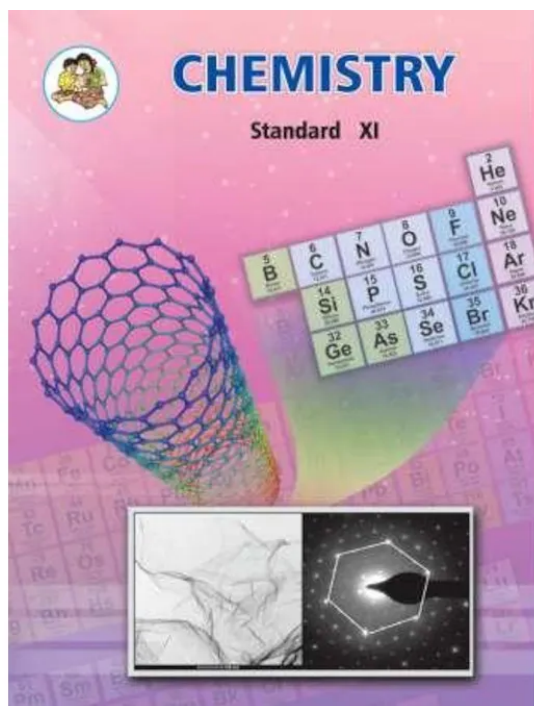


Maharashtra Board Solutions Class 11-Chemistry: Chapter 6- Redox Reactions

Class 11 - Chapter 6 Redox Reactions



For any clarifications or questions you can write to info@indcareer.com

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Maharashtra Board Solutions Class 11-Chemistry: Chapter 6- Redox Reactions

Class 11: Chemistry Chapter 6 solutions. Complete Class 11 Chemistry Chapter 6 Notes.

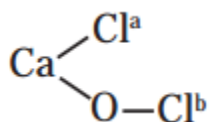
Maharashtra Board Solutions Class 11-Chemistry: Chapter 6- Redox Reactions

Maharashtra Board 11th Chemistry Chapter 6, Class 11 Chemistry Chapter 6 solutions

1. Choose the most correct option

Question A.

Oxidation numbers of Cl atoms marked as Cl^a and Cl^b in CaOCl₂ (bleaching powder) are



- a. zero in each
- b. -1 in Cl^a and +1 in Cl^b
- c. +1 in Cl^a and -1 in Cl^b
- d. 1 in each

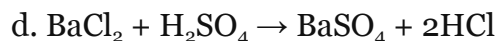
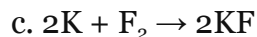
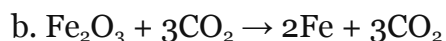
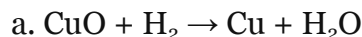
Answer:

<https://www.indcareer.com/schools/maharashtra-board-solutions-class-11-chemistry-chapter-6-redox-reactions/>

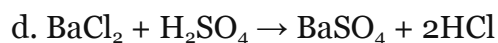
b. -1 in Cl^{a} and +1 in Cl^{b}

Question B.

Which of the following is not an example of redox reaction ?

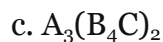
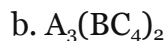
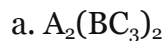


Answer:

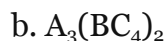


Question C.

A compound contains atoms of three elements A, B and C. If the oxidation state of A is +2, B is +5 and that of C is -2, the compound is possibly represented by



Answer:



Question D.

The coefficients p, q, r, s in the reaction

$\text{pCr}_2\text{O}_7^{2-} + \text{qFe}^{2+} \rightarrow \text{rCr}^{3+} + \text{sFe}^{3+} + \text{H}_2\text{O}$ respectively are :

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a. 1, 2, 6, 6

b. 6, 1, 2, 4

c. 1, 6, 2, 6

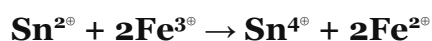
d. 1, 2, 4, 6

Answer:

c. 1, 6, 2, 6

Question E.

For the following redox reactions, find the correct statement.



a. Sn^{2+} is undergoing oxidation

b. Fe^{3+} is undergoing oxidation

c. It is not a redox reaction

d. Both Sn^{2+} and Fe^{3+} are oxidised

Answer:

a. Sn^{2+} is undergoing oxidation

Question F.

Oxidation number of carbon in H_2CO_3 is

a. +1

b. +2

c. +3

d. +4

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Answer:

d. +4

Question G.

Which is the correct stock notation for manganese dioxide ?

a. Mn(I)O_2

b. Mn(II)O_2

c. Mn(III)O_2

d. Mn(IV)O_2

Answer:

d. Mn(IV)O_2

Question I.

Oxidation number of oxygen in superoxide is

a. -2

b. -1

c. -12

d. 0

Answer:

c. -12

Question J.

Which of the following halogens does always show oxidation state -1 ?

a. F

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b. Cl

c. Br

d. I

Answer:

a. F

Question K.

The process $\text{SO}_2 \rightarrow \text{S}_2\text{Cl}_2$ is

a. Reduction

b. Oxidation

c. Neither oxidation nor reduction

d. Oxidation and reduction.

Answer:

a. Reduction

2. Write the formula for the following compounds :

A. Mercury(II) chloride

B. Thallium(I) sulphate

C. Tin(IV) oxide

D. Chromium(III) oxide

Answer:

i. HgCl_2

ii. Tl_2SO_4

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iii. SnO_2

iv. Cr_2O_3

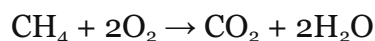
3. Answer the following questions

Question A.

In which chemical reaction does carbon exhibit variation of oxidation state from -4 to +4 ? Write balanced chemical reaction.

Answer:

In combustion of methane, carbon exhibits variation from -4 to +4. The reaction is as follows:

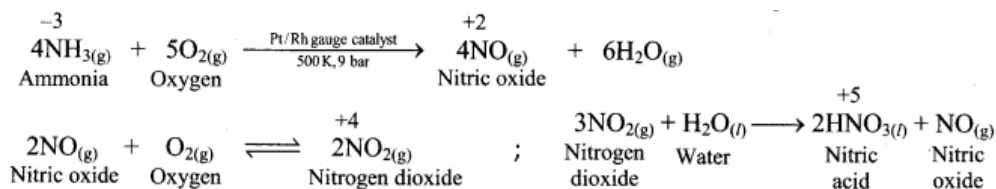


In CH_4 , the oxidation state of carbon is -4 while in CO_2 , the oxidation state of carbon is +4.

Question B.

In which reaction does nitrogen exhibit variation of oxidation state from -3 to +5 ?

Answer:



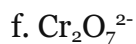
C. Calculate the oxidation number of underlined atoms.

a. H_2SO_4

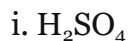
b. HNO_3

c. H_3PO_3

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Answer:



Oxidation number of H = +1

Oxidation number of O = -2

H_2SO_4 is a neutral molecule.

$\therefore$ Sum of the oxidation numbers of all atoms of $\text{H}_2\text{SO}_4 = 0$

$\therefore 2 \times (\text{Oxidation number of H}) + (\text{Oxidation number of S}) + 4 \times (\text{Oxidation number of O}) = 0$

$\therefore 2 \times (+1) + (\text{Oxidation number of S}) + 4 \times (-2) = 0$

$\therefore$ Oxidation number of S + 2 - 8 = 0

$\therefore$ Oxidation number of S in $\text{H}_2\text{SO}_4 = +6$



Oxidation number of H = +1

Oxidation number of O = -2

HNO_3 is a neutral molecule.

$\therefore$ Sum of the oxidation numbers of all atoms of $\text{HNO}_3 = 0$

$\therefore (\text{Oxidation number of H}) + (\text{Oxidation number of N}) + 3 \times (\text{Oxidation number of O}) = 0$

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$$\therefore (+1) + (\text{Oxidation number of N}) + 3 \times (-2) = 0$$

$$\therefore \text{Oxidation number of N} + 1 - 6 = 0$$

$$\therefore \text{Oxidation number of N in HNO}_3 = +5$$

iii. H_3PO_3

$$\text{Oxidation number of O} = -2$$

$$\text{Oxidation number of H} = +1$$

H_3PO_3 is a neutral molecule.

$$\therefore \text{Sum of the oxidation numbers of all atoms} = 0$$

$$\therefore 3 \times (\text{Oxidation number of H}) + (\text{Oxidation number of P}) + 3 \times (\text{Oxidation number of O}) = 0$$

$$\therefore 3 \times (+1) + (\text{Oxidation number of P}) + 3 \times (-2) = 0$$

$$\therefore \text{Oxidation number of P} + 3 - 6 = 0$$

$$\text{Oxidation number of P in H}_3\text{PO}_3 = +3$$

iv. $\text{K}_2\text{C}_2\text{O}_4$

$$\text{Oxidation number of K} = +1$$

$$\text{Oxidation number of O} = -2$$

$\text{K}_2\text{C}_2\text{O}_4$ is a neutral molecule.

$$\therefore \text{Sum of the oxidation number of all atoms} = 0$$

$$\therefore 2 \times (\text{Oxidation number of K}) + 2 \times (\text{Oxidation number of C}) + 4 \times (\text{Oxidation number of O}) = 0$$

$$\therefore 2 \times (+1) + 2 \times (\text{Oxidation number of C}) + 4 \times (-2) = 0$$

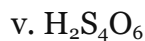
$$\therefore 2 \times (\text{Oxidation number of C}) + 2 - 8 = 0$$

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$$\therefore 2 \times (\text{Oxidation number of C}) = +6$$

$$\therefore \text{Oxidation number of C} = +3$$

$$\therefore \text{Oxidation number of C in } K_2C_2O_4 = +3$$



$$\text{Oxidation number of H} = +1$$

$$\text{Oxidation number of O} = -2$$

$H_2S_4O_6$ is a neutral molecule.

$$\therefore \text{Sum of the oxidation numbers of all atoms} = 0$$

$$\therefore 2 \times (\text{Oxidation number of H}) + 4 \times (\text{Oxidation number of S}) + 6 \times (\text{Oxidation number of O}) = 0$$

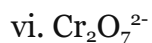
$$\therefore 2 \times (+1) + 4 \times (\text{Oxidation number of S}) + 6 \times (-2) = 0$$

$$\therefore 4 \times (\text{Oxidation number of S}) + 2 - 12 = 0$$

$$\therefore 4 \times (\text{Oxidation number of S}) = +10$$

$$\therefore \text{Oxidation number of S} = +2.5$$

$$\therefore \text{Oxidation number of S in } H_2S_4O_6 = +2.5$$



$$\text{Oxidation of O} = -2$$

$Cr_2O_7^{2-}$ is an ionic species.

$$\therefore \text{Sum of the oxidation numbers of all atoms} = -2$$

$$\therefore 2 \times (\text{Oxidation number of Cr}) + 7 \times (\text{Oxidation number of O}) = -2$$

$$\therefore 2 \times (\text{Oxidation number of Cr}) + 7 \times (-2) = -2$$

$$\therefore 2 \times (\text{Oxidation number of Cr}) - 14 = -2$$

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$$\therefore 2 \times (\text{Oxidation number of Cr}) = -2 + 14$$

$$\therefore \text{Oxidation number of Cr} = +122$$

$$\therefore \text{Oxidation number of Cr in } \text{Cr}_2\text{O}_7^{2-} = +6$$

vii. NaH_2PO_4

$$\text{Oxidation number of Na} = +1$$

$$\text{Oxidation number of H} = +1$$

$$\text{Oxidation number of O} = -2$$

NaH_2PO_4 is a neutral molecule

Sum of the oxidation numbers of all atoms = 0

$$(\text{Oxidation number of Na}) + 2 \times (\text{Oxidation number of H}) + (\text{Oxidation number of P}) + 4 \times (\text{Oxidation number of O}) = 0$$

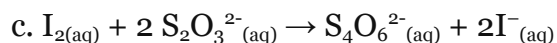
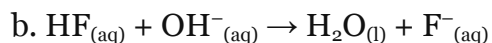
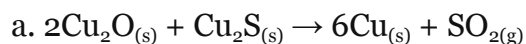
$$(+1) + 2 \times (+1) + (\text{Oxidation number of P}) + 4 \times (-2) = 0$$

$$(\text{Oxidation number of P}) + 3 - 8 = 0$$

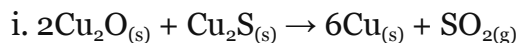
$$\text{Oxidation number of P in } \text{NaH}_2\text{PO}_4 = +5$$

Question D.

Justify that the following reactions are redox reaction; identify the species oxidized/reduced, which acts as an oxidant and which act as a reductant.

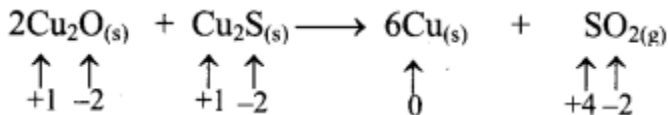


Answer:

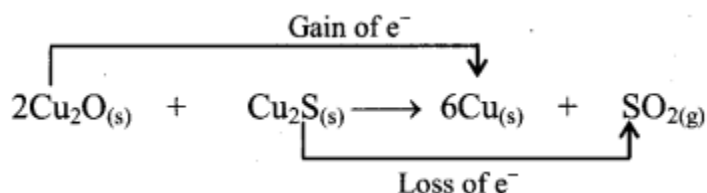


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a. Write oxidation number of all the atoms of reactants and products.



b. Identify the species that undergoes change in oxidation number.



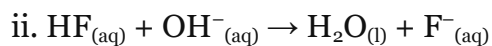
c. The oxidation number of S increases from -2 to +4 and that of Cu decreases from +1 to 0. Because oxidation number of one species increases and that of the other decreases, the reaction is a redox reaction.

d. The oxidation number of S increases by loss of electrons and therefore, S is a reducing agent and it itself is oxidised. On the other hand, the oxidation number of Cu decreases by gain of electrons and therefore, Cu is an oxidising agent and itself is reduced.

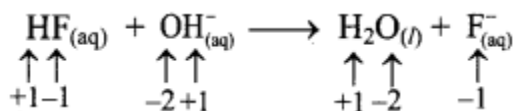
Result:

1. The given reaction is a redox reaction.
2. Oxidant/oxidising agents (Reduced species): Cu_2O / Cu_2S
3. Reductant/reducing agent (Oxidised species): Cu_2S

[Note: Cu in both Cu_2O and Cu_2S undergoes reduction. Hence, both Cu_2O and Cu_2S can be termed as oxidising agents in the given reaction.]

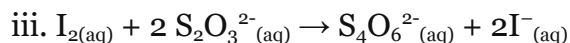


a. Write oxidation number of all the atoms of reactants and products.

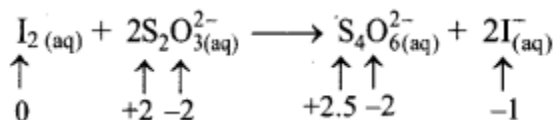


b. Since, the oxidation numbers of all the species remain same, this is NOT a redox reaction. Result:

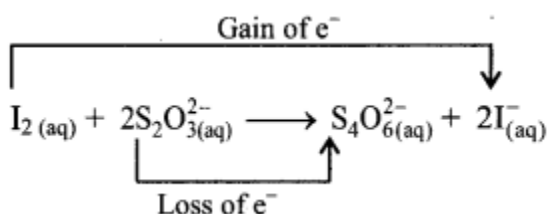
The given reaction is NOT a redox reaction.



a. Write oxidation number of all the atoms of reactants and products.



b. Identify the species that undergoes change in oxidation number.



c. The oxidation number of S increases from +2 to +2.5 and that of I decreases from 0 to -1. Because oxidation number of one species increases and that of the other decreases, the reaction is a redox reaction.

d. The oxidation number of S increases by loss of electrons and therefore, S is a reducing agent and itself is oxidised. On the other hand, the oxidation number of I decreases by gain of electrons and therefore, I is an oxidising agent and itself is reduced.

Result:

1. The given reaction is a redox reaction.
2. Oxidant/oxidising agent (Reduced species): I_2
3. Reductant/reducing agent (Oxidised species): $\text{S}_2\text{O}_3^{2-}$

Question E.

What is oxidation? Which one of the following pairs of species is in its oxidized state ?

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a. $\text{Mg} / \text{Mg}^{2+}$

b. $\text{Cu} / \text{Cu}^{2+}$

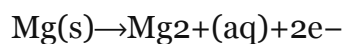
c. $\text{O}_2 / \text{O}^{2-}$

d. $\text{Cl}_2 / \text{Cl}^-$

Answer:

a. $\text{Mg} / \text{Mg}^{2+}$

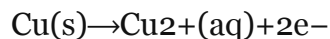
Here, Mg loses two electrons to form Mg^{2+} ion.



Hence, $\text{Mg} / \text{Mg}^{2+}$ is an oxidized state.

b. $\text{Cu} / \text{Cu}^{2+}$

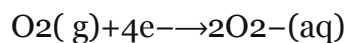
Here, Cu loses two electrons to form Cu^{2+} ion.



Hence, $\text{Cu} / \text{Cu}^{2+}$ is in an oxidized state.

c. $\text{O}_2 / \text{O}^{2-}$

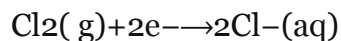
Here, each O gains two electrons to form O^{2-} ion.



Hence, $\text{O}_2 / \text{O}^{2-}$ is in a reduced state.

d. $\text{Cl}_2 / \text{Cl}^-$

Here, each Cl gains one electron to form Cl^- ion.



Hence, $\text{Cl}_2 / \text{Cl}^-$ is in a reduced state.

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Question F.

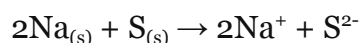
Justify the following reaction as redox reaction.



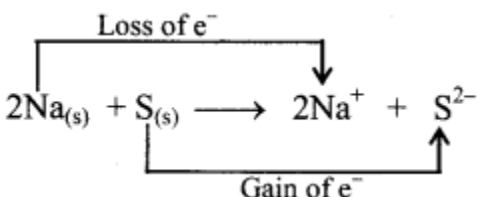
Find out the oxidizing and reducing agents.

Answer:

i. Redox reaction can be described as electron transfer as shown below:



ii. Charge development suggests that each sodium atom loses one electron to form Na^+ and sulphur atom gains two electrons to form S^{2-} . This can be represented as follows:



iii. When Na is oxidised to Na_2S , the neutral Na atom loses electrons to form Na^+ in Na_2S while the elemental sulphur gains electrons and forms S^{2-} in Na_2S .

iv. Each of the above steps represents a half reaction which involves electron transfer (loss or gain).

v. Sum of these two half reactions or the overall reaction is a redox reaction.

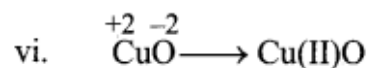
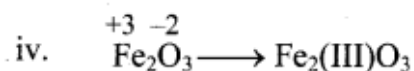
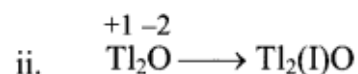
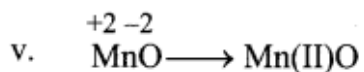
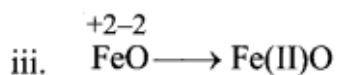
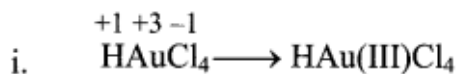
vi. Oxidising agent is an electron acceptor and hence, S is an oxidising agent. Reducing agent is an electron donor and hence, Na is a reducing agent.

Question G.

Provide the stock notation for the following compounds : HAuCl_4 , Ti_2O , FeO , Fe_2O_3 , MnO and CuO .

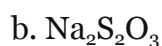
Answer:

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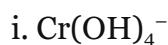


Question H.

Assign oxidation number to each atom in the following species.



Answer:



Oxidation number of O = -2

Oxidation number of H = +1

Cr(OH)_4^- is an ionic species.

$\therefore$ Sum of the oxidation numbers of all atoms = -1

$\therefore$ Oxidation number of Cr + 4 × (Oxidation number of O) + 4 × (Oxidation number of H) = -1

$\therefore$ Oxidation number of Cr + 4 × (-2) + 4 × (+1) = -1

$\therefore$ Oxidation number of Cr - 8 + 4 = -1

$\therefore$ Oxidation number of Cr - 4 = -1

$\therefore$ Oxidation number of Cr = -1 + 4

$\therefore$ Oxidation number of Cr in Cr(OH)_4^- = +3

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ii. $\text{Na}_2\text{S}_2\text{O}_3$

Oxidation number of Na = +1

Oxidation number of O = -2

$\text{Na}_2\text{S}_2\text{O}_3$ is a neutral molecule.

$\therefore$ Sum of the oxidation numbers of all atoms = 0

$\therefore 2 \times (\text{Oxidation number of Na}) + 2 \times (\text{Oxidation number of S}) + 3 \times (\text{Oxidation number of O}) = 0$

$\therefore 2 \times (+1) + 2 \times (\text{Oxidation number of S}) + 3 \times (-2) = 0$

$\therefore 2 \times (\text{Oxidation number of S}) + 2 - 6 = 0$

$\therefore 2 \times (\text{Oxidation number of S}) = +4$

$\therefore$ Oxidation number of S = +2

$\therefore$ Oxidation number of S in $\text{Na}_2\text{S}_2\text{O}_3 = +2$

iii. H_3BO_3

Oxidation number of H = +1

Oxidation number of O = -2

H_3BO_3 is a neutral molecule.

$\therefore$ Sum of the oxidation numbers of all atoms = 0

$\therefore 3 \times (\text{Oxidation number of H}) + (\text{Oxidation number of B}) + 3 \times (\text{Oxidation number of O}) = 0$

$\therefore 3 \times (+1) + (\text{Oxidation number of B}) + 3 \times (-2) = 0$

$\therefore$ Oxidation number of B + 3 - 6 = 0

$\therefore$ Oxidation number of B in $\text{H}_3\text{BO}_3 = +3$

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Question I.

Which of the following redox couple is stronger oxidizing agent ?

- a. Cl_2 ($E^\circ = 1.36 \text{ V}$) and Br_2 ($E^\circ = 1.09 \text{ V}$)
- b. MnO_4^- ($E^\circ = 1.51 \text{ V}$) and $\text{Cr}_2\text{O}_7^{2-}$ ($E^\circ = 1.33 \text{ V}$)

Answer:

- a. Cl_2 has a larger positive value of E° than Br_2 . Thus, Cl_2 is a stronger oxidizing agent than Br_2 .
- b. MnO_4^- has larger positive value of E° than $\text{Cr}_2\text{O}_7^{2-}$. Thus, MnO_4^- is stronger oxidizing agent than $\text{Cr}_2\text{O}_7^{2-}$

Question J.

Which of the following redox couple is stronger reducing agent ?

- a. Li ($E^\circ = -3.05 \text{ V}$) and Mg ($E^\circ = -2.36 \text{ V}$)
- b. Zn ($E^\circ = -0.76 \text{ V}$) and Fe ($E^\circ = -0.44 \text{ V}$)

Answer:

- a. Li has a larger negative value of E° than Mg . Thus, Li is a stronger reducing agent than Mg .
- b. Zn has a larger negative value of E° than Fe . Thus, Zn is a stronger reducing agent than Fe .

4. Balance the reactions/equations :**Question A.**

Balance the following reactions by oxidation number method

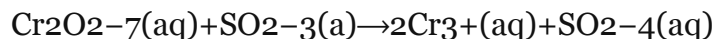
<https://www.indcareer.com/schools/maharashtra-board-solutions-class-11-chemistry-chapter-6-redox-reactions/>

- a. $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{SO}_3^{2-}(\text{aq}) \longrightarrow \text{Cr}^{3+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$ (acidic)
- b. $\text{MnO}_4^{-}(\text{aq}) + \text{Br}^{-}(\text{aq}) \longrightarrow \text{MnO}_2(\text{s}) + \text{BrO}_3^{-}(\text{aq})$ (basic)
- c. $\text{H}_2\text{SO}_4(\text{aq}) + \text{C}(\text{s}) \longrightarrow \text{CO}_2(\text{g}) + \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ (acidic)
- d. $\text{Bi}(\text{OH})_3(\text{g}) + \text{Sn}(\text{OH})_3^{-}(\text{aq}) \longrightarrow \text{Bi}(\text{s}) + \text{Sn}(\text{OH})_6^{2-}(\text{aq})$ (basic)

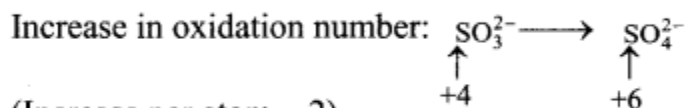
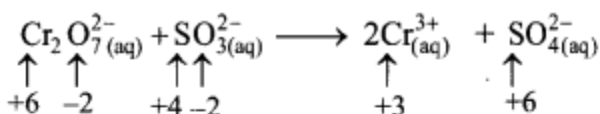
Answer:

- i. $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{SO}_3^{2-}(\text{aq}) \longrightarrow \text{Cr}^{3+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$ (acidic)

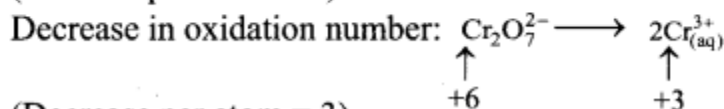
Step 1: Write skeletal equation and balance the elements other than O and H.



Step 2: Assign oxidation number to Cr and S. Calculate the increase and decrease in the oxidation number and make them equal.



(Increase per atom = 2)



(Decrease per atom = 3)

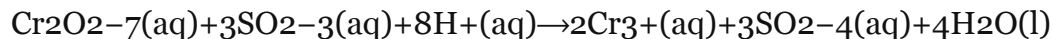
To make the net increase and decrease equal, we must take 3 atoms of S and 2 atoms of Cr. (There are already 2 Cr atoms.)

Step 3: Balance 'O' atoms by adding $4\text{H}_2\text{O}$ to the right-hand side.

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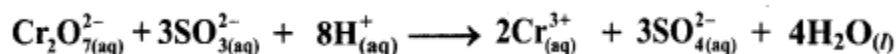


Step 4: The medium is acidic. To make the charges and hydrogen atoms on the two sides equal, add 8H⁺ on the left-hand side.

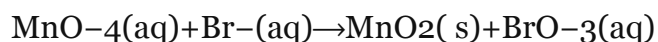


Step 5: Check two sides for balance of atoms and charges.

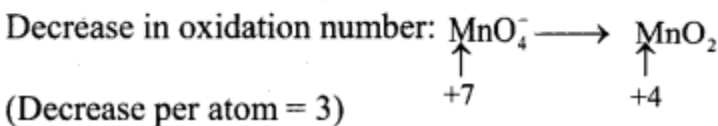
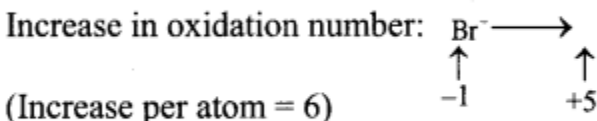
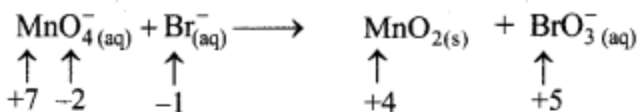
Hence, balanced equation:



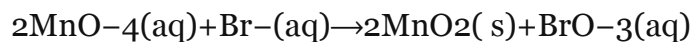
Step 1: Write skeletal equation and balance the elements other than O and H.



Step 2: Assign oxidation number to Mn and Br. Calculate the increase and decrease in the oxidation number and make them equal.



To make the net increase and decrease equal, we must take 2 atoms of Mn.

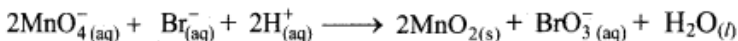


Step 3: Balance 'O' atoms by adding H₂O to the right-hand side.

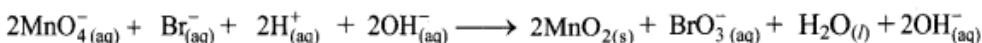
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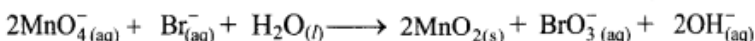
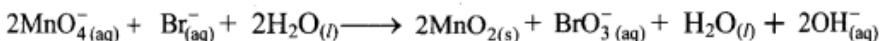
Step 4: The medium is basic. To make the charges and hydrogen atoms on the two sides equal, add 2H^+ on the left-hand side.



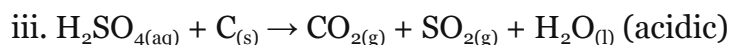
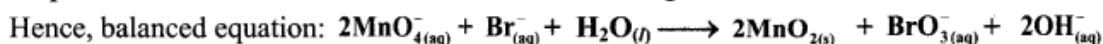
Add OH^- ions equal to the number of H^+ ions on both sides of the equation.



The H^+ and OH^- ions appearing on the same side of the reaction are combined to give H_2O molecules.



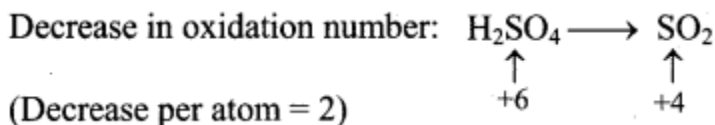
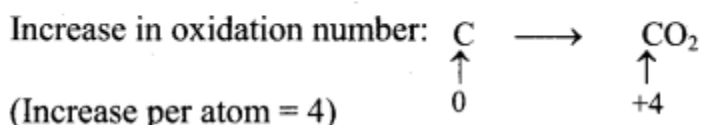
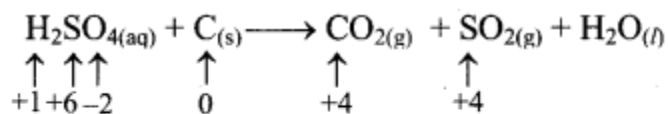
Step 5: Check two sides for balance of atoms and charges.



Step 1: Write skeletal equation and balance the elements other than O and H.



Step 2: Assign oxidation number to S and C. Calculate the increase and decrease in the oxidation number and make them equal.

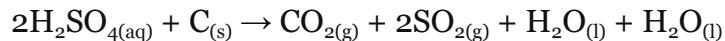


To make the net increase and decrease equal, we must take 2 atoms of S.



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Step 3: Balance 'O' atoms by adding H₂O to the right-hand side.

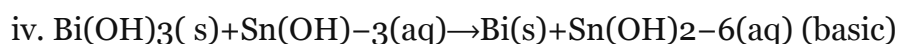


Step 4: The medium is acidic. There is no charge on either side. Hydrogen atoms are equal on both side.



Step 5: Check two sides for balance of atoms and charges.

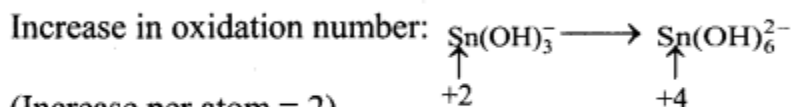
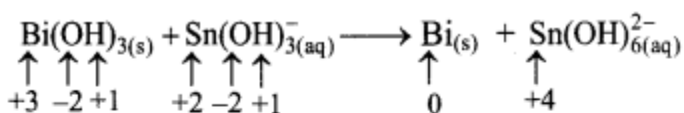
Hence, balanced equation: $2\text{H}_2\text{SO}_{4(\text{aq})} + \text{C}_{(\text{s})} \rightarrow \text{CO}_{2(\text{g})} + 2\text{SO}_{2(\text{g})} + \text{H}_2\text{O}_{(\text{l})}$



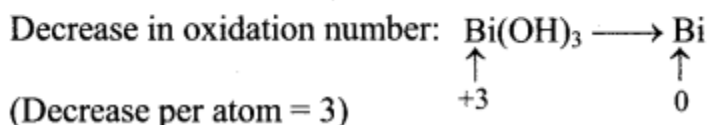
Step 1: Write skeletal equation and balance the elements other than O and H.



Step 2: Assign oxidation numbers to Bi and Sn. Calculate the increase and decrease in the oxidation number and make them equal.



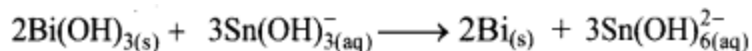
(Increase per atom = 2)



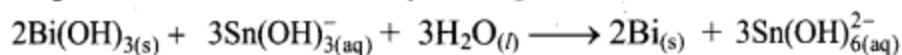
(Decrease per atom = 3)

To make the net increase and decrease equal, we must take 3 atoms of Sn and 2 atoms of Bi.

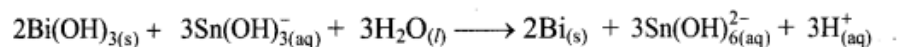
<https://www.indcareer.com/schools/maharashtra-board-solutions-class-11-chemistry-chapter-6-redox-reactions/>



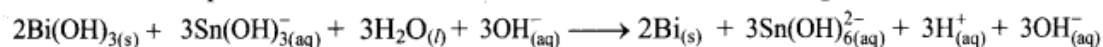
Step 3: Balance 'O' atoms by adding $3\text{H}_2\text{O}$ to the left-hand side.



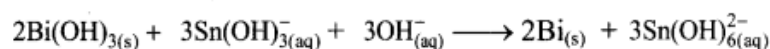
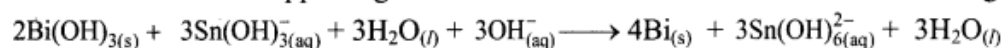
Step 4: The medium is basic. To make hydrogen atoms on the two sides equal, add 3H^+ on the right-hand side.



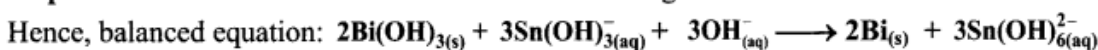
Add OH^- ions equal to the number of H^+ ions on both sides of the equation.



The H^+ and OH^- ions appearing on the same side of the reaction are combined to give H_2O molecules.

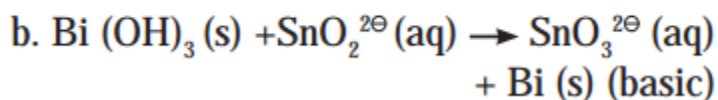
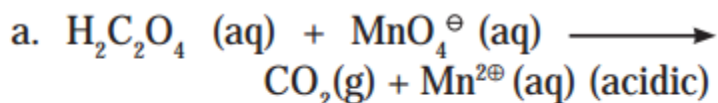


Step 5: Check two sides for balance of atoms and charges.



Question B.

Balance the following redox equation by half reaction method

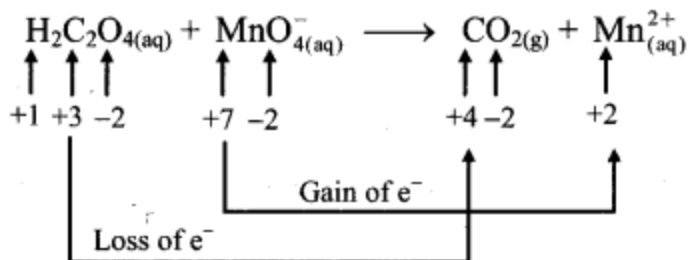


Answer:



Step 1: Write unbalanced equation for the redox reaction. Assign oxidation number to all the atoms in reactants and products. Divide the equation into two half equations.

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Oxidation half reaction: $\text{H}_2\text{C}_2\text{O}_{4(\text{aq})} \longrightarrow \text{CO}_{2(\text{g})}$

Reduction half reaction: $\text{MnO}_{4(\text{aq})}^- \longrightarrow \text{Mn}_{(\text{aq})}^{2+}$

Step 2: Balance the atoms except O and H in each half equation. Balance half equation for O atoms by adding $4\text{H}_2\text{O}$ to the right side of reduction half equation.

Oxidation: $\text{H}_2\text{C}_2\text{O}_{4(\text{aq})} \longrightarrow 2\text{CO}_{2(\text{g})}$

Reduction: $\text{MnO}_{4(\text{aq})}^- \longrightarrow \text{Mn}_{(\text{aq})}^{2+} + 4\text{H}_2\text{O}_{(\text{l})}$

Step 3: Balance H atoms by adding H^+ ions to the side with less H. Hence, add 2H^+ ions to the right side of oxidation half equation and 8H^+ ions to the left side of reduction half equation.

Oxidation: $\text{H}_2\text{C}_2\text{O}_{4(\text{aq})} \longrightarrow 2\text{CO}_{2(\text{g})} + 2\text{H}_{(\text{aq})}^+$

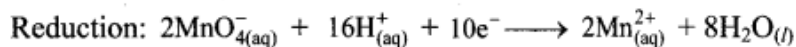
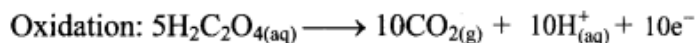
Reduction: $\text{MnO}_{4(\text{aq})}^- + 8\text{H}_{(\text{aq})}^+ \longrightarrow \text{Mn}_{(\text{aq})}^{2+} + 4\text{H}_2\text{O}_{(\text{l})}$

Step 4: Now add 2 electrons to the right side of oxidation half equation and 5 electrons to the left side of reduction half equation to balance the charges.

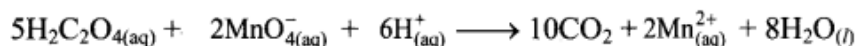
Oxidation: $\text{H}_2\text{C}_2\text{O}_{4(\text{aq})} \longrightarrow 2\text{CO}_{2(\text{g})} + 2\text{H}_{(\text{aq})}^+ + 2e^-$

Reduction: $\text{MnO}_{4(\text{aq})}^- + 8\text{H}_{(\text{aq})}^+ + 5e^- \longrightarrow \text{Mn}_{(\text{aq})}^{2+} + 4\text{H}_2\text{O}_{(\text{l})}$

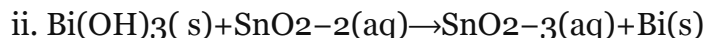
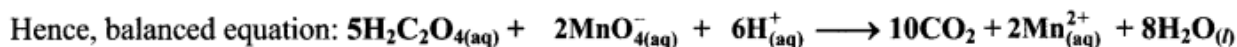
Step 5: Multiply oxidation half equation by 5 and reduction half equation by 2 to equalize number of electrons in two half equations. Then add two half equation.



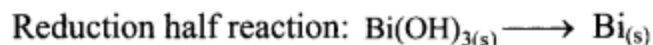
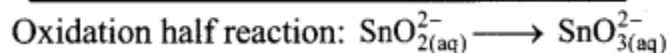
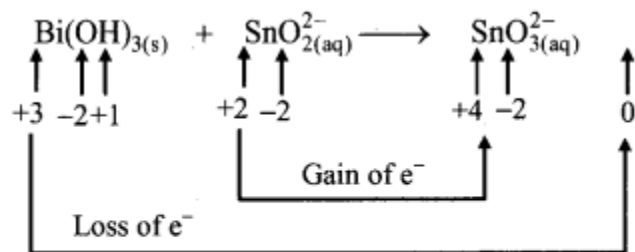
Add two half equations:



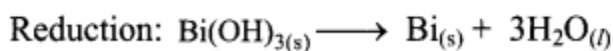
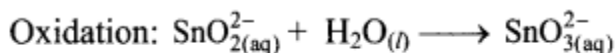
The equation is balanced in terms of number of atoms and the charges.



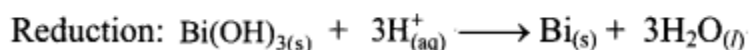
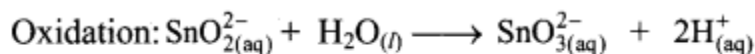
Step 1: Write unbalanced equation for the redox reaction. Assign oxidation number to all the atoms in reactants and products. Divide the equation into two half equations.



Step 2: Balance half equations for O atoms by adding H_2O to the side with less O atoms. Add $1\text{H}_2\text{O}$ to left side of oxidation half equation and $3\text{H}_2\text{O}$ to the right side of reduction half equation.

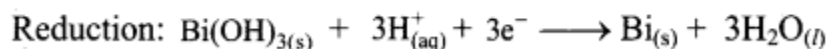
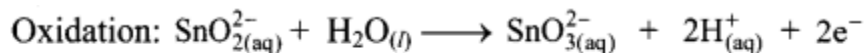


Step 3: Balance H atoms by adding H^+ ions to the side with less H. Hence, add 2H^+ ions to the right side of oxidation half equation and 3H^+ ions to the left side of reduction half equation.

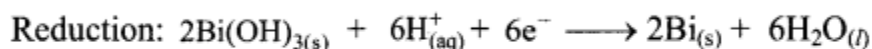
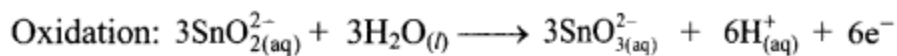


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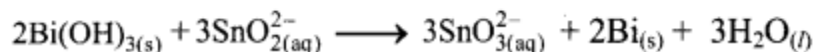
Step 4: Now add 2 electrons to the right side of oxidation half equation and 3 electrons to the left side of reduction half equation to balance the charges.



Step 5: Multiply oxidation half equation by 3 reduction half equation by 2 to equalize number of electrons in two half equations. Then add two half equation.

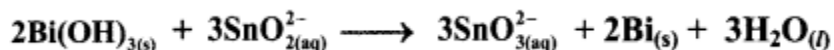


Add two half equations:



Reaction occurs in basic medium. However, H^{+} ions cancel out and the reaction is balanced. Hence, no need to add OH^{-} ions. The equation is balanced in terms of number of atoms and the charges.

Hence, balanced equation:



5. Complete the following table :

Assign oxidation number to the underlined species and write Stock notation of compound

Compound	Oxidation number	Stock notation

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AuCl_3		
SnCl_2		
$\text{V}^{+5}\text{O}_4^{2-}$		
$\text{Pt}^{+4}\text{Cl}_2$		
H_3AsO_3		

Answer:

Compound	Oxidation number	Stock notation
AuCl_3	+3	Au(III)Cl_3
SnCl_2	+2	Sn(II)Cl_2
$\text{V}^{+5}\text{O}_4^{2-}$	+5	$\text{V}_2(\text{V})\text{O}_4^{2-}$
$\text{Pt}^{+4}\text{Cl}_2$	+4	Pt(IV)Cl_2
H_3AsO_3	+3	$\text{H}_3\text{As(III)O}_3$

Can you tell? (Textbook Page No. 81)

Question i.

Why does cut apple turn brown when exposed to air?

Answer:

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Cut apple turns brown when exposed to air because polyphenols are released. These polyphenols undergo oxidation in the presence of air and impart brown colour.

Question ii.

Why does old car bumper change colour?

Answer:

Car bumper is made of iron which undergoes rusting over a period of time. Hence, old car bumper changes colour.

Question iii.

Why do new batteries become useless after some days?

Answer:

Batteries generate electricity by redox reactions. Once the chemicals taking part in redox reaction are used up, the battery cannot generate power. Hence, new batteries become useless after some days.

Can you recall? (Textbook Page No. 81)

Question i.

What is combustion reaction?

Answer:

Combustion is a process in which a substance combines with oxygen.

Question ii.

Write an equation for combustion of methane.

Answer:

Combustion of methane: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Heat} + \text{Light}$

Question iii.

<https://www.indcareer.com/schools/maharashtra-board-solutions-class-11-chemistry-chapter-6-redox-reactions/>

What is the driving force behind reactions of elements?

Answer:

The ability of element to combine with other element or the ability of element to replace other element in compound is the driving force behind the reactions. This may involve formation of precipitates, formation of water, release of gas, etc.

Try this. (Textbook Page No. 82)

Question 1.

Complete the following table of displacement reactions. Identify oxidising and reducing agents involved.

Reactants	Products
$\text{Zn}_{(s)} + \text{-----}_{(aq)}$	$\text{-----}_{(aq)} + \text{Cu}_{(s)}$
$\text{Cu}_{(s)} + 2\text{Ag}^+_{(aq)}$	$\text{-----} + \text{-----}$
$\text{-----} + \text{-----}$	$\text{Co}^{2+}_{(aq)} + \text{Ni}_{(s)}$

Answer:

Reactants	Products	Oxidising agent	Reducing agent
$\text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)}$	$\text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$	Cu^{2+}	Zn
$\text{Cu}_{(s)} + 2\text{Ag}^+_{(aq)}$	$\text{Cu}^{2+}_{(aq)} + 2\text{Ag}_{(s)}$	Ag^+	Cu
$\text{Co}_{(s)} + \text{Ni}^{2+}_{(aq)}$	$\text{Co}^{2+}_{(aq)} + \text{Ni}_{(s)}$	Ni^{2+}	Co

Try this (Textbook Page No. 88)

Question 1.

Classify the following unbalanced half equations as oxidation and reduction.

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Example	Type
$\text{Cl}^-_{(\text{aq})} \longrightarrow \text{Cl}_{2(\text{g})}$	Oxidation
$\text{OCl}^-_{(\text{aq})} \longrightarrow \text{Cl}^-_{(\text{g})}$	-----
$\text{Fe}(\text{OH})_2 \longrightarrow \text{Fe}(\text{OH})_3$	-----
$\text{VO}^{2+}_{(\text{aq})} \longrightarrow \text{V}^{3+}_{(\text{aq})}$	

Answer:

Example	Type
$\text{Cl}^-_{(\text{aq})} \longrightarrow \text{Cl}_{2(\text{g})}$	Oxidation
$\text{OCl}^-_{(\text{aq})} \longrightarrow \text{Cl}^-_{(\text{g})}$	Reduction
$\text{Fe}(\text{OH})_2 \longrightarrow \text{Fe}(\text{OH})_3$	Oxidation
$\text{VO}^{2+}_{(\text{aq})} \longrightarrow \text{V}^{3+}_{(\text{aq})}$	Reduction



Maharashtra Board Solutions

Class 11 Chemistry

- Chapter 1- Some Basic Concepts of Chemistry
- Chapter 2- Introduction to Analytical Chemistry
- Chapter 3- Basic Analytical Techniques
- Chapter 4- Structure of Atom
- Chapter 5- Chemical Bonding
- Chapter 6- Redox Reactions
- Chapter 7- Modern Periodic Table
- Chapter 8- Elements of Group 1 and 2
- Chapter 9- Elements of Group 13, 14 and 15
- Chapter 10- States of Matter
- Chapter 11- Adsorption and Colloids
- Chapter 12- Chemical Equilibrium
- Chapter 13- Nuclear Chemistry and Radioactivity
- Chapter 14- Basic Principles of Organic Chemistry
- Chapter 15- Hydrocarbons
- Chapter 16- Chemistry in Everyday Life

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About About Maharashtra State Board (MSBSHSE)

The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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How many state boards are there in Maharashtra?

The Maharashtra State Board of Secondary & Higher Secondary Education, conducts the HSC and SSC Examinations in the state of Maharashtra through its nine Divisional Boards located at Pune, Mumbai, Aurangabad, Nasik, Kolhapur, Amravati, Latur, Nagpur and Ratnagiri.

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