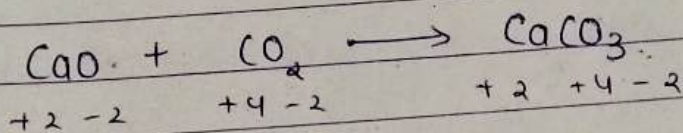
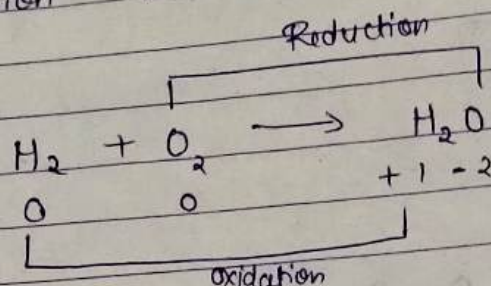


$$\boxed{\text{S} = +8} \times$$

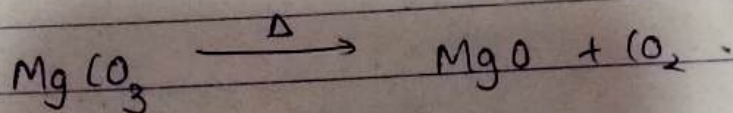
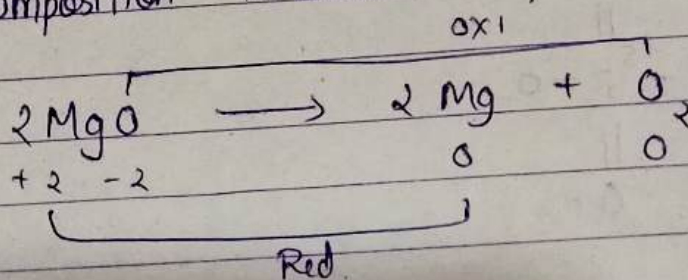


* Type of Redox Reaction.

⊕ Combination Reaction

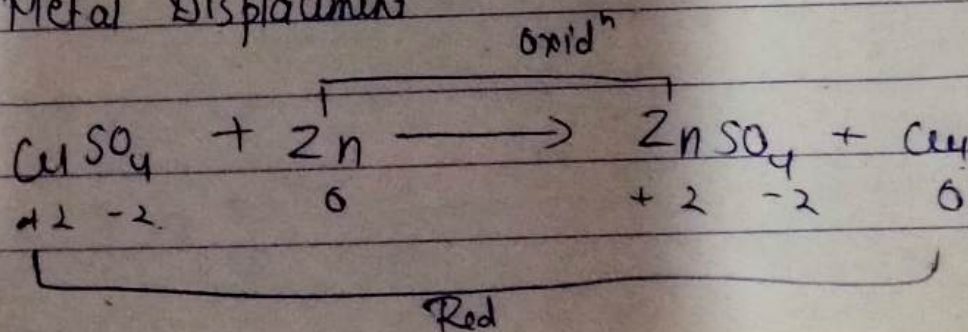


⊖ Decomposition Reaction

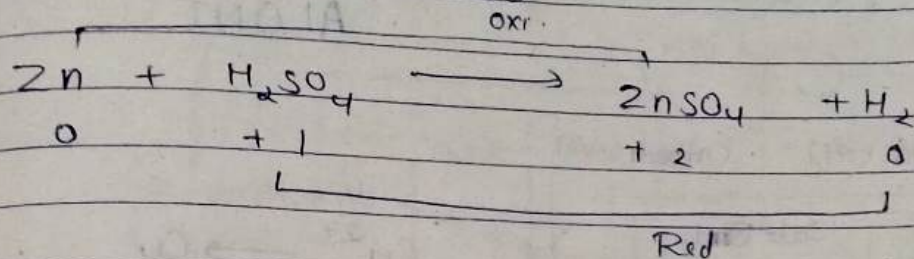


⊖ Displacement Reaction

a. Metal Displacement



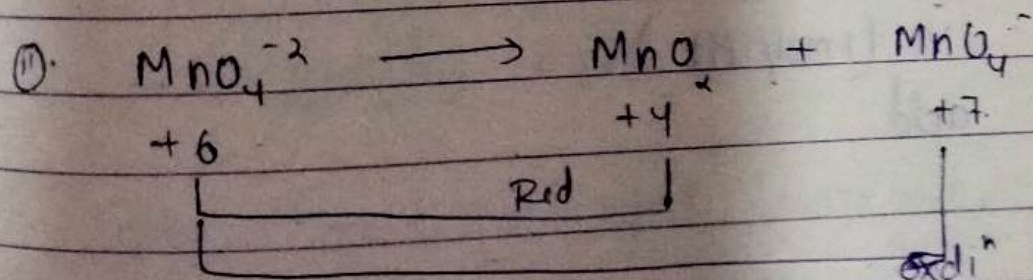
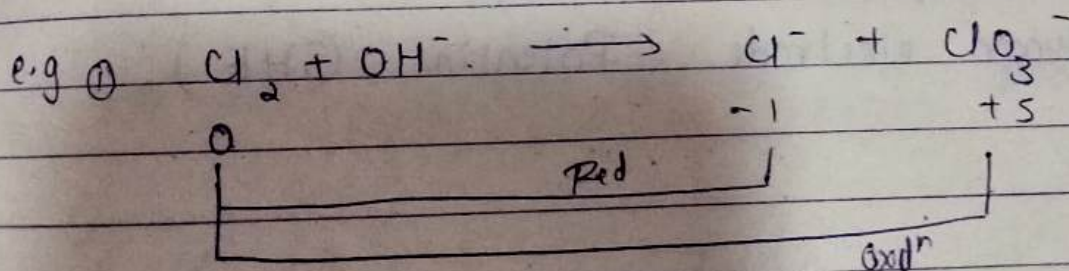
b. Non-metal Displacement



④. Disproportionation Reaction

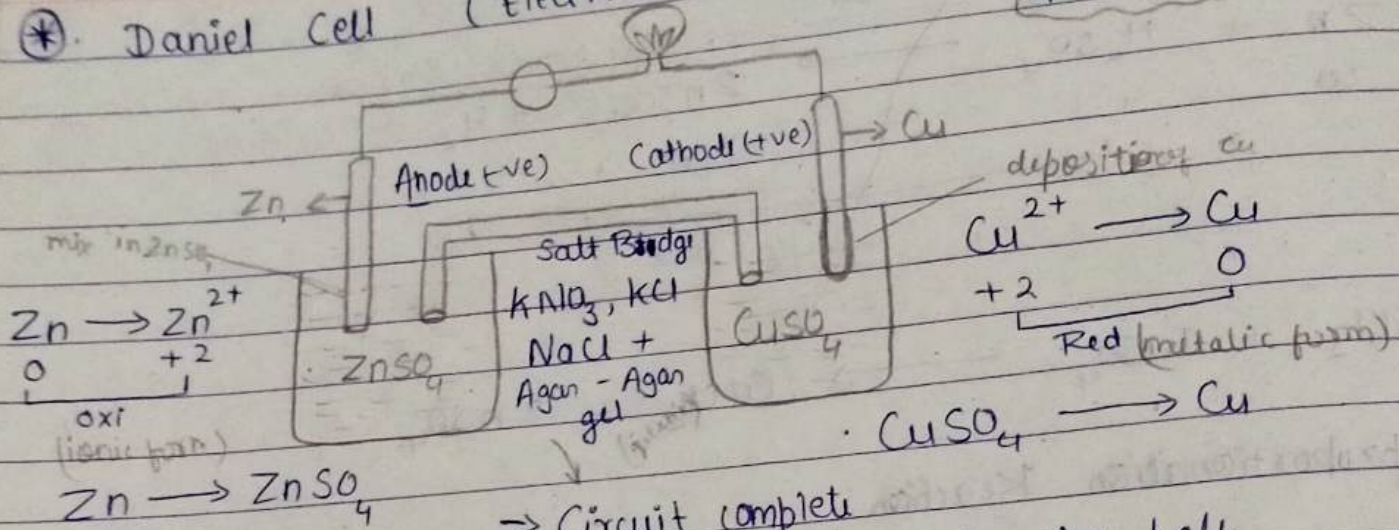
A Reaction in which oxidation and Reduction take place in some entities that is called Disproportion

Identification: In a Reaction, an entity have 3 oxidⁿ no. in one Rxn



* Daniel Cell (Electrochemical cell)

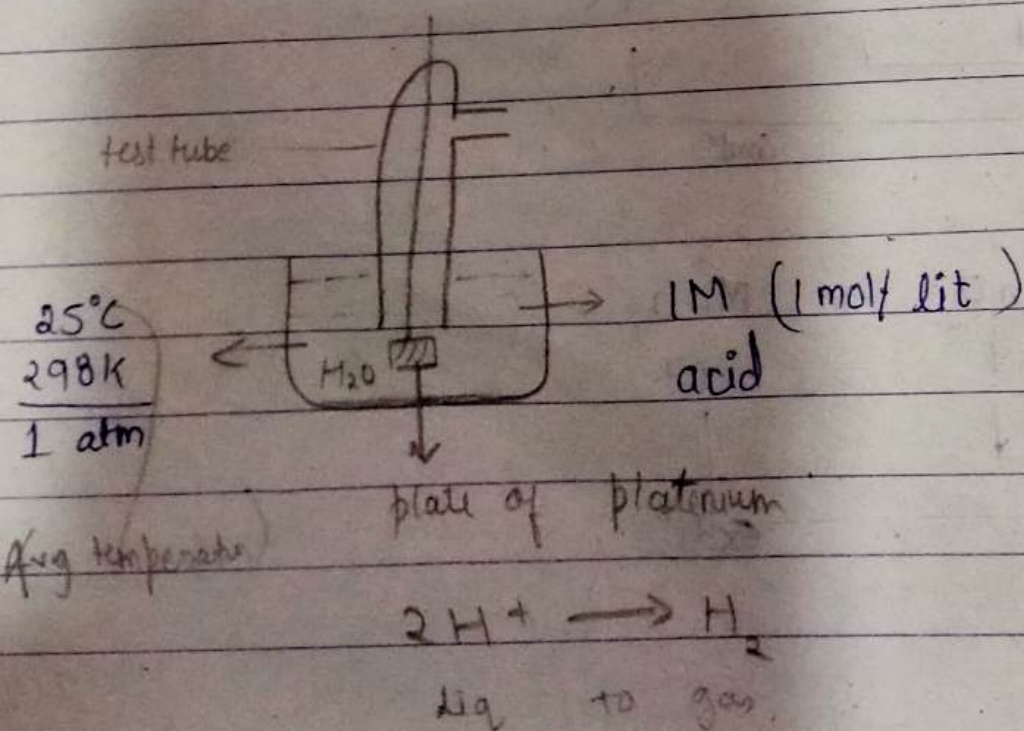
ALONE

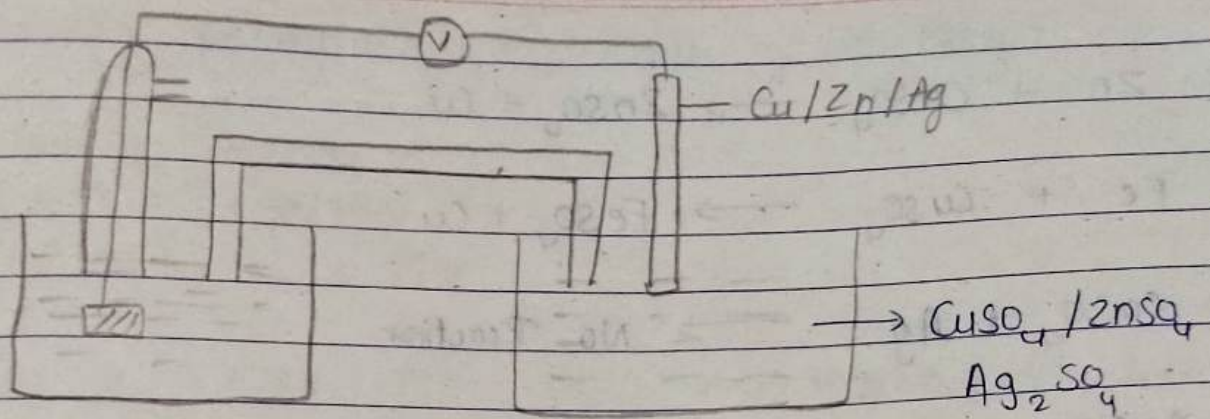


→ Circuit complete
 → e^- transfer / ion transfer help

- A = Anode
- O = oxidation
- L = Left
- N = Negative

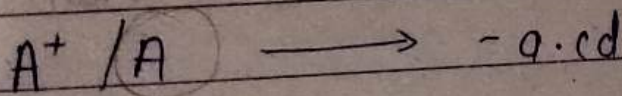
* Standard Hydrogen electrode . Potential (SHE)





(*) Electrochemical series / Reduction potential series

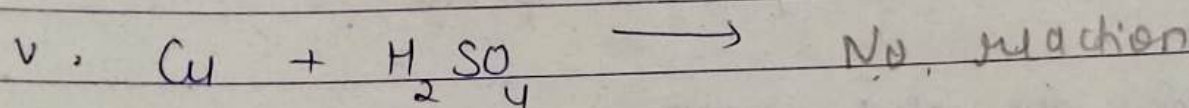
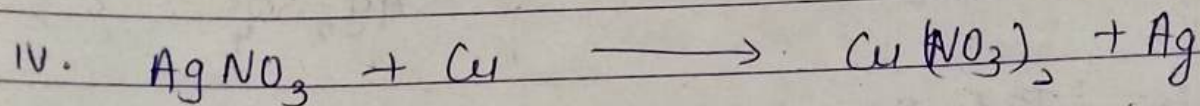
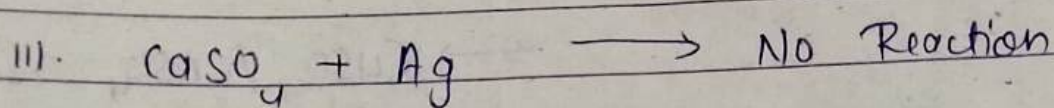
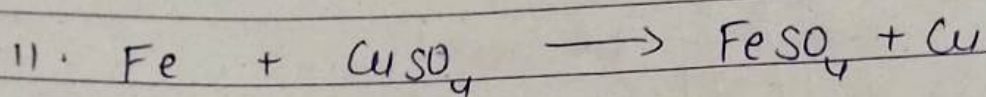
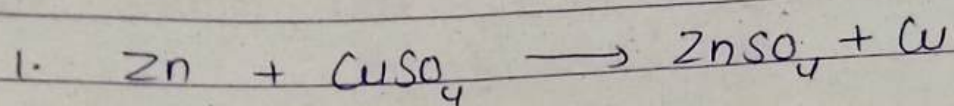
- i. Top to the series are electro positive
- ii. Down of the series are electro negative
- iii. Top of the series good Reducing Agent
- iv. Down of the series good oxidising Agent
- v. ऊपर वाले entity नीचे वाले को Replace करते हैं।



Reductive

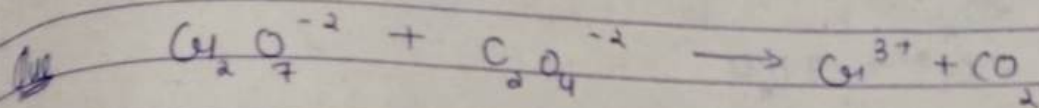
→ good reducing agent (more -ve) → always right

→ good oxidising agent (more +ve) → always left

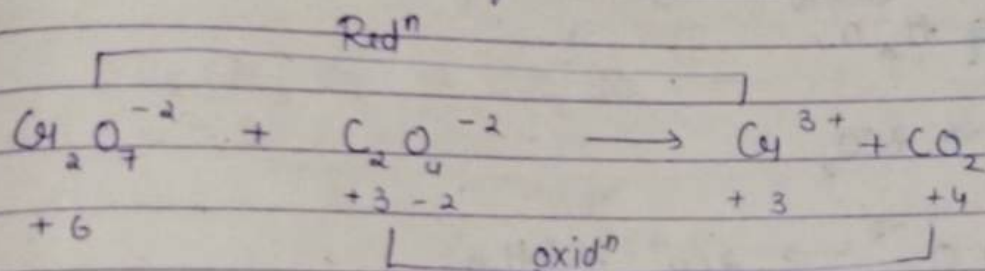


* Balancing

I. ion - electron method

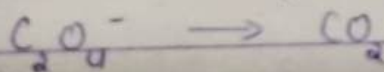


Step 1 // Write O.No. of All entities

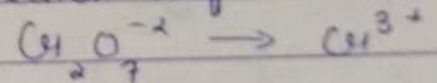


Step 2 // Write half reaction

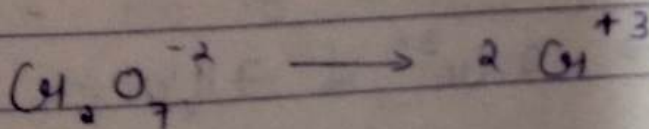
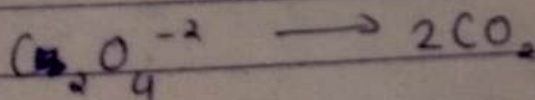
oxidation half Reaction



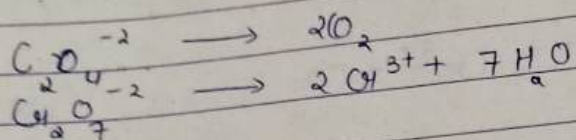
Reduction half Reaction



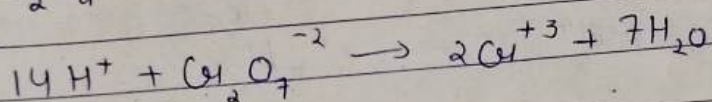
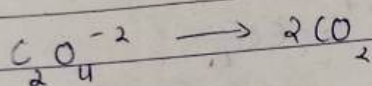
Step 3 // Balance all the entities L.H.S = R.H.S
except Hydrogen and Oxygen



Step 4). Balance oxygen by adding H_2O in opposite side

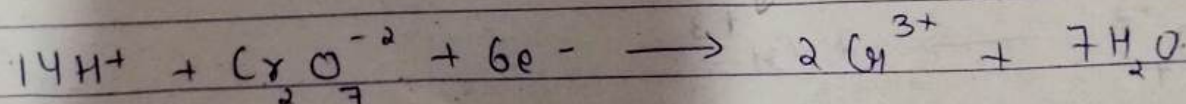
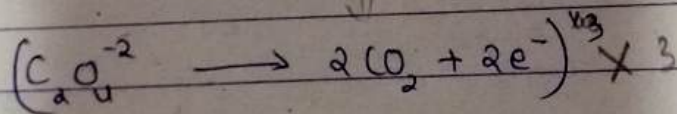
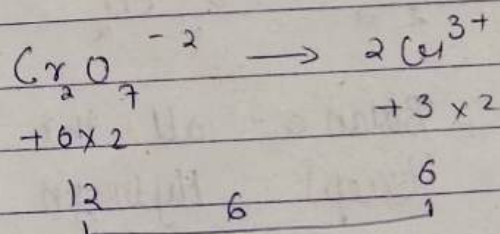
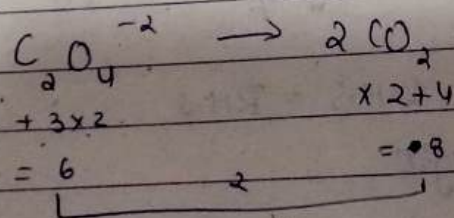


Step 5). Balance Hydrogen by adding H^+ in opposite side of H_2O .



Step 6). Balance no. of electron

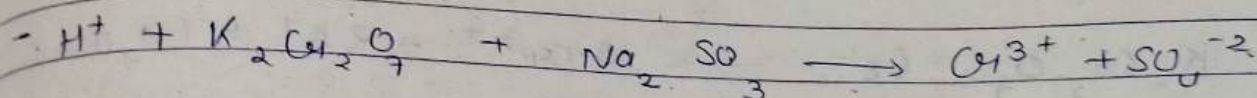
Only in Rough



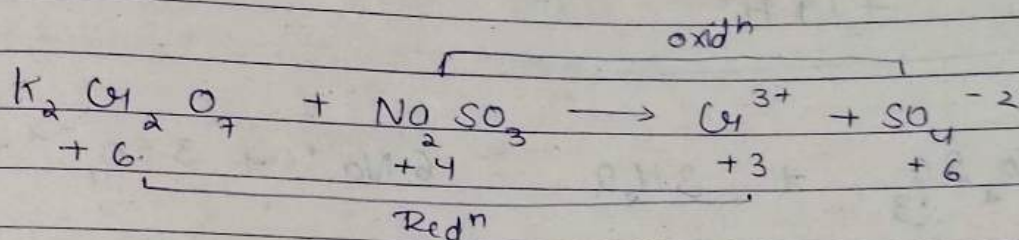
Step VII). Write over all Reaction and check all entities

$$3C_2O_4^{2-} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6CO_2 + 2Cr^{3+} + 7H_2O$$

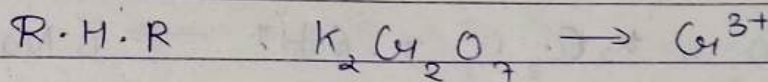
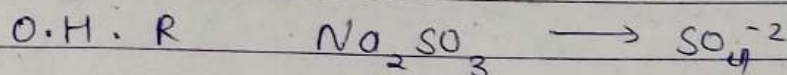
Write the net ionic equation for Reaction of potassium dichromate (VI) $K_2Cr_2O_7$ with sodium sulphite Na_2SO_3 in an acidic solution and give Chromium (III) ion and the sulphate ion.



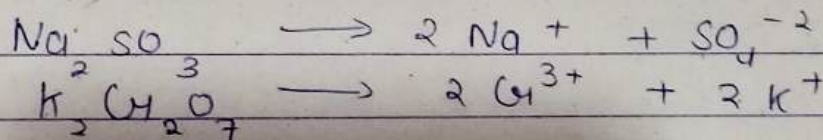
Step I.



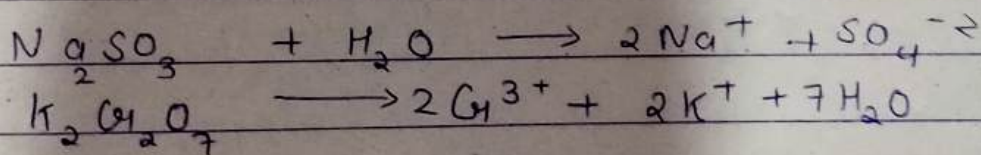
Step 2



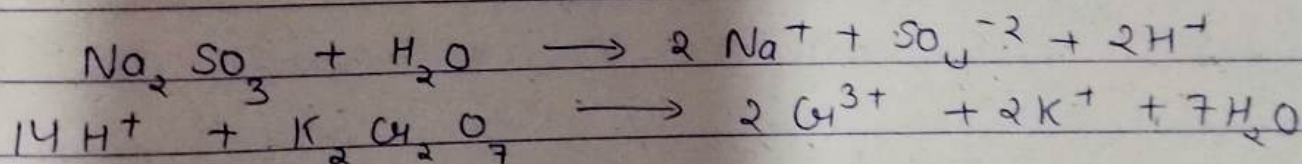
Step 3



Step 4

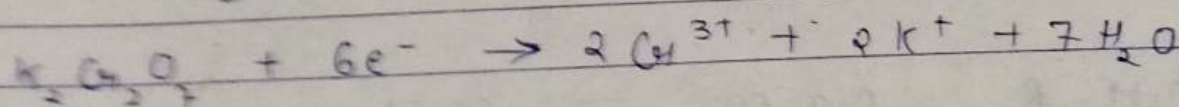
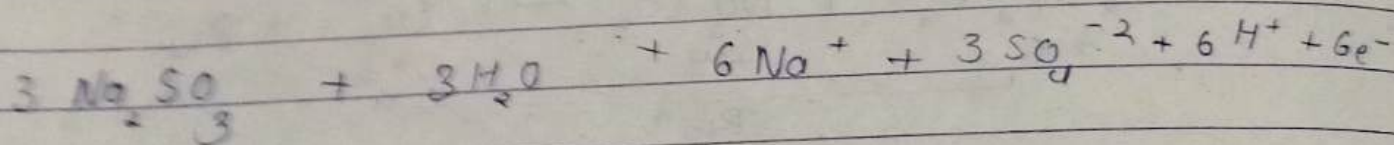
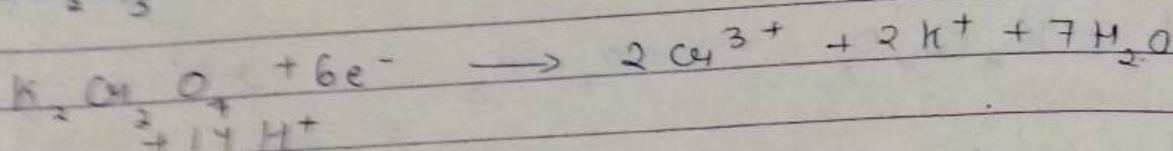
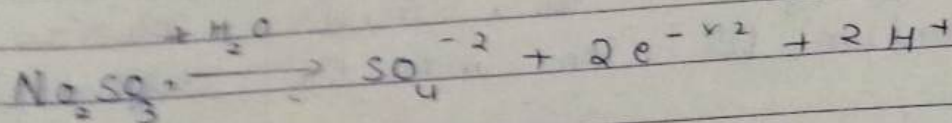
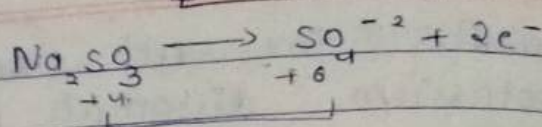


Step 5

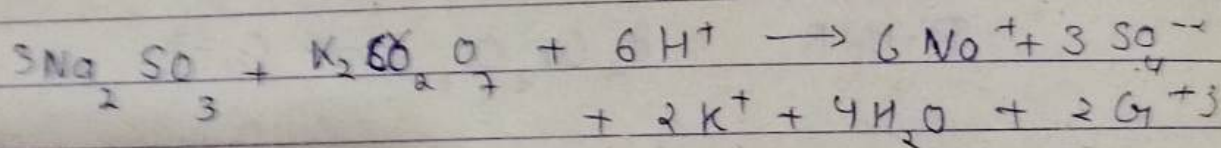


Step 6)

Balance e^-



Step 7)



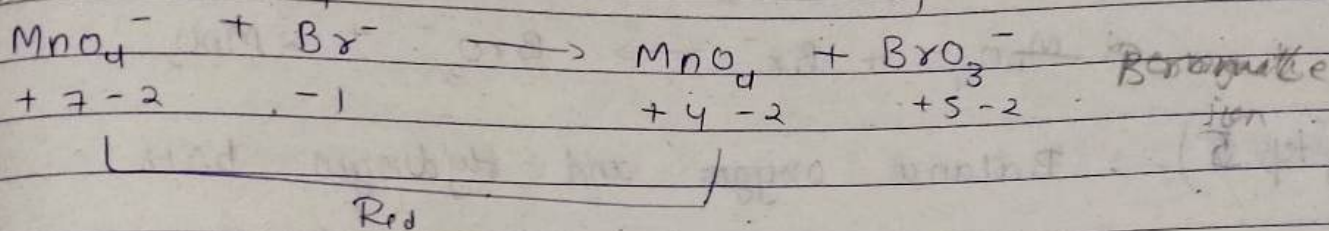
Oxidation Number Method

basic medium

Step 1 → write unbalanced equation and write Ox. no. of all entities

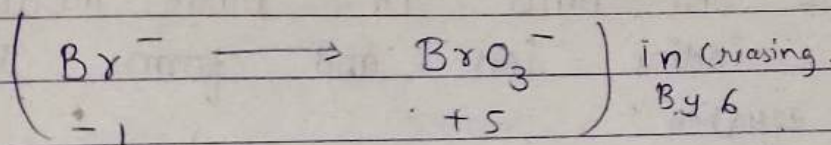
reduct ion

oxdⁿ

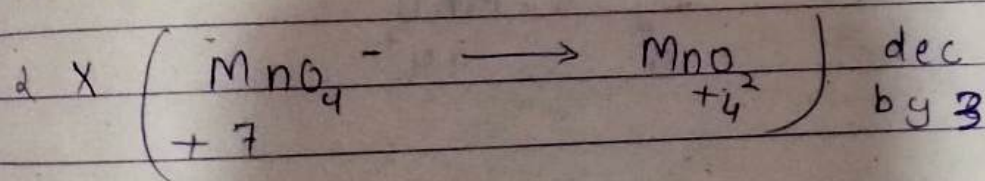


Step 2 write half Reaction

oxl half Rxn

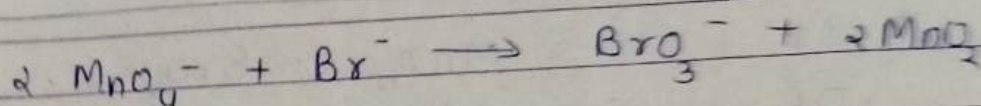
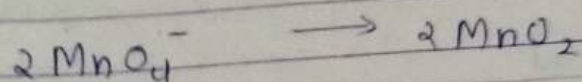
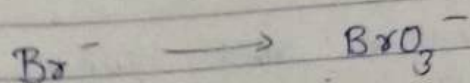


Red half Rxn

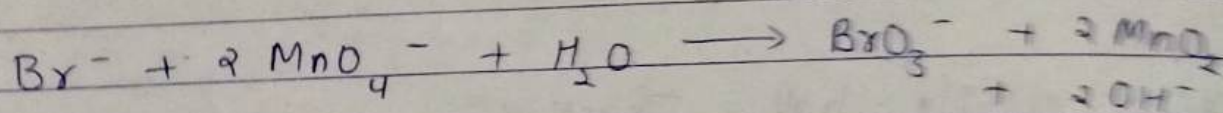


Step III) Balance all entities except O & H with all balancing of O. No.

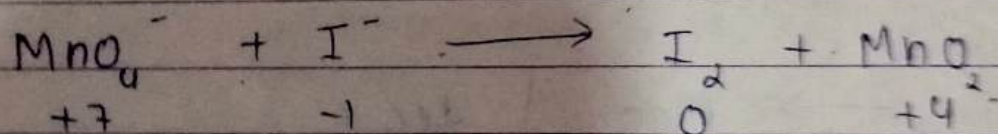
Step 4) write balancing equation without balancing of O and H



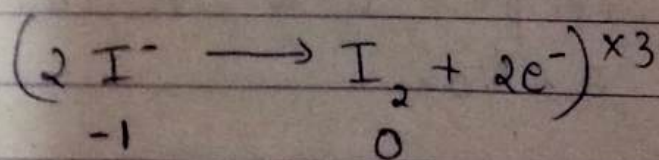
Step 5) Balance oxygen and Hydrogen both



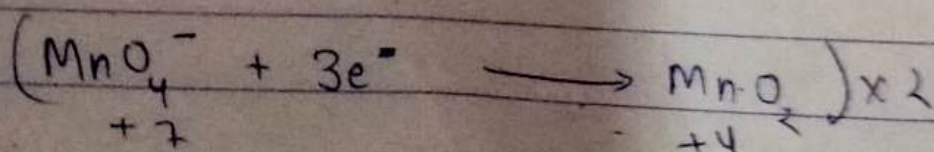
Ques Permanganate VII ion MnO_4^- in basic medium react with iodine ion and form $\text{I}_2 + \text{MnO}_2$. Balance the equation.

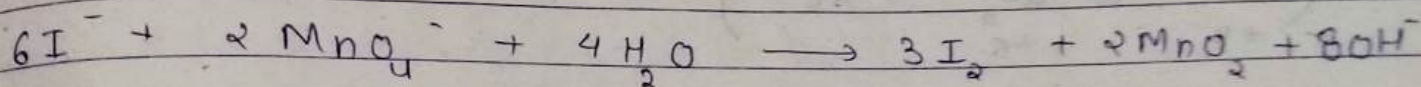
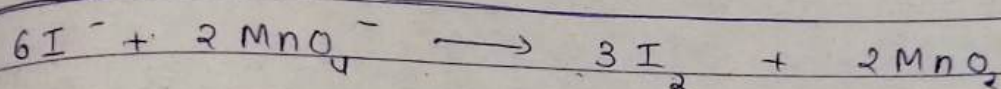
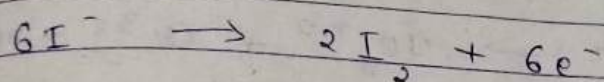


Oxi Half Rxn



Redⁿ Half Rxn





Trick

Medium acidic $\rightarrow$ 1st $\rightarrow$ oxygen $\rightarrow$ H_2O
 2nd $\rightarrow$ hydrogen $\rightarrow$ H^+

Medium basic $\rightarrow$ Combined H^+
 OH^-
 oxygen
 Hydrogen