

Class:- IX

IIT Foundation Plus

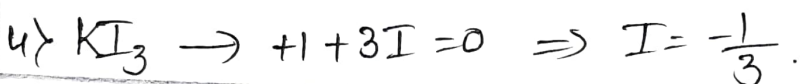
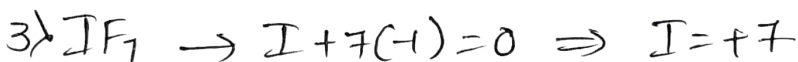
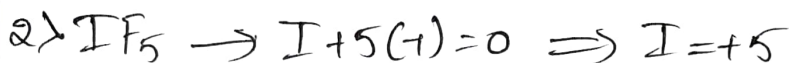
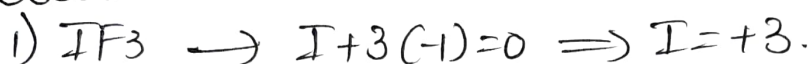
Concept of Redox Reactions

Teaching Task

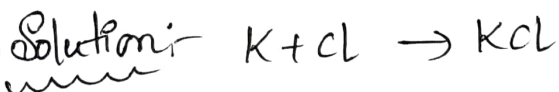
JEE Mains level Questions

Q1) Ans:- 4

Solution:-

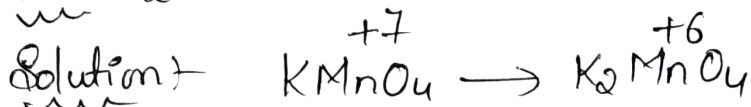


Q2) Ans:- 3.



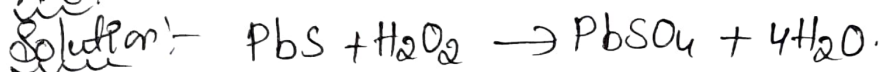
Potassium gets oxidized and chlorine gets reduced. So it is an redox reaction.

Q3) Ans:- 2.



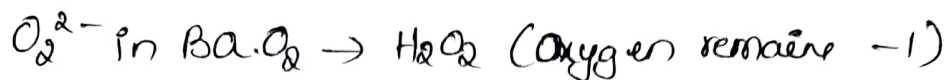
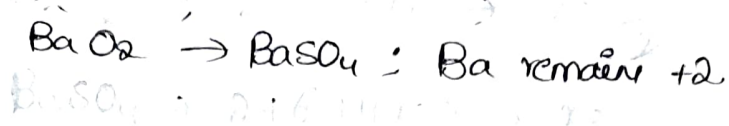
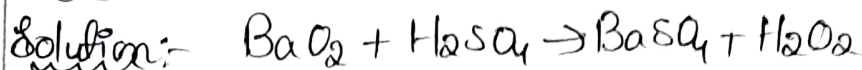
The given reaction is an example of reduction half reaction.

Q4) Ans:-



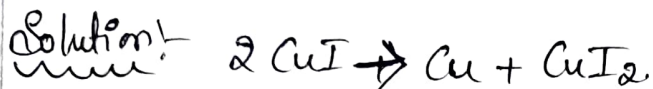
PbS undergoes oxidation

Q9b Ans:- 2



No change in oxidation state.

Q10b Ans:- 1



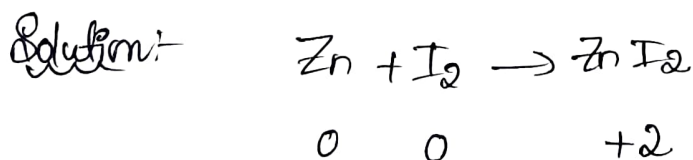
Oxidation State of Cu in CuI

In CuI , Cu is in +1 oxidation state

In Cu , Cu is 0 oxidation state } Reduction

In CuI_2 , Cu is in the +2 oxidation state
Oxidation

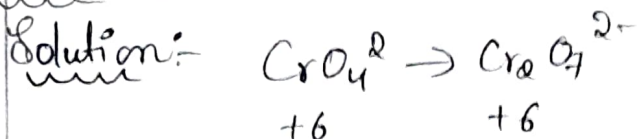
Q11 Ans:- 3.



Iodine (I_2) goes from 0 to -1, meaning it gains electrons (reduction)

In ZnI_2 , Zn has oxidation state from 0 to +2
Zn, Oxidation

Q12) Ans:- 3.

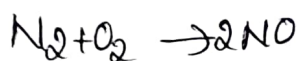


Chromium oxidation state remains +6 in both CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$.

It is not a oxidation & reduction reaction.

Q13) Ans:- 4

Solution:- Formation of Nitrogen oxide (NO) from N_2 and O_2 by lightning



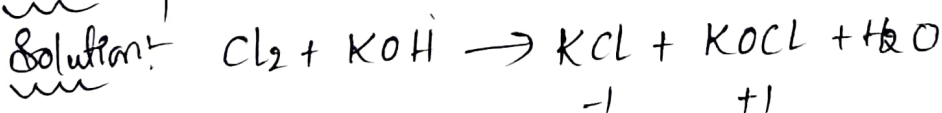
Nitrogen (N_2) is oxidized to NO &

O_2 is reduced.

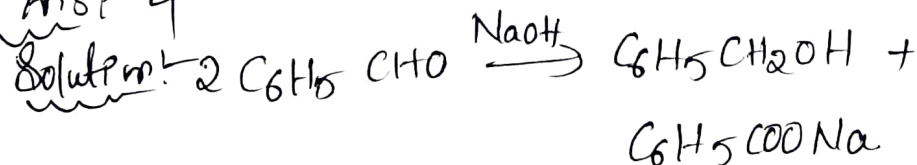
Q14) Ans:- 2

Solution:- Metallic Iron (Fe) loses electrons to form Fe^{3+} , meaning it undergoes oxidation.

Q15) Ans:- 4



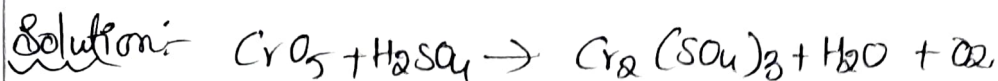
Q16) Ans:- 4



This is a cannizzaro's reaction taking place

$\text{C}_6\text{H}_5\text{CHO}$ is oxidised to $\text{C}_6\text{H}_5\text{COO}^-$ as well as reduced to $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$

Q17) Ans: B



CrO₅ :- In this one oxygen oxidation state is '-2' &
four oxygens $\rightarrow$ '-1'

$$\text{Cr} + 1(-2) + 4(-1) = 0 \Rightarrow \text{Cr} = +6.$$

Cr₂(SO₄)₃ :- $2\text{Cr} + 3(-2) = 0$
 $2\text{Cr} = 6, \text{Cr} = +3$

Change in oxidation state for one Cr atom
is $6 - 3 = 3$.

$\therefore$ For each mole of Cr reduced, 3 moles of
electrons are needed.

Q18) Ans: C

Solution: No. of e^- transferred in each case =
change in oxidation state

$$\text{KMnO}_4 \rightarrow +1 + \text{Mn} + 4(-2) = 0 \Rightarrow \text{Mn} = +7$$

$$\text{MnO}_4^{2-} \rightarrow \text{Mn} + 4(-2) = -2 \Rightarrow \text{Mn} = +6.$$

$$\text{KMnO}_4 \xrightarrow{+7} \text{MnO}_4^{2-} \xrightarrow{+6} \underline{7-6=1 e^- \text{ transferred.}}$$

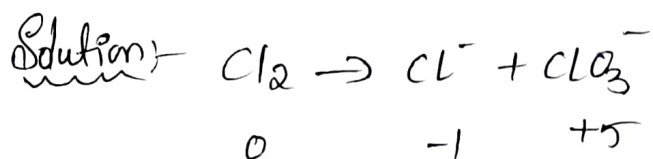
$$\text{MnO}_2 \rightarrow \text{Mn} + 2(-2) = 0 \Rightarrow \text{Mn} = +4$$

$$\text{KMnO}_4 \rightarrow \text{MnO}_2 \Rightarrow \underline{7-4=3 e^- \text{ transferred}}$$

$$\text{Mn}_2\text{O}_3 \rightarrow 2\text{Mn} + 3(-2) = 0 \Rightarrow \text{Mn} = 3, \underline{[7-3=4 e^- \text{ transferred}]}$$

$$\text{Mn}^{2+} \rightarrow \underline{7-2=5 e^- \text{ transferred.}}$$

Q19) Ans:- C.



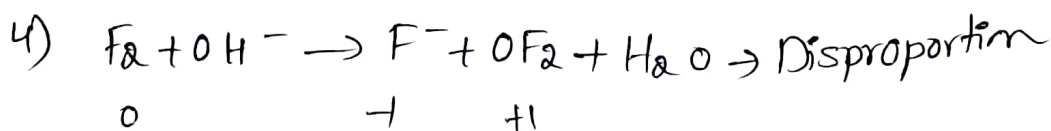
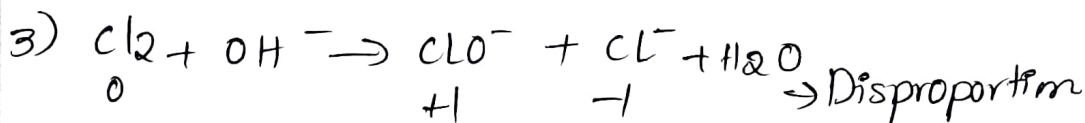
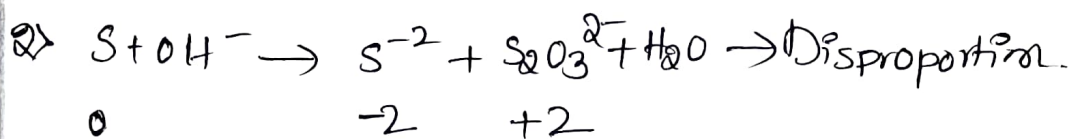
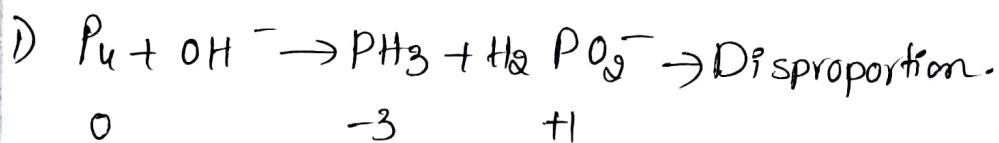
Chloride ion (Cl^-) $\rightarrow$ Oxidation state = -1
(Reduction)

Chlorate ion (ClO_3^-) $\rightarrow$ oxidation.

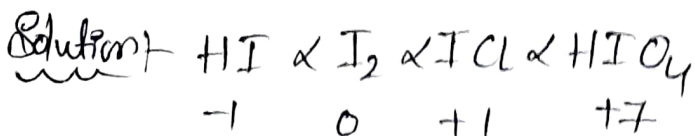
In this reaction both oxidation & reduction takes place. So it is called as disproportion reaction.

Q20) Ans:- None

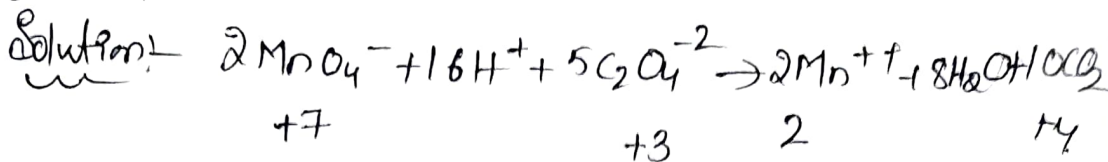
Solution:-



Q21)

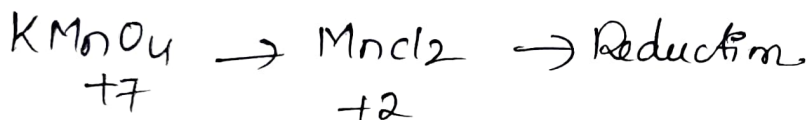
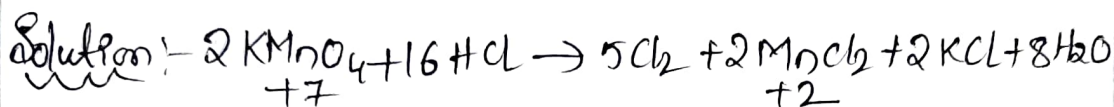
Ans:- 4.

Q22)

Ans:- 1

MnO_4^- is the oxidizing agent since it gets reduced.

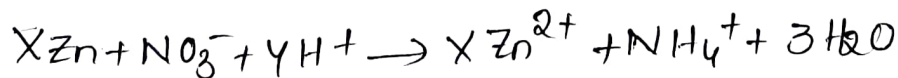
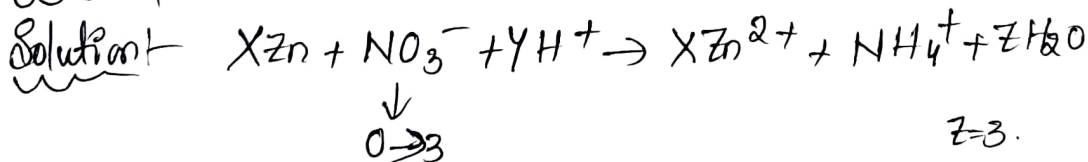
Q23)

Ans:- 2.

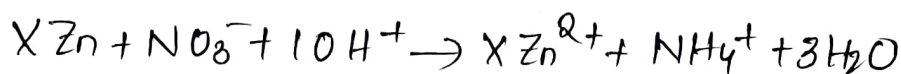
Cl in HCl $\rightarrow -1$ to Cl in $\text{Cl}_2 \rightarrow 0$ (Oxidation).

$\therefore \text{MnCl}_2$ is the reduction product

Q24)

Ans:- 1

H $\rightarrow 10$, so $Y=10$.

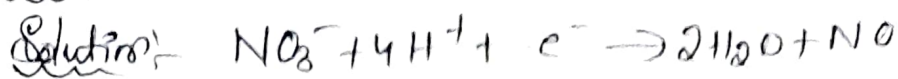


$10^+ \& 1^- = 9^+$ $X(\text{positive}^{+2}) + 1 \text{ positive}$

$4^+ (+2) + 1 = 9.$

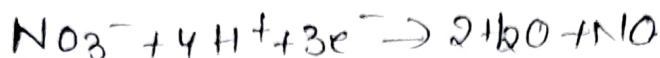
$X=4$

Q25) Ans:- 3



$$-1 + 4 + 3e^-$$

In this equation, all atoms are balanced
charge add $3e^-$ to L.H.S we have.



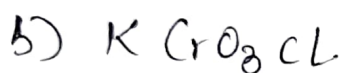
JEE Advanced Level Questions

Q26) Ans:- b, c



$$+2 + 2(\text{Cr} + 4(-2)) = 0 \Rightarrow \cancel{\text{Cr} = 6}$$

$$\text{Cr} = +3$$



$$+1 + \text{Cr} + 3(-2) + (-1) = 0 \quad \checkmark$$

$$\text{Cr} = +6$$

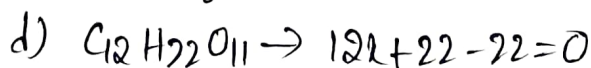
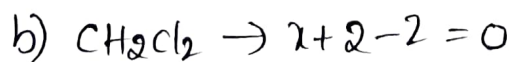
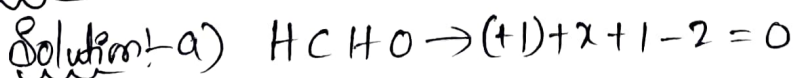


$$x + 4(-1) - 2 = 0 \Rightarrow x = +6.$$



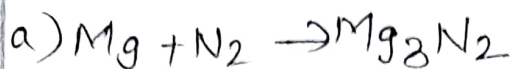
$$x + 4(-1) = -1 \Rightarrow x = -1 + 4 \Rightarrow x = +3$$

Q27) Ans:- a, b, c, d



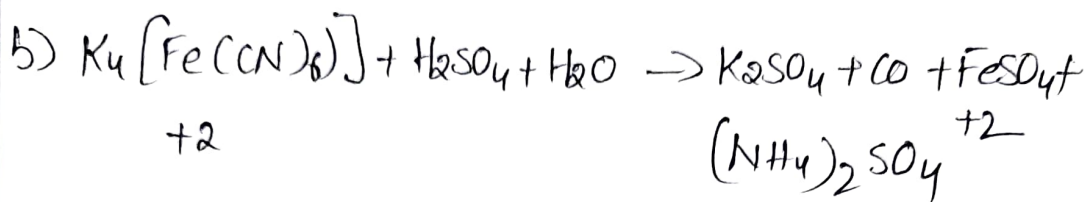
Q28) Ans: b, d.

Solution:-



0 0

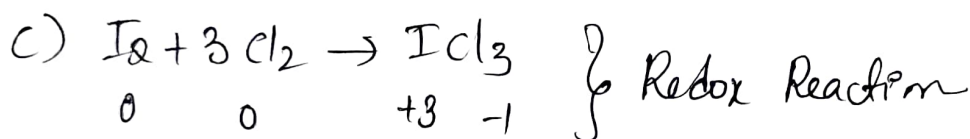
In Mg_3N_2 :- Mg forms Mg^{+2} (+2) } Redox
N forms N^{3-} (-3) } reaction



+2

+2

No change $\rightarrow$ Not a redox reaction

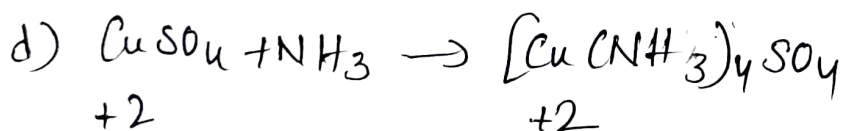


0

0

+3

-1

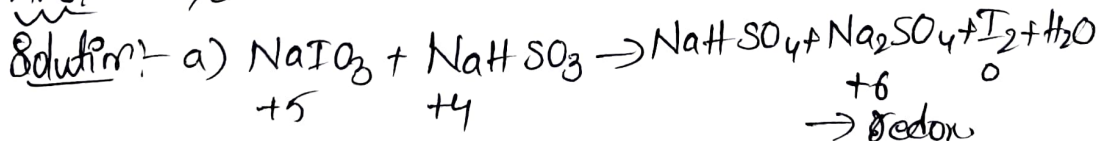


+2

+2

Not a redox reaction

Q29) Ans: a, d.



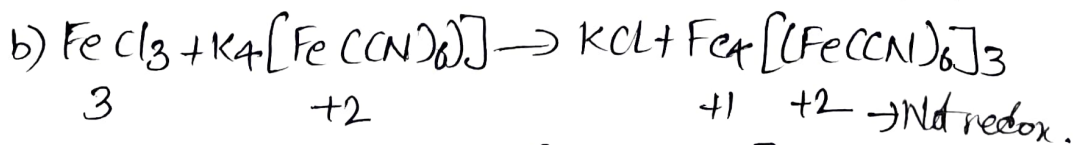
+5

+4

+6

0

$\rightarrow$ Redox



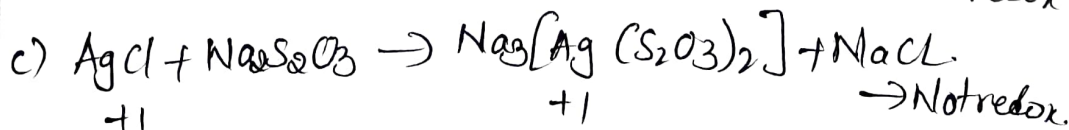
3

+2

+1

+2

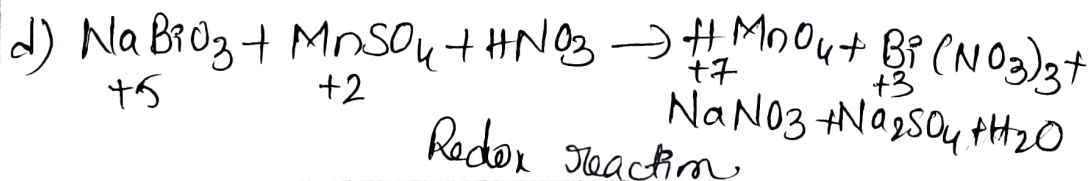
$\rightarrow$ Not redox.



+1

+1

$\rightarrow$ Not redox.



+5

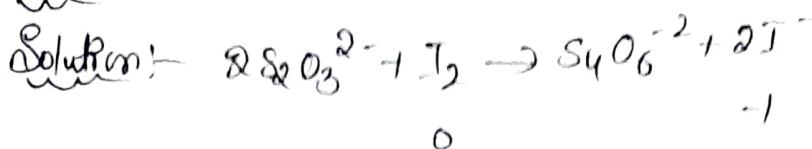
+2

+7

+3

Redox reaction

Q30) Ans:- A



Q31) Ans:- 3.

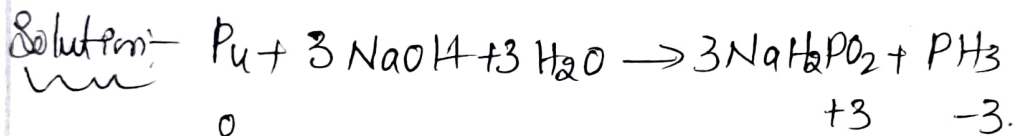
Solution:- Nitrous acid (HNO_2)

Nitrogen $\rightarrow +3$.

It can act as an oxidizing agent by getting reduced to NH_3 (-3) or N_2 (0).

$\rightarrow$ It can act as a reducing agent by getting oxidized to NO_3^- (Oxidation state +5)

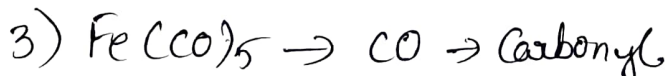
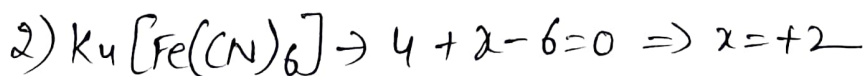
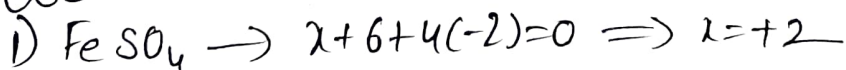
Q32) Ans:- 3



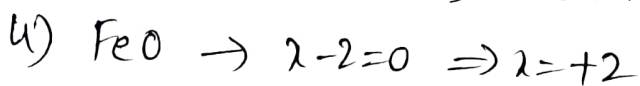
Both oxidation & reduction takes place so it is called as disproportion reaction.

Q33) Ans:- 3.

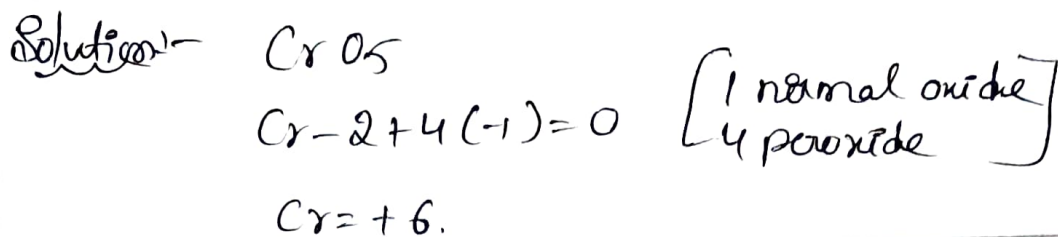
Solution:-



$Fe \rightarrow 0$ with Carbonyl group



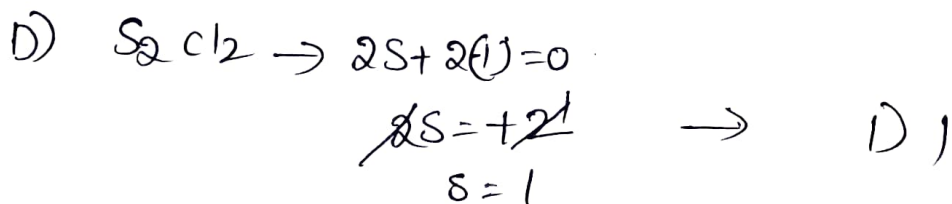
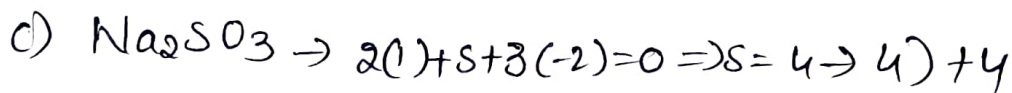
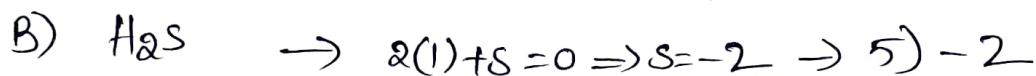
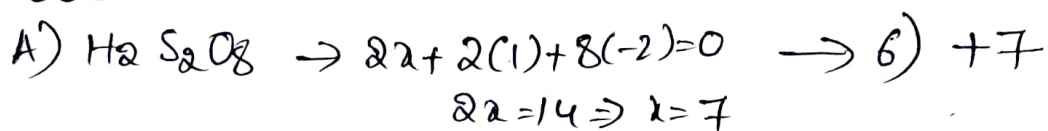
Q34) Ans 2



Matrix Matching

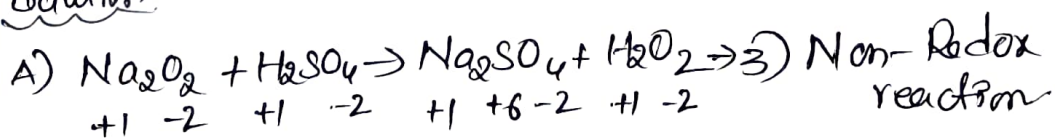
Q35) Ans A) 6 B) 5 C) 4 D) 1

Solution:-



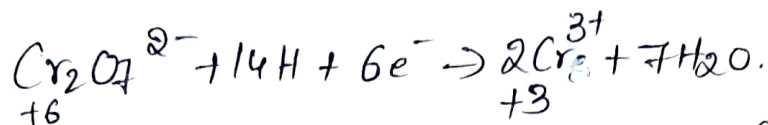
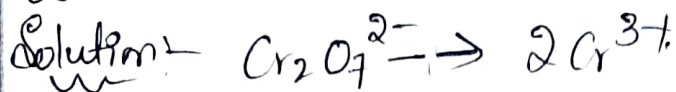
Q36) Ans 1

Solution:-



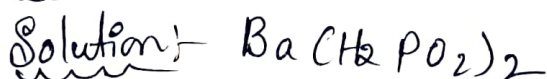
Integer Type

Q37) Ans:- 6



Oxidation state of Cr is decreasing from +6 to +3 per atom, one Cr atom gaining 3e^- , then 2 Cr atoms gain 6e^- .

Q38) Ans:- 1



$$2 + 2[2 + P + 2(-2)] = 0$$

$$2 + 2[P - 2] = 0 \Rightarrow 2 + 2P - 4 = 0$$

$$2P = 2$$

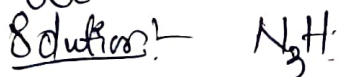
$$P = +1$$

Learners Table

Q1) Ans:- 1

Solution:- Oxidation number of elemental form of S_8 is zero.

Q2) Ans:- 3



$$3N + (1) = 0$$

$$N = -\frac{1}{3}$$

Q3) Ans:- 3.

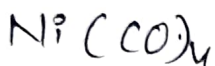
Solution:- $C + 12O$

$$C + 2(1) - 2 = 0$$

$$C = 0$$

Q4) Ans:- 1

Solution:- Carbonyl group, oxidation number = 0



$$Ni + 4(O) = 0$$

$$Ni = 0$$

Q5) Ans:- 3.

Solution:- $K_4[Fe(CN)_6]$

$$4(1) + Fe + 6(-1) = 0$$

$$Fe = +2$$

Q6) Ans:- 2

Solution:- OF_2

Valency of oxygen = 2

Oxidation state of oxygen is

$$2 + 2(-1) = 0 \Rightarrow x = +2$$

Q7) Ans:- 2

Solution:- 1) $HClO_4 \rightarrow +1 + x + 4(-2) = 0 \Rightarrow x = +7$

2) $HClO_3 \rightarrow +1 + x - 6 = 0 \Rightarrow x = +5$

3) $HClO_2 \rightarrow +1 + x - 4 = 0 \Rightarrow x = +3$

4) $HCl \rightarrow +1 + x = 0 \Rightarrow x = -1$

Q8) Ans:- 3.

Solution:- In its elemental form, all elements commonly exhibit an oxidation state of zero.

Q9) Ans:- 1

Solution:- The maximum oxidation state that Fluorine exhibits is -1

Q10) Ans:- 3.

Solution:- Fluorine always exhibits a negative oxidation state in its compounds.

Q11) Ans:- 2.

Solution:- Minimum oxidation state of Nitrogen is '-3'.

Q12) Ans:- 4

Solution:- $K_2Cr_2O_7$

$$\begin{aligned} \underline{\underline{Cr:-}} \quad 2(1) + 2Cr + 7(-2) &= 0 \\ 2Cr - 12 &= 0 \Rightarrow 2Cr = 12 \Rightarrow Cr = +6. \end{aligned}$$

$$\begin{aligned} \text{In } K_2CrO_4, \quad 2(1) + Cr + 4(-2) &= 0 \Rightarrow Cr - 6 = 0 \\ Cr &= +6. \end{aligned}$$

K remains +1 (No change)

Cr remains +6 (No change)

O remains -2 (No change)

No element changes its oxidation state, this is not a redox reaction

Q13) Ans:- 3.

Solution:- HN_3

$$1 + 3N = 0$$

$$3N = -1 \Rightarrow N = -\frac{1}{3}$$

Q14) Ans:- 2

Solution:- CO_2

$$C + 2(-2) = 0 \Rightarrow C = +4$$

Q15) Ans:- 3.

Solution:- 1) $\text{H}_2\text{O} \rightarrow 2(1) + 2 = 0 \Rightarrow x = -2$

2) $\text{H}_2\text{O}_2 \rightarrow 2(1) + 2x = 0 \Rightarrow \cancel{2x} = \cancel{-2} \Rightarrow x = -1$

3) $\text{OF}_2 \rightarrow x + 2(-1) = 0 \Rightarrow x = +2 \checkmark$

4) $\text{H}_2\text{SO}_4 \rightarrow 2 + 6 + 4x = 0 \Rightarrow \cancel{4x} = \cancel{-8} = -2$

Q16) Ans:- 1

Solution:- In $\text{S}_8 \rightarrow$ Oxidation state = 0

$\text{S}_2\text{F}_2 \Rightarrow 2S + 2(-1) = 0 \Rightarrow \cancel{2S} = \cancel{-2} \Rightarrow S = 1$

$\text{H}_2\text{S} \Rightarrow 2(1) + S = 0 \Rightarrow S = -2$

Q17) Ans:- 4

Solution:- $\text{CrO}_4^{2-} \rightarrow \text{Cr}_2\text{O}_7^{2-}$

CrO_4^{2-}

$$\text{Cr} + 4(-2) = -2 \Rightarrow \text{Cr} = 6$$

$\text{Cr}_2\text{O}_7^{2-}$

$$2\text{Cr} + 7(-2) = -2 \Rightarrow 2\text{Cr} = -2 + 14$$

$$\text{No change } 2\text{Cr} = 12 \Rightarrow \text{Cr} = 6$$

Q18)

Ans:- 3.Solution:- Glucose $C_6H_{12}O_6$

$$6x + 12 + 6(-2) = 0$$

$$6x = 0 \Rightarrow x = 0$$

Q19)

Ans:- 2

Solution:- Lost of electrons means oxidation, so in manganese if it lost three electrons means it undergo oxidation and therefore oxidation state is increased to '+6'

Q20)

Ans:- 3.Solution:- S_8 oxidation state is zero.

S_8 exists in crown like structure in which each sulphur atom is attached to 2 other sulphur atoms. Therefore the covalency of S_8 is 2

Q21)

Ans:- 1Solution:- Acetaldehyde $\rightarrow CH_3CHO$.

$$2x + 4(1) + (-2) = 0$$

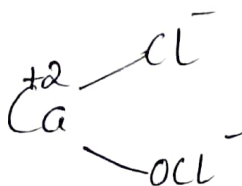
$$2x = -2$$

Q22)

Ans:- 3Solution:- $CaOCl_2$ Cl^- : oxidation state = -1

$$OCl^- \rightarrow -2 + Cl = -1$$

$$Cl = -1 + 2 = +1$$



Q23) Ans:- 4

Solution:- $\text{H}_2\text{S}_2\text{O}_7$

$$2(1) + 2S + 7(-2) = 0$$

$$2S - 12 = 0 \Rightarrow S = 12/2$$

$$S = +6$$

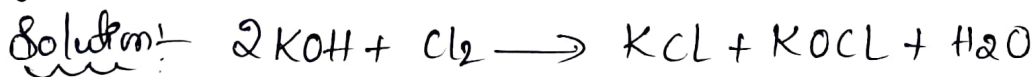
Q24) Ans:- 1

Solution:- Alloys are not compounds.

→ There is no chemical combination or chemical reaction b/w mercury and sodium in sodium amalgam.

→ Hence the oxidation state of mercury and sodium are zero

Q25) Ans:- 4



$$\text{KCl} \rightarrow 1 + \text{Cl} = 0 \Rightarrow \text{Cl} = -1$$

$$\text{KOCl} \rightarrow 1 + (-2) + \text{Cl} = 0 \Rightarrow \text{Cl} = +1$$

Q26) Ans:- 3

Solution:- $\text{Na}_2\text{S}_4\text{O}_6$

$$2(1) + 4S + 6(-2) = 0$$

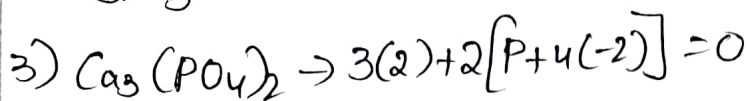
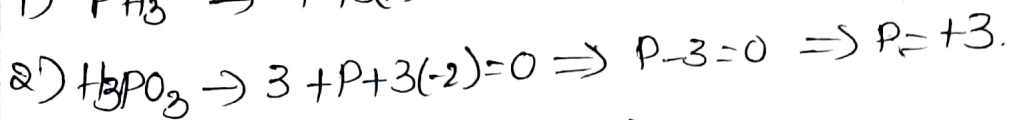
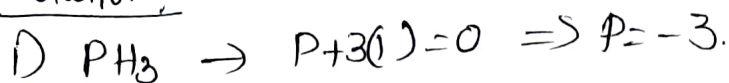
$$4S + 2 - 12 = 0$$

$$4S = 10$$

$$S = \frac{10}{4} = \frac{5}{2}$$

Q27) Ans:- 3.

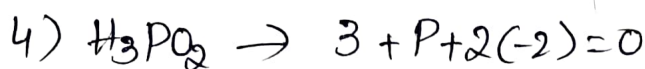
Solution:-



$$6 + 2\text{P} - 16 = 0 \Rightarrow 2\text{P} - 10 = 0$$

$$2\text{P} = 10 \Rightarrow$$

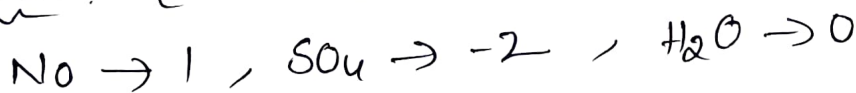
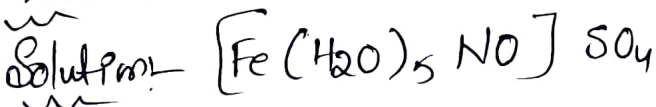
$$\text{P} = +5 \checkmark$$



$$\text{P} - 1 = 0 \Rightarrow \text{P} = +1.$$

JEE Main Level Questions

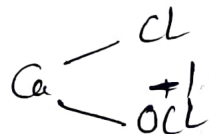
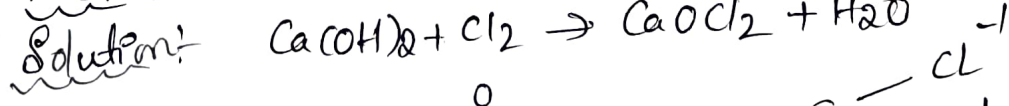
Q28) Ans:- 1



$$\text{Fe} + 5(0) + 1 + (-2) = 0$$

$$\text{Fe} - 1 = 0 \Rightarrow \underline{\text{Fe} = +1}$$

Q29) Ans:- 2



$$\text{OCl} \rightarrow -2 + \text{Cl} = -1 \Rightarrow \text{Cl} = +1.$$

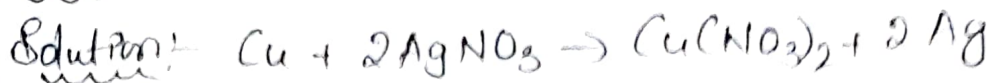
In CaOCl_2 , one $\text{Cl} \rightarrow -1$, another $\text{Cl} \rightarrow +1$.

Here Cl oxidation changes from zero to -1

or

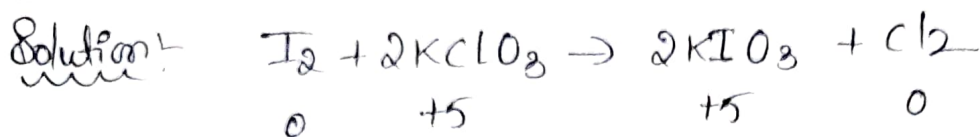
zero to +1

Q30)

Ans: 3.

When copper is added to silver nitrate solution, silver is precipitated due to oxidation of copper & reduction of silver

Q32)

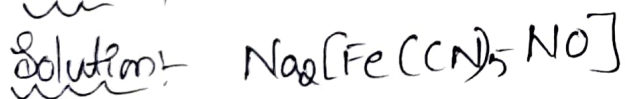
Ans: 3.

$\text{I}_2 \rightarrow$ Undergoes oxidation $\rightarrow$ Reducing agent

$\text{KClO}_3 \rightarrow$ Undergoes reduction $\rightarrow$ Oxidising agent

Iodine displaces chlorine.

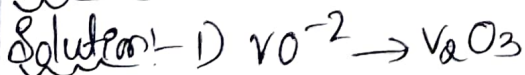
Q33)

Ans: 1

$$2(1) + \text{Fe} + 5(-1) + 1 = 0$$

$$\text{Fe} - 2 = 0 \Rightarrow \text{Fe} = +2$$

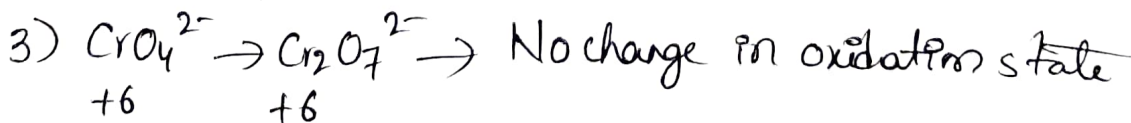
Q34)

Ans: 3

$$\text{V} = 0$$

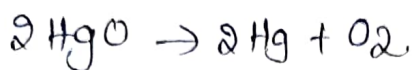
$$\text{V} = 3$$

$\rightarrow$ Change in oxidation state



Q35) Ans:- 1

Solution:- Reaction in which single compound breaks down into smaller compounds is decomposition reaction.



Q36) Ans:- 4

Solution:- $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
double displacement reaction

Q37) Ans:- 4.

Solution:- When halogens react with NaOH, it is a disproportionation reaction.



Q38) Ans:- 1

Solution:- A reaction in which a more electropositive metal displaces a less electropositive metal is called metal displacement reaction.

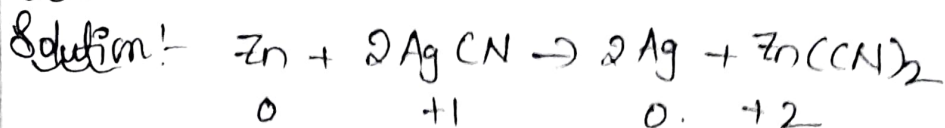


Q39) Ans:- 2

Solution:- $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}.$

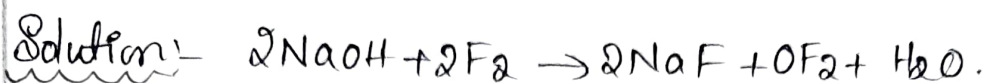
Zn acts as reducing agent because it undergoes oxidation.

Q401 Ans:- 4.



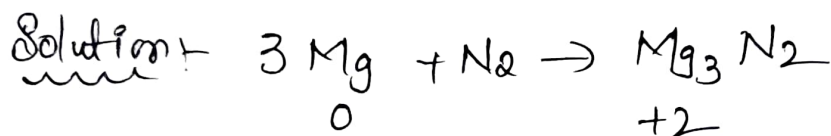
Redox reaction

Q411 Ans:- 3



This reaction is redox reaction but not disproportionation reaction.

Q421 Ans:- 2



Mg oxidised

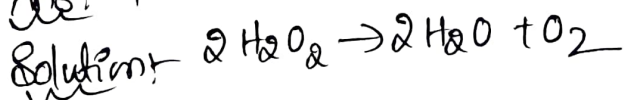
Q431 Ans:- 3.

Solution:- Oxidation power of halogen is,
$$\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$$

No other halogen can oxidize F^- to F_2 . So it is not possible to prepare F_2 by oxidation of F^- .

It is prepared by electrolytic oxidation of ion using fused KHF_2

Q441 Ans:- 1



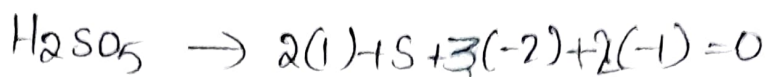
Same element oxygen undergoes both oxidation & reduction. Hence it is a disproportionation reaction

JEE Advanced Level Questions

Q45) Ans:- a, b, c.

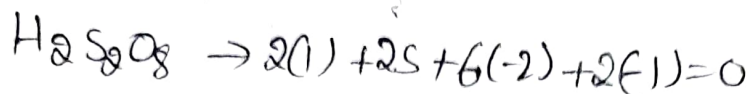
Solution:-

→ Peroxomonosulphuric acid (Caro's acid)



$$\text{S} - 6 = 0 \Rightarrow \text{S} = +6.$$

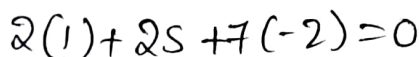
→ Peroxodisulphuric acid (Marshall's acid)



$$2 + 2\text{S} - 12 - 2 = 0$$

$$2\text{S} = 12 \Rightarrow \text{S} = +6.$$

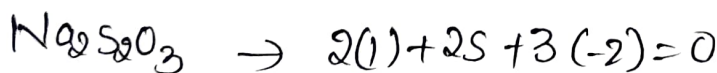
→ Pyrosulphuric acid (Oleum) → $\text{H}_2\text{S}_2\text{O}_7$



$$2 + 2\text{S} - 14 = 0$$

$$2\text{S} = 12 \Rightarrow \text{S} = +6.$$

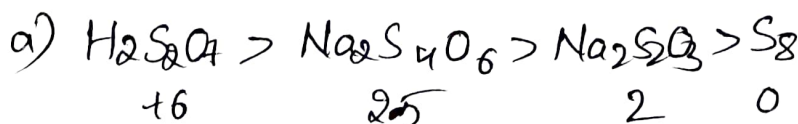
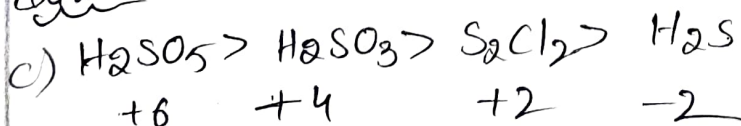
→ Sodium tetrathionate (Hypo)



$$4\text{S} = 4$$

Q46) Ans:- a, c, d

Solution:-



Q47) Ans:- A.

Solution:- Fluorine's high electronegativity & its seven valen electrons lead to it always exhibiting a '-1' oxidation state in its compounds

Q48) Ans:- B.

Solution:- A & R are correct, R is not a proper explanation of A.

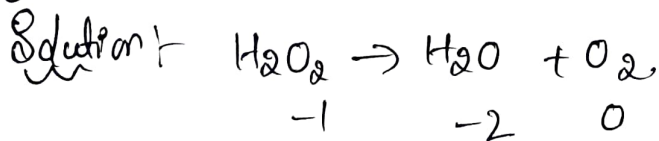
Stoichiometry relies on the law of conservation of mass, and redox reactions involve simultaneous oxidation and reduction, but these concepts are distinct

Q49) Ans:- 3.

Solution:- Initial oxidation number is +3

It losing $3e^-$ so the final oxidation number = $3+3 = \underline{+6}$

Q50) Ans:- 2.



H_2O_2 undergoes both oxidation & reduction

Matrix Matching

Q51) Ans:- A) 5 B) 2 C) 1 D) 3.

Solution:-

A) +3 $\rightarrow$ 5) Nitrite ion (NO_2^-)

$$x + 2(-2) = -1 \Rightarrow x = -1 + 4 = 3.$$

B) +1 $\rightarrow$ 2) Nitrous oxide (N_2O)

$$2x + (-2) = 0 \Rightarrow 2x = 2 \Rightarrow x = 1.$$

C) 0 $\rightarrow$ 1) Nitrogen

D) +5 $\rightarrow$ 3) Nitrate ion (NO_3^-)

$$x + 3(-2) = -1$$

$$x = -1 + 6 = +5.$$

Q52) Ans:- A) 4 B) 1 C) 2 D) 3

Solution:-

A) $\text{NH}_3 \rightarrow$ 4) Reductant

B) $\text{KMnO}_4 \rightarrow$ 1) Oxidant

C) $\text{SO}_2 \rightarrow$ 2) Both oxidant & reductant

D) He $\rightarrow$ 3) Neither oxidant nor reductant

Integer Type

Q53) Ans:- +7

Solution:- $\text{KMnO}_4 \Rightarrow +1 + x + 4(-2) = 0$
 $x = +7$

Q54) Ans:- +7

Solution:- $\text{S}_2\text{O}_8^{2-}$

$$2S + 8(-2) = -2 \Rightarrow 2S = -2 + 16 \Rightarrow 2S = 14$$

$$S = +7$$