Chapter 8. Redox Reactions

1. Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behaviour?

(a) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

(b) $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

(c) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$

(d) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

(NEET-II 2016)

2. The pair of compounds that can exist together is

(a) $FeCl_3$, $SnCl_2$ (b) $HgCl_2$, $SnCl_2$

(c) $FeCl_2$, $SnCl_2$ (d) $FeCl_3$, KI

(2014)

3. (I) $H_2O_2 + O_3 \longrightarrow H_2O + 2O_2$

(II) $H_2O_2 + Ag_2O \longrightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively

(a) oxidizing in (I) and reducing in (II)

(b) reducing in (I) and oxidizing in (II)

(c) reducing in (I) and (II)

(d) oxidizing in (I) and (II) *(2014)*

4. In acidic medium, H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has two (—O—O—) bonds. Oxidation state of Cr in CrO_5 is

(a) +5 (b) +3 (c) +6 (d) –10

(2014)

5. When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from

(a) zero to +1 and zero to –5

(b) zero to –1 and zero to +5

(c) zero to –1 and zero to +3

(d) zero to +1 and zero to –3 *(2012)*

6. A mixture of potassium chlorate, oxalic acid and sulphuric acid is heated. During the reaction which element undergoes maximum change in the oxidation number?

(a) S (b) H

(c) Cl (d) C

(2012)

7. Oxidation numbers of P in PO_4^{3-}, of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively

(a) +3, +6 and +5 (b) +5, +3 and +6

(c) –3, +6 and +6 (d) +5, +6 and +6

(2009)

8. Number of moles of MnO_4^- required to oxidize one mole of ferrous oxalate completely in acidic medium will be

(a) 7.5 moles (b) 0.2 moles

(c) 0.6 moles (d) 0.4 moles.

(2008)

9. Which is the best description of the behaviour of bromine in the reaction given below?

$H_2O + Br_2 \rightarrow HOBr + HBr$

(a) Proton acceptor only

(b) Both oxidised and reduced

(c) Oxidised only

(d) Reduced only *(2004)*

10. The oxidation states of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order

(a) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

(b) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$

(c) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

(d) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$ *(2003)*

11. Oxidation state of Fe in Fe_3O_4 is

(a) $\frac{5}{4}$ (b) $\frac{4}{5}$

(c) $\frac{3}{2}$ (d) $\frac{8}{3}$ *(1999)*

12. Which of the following is redox reaction?
(a) Evaporation of H_2O
(b) Both oxidation and reduction
(c) H_2SO_4 with NaOH
(d) In atmosphere O_3 from O_2 by lighting.
(1997)

13. The oxide, which cannot act as a reducing agent is
(a) CO_2 (b) ClO_2
(c) NO_2 (d) SO_2 *(1995)*

14. Which substance is serving as a reducing agent in the following reaction?
$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 7H_2O + 2Cr^{3+} + 3Ni^{2+}$
(a) H^+ (b) $Cr_2O_7^{2-}$
(c) H_2O (d) Ni
(1994)

15. The oxidation state of I in $H_4IO_6^-$ is
(a) + 1 (b) – 1
(c) + 7 (d) + 5
(1994)

Answer Key

1. (d) **2.** (c) **3.** (c) **4.** (c) **5.** (b) **6.** (c) **7.** (d) **8.** (d) **9.** (b) **10.** (a)
11. (d) **12.** (b) **13.** (a) **14.** (d) **15.** (c)

EXPLANATIONS

1. (d) : $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

Here, the oxidation state of every atom remains the same so, it is not a redox reaction.

2. (c) : Both $FeCl_2$ and $SnCl_2$ are reducing agents with low oxidation numbers.

3. (c) :

Increase in oxidation state (reducing agent)

$$\overset{-1}{H_2O_2} + O_3 \longrightarrow \overset{0}{H_2O} + 2O_2$$

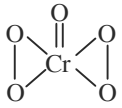
Increase in oxidation state (reducing agent)

$$\overset{-1}{H_2O_2} + \overset{+1}{Ag_2O} \longrightarrow \overset{0}{2Ag} + H_2O + \overset{0}{O_2}$$

Decrease in oxidation state

H_2O_2 acts as reducing agent in all those reactions in which O_2 is evolved.

4. (c) : CrO_5 has butterfly structure having two peroxo bonds.



Peroxo oxygen has –1 oxidation state.

Let oxidation state of Cr be 'x'

$CrO_5 : x + 4(-1) + 1(-2) = 0 \Rightarrow x = +6$

5. (b) :

$$\overset{0}{3Cl_2} + \underset{\text{(hot and conc.)}}{6NaOH} \longrightarrow 5Na\overset{-1}{Cl} + Na\overset{+5}{Cl}O_3 + 3H_2O$$

This is an example of disproportionation reaction and oxidation state of chlorine changes from 0 to –1 and +5.

6. (c) : $\overset{+1\ +5\ -2}{KClO_3} + (COOH)_2 + \overset{+6}{H_2SO_4} \longrightarrow$

$$\overset{+6}{K_2SO_4} + K\overset{-1}{Cl} + CO_2 + H_2O$$

Maximum change in oxidation number of chlorine, *i.e.*, from +5 to –1.

7. (d) : Let oxidation number of P in PO_4^{3-} be x.

$\therefore \quad x + 4(-2) = -3 \quad \Rightarrow \quad x = +5$

Let oxidation number of S in SO_4^{2-} be y.

$\therefore \quad y + 4(-2) = -2 \quad \Rightarrow \quad y = +6$

Let oxidation number of Cr in $Cr_2O_7^{2-}$ be z.

$\therefore \quad 2z + 7(-2) = -2 \quad \Rightarrow \quad z = +6$

8. (d) : $[5e^- + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$ ..(i)$] \times 2$

$[C_2O_4^{2-} \rightarrow 2e^- + 2CO_2$ ....(ii)$] \times 5$

$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow 2Mn^{2+} + 10CO_2$

2 moles of MnO_4^- required to oxidise 5 moles of oxalate.

$\therefore$ Number of moles of MnO_4^- required to oxidise 1 mole of oxalate = 2/5 = 0.4

9. (b) : $H_2O + \overset{0}{Br_2} \rightarrow \overset{+1}{HOBr} + \overset{-1}{HBr}$

In the above reaction the oxidation number of Br_2 increases from zero (in Br_2) to +1 (in HOBr) and decreases from zero (in Br_2) to –1 (in HBr). Thus Br_2 is oxidised as well as reduced and hence it is a redox reaction.

10. (a) : $SO_3^{2-} : x + (-2)3 = -2$

or $\quad x - 6 = -2$ or $x = +4$

$S_2O_4^{2-} : 2x + (-2)4 = -2$

or $\quad 2x - 8 = -2$ or $2x = +6 \ \therefore \ x = +3$

$S_2O_6^{2-} : 2x + (-2)6 = -2$

or, $\quad 2x - 12 = -2$ or $2x = +10 \ \therefore \ x = +5$

Oxidation states follow the order:

$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

11. (d) : $Fe_3O_4 \rightarrow 3x + 4(-2) = 0 \Rightarrow x = +\frac{8}{3}$

12. (b) : Redox reactions are those chemical reactions which involve transfer of electrons from one chemical species to another.

13. (a) : Since carbon is in maximum state of + 4, therefore carbon dioxide (CO_2) cannot act as a reducing agent.

14. (d) : Since the oxidation number of Ni increases from 0 to 2, therefore it acts as a reducing agent.

15. (c) : Let x = Oxidation state of I. Since oxidation state of H = + 1 and oxidation state of O = – 2, therefore for $H_4IO_6^-$, we get

$(4 \times 1) + x + (6 \times -2) = -1$

or $\quad x = +7$