# DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

# CHEMISTRY 15

**SYLLABUS :** Redox Reactions

**Max. Marks : 120** **Time : 60 min.**

**GENERAL INSTRUCTIONS**

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

**DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.**

**Q.1** When $K_2Cr_2O_7$ is converted into $K_2CrO_4$ the change in oxidationnumber of Cr is–

(a) 0 (b) 3 (c) 4 (d) 6

**Q.2** The oxidation number of S in $(CH_3)_2SO$ is–

(a) 1 (b) 2 (c) 0 (d) 3

**Q.3** What will be the value of a, b, c, d, e and f in the following equation ?

$$aMnO_4^- + bC_2O_4^{2-} + cH^+ \rightarrow dMn^{2+} + eCO_2 + fH_2O$$

(a) 2,2,10,8,5,16 (b) 2,5,16,2,10,8

(c) 2,5,10,2,8,16 (d) 2,8,16,2,5,10

**Q.4** What will be the equivalent weight of permanganate ion in the following redox reaction ?

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

(a) M/5 (b) M/6

(c) M/8 (d) 5M

**Q.5** What will be the equivalent weight of the reducing agent which donates one electron in the following chemical reaction?

$$2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2e^-$$

(a) 2M (b) 3M

(c) M/2 (d) M

| RESPONSE GRID | 1. ⓐⓑⓒⓓ | 2. ⓐⓑⓒⓓ | 3. ⓐⓑⓒⓓ | 4. ⓐⓑⓒⓓ | 5. ⓐⓑⓒⓓ |
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**Q.6** In the following reaction, what is the equivalent weight of oxidant and reductant respectively ?

$5Zn + V_2O_5 \rightarrow 5ZnO + 2V$

[V = 50.94, Zn = 65.38 and O = 16]

(a) 18.2, 32.69 (b) 30, 20

(c) 34.10, 20.2 (d) 40, 10

**Q.7** Which of the following acts as both oxidant and reductant?

(a) $HNO_3$

(b) $HNO_2$

(c) Both $HNO_3$ & $HNO_2$

(d) Neither $HNO_3$ nor $HNO_2$

**Q.8** State which of the following reactions is neither oxidation nor reduction ?

(a) $Na \rightarrow NaOH$

(b) $Cl_2 \rightarrow Cl^- + ClO_3^-$

(c) $P_2O_5 \rightarrow H_4P_2O_7$

(d) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

**Q.9** In the reaction

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

the reductant is –

(a) $C_2O_4^{2-}$ (b) $H^+$

(c) $MnO_4^-$ (d) None of the above

**Q.10** What is the oxidation state of nitrogen in $NaN_3$ ?

(a) – 3/1 (b) 3

(c) – 3 (d) – 1/3

**Q.11** What is the oxidation number of oxygen in $OF_2$ ?

(a) +2 (b) +4

(c) +3 (d) None

**Q.12** Oxidation number of cobalt in $[Co(NH_3)_6]Cl_2Br$ is–

(a) +6 (b) zero

(c) +3 (d) +2

**Q.13** The order of increasing O.N. of S in $S_8$, $S_2O_8^{-2}$, $S_2O_3^{-2}$, $S_4O_6^{-2}$ is :

(a) $S_8 < S_2O_8^{-2} < S_2O_3^{-2} < S_4O_6^{-2}$

(b) $S_2O_8^{-2} < S_2O_3^{-2} < S_4O_6^{-2} < S_8$

(c) $S_2O_8^{-2} < S_8 < S_4O_6^{-2} < S_2O_3^{-2}$

(d) $S_8 < S_2O_3^{-2} < S_4O_6^{-2} < S_2O_8^{-2}$

**Q.14** The composition of a sample of wustite is $Fe_{0.93}O_{1.00}$. What percentage of iron is present in the form of Fe (III) ?

(a) 13.05 (b) 14.05

(c) 15.05 (d) 16.05

**Q.15** The O.N. of Cl in $NOClO_4$ is–

(a) + 11 (b) + 9

(c) + 7 (d) + 5

**Q.16** The two possible oxidation numbers of N atoms in $NH_4NO_3$ are respectively –

(a) +3, +5 (b) +3, –5

(c) –3, +5 (d) –3, –5

**Q.17** The oxidation number of S in $H_2S_2O_8$ is–

(a) + 8 (b) – 8

(c) + 6 (d) + 4

**Q.18** What will be the oxidation number of I in the $KI_3$ ?

(a) $-\frac{1}{3}$ (b) $-\frac{1}{4}$ (c) + 4 (d) + 3

**Q.19** Oxidation number of Fe in $[Fe(CN)_6]^{-3}$, $[Fe(CN)_6]^{-4}$, $[Fe(SCN)]^{+2}$ and $[Fe(H_2O)_6]^{+3}$ respectively would be–

(a) +3, +2, +3 and +3 (b) +3, +3, +3 and +3

(c) +3, +2, +2 and +2 (d) +2, +2, +2 and +2

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 6. ⓐⓑⓒⓓ | 7. ⓐⓑⓒⓓ | 8. ⓐⓑⓒⓓ | 9. ⓐⓑⓒⓓ | 10. ⓐⓑⓒⓓ |
| | 11. ⓐⓑⓒⓓ | 12. ⓐⓑⓒⓓ | 13. ⓐⓑⓒⓓ | 14. ⓐⓑⓒⓓ | 15. ⓐⓑⓒⓓ |
| | 16. ⓐⓑⓒⓓ | 17. ⓐⓑⓒⓓ | 18. ⓐⓑⓒⓓ | 19. ⓐⓑⓒⓓ | |

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**Q.20** In the redox reaction –

$10FeC_2O_4 + x\,KMnO_4 + 24H_2SO_4 \rightarrow$

$5Fe_2(SO_4)_3 + 20CO_2 + yMnSO_4 + 3K_2SO_4 + 24H_2O$.

The values of x and y are respectively –

(a) 6,3 (b) 3,6 (c) 3,3 (d) 6,6

**Q.21** A solution containing $2.68 \times 10^{-3}$ mol of $A^{+n}$ ions requires $1.61 \times 10^{-3}$ mole of $MnO_4^-$ for the oxidation of $A^{+n}$ to $AO_3^-$ in acidic medium. What is the value of n ?

(a) 1 (b) 2 (c) 3 (d) 4

**DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:**

**Codes :**

**(a)** 1, 2 and 3 are correct **(b)** 1 and 2 are correct

**(c)** 2 and 4 are correct **(d)** 1 and 3 are correct

**Q.22** Choose the correct value of x, y and z in the following equation–

$H_2C_2O_4 + xH_2O_2 \rightarrow yCO_2 + zH_2O$

(1) x = 1 (2) y = 2 (3) z = 2 (4) z = 4

**Q.23** Consider the redox reaction :

$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$

(1) $S_2O_3^{2-}$ gets oxidised to $S_4O_6^{2-}$

(2) $S_2O_3^{2-}$ gets reduced to $S_4O_6^{2-}$

(3) $I_2$ gets reduced to $I^-$

(4) $I_2$ gets oxidised to $I^-$

**Q.24** Which of the following are redox reactions?

(1) $\frac{1}{2}H_2 + \frac{1}{2}I_2 \rightarrow HI$

(2) $PCl_5 \rightarrow PCl_3 + Cl_2$

(3) $2CuSO_4 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$

(4) $CaOCl_2 \rightarrow Ca^{+2} + OCl^- + Cl^-$

**DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :**

Redox reactions play a pivotal role in chemistry and biology. The values of standard redox potential (E°) of two half-cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited. Given below are a set of half-cell reactions (acidic medium) along with their E° (V with respect to normal hydrogen electrode) values. Using this data obtain the correct explanations to questions given.

$I_2 + 2e^- \rightarrow 2I^-$ E°=0.54 V

$Cl_2 + 2e^- \rightarrow 2Cl^-$ E°=1.36V

$Mn^{3+} + e^- \rightarrow Mn^{2+}$ E°=1.50V

$Fe^{3+} + e^- \rightarrow Fe^{2+}$ E°=0.77V

$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ E°=1.23V

**Q.25** Among the following, identify the correct statement :

(a) Chloride ion is oxidised by $O_2$

(b) $Fe^{2+}$ is oxidised by iodine

(c) Iodide ion is oxidised by chlorine

(d) $Mn^{2+}$ is oxidised by chlorine

**Q.26** While $Fe^{3+}$ is stable, $Mn^{3+}$ is not stable in acid solution because

(a) $O_2$ oxidises $Mn^{2+}$ to $Mn^{3+}$

(b) $O_2$ oxidises both $Mn^{2+}$ to $Mn^{3+}$ and $Fe^{2+}$ to $Fe^{3+}$

(c) $Fe^{3+}$ oxidises $H_2O$ to $O_2$

(d) $Mn^{3+}$ oxidises $H_2O$ to $O_2$

**Q.27** Sodium fusion extract, obtained from aniline, on treatment with iron (II) sulphate and $H_2SO_4$ in presence of air gives a prussian blue precipitate. The blue colour is due to the formation of

(a) $Fe_4[Fe(CN)_6]_3$

(b) $Fe_3[Fe(CN)_6]_2$

(c) $Fe_4[Fe(CN)_6]_2$

(d) $Fe_3[Fe(CN)_6]_3$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 20. ⓐⓑⓒⓓ | 21. ⓐⓑⓒⓓ | 22. ⓐⓑⓒⓓ | 23. ⓐⓑⓒⓓ | 24. ⓐⓑⓒⓓ |
| | 25. ⓐⓑⓒⓓ | 26. ⓐⓑⓒⓓ | 27. ⓐⓑⓒⓓ | | |

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**DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.**

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1..

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

**Q.28 Statement 1 :** Oxidation number of carbon in $CH_2O$ is zero.

**Statement 2 :** $CH_2O$ formaldehyde, is a covalent compound.

**Q.29 Statement 1 :** $H_2SO_4$ cannot act as reducing agent.

**Statement 2 :** Sulphur cannotincrease its oxidation number beyond +6.

**Q.30 Statement 1 :** $HClO_4$ is a stronger acid than $HClO_3$.

**Statement 2 :** Oxidation state of Cl in $HClO_4$ is + VII and in $HClO_3$ + V.

| RESPONSE GRID | 28.ⓐⓑⓒⓓ | 29.ⓐⓑⓒⓓ | 30.ⓐⓑⓒⓓ |
|---|---|---|---|

| DAILY PRACTICE PROBLEM SHEET 15 - CHEMISTRY | | | |
|---|---|---|---|
| Total Questions | 30 | Total Marks | 120 |
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 44 | Qualifying Score | 64 |
| Success Gap = Net Score – Qualifying Score | | | |
| Net Score = (Correct × 4) – (Incorrect × 1) | | | |

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# DAILY PRACTICE PROBLEMS — CHEMISTRY SOLUTIONS (15)

**(1)** **(a)** When $Cr_2O_7^{2-}$ is converted into $CrO_4^{2-}$ the change in oxidation number of Cr is zero

$$\overset{+6}{Cr_2O_7^{2-}} \rightarrow \overset{+6}{CrO_4^{2-}}$$

There is no change in oxidation state of Cr, hence it is neither oxidised nor reduced and remains in the same oxidation state.

**(2)** **(c)** Let the oxidation no. of S is 'a'

O.N. of $CH_3 = +1$

O.N. of $O = -2$

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

$a = 0$

Hence the oxidation no. of S in dimethyl sulphoxide is zero.

**(3)** **(b)**

(i) The half reaction for reduction is,

$$MnO_4^- \rightarrow Mn^{2+}$$

Balancing with respect to oxygen by adding $4H_2O$ on R.H.S.,

$$MnO_4^- \rightarrow Mn^{2+} + 4H_2O$$

Balancing with respect to hydrogen by adding $8H^+$ on L.H.S.,

$$MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$$

Balancing charge by adding electrons,

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

(ii) The half-reaction for oxidation is,

$$C_2O_4^{2-} \rightarrow 2CO_2$$

Balancing with respect to electrical charge by adding electrons on R.H.S.

$$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$$

Now, to equalise the number of electrons, the reduction half reaction is multiplied by 2 and oxidation half reaction by 5, so on adding, we get

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

$$(MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O) \times 2$$

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$

This is the balanced equation.

**(4)** **(a)** Equivalent weight of $MnO_4^-$

$$= \frac{\text{Molecular weight of } MnO_4^-}{5} = \frac{M}{5}$$

($\because$ Change in oxi. state = 5)

**(5)** **(d)** Equivalent weight of $S_2O_3^{2-} = \frac{2M}{2} = M.$

**(6)** **(a)**

$$\overset{\text{oxidation}}{5Zn} + V_2O_5 \rightarrow \overset{\text{reduction}}{5ZnO} + 2V$$

Zn undergoes oxidation and is

$\therefore$ acting as reductant.

Change in O.S. of Zn : $Zn \longrightarrow ZnO$

or, $Zn \longrightarrow Zn^{2+}$

i.e. O.S. of Zn changes by 2

$\therefore$ Eq. wt. of reductant i.e., $Zn = \frac{\text{mol wt.}}{n}$

$$= \frac{65.38}{2} = 32.69\,g$$

$V_2O_5$ undergoes reduction and is

$\therefore$ acting as oxidant

Change in O.S. of V : $V_2O_5 \rightarrow 2V$

or, $V^{5+} \rightarrow V$

or, $2V^{5+} \rightarrow 2V$

i.e. O.S. of 2V changes by 10

$\therefore$ Eq. wt. of oxidant i.e. $V_2O_5 = \frac{\text{mol wt.}}{n}$

$$= \frac{50.94 \times 2 + 80}{10} = 18.2\,g$$

**(7)** **(b)** O.N. of N in $HNO_2$ is + 3

Max. O.N. of N is + 5

Min. O.N. of N is − 3

Thus O.N. of N in $HNO_2$ can show an increase or decrease as the case may be. That is why $HNO_2$ acts as oxidant and reductant both.

O.N. of N in $HNO_3$ is + 5,

Hence it can act only as an oxidant.

**(8)** **(c)**

$$\overset{0}{Na} \rightarrow \overset{+1}{NaOH}$$

$$\overset{0}{Cl_2} \rightarrow \overset{-1}{Cl^-} + \overset{+5}{ClO_3^-}$$

$$\overset{+5}{P_2O_5} \rightarrow H_4\overset{+5}{P_2O_7}$$

$$\overset{0}{Zn} + \overset{+2}{H_2SO_4} \rightarrow \overset{+2}{ZnSO_4} + \overset{0}{H_2}$$

Thus, O.S. of P remains the same in $P_2O_5$ and $H_4P_2O_7$. In rest of the reactions, there occurs a change of O.S. Hence, all other reactions except (c) are redox reactions.

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**(9)** **(a)** In the above reaction $C_2O_4^{2-}$ acts as a reductant because it is oxidised to $CO_2$ as :

$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$ (oxidation)

$C_2O_4^{2-}$ reduces $MnO_4^-$ to $Mn^{2+}$ ion in solution.

**(10)** **(d)** $NaN_3 \Rightarrow +1+3x=0$

$\Rightarrow 3x=-1 \Rightarrow x=-\frac{1}{3}$

So, oxidation number of nitrogen in $NaN_3$ is $-1/3$.

**(11)** **(a)** $InOF_2$, O.N.(O)+2 O.N.(F)=0

$\Rightarrow x + 2(-1) = 0,\ x = +2$

Hence, oxidation number of oxygen in $OF_2 = +2$.

**(12)** **(c)** Let the O.N.of Co be x

O.N. of $NH_3$ is zero

O.N. of Cl is $-1$

O.N.of Br is $-1$

$\therefore$ ON(Co) +6 ON($NH_3$) + 2 ON(Cl) + ON (Br) = 0

$\Rightarrow x + 6(0) - 1 \times 2 - 1 = 0$

$\therefore\ x = +3$

So, the oxidation number of cobalt in the given complex compound is+3.

**(13)** **(d)** The oxidation number of S are shown below along with the compounds

$\underset{0}{S_8},\ \underset{+6}{S_2O_8^{-2}},\ \underset{+2}{S_2O_3^{-2}},\ \underset{+2.5}{S_4O_6^{-2}}$

Hence the order of increasing O.N. of S is

$S_8 < S_2O_3^{-2} < S_4O_6^{-2} < S_2O_8^{-2}$

**(14)** **(c)** O.N. of Fe in wustite is= $\frac{200}{93} = 2.15$

It is an intermediate value between Fe (II) & Fe (III)

Let % of Fe (III) be a, then

$2 \times (100-a) + 3 \times a = 2.15 \times 100$

$a = 15.05$

$\therefore$ % of Fe(III) = 15.05%

**(15)** **(c)** The compound may be written as $NO^+ ClO_4^-$

For $ClO_4^-$, Let O.N. of Cl = a

$\therefore$ in $ClO_4^-$, O.N. (Cl) + 4 O.N. (O) = $-1$

$a + 4 \times (-2) = -1$

$a = +7$

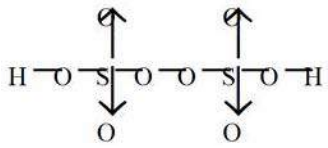
Hence, the oxidation no. of Cl in $NOClO_4$ is +7.

**(16)** **(c)** There are two N atoms in $NH_4NO_3$, but one N atom has negative oxidation number (attached to H) and the other has positive O.N. (attached to O). Therefore, evaluation should be made separately as –

| O.N. of N is $NH_4^+$ | O.N. of N in $NO_3^-$ |
|---|---|
| $a + 4 \times (+1) = +1$ | $a + 3(-2) = -1$ |
| $\therefore\ a = -3$ | $\therefore\ a = +5$ |

Here the two O.N. are $-3$ and +5 respectively.

**(17)** **(c)** In $H_2S_2O_8$, two O atoms form peroxide linkage i.e.



$\Rightarrow 2ON(H) + 2ON(S) + 6ON(O^{2-}) + 2ON(O_2^{2-}) = 0$

$\Rightarrow 2 \times 1 + 2a + 6(-2) + 2(-1) = 0$

$\therefore\ a = +6$

Thus the O.N. of S in $H_2S_2O_8$ is +6

**(18)** **(a)** In $KI_3$, $1 + 3 \times (a) = 0$

$a = -\frac{1}{3}$

or $KI_3$ is $KI + I_2$

$\therefore$ I has two oxidation no. $-1$ and 0 respectively. However factually speaking oxidation number of I in $KI_3$ is an average of two values $-1$ and 0.

$\text{Average O.N.} = \frac{-1+2\times(0)}{3} = -\frac{1}{3}$.

**(19)** **(a)** O.N. of Fe in : $[Fe(CN)_6]^{3-} \Rightarrow x - 6 = -3 \Rightarrow x = +3$

$[Fe(CN)_6]^{4-} \Rightarrow x - 6 = -4 \Rightarrow x = +2$

$[Fe(SCN)]^{2+} \Rightarrow x - 1 = +2 \Rightarrow x = +3$

$[Fe(H_2O)_6]^{3+} \Rightarrow x + 0 = +3 \Rightarrow x = +3$

Thus, option (a) is correct.

**(20)** **(d)** The balanced redox reaction given above can be written as:

$10FeC_2O_4 + 6KMnO_4 + 24H_2SO_4 \rightarrow$

$5Fe_2(SO_4)_3 + 20CO_2 + 6MnSO_4 + 3K_2SO_4 + 24H_2O$

So the value of x = 6 and y = 6

**(21)** **(b)** The reaction is

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$

$A^{+n} + 3H_2O \rightarrow AO_3^- + 6H^+ + (5-n)\,e^-$

Amount of electrons involved in the given amount of $MnO_4^- = 5 \times 1.61 \times 10^{-3}$ mol.

Equating these two we get

$5 \times 1.61 \times 10^{-3} = (5-n)\,2.68 \times 10^{-3}$

$\therefore\ n = 2$ (approx.)

**(22)** **(a)** (i) The half reaction for oxidation is,

$H_2C_2O_4 \rightarrow CO_2$

Balancing carbon atoms on both sides,

$H_2C_2O_4 \rightarrow 2CO_2$

Balancing hydrogen atoms on both sides,

$H_2C_2O_4 \rightarrow 2CO_2 + 2H^+$

Balancing the charge on both sides,

$H_2C_2O_4 \rightarrow 2CO_2 + 2H^+ + 2e^-$

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(ii) The half-reaction for reduction is–

$H_2O_2 \rightarrow H_2O$

Balancing oxygen atoms on both sides,

$H_2O_2 \rightarrow 2H_2O$

Balancing hydrogen atoms,

$H_2O_2 + 2H^+ \rightarrow 2H_2O$

Balancing the charge,

$H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

Now, adding both equations,

$H_2C_2O_4 + H_2O_2 \rightarrow 2CO_2 + 2H_2O$

This is balanced equation.

**(23)** **(d)** $2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$

Oxidation half-reaction : $\overset{+2}{S_2}O_3^{2-} \rightarrow \overset{+4}{S_4}O_6^{2-}$

Reduction half-reaction : $I_2^0 \rightarrow 2I^-$

Hence, $S_2O_3^{2-}$ is getting oxidised to $S_4O_6^{2-}$, while $I_2$ is getting reduced to $2I^-$. So, (d) is the correct answer.

**(24)** **(a)** $\frac{1}{2}\overset{0}{I_2} + \frac{1}{2}\overset{0}{I_2} \rightarrow \overset{+1-1}{H\ I}$ ....(i)

$\overset{+5\ -1}{P\ Cl_5} \rightarrow \overset{+3}{PCl_3} + \overset{0}{Cl_2}$ ....(ii)

$\overset{+2}{2CuSO_4} + 4\overset{+1-1}{K\ I} \rightarrow \overset{+1\ -1}{Cu_2\ I_2} + 2K_2SO_4 + \overset{0}{I_2}$ ....(iii)

$\overset{+2}{Ca}\overset{-1}{OCl_2} \rightarrow Ca^{2+} + OCl^- + Cl^-$ ....(iv)

Except (4), there occurs a change in O.S. of the reactants and products. Hence, except (4), all other are redox reactions.

**(25)** **(c)** $2I^- + Cl_2 \longrightarrow I_2 + 2Cl^-$

$E^\bullet = E^\circ_{I^-/I_2} + E^\bullet_{Cl_2/Cl^-} = -0.54 + 1.36$

$E^\bullet = 0.82V$

$E^\circ$ is positive hence, iodide ion is oxidized by chlorine.

**(26)** **(d)** $4Mn^{3+} + 2H_2O \longrightarrow 4Mn^{2+} + O_2 + 4H^+$

$E^\circ_{Mn^{3+}/Mn^{2+}} + E^\bullet_{H_2O/O_2} = 1.50 + (-1.23) = 0.27V$

Reaction is feasible. [$\because$ $E^\circ$ is positive]

**(27)** **(a)** $Na + C + N \longrightarrow NaCN$

$Fe^{2+} + 6CN^- \longrightarrow [Fe(CN)_6]^{4-}$

In presence of air, $Fe^{2+}$ gets oxidised to $Fe^{3+}$, i.e.,

$4Fe^{2+} + 4H^+ + O_2 \longrightarrow 4Fe^{3+} + 2H_2O$

$Fe^{3+}$ then combines with $[Fe(CN)_6]^{4-}$ to form ferric ferrocyanide which is Prussian blue in colour, i.e.

$4Fe^{3+} + 3[Fe(CN)_6]^{4-} \longrightarrow \underset{\text{Prussian blue}}{Fe_4[Fe(CN)_6]_3}$

**(28)** **(b)** Oxidation number can be calculated using some rules. H is assigned +1 oxidation state and O has oxidation number –2

$\therefore$ O. No. of C in $CH_2O$:

O.no. of C+2 (+1) + (–2) =0

$\therefore$ O. No. of C = 0

**(29)** **(a)** In $H_2SO_4$, the O.N. of S is + 6, which is maximum. Therefore, $H_2SO_4$ can only decrease its O.N. and can act only as an oxidising agent.

**(30)** **(a)** Acid strength of oxoacids of the same halogen increases with increase in O.N. of the halogen, i.e.

| Acid | $\overset{+7}{HClO_4}$ | > | $\overset{+5}{HClO_3}$ |
|---|---|---|---|
| $pK_a$ | – 10 | | – 1.2 |

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