REDOX REACTIONS

Que.1. In the following reaction   **[Marks :(2)]**

Mg + F$_2$→ MgF$_{2\ (s)}$
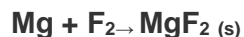
a) the element which get Oxidised?

b) the element which get Reduced?

c) which is the Oxidising Agent?

d) which is the Reducing Agent?

Ans. a) Mg

b) F$_2$

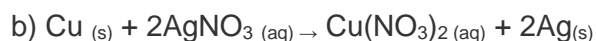c) F$_2$

d) Mg

Que.2. A brown copper rod is dipped in a colourless silver nitrate solution taken in a beaker.   **[Marks :(2)]**

a) what changes do you observe?

b) write the chemical reaction taking place during these changes

Ans. a) Silver deposited on Copper rod and colourless Silver Nitrate become   blue in colour

b) Cu $_{(s)}$ + 2AgNO$_{3\ (aq)}$ → Cu(NO$_3$)$_{2\ (aq)}$ + 2Ag$_{(s)}$

Que.3. H$_2$O $_{(l)}$ + F$_{2\ (g)}$ →HF$_{(aq)}$ + HOF$_{(aq)}$ **[Marks :(3)]**

a) Write the oxidation states of all species in the equation.

b) Which substance undergo disproportionation reaction in this reaction? why?

c) Write one example each for compound containing oxygen which show +1 and +2 oxidation state

Ans. a) H$_2^{+1}$O^{-2} $_{(l)}$ + F$_2$ $^0_{(g)}$ H^{+1}F^{-1}$_{(aq)}$ + H^{+1}O^{-2}F^{+1}$_{(aq)}$

b) Disproportionation reaction is a special type of redox reaction in which same element is simultaneously oxidised as well as reduced.
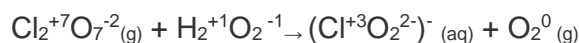
c) O^{+2}F$_2^{-1}$ and O$_2^{+1}$F$_2^{-1}$ (OF$_2$ and O$_2$F$_2$)

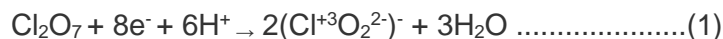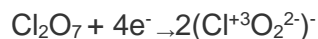**Que.4. Balance the chemical equation by Ion electron method**   **[Marks :(3)]**

Cl$_2$O$_{7\ (g)}$ + H$_2$O$_2$ →ClO$_2^-$ $_{(aq)}$ + O$_{2\ (g)}$ (Acidic Medium)

Ans. Cl$_2$O$_{7\ (g)}$ + H$_2$O$_2$→ ClO$_2^-$ $_{(aq)}$ + O$_{2\ (g)}$ (Acidic Medium)

Cl$_2^{+7}$O$_7^{-2}$$_{(g)}$ + H$_2^{+1}$O$_2$ $^{-1}$→ (Cl^{+3}O$_2^{2-}$)$^-$ $_{(aq)}$ + O$_2^0$ $_{(g)}$

Half reduction step :

Cl$_2^{+7}$O$_7^{-2}$→ (Cl^{+3}O$_2^{2-}$)$^-$

$Cl_2O_7 + 4e^- \rightarrow (Cl^{+3}O_2{}^{2-})^-$

$Cl_2O_7 + 4e^- \rightarrow 2(Cl^{+3}O_2{}^{2-})^-$

$Cl_2O_7 + 8e^- + 6H^+ \rightarrow 2(Cl^{+3}O_2{}^{2-})^- + 3H_2O$ ....(1)

Half oxidation step:

$H_2O_2 \rightarrow O_2$

$H_2{}^{+1}O_2{}^{-1} \rightarrow O_2{}^0 + 2H^+ + 2e^-$ ....(2)

Multiply (2) by 4

$4H_2{}^{+1}O_2{}^{-1} \rightarrow 4O_2{}^0 + 8H^+ + 8e^-$ .... (3)

Adding (1) and (3)

$6H^+ + Cl_2O_7 + 8e^- \rightarrow 2(Cl^{+3}O_2{}^{2-})^- + 3H_2O$

$4H_2{}^{+1}O_2{}^{-1} \rightarrow 4O_2{}^0 + 8H^+ + 8e^-$

$Cl_2O_7 + 4H_2{}^{+1}O_2{}^{-1} \rightarrow 2(Cl^{+3}O_2{}^{2-})^- + 3H_2O + 4O_2{}^0 + 2H^+$
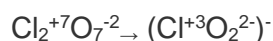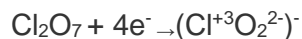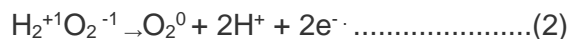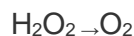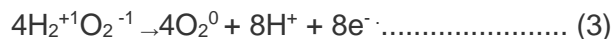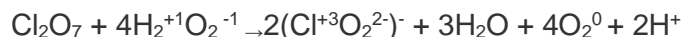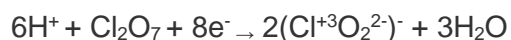
Que.5. Classify the following redox reactions into different types   **[Marks :(2)]**

i) $Br_2 + 2OH^- \rightarrow BrO^- + Br^- + H_2O$

ii) $2\ NH_3 \rightarrow N_2 + 3H_2$

iii) $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$

iv) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
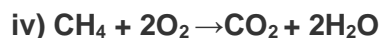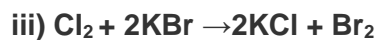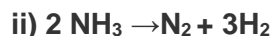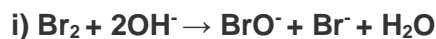
Ans. i) Disproportination reaction

ii) Decomposition reaction

iii) Non metal displacement reaction

iv) Combination Reaction

Que.6. Calculate the Oxidation number of Cl in $KClO_3$ Cl_2O_7, Cr in $CrO_3{}^{2-}$ and $Cr_2O_7{}^{2-}$

[Marks :(2)]

Ans. +5, +7 and +4, +6

Que.7. Name the category to which the following redox reaction belongs to?

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

[Marks :(1)]

Ans. Non metal displacement redox reactions

Que.8. A farmer prepared 1% solution of copper sulphate using iron rod as stirrer for preparing Bordeaux mixture. Next day he notices that the blue colour almost faded and iron get coated with reddish brown material.

a) what is the reddish brown material deposited on the iron rod?

b) Account for the colour change of the solution?

c) Justify that the above phenomenon is a redox reaction.

[Marks :(3)]

Ans. a) Copper is a reddish brown material deposited on the iron rod.

b) Due to solvated electron

c) Oxidation potential of Fe is greater than that of Copper

Que.9. What will happen if chlorine is passed through an aqueous solution of potassium bromide?

[Marks :(1)]

Ans. $2KBr + Cl_2 \rightarrow KCl + Br_2$

Que.10. Calculate the Oxidation number of S in H_2S, SO_2, $S_2O_7^{2-}$ and SO_4^{2-}

[Marks :(2)]

Ans. 2, +4, +6, +6

Que.11. Write the formula of the following compounds

a) Nickel (II) Sulphate   **b) Tin (IV) Oxide**

[Marks :(2)]

Ans. a) $NiSO_4$ b) SnO_2

Que.12. Define Oxidation and Reduction in terms of Oxidation Number

[Marks :(2)]

Ans. Oxidation is process involving an increase in the oxidation number of the element

Reduction is process involving a decrease in the oxidation number of the element

Que.13. What are the four types of redox reactions?

[Marks :(2)]

Ans. a) Combination Reaction

b) Decomposition Reaction

c) Displacement Reaction

d) Disproportionation Reaction

Que.14. Calculate the oxidation number of

[Marks :(2)]

a) Cl in $HClO_4$

b) Xe in XeO₃

c) S in H₂S₂O₇

d) N in HNO₂

Ans. a) +7

b) +6

c) +6

d) +3

Que.15. In the reaction 2KI $_{(aq)}$ + Cl$_{2\,(g)}$ →2KCl $_{(aq)}$ + I$_{2\,(s)}$ which compound is get oxidized

[Marks :(1)]

Ans. KI is being oxidised to iodine

Que.16. Fill in the blanks

[Marks :(3)]

i) The oxidation state of Cl in HClO4 is ....

ii) A reducing agent is substance which ....electrons in a chemical reaction.

iii) Among the elements fluorine and iodine, ...exhibit both positive and negative oxidation states.

Ans. i) +7

ii) lose (donate)

iii) Iodine

Que.17. Balance by ion electron method Cl₂ + OH⁻ →Cl⁻ + ClO₃⁻ (basic medium)

[Marks :(3)]

Ans. ^{0}Cl₂ + OH⁻→ $^{-1}$Cl⁻ + $^{-5}$ClO₃⁻

Oxidation Half reaction

i) Cl₂ →ClO₃⁻

ii) Cl₂ →2ClO₃⁻

iii) Cl₂ →2ClO₃⁻ + 10 e⁻

iv) Cl₂ + 12OH⁻ →2ClO₃⁻ + 10 e⁻

v) Cl₂ + 12OH⁻ →2ClO₃⁻ + 10 e⁻ + 6H₂O ....(1)

Reduction Half reaction

i) Cl₂ →Cl⁻

ii) Cl₂ →2Cl⁻

iii) $Cl_2 + 2e^- \rightarrow 2Cl^-$ .... (2)

Multiply (2) by 5

$5Cl_2 + 10e^- \rightarrow 10Cl^-$ .... (3)

Adding (1) and (3)

$Cl_2 + 12OH^- \rightarrow 2ClO_3^- + 10 \ e^- + 6H_2O$

$5Cl_2 + 10e^- \rightarrow 10Cl^-$

....

$6Cl_2 + 12OH^- \rightarrow 2ClO_3^- + 10Cl^- + 6H_2O$

Que.18. Balance NH3 + O2 →NO + H2O (Neutral medium)

[Marks :(3)]

Ans. i) $^{-3}NH_3 + \ ^{0}O_{2 \rightarrow} \ ^{+2}NO + H_2O^{-2}$
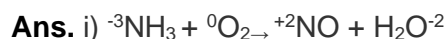
Oxidation number of N increases by 5 per atom

ii) $^{-3}NH_3 + \ ^{0}O_2 \rightarrow ^{+2}NO + H_2O^{-2}$
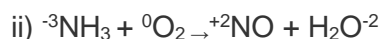
Oxidation number of O decreases by 2 per atom

Here there are two oxygen atoms

iii) $4NH_3 + 5O_2 \rightarrow NO + H_2O$

iv) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
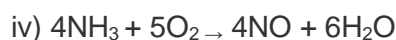
Que.19. Balance the equation Cu + NO3- + H+ →Cu2+ + NO + H2O by oxidation number method

[Marks :(4)]

Ans. i) $Cu + NO_3^- + H^+ \rightarrow Cu^{2+} + NO + H_2O$
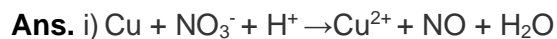
Oxidation Number of N decreases by 3 per atom

ii) $^{0}Cu + \ ^{+5}NO_3^- \rightarrow \ ^{+2}Cu^{2+} + \ ^{+2}NO$
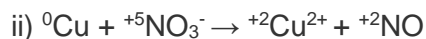
Oxidation Number of Cu increases by 2 per atom

iii) $3Cu + 2NO_3^- \rightarrow Cu^{2+} + NO$

iv) $3Cu + 2NO_3^- \rightarrow 3Cu^{2+} + 2NO$

v) $3Cu + 2NO_3^- \rightarrow 3Cu^{2+} + 2NO + 4H_2O$

vi) $3Cu + 2NO_3^- + 8H^+ \rightarrow 3Cu^{2+} + 2NO + 4H_2O$
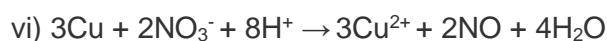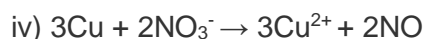
Que.20. Identify the Reductant in the following reaction. Define reductant.

$Br_2 + H_2S \rightarrow 2HBr + S$

[Marks :(2)]

Ans. a) H_2S
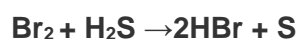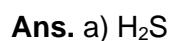
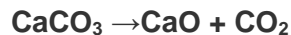b) Reducing agent or reductant is a substance which supplies hydrogen / any other electropositive element, or removes oxygen / any other electronegative element.

Que.21. Is thermal decomposition of Calcium Carbonate a redox reaction? If not then why?

$CaCO_3 \rightarrow CaO + CO_2$

[Marks :(2)]

Ans. No, it is not a redox reaction. A decomposition reaction consider as redox only when compounds break down into two or more components at least one of which must be in the elemental state.

Que.22. Using electron transfer concept, identify the species undergoing Oxidation and Reduction, Oxidant and Reductant in the following redox reaction.

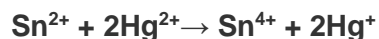**$2[Fe(CN)_6]^{4-} + H_2O_2 + 2H^+ \rightarrow 2[Fe(CN)_6]^{3-} + 2H_2O$**

[Marks :(2)]

Ans. Oxidised : $[Fe(CN)_6]^{4-}$

Reduced : H_2O_2

Oxidant : H_2O_2

Reductant : $[Fe(CN)_6]^{4-}$

Que.23. Identify Oxidant and Reductant in the following reaction.

$Sn^{2+} + 2Hg^{2+} \rightarrow Sn^{4+} + 2Hg^+$

[Marks :(2)]

Ans. Oxidant : Sn^{2+}

Reducatnt : Hg^{2+}

Que.24. A popular laboratory test in which Cl_2 is used to identify Br^- and I^- is known as ....

[Marks :(1)]

Ans. Layer Test

Que.25. Complete the redox reactions

i) $Zn + Cu^{2+} \rightarrow$ .... + ...

ii) $Cu + Fe^{2+} \rightarrow$ .... + ...

Which reaction is feasible and why? ($E^0_{Fe^{2+}/Fe}$ = -0.44; $E^0_{Cu^{2+}/Cu}$ = 0.34; $E^0_{Zn^{2+}/Zn}$ = -0.76V)

[Marks :(1)]

Ans. i) $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

It is possible. Oxidation potential of Zn is greater than that of Copper. Thus metal redox displacement will occur.

ii) $Cu + Fe^{2+} \rightarrow$ No reaction

It is not possible because Oxidation potential of Cu is lesser than that of Iron. Thus no metal redox displacement will occur.