## EXERCISE-01

SELEC1	THE CORRECT	ALTERNATIVE	ONLY ONE	CORRECT ANS	WER)	
1.	50 mL of 0.1 M s	solution of a salt	reacted with 2	5 mL of 0.1 M so	blution of sodium sulphite. The half	
	reaction for the oxi	dation of sulphit	e ion is :-			
	$SO_3^{2-}(aq) + H_2^{2}(aq)$	$O(\ell) \longrightarrow SO_4^{2-}$	(aq) + 2H <sup>+</sup> (aq)	+ 2e <sup>-</sup>		
	If the oxidation nun	nber of metal in	the salt was 3, v	what would be the i	new oxidation number of metal :	
	(A) zero	(B) 1		(C) 2	(D) 4	
2.	An element A in a c experiment 1.68 Y number of A after o	compound ABD   [ 10 <sup>-3</sup> moles of ] oxidation is :-	nas oxidation nu K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> were us	mber A <sup>n-</sup> . It is oxidi sed for 3.26 Ч 10 <sup>-</sup>	sed by Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> in acid medium. In the <sup>3</sup> moles of ABD. The new oxidation	
	(A) 3	(B) 3 – n		(C) n – 3	(D) +n	
3.	The incorrect order	r of decreasing c	xidation numbe	er of S in compounds is :-		
	(A) $H_2 S_2 O_7 > Na_2 S_2$	$_{4}O_{6} > Na_{2}S_{2}O_{3}$	> S <sub>8</sub>	(B) $H_2 SO_5 > H_2 SO_5$	$SO_3 > SCl_2 > H_2S$	
	(C) $SO_3 > SO_2 > H$	$I_2 S > S_8$		(D) $H_2 SO_4 > SO_4$	$_{2} > H_{2}S > H_{2}S_{2}O_{8}$	
4.	Which reaction doe	es not represent	sproportionation :-			
	(A) $\operatorname{Cl}_2 + \operatorname{OH}^- \longrightarrow$	$Cl^- + ClO_3^- + H$	∃ <sub>2</sub> O	(B) $2H_2O_2 \longrightarrow H_2O + O_2$		
	$(C) 2Cu^+ \longrightarrow Cu^+$	<sup>2</sup> + Cu		(D) $(NH_4)_2 Cr_2 O_7 \longrightarrow N_2 + Cr_2 O_3 + 4H_2 O_3$		
5.	Match List-I (Comp	ounds) with List-	II (Oxidation sta	tes of nitrogen) and	l select answer using the codes given	
	below the lists :-					
	List-I		List-II			
	(a) NaN <sub>3</sub>	1.	+5			
	(b) $N_2H_2$	2.	+2			
	(c) NO	3.	-1/3			
	(d) $N_2O_5$	4.	-1			
	Code : (a)	(b) (c)	(d)			
	(A) 3	4 2 2 0	1			
	(B) 4	3 2	1			
	(C) 3	4 1	42			
C	$(D) \qquad 4$	3 1	Z			
6.	Which of the follow	ng is a redox re	action :-			
	(A) $2 \operatorname{CrO}_{4}^{2-} + 2H^{+} - (C) \operatorname{Na}_{2} \operatorname{S}_{2} \operatorname{O}_{3} + \operatorname{I}_{2} \rightarrow$	$\rightarrow \operatorname{Cr}_2\operatorname{O}_7^{2-} + \operatorname{H}_2\operatorname{O}_6$ $\rightarrow \operatorname{Na}_2\operatorname{S}_4\operatorname{O}_6 + \operatorname{NaI}_6$	)	(B) $CuSO_4 + 4 N$ (D) $Cr_2O_7^{2-} + 2O$	$H_{3} \rightarrow [Cu(NH_{3})_{4}] SO_{4}$ $H^{-} \rightarrow 2 CrO_{4}^{2-} + H_{2}O$	
7.	In which of the follo	owing reaction is	s there a change	e in the oxidation n	number of nitrogen atoms :-	
	(A) 2 NO <sub>2</sub> $\rightarrow$ N <sub>2</sub> O <sub>2</sub>	4		(B) NH <sub>3</sub> + H <sub>2</sub> O	$\rightarrow \mathrm{NH}_4^+ + \mathrm{OH}^-$	
	(C) $N_2O_5 + H_2O \rightarrow$	2HNO <sub>3</sub>		(D) none		
8.	In the reaction	5				
	xHI + yHNO <sub>3</sub> $\longrightarrow$	$NO + I_2 + H_2O$				

**9.** For the redox reaction :

$$\begin{array}{ll} MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O \\ \text{the correct stoichiometric coefficients of } MnO_4^-, C_2O_4^{2-} \text{ and } H^+ \text{ are respectively} \\ \text{(A) } 2,5,16 & \text{(B) } 16,5,2 & \text{(C) } 5,16,2 & \text{(D) } 2,16,5 \end{array}$$

(A) x = 3, y = 2 (B) x = 2, y = 3 (C) x = 6, y = 2 (D) x = 6, y = 1

10.	Which of the following relations is incorrect :-							
	(A) 3 N Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> = 0.5 M (C) 1 M H <sub>3</sub> PO <sub>4</sub> = $1/3$ N	$\text{IAl}_2(\text{SO}_4)_3$ $\text{H}_3\text{PO}_4$	(B) 3 M $H_2SO_4 = 6 N H_2$ (D) 1 M $Al_2(SO_4)_3 = 6 N$	$SO_4$ $Al_2(SO_4)_3$				
11.	The mass of oxalic acid o	crystals (H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> . 2H <sub>2</sub> O) re	quired to prepare 50 mL o	of a 0.2 N solution is :-				
	(A) 4.5 g	(B) 6.3 g	(C) 0.63 g	(D) 0.45 g				
12.	125 mL of 63% (w/v) H resulting solution is :-	$_{2}C_{2}O_{4}$ . $2H_{2}O$ is made to re	eact with 125 mL of a 409	% (w/v) NaOH solution. The				
	(A) neutral	(B) acidic	(C) strongly acidic	(D) alkaline				
13.	A certain weight of pure 224 mL of CO <sub>2</sub> gas at S	e CaCO <sub>3</sub> is made to react TP. The normality of the 1	completely with 200 mL HCl is :-	of an HCl solution to give				
	(A) 0.05 N	(B) 0.1 N	(C) 1.0 N	(D) 0.2 N				
14.	The volume of 1.5 MH <sub>3</sub> P	$O_{4}$ solution required to neu	tralize exactly 90 mL of a	0.5 M Ba (OH), solution is :-				
	(A) 10 mL	(B) 30 mL	(C) 20 mL	(D) 60 mL				
15.	Volume $V_1 \text{ mL of } 0.1 \text{ MH}$ volume of 0.3 M KMnO <sub>4</sub>	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> is needed for com needed for same oxidatio	plete oxidation of 0.678 g n in acidic medium will be	$N_2H_4$ in acidic medium. The :-				
	(A) $\frac{2}{5}V_1$	(B) $\frac{5}{2}V_1$	(C) 113 V <sub>1</sub>	(D) can't say				
16.	If equal volumes of 0.1 M medium, then $Fe^{2+}$ oxidis	$KMnO_4$ and 0.1 M K <sub>2</sub> Cr <sub>2</sub> red will be :-	$\mathrm{D_7}$ solutions are allowed to oxidise $\mathrm{Fe}^{2+}$ to $\mathrm{Fe}^{3+}$ in acidic					
	(A) more by $\rm KMnO_4$		(B) more by K <sub>2</sub> CrO <sub>7</sub>					
	(C) equal in both cases		(D) can't be determined					
17.	If 10 g of $V_2O_5$ is dissolved in acid and is reduced to $V^{2+}$ by zinc metal, how many mole $I_2$ could be reduced by the resulting solution if it is further oxidised to $VO^{2+}$ ions ?							
	[Assume no change in sta	ate of $Zn^{2+}$ ions] (V = 51, 0	O = 16, I = 127) :					
	(A) 0.11 mole of $I_2$	(B) 0.22 mole of $I_2$	(C) 0.055 mole of $I_2$	(D) 0.44 mole of $I_2$				
18.	Given that 50.0 mL of 0 Cl (g) + S O $^{2-} \longrightarrow$ S	.01 M Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> solution ar SO <sup>2-</sup> + Cl <sup>-</sup> + S	nd 5 $\mathrm{H}~10^{-4}$ mole of $\mathrm{Cl_2}$ rea	act according to equation,				
	Answer the following $\cdot$							
(i)	The balanced molecular equation is							
()	(A) $Cl_2 + H_2O + Na_2S_2O$ (C) $Cl_2 + S_2O_2^{2-} \longrightarrow SO_2^{2-}$	$_{3} \longrightarrow \text{Na}_{2}\text{SO}_{4} + \text{S} + 2\text{HG}_{4}$	Cl (B) $Cl_2 + Na_2S_2O_3 \longrightarrow$ (D) none of these	2NaCl + Na <sub>2</sub> SO <sub>4</sub>				
(ii)	How many moles of S <sub>2</sub> O	$\int_{2}^{2}$ are in the above sample	e :-					
	(A) 0.00050	(B) 0.0025	(C) 0.01	(D) 0.02				
(iii)	How many equivalents of	f oxidising agents are in th	is sample for the above rea	action :-				
	(A) 0.001	(B) 0.080	(C) 0.020	(D) 0.010				
(iv)	What is the molarity of N	la_SO_ in this solution :-						
	(A) 0.080 M	(B) 0.040 M	(C) 0.020 M	(D) 0.010 M				
19.	0.3 g of an oxalate salt w complete oxidation. The	as dissolved in 100 mL solu % of oxalate ion in salt is	ution. The solution required	$1.90 \text{ mL of N/20 KMnO}_4 \text{ for}$				
	(A) 33%	<b>(B)</b> 66%	(C) 70%	(D) 40%				
20.	A 0.518 g sample of limit filtering and washing the to titrate it as. The perce	estone is dissolved in HCl precipitate, it requires 40.1 ntage of CaO in the samp $\frac{1}{2}$	and then the calcium is pr 0 mL of 0.250 N KMnO <sub>4</sub> s le is :-	recipitated as $CaC_2O_4$ . After solution acidified with $H_2SO_4$				
	(A) 54 0 %	(B) 27.1 %	(C) 42 %	(D) 84 %				
	(4 ) JT.U /0	(L) L1.1 /0	$(\bigcirc) = 2 / 0$					

21.	In the reaction $CrO_5 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + H_2O + O_2$ one mole of $CrO_5$ will liberate how many moles of $O_2$ :-								
	(A) 5/2	(B) 5/4	(C) 9/2	(D) 7/2					
22.	One gram of Na <sub>3</sub> absorbed in Kl so AsO <sub>4</sub> <sup>3-</sup> + 2H <sup>+</sup>	One gram of Na <sub>3</sub> AsO <sub>4</sub> is boiled with excess of solid Kl in presence of strong HCl. The iodine evolved is absorbed in Kl solution and titrated against 0.2 N hyposolution. Assuming the reaction to be $AsO_4^{3-} + 2H^+ + 2I^- \longrightarrow AsO_3^{3-} + H_2O + I_2,$							
	calculate the volu	me of thiosulphate hypo consum	ned. [Atomic weight	of As = 75]					
	(A) 48.1 mL	(B) 38.4 mL	(C) 24.7 mL	(D) 30.3 mL					
23.	Which of the follc to be reduced to I	wing samples of reducing agents Mn <sup>2+</sup> and water :-	s is/are chemically e	quivalent to 25 mL of 0.2 N KMnO $_4$					
	(A) 25 mL of 0.2	${\rm M}~{\rm FeSO}_4$ to be oxidized to ${\rm Fe}^{3{\scriptscriptstyle +}}$	(B) 50 mL of 0.	$1 \text{ M H}_3\text{AsO}_3$ to be oxidized to $\text{H}_3\text{AsO}_4$					
	(C) 25 mL of 0.1	(C) 25 mL of 0.1 M $H_2O_2$ to be oxidized to $H^+$ and $O_2$ (D) 25 mL of 0.1 M SnCl <sub>2</sub> to be oxidized to Sn <sup>4+</sup>							
24.	Find the volume of strength of $H_2O_2$ solution prepared by mixing of 250 mL of 3N $H_2O_2$ & 750 mL of 1N $H_2O_2$ solution :-								
	(A) 1.5 V	(B) 8.4 V	(C) 5.6 V	(D) 11.2 V					
25.	25 mL of 0.50 M $H_2O_2$ solution is added to 50 mL of 0.20 M KMn $O_4$ in acid solution. Which of the following statement are true :-								
	(A) 0.010 mole o (C) 0.030 g atom	f oxygen is liberated of oxygen gas is evolved	(B) 0.005 mole c (D) 0.0025 mole	(B) 0.005 mole of $KMnO_4$ are left (D) 0.0025 mole $H_2O_2$ does not react with $KMnO_4$					
26.	Hydrogen peroxic	de in aqueous solution decompos	ses on warming to gi	ve oxygen according to the equation					
	$2H_2O_2$ (aq) —	$2H_2O_2$ (aq) $\longrightarrow 2H_2O(\ell) + O_2(g)$							
	Under conditions where 1 mole of gas occupies 24 dm <sup>3</sup> . 100 cm <sup>3</sup> of XM solution of $H_2O_2$ produces 3 dm <sup>3</sup> of $O_2$ . Thus X is :-								
	(A) 2.5	(B) 1	(C) 0.5	(D) 0.25					
27.	Temporary hardn Ca(HCO <sub>2</sub> ) <sub>2</sub> + (	ess is due to $HCO_3^-$ of $Mg^{2+}$ and CaO $\rightarrow 2CaCO_3 + H_2O$	Ca <sup>2+</sup> . It is removed	by addition of CaO.					
	Mass of CaO requ	uired to precipitate 2 g CaCO, is	5 :-						
	(A) 2.00	(B) 0.56 g	(C) 0.28 g	(D) 1.12 g					
28.	Bottle (A) contain having normality s bottle (C) in term	Bottle (A) contain 320 mL of $H_2O_2$ solution & labeled with 10 V $H_2O_2$ & Bottle (B) contain 80 mL $H_2O_2$ having normality 5N. If bottle (A) & bottle (B) mixed & solution filled in bottle (C). Select the correct lable for bottle (C) in term of volume strength & in term of g / litre. :-							
	(A) 13.6 "V" & 4	(A) 13.6 "V" & 41.285 g/L (B) 11.2 "V" & 0.68 g/L							
	(C) 5.6 "V" & 0.68 g/L (D) 5.6 "V" & 41.285 g/L								

CHEC	K YOU	R GRAS	SP			A	NSW	ER K	EY				E	EXERCIS	SE -1
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	С	В	D	D	А	С	D	С	А	С	С	А	В	С	А
Que.	16	17	18(i)	(ii)	(iii)	(iv)	19	20	21	22	23	24	25	26	27
Ans.	В	А	А	А	А	D	В	А	D	А	A,C,D	В	В	А	В
Que.	28														
Ans.	А														

SELECT	THE CORRECT ALTE	ERNATIVES (ONE OR M	IORE THEN ONE COR	RECT ANSWERS)				
1.	1 mol of iron (Fe) reacts	completely with 0.65 mol	$O_2$ to give a mixture of only	y FeO and $Fe_2O_3$ . Mole ratio				
	of ferrous oxide to ferric	oxide is :-						
	(A) 3 : 2	(B) 4 : 3	(C) 20 : 13	(D) none of these				
2.	The molar ratio of $Fe^{++}$ to	o Fe <sup>+++</sup> in a mixture of FeSO	$D_4$ and $Fe_2(SO_4)_3$ having equ	ual number of sulphate ion in				
	both ferrous and ferric su	Ilphate is :-						
	(A) 1 : 2	(B) 3 : 2	(C) 2 : 3	(D) can't be determined				
3.	If a piece of iron gains 10% of its weight due to partial rusting into $Fe_2O_3$ . The percentage of total iron that							
	has rusted is :-							
	(A) 23	(B) 13	(C) 23.3	(D) 25.67				
4.	An ore of iron, Wustite Fe(II) is :-	has the formula $F_{0.93}O_{1.00}$ .	The mole fraction of total	iron present in the form of				
	(A) 0.82	(B) 0.85	(C) 0.15	(D) 0.37				
5.	$HNO_3$ oxidises $NH_4^+$ ions of $(NH_4)_2SO_4$ is :-	to nitrogen and itself gets	reduced to $NO_2$ . The moles	s of $\mathrm{HNO}_3$ required by 1 mol				
	(A) 4	(B) 5	(C) 6	(D) 2				
6.	25 mL of a 0.1 M soluti acidified $KMnO_4$ solution	on of a stable cation of tra . Which of the following is	ansition metal Z reacts exa most likely to represent the	actly with 25 ml of 0.04 mL e change in oxidation state of				
	$(\Lambda)$ 7 <sup>+</sup> $(7^{2+})$	( <b>B</b> ) $7^{2+}$ $7^{3+}$	(C) $7^{3+}$ > $7^{4+}$	(D) 7 <sup>2+</sup> 7 <sup>4+</sup>				
7	$(A) \ \angle \rightarrow \angle$	$(D) \mathcal{L} \to \mathcal{L}$	(C) $L \rightarrow L$	$(D) \mathcal{L} \to \mathcal{L}$				
7.	$(\Lambda)$ 3 54 litroc	(R) 7 08 litros	(C) 1 77 litros	(D) pope of these				
Q	(A) 3.34 miles	(D) 7.00 littles	(C) 1.77 Intes	(D) none of these				
0.	in alkaline medium is :-							
	(A) 1 : 5	(B) 5 : 1	(C) $3:1$	(D) 1 : 3				
sp**9.	$28 \text{ NO}_3 + 3\text{As}_2\text{S}_3 + 4\text{H}_2$	$_{2}O \rightarrow 6AsO_{4}^{3} + 28 NO +$	$9SO_4^2 + H^2$					
	What will be the equivale	nt mass of $As_2S_3$ in above :	reaction					
	(A) $\frac{M.wt.}{2}$	(B) $\frac{M.wt.}{d}$	(C) $\frac{M.wt.}{R}$	(D) $\frac{M.wt.}{2}$				
10	$\frac{1}{2}$	( <sup>-,</sup> 4	<sup>(-)</sup> 24	<sup>(-)</sup> 28				
10.	When Zh5 is bolled with a	the evidetion numbers of	7 s and N	nc acid and hitrogen dioxide.				
	$(\Delta) \pm 2 \pm 4 = 1$	$(R) \pm 2 \pm 6 = 2$	$(C) 0 \pm 1 = 2$	(D) 0 ±8 _1				
11	When arconic sulphide is	boiled with NaOH sodiur	(0, 0, 14, 2)	arsonito aro formod				
11.	when arsenic sulpride is			disente die formed				
	$x \operatorname{As}_2 S_3 + y \operatorname{NaOH} \longrightarrow$	$Na_3AsO_3 + x Na_3AsS_3 + \frac{1}{2}$	$\frac{9}{2}$ H <sub>2</sub> O. What are the value	es of x and y ?				
	(A) 1, 6	(B) 2, 8	(C) 2, 6	(D) 1, 4				
12.	An element forms two di numbers of the element	fferent sulphates in which i in these sulphates ?	ts weight % is 28 and 37. V	What is the ratio of oxidation				
	(A) 1 : 2	(B) 1 : 3	(C) 2 : 1	(D) 3 : 2				
sp**13.	$\rm CN^{\scriptscriptstyle -}$ is oxidised by $\rm NO_3^{\scriptscriptstyle -}$ i	n presence of acid :						
	a $CN^-$ + b $NO_3^-$ + c H	$I^+ \longrightarrow$ (a + b) NO + a CO	$_2 + \frac{c}{2} H_2O$					
	What are the values of a	, b, c in that order :						
	(A) 3,7,7	(B) 3,10,7	(C) 3,10,10	(D) 3,7,10				
14.	Which of the following so	olutions will exactly oxidize	25 mL of an acid solution of	of 0.1 M Fe (II) oxalate :-				
	(A) 25 mL of 0.1 M KMn	$O_4$	(B) 25 mL of 0.2 M KMn	$O_4$				
	(C) $25 \text{ mL of } 0.6 \text{ M KMnO}_4$ (D) $15 \text{ mL of } 0.1 \text{ M KMnO}_4$							

15.	$4.9 \text{ gm}$ of $\text{K}_2\text{Cr}_2\text{O}_7$ is taken to prepare 0.1 L of the solution. 10 mL of this solution is further taken to oxidise									
	$\mathrm{Sn}^{2+}$ ion into $\mathrm{Sn}^{4+}$	ion Sn <sup>4+</sup> so produced is used	in $2^{nd}$ reaction to prepare	$\mathrm{Fe}^{3+}$ ion then the millimoles of $\mathrm{Fe}^{3+}$						
	ion formed will be	(assume all other componen	ts are in sufficient amount	) [Molar mass of $K_2Cr_2O_7 = 294$ g].						
	(A) 5	(B) 20	(C) 10	(D) none of these						
16.	The following equ	The following equations are balanced atomwise and chargewise.								
	(i) $\operatorname{Cr}_2 \operatorname{O}_7^{2-} + 8 \operatorname{H}^+$	$+ 3H_2O_2 \longrightarrow 2Cr^{3+} + 7H_2O_2$	$O + 3O_2$							
	(ii) $\operatorname{Cr}_2 \operatorname{O}_7^{2-} + 8 \operatorname{H}^+$	$+ 5H_2O_2 \longrightarrow 2Cr^{3+} + 9H_2O_2$	$O + 4O_2$							
	(iii) $\operatorname{Cr}_2 \operatorname{O}_7^{2-} + 8 \operatorname{H}^+$	+ $7H_2O_2 \longrightarrow 2Cr^{3+} + 11H$	$_{2}O + 5O_{2}$							
	The precise equat	ion/equations representing f	the oxidation of $\mathrm{H_2O_2}$ is /	are :						
	(A) (i) only	(B) (ii) only	(C) (iii) only	(D) all the three						
17.	35 mL sample of of H <sub>2</sub> O <sub>2</sub> sample w	hydrogen peroxide gives of { rill be :-	500 mL of O <sub>2</sub> at 27°C an	d 1 atm pressure. Volume strength						
	(A) 10 volume	(B) 13 volumes	(C) 11 volume	(D) 12 volume						
18.	20 mL of 0.1 M	solution of compound Na <sub>2</sub> C	O3.NaHCO3.2H2O is titra	ated against 0.05 M HCl, x mL of						
	HCl is used when	phenolphthalein is used as a	an indicator and y mL of I	HCl is used when methyl orange is						
	the indicator in tw	vo separate titrations. Hence	(y – x) is :-							
	(A) 40 mL	(B) 80 mL	(C) 120 mL	(D) none of these						
19.	0.10 g of a samp	le containing CuCO <sub>3</sub> and sc	ome inert impurity was di	ssolved in dilute sulphuric acid and						
	volume made up to 50 mL. This solution was added into 50 mL of 0.04 M KI solution where copper									
	precipitates as Cu	I and I <sup>-</sup> is oxidized into $I_3^-$ . A	10 mL portion of this so	olution is taken for analysis, filtered						
	and made up free $I_3^-$ and then treated with excess of acidic permanganate solution. Liberated iodine re-									
	quired 20 mL of 2	quired 20 mL of 2.5 mM sodium thiosulphate solution to reach the end point.								
	Determine weight	percentage of CuCO <sub>3</sub> in the	e original sample.							
	(A) 7.41	(B) 74.1	(C) 61.75	(D) none of these						
20.	A 150 mL of sol	ution of $I_2$ is divided into tw	vo unequal parts. I part i	reacts with hypo solution in acidic						
	medium. 15 mL of 0.4 M hypo was consumed. II part was added with 100 mL of 0.3 M NaOH solution.									
	Residual base req	uired 10 mL of 0.3 M $H_2SC$	$D_4$ solution for complete $r$	neutralization. What was the initial						
	concentration of I	2?								
	(A) 0.08 M	(B) 0.1 M	(C) 0.2 M	(D) none of these						
21.	A mixture of H <sub>2</sub> S	$O_4$ and $H_2C_2O_4$ (oxalic acid)	and some inert impurity	weighing 3.185 g was dissolved in						
	water and the sol	lution made up to 1 litre, 1	0 mL of this solution re	quired 3 mL of 0.1 N NaOH for						
	complete neutraliz	zation. In another experime	ent 100 mL of the same	solution in hot condition required						
	4 mL of 0.02M K	$MnO_4$ solution for complete	reaction. The wt. % of F	$I_2 SO_4$ in the mixture was :-						
~ ~	(A) 40	(B) 50	(C) 60	(D) 80						
22.	0.80 g of sample	ot impure potassium dichron	nate was dissolved in wate	er and made upto 500 mL solution.						
	25 mL of this sol	ution treated with excess of	KI in acidic medium and	d $I_2$ liberated required 24 mL of a						
	of pure potoco	dichromate What was the	$\frac{1}{2}$	riven comple?						
	$(\Lambda)$ 72 E 04	$(\mathbf{D})$ 7E 2.04	$(C) 26.7^{\text{E}} 0/$	(D) pape of the sec						
	(A) 13.3 %	(D) / J.J %	(U) 30.75 %	(D) none of these						

BRAIN TEASERS ANSWER KEY									H	EXERCI	SE -2				
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	В	В	С	В	С	D	А	А	D	D	А	D	D	D	С
Que.	16	17	18	19	20	21	22								
Ans.	А	В	В	В	В	А	А								

## EXERCISE-03

TRUE /	' FALSE
1.	In a compound, all the atoms of a particular element have the same oxidation number.
2.	In $H_2O_2$ , both oxygen atoms have same oxidation number but in $Na_2S_2O_3$ , the two S-atoms do not have same oxidation number.
3.	In the reaction :
	3 Cl <sub>2</sub> + 6 NaOH $\longrightarrow$ 5 NaCl + NaClO <sub>3</sub> + 3H <sub>2</sub> O, Cl <sub>2</sub> acts purely as an oxidizing agent.
4.	In a redox reaction, the oxidation number of an element can either increase or decrease but both cannot happen simultaneously.
5.	In $CaOCl_2$ both the chlorine atom are in same oxidation state.
FILL IN	THE BLANKS
1.	Oxidizing agent (or oxidant) is a substance in which oxidation number of one of the atoms
2.	Reducing agent (or reductant) is a substance which electrons.
3.	In the reaction 2 $H_2O_2 \longrightarrow 2 H_2O + O_2$ , hydrogen peroxide is
4.	In the reaction 2 $\text{KClO}_3 \longrightarrow$ 2 $\text{KCl} + 3 \text{ O}_2$ , the element which has been oxidised is and the element which has been reduced is
5.	The compound $YbBa_2Cu_3O_7$ which shows superconductivity, has copper in oxidation state Assume that the rare earth element ytterbium is in the usual + 3 oxidation state.
6.	In HCN oxidation number of carbon is
7.	The reaction $NH_4NO_2 \rightarrow N_2 + 2H_2O$ disproportionation reaction.
MATCH	I THE COLUMN

1.	Column-I			Column-II	
	(A)	When $Bi_2S_{_3}$ converted into $Bi^{5\scriptscriptstyle +}$ and $S$	(p)	18	
	(B)	When $Al_2(Cr_2O_7)_3$ reduced into $Cr^{3+}$	(q)	11	
		in acidic medium			
	(C)	When $\mathrm{FeS}_{\mathrm{2}}$ converted into $\mathrm{Fe_2O_3}$ and	(r)	2	
		SO <sub>2</sub>			
	(D)	When $Mn(NO_3)_2$ converted into $MnO_4^{2-}$	(s)	10	
		and NO			

sp##2.		Column-I		Column-II
	(A)	Eq. wt. = $\frac{\text{Molecular weight}}{33}$	(p)	When $\operatorname{Crl}_3$ oxidises into $\operatorname{Cr}_2\operatorname{O}_7^{2-}$ and $\operatorname{IO}_4^{-}$
	(B)	Eq. wt. = $\frac{\text{Molecular weight}}{27}$	(q)	When Fe(SCN) <sub>2</sub> oxidises into Fe <sup>3+</sup> , SO <sub>4</sub> <sup>2-</sup> , CO <sub>3</sub> <sup>2-</sup>
	(C)	Eq. wt. = $\frac{\text{Molecular weight}}{28}$	(r)	When $NH_4SCN$ oxidizes into $SO_4^{2-}$ , $CO_3^{2-}$ and $NO_3^{-}$
	(D)	Eq. wt. = $\frac{\text{Molecular weight}}{24}$	(s)	When $As_2S_3$ oxidises into $AsO_3^-$ and $SO_4^{2-}$

3.	$\bigcap$	Column-I	$\square$	Column-II
	(A)	$\underbrace{P_2H_4}{\longrightarrow} PH_3 + P_4H_2$	(p)	$E = \frac{3M}{4}$
	(B)	$\underline{I_2} \longrightarrow I^- + IO_3^-$	(q)	$E = \frac{3M}{5}$
	(C)	$MnO_4^- + Mn^{2+} + H_2O \longrightarrow Mn_3O_4 + H^+$	(r)	$E = \frac{15M}{26}$
	(D)	$\underbrace{H_3PO_2}_{-\!-\!-\!-\!-}PH_3 + H_3PO_3$	(s)	$E = \frac{5M}{6}$

### ASSERTION & REASON

These questions contains, Statement I (assertion) and Statement II (reason).

- (A) Statement-I is true, Statement-II is true; Statement-II is correct explanation for Statement-I.
- (B) Statement-I is true, Statement-II is true; Statement-II is NOT a correct explanation for statement-I
- (C) Statement-I is true, Statement-II is false

(D) Statement-I is false, Statement-II is true

- 1. Statement-I: Oxidation involves loss of electrons and reduction involves gain of electrons.
  - Because

Statement-II: The overall reaction in which oxidation and reduction occur simultaneously is called redox reaction.

2. **Statement-I** :  $H_2SO_4$  cannot act as reducing agent. Because

Statement-II : Sulphur cannot increase its oxidation number beyond +6.

3. Statement-I: The oxidation state of superoxide ion in  $KO_2$ ,  $CsO_2$  and  $RbO_2$  is -1/2.

#### Because

Statement-II: Since the oxidation state of an alkali metal in any compound is always +1, the oxidation state of oxygen is -1/2 in the  $O_2^-$  ion.

4. Statement-I : In the redox reaction

8 H<sup>+</sup> (aq) + 4 NO<sub>3</sub><sup>-</sup> + 6 Cl<sup>-</sup> + Sn (s)  $\rightarrow$  SnCl<sub>6</sub><sup>2-</sup> + 4 NO<sub>2</sub> + 4 H<sub>2</sub>O the reducing agent is Sn (s),

### Because

**Statement-II** : In balancing half reaction,  $S_2O_3^{2-} \rightarrow S(s)$ , the number of electrons added on the left is 4. Statement-I: Among Br<sup>-</sup>,  $O_2^{2^-}$ , H<sup>-</sup> and  $NO_3^{-}$ , the ions that could not act as oxidising agents are Br<sup>-</sup> and 5. H⁻.

Because

**Statement-II** :  $Br^{\Theta}$  and  $H^{-}$  could not be reduced.

## COMPREHENSION BASED QUESTIONS

## Comprehension # 1

Oleum is considered as a solution of  $SO_3$  in  $H_2SO_4$ , which is obtained by passing  $SO_3$  in solution of  $H_2SO_4$ . When 100 g sample of oleum is diluted with desired weight of  $H_2O$  then the total mass of  $H_2SO_4$ obtained after dilution is known as % labelling in oleum.

For example, a oleum bottle labelled as '109%  $H_2SO_4$ ' means the 109 g total mass of pure  $H_2SO_4$  will be formed when 100 g of oleum is diluted by 9 g of H2O which combines with all the free SO3 present in oleum to form  $H_2SO_4$  as  $SO_3 + H_2O \longrightarrow H_2SO_4$ 

1.	What is the % of free $SO_3$ in an oleum that is labelled as '104.5 % $H_2SO_4$ '?						
	(A) 10	(B) 20	(C) 40	(D) none of these			
2.	9.0  g water is added into in the solution is :	oleum sample labelled as '	112% $H_2SO_4$ then the an	nount of free $SO_3$ remaining			
	(A) 14.93 L at STP	(B) 7.46 L at STP	(C) 3.73 L at STP	(D) 11.2 L at STP			
3.	If excess water is added into a bottle sample labelled as '112 % $H_2SO_4$ ' and is reacted with 5.3 g $Na_2CO_3$ , then find the volume of $CO_2$ evolved at 1 atm pressure and 300 K temperature after the completion of the reaction :						
	(A) 2.46 L	(B) 24.6 L	(C) 1.23 L	(D) 12.3 L			
4.	1 g of oleum sample is a neutralization. The $\%$ of	tiluted with water. The so free $SO_3$ in the sample	lution required 54 mL of is :	0.4 N NaOH for complete			
	(A) 74	(B) 26	(C) 20	(D) none of these			
Compre	hension # 2						
	The strength of $H_2O_2$ is etc. The strength of "10 STP or 1 litre of $H_2O_2$ g	expressed in several ways V" means 1 volume of H gives 10 litre of O <sub>2</sub> at ST	s like molarity, normality, <sub>2</sub> O <sub>2</sub> on decomposition give P. The decomposition of	% (w/V), volume strength, es 10 volumes of oxygen at $H_2O_2$ is shown as under :			
	$H_2O_2$ (aq) $\longrightarrow H_2O$	$(\ell) + \frac{1}{2}O_2$ (g)					
4	$H_2O_2$ can acts as oxidisin as reducing agent $H_2O_2$ $\therefore$ Normality of $H_2O_2$ so	ing as well as reducing age converted into $O_2$ , both plution = 2 Y Molarity of	ent, as oxidizing agent $H_2$ cases it's n-factor is 2. $H_2O_2$ solution	$O_2$ converted into $H_2O$ and			
1.	What is the molarity of	(P) = M		(D) 11 0 M			
0	(A) I M	(B) $Z$ [M]	(C) 5.6 M	(D) 11.2 M			
۷.	(A) 1 7	(P) 2 A	$2 \vee \Pi_2 U_2$ :	(D) none of these			
3.	(A) 1.7 (B) 3.4 (C) 34 (D) none of these 20 mL of $H_2O_2$ solution is reacted with 80 mL of 0.05 M KMnO <sub>4</sub> in acidic medium then what is the volume strength of $H_2O_2$ ?						
	(A) 2.8	(B) 5.6	(C) 11.2	(D) none of these			

4. 40 g Ba(MnO<sub>4</sub>)<sub>2</sub> (mol. wt. = 375) sample containing some inert impurities in acidic medium is completely reacted with 125 mL of "33.6 V" of  $H_2O_2$ . What is the percentage purity of the sample ? (A) 28.12 % (B) 70.31 % (C) 85 % (D) none of these

### Comprehension # 3

Equivalent weight =  $\frac{\text{Molecular weight / Atomic weight}}{n - \text{factor}}$ 

n-factor is very important in redox as well as non-redox reactions. With the help of n-factor we can predicts the molar ratio of the reactant species taking part in reactions. The reaciprocal of n-factor's ratio of the reactants is the molar ratio of the reactants.

In general n-factor of acid/base is number of moles of  $H^+$  /OH<sup>-</sup> furnished per mole of acid/base. n-factor of a reactant is no. of moles of electrons lost or gained per mole of reactant.

#### Example 1 :

- 1. In acidic medium :  $KMnO_4$  (n = 5)  $\longrightarrow Mn^{2+1}$
- 2. In basic medium  $: \text{KMnO}_4 \text{ (n = 3)} \longrightarrow \text{Mn}^{2+}$
- 3. In neutral medium :  $KMnO_4$  (n = 1)  $\longrightarrow Mn^{6+1}$

	<b>Example 2</b> : $FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2$											
	Total no. of moles of $e^-$ lost by 1 mole of $\text{FeC}_2\text{O}_4$ = 1 + 1 4 2 $\Rightarrow$ 3											
	$\therefore$ n-factor of FeC <sub>2</sub> O <sub>4</sub> =	3										
1.	n-factor of $Ba(MnO_4)_2$ in acidic medium is :											
	(A) 2	(B) 6	(C) 10	(D) none of these								
2.	For the reaction,											
	$H_3PO_2 + NaOH \longrightarrow NaH_2PO_2 + H_2O$											
	What is the equivalent weight of $H_3PO_2$ ? (mol. wt. is M)											
	(A) M	(B) M/2	(C) M/3	(D) none of these								
3.	For the reaction, $Fe_{0.95}C$	) (molar mass : M) $\longrightarrow$	$Fe_2O_3$ . What is the eq. w	t. of Fe <sub>0.95</sub> O ?								
	(A) $\frac{M}{0.85}$	(B) $\frac{M}{0.95}$	(C) $\frac{M}{0.8075}$	(D) none of these								
4.	In the reaction, xVO $+$	$yFe_2O_3 \longrightarrow FeO + V_2O$	$_{5}$ . What is the value of x	and y respectively ?								
	(A) 1, 1	(B) 2, 3	(C) 3, 2	(D) none of these								

MIS	CELLANEOUS TYPE QUESTION	ANS	WER KEY		EXERCISE -3								
•	True / False												
	1. F 2. T 3. H	- 4	<b>.</b> F	<b>5.</b> F									
•	Fill in the Blanks												
	<b>1</b> . decrease <b>2</b> . loses	3	<b>3.</b> oxidized as	s well as reduc	ed								
	<b>4.</b> oxygen has been oxidised ( $O^{2-} \longrightarrow O_2^{\circ}$ ); chlorine has been reduced ( $Cl^{+5} \longrightarrow Cl^{-1}$ )												
	<b>5.</b> x = +7/3 <b>6.</b> +2	7	7. is not										
•	Match the Column												
	$\overline{1. (A) \rightarrow s ; (B) \rightarrow p ; (C)} \rightarrow q ; (D)$	$\rightarrow$ r											
	<b>2.</b> (A) $\rightarrow$ q ; (B) $\rightarrow$ p ; (C) $\rightarrow$ s ; (D)	$\rightarrow$ r											
	<b>3.</b> (A) $\rightarrow$ s ; (B) $\rightarrow$ q ; (C) $\rightarrow$ r ; (D)	→p											
•	Assertion - Reason Question	ns											
	1. B 2. A	<b>3</b> . A	<b>4</b> . B	<b>5</b> . A	Δ								
•	Comprehension Based Que	stions											
	Comprehension #1 : 1. (B)	<b>2</b> . (C)	<b>B.</b> (C)	<b>4.</b> (B)									
	Comprehension #2 : 1. (A)	<b>2</b> . (B) <b>3</b>	<b>3.</b> (B)	<b>4.</b> (B)									
	Comprehension #3 : 1. (C)	2. (A) 3	<b>B.</b> (C)	<b>4.</b> (B)									

## EXERCISE-04 [A]

- 1. Calculate the oxidation number of underlined elements in the following compounds :
  - (a)  $K[Co(C_2O_4)_2.(NH_3)_2]$  (b)  $K_4P_2O_7$  (c)  $CrO_2Cl_2$ (d)  $Na_2[Fe(CN)_5NO^+]$  (e)  $Mn_3O_4$  (f)  $Ca(ClO_2)_2$
- 2. Write balanced net ionic equation for the following reactions in acidic solution.

(a) 
$$S_4O_6^{2-}$$
 (aq) +Al (s)  $\longrightarrow H_2S$  (aq) + Al<sup>3+</sup> (aq)

- (b)  $S_2O_3^{2-}$  (aq) +  $Cr_2O_7^{2-}$  (aq)  $\longrightarrow S_4O_6^{2-}$  (aq) +  $Cr^{3+}$  (aq)
- (c)  $\text{ClO}_3^-$  (aq) +  $\text{As}_2\text{S}_3^-$  (s)  $\longrightarrow$   $\text{Cl}^-$  (aq) +  $\text{H}_2\text{AsO}_4^-$  (aq) +  $\text{HSO}_4^-$  (aq)
- (d)  $IO_3^{-}$  (aq) + Re (s)  $\longrightarrow ReO_4^{-}$  (aq) +  $I^{-}$  (aq)
- (e)  $HSO_4^-$  (aq) +  $As_4^-$  (s) +  $Pb_3O_4^-$  (s)  $\longrightarrow PbSO_4^-$  (s) +  $H_2AsO_4^-$  (aq)
- (f)  $HNO_2$  (aq)  $\longrightarrow NO_3^- + NO$  (g)
- **3**. Write balanced net ionic equations for the following reactions in basic solution :
  - (a)  $C_4H_4O_6^{2-}(aq) + ClO_3^{-}(aq) \longrightarrow CO_3^{2-}(aq) + Cl^{-}(aq)$
  - (b) Al (s) + BiONO<sub>3</sub> (s)  $\longrightarrow$  Bi (s) + NH<sub>3</sub> (aq) + Al (OH)<sub>4</sub><sup>-</sup>(aq)
  - (c)  $H_2O_2$  (aq) +  $Cl_2O_7$  (aq)  $\longrightarrow ClO_2^-$  (aq) +  $O_2^-$  (g)
  - (d)  $Tl_2O_3$  (s) +  $NH_2OH$  (aq)  $\longrightarrow$  TIOH (s) +  $N_2$  (g)
  - (e)  $\operatorname{Cu}(\operatorname{NH}_3)_4^{2+}$  (aq) +  $\operatorname{S_2O_4^{2-}}$  (aq)  $\longrightarrow$   $\operatorname{SO_3^{2-}}$  (aq) + Cu (s) +  $\operatorname{NH}_3$  (aq)
  - (f)  $Mn(OH)_2$  (s) +  $MnO_4^-$  (aq)  $\longrightarrow MnO_2^-$  (s)
- 4.  $KMnO_4$  oxidizes  $X^{n+}$  ion to  $XO_3^{-}$ , itself changing to  $Mn^{2+}$  in acid medium. 2.68  $ext{ 10}^{-3}$  mole of  $X^{n+}$  requires 1.61  $ext{ 10}^{-3}$  mole of  $MnO_4^{-}$ . What is the value of n? Also calculate the atomic mass of X, if the weight of 1g equivalent of  $XCl_n$  is 56.
- 5. In a quantitative determination of iron in an ore, an analyst converted 0.40 g, of the ore into its ferrous. This required 40.00 mL of 0.1 N solution of  $KMnO_4$  for titration.
  - (i) How many milliequivalents of  $KMnO_4$  does 40.00 mL of 0.1 N solution represent?
  - (ii) How many equivalents of iron were present in the sample of the ore taken for analysis?
  - (iii) How many grams of iron were present in the sample?
  - (iv) What is the percentage of iron in the ore?
  - (v) What is the molarity of  $KMnO_4$  solution used?
  - (vi) How many moles of  $KMnO_4$  were used for titration ? (Fe = 56)
- 6. The mixture of CuS (molar weight =  $M_1$ ) and Cu<sub>2</sub>S (molecular weight =  $M_2$ ) oxidised by KMnO<sub>4</sub> (molecular weight =  $M_3$ ) in acidic medium, the product obtained are Cu<sup>2+</sup>, SO<sub>2</sub>. Find the equivalent weight of CuS, Cu<sub>2</sub>S and KMnO<sub>4</sub> respectively.
- 7. Consider the reaction  $H^+ + IO_4^- + I^- \rightarrow I_2^- + H_2O$ . Find the ratio of coefficients of  $IO_4^-$ ,  $I^-$  and  $I_2$ .
- 8. A dilute solution of  $H_2SO_4$  is made by adding 5 mL of 3N  $H_2SO_4$  to 245 mL of water. Find the normality and molarity of the solution.
- 9. What volume at NTP of gaseous ammonia will be required to be passed into 30 cc of  $N H_2SO_4$  solution to bring down the acid strength of the latter to 0.2 N.

- **10.** A solution containing 4.2 g of KOH and  $Ca(OH_2)$  is neutralized by an acid. It consums 0.1 equivalent of acid, calculate the percentage composition of the sample.
- 11. How many mL of 0.1 N HCl are required to react completely with 1 g mixture of  $Na_2CO_3$  and  $NaHCO_3$  containing equimolar amounts of two?
- **12.** 0.5 g of fuming  $H_2SO_4$  (oleum) is diluted with water. The solution requires 26.7 mL of 0.4N NaOH for complete neutralization. Find the % of free  $SO_3$  in the sample of oleum.
- **13.** 10 g CaCO<sub>3</sub> were dissolved in 250 mL of M HCl and the solution was boiled. What volume of 2 M KOH would be required to equivalence point after boiling? Assume no change in volume during boiling.
- 14.  $H_3PO_4$  is a tri basic acid and one of its salt is  $NaH_2PO_4$ . What volume of 1 M NaOH solution should be added to 12 g of  $NaH_2PO_4$  to convert it into  $Na_3PO_4$ ?
- **15.** 1.64 g of mixture of  $CaCO_3$  and  $MgCO_3$  was dissolved in 50 mL of 0.8 M HCl. The excess of acid required 16 mL of 0.25 M NaOH for neutralization. Calculate the percentage of  $CaCO_3$  and  $MgCO_3$  in the sample.
- 16. 1.5 g of chalk were treated with 10 mL of 4N HCl. The chalk was dissolved and the solution made to 100 mL, 25 mL of this solution required 18.75 mL of 0.2 N NaOH solution for complete neutralisation. Calculate the percentage of pure CaCO<sub>3</sub> in the sample of chalk?
- 17. A solution contains Na<sub>2</sub>CO<sub>3</sub> and NaHCO<sub>3</sub>. 20 mL of this solution required 4 mL of 1N HCl for titration with Ph indicator. The titration was repeated with the same volume of the solution but with MeOH. 10.5 mL of 1 N HCl was required this time. Calculate the amount of Na<sub>2</sub>CO<sub>3</sub> & NaHCO<sub>3</sub>.
- 18. A solution contains a mix of Na<sub>2</sub>CO<sub>3</sub> and NaOH. Using Ph as indicator 25 mL of mixture required 19.5 mL of 0.995 N HCl for the end point. With MeOH, 25 mL of the solution required 25 mL of the same HCl for the end point. Calculate g/L of each substance in the mixture.
- **19.** 200 mL of a solution of mixture of NaOH and  $Na_2CO_3$  was first titrated with Ph and  $\frac{N}{10}$  HCl. 17.5 mL of HCl was required for end point. After this MeOH was added and 2.5 mL of same HCl was again required for next end point. Find out amounts of NaOH and  $Na_2CO_3$  in the mix.
- **20.** A solution contains  $Na_2CO_3$  and  $NaHCO_3$ . 10 mL of this requires 2 mL of 0.1 M  $H_2SO_4$  for neutralisation using Ph indicator. MeOH is then added when a further 2.5 mL of 0.2 M  $H_2SO_4$  was needed. Calculate strength of  $Na_2CO_3$  and  $NaHCO_3$ .
- 21. A sample containing Na<sub>2</sub>CO<sub>3</sub> & NaOH is dissolved in 100 mL solution. 10 mL of this solution requires 25 mL of 0.1 N HCl when Ph is used as indicator. If MeOH is used as indicator 10 mL of same solution requires 30 mL of same HCl. Calculate % of Na<sub>2</sub>CO<sub>3</sub> and NaOH in the sample.
- 22. It required 40.05 mL of 1 M Ce<sup>4+</sup> to titrate 20 mL of 1 M Sn<sup>2+</sup> to Sn<sup>4+</sup>. What is the oxidation state of the cerium in the product.
- **23.** A volume of 12.53 mL of  $0.05093 \text{ M SeO}_2$  reacted with exactly 25.52 mL of  $0.1 \text{ M CrSO}_4$ . In the reaction,  $Cr^{2+}$  was oxidized to  $Cr^{3+}$ . To what oxidation state was selenium converted by the reaction.
- **24.** Pottasium acid oxalate  $K_2C_2O_4.3H_2C_2O_4.4H_2O$  can be oxidized by  $MnO_4$  in acid medium. Calculate the volume of 0.1 M KMnO<sub>4</sub> reacting in acid solution with one gram of the acid oxalate.
- **25.** A 1.0 g sample of  $H_2O_2$  solution containing x%  $H_2O_2$  by mass requires x cm<sup>3</sup> of a KMnO<sub>4</sub> solution for complete oxidation under acidic conditions. Calculate the normality of KMnO<sub>4</sub> solution.

- **26.** Metallic tin in the presence of HCl is oxidized by  $K_2Cr_2O_7$  to stannic chloride, SnCl<sub>4</sub>. What volume of deci-normal dichromate solution would be reduce by 1 g of tin.
- 27. 5 g sample of brass was dissolved in one litre dil.  $H_2SO_4$ . 20 mL of this solution were mixed with KI, liberating  $I_2$  and  $Cu^+$  and the  $I_2$  required 20 mL of 0.0327 N hypo solution for complete titration. Calculate the percentage of Cu in the alloy.
- 28. 0.84 g iron ore containing x percent of iron was taken in a solution containing all the iron in ferrous condition. The solution required x mL of a dichromatic solution for oxidizing the iron content to ferric state. Calculate the strength of dichromatic solution.
- **29.** The neutralization of a solution of 1.2 g of a substance containing a mixture of  $H_2C_2O_4.2H_2O$ ,  $KHC_2O_4.H_2O$  and different impurities of a neutral salt consumed 18.9 mL of 0.5 N NaOH solution. On titration with  $KMnO_4$  solution, 0.4 g, of the same substance needed 21.55 mL of 0.25 N KMnO<sub>4</sub>. Calculate the % composition of the substance.
- **30.** 50 g of a sample of  $Ca(OH)_2$  is dissolved in 50 mL of 0.5 N HCl solution. The excess of HCl was titrated with 0.3 N NaOH. The volume of NaOH used was 20cc. Calculate % purity of  $Ca(OH)_2$ .
- 31. One g of impure sodium carbonate is dissolved in water and the solution is made up to 250 mL. To 50 mL of this made up solution, 50 mL of 0.1 N HCl is added and the mix after shaking well required 10 mL of 0.16 N NaOH solution for complete titration. Calculate the % purity of the sample.
- **32.** What amount of substance containing 60% NaCl, 37% KCl should be weighed out for analysis so that after the action of 25 mL of 0.1 N AgNO<sub>3</sub> solution, excess of Ag<sup>+</sup> is back titrates with 5 mL of NH<sub>4</sub>SCN solution. Given that 1 mL of NH<sub>4</sub>SCN = 1.1. mL of AgNO<sub>3</sub>.
- **33.** A bottle labelled with "12 V  $H_2O_2$ " contain 700 mL solution. If a student mix 300 mL water in it what is the g/litre strength & normality and volume strength of final solution.
- 34. 50 mL of an aqueous solution of  $H_2O_2$  were treated with an excess of KI solution and dilute  $H_2SO_4$ , the liberated iodine required 20 mL of 0.1 N  $Na_2S_2O_3$  solution for complete interaction. Calculate the concentration of  $H_2O_2$  in g/ $\ell$ .
- **35.** 100 kg hard water contains 5 g  $MgSO_4$ . Find hardness.
- **36.** One litre hard water contains 1 mg  $CaCl_{2}$  and 1 mg  $MgSO_{4}$ . Find hardness.
- **37.** Calculate the hardness of water sample which contains  $0.001 \text{ mol MgSO}_4$  per litre of water.
- **38.** A solution of a 0.4 g sample of  $H_2O_2$  reacted with 0.632 g of KMnO<sub>4</sub> in the presence of sulphuric acid. Calculate the percentage purity of the sample of  $H_2O_2$ .
- **39.** 5 litre of a solution of  $H_2O_2$  with x N strength is diluted to 5.5 litre. This 5.5 litre  $H_2O_2$  solution gives 28 litre  $O_2$  at NTP. Find the value of x.
- **40.** Calculate the amount of lime Ca(OH)<sub>2</sub> required to remove the hardness in 60 litre of pond water containing 1.62 mg of calcium bicarbonate per 100 mL of water.
- 41. 10 g sample of bleaching powder was dissolved into water to make the solution one litre. To this solution 35 mL of 1.0 M Mohr salt solution was added containing enough  $H_2SO_4$ . After the reaction was complete, the excess Mohr salt required 30 mL of 0.1 M KMnO<sub>4</sub> for oxidation. Find out the % of available Cl<sub>2</sub> approximately is (mol wt. 71).

- Calculate the amount (in milligrams) of  $\text{SeO}_3^{-2}$  in solution on the basis of following data 20 mL of M/60 42. solution of  $KBrO_3$  was added to a definite volume of  $SeO_3^{-2}$  solution. The bromine evolved was removed by boiling and excess of KBrO3 was back titrated with 5 mL of M/25 solution of NaAsO2. The reactions are given below. (Atomic mass of K = 39, Br = 80, As = 75, Na = 23, O = 16, Se = 79) (a)  $\operatorname{SeO}_{3}^{-2} + \operatorname{BrO}_{3}^{-} + \operatorname{H}^{+} \longrightarrow \operatorname{SeO}_{4}^{-2} + \operatorname{Br}_{2} + \operatorname{H}_{2}O$ (b)  $\operatorname{BrO}_{3}^{-} + \operatorname{AsO}_{2}^{-} + \operatorname{H}_{2}O \longrightarrow \operatorname{Br}^{-} + \operatorname{AsO}_{4}^{-3} + \operatorname{H}^{+}$
- 43. A 1.0 g sample of  $Fe_2O_3$  solid of 55.2% purity is dissolved in acid and reduced by heating the solution with zinc dust. The resultant solution is cooled and made upto 100.0 mL. An aliquot of 25.0 mL of this solution requires 17.0 mL of 0.0167 M solution of an oxidant for titration. Calculate the number of moles of electrons taken up by the oxidant in the reaction of the above titration.

C	ONCE	PTUAL SUBJE	CTIVI	E EXERCISE	AN	ISWER KEY	7			EXERCISE-4(A)			
1	(a)	+3	(b)	+5	(c)	+6	(d)	+2	(e) 8	3/3 or $(2  and  3)$			
	(œ,	13	(c) (a)	12	(e) (h)	10	(œ) (i)	200/03 -	0 15	, o or (2 and 0)			
	(I) (N)	+3			(II) ( )	+2	(II)	200/93 =	2.13				
2.	(a)	$S_4O_6$ (aq) + 6	AI (s)	$+ 20 H \longrightarrow 4 H_2S$	(aq)	+ 6Al (aq) + 6	5Н <sub>2</sub> С	)					
	(b)	$6S_2O_3^{2-}(aq) +$	$Cr_2C$	$P_7^{2-}$ (aq) + 14 H <sup>+</sup> $\longrightarrow$	3 S,	${}_{4}O_{6}^{2^{-}}$ (aq) + 2 Cr	r³⁺ (ao	q) + 7H <sub>2</sub> O					
	(c)	14ClO <sub>3</sub> (aq) +	3As	$_{2}S_{3}$ (s) + 18 H <sub>2</sub> O	<b>→</b> 14	$\text{Cl}^-$ (aq) + 6H <sub>2</sub> A	$sO_4^-$	(aq) + 9HSC	$D_4^{-}$ (a)	q) + 15H <sup>+</sup>			
	(d)	<b>d)</b> $7IO_3^{-}(aq) + 6Re(s) + 3H_2O \longrightarrow 6 ReO_4^{-}(aq) + 7I^{-}(aq) + 6H^+$											
	(e)	e) $30HSO_4^{-}(aq) + As_4^{-}(s) + 10 Pb_3^{-}O_4(s) + 26H^+ \longrightarrow 30 PbSO_4^{-}(s) + 4H_2^{-}AsO_4^{-}(aq) + 24H_2^{-}O_4^{-}(aq) + 24H_2^$											
	(f) $3HNO_2(aq) \longrightarrow HNO_3 + 2NO(g) + H_2O$												
3.	(a)	(a) $3C_4H_4O_6^{2-}(aq) + 5ClO_3^{-}(aq) + 18 \text{ OH}^- \longrightarrow 12 \text{ CO}_3^{2-}(aq) + 5 \text{ Cl}^-(aq) + 15H_2O_3^{2-}(aq) + 1000 \text{ Cl}^-(aq) + 10000 \text{ Cl}^-(aq) + 10000 \text{ Cl}^-(aq) + 10000 \text{ Cl}^-(aq) + 1000$											
	(b)	(b) 11Al (s) + $3BiONO_3$ (s) + $21H_2O$ + $11OH^- \longrightarrow 3Bi$ (s) + $3NH_3$ (aq) + $11Al$ ( $OH)_4^-$ (aq)											
	(c)	(c) $4H_2O_2$ (aq) + $Cl_2O_7$ (aq) + $2OH^- \longrightarrow 2ClO_2^-$ (aq) + $4O_2$ (q) + $5H_2O_2$											
	(d)	$Tl_{2}O_{3}$ (s) + 4N	H,O	H (aq) $\longrightarrow$ 2TIOH (	s) +	$2N_{2}(g) + 5H_{2}O$	)						
	(e) (	$Cu(NH_3)^{2+}$ (aq)	+ S	$_{2}O_{4}^{2-}$ (aq) + 40H <sup>-</sup> —	$\rightarrow 2$	$2SO_{3}^{2-}$ (aq) + Ci	u (s) ·	+ 4NH <sub>3</sub> (aq)	+ 21	H <sub>2</sub> O			
	(f)	3Mn(OH) <sub>2</sub> (s) +	- 2M	$nO_1^-(aq) \longrightarrow 5MnO_1^-(aq)$	ຸ (s)	+ 2H <sub>o</sub> O + 2OH	-I-	5 -		2			
4.	2, 4	1		4 . 2	2	Δ.							
5.	(i)	4.0, <b>(ii)</b> 0.004	40, <b>(</b>	<b>iii)</b> 0.224, <b>(iv)</b> 56.0	0%,	(v) 0.02M, (vi)	0.0	008 mol					
6.	$\frac{M_1}{6}$	$,\frac{M_2}{8},\frac{M_3}{5}$	7.	1:7:4	8.	0.06 N and 0.0	03 M		9.	537.6 mL			
10	. KO	H = 35%, Ca(	$(OH)_2$	= 65%	11.	V = 157.89 m	L		12.	20.72 %			
13	. V =	= 25 mL	14.	200 mL	15.	$MgCO_{3} = 51.2$	22%,	$CaCO_3 = 4$	8.78	%			
16	. 83.	33	17.	0.424 g; 0.21g	18.	23.2 g, 22.28	g		19.	0.06 g; 0.0265 g			
20	. 4.2	4 g/L ; 5.04 g	/L		21.	39.85%; 60.1	5%		22.	+3			
23	. zero	C	24.	V = 31.68  mL	25.	337 mL							
27	. 41.	53 %	28.	0.15 N	29.	$H_{2}C_{2}O_{4}.2H_{2}O$	= 14	.36%, KH <sub>2</sub> C	$H_{4}$	O=81.71%			
30	. 1.4	06 %	31.	90.1%	32.	0.1281 g							
33	. 25.	5 g/L, 1.5 N,	8.4 V	J	34.	0.68 g/L			35.	41.66 ppm			
36	. 1.7	34 ppm	37.	100 ppm	38.	85%			39.	x = 1			
40	. 0.4	44 g	41.	7.1%	42.	84mg			43.	6			

- 1. 1.2475 g of crystalline copper sulphate was dissolved in water and excess of KI was added. The liberated iodine consumed 50 mL N/10  $Na_2S_2O_3$  solution to reach the end point of the titration. Calculate the number of water molecules of hydration in crystalline copper sulphate salt.
- 2. A 1g sample of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> containing some inert material was entirely reduced with conc. HCl. The chlorine liberated was passed through hot solution of NaOH at 80<sup>o</sup>C, and it completely diproportionates to form ClO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup>. This NaClO<sub>3</sub> was isolated and its reduction with KI (aq) liberated iodine, giving Cl<sup>-</sup>. The iodine thus liberated required 100 mL of decinormal hypo solution for complete titration. What is the percentage purity of the dichromate sample?
- 3. 2.5g of mixture of crystalline oxalic acid ( $H_2C_2O_4$ .  $2H_2O$ ) and sodium oxalate ( $Na_2C_2O_4$ ) was dissolved in 100 mL of water. 50 mL of this solution was titrated against N/10 NaOH solution when 119.05 mL of the base was found necessary to reach the end point with phenolphthalein as the indicator. 1g of the mixture was dissolved in water and the solution titrated against N/10 KMnO<sub>4</sub> in the presence of dil.  $H_2SO_4$ . What is the volume of KMnO<sub>4</sub> needed for getting the end point with 0.5g of the mixture?
- 4. 25 mL of a solution containing HCl was treated with excess of  $M/5 \text{ KIO}_3$  and Kl solution of unknown concentration where  $I_2$  liberated is titrated against a standard solution of  $0.021 \text{ M Na}_2\text{S}_2\text{O}_3$  solution whose 24 mL were used up. Find the strength of HCl and volume of  $\text{KIO}_3$  solution consumed :
- 5. 0.6213 g of sample contains an unknown amount of  $As_2O_3$ . The sample was treated with HCl resulting information of  $AsCl_3$  (g) which was distilled into a beaker of water. The hydrolysis reaction is as follows :  $AsCl_3 + 2H_2O \rightarrow HAsO_2 + 3H^+ + 3Cl^-$

The amount of  $HAsO_2$  was determined by titration with 0.04134 M I<sub>2</sub>, requiring 23.04 mL to reach the equivalence point. The redox products in the titration were  $H_3AsO_4$  and  $\Gamma$ . Find the amount of  $KMnO_4$  needed to oxidize As in  $As_2O_3$  to its maximum possible oxidation state in acidic medium.

- 6. A sample of steel weighing 0.6 g and containing S as an impurity was burnt in a stream of  $O_2$ , when S was converted to its oxide  $SO_2.SO_2$  was then oxidized to  $SO_4^{--}$  by using  $H_2O_2$  solution containing 30 mL of 0.04 M NaOH. 22.48 mL of 0.024 M HCl was required to neutralize the base remaining after oxidation. Calculate the % of S in the sample :
- 7. In the presence of fluoride ion,  $Mn^{2+}$  can be titrated with  $MnO_4^-$ , both reactants being converted to a complex of Mn(III). A 0.545 g sample containing  $Mn_3O_4$  was dissolved and all manganese was converted to  $Mn^{2+}$ . Titration in the presence of fluoride ion consumed 31.1 mL of KMnO<sub>4</sub> that was 0.177 N against oxalate.
  - (a) write a balanced chemical equation for the reaction, assuming that the complex is  $MnF_4^-$ .
  - (b) what was the % of  $Mn_3O_4$  in the sample ?
- 8. A mixture of two gases,  $H_2S$  and  $SO_2$  is passed through three beakers successively. The first beaker contains  $Pb^{2+}$  ions, which absorbs  $S^{2-}$  forming PbS. The second beaker contains 25 mL of 0.0396 N  $I_2$  to oxidize  $SO_2$  to  $SO_4^{2-}$ . The third contains 10 mL of 0.0345 N thiosulphate solution to retain any  $I_2$  carried over from the second absorber. A 25 L gas sample was passed through the apparatus followed by an additional amount of  $N_2$  to sweep last traces of  $SO_2$  from first and second absorber. The solution from the first absorber was made acidic and treated with 20 mL of 0.0066 M  $K_2Cr_2O_7$  which converted  $S^{2-}$  to  $SO_2$ . The excess dichromate was reacted with solid KI and the liberated iodine required 7.45 mL of 0.0345 N  $Na_2S_2O_3$  solution. The solutions in the second and third absorbers were combined and the resultant iodine was titrated with 2.44 mL of the same thiosulphate solution. Calculate the concentrations of  $SO_2$  and  $H_2S$  in mg/L of the sample :

9. 1 g of a moist sample of a mixture of  $\text{KClO}_3$  and KCl was dissolved in water and made upto 250 mL. 25 mL of this solution was treated with SO<sub>2</sub> to reduced chlorate into chloride and the excess SO<sub>2</sub> was boiled off. When the total chloride was precipitated, 0.1435 g of AgCl was obtained. In another experiment 25 mL of the original solution was treated with 30 mL of 0.2 N solution of FeSO<sub>4</sub> and unreacted FeSO<sub>4</sub> required 37.5 mL of 0.08 N solution of an oxidizing agent for complete oxidation. Calculate the molar ratio of chlorate and chloride in the given mixture. Fe<sup>2+</sup> reacts with ClO<sub>3</sub><sup>-</sup> according to equation :  $\text{ClO}_3^- + 6\text{Fe}^{2+} + 6\text{H}^+ \rightarrow \text{Cl}^- + 6\text{Fe}^{3+} + 3\text{H}_2\text{O}$ 

Also calculate the mass percent of moisture present in the moist sample.

- 10. A steel sample is to be analysed for Cr and Mn simultaneously. By suitable treatment the Cr is oxidized to  $Cr_2O_7^{2-}$  and the Mn to  $MnO_4^-$ . A 10.00 g sample of steel is used to produce 250.0 mL of a solution containing  $Cr_2O_7^{2-}$  and  $MnO_4^-$ . A 10.00 mL portion of this solution is added to a  $BaCl_2$  solution and by proper adjustment of the acidity, the chromium is completely precipitated as  $BaCrO_4$ ; 0.0549 g is obtained. A second 10.00 mL portion of this solution requires exactly 15.95 mL of 0.0750 M standard Fe<sup>2+</sup> solution for its titration (in acid solution). Calculate the % of Mn and % of Cr in the steel sample.
- 11. 1.16 g CH<sub>3</sub>(CH<sub>2</sub>)<sub>n</sub>COOH was burnt in excess air and the resultant gases (CO<sub>2</sub> and H<sub>2</sub>O) were passed through excess NaOH solution. The resulting solution was divided in two equal parts. One part required 50 mL of 1 N HCl for neutralization using phenolphthalein as indicator. Another part required 80 mL of 1 N HCl for neutralization using methyl orange as indicator. Find the value of n and the amount of excess NaOH solution taken initially.
- 12. A 1.5 g sample containing oxalic acid and some inert impurity was dissolved in enough water and volume made up to 250 mL. A 20 mL portion of this solution was then mixed with 30 mL of an alkali solution. The resulting solution was then treated with stoichiometric amount of CaCl<sub>2</sub> just needed for precipitation of oxalate as CaC<sub>2</sub>O<sub>4</sub>. Solution was filtered off and filtrate was finally titrated against 0.1 M HCl solution. 8.0 mL of acid was required to reach the equivalence point. At last, the above neutral solution was treated with excess of AgNO<sub>3</sub> solution and AgCl obtained was washed, dried and weighed to be 0.4305 g. Determine mass percentage of oxalic acid in the original sample :
- 13. A 1 g sample containing NaOH as the only basic substance and some inert impurity was left exposed to atmosphere for a very long time so that part of NaOH got converted into Na<sub>2</sub>CO<sub>3</sub> by absorbing CO<sub>2</sub> from atmosphere. The resulting sample was dissolved in water and volume made upto 100 mL. A 20 mL portion of this solution required 16 mL 0.25 M HCl solution to reach the equivalence point when methyl orange was used as indicator. In a separate analysis, 20 mL portion of the same solution was taken along with phenolphthalein indicator and mixed with 50 mL of 0.1 M HCl solution. An additional 9.00 mL 0.1 M Ba(OH)<sub>2</sub> solution was required to just restore the pink colour of solution. Determine mass percentage of NaOH in the original sample and mass percentage of Na<sub>2</sub>CO<sub>3</sub> in the sample after exposure to atmosphere.

BF	AIN STORMING SUBJECTIVE EXERCISE	ANSWE	R KEY		EXERCISE-4(B)
1.	5	2.	58.8%	3.	77.45 mL
4.	$V_{\text{KIO}_3} = 0.42 \text{mL}$ , [HCl] = 0.0168 N	5.	0.06 g	6.	1.76 %
7.	40.77%	8.	0.12 mg H <sub>2</sub> S/L, 0.718	mg S	$O_2/L$
9.	$ClO_{3}^{-}/Cl^{-} = 1, 1.5\%$ moisture by mass	10.	Cr=2.821% , $Mn=1.$	498%	, )
11.	n = 4, NaOH = 6.4 g	12.	82.5	13.	80, 36.05 %

# EXERCISE-05 [A]

1.	$MnO_4^-$ is good oxidisin $MnO_4^ \longrightarrow$ $MnO_4^{2-}$ $\longrightarrow$ $MnO_2^{2-}$ $\longrightarrow$ $MnO_2$ $\longrightarrow$ $MnO_2$ $\longrightarrow$ $Mn_2O_3$ Changes in oxidation n		[AIEEE-02]		
	(1) 1, 3, 4, 5	(2) 5, 4, 3, 2	(3) 5, 1, 3, 4	(4) 2, 6, 4, 3	5
2.	Oxidation number of C (1) Zero, since it contain (2) -1, since it contains (3) +1, since it contains (4) +1 and -1 since it contains		[AIEEE-02]		
3.	Which of the following	is a redox			[AIEEE-02]
	(1) 2NaAg(CN) <sub>2</sub> + Zn-	$\longrightarrow$ Na <sub>2</sub> Zn (CN) <sub>4</sub> + 2 Ag	(2) BaO <sub>2</sub> + H <sub>2</sub> SO <sub>4</sub>	$\rightarrow BaSO_4 + H_2$	2 <sup>0</sup> 2
	$(3) N_2O_5 + H_2O \longrightarrow$	2HNO <sub>3</sub>	$(4) \operatorname{AgNO}_3 + \operatorname{KI} \longrightarrow A$	AgI + KNO <sub>3</sub>	
4.	In the coordination con	npound, $K_4$ [Ni (CN) <sub>6</sub> ], the o	xidation state of nickel is		[AIEEE-03]
	(1) +1	(2) +2	(3) –1	(4) 0	
5.	The oxidation state of (	Cr in [Cr(NH <sub>3</sub> ) <sub>4</sub> Cl <sub>2</sub> ]+ is -			[AIEEE-05]
	(1) +2	(2) +3	(3) 0	(4) +1	
6.	The oxidation state of	chromium in the final prod	duct formed by the reaction	on between Kl	and acidified
	potassium dichromate s	solution is -			[AIEEE-05]
	(1) +6	(2) +4	(3) +3	(4) +2	
7.	Which of the following	chemical reaction depicts th	he oxidizing behaviour of l	H <sub>2</sub> SO <sub>4</sub> ?	[AIEEE-06]
	(1) Ca(OH) <sub>2</sub> + H <sub>2</sub> SO <sub>4</sub> -	$\rightarrow$ CaSO <sub>4</sub> + 2H <sub>2</sub> O			
	(2) NaCl + $H_2SO_4 \rightarrow I$	NaHSO <sub>4</sub> + HCl			
	(3) $2PCl_5 + H_2SO_4 \rightarrow$	$2POCl_3 + 2HCl + SO_2Cl_2$			
	(4) $2HI + H_2SO_4 \rightarrow I_2$	$+ SO_2 + 2H_2O$			
	<b>_</b>	-			

PREVIOUS YEARS QUESTIONS				ANSWER KEY					EXERCISE -5[A]
	Que.	1	2	3	4	5	6	7	
	Ans	3	4	1	2	2	3	4	

# EXERCISE-05 [B]

1.	The oxidation number o	f phosphorus in Ba(H <sub>2</sub> PO	$_{2})_{2}$ is :		[JEE 1990]
~	(A) +3	(B) +2	(C) + 1	(D) –1	
2.	The number of electrons $NO_3^- + 4H^+ + e^- \rightarrow 2$	to balance the following $2H_2O + NO$ is	equation :-		[JEE 1991]
	(A) 5	(B) 4	(C) 3	(D) 2	
3.	What is the volume stren	ngth of 1.5 N $H_2O_2$ :			[JEE 1991]
	(A) 4.8	(B) 8.4	(C) 3.0	(D) 8.0	
4.	The oxidation states of t	he most electronegative e	element in the products of	the reaction	of BaO <sub>2</sub> with
	dilute $H_2SO_4$ .				[JEE 1991]
	(A) 0 and -1	(B) $-1$ and $-2$	(C) –2 and 0	(D) -2 and +	-2
5.	For the redox reaction, $MnO_4^- + C_2O_4^{2-} + H^2$	$^{+} \rightarrow \mathrm{Mn}^{2+} + \mathrm{CO}_2 + \mathrm{H}_2\mathrm{O}$			[JEE 1992]
	the correct coefficients c	of the reactants for the ba	lanced reaction are :		
	$MnO_4^-$	$C_2 O_4^{2-}$	$H^+$		
	(A) 2	5	16		
	(B) 16	5	2		
	(C) 5	16	2		
	(D) 2	16	5		
6.	The number of mole of k	KMnO, that will need to re	act completely with one m	ole ferrous o	kalate in acidic
	solution is :	4			[JEE 1997]
	(A) 2/5	(B) 3/5	(C) 4/5	(D) 1	
7.	The number of mole of K	MnO, that will be needed	to react with one mole of s	ulphite ion in	acidic solution
	is :	4		- <b>F</b>	[JEE 1997]
	(A) 2/5	(B) 3/5	(C) 4/5	(D) 1	
8.	The equivalent mass of 1	MnSO, is half its molecula	ar mass when it is convert	ted to :	[JEE 1998]
	(A) $Mn_0O_0$	(B) $MnO_{\alpha}$	(C) $MnO_4^-$	(D) $MnQ_{4}^{2-}$	[0== 1770]
9.	The oxidation number of	f sulphur in S., S.F. and	H.S respectively are :	(-,4	[JEE 1999]
	(A) $0, \pm 1$ and $-2$		(B) $+2$ , $+1$ and $-2$		
	(C) 0, $\pm 1$ and $\pm 2$		(D) $-2$ +1 and $-2$		
10	The normality of 0.3 M	phosphorus acid (H PO )	is :		[JEE 1999]
10.	(A) 0 1	(B) 0.9	(C) 0 3	(D) 0.6	
11	Among the following spe	cies in which oxidation s	tate of the element is $+6$	(D) 0.0	LIFE 20001
	(A) $Mn\Omega_{-}^{-}$	(B) $Cr(CN)$ . <sup>3–</sup>	(C) NiF $_{-}^{2-}$	$(D) CrO_{2}Cl_{2}$	
12	Ovidation number of iro	n in Na $[Fe(CN) \ NO^{\oplus}]$ is	· · ·	(B) 0102012	LIFE 2001]
12.	$(\Delta) + 2$	(R) + 3	· · · · · · · · · · · · · · · · · · ·	(D) none of	these
13	$\Delta n$ aqueous solution of 6	3 a of ovalic acid dibudrat	ta is mada unto 250 ml - 1	(D) none or	f = 0 + 1 = N = OH
10.	required to completely p	outralise 10 mL of this se	olution is :		
	$(\Lambda) 10 \text{ mJ}$	(B) 20 ml	(C) 10  mJ	(D) 4 mI	
14	(A) 40 IIIL How many males of also	(D) 20 IIIL	(C) 10 IIIL	(D) 4 IIIL	[IEE 2002]
17.	Thow many moles of elec		6.023	1	[322 2002]
	(A) 6.023 Y 10 <sup>23</sup>	(B) $\frac{1}{9.108} \times 10^{31}$	(C) $\frac{0.023}{9.108} \times 10^{54}$	(D) $\frac{1}{9.108 \times 100}$	$\frac{10^{8}}{6.023} \times 10^{8}$
15.	Which has maximum nu	mber of atoms :	2.100	9.100 X	[JEE 2003]
-	(A) 24 g of C (12)	(B) 56 g of Fe (56)	(C) 27 g of Al (27)	(D) 108 a of	Ag (108)
16.	In basic medium I oxidis	ses by MnO, . In this pro	cess I replaces by :	, , , , , , , , , , , , , , , , , , , ,	[JEE 2004]
	(A) $IO_{2}^{-}$	(B) I <sub>0</sub>	(C) IQ	(D) IO <sup>-</sup>	<b>-</b> 001]
	(-, 103		(0,104	(2)10	

- 17. Amongst the following, the pair having both the metals in their highest oxidation state is :[JEE 2004] (A)  $[Fe(CN)_{6}]^{3-}$  and  $[Co(CN)_{6}]^{3-}$ (B)  $[CrO_2Cl_2]$  and  $[MnO_4^{-}]$ (C)  $TiO_2$  and  $MnO_2$
- 18.  $O_3$  does not oxidise : (A) KI

- (D)  $[MnCl_{4}]^{2-}$  and  $[NiF_{6}]^{-2}$
- [JEE 2005]

(C) KMnO<sub>4</sub>

(D)  $K_2MnO_4$ 

19. A 5.0 cm<sup>3</sup> solution of H<sub>2</sub>O<sub>2</sub> liberates 0.508 g of iodine from an acidified KI solution. Calculate the strength [JEE' 1995] of  $H_2O_2$  solution in terms of volume strength at STP.

(B) FeSO₄

- A 3.00 g sample containing Fe<sub>3</sub>O<sub>4</sub>, Fe<sub>2</sub>O<sub>3</sub> and an inert impure substance, is treated with excess of KI solution 20. in presence of dilute  $H_2SO_4$ . The entire iron is converted into Fe<sup>2+</sup> along with the liberation of iodine. The resulting solution is diluted to 100 mL. A 20 mL of the diluted solution require 11 mL of 0.5 M Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> solution to reduce the iodine present. A 50 mL of diluted solution after complete extraction of the iodine requires 12.80 mL of 0.25 KMnO<sub>4</sub> solution in dilute  $H_2SO_4$  medium for the oxidation of Fe<sup>2+</sup>. Calculate the percentages of  $Fe_2O_3$  and  $Fe_3O_4$  in the original sample. [JEE 2000]
- 21. One litre of a mixture of O2 and O3 at NTP was allowed to react with an excess of acidified solution of KI. The lodine liberated required 40 mL of M/10 sodium thiosulphate solution for titration. What is the percent of ozone in the mixture ? Ultraviolet radiation of wavelength 300 nm can decompose ozone. Assuming that one photon can decompose one ozone molecule, how many photons would have been required for the complete decomposition of ozone in the original mixture? [JEE 97,5]
- A sample of hard water contains 96 ppm of  $SO_4^{2-}$  and 183 ppm of  $HCO_3^{-}$ , with  $Ca^{2+}$  as the only cation. 22. How many moles of CaO will be required to remove HCO3 from 1000 kg of this water? If 1000 kg of this water is treated with the amount of CaO calculate above, what will be the concentration (in ppm) of residual Ca<sup>2+</sup> ions (Assume CaCO<sub>3</sub> to be completely insoluble in water)? If the Ca<sup>2+</sup> ions in one litre of the treated water are completely exchanged with hydrogen ions, what will be its pH (one ppm means one [JEE' 1997] part of the substance in one million part of water, weight / weights)?
- 23. An aqueous solution containing 0.10 g KIO<sub>3</sub> (formula wt. 214.0) was treated with an excess of KI solution. The solution was acidified with HCl. The liberated I2 consumed 45.0 mL of thiosulphate solution to decolourise the blue starch – iodine complex. Calculate the molarity of the sodium thiosulphate solution.[JEE 1998]
- 24. How many millilitre of 0.5 M H<sub>2</sub>SO<sub>4</sub> are needed to dissolve 0.5 g of copper II carbonate ?[JEE 1999]
- Hydrogen peroxide solution (20 mL) reacts quantitatively with a solution of KMnO4 (20 mL) acidified with 25. dilute H<sub>2</sub>SO<sub>4</sub>. The same volume of KMnO<sub>4</sub> solution is just decolorized by 10 mL of MnSO<sub>4</sub> in neutral medium simultaneously forming a dark brown precipitate of hydrated MnO<sub>2</sub>. The brown precipitate is dissolved in 10 mL of 0.2 M sodium oxalate under boiling condition in the presence of dilute  $H_2SO_4$ . Write the balanced equations involved in the reactions and calculate the molarity of H<sub>2</sub>O<sub>2</sub>. [JEE 2001]

PREVIOUS YEARS QUESTIONS							ANSWER KEY					EXERCISE -5[B]			
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	С	С	В	В	А	В	А	В	А	D	D	А	А	D	А
Que.	16	17	18												
Ans.	А	В	С												
19.	4.48							20.	Fe <sub>2</sub> O3	<sub>3</sub> = 49.3	33 %, Fe	$e_{3}O_{4} = 3$	4.8%		
21.	6.57%	O <sub>3</sub> (by	weight),	1.2Ч10	) <sup>21</sup> photo	ons		22.	1.5, 40  ppm, pH = 2.6989						
23.	0.0623 M							24.	8.097 mL						
25.	0.1 M														