Chemistry Class 11 NCERT Solutions: Chapter 8 Redox Reactions Part 1

Q: 1. Assign oxidation numbers to the underlined elements in each of the following species

(A) $NaH_2\underline{P}O_4$

(B) $NaH\underline{S}O_4$

(C) $H_4\underline{P_2}O_7$

(D) $K_2\underline{Mn}O_4$

(E) $\underline{CaO_2}$

(F) $Na\underline{B}H_4$

(G) $H_2\underline{S_2}O_7$

(H) $KAl\left(\underline{S}O_4\right)_2.12H_2O$

Answer:

(A) $NaH_2\underline{P}O_4$

Let the oxidation number of P be x.

We know that,

Oxidation number of $Na = +1$

Oxidation number of $H = +1$

Oxidation number of $O = -2$

$$\Rightarrow \begin{matrix} +1 & +1 & x & -2 \\ Na & H_2 & P & O_4 \end{matrix}$$

Then, we have

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

$$\Rightarrow 1 + 2 + x - 8 = 0$$

$$\Rightarrow x = +5$$

Hence, the oxidation number of P is + 5

(B) $NaH\underline{S}O_4$

$$\begin{matrix} +1 & +1 & x & -2 \\ Na & H_2 & S & O_4 \end{matrix}$$

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

$$\Rightarrow 1 + 1 + x - 8 = 0$$

$$\Rightarrow x = +6$$

Hence, the oxidation number of S is + 6.

(C) $H_4\underline{P_2}O_7$

$$\begin{matrix} +1 & x & -2 \\ H_4 & P_2 & O_7 \end{matrix}$$

Then, we have

$$4(+1) + 2(x) + 7(-2) = 0$$

$$\Rightarrow 4 + 2x - 14 = 0$$

$$\Rightarrow 2x = +10$$

$$\Rightarrow x = +5$$

Hence, the oxidation number of P is + 5.

(D) $K_2\underline{Mn}O_4$

$$\begin{matrix} +1 & x & -2 \\ K_2 & Mn & O_4 \end{matrix}$$

Then, we have

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

$$\Rightarrow 2 + x = -8 = 0$$

$$\Rightarrow x = +6$$

Hence, the oxidation number of Mn is + 6.

(E) $Ca\underline{O_2}$

$$\begin{matrix} +2 & x \\ Ca & O_2 \end{matrix}$$

Then, we have

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

$$\Rightarrow 2 + 2x = 0$$

$$\Rightarrow x = -1$$

Hence, the oxidation number of O is -1.

(F) $Na\underline{B}H_4$

$$\begin{matrix} +1 & x & -1 \\ Na & B & H_4 \end{matrix}$$

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

$$\Rightarrow 1+x-4=0$$

$$\Rightarrow x=+3$$

Hence, the oxidation number of B is + 3.

(G) $H_2\underline{S_2}O_7$

$$\begin{matrix} +1 & x & -2 \\ H_2 & S_2 & H_7 \end{matrix}$$

Then, we have

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

$$\Rightarrow 2+2x-14=0$$

$$\Rightarrow 2x=12$$

$$\Rightarrow x=+6$$

Hence, the oxidation number of S + 6.

(H) $KAl\left(\underline{S}O_4\right)_2.12H_2O$

$$\begin{matrix} +1 & 3+ & \left(\begin{matrix} x & 2- \\ S & O_4 \end{matrix}\right)_2 .12 & \begin{matrix} +1 & -2 \\ H_2 & O \end{matrix} \\ K & Al & & \end{matrix}$$

Then, we have

$$1(+1)+1(+3)+2(x)+8(-2)+24(+1)+12(-2)=0$$

$$\Rightarrow 1+3+2x-16+24-24=0$$

$$\Rightarrow 2x=12$$

$$\Rightarrow x=+6$$

Or,

We can ignore the water molecule, as it is a neutral molecule. Then, the sum of the oxidation numbers of all atoms of the water molecule may be taken as zero. Therefore, after ignoring the water molecule, we have

$$1(+1)+1(+3)+2(x)+8(-2)=0$$

$$\Rightarrow 1+3+2x-16=0$$

$$\Rightarrow 2x=12$$

$$\Rightarrow x=+6$$

Hence, the oxidation number of S is + 6.