CHAPTER - 07
REDOX REACTIONS

PART I - (JEEMAIN LEVEL)

1. 2 $S + 2e^- \rightarrow S^{2-}$

2. 1 Oxidation number of P in P_4 = 0, KH_2PO_2 = +1 and PH_3 = –3. Thus P is both oxidised and reduced in the given reaction.

3. 2 H_2O_2 can undergo oxidation as well as reduction since oxygen is present in –1 oxidation state. Thus H_2O_2 acts as both oxidant and reductant.

4. 3

Species	Oxidation number of Mn
$KMnO_4$	+7
MnO_4^{2-}	+6
MnO_2	+4
Mn_2O_3	+3

5. 2

Compound	Oxidation number of N
NO	+2
N_2O	+1
NH_2OH	–1
N_2H_4	–2

6. 4 Reaction (IV) is not a redox reaction

7. 1

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

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

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

Thus the coefficient of MnO_4^-, $C_2O_4^{2-}$ and H^+ in the above balanced equation respectively are 2, 5, 16.

8. 1

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

$(Sn^{2+} \rightarrow Sn^{4+} + 2e^-) \times 3$

$Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+} \rightarrow 3Sn^{4+} + 2Cr^{3+} + 7H_2O$

It is clear from this equation that 3 moles of Sn^{2+} reduce one mole of $Cr_2O_7^{2-}$, hence 1 mol. of Sn^{2+} will reduce $\frac{1}{3}$ moles of $Cr_2O_7^{2-}$.

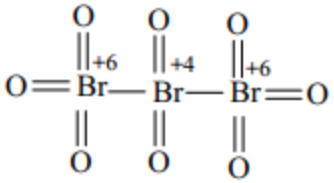
9. 1 The balanced equation is , $S_8 + 12OH^- \longrightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

10. 3 Oxidising power increases with increase in E° value

11. 4 $E^0_{X_2/X^-}$ for halogens follows the order - $F_2 > Cl_2 > Br_2 > I_2$

Thus, I^- is the strongest reducing agent among halide ions

12. 4



13. 6

Compound	Oxidation number of oxygen
K_2O	–1
K_2O_2	–1
KO_2	$\frac{-1}{2}$

14. 18 $KMnO_4$ oxidises Fe^{2+} to Fe^{3+} and $C_2O_4^{2-}$ to CO_2 and itself gets reduced to Mn^{2+} under acidic conditions. The given mixture contains 1 mol Fe^{2+} (1 equiv) and 4 mol $C_2O_4^{2-}$ (8 equiv)

Thus, equivalents of $KMnO_4$ required = 9 equiv and moles of $KMnO_4$ required = $\frac{9}{5}$ = 1.8 mol or 18×10^{-1} mol

15. D Oxidation state is zero for C in HCHO, C in CH_2Cl_2 middle C in C_3O_2 and two middle S atoms in $S_4O_6^{2-}$

16. C $H_2\overset{-1}{O_2}$, $\overset{+4}{S}O_2$ and $H\overset{+3}{N}O_2$ can act as both oxidant and reductant because they can be both oxidised and reduced

17. A As E° increases, reducing power of the metal decreaes

18. D $12H_2O + 8Al \longrightarrow 4Al_2O_3 + 24H^+ + 24e^-$

$24H^+ + 3Fe_3O_4 + 24e^- \longrightarrow 9Fe + 12H_2O$

24 electrons are transferred from reductant to oxidant

19. D $H_3\overset{+1}{P}O_2 \xrightarrow{+4e^-} \overset{-3}{P}H_3; H_3\overset{+1}{P}O_2 \xrightarrow{-2e^-} H_3\overset{+3}{P}O_3$

$\therefore$ Equivalent mass of $H_3PO_2 = \frac{M}{(4/3)}$ ($\because$ n - factor = 4/3)

SECTION - IV (More than one correct answer)

20. AB Reactions A and B are not disproportionation

21. ABC

Element	Highest O.S
Os	+8
Xe	+8
Cr	+6
Mn	+7

22. AC

23. ABD Question: 100mL of 0.01M $Ca(MnO_4)_2$ in acidic medium can be 'reduced' completely with:

Substance	Milliequivalents
$100mL \times 0.1M Ca(MnO_4)_2$	$100 \times 0.1 \times 10 = 100$
$100mL \times 1M\ FeSO_4(A)$	$100 \times 1 \times 1 = 100$
$\frac{100}{3}mL \times 1M Fe_2C_2O_4(B)$	$\frac{100}{3} \times 1 \times 3 = 100$
75mL x 1M $K_2C_2O_4$ (D)	$75 \times 1 \times 2 = 150$

Thus, solution (A), (B) and (D) will completely reduce 100mL of 0.1M $Ca(MnO_4)_2$ in the acidic medium

24. AB milliequiv. of $S_2O_3^{2-}$ = milliequiv. of CrO_4^{2-}

$0.25 \times 8 \times 40 = 0.154 \times 3 \times v \Rightarrow$ v =173.16mL

SECTION - V (Numerical Type - Upto two decimal place)

25. 4.00 $NO^+ + 3H^+ + 4e^- \longrightarrow NH_2OH$

26. 8.00 $\overset{-3}{N}H_4\overset{+5}{N}O_3$

27. 2.00 Equivalents of A^{n+} = Eqs. of MnO_4^-

$2.68\times10^{-3}\times(5-n)=1.61\times10^{-3}\times5;\ \therefore\ n=2$

28. 6.00 $2IO_3^- + 10I^- \rightarrow 6I_2$

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

Three moles of I_2 requires Six moles of $S_2O_3^{2-}$

29. 1.00

Question: 1L of 0.1M $Ba(MnO_4)_2$ in acidic medium can 'react' completely with

Solution : Equivalents of $Ba(MnO_4)_2$ = Equivalents of $Fe_2(C_2O_4)_3$

$$0.1\times10\times1 = x\times6\times\frac{1}{6}$$

$$\Rightarrow \quad x = 1$$

SECTION - VI (Matrix Matching)

30. C

Compound	O.S of N
Mg_3N_2	–3
NO	+2
$(N_2H_5)_2SO_4$	–2
NH_2OH	–1