

Name of the Teacher-SUTAPA CHAKRABARTY

Subject: Chemistry

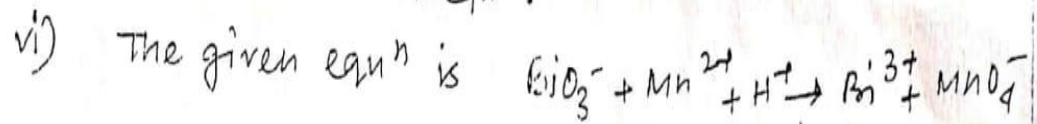
Class: Semester-2

Paper: C3T:Inorganic Chemistry

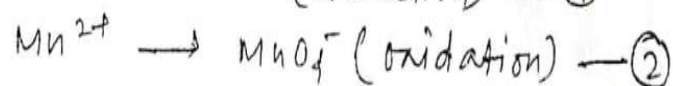
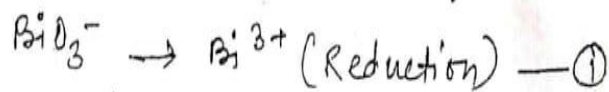
Topic: Redox and Precipitation Reaction

Part 2

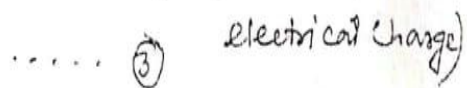
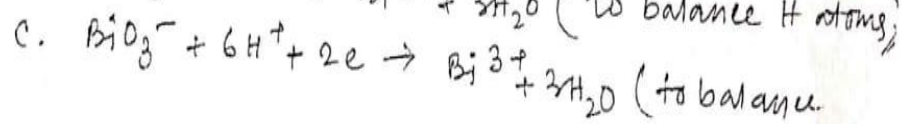
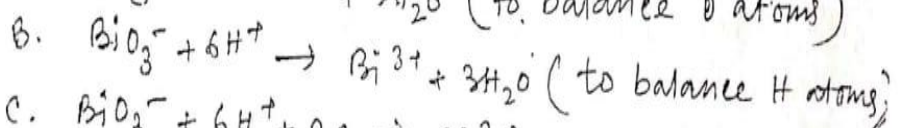
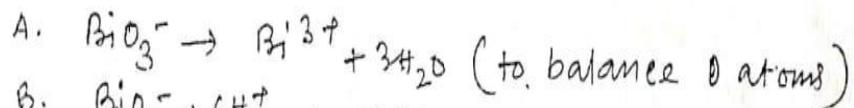
... to the balanced eqnⁿ.



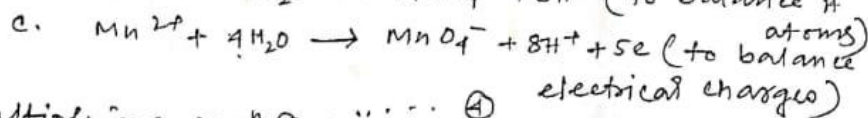
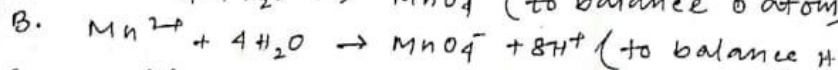
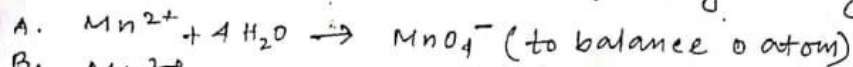
a) This eqnⁿ is in the ionic form. Since H^+ ions are involved in this eqnⁿ hence this rxn occurs in acid medium. In this eqnⁿ BiO_3^- is reduced to Bi^{3+} and Mn^{2+} is oxidised to MnO_4^- ion. Thus the given eqnⁿ can be broken into two partial equations are.



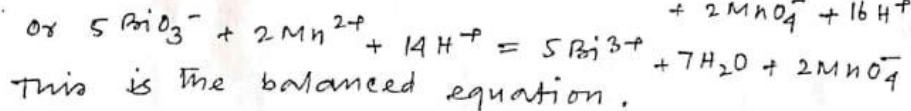
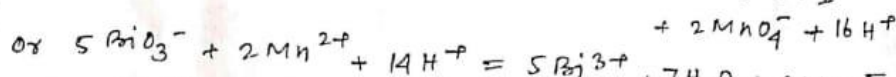
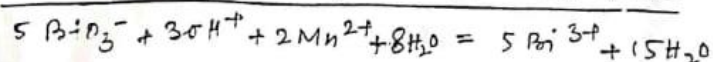
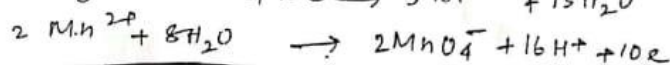
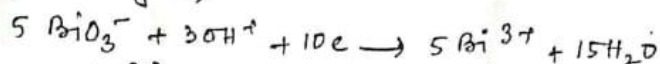
b) The eqnⁿ ① can be balanced by using the following steps.



c) The equation ② can be balanced by using following steps.



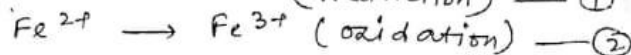
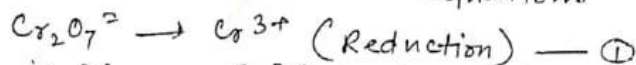
d) Multiplying eqnⁿ ③ by 5 and eqnⁿ ④ by 2 and adding them we get,



This is the balanced equation.

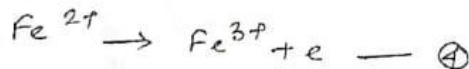
vii) The given eqnⁿ is $Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow Cr^{3+} + Fe^{3+} + H_2O$

a) This eqnⁿ is in the ionic form. Since H^+ ions are involved in this equation, hence this rxn occurs in acid medium. In this equation $Cr_2O_7^{2-}$ is reduced to Cr^{3+} and Fe^{2+} is oxidised to Fe^{3+} . Thus the given equation can be broken into two partial equations

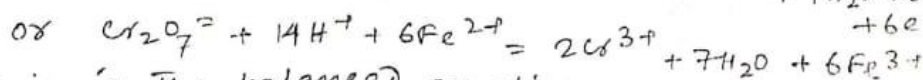
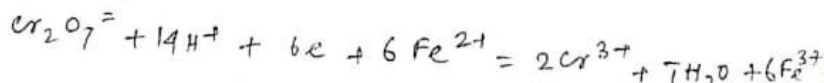


b) The eqnⁿ ① can be balanced and finally we get $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ — ③

c) The eqnⁿ ② can be balanced and finally we get



d) Multiplying eqnⁿ ③ by 1 and eqnⁿ ④ by 6 and adding them we get

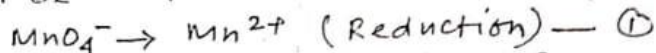


This is the balanced equation.

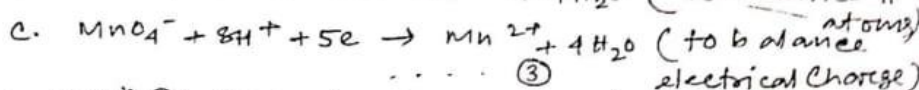
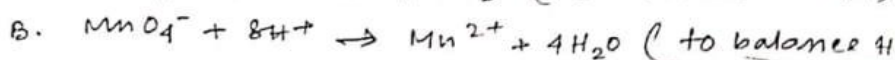
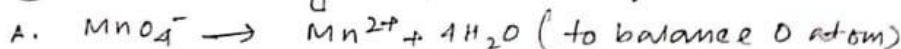
viii) The given eqnⁿ is $MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$

So, this equation is in the ionic form. Since H^+ ions are involved in this equation, hence this rxn occurs

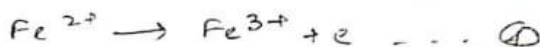
in acid medium. In this equation MnO_4^- is reduced to Mn^{2+} and Fe^{2+} is oxidised to Fe^{3+} ion. Thus the equation can be broken into two partial equations.



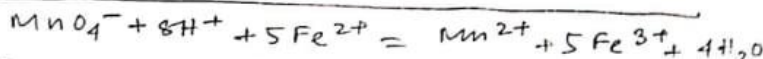
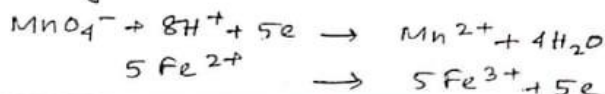
b) To balance all the atoms and electrical charge in equation ① the following steps are required.



c) The eqn ② can also be balanced as follows.



d) Multiplying eqn ③ by 1 and eqn ④ by 5 and adding them we get

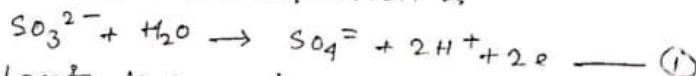


This is the balanced equation.

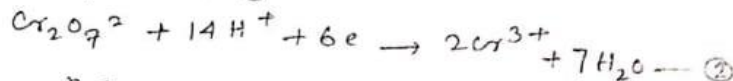
• Some example for balancing of Redox Rxn by ion electron method

i) Rxn between sodium sulphite and Potassium dichromate in acid medium.

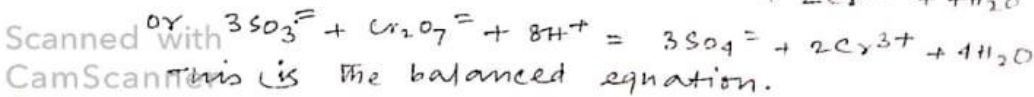
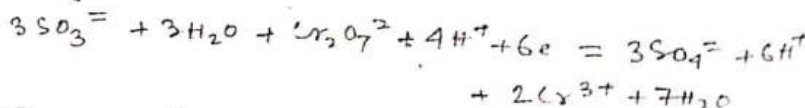
As the medium is acidic, Na_2SO_3 is oxidised to Na_2SO_4 and the partial equation is



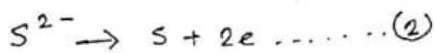
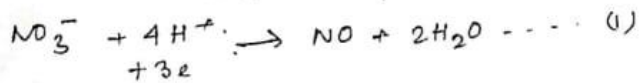
The oxidant $\text{K}_2\text{Cr}_2\text{O}_7$ is reduced to chromic salt and the partial equation is



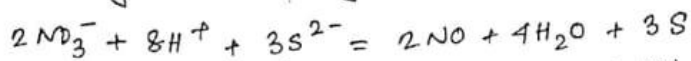
Multiplying eqn ① by 3 and eqn ② by 1 and adding them we get



Sulphide dissolves in hot dil. HNO_3 soln.
 In this rxn dil HNO_3 is reduced to NO and S is oxidised to 's'. The partial equations are,

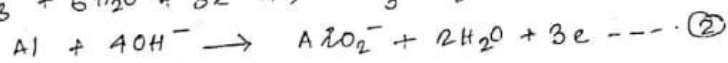
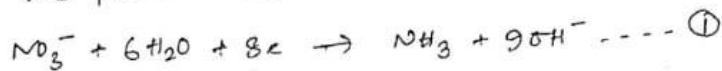


Multiplying equation $\textcircled{1}$ by 2 and equation $\textcircled{2}$ by 3 and adding them we get,

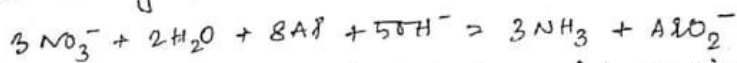


iii) Rxn between sodium nitrate and metallic Al in presence of $NaOH$

In this rxn nitrate is reduced to NH_3 and Al is oxidised to Aluminate. Since the medium is alkaline the partial equations are,

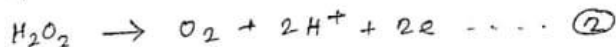
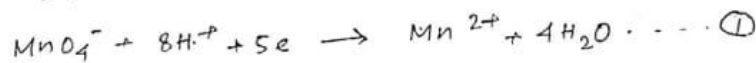


Multiplying equation $\textcircled{1}$ by 3 and equⁿ $\textcircled{2}$ by 8 and adding them we get,

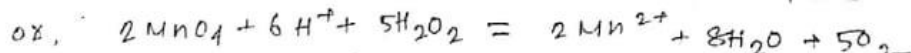
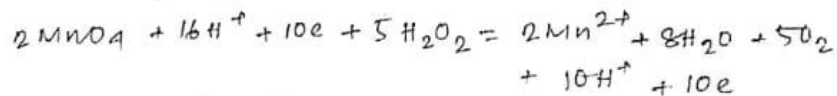


iv) Rxn between $KMnO_4$ and H_2O_2 in acid medium.

In this rxn $KMnO_4$ is reduced to manganous salt and H_2O_2 oxidised to O_2 . The partial equations are -



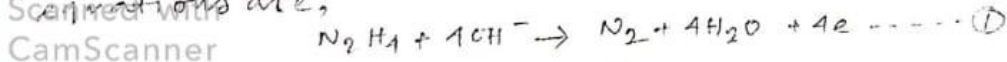
Multiplying equⁿ $\textcircled{1}$ by 2 and equⁿ $\textcircled{2}$ by 5 and adding them we get,

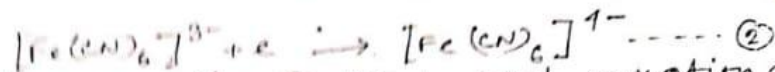


v) Rxn between $K_2[Fe(CN)_6]$ and hydrazine in alkaline solⁿ

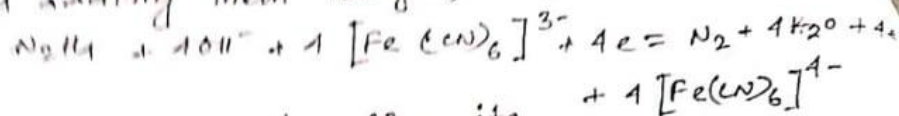
In this rxn N_2H_4 is oxidised to N_2 and ferri-cyanide is reduced to ferrocyanide and the partial

equations are,



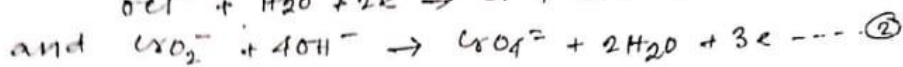
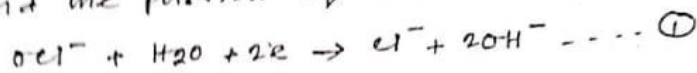


Multiplying equation ① by 1 and equation ② by 4 and adding them we get,



vi) Rxn between sodium chromite (Na_2CrO_2) and sodium hypochlorite in alkaline solution

As the medium is alkaline, hypochlorite is reduced to chloride and chromite is oxidised to chromate and the partial equations are,

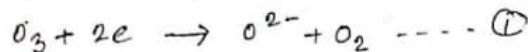


Multiplying equⁿ ① by 3 and equⁿ ② by 2 and adding them we get,

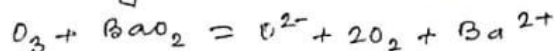


vii) Rxn between Barium peroxide and ozone (O_3)

In this rxn one atom of 'O' in ozone is reduced to oxide ion and BaO_2 is oxidised to oxygen. The partial equations are,

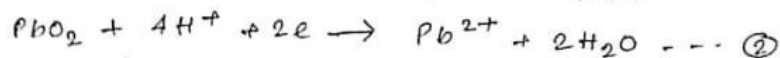
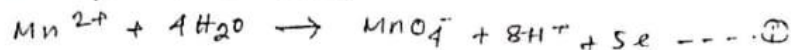


Adding them we get,

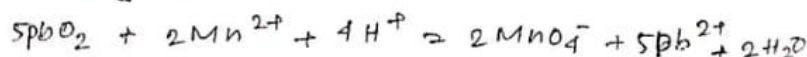


viii) Rxn between manganous salt and PbO_2 in acid medium.

As the medium is acidic, Mn^{2+} is oxidised to MnO_4^- and PbO_2 is reduced to lead salt (Pb^{2+}) and the partial equations are,



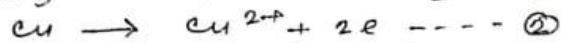
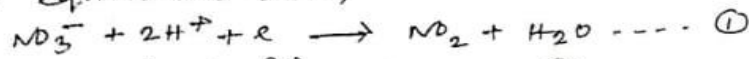
Multiplying equⁿ ① by 2 and equⁿ ② by 5 and adding them we get,



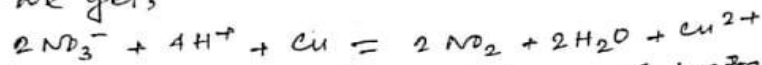
ix) The action of conc. HNO_3 on Cu-turnings.

In this rxn, conc HNO_3 is reduced to NO_2 and Cu is oxidised to cupric salt (Cu^{2+}). The

partial equations are,

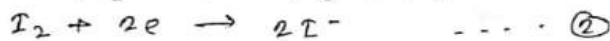
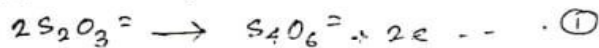


Multiplying equⁿ ① by 2 and equⁿ ② by 1 and adding them we get,



x) The action of I₂ on sodium thio-sulphate solⁿ.

In this rxn thio-sulphate is oxidised to Tetra Thionate and I₂ is reduced to iodide ion (I⁻). The partial equations are,

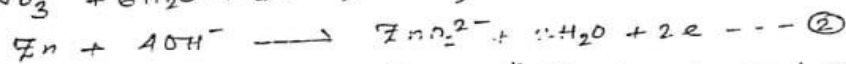
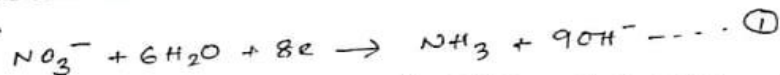


Adding equⁿ ① and ② we get,

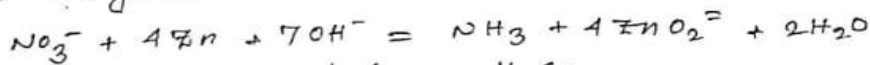


xi) Rxn between NaNO₃ and Zn dust in alkaline med.

In this rxn NaNO₃ is reduced to NH₃ and Zn dust is oxidised to sodium zincate. The partial equations are,

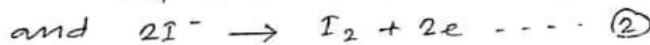
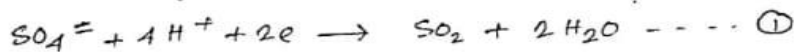


Multiplying equⁿ ① by 1 and equⁿ ② by 4 and adding them we get,

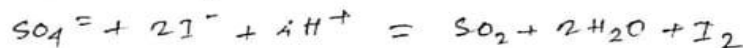


xii) Rxn between HI and conc. H₂SO₄

In this rxn conc. H₂SO₄ is reduced to SO₂ and I⁻ is oxidised to I₂. The partial equations are,

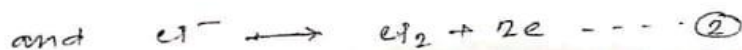


Adding them we get,



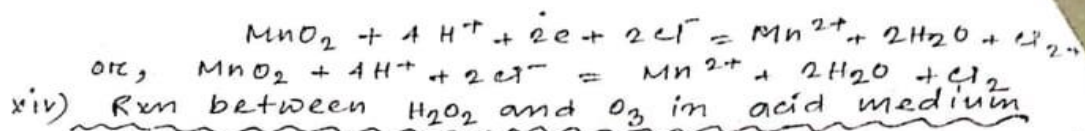
xiii) Rxn between MnO₂ and conc. HCl in acid med.

In this rxn MnO₂ is reduced to Mn²⁺ and HCl is oxidised to Cl₂. The partial equations are



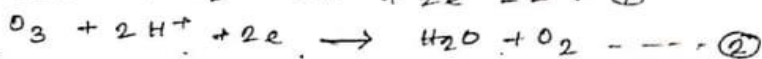
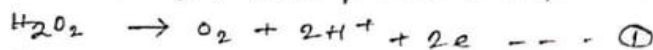
Adding equⁿ ① and equⁿ ② we get,





xiv) Rxn between H_2O_2 and O_3 in acid medium

In this rxn H_2O_2 is oxidised to O_2 and O_3 is also reduced to O_2 . The partial equations are,



Adding them we get,



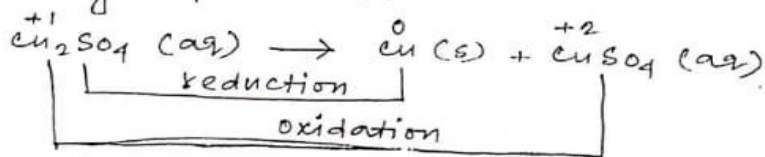
Disproportionation Or Dismutation Reaction.

There are some chemical changes in which an element is converted into two oxidation states, one higher and another is lower, than it's oxidation state in the reactants. Such reactions are called disproportionation or dismutation reaction.

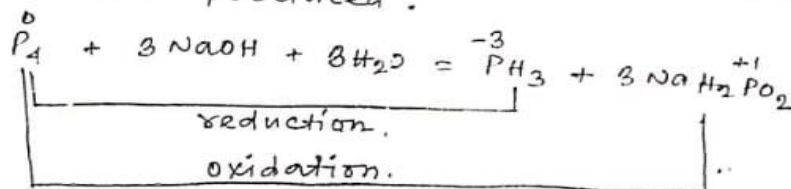
Disproportionation rxn is that redox rxn in which some part of a substance undergoes oxidation while the remaining part of that same substance undergoes reduction i.e. the same substance is oxidised as well as reduced. Hence this substance acts both as oxidising as well as reducing agent.

Some examples are given below,

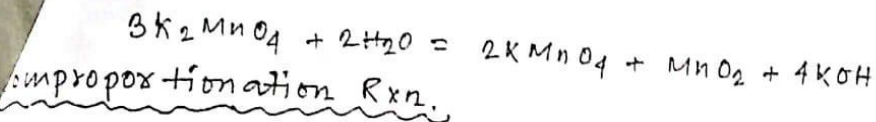
i) The soluble cuprous compounds disproportionate in solⁿ, with the formation of metallic copper and corresponding cupric salt.



ii) When white P is boiled with caustic soda, in an inert atmosphere PH_3 is evolved and sodium hypophosphite is also produced.



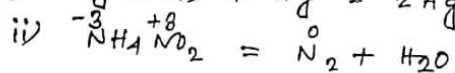
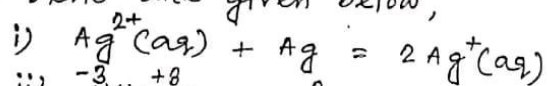
iii) Manganate ion is stable in highly alkaline medium. But on adding large quantity of water or on acidifying the solⁿ, it readily undergoes disproportionation to produce MnO_2 and MnO_4^- ion.



Comproportionation rxn is the reverse of the disproportionation rxn.

In this rxn, two different oxidation states of the same element give a product with intermediate oxidation state.

The examples of the spontaneous comproportionation rxns are given below,



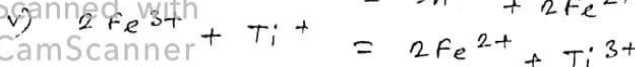
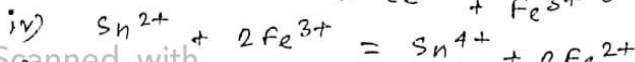
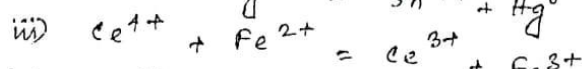
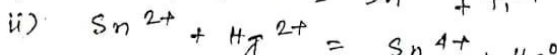
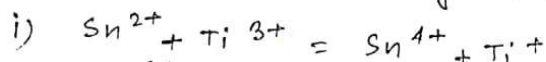
✓ Complementary and Non-Complementary Redox rxn.

The redox rxn in which oxidants gain the same no. of electrons as the reductant loses, are called Complementary redox rxns.

When the no. of electrons gained and lost are different, the redox rxns are called non-complementary redox rxn.

The complementary redox rxns are generally faster than the non-complementary rxns.

The examples are given below,



} Complementary redox rxn.

} Non Complementary redox rxn

[N.B.-Acknowledgement of indebtedness to Mr. Sibshankar Das, my respected Teacher regarding collection of study materials in Inorganic Chemistry]