Redox Reactions

Question1

What is the oxidation number of carbon in methanal?

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Options:

A.

-2

B.

+2

C.

zero

D.

+4

Answer: C

Solution:

Step 1: Write the formula

Methanal $\rightarrow H_2C=O$

Structure: two hydrogens attached to carbon, and a double-bonded oxygen.

Step 2: Assign known oxidation numbers

- Hydrogen (when bonded to nonmetals): **+1** each
- Oxygen (in most compounds except peroxides): **−2**

Step 3: Set up the equation

Let oxidation number of carbon = x.

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

$2 + x - 2 = 0$

$x = 0$

Step 4: Answer

Oxidation number of carbon in methanal = **0**

✅ Correct Option: **C. zero**

Question2

In the equation, $\mathrm{BiO_3^-} + 6\mathrm{H^+} + x\mathrm{e^-} \rightarrow \mathrm{Bi^{3+}} + 3\mathrm{H_2O}$ What is the value of x ?

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Options:

A. 2

B. 3

C. 4

D. 6

Answer: A

Solution:

For balanced equation, charges must be balanced on both the sides of the reaction.

$$\mathrm{BiO_3^-} + 6\mathrm{H^+} + x\mathrm{e^-} \longrightarrow \mathrm{Bi^{3+}} + 3\mathrm{H_2O}$$
$$-1 + (+6) + x(-1) = +3 + 0$$
$$5 - x = +3$$
$$x = 2$$

Question3

What is the charge required to convert $2\ \text{mol}\text{KMnO}_4$ to MnSO_4 ?

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Options:

A. 2 F

B. 4 F

C. 5 F

D. 10 F

Answer: D

Solution:

We need to change the manganese in KMnO_4 from a high oxidation state (Mn^{+7}) to a lower one found in MnSO_4 (Mn^{+2}). This type of reaction is called a reduction.

The chemical equation is: $\text{Mn}^{+7} + 5\text{e}^- \longrightarrow \text{Mn}^{+2}$This means one manganese ion (Mn^{+7}) needs 5 electrons ($5\,\text{e}^-$) to become Mn^{+2}.

To provide 5 electrons for each manganese atom, we need 5 Faradays (F) of electric charge for every 1 mole of Mn^{+7}.

So, for 2 moles of KMnO_4, we need $2 \times 5 = 10$ Faradays (F) of charge to complete the reduction to MnSO_4 .

Question4

What is oxidation number of sulphur in SO_3 ?

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Options:

A. +3

B. +4

C. +6

D. -3

Answer: C

Solution:

We need to find the oxidation number of sulphur in SO_3 (sulphur trioxide).

Step 1: Oxygen is generally assigned an oxidation number of -2.

Step 2: There are 3 oxygen atoms, so total = $3 \times (-2) = -6$.

Step 3: Let oxidation state of sulphur = x.

The molecule is neutral, so:

$x + (-6) = 0$

$x = +6$

✅ Therefore the oxidation number of sulphur in SO_3 is **+6**.

Correct Option: C (+6)

Question5

Which of the following species acts as an weakest reducing agent?

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Options:

A. Li

B. Li^+

C. F_2

D. F^-

Answer: D

Solution:

The **correct answer is D: F^-**

Reasoning:

A **reducing agent** donates electrons and itself gets oxidized. The *weaker* the reducing agent, the **less willing it is to lose electrons** .

Let's briefly assess each option:

- **Li** → Very strong reducing agent (alkali metal, easily loses an electron).
- **Li^+** → Already oxidized; it cannot donate electrons, so it's typically not considered an active reducing agent.
- **F_2** → A very strong **oxidizing** agent, not a reducing agent.
- **F^-** → Has a complete octet and is extremely stable; it has **almost no tendency to lose electrons** .

Therefore, **F^- is the weakest reducing agent** among the given options.

Question6

What is the oxidation number of phosphorus in calcium phosphate?

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Options:

A. +3

B. +4

C. +5

D. +6

Answer: C

Solution:

Chemical formula of calcium phosphate is $Ca_3(PO_4)_2$

Let oxidation state of P in $Ca_3(PO_4)_2$ is x

$\Rightarrow 3(+2) + 2x + 8(-2) = 0$
$6 + 2x - 16 = 0$
$\Rightarrow 2x = +10$
$x = +5$

Oxidation state of P $= +5$

Question7

For a reaction, $NH_4NO_2 \longrightarrow N_2 + 2H_2O$. Which from following phenomena is true regarding nitrogen?

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Options:

A. Oxidised

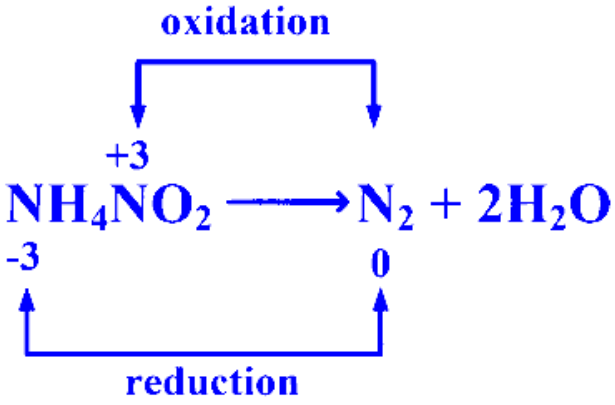
B. Reduced

C. Oxidised as well as reduced

D. Neither oxidised nor reduced

Answer: C

Solution:



Question8

Identify correct statement for reaction stated below.

$$\mathrm{Ag_2O + H_2O + 2e^- \longrightarrow 2Ag + 2OH^-}$$

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Options:

A. Water is oxidised.

B. Hydrogen is oxidised.

C. Silver is reduced.

D. Hydrogen is reduced.

Answer: C

Solution:

We are asked to analyze the reaction:

$\mathrm{Ag_2}O + H_2O + 2e^- \longrightarrow 2Ag + 2OH^-$

Step 1. Look at oxidation states

- In $\mathrm{Ag_2}O$, oxygen is -2.

  Therefore, each Ag must be $+1$.
- In the products: Ag is elemental, oxidation state = 0.

So silver is going from $+1$ to 0. **This is a reduction**.

Electrons are being gained by Ag, consistent with the reduction half-reaction.

Step 2. Role of other species

- Oxygen remains -2 in OH^-.
- Hydrogen in both $\mathrm{H_2O}$ and $\mathrm{OH^-}$ is $+1$.

So no change in oxidation states of H or O.

Step 3. Evaluate given options

- **Option A**: Water is oxidized → False. No change in hydrogen's oxidation state.
- **Option B**: Hydrogen is oxidized → False. Hydrogen remains +1.
- **Option C**: Silver is reduced → **True** ($Ag^{+} \rightarrow Ag^{0}$).
- **Option D**: Hydrogen is reduced → False.

✅ **Correct answer: Option C — Silver is reduced.**

Question9

A compound of Xe and F is found to have atomic ratio Xe : F as 0.4 : 2.4, Find the oxidation number of Xe ?

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Options:

A. -4

B. Zero

C. +4

D. +6

Answer: D

Solution:

Step 1. Simplify the atomic ratio.

$\mathrm{Xe{:}F} = 0.4 : 2.4 = \frac{0.4}{0.4} : \frac{2.4}{0.4} = 1 : 6$

So the empirical formula is $\mathrm{XeF_6}$.

Step 2. Assign oxidation number.

Fluorine always has oxidation number -1.

In $\mathrm{XeF_6}$:

Oxidation number of $\mathrm{Xe} + 6(-1) = 0$

Oxidation number of $\mathrm{Xe} - 6 = 0$

Oxidation number of $\mathrm{Xe} = +6$

Final Answer:

$\boxed{+6}$

Correct Option: D. +6

Question10

Which of the following species acts as strongest oxidising agent?

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Options:

A. Li

B. Li^{+}

C. F_2

D. F^{-}

Answer: C

Solution:

Step 1: Recall the concept of an oxidising agent

An **oxidising agent** is a species that gets **reduced** easily. That means it has a strong tendency to **gain electrons**.

Step 2: Analyze the options

- **Option A: Li (metallic lithium)**

  Lithium is a strong *reducing agent* (it loses electrons readily). Hence, it is *not* a strong oxidising agent.

- **Option B:** Li^{+}

  To act as an oxidising agent, Li^{+} would need to gain electrons (get reduced to Li). But in reality, Li^{+} is already very stable, and going back to Li metal is not favoured under normal conditions. So not a strong oxidiser.

- **Option C:** $\mathrm{F_2}$

  Fluorine is the most electronegative element. $\mathrm{F_2}$ readily accepts electrons to form $\mathrm{F^-}$. It has the **highest standard electrode potential (+2.87 V)** for the half-reaction:

  $\mathrm{F_2} + 2e^- \rightarrow 2F^-$

  Hence, $\mathrm{F_2}$ is the **strongest oxidising agent**.

- **Option D:** $\mathrm{F^-}$

  $\mathrm{F^-}$ is already reduced; it has very little tendency to gain another electron. In fact, it cannot oxidise anything. So it is *not* an oxidising agent.

✅ **Final Answer:**

$\boxed{\mathrm{F_2}}$

is the strongest oxidising agent among the given species.

Question11

What is the difference in oxidation number of Mn in $\mathrm{KMnO_4}$ and $\mathrm{MnO_2}$?

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Options:

A. 1

B. 3

C. 4

D. 5

Answer: B

Solution:

Let x be the oxidation number of Mn in $\mathrm{KMnO_4}$

$\therefore \quad 1 + x + (-2 \times 4) = 0$
$\therefore \quad x = +7$

Let y be the oxidation number of Mn in MnO_2

$\therefore \quad y + (-2 \times 2) = 0$
$\therefore \quad y = +4$

The difference in oxidation number of Mn in $KMnO_4$ and MnO_2

$= x - y = 7 - 4 = 3$

Question12

Identify correct statement for the reaction.

$$I_2 + KClO_3 \xrightarrow{\Delta} ICl + KIO_3$$

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Options:

A. I_2 is an oxidising agent

B. $KClO_3$ is reducing agent

C. Oxidation number of ' Cl' decreases by 6

D. Oxidation number of I increases by 2

Answer: C

Solution:

$$\overset{0}{I_2} + \overset{+1}{K}\overset{+}{Cl}O_3 \overset{-2}{} \xrightarrow{\Delta} \overset{+1-1}{I}Cl + \overset{+1+5}{K}\overset{+}{IO_3}\overset{-}{}$$

From above reaction we can say that,

i. I_2 is oxidized, from 0 to +1 and 0 to +5 thus acts a reducing agent.

ii. $KClO_3$ is reduced, thus acts as a oxidizing agent.

iii. Oxidisation number of Cl changes from +5 to -1 .

$\therefore$ Oxidation number of ' Cl ' decreases by 6

(i.e., $= +5 - (-1) = +6$)

Question13

What is the number of electrons transferred considering Mn when $KMnO_4$ is converted into Mn_2O_3 ?

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Options:

A. 1

B. 3

C. 4

D. 5

Answer: C

Solution:

We are asked: *the number of electrons transferred considering Mn when*

$KMnO_4 \quad \rightarrow \quad Mn_2O_3$

Step 1: Find oxidation state of Mn in $KMnO_4$

In permanganate, MnO_4^-:

Oxidation state of Mn $+ 4(-2) = -1$

Oxidation state of Mn $= +7$

So in $KMnO_4$, Mn is in **+7** oxidation state.

Step 2: Find oxidation state of Mn in Mn_2O_3

$2x + 3(-2) = 0 \quad \Rightarrow \quad 2x - 6 = 0 \quad \Rightarrow \quad 2x = 6$

$x = +3$

So in Mn_2O_3, Mn is in **+3** oxidation state.

Step 3: Change in oxidation state

$+7 \quad \rightarrow \quad +3$

Change per Mn = **4 electrons gained** (reduction).

Step 4: Accounting for reaction

Each Mn atom undergoes reduction from +7 to +3, so **4 electrons are transferred per Mn atom**.

Since the problem states *considering Mn*, the relevant number is **4**.

✅ Final Answer:

$\boxed{4}$

Correct Option: C

Question14

Which is NOT correct regarding stock notation?

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Options:

A.

$Hg_2(I)Cl_2$ is reduced form of $Hg(II)Cl_2$

B.

$Hg(II)Cl_2$ is oxidised form of $Hg_2(I)Cl_2$

C.

It helps to identify whether species is present in oxidised form or reduced form

D.

Aurous chloride is written as Au (III) Cl_3

Answer: D

Solution:

Aurous chloride is written as $Au(I)Cl_3$ and Auric chloride is written as $Au(III)Cl_3$.

Question15

If a reaction occurs in following two steps

i. $2\mathrm{ClO}^- \longrightarrow \mathrm{ClO}_2^-$

ii. $\mathrm{ClO}_2^- + \mathrm{ClO}^- \longrightarrow \mathrm{ClO}_3^- + \mathrm{Cl}^-$

Find the reaction intermediate.

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Options:

A. ClO^-

B. ClO_3^-

C. Cl^-

D. ClO_2^-

Answer: D

Solution:

Let us analyze both steps one by one:

Step i:

$2\ \mathrm{ClO}^- \longrightarrow \mathrm{ClO}_2^-$

Step ii:

$\mathrm{ClO}_2^- + \mathrm{ClO}^- \longrightarrow \mathrm{ClO}_3^- + \mathrm{Cl}^-$

Step-by-step logic

Step 1: Identify the intermediate.

A *reaction intermediate* is a species that is produced in one step of a reaction mechanism and consumed in a subsequent step. It does **not** appear in the overall reaction.

Step 2: Which species fits this definition?

- ClO_2^- is *produced* in Step i and *consumed* in Step ii.

- ClO^- appears as a reactant in both steps.
- ClO_3^- and Cl^- are only *produced*, not consumed (so they are final products, not intermediates).

Step 3: Conclusion

Thus, ClO_2^- is the reaction intermediate.

Correct Option:

Option D: ClO_2^-

Question16

A compound contains atoms of x, y and z elements. Oxidation numbers of x, y and z are +3 , +5 and -2 respectively. Identify the possible formula of this compound.

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Options:

A. XYZ_2

B. $Y_2(XZ_3)_2$

C. $X_3(YZ_4)_3$

D. $X_3(Y_4Z)_2$

Answer: C

Solution:

Let the oxidation numbers be:

- $x = +3$
- $y = +5$
- $z = -2$

For a compound to be neutral, the sum of the oxidation numbers (overall charge) must be 0.

Let us check all options one by one.

Option A: $\mathrm{XYZ_2}$

Total oxidation number:

$(+3) + (+5) + 2 \times (-2) = 3 + 5 - 4 = 4 \neq 0$

Not neutral. **Not possible**

Option B: $\mathrm{Y_2(XZ_3)_2}$

First, expand the formula:

- Y: 2
- X: 2
- Z: $3 \times 2 = 6$

Total oxidation number:

$2 \times (+5) + 2 \times (+3) + 6 \times (-2) = 10 + 6 - 12 = 4 \neq 0$

Not neutral. **Not possible**

Option C: $\mathrm{X_3(YZ_4)_3}$

Expand the formula:

- X: 3
- Y: 3
- Z: $4 \times 3 = 12$

Total oxidation number:

$3 \times (+3) + 3 \times (+5) + 12 \times (-2) = 9 + 15 - 24 = 0$

Sum is zero (neutral). This is possible.

Option D: $\mathrm{X_3(Y_4Z)_2}$

Expand the formula:

- X: 3
- Y: $4 \times 2 = 8$
- Z: 2

Total oxidation number:

$3 \times (+3) + 8 \times (+5) + 2 \times (-2) = 9 + 40 - 4 = 45 \neq 0$

Not neutral. **Not possible**

Final Answer

The possible formula of the compound is:

$\boxed{X_3(YZ_4)_3}$

Question17

Which metal in following compounds is not present in fractional oxidation state?

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Options:

A. Fe_3O_4

B. Mn_3O_4

C. Pb_3O_4

D. $Na_2\ S_4O_6$

Answer: D

Solution:

Let us find the oxidation states of each metal in the given compounds:

Option A: Fe_3O_4

Suppose the oxidation state of Fe is x. Let total charge on Fe be $3x$.

Oxygen has an oxidation state of -2. There are 4 oxygen atoms, so the total oxidation state of O is $4 \times (-2) = -8$.

The compound is neutral, so:

$3x + (-8) = 03x = +8x = \frac{8}{3}$

But *actually*, Fe_3O_4 is a mixed oxide: it is better written as $FeO \cdot Fe_2O_3$ (i.e., Fe(II) and Fe(III) are present). So, the oxidation states are fractional on average, not all atoms are in the same oxidation state.

Option B: Mn_3O_4

Let the oxidation state of Mn be x.

$3x + 4(-2) = 03x - 8 = 03x = 8x = \frac{8}{3}$

Again, this shows an average (fractional) oxidation state. Actually, it contains Mn(II) and Mn(III) ions.

Option C: $\mathrm{Pb_3O_4}$

Let the oxidation state of Pb be x.

$3x + 4(-2) = 0 3x - 8 = 0 3x = 8 x = \frac{8}{3}$

But $\mathrm{Pb_3O_4}$ is also a mixed oxide $(2\mathrm{PbO} \cdot \mathrm{PbO_2})$, i.e., contains $\mathrm{Pb^{2+}}$ and $\mathrm{Pb^{4+}}$ ions.

Option D: $\mathrm{Na_2S_4O_6}$

Let's check the oxidation state of Na (metal):

Each Na is always $+1$, so for 2 Na atoms: $2 \times (+1) = +2$.

Here, the sodium is present only as $+1$ (not a mixture of different oxidation states, and not a fraction).

Final Answer:

The metal **not** present in fractional oxidation state is:

Option D $\mathrm{Na_2S_4O_6}$

Question18

Which of the following is a redox reaction?

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Options:

A.

$\mathrm{NaCl + KNO_3 \longrightarrow NaNO_3 + KCl}$

B.

$\mathrm{Mg(OH)_2 + 2NH_4Cl \longrightarrow MgCl_2 + 2NH_4OH}$

C.

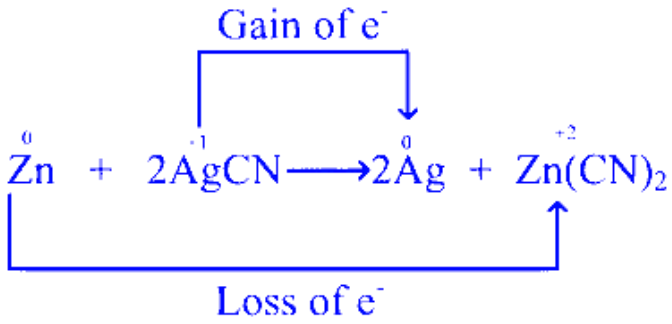
$\mathrm{CaC_2O_4 + 2HCl \longrightarrow CaCl_2 + H_2C_2O_4}$

D.

$\mathrm{Zn + 2AgCN \longrightarrow 2Ag + Zn(CN)_2}$

Answer: D

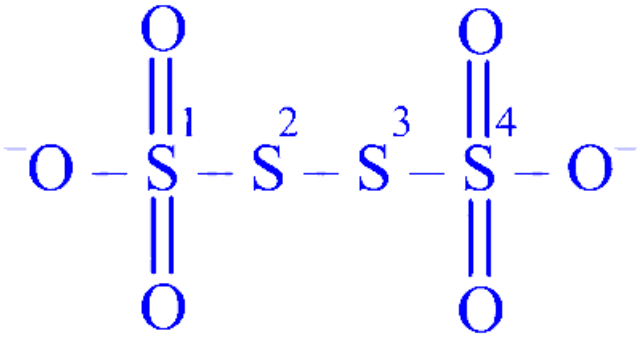
Solution:



There is no change in oxidation numbers in the remaining options.

Question19

What are the respective oxidation states of sulphur atoms numbered 1 to 4 in tetrathionate ion shown below?



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Options:

A. $0, +5, +5, 0$

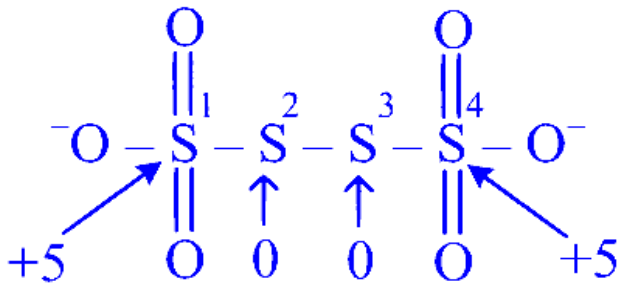
B. $+5, 0, 0, +5$

C. $+2, 0, 0, +2$

D. $+2, -1, -1, +2$

Answer: B

Solution:



Question20

What is the oxidation number of Mn in MnO_4^-?

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Options:

A. -5

B. 5

C. 6

D. 7

Answer: D

Solution:

In the permanganate ion (MnO_4^-), the oxidation number of manganese (Mn) can be determined by considering the oxidation states of each element and the overall charge of the ion.

Oxygen (O) typically has an oxidation number of -2. Since there are 4 oxygen atoms, the total oxidation contribution from oxygen is:

$4 \times (-2) = -8$

Let the oxidation number of Mn be x.

The sum of the oxidation numbers in the ion MnO_4^- must equal the charge on the ion, which is -1.

Thus, we can set up the equation:

$x + (-8) = -1$

Simplifying the equation gives:

$x - 8 = -1$

Adding 8 to both sides:

$x = 7$

Therefore, the oxidation number of Mn in $\mathrm{MnO_4^-}$ is 7.

Option D: 7

Question21

What is the oxidation state of phosphorus in phosphate ion?

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Options:

A. -5

B. $+3$

C. $+5$

D. $+6$

Answer: C

Solution:

Phosphate ion, represented by the chemical formula $\mathrm{PO_4^{3-}}$, consists of one phosphorus (P) atom and four oxygen (O) atoms. To determine the oxidation state of phosphorus in this ion, consider the following steps:

Oxygen typically has an oxidation state of -2.

In the phosphate ion, there are four oxygen atoms, contributing a total oxidation state of $4 \times (-2) = -8$.

The overall charge on the ion is -3.

The sum of the oxidation states in the ion must equal the charge on the ion:

(Oxidation state of P) $+ 4 \times (-2) = -3$

Let the oxidation state of phosphorus be x. Then, the equation becomes:

$x - 8 = -3$

Solving for x, we find:

$x = -3 + 8$

$x = +5$

Therefore, the oxidation state of phosphorus in the phosphate ion is $+5$.

Correct Option: Option C $+5$

Question22

What is change in oxidation number of nitrogen when NO_3^- is converted to NH_4^+ ion?

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Options:

A. $+5$ to -3

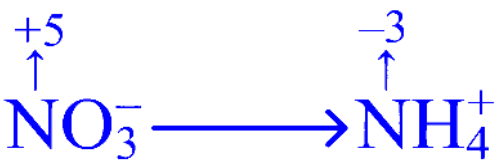
B. $+3$ to -5

C. -3 to $+5$

D. -5 to $+3$

Answer: A

Solution:



Question23

Calculate the oxidation number of Cr in CrO_4^{2-} ion and $K_2Cr_2O_7$ respectively.

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Options:

A. +4 and +6

B. +3 and +2

C. +6 and +6

D. +8 and +2

Answer: C

Solution:

To calculate the oxidation number of chromium (Cr) in the given compounds :

For CrO_4^{2-} ion :

The ion CrO_4^{2-} is known as chromate. Let the oxidation number of Cr be x.

Using the rule that the sum of oxidation numbers in a neutral compound or ion must equal the overall charge :

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

Simplifying the equation :

$x - 8 = -2$

$x = +6$

So, the oxidation number of Cr in CrO_4^{2-} is **+6**.

For $K_2Cr_2O_7$:

This compound is potassium dichromate. Each potassium (K) atom has an oxidation number of +1, and oxygen (O) typically has an oxidation number of -2.

Let the oxidation number of each Cr atom be x. The compound is neutral, so :

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

Simplifying the equation :

$2 + 2x - 14 = 0$

$2x - 12 = 0$

$2x = 12$

$x = +6$

Therefore, the oxidation number of Cr in $K_2Cr_2O_7$ is **+6**.

Thus, the correct answer is :

Option C

+6 and +6

Question24

Identify the correct statement for following reaction.

$$3Mg + N_2 \longrightarrow Mg_3\,N_2$$

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Options:

A. Mg is reduced

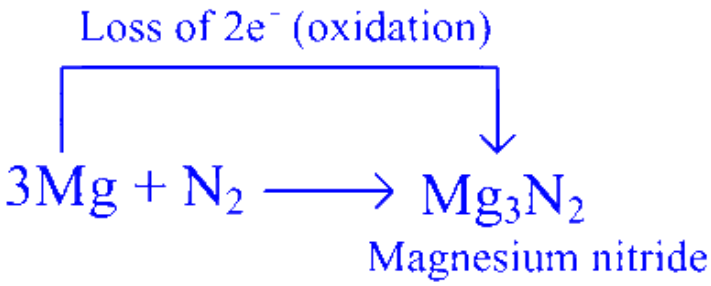
B. Mg is oxidised

C. N_2 is oxidised

D. oxidation state of Mg changes from +2 to zero

Answer: B

Solution:



Question25

What is oxidation number of S in SO_3^{2-} ?

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Options:

A. -2

B. -3

C. $+4$

D. $+6$

Answer: C

Solution:

To determine the oxidation number of sulfur (S) in the sulfite ion SO_3^{2-}, we need to consider the typical oxidation state of oxygen and use the overall charge of the ion.

Oxygen typically has an oxidation number of -2.

Let the oxidation number of sulfur be x.

The sulfite ion SO_3^{2-} consists of one sulfur atom and three oxygen atoms.

The equation for the oxidation states in the ion is:

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

Simplifying the equation:

$x - 6 = -2$

Solve for x:

$x = -2 + 6$

$x = +4$

Therefore, the oxidation number of sulfur in SO_3^{2-} is $+4$.

Correct Answer: Option C $+4$

Question26

What is the change in oxidation number of S in following reaction?

$$H_2S + NO_3^- \longrightarrow H_2O + NO + S$$

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Options:

A. -2 to 0

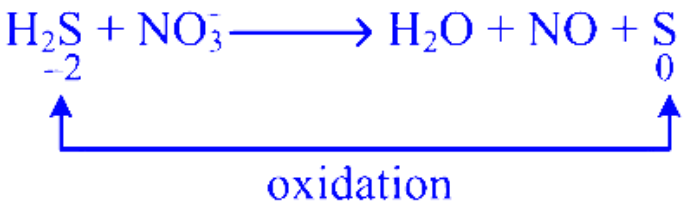
B. 0 to -2

C. -2 to +2

D. 0 to +2

Answer: A

Solution:



Question27

What is the oxidation number of carbon in $\mathrm{K_2C_2O_4}$?

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Options:

A. -2

B. -3

C. $+3$

D. $+4$

Answer: C

Solution:

To determine the oxidation number of carbon in the compound $\mathrm{K_2C_2O_4}$, follow these steps:

Identify the oxidation numbers of known elements:

Potassium (K) typically has an oxidation number of $+1$.

Oxygen (O) typically has an oxidation number of -2.

Set up the equation based on the compound neutrality:

The compound $\mathrm{K_2C_2O_4}$ is neutral, so the sum of all oxidation numbers must equal zero.

Write out the expression:

Let the oxidation number of carbon be x.

Potassium contributes $2(+1) = +2$ to the total oxidation number.

Each oxygen contributes -2, and there are 4 oxygens, so they contribute $4(-2) = -8$.

Create the equation and solve for x:

The equation is:

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

Simplify:

$2 + 2x - 8 = 0$

Combine like terms:

$2x - 6 = 0$

Solve for x:

$2x = 6$

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

$x = +3$

Therefore, the oxidation number of carbon in $K_2C_2O_4$ is $+3$. The correct answer is Option C: $+3$.

Question28

What is the oxidation state of iodine in I_2Cl_6 ?

MHT CET 2024 10th May Morning Shift

Options:

A. $+7$

B. -3

C. $+3$

D. -2

Answer: C

Solution:

In I_2Cl_6, each iodine atom is bonded to three chlorine atoms forming ICl_3 units. Since chlorine is more electronegative than iodine, each Cl atom will take on the oxidation state of -1.

The total oxidation state of three chlorine atoms per iodine is $3 \times (-1) = -3$. Let the oxidation state of iodine be x.

In the compound I_2Cl_6, the sum of the oxidation states must be zero because it is a neutral compound. Therefore, the equation to determine the oxidation state of iodine is:

$2x + 6(-1) = 0$

Simplify to solve for x:

$2x - 6 = 0$

$2x = 6$

$x = 3$

Thus, the oxidation state of iodine in I_2Cl_6 is +3.

Option C: +3

Question29

Which of the following changes involves transfer of 5 electrons?

MHT CET 2024 9th May Evening Shift

Options:

A. $MnO_4^- \longrightarrow Mn^{2+}$

B. $CrO_4^{2-} \longrightarrow Cr^{3+}$

C. $NO_3^- \longrightarrow NH_4^+$

D. $Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$

Answer: A

Solution:

Reaction	Number of electrons transferred
$MnO_4^- \rightarrow Mn^{2+}$	5
$CrO_4{}^{2-} \rightarrow Cr^{3+}$	3
$NO_3^- \rightarrow NH_4^+$	8
$Cr_2O_7{}^{2-} \rightarrow 2Cr^{3+}$	6

Question30

What is the value of x and y in order to balance following redox reaction?

$$\mathrm{xCuO} + \mathrm{yNH_3} \longrightarrow \mathrm{xCu} + \mathrm{N_2} + \mathrm{xH_2O}$$

MHT CET 2024 9th May Morning Shift

Options:

A. $\mathrm{x} = 3, \mathrm{y} = 2$

B. $\mathrm{x} = 1, \mathrm{y} = 2$

C. $\mathrm{x} = 2, \mathrm{y} = 3$

D. $\mathrm{x} = 2, \mathrm{y} = 3$

Answer: A

Solution:

To balance the redox reaction:

$\mathrm{xCuO} + \mathrm{yNH_3} \longrightarrow \mathrm{xCu} + \mathrm{N_2} + \mathrm{xH_2O}$

First, balance the number of atoms for each element on both sides of the equation:

Copper (Cu): The number of copper atoms will be balanced since each CuO gives one Cu:

$x\mathrm{CuO} \longrightarrow x\mathrm{Cu}$

Nitrogen (N): In $\mathrm{NH_3}$, nitrogen ends up as $\mathrm{N_2}$. Therefore, to balance the nitrogen atoms:

Each $\mathrm{NH_3}$ contains 1 nitrogen atom, while $\mathrm{N_2}$ contains 2 nitrogen atoms. Therefore, 2 moles of $\mathrm{NH_3}$ will produce 1 mole of $\mathrm{N_2}$.

$2\mathrm{NH_3} \longrightarrow \mathrm{N_2}$

Hydrogen (H): The hydrogen from $\mathrm{NH_3}$ ends up in $\mathrm{H_2O}$. Each molecule of $\mathrm{NH_3}$ contains 3 hydrogen atoms, contributing a total of $3 \times \mathrm{y}$ hydrogen atoms. These must be balanced with the water molecules, where each $\mathrm{H_2O}$ has 2 hydrogen atoms:

$3y = 2x$

Balance Oxygen (O): The oxygen atoms initially from CuO will create the water molecules $\mathrm{H_2O}$:

$x\mathrm{O} \longrightarrow x\mathrm{H_2O}$

Now, solve the equation $3y = 2x$ for small integer values of x and y:

Choosing $x = 2$,

$3y = 2 \times 2 = 4 \Rightarrow y = \frac{4}{3}$

To keep y as an integer, select $x = 3$:

$3y = 2 \times 3 = 6 \Rightarrow y = 2$

With $x = 3$ and $y = 2$, substitute back to verify:

Copper: 3 $CuO \longrightarrow 3\ Cu$

Nitrogen: 2 $NH_3 \longrightarrow 1\ N_2$

Hydrogen: $2 \times 3 = 6$ hydrogen atoms in NH_3 match with $3 \times 2 = 6$ hydrogen atoms in water ($3H_2O$).

Oxygen: 3 O from CuO balances with 3 H_2O.

Thus, even after the check, the balanced coefficients are:

Option A: $\mathrm{x} = 3, \mathrm{y} = 2$.

Therefore, the correct answer is:

Option A: $\mathrm{x} = 3, \mathrm{y} = 2$**.**

Question31

What is the oxidation state of S in SO_4^{2-} ?

MHT CET 2024 4th May Evening Shift

Options:

A. $+6$

B. -6

C. $+2$

D. $+3$

Answer: A

Solution:

In the sulfate ion, SO_4^{2-}, the oxidation state of sulfur can be determined by using the known oxidation states of the constituent atoms and the overall charge of the ion.

The oxidation state of oxygen is typically -2.

In SO_4^{2-}, there are four oxygen atoms, contributing a total of $4 \cdot (-2) = -8$ to the oxidation state.

Let the oxidation state of sulfur be x.

The sum of the oxidation states of all atoms in the sulfate ion must equal the overall charge of the ion, which is -2:

$x + 4 \cdot (-2) = -2$

Simplifying this equation:

$x - 8 = -2$

$x = +6$

Therefore, the oxidation state of sulfur in SO_4^{2-} is $+6$.

Correct option: A) $+6$.

Question32

Which compound from following contains iodine with highest oxidation number?

MHT CET 2024 4th May Morning Shift

Options:

A. KIO_3 (B)

B. KI

C. IF_5

D. KIO_4

Answer: D

Solution:

Compound	Oxidation state of I
KIO_3	+5
KI	-1
IF_5	+5

Compound	Oxidation state of I
KIO_4	+7

Question33

In which of the following compounds chlorine has highest oxidation state?

MHT CET 2024 3rd May Evening Shift

Options:

A. KCl

B. $HClO$

C. $HClO_2$

D. $HClO_4$

Answer: D

Solution:

Compound	O.S. of Chlorine
KCl	-1
$HClO$	$+1$
$HClO_2$	$+3$
$HClO_4$	$+7$

Question34

Identify the element reduced in following reaction.

$$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 3H_2O + 3I_2$$

MHT CET 2024 3rd May Morning Shift

Options:

A. Cr

B. H

C. O

D. I

Answer: A

Solution:

To identify the element that is reduced in a chemical reaction, one must determine the element whose oxidation state decreases. Examine the given reaction:

$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 3H_2O + 3I_2$

Step 1: Determine the oxidation states of each element in both the reactants and products.

Chromium (Cr):

In $Cr_2O_7^{2-}$, the oxidation state of Cr is +6. This can be determined knowing the overall charge of the dichromate ion is -2 and the oxygen is -2.

In Cr^{3+}, the oxidation state of Cr is +3.

Iodine (I):

In I^-, the oxidation state is -1.

In I_2, the oxidation state is 0.

Step 2: Compare the changes in oxidation states.

The oxidation state of Cr changes from +6 in $Cr_2O_7^{2-}$ to +3 in Cr^{3+}. This is a reduction (a gain of electrons).

The oxidation state of I changes from -1 in I^- to 0 in I_2. This is an oxidation (a loss of electrons).

Conclusion:

The element being reduced is Chromium (Cr), as its oxidation state decreases from +6 to +3. Therefore, the correct answer is:

Option A: Cr

Question35

What is the oxidation number of underlined species in PF_6^- and $\mathrm{V}_2\mathrm{O}_7^{-4}$ ions respectively?

MHT CET 2024 2nd May Morning Shift

Options:

A. +5 and -5

B. 5 and +5

C. -5 and +5

D. 3 and +3

Answer: B

Solution:

Let oxidation number of P in $\mathrm{PF}_6^- = x$

$$\therefore \quad x + (6 \times -1) = -1$$
$$x = +5$$

Let oxidation number of V in $\mathrm{V}_2\mathrm{O}_7^{4-} = y$

$$\therefore \quad 2y + (-2 \times 7) = -4$$
$$y = +5$$

Question36

Which among the following species is reduced by tin easily?

MHT CET 2023 14th May Evening Shift

Options:

A. Iodine

B. Iron

C. Zinc

D. Sodium

Answer: A

Solution:

Among the given species, only iodine has positive E° value. Higher (more positive) E° value for a half reaction indicates its greater tendency to get reduced.

Therefore, iodine is reduced by tin easily.

Question37

What is the number of moles of electrons gained by one mole oxidizing agent in following redox reaction?

$$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_2 + H_2$$

MHT CET 2023 14th May Morning Shift

Options:

A. 4

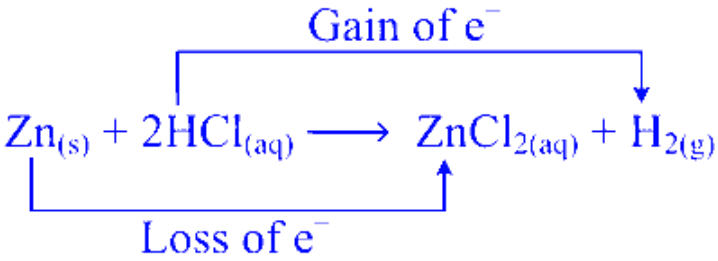
B. 3

C. 2

D. 1

Answer: D

Solution:



Oxidant/oxidising agent : HCl

2 moles of HCl gain 2 mol of electrons. Hence, 1 mole of HCl will gain 1 mole of electrons.

Question38

Which from following elements exhibits usual tendency to undergo reduction?

MHT CET 2023 13th May Evening Shift

Options:

A. Mg

B. Ni

C. O

D. Cu

Answer: C

Solution:

Among the given species oxygen has sixelectrons in its outermost shell. So, to attain stable electronic configuration it easily gains electrons due to which its oxidation number decreases and it undergoes reduction.

Question39

What is the change in oxidation number of selenium in the following redox reaction?

$$\mathrm{SeO}_{3(\mathrm{(a)}\ \ )}^{2-}+\mathrm{Cl}_{2(\ \mathrm{g})}+2\mathrm{OH}^{-} \longrightarrow \mathrm{SeO}_{4(\mathrm{(a)}\ \ )}^{2-}+2\mathrm{Cl}_{(\mathrm{(a)}\ \ )}^{-}+\mathrm{H}_2\mathrm{O}$$

MHT CET 2023 13th May Morning Shift

Options:

A. +2 to −2

B. −2 to +2

C. +4 to +6

D. +3 to +4

Answer: C

Solution:

SeO_3^{2-}	SeO_4^{2-}
$x+(-2\times 3)=-2$ $x=+4$	$x+(-2\times 4)=-2$ $x=+6$

Question40

What is the change in oxidation number of Cr in the following redox reaction?

$$3\mathrm{H}_2\mathrm{O}_{2(\mathrm{aq})}+\mathrm{Cr}_2\mathrm{O}_{7\ (\mathrm{aq})}^{2-}\ \ +8\mathrm{H}_{(\mathrm{aq})}^{+} \longrightarrow 3\mathrm{O}_{2(\ \mathrm{g})}+2\mathrm{Cr}^{3}+7\mathrm{H}_2\mathrm{O}$$

MHT CET 2023 12th May Evening Shift

Options:

A. +2 to +3

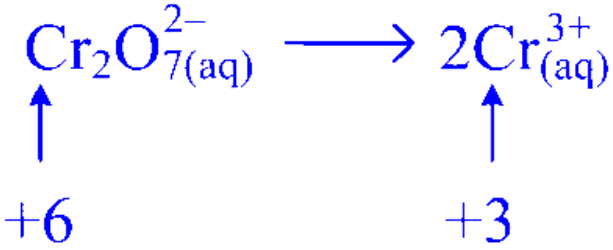
B. −2 to +3

C. +7 to +3

D. +6 to +3

Answer: D

Solution:



Question41

What is the oxidation number of sulfur in H_2SO_5 ?

MHT CET 2023 11th May Evening Shift

Options:

A. +4

B. +6

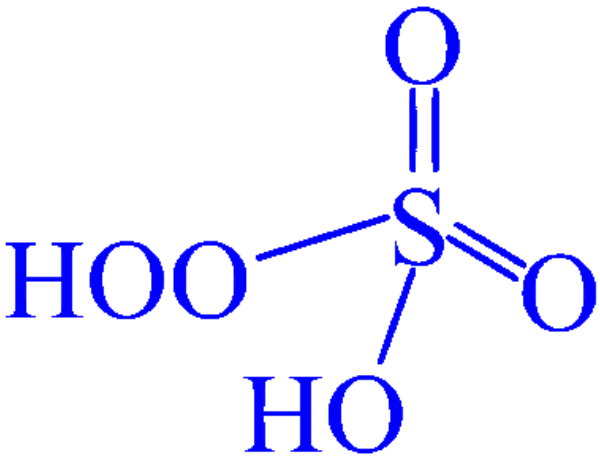
C. +8

D. +5

Answer: B

Solution:

H_2SO_5 : Peroxymonosulfuric acid



It has a peroxide linkage.

$$(2 \times 1) + x + (3 \times -2) + (2 \times -1) = 0$$
$$\therefore \quad x = +6$$

Question42

Identify the elements undergoing reduction and oxidation respectively in the following redox reaction.

$$3H_3AsO_{3(aq)} + BrO^-_{3(aq)} \rightarrow Br^-_{(aq)} + 3H_3AsO_4$$

MHT CET 2023 10th May Evening Shift

Options:

A. As and O

B. Br and As

C. As and Br

D. Br and O

Answer: B

Solution:

The oxidation number of Br decreases from +5 to -1 and that of As increases from +3 to +5.

Hence, Br undergoes reduction and As undergoes oxidation.

Question43

What is the value of x in order to balance following redox reaction?

$$\mathrm{Mn}_{(\mathrm{aq})}^{2+}+x\mathrm{ClO}_{3(\mathrm{aq})}^{-} \rightarrow \mathrm{MnO}_{2(\mathrm{~s})}+x\mathrm{ClO}_{2(\mathrm{aq})}$$

MHT CET 2023 10th May Morning Shift

Options:

A. $x=1$

B. $x=2$

C. $x=3$

D. $x=4$

Answer: B

Solution:

The balanced equation is:

$\mathrm{Mn}_{(\mathrm{aq})}^{2+}+2\mathrm{ClO}_{3(\mathrm{sq})} \rightarrow \mathrm{MnO}_{2(\mathrm{~s})}+2\mathrm{ClO}_{2(\mathrm{aq})}$

Question44

What is the oxidation state of carbon in CaC_2 and $\mathrm{K}_2\mathrm{C}_2\mathrm{O}_4$ respectively?

MHT CET 2023 9th May Morning Shift

Options:

A. -2 and $+6$

B. -1 and $+3$

C. $+2$ and $+2$

D. -2 and $+3$

Answer: B

Solution:

$\mathrm{CaC_2}$

$\therefore \quad +2+(x \times 2)=0$ or $x=-1$

$\mathrm{K_2C_2O_4}$

$\therefore \quad (+1 \times 2)+(x \times 2)+(-2 \times 4)=0$ or $x=+3$

Question45

Which one of the following conversions does NOT involve either oxidation or reduction?

MHT CET 2022 11th August Evening Shift

Options:

A. $\mathrm{Na} \rightarrow \mathrm{Na}^{+}$

B. $\mathrm{VO}_2^{+} \rightarrow \mathrm{V}_2\mathrm{O}_3$

C. $\mathrm{Zn}^{2+} \rightarrow \mathrm{Zn}$

D. $\mathrm{CrO}_4^{2-} \rightarrow \mathrm{Cr}_2\mathrm{O}_7^{2-}$

Answer: D

Solution:

Oxidation and reduction are chemical processes often involving the transfer of electrons between species. Oxidation involves the loss of electrons or an increase in oxidation state, whereas reduction involves the gain

of electrons or a decrease in oxidation state.

- Option A: $\mathrm{Na} \rightarrow \mathrm{Na}^{+}$ represents the oxidation of sodium metal to sodium ions, with sodium losing an electron (oxidation).
- Option B: $\mathrm{VO}_2^{+} \rightarrow \mathrm{V}_2\mathrm{O}_3$ involves a change in the oxidation state of vanadium. In VO_2^{+}, the vanadium is in a +4 oxidation state, whereas in $\mathrm{V}_2\mathrm{O}_3$, vanadium is in a +3 oxidation state, suggesting that vanadium has been reduced.
- Option C: $\mathrm{Zn}^{2+} \rightarrow \mathrm{Zn}$ involves the reduction of zinc ions to zinc metal, with zinc ions gaining two electrons (reduction).
- Option D: $\mathrm{CrO}_4^{2-} \rightarrow \mathrm{Cr}_2\mathrm{O}_7^{2-}$ does not involve a change in the oxidation state of chromium. Both species contain chromium in a +6 oxidation state. The conversion between chromate, CrO_4^{2-}, and dichromate, $\mathrm{Cr}_2\mathrm{O}_7^{2-}$, involves a change in the arrangement of oxygen atoms around chromium atoms, but does not involve a change in the oxidation number of chromium. Therefore, this conversion does not involve oxidation or reduction.

Based on these considerations, the correct answer to the question of which conversion does NOT involve either oxidation or reduction is:

Option D: $\mathrm{CrO}_4^{2-} \rightarrow \mathrm{Cr}_2\mathrm{O}_7^{2-}$

Question46

Which among the following reactions exhibits the reducing property of ozone?

MHT CET 2021 24th September Evening Shift

Options:

A. $\mathrm{PbS}_{(\mathrm{s})}+4 \mathrm{O}_{3(\mathrm{~g})} \rightarrow \mathrm{PbSO}_{4(\mathrm{~s})}+4 \mathrm{O}_{2(\mathrm{~g})}$

B. $\mathrm{BaO}_{2\,(\mathrm{g})}+\mathrm{O}_{3(\mathrm{~g})} \rightarrow \mathrm{BaO}_{(\mathrm{s})}+2 \mathrm{O}_{2\,(\mathrm{g})}$

C. $\mathrm{NO}_{(\mathrm{g})}+\mathrm{O}_{3(\mathrm{~g})} \rightarrow \mathrm{NO}_{2(\mathrm{~g})}+\mathrm{O}_{2(\mathrm{~g})}$

D. $2 \mathrm{KI}_{(\mathrm{qq})}+\mathrm{H}_2\mathrm{O}_{(\mathrm{l})}+\mathrm{O}_{3(\mathrm{~g})} \rightarrow 2 \mathrm{KOH}_{(\mathrm{aq})}+\mathrm{I}_{2(\mathrm{~g})}+\mathrm{O}_2(\mathrm{~g})$

Answer: B

Solution:

$\mathrm{BaO}_{2(\mathrm{~g})}+\mathrm{O}_{3(\mathrm{~g})} \rightarrow \mathrm{BaO}_{(\mathrm{s})}+2 \mathrm{O}_{2(\mathrm{~g})}$

Ozone reduces peroxide to oxide.

Question47

Which of following is NOT a redox reaction?

MHT CET 2021 24th September Evening Shift

Options:

A. $CH_3CHO + Cu(OH)_2 \longrightarrow CH_3COOH + Cu_2O$

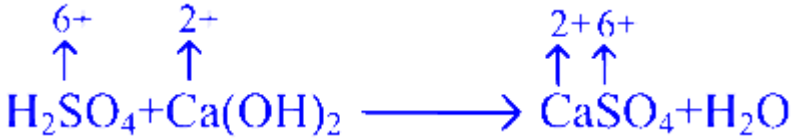
B. $SnCl_4 + FeCl_2 \longrightarrow FeCl_3 + SnCl_2$

C. $H_2SO_4 + Ca(OH)_2 \longrightarrow CaSO_4 + H_2O$

D. $C_2H_5OH + [O] \longrightarrow CH_3CHO + H_2O$

Answer: C

Solution:



No change in oxidation number of any species, hence it is not a redox reaction.

Question48

What is the change in oxidation number of nitrogen in following conversion?

$NO_3^- \longrightarrow NO_2$

MHT CET 2021 24th September Morning Shift

Options:

A. +4 to +5

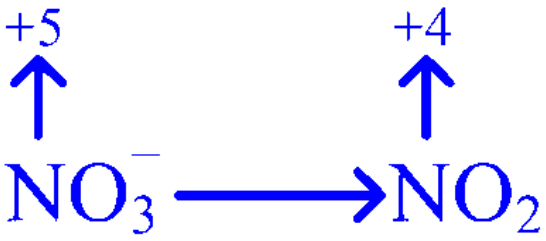
B. +3 to +5

C. +5 to +4

D. −3 to +5

Answer: C

Solution:



Question49

Identify reducing agent in following reaction

$$H_2O_{2(ag)} + ClO^-_{4(aq)} \rightarrow ClO^-_{2(aq)} + O_{2(g)}$$

MHT CET 2021 22th September Evening Shift

Options:

A. $ClO^-_{2(aq)}$

B. $H_2O_{2\,(aq)}$

C. $ClO^-_{4(aq)}$

D. $O_{2(g)}$

Answer: B

Solution:

Oxidation number of O atom increases from -1 to 0. Hence it undergoes oxidation.

$\therefore H_2O_2$ acts as reducing agent.

Question50

Identify reductant in following reaction.

$$H_2S + NO_2 \rightarrow H_2O + NO + S$$

MHT CET 2021 22th September Morning Shift

Options:

A. H_2S

B. NO_2

C. NO

D. S

Answer: A

Solution:

In any redox (reduction-oxidation) reaction, the reductant (or reducing agent) is the substance that donates electrons and gets oxidized in the process. To identify the reductant in this reaction, we need to observe the changes in the oxidation states of the elements involved in the reaction:

$H_2S + NO_2 \rightarrow H_2O + NO + S$

Let's analyze the oxidation states:

For H_2S:

- Hydrogen (H) has an oxidation state of +1.

- Therefore, sulfur (S) in H_2 S must have an oxidation state of -2.

For NO_2:

- The typical oxidation state for oxygen (O) is -2.

- Let the oxidation state of nitrogen (N) in NO_2 be x.

- Hence, the equation is:

$x + 2(-2) = 0 \rightarrow x - 4 = 0 \rightarrow x = +4$

- So, the oxidation state of nitrogen in NO_2 is +4.

For S:

- As elemental sulfur (S) has an oxidation state of 0.

For NO:

- The typical oxidation state for oxygen (O) is -2.

- Let the oxidation state of nitrogen (N) in NO be x.

- Hence, the equation is:

$x + (-2) = 0 \rightarrow x - 2 = 0 \rightarrow x = +2$

- So, the oxidation state of nitrogen in NO is +2.

For H_2O:

- Hydrogen (H) has an oxidation state of +1.

- Oxygen (O) has an oxidation state of -2.

Now, let's compare the changes in oxidation states:

- Sulfur in H_2 S goes from -2 (in H_2 S) to 0 (in elemental sulfur, S). Hence, it loses electrons and is oxidized.

- Nitrogen in NO_2 goes from +4 (in NO_2) to +2 (in NO). Hence, it gains electrons and is reduced.

Since H_2 S is oxidized (loses electrons), it acts as the reductant in this reaction. Therefore, the correct answer is:

Option A: H_2 S

Question51

Oxidation state of Cr in potassium dichromate is

MHT CET 2021 21th September Morning Shift

Options:

A. +7

B. +6

C. +1

D. +5

Answer: B

Solution:

Potassium dichromate $\rightarrow \mathrm{K_2Cr_2O_7}$ Consider, oxidation state of Cr is X.

$$\begin{aligned}\mathrm{K_2Cr_2O_7} \rightarrow & 2(+1)+2(\mathrm{x})+7(-2)=0 \\ \therefore\ & 2+2\mathrm{x}-14=0 \\ & 2\mathrm{x}=12 \\ \therefore\ & \mathrm{x}=+6\end{aligned}$$

$\therefore$ Oxidation state of $\mathrm{Cr}=+6$

Question52

What is the value of 'x' in order to balance the following redox reaction by ion electron method?

$$\mathrm{xH_2O_2 + ClO_4 \rightarrow xO_2 + ClO_2 + 2H_2O}$$

MHT CET 2021 20th September Evening Shift

Options:

A. 3

B. 4

C. 1

D. 2

Answer: D

Solution:

$2H_2O_2 + ClO_4^{\ominus} \longrightarrow 2O_2 + ClO_2^{\ominus} + 2H_2O$

Question53

Identify reductant in following reaction.

$$C_2O_4^{2-} + MnO_4^- + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$$

MHT CET 2021 20th September Morning Shift

Options:

A. H^+

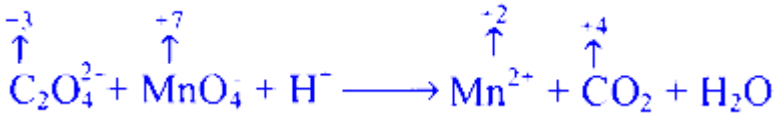
B. H_2O

C. $C_2O_4^{2-}$

D. MnO_4^-

Answer: C

Solution:



The oxidation number of C increases from $+3(C_2O_4^{2-})$ to $+4(CO_2)$ in above reaction.

$\therefore (C_2O_4^{2-})$ acts as a reductant.

Question54

What is the oxidation number of Mn in MnO_4^{2-} ion?

MHT CET 2020 19th October Evening Shift

Options:

A. +6

B. +8

C. -8

D. -6

Answer: A

Solution:

Oxidation number of Mn in MnO_4^{2-} ion is +6.

MnO_4^{2-}

Let, oxidation of $Mn = x$

We know that,

oxidation state of $O = -2$

Putting the value in formula

$$x + 4(-2) = -2$$
$$x - 8 = -2$$
$$x = -2 + 8 = +6$$

Question55

Which among the following is used as an oxidising agent to bleach wood pulp into white paper?

MHT CET 2020 16th October Evening Shift

Options:

A. H_2O_2

B. Cl_2

C. $Mn(OH)_2$

D. NaOCl

Answer: B

Solution:

Cl_2 (Chlorine) used as an oxidising agent to bleach wood pulp into white paper. A bleaching agent is a substance that can whiten or decolourise other substance. The use of chlorine dioxide minimises the amount of organochloride compound produced. About 95% of all bleached Kraft pulp is made using chlorine dioxide in ECF bleaching sequences.

Question56

What is the oxidation number of As in H_3AsO_3 ?

MHT CET 2020 16th October Morning Shift

Options:

A. + 4

B. + 3

C. $-$ 3

D. + 2

Answer: B

Solution:

To find the oxidation number of arsenic (As) in arsenious acid, H_3AsO_3, we can use the known oxidation states of other elements and the fact that the sum of oxidation numbers in a neutral molecule equals zero.

Oxygen always has an oxidation number of -2 (except in peroxides, molecular oxygen, and superoxides). Hydrogen usually has an oxidation number of +1, especially when bonded to non-metals.

Therefore, for H_3AsO_3:

- The total oxidation number for hydrogen is $+1 \times 3 = +3$.
- The total oxidation number for oxygen is $-2 \times 3 = -6$.

Let's denote the oxidation number of As as x. Then, according to the rule that the sum of oxidation numbers in a compound equals zero, we have:

$+3 + x + (-6) = 0$

Solving for x gives:

$x - 3 = 0 \Rightarrow x = 3$

So, the oxidation number of arsenic (As) in H_3AsO_3 is +3, making the correct answer:

Option B: +3

Question57

Which of the following oxides can act both as an oxidising agent as well as reducing agent?

MHT CET 2019 3rd May Morning Shift

Options:

A. N_2O

B. SO_2

C. SO_3

D. P_2O_5

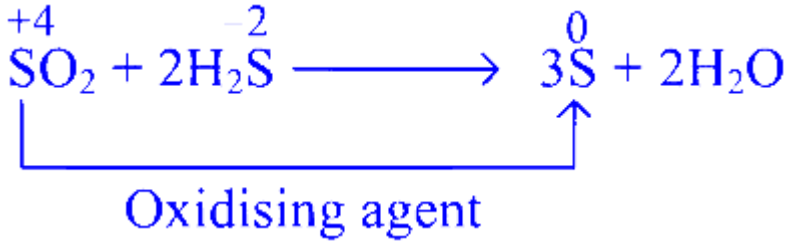
Answer: B

Solution:

SO_2 oxides can act both as an oxidising agent as well as reducing agent. It behaves as a reducing agent in moist conditions. It convert iron (III) ions to iron (II) ions and decolourises acidified potassium permanganate (VII) solution.

$2Fe^{3+} + SO_2 + 2H_2O \longrightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$

When SO_2 reacts with H_2S, it produces sulphur and water. In this reaction, ' SO_2 ' act as an oxidising agent.



Question58

Oxidation state of nitrogen in nitric oxide is

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Options:

A. +2

B. +3

C. +4

D. −2

Answer: A

Solution:

Oxidation state of nitrogen in nitric oxide (NO) is +2 .

Molecular formula of nitric oxide = NO

$x - 2 = 0$

$x = +2$

Question59

In which among the following compounds, oxidation number of nitrogen is +5 ?

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Options:

A. N_2O

B. N_2O_3

C. NO_2

D. HNO_3

Answer: D

Solution:

Oxidation number of nitrogen is $+5$ in HNO_3.

$$1 + x + 3(-2) = 0$$
$$x - 5 = 0$$
$$x = +5$$

Question60

The oxidation number of sulphur in S_8 molecule is

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Options:

A. 6

B. 0

C. 2

D. 3

Answer: B

Solution:

Oxidation number of sulphur is zero in S_8 molecule as it a monoatomic molecule.

Question61

The oxidation state of sulphur in $H_2S_2O_7$ is

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Options:

A. +4

B. +6

C. +5

D. +7

Answer: B

Solution:

To determine the oxidation state of sulfur in $H_2S_2O_7$, consider the following steps:

Write the Oxidation States of Known Atoms:

Hydrogen (H) generally has an oxidation state of +1.

Oxygen (O) generally has an oxidation state of -2.

Set Up the Equation:

In the compound $H_2S_2O_7$, the total oxidation states must sum to zero because it is a neutral molecule.

Let x be the oxidation state of sulfur (S).

The oxidation state equation based on the compound is:

$2(+1) + 2(x) + 7(-2) = 0$.

Solve for x:

Calculate the contributions from hydrogen and oxygen:

Hydrogen: $2(+1) = +2$

Oxygen: $7(-2) = -14$

Plug these values into the equation:

$+2 + 2x - 14 = 0$.

Simplify the equation:

$2x - 12 = 0$.

Solve for x:

$2x = 12$

$x = 6$.

Thus, the oxidation state of sulfur in $H_2S_2O_7$ is +6. This corresponds to Option B: +6.

Question62

The ionic charges of manganate and permanganate ion are respectively

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Options:

A. $-2, -2$

B. $-1, -2$

C. $-2, -1$

D. $-1, -1$

Answer: C

Solution:

Chemical formula for manganate and permanganate ion respectively are MnO_4^{2-} and MnO_4^-. Thus, the ionic charge of manganate and permanganate ion are respectively -2 and -1.

Question63

In the reaction,

$$\mathrm{MnO_4^{-1}}(aq) + \mathrm{Br^{-1}}(aq) \longrightarrow \mathrm{MnO_2}(s) + \mathrm{BrO_3^{-1}}(aq)$$

,the correct change in oxidation number of the species involved is

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Options:

A. Br^{+5} to Br^{-1}

B. Mn^{+7} to Mn^{+2}

C. Mn^{+7} to Mn^{+3}

D. Br^{-1} to Br^{+5}

Answer: D

Solution:

$$\overset{+7}{\mathrm{MnO_4^{-1}}}\ (aq) + \mathrm{Br^{-1}}(aq) \longrightarrow + \overset{+4}{\mathrm{MnO_2}}\ (s) + \overset{+5}{\mathrm{BrO_3^{-1}}}\ (aq)$$

In the above reaction, oxidation number of Mn in $\mathrm{MnO_4^{-1}}(aq)$ decreases from +7 to +4 in $\mathrm{MnO_2}(s)$ and oxidation number of Br increase from- 1 (in $\mathrm{Br^-}(aq)$ to +5 (in $\mathrm{BrO_3^{-1}}(aq)$). Thus, the correct option is (d).
