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## CHEMISTRY

## BOOKS - CENGAGE CHEMISTRY (ENGLISH)

## STOICHIOMETRY

## Solved Examples

1. $\mathrm{H}_{2} \mathrm{SO}$ acts as
(i). An acid.
(ii) An oxidising agent

A dehydrating agent
Select equations from rthe following which explain each type
(a) $5 \mathrm{H}_{2} \mathrm{SO}_{4}$ (conc) $+4 \mathrm{Zn} \rightarrow 4 \mathrm{Zn}^{2+}+\mathrm{H}_{2} \mathrm{~S}+4 \mathrm{SO}_{4}^{2-}+4 \mathrm{H}_{2} \mathrm{O}$
(b) $\mathrm{H}_{2} \mathrm{SO}_{4}($ dil $)+\mathrm{Zn} \rightarrow \mathrm{Zn}^{2+}+\mathrm{H}_{2}+\mathrm{SO}_{4}^{2-}$
(c) $\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{6} \xrightarrow{\mathrm{H}_{2} \mathrm{SO}_{4}(\text { conc })} 6 \mathrm{C}+6 \mathrm{H}_{2} \mathrm{O}$
(d) $\mathrm{H}_{2} \mathrm{SO}_{4}($ dil $)+\mathrm{ZnCO}_{3} \rightarrow \mathrm{Zn}^{2+}+\mathrm{CO}_{2}+\mathrm{SO}_{4}^{2-}+\mathrm{H}_{2} \mathrm{O}$.

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2. (a) NaBr on reaction with conc $\mathrm{H}_{2} \mathrm{SO}_{4}$ gives $\mathrm{SO}_{2}, \mathrm{HBr}$, and $\mathrm{Br}_{2}$, whereas NaCl with conc $\mathrm{H}_{2} \mathrm{SO}_{4}$ gives HCl but no $\mathrm{Cl}_{2}$ or $\mathrm{SO}_{2}$ is produced. Explain ?
(b) Which of the following reactions occur ?
(i) $\mathrm{Br}_{2}+2 \mathrm{NaC}<o \mathrm{Cl}_{2}+\mathrm{NaBr}$
(ii) $\mathrm{Cl}_{2}+\mathrm{NaBr} \rightarrow \mathrm{Br}_{2}+2 \mathrm{NaCl}$

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3. Which of the following is correct ?

Aqueous solution of $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ on reaction with $\mathrm{Cl}_{2}$ gives ?
(a) $\mathrm{Na}_{2} \mathrm{~S}_{4} \mathrm{O}_{6}$
(b) $\mathrm{NaHSO}_{4}$
(c) NaCl
(d) NaOH
4. Complete and balance the followig equations in basic solution :

$$
\mathrm{Hg}_{2}(\mathrm{CN})_{2}+\mathrm{Ce}^{4+} \rightarrow \mathrm{CO}_{3}^{2-}+\mathrm{NO}_{3}^{\ominus}+\mathrm{Hg}(\mathrm{OH})_{2}+\mathrm{Ce}^{3+}
$$

(a) By considering C in +4 oxidation state and N in +5 oxidation state.
(b) By considering C in +4 oxidation state and N in +5 oxidation state
(c) By considering Hg in +2 and C in +4 oxidation state.
(d) Explain why the same result is obtained regardless of the choice of oxidation state.

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5. Complete and balance the followig equations:
$\mathrm{P}_{4} \mathrm{~S}_{6}+\mathrm{H}^{\oplus}+\mathrm{NO}_{3}^{\ominus} \rightarrow \mathrm{NO}+\mathrm{H}_{3} \mathrm{PO}_{4}+\mathrm{SO}_{2}+\mathrm{H}_{2} \mathrm{O}$

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6. $B r_{2}$ undergoes disproportionation reaction in basic medium to give $\mathrm{Br}^{\ominus}$ ion and $\mathrm{BrO}_{3}^{\ominus}$ (bromate) ion in reduction and oxidation reaction.
7. $P_{4}$ undergoes disproportionation in basic medium to give $P H_{3}$ (phosphine) and $\mathrm{H}_{2} \mathrm{PO}^{\ominus}$ (dihydrogen hypophoshite ion). Atomic weight of P is 31 .

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8. What volume of $0.1 \mathrm{M} \mathrm{KMnO}_{4}$ is required to oxidise 100 " mL of " 0.2 M FeSO 44 in acidic medium ? The reaction involved is

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9. What volume of $0.2 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is required to oxidise 50 mL of " $0.3 \mathrm{M} \mathrm{Na}{ }_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ in acidic medium?

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10. 5 mL solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ liberates 1.27 g of iodine from an acidified KI solution. What is the molarity of $\mathrm{H}_{2} \mathrm{O}_{2}$ ?

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11. How many moles of $\mathrm{KMnO}_{4}$ will be required to react completely with 1 " mol of " $\mathrm{K}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ (potassium oxalate) in acidic medium?

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12. How many moles of $\mathrm{H}_{2} \mathrm{O}_{2}$ will be requried to react completely with 1.5
" mol of " $\mathrm{K}\left[\mathrm{Cr}(\mathrm{OH})_{4}\right]$ (potassium tetrahydroxochromate (I)) in basic medium?

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13. The total volume of $0.1 \mathrm{MKMnO}_{4}$ solution that are needed to oxidize 100mg each of ferrius oxalate and ferrous sulphate in a mixture in acidic
medium is:

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14. How many moles of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ are required to reduce 2 " mol of " $\mathrm{KMnO}_{4}$ in acidic medium?

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15. 100 " mL of " $\mathrm{x} \mathrm{M} \mathrm{KMnO}_{4}$ is requried oxidise 200 " mL of " 0.2 M ferric oxalate in acidic medium what is the normality of $\mathrm{KMnO}_{4}$ ?

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16. What volume of $0.2 \mathrm{~N} \mathrm{KMnO}_{4}$ is required to oxidise 10 mg of " ferrous oxalate in acidic medium? (Molecular Weight of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ is 144 g )
17. What volume of $0.1 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is required to oxidise 50 mL of " 0.2 M $C u_{2} S$ (cuprous sulphide) in acidic medium to give $\mathrm{Cr}^{3+}, \mathrm{Cr}^{2+}$, and $\mathrm{SO}_{2}(\mathrm{~g})$ ?

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18. How many moles of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required to react completely with 1 mol of $H_{2} S$ in acidic medium?

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19. What weight of $\mathrm{KmNO}_{4}$ is required to react completely with 500 mL of 0.4 M Cus in acidic medium?

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20. Calculate the volume of $0.5 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$ required to dissolve 0.5 g of copper (II) carbonate $\left(\mathrm{CuCO}_{3}\right)$.

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21. In a chrome plating plant, $\mathrm{CrO}_{4}^{2-}$ (chromate) ions are present in waste water. The chromate ions are reduced to insoluble chromium hydroxide, $\mathrm{Cr}(\mathrm{OH})_{3}$, by dithionate ion, $\mathrm{S}_{2} \mathrm{O}_{4}^{2-}$ in basic medium.
$\mathrm{CrO} \mathrm{O}_{4}^{2-}+\mathrm{S}_{2} \mathrm{O}_{4}^{2-}+\stackrel{\ominus}{\mathrm{O}} \mathrm{H}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Cr}_{2}\left(\mathrm{OH}_{3}\right)+\mathrm{SO}_{3}^{2-} 10 \mathrm{~L}$ of water requires 522 g of $\mathrm{Na}_{2} \mathrm{~S}+2 \mathrm{O}_{4}$. Calculate the normality and molarity of $\mathrm{CrO}_{4}^{2-}$ in waste water. .

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22. Metalic $\operatorname{tin}(\mathrm{Sn})$ is oxidised to its maximum oxidation state by $\mathrm{KMnO}_{4}$ and $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ separately in the presence of HCl . Calculate the ratios of the volumes of decimolar solutions of $\mathrm{KMnO}_{4}$ and $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ that would be reduced by 1.0 g of Sn (Atomic weight of $S n=118.6$ ).

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23. Upon heating 1 L of 2 N HCl solution, 36.5 g of HCl is lost and the volume of solution resuces to 800 mL . Calculate . (a). The normality of the resultant solution.

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24. How many moles of $\mathrm{HgI}_{4}^{2-}$ will be formed when 1 l mol of " $\mathrm{Hg}^{2+}$ and $1 \mathrm{~mol} I^{\ominus}$ react according to the following equation?
$\mathrm{Hg}^{2+}+4 \mathrm{I}^{\ominus} \rightarrow \mathrm{HgI}_{4}^{2-}$
(a). 1 mol
(b). 0.5 mol
(c). 0.25 mol
(d). 2 mol

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25.80 mmL of " $\mathrm{KMnO}_{4}$ solution reacts with 3.4 g of $\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4.2} \mathrm{H}_{2} \mathrm{O}$ in acidic medium. The molarity of the $\mathrm{KMnO}_{4}$ solution is.
(a). 0.5 M
(b). 0.1 M
(c). 5 M
(d). 1M

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26. What weight of $\mathrm{NaHSO}_{3}$ is required to react with 100 mL of " solution containing 0.33 g of $\mathrm{NaIO}_{3}$ according to the following reaction:
$\mathrm{IO}_{3}^{\ominus}+\mathrm{HSO}_{3}^{\ominus} \rightarrow I^{\ominus}+\mathrm{SO}_{3}^{2-}$
(a). $0.52 g$
(b). $5.2 g$
(c). $1.04 g$
(d). $10.4 g$
27. KI reacts with $\mathrm{H}_{2} \mathrm{SO}_{4}$ producing $I_{2}$ and $H_{2} S$. The volume of 0.2 M $\mathrm{H}_{2} \mathrm{SO}_{4}$ required to produce 0.1 mol of $\mathrm{H}_{2} \mathrm{~S}$ is
(a). 2.5 L
(b). 3.8 L
(c). 4 L
(d). 5 L

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28. It requires 40.0 mL of $0.50 \mathrm{MCe} \mathrm{e}^{4+}$ to titrate 10.0 mL of $1.0 \mathrm{MSn}^{2+} \mathrm{toSn}^{4+}$. What is the oxidation state of cerium in the reduced product?

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29. Calculate the weight of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required to produce from excess oxalic acid $\left(\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}\right), 8.2 \mathrm{~L}$
$\mathrm{CO}_{2}$ at $127^{2}$ and 1.0 atm pressure?
30. $0.5 \mathrm{~g} \mathrm{CaBr} r_{2}$ was dissolved in water and the solution is acidified with nitric acid, 50 " mL of " standard $0.1{\mathrm{~N} \mathrm{AgNO}_{3} \text { is added and the solution }}^{2}$ is shaken thoroughly, the remaining $A g^{\oplus}$ ions required 15 " mL of " 0.1 N $\mathrm{NH}_{4} \mathrm{CNS}$ solution using ferric alum as the indicator. Calculate the percentage of $\mathrm{CaBr}_{2}$ in the sample.

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31. 4 " mol of "a solution $A^{n+}$ requires 1.6 " mol of " $\mathrm{MnO}_{4}^{-}$ions for the oxidation of $A^{n+}$ to $A O_{3}^{\theta}$ in acidic medium the value of n is (a). 1
(b). 2.
(c). 3 .
(d). 4.
32.50 mLL of " an acidic solution of $0.255 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}, 30$ " mL of " 0.4 M $K_{2} C_{2} O_{4}$, and 120 mL of " 0.2 M Fe 2+ are added together. Compute the molarities of $\mathrm{Fe}^{3+}$ ions and $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$ ions in the final solution.

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33. When 100 mL of " $0.06 \mathrm{M} \mathrm{Fe}\left(\mathrm{NO}_{3}\right)_{3}, 50 \mathrm{~mL}$ of $0.2 \mathrm{MFeCl}_{3}$ and 100 mL of $0.26 \mathrm{M} \mathrm{Mg}\left(\mathrm{NO}_{3}\right)_{2}$, are mixed In the final solution.....
$\left[F e^{3+}\right]=\ldots$.
$\left[\mathrm{NO}_{3}^{\ominus}\right]=\ldots .$.
$\left[C l^{\ominus}\right]=. . . .$.
$\left[M g^{2+}\right]=\ldots . . .$.

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34. Calculate the concentration of $K^{\oplus}(\mathrm{x})$ and $C l^{\ominus}(\mathrm{y})$ in a solution obtained by mixing 20 " mL of " $0.1 \mathrm{M} \mathrm{NaCl}, 30 \mathrm{~mL}$ of " 0.2 M KCl , and 25 " mL of " $0.15 \mathrm{M} \mathrm{KNO}_{3}$ and making the solution up to 100 mL .
(a). $x=0.06, y=0.0375$
(b). $x=0.0975, y=0.08$
(c). $x=0.08, y=0.08$
(d). $x=0.08, y=0.0375$

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35. 250 m mL of " x M solution and 500 mL of " $\mathrm{y} M$ solution of a solute are mixed and diluted to 2 L to produce a final concentration of 1.6 M . If $x: y=5: 4$, calculate x and y.

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36. What is the normality of a solution that results from mixing 7.4 g of $\mathrm{Ca}(\mathrm{OH})_{2}, 500 \mathrm{~m} \mathrm{~mL}$ of " $1 \mathrm{MHNO}_{3}$ and 10.0 mL of $\mathrm{H}_{2} \mathrm{SO}_{4}$ (specific gravity $=1.2,49 \% \mathrm{H}_{2} \mathrm{SO}_{4}$ by weight)?

The total volume of the solution was made to 1 L after adding water?
37. How many grams of borax $\left(\mathrm{Na}_{2} \mathrm{~B}_{4} \mathrm{O}_{7.10} \mathrm{H}_{2} \mathrm{O}\right)$ are required to neutralise 25 " mL of " 0.2 M HCl and $\mathrm{H}_{2} \mathrm{SO}_{4}$ separately?

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38. 1.0 g of a metal oxide gave 0.2 g of metal. Calculate the equivalent weight of the metal.

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39.3 .0 g of metal chloride gave 2.0 g of metal. Calculate the equivalent weight of the metal.

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40. 1.0 g of metal nitrate gave 0.86 g of metal sulphate. Calculate equivalent weight of metal.

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41. Calculate (a) normality (b) molarity (c) strength in $g L^{-1}$ and (d) percentage strength of 10 volume strength of $\mathrm{H}_{2} \mathrm{O}$

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42. Calculate the number of moles and weight of $O_{2}$ produced on heating
1.12 L of 10 volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ at STP.

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43. 10 " mL of " $\mathrm{H}_{2} \mathrm{O}_{2}$ liberates 12.7 g of iodine form an acidic KI solution.

Calculate the normality

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44. A solution of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ containing $4.9 \mathrm{~g} L^{-1}$ is used to titrate $\mathrm{H}_{2} \mathrm{O}_{2}$ solution containing $3.4 g L^{-1}$ in acidic medium. What volume of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ will be required to react with 20 " mL of " $\mathrm{H}_{2} \mathrm{O}_{2}$ solution? Also calculate the strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ in terms of available oxygen.

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45. When 25 kl of " an aqueous solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ is titrated with an excess of KI solution in dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$, the liberated $I_{2}$ required 20 mL of " $0.3 \mathrm{NNa} a_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution for complete reaction.volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution.

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46. Calculate the volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution if 50 mL of " this diluted solution required 40 mL of " $\frac{M}{60} K_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution in presence of $\mathrm{H}_{2} \mathrm{SO}_{4}$ for complete reaction.
47. 50 " mL of " ozone $\left(\mathrm{O}_{3}\right)$ at STP were passed through 50 mL of " 5 volume $\mathrm{H}_{2} \mathrm{O}_{2}$ solution. What is the volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ after the reaction?

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48. 5.1 g sample of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution containg $x \mathrm{H}_{2} \mathrm{O}_{2}$ by weight requires x " mL of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution for complete oxidation under acidic condition. What is the molarity of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution?

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49. 200 m mL of " acidified $3 \mathrm{~N} \mathrm{H}_{2} \mathrm{O}_{2}$ is reacted with $\mathrm{KMnO}_{4}$ solution till there is a light tinge of purple colour. Calculate the volume of $O_{2}$ produced at STP.
50. 0.71 g of a sample of bleaching powder $\left(\mathrm{CaOCl}_{2}\right)$ is dissolved in 100 " mL of " water. 50 mLL of " this solution is titrated with KI solution. The $I_{2}$ so liberated required $10 \mathrm{~mL} 0.1 \mathrm{M} \mathrm{Na} a_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ (hypo) solution in acidic medium for complete neutralisation. Calculate the percentage of available $C l_{2}$ from the sample of bleaching power.

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51. 0.5 g sample of copper ore is converted into $\mathrm{CuSO}_{4}$ solution. The resulting solution is acidified with dilute $\mathrm{CH}_{3} \mathrm{COOH}$ (acetic acid) and excess KI added. The liberated $\mathrm{I}_{2}$ required $0.248 \mathrm{~g} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3.5} \mathrm{H}_{2} \mathrm{O}$ for complete reaction. Calculate the percantage of Cu in the ore.

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52. 50.0 g sample of brass is dissolved in 1 L dil $\mathrm{H}_{2} \mathrm{SO}_{4.20} \mathrm{~mL}$ of this solution is mixed with KI , and the liberated $I_{2}$ required 20 " mL of " 0.5 M
hypo solution for titration calculate the amount of Cu in the alloy.

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53. Mercuric iodate $\left[\mathrm{Hg}_{5}\left(\mathrm{IO}_{6}\right)_{2}\right]$ reacts with a mixutre of KI and HCl

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54. 0.5 g of fuming sulphuric acid $\left(\mathrm{H}_{2} \mathrm{SO}_{4}+\mathrm{SO}_{3}\right)$, called oleum, is diluted with water. Thus solution completely neutralised 26.7 " mL of " 0.4 M NaOH . Find the percentage of free $\mathrm{SO}_{3}$ in the sample solution.

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55. 1.84 g of $\mathrm{CaCO}_{3}$ and $\mathrm{MgCO}_{3}$ were treated with 50 mL of 0.8 HCl solution. Calculate the percentage of $\mathrm{CaCO}_{3}$ and $\mathrm{MgCO}_{3}$.
56. 5.5 g of a mixutre of $\mathrm{FeSO}_{4.7} \mathrm{H}_{2} \mathrm{O}$ and $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3.9} \mathrm{H}_{2} \mathrm{O}$ requires 5.4 " mL of " $0.1 \mathrm{NKMnO}_{4}$ solution for complete oxidation. Calculate the number of gram moles of hydrated ferric sulphate in the mixture.

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57. 0.4 g of a mixutre containing sodium oxalate $\left(\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4}\right)$ and potassium oxalate requires 50 mLL of " $\frac{M}{60} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution in acidic medium for complete reaction. Calculate the percentage composition of the mixture.

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58.2.1 g of a mixture of $\mathrm{NaHCO}_{3}$ and $\mathrm{KCIO}_{3}$ required 100 " mL of " 0.1

HCl for complete reaction. Calculate the amount of residue that would be obtained on heating 2.2 g of the same mixture strongly.
59. The composition of a sample of Wustite is $\mathrm{Fe}_{0.93} \mathrm{O}_{1.00}$. What percentage of the iron is present in the form of $F e(I I I)$ ?

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60. 1.67 g mixture of Al and Zn was completely dissolved in acid and evolved 1.69 L of $H_{2}$ at STP. Calculate the weight Al and Zn in the mixture.

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61. A mixture of FeO and $\mathrm{Fe}_{3} \mathrm{O}_{4}$ when heated in air to a constant weight, gains $5 \%$ of its weight. Find the composition of the intial mixutre.

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62. A mixture of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and HCOOH is heated with conc $\mathrm{H}_{2} \mathrm{SO}_{4}$. The gas produced is collected and on treatment with KOH solution, the
volume of the gas decreases by $\frac{1}{6}$ calculate the molar ratio of the two acids in the original mixture.

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63. 2.0 g of mixure of $\mathrm{Na}_{2} \mathrm{CO}_{3}, \mathrm{NaHCO}_{3}$, and NaCl on heating produced 56 " mL of " $\mathrm{CO}_{2}$ at STP. 1.6 g of the same mixture required 25 " mL of " 0.5 M $\mathrm{H}_{2} \mathrm{SO}_{4}$ for complete neutralisation. Calculate the percentage of each component present in the mixture.

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64. 500 mL of " $1.0 \mathrm{M} \mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$, 100 mL of " $2.0 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{4}$, and 40 g of

NaOH are mixed together, 30 mL of " the above mixture is titrated against a standard solution of sodium carbonate containing 14.3 g of
$\mathrm{Na}_{2} \mathrm{CO}_{3.10} \mathrm{H}_{2} \mathrm{O}$ per 100 mL of " solution. Find the volume of carbonate solution used for complete neutralisation.
65. One litre of mixture of $O_{2}$ and $O_{3}$ at STP was allowed to react with an excess of acidified solution of KI . The iodine liberated required 40 mL of " $\frac{M}{10}$ sodium thiosulphate solution for titration. What is the mass per cent 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 complete decomposition of ozone in the original mixture?

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66. 3 L mixture of propane and butane on complete combustion at 298 K gave 10 LCO 2 Calculate the compostion of the gas mixture.

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67. Calculate the percentage composition of a solution obtained by mixing 200 g of a $20 \%$ and 300 g of a $30 \%$ solution by weight.
68. 3.75 g of a mixture of $\mathrm{CaCO}_{3}$ and $\mathrm{MgCO}_{3}$ is dissolved in 1 L of 0.1 M HCl to liberate 0.04 " mol of " $\mathrm{CO}_{2}$. Calculate
(a). The percentage of each compound in the mixture.
(b). The amound of acid used.
(c). The amound of acid left after the reaction.

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69. 1.5 g of chalk was treated with 10 mL of " 4 N HCl . The chalk was dissolved and the solution was made to 100 mL .25 " mL of " this solution required 18.75 " mL of " 0.2 N NaOH solution for comjplete neutralisation.

Calculate the percentage of pure $\mathrm{CaCO}_{3}$ in the sample of chalk.

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70. 10 g of a mixture of $C u_{2} S$ and Cus was titrated with 200 mL of " 0.75 M $\mathrm{MnO}_{4}^{\ominus}$ in acidic medium producing $\mathrm{SO}_{2}, \mathrm{Cu}^{2+}$, and $\mathrm{Mn}^{2+}$. The $\mathrm{SO}_{2}$ was boiled off and the excess of $M n O_{4}^{\ominus}$ was titrated with 175 mL of " $1 \mathrm{MFe}^{2+}$ solution. Find the percentage of CuS the in original mixture.

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71. Hydroxylamine reduces $\mathrm{Fe}^{3+}$ accoeding to the following reaction:
$2 \mathrm{NH}_{2} \mathrm{OH}+4 \mathrm{Fe}^{3+} \rightarrow \mathrm{H}_{2} \mathrm{O}+4 \mathrm{Fe}^{2+}+4 \mathrm{H}^{\oplus}+\mathrm{N}_{2} \mathrm{O}$
$\mathrm{Fe}^{2+}$ produced is is estimated by titration with $\mathrm{KMnO}_{4}$ solution A 10 mL sample of $\mathrm{NH}_{2} \mathrm{OH}$ is diluted to 1000 mL .50 mL of " this diluted sample is boiled with excess of Fe (III) solution. The resulting solution required 12 " mL of " $0.02 \mathrm{M} \mathrm{KMnO}_{4}$ for complete oxidation. Determine the strength of $\mathrm{NH}_{2} \mathrm{OH}$.

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72. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was added to a sample of $\mathrm{SeO}_{3}^{2-}$, The bromine evolved was removed and the excess of $\mathrm{KBrO}_{3}$ was titrated with 5.1 " mL of " $\frac{M}{25}$ solution of $\mathrm{NaAsO}_{2}$. Calculate the amound of $\mathrm{SeO}_{3}^{2-}$ and balance the equation.
$\mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-} \mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O}$
$\mathrm{BrO}_{3}^{\ominus}+\mathrm{AsO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus}$
$(B r=80, K=39, A s=75, S e=79)$

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73.30 " mL of " a solution containing $9.15 g L^{-1}$
of an oxalate $K_{x} H_{y}\left(\mathrm{C}_{2} \mathrm{O}_{4}\right)_{2} . n \mathrm{H}_{2} \mathrm{O}$ required for titration 27 " mL of " 0.12 N NaOH and 36 " mL of " $0.12 \mathrm{~N} \mathrm{KMnO}_{4}$ for oxidation Find $\mathrm{x}, \mathrm{y}, \mathrm{z}$. and n .

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74. The neutralisation of a 1.20 g solution of a mixture of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4.2} \mathrm{H}_{2} \mathrm{O}$ and $\mathrm{KHC}_{2} \mathrm{O}_{4}$. $\mathrm{H}_{2} \mathrm{O}$ and different impurities of a neutral salt consumed
37.80 " mL of " 0.25 N NaOH solution. On the other hand, on titration with $\mathrm{KMnO}_{4}$ for 0.40 g of the same substance, 43.10 mL of " 0.125 N $\mathrm{KMnO}_{4}$ was required. Find the percentage composition of the substance being analysed.

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75. An equal volume of reducing agent is titrated separately with $1 \mathrm{MKMnO}_{4}$ in acid, neutral and alkaline medium. The volumes of $\mathrm{KMnO}_{4}$ required are $20 \mathrm{~mL}, 33.3 m L$ and 100 mL in acid, neutral and alkaline medium respectively. Find out oxidation state of $M n$ in each reaction product. Give balance equation. Find the volume of $1 \mathrm{MK}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ consumed if same volume of reductant is titrated in acid medium.

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76. A sample of pyrolusite $\left(\mathrm{MnO}_{2}\right)$ weighs 0.5 g . To its solution, 0.6674 g of $\mathrm{As}_{2} \mathrm{O}_{3}$ and dilute, acid are added. After the reaction has ceased,
arsenic $\left(A s^{3+}\right)$ in $A s_{2} O_{3}$ is titrated with $45 m L$ of $\frac{M}{50} K M n O_{4}$ solution. Calculate the percentage of $\mathrm{MnO}_{2}$ in pyrolusite. (Atomic weight of As is 74.9 and that of Mn is 55 .)

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77. 0.6 g of a sample of pyrolusite was boiled with 200 mL of " $\frac{N}{10}$ oxalic acid and excess of dilute sulphuric acid. The liquid was filtered and the residue washed. The filtrate and washing were mixed and made up to 500 mL in a measuring flask. 100 mL of "this solution required 50 mL of " $\frac{\mathrm{N}}{30} \mathrm{KMnO}_{4}$ solution. Calculate the percentage of $\mathrm{MnO}_{2}$ in the sample ( $M n=55$ ).

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78. 1.5 g of a mixture containing $\mathrm{As}_{2} \mathrm{O}_{5}, \mathrm{Na}_{2} \mathrm{HAsO}_{3}$, and some inert impurities is dissolved in water, and the solution is kept neutral by adding excess of $\mathrm{NaHCO}_{3}$. The solution when titrated with $0.1 \mathrm{M} \mathrm{I}_{2}$ required
35.0 nL of it for complete titration. The solution is then acidified and excess of KI is added to it. The $I_{2}$ liberated required 35.0 mL of $0.3 M N a_{2} S_{2} O_{3}$ solution for complete titration. Find the percentage composition of the mixture (Atomic mass of As is $75, \mathrm{Na}$ is 23 and O is 16.)

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79. To 100 " mL of " $\mathrm{KMnO}_{4}$ solution containing 0.632 g of $\mathrm{KMnO}_{4} 200$ " mL of " $\mathrm{SnCl}_{2}$ containing 2.4 g is added in presence of HCl . To the resulting solution, an excess of $\mathrm{HgCl}_{2}$ is added at once. How many grams of $\mathrm{Hg}_{2} \mathrm{Cl}_{2}$ will be precipitated? (molarcular mass of $\mathrm{KMnO}_{4}$ is 158 , $\mathrm{SnCl}_{2}$ is 95 , and $\mathrm{Hg}_{2} \mathrm{Cl}_{2}$ is $471 \mathrm{~g} \mathrm{~mol}^{-1}$ )

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80. 3.0 g of impure $\mathrm{Na}_{2} \mathrm{CO}_{3}$ is dissolved in water and the solution is made up to 250 mL . To 50 " mL of " this solution, 50 mL of " 0.1 N HCL is added and the mixture, after shaking well, required 10 " mL of " 0.16 N

NaOH solution for cojmplete neutralisation. Calculate the percentage purity of the sample of $\mathrm{Na}_{2} \mathrm{CO}_{3}$.

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81. 10 " mL of " a sample of phenol was diluted with $\mathrm{H}_{2} \mathrm{O}$ and made up to 1.0L. 20 " mL of " this solution was treted with 40 mL brominating solution (a mixture of $\mathrm{KBrO} \mathrm{O}_{3}$ and KBr ) in dil $\mathrm{H}_{2} \mathrm{SO}_{4}$. Excess of KI was added, and the liberated $I_{2}$ required 15 " mL of " $0.1 \mathrm{M} \mathrm{Na} \mathrm{N}_{2} S_{2} \mathrm{O}_{3}$ for complete reaction. 25 mmL of " the same brominating solution, on similar treatment required, 20 " mL of " $0.1 \mathrm{M} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$. Calculate the weight of phenol per litre of the original sample.

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82. 

1 " mol of "an organic compound (A) reacts with NaOH . How many moles of NaOH are required to react with (A)?

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83. A sample of pure aniline was dissolved in HCl and diluted to 100 mL with $\mathrm{H}_{2} \mathrm{O} .20 \mathrm{~mL}$ of " liquid was treated with 25 mL of " 0.017 M $\mathrm{KBrO}_{3}$ and about 10 g KBr was added to form $\mathrm{Br}_{2}$. After 10 min , an excess of KI was added and the liberated $I_{2}$ was titrated with 12.92 mL of " $0.12 \mathrm{M} \mathrm{Na} \mathrm{N}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$. Calculate the weight of aniline taken.

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84. In the reaction of Mohr's salt $\left[\mathrm{FeSO}_{4}\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4.6} \mathrm{H}_{2} \mathrm{O}\right]$ with oxalate ions in the presence of $\mathrm{H}_{2} \mathrm{O}_{2}$ and $\mathrm{H}^{\oplus}$ ions, $\left[\mathrm{Fe}\left(\mathrm{C}_{2} \mathrm{O}_{4}\right)_{3}\right]^{3-}$ ion is formed. Calculate the minimum mass of Mohr's salt and $K_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ required to prepare 10 g of $\mathrm{K}_{3} \mathrm{Fe}\left(\mathrm{C}_{2} \mathrm{O}_{4}\right)_{2}$.

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85. Calcium phoshide formed by reacting calcium orthophosphate with
$M g$ was hydrolysed by water. The phosphine evolved was burnt in air to yield $P_{2} O_{5}$. How many litres of air, containg $21 \%$ by volume of $O_{2}$, was required to burn $P H_{3}$ and how many grams of magnesium metaphosphate would be obtained if 204 g of Mg was was used for reducing calcium phosphide and the volumes of the gases were measured at STP?

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86. A mixutre of $\mathrm{Cu}, \mathrm{Fe}$, and Al was reacted with 13.33 g of NaOH . During chlorination with the same amount of meta mixture entered into reaction with 12.5 L of chlorine measured at STP, while for treating the same amound of the metal mixture at STP, while for treating the same amound of the metal mix mixutre
343.64 " mL of " HCl , havig a density of $.1 \mathrm{gmL}^{-1}$ and containing $10 \%$ by mass of HCl were required. Determine the mass percentage of the metals in the mixture.

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87. Perdisulphuric acid ( $\mathrm{H}_{2} \mathrm{~S}_{2} \mathrm{O}_{8}$ ) or Marshall's acid can be prepared by the electrolytic oxidation of $\mathrm{H}_{2} \mathrm{SO}_{4}$. AT anode $\mathrm{O}_{2}$ and $\mathrm{H}_{2}$ are obtained as side products. After passing a current of 0.5 A for a certain time, the volume of $\mathrm{H}_{2}$ and $\mathrm{O}_{2}$ collected was found to be 10.08 and 2.24 L , respectively, at STP. What is the weight of $\mathrm{H}_{2} \mathrm{~S}_{2} \mathrm{O}_{8}$ produced during the same time? Also find the duration of electrolysis (in seconds) assuming $75 \%$ efficiency of electronysis. Give all the electronde reaction.
88. 0.6 g of a sample of pyrolusite was boiled with 200 " mL of " $\frac{N}{10}$ oxalic acid and excess of dilute sulphuric acid. The liquid was filtered and the residue washed. The filtrate and washing were mixed and made up to 500 mL in a measuring flask. 100 mL of "this solution required 50 mL of " $\frac{\mathrm{N}}{30} \mathrm{KMnO}_{4}$ solution. Calculate the percentage of $\mathrm{MnO}_{2}$ in the sample ( $M n=55$ ).

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89.1.0 g $\mathrm{NaHSO}_{3}$ and $\mathrm{Na}_{2} \mathrm{SO}_{3}$ was dissolved in water to prepare a 200 mL solution. Two separate experiments were carried out.
(a). 25 mL of " sample was mixed with 25 mL of " $I_{2}$ solution and excess of $I_{2}$ left after the reaction with $\mathrm{NaHSO}_{3}$ and $\mathrm{Na}_{2} \mathrm{SO}_{3}$ was back titrated with $0.1002 \mathrm{~N} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}, 1.34 \mathrm{~mL}$ of " which was required ( 25 m mL of " $I_{2}$ solution is equivalent to 24.20 mL of " $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution).
(b). 50 m mL of " sample was oxidised to $\mathrm{Na}_{2} \mathrm{SO}_{4}$ by the action of $\mathrm{H}_{2} \mathrm{O}_{2}$,
$\mathrm{H}_{2} \mathrm{SO}_{4}$ sormed (from $\mathrm{NaHSO}_{3}$ ) was titrated with 22.3 " mL of " 0.1 N NaOH . Find percentage of $\mathrm{NaHSO}_{3}$ and $\mathrm{Na}_{2} \mathrm{SO}_{3}$ in the original sample.

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90. There are three acid-base indicators. Methyl orange (end point at $p H=4$ ), bromothymol blue (end point at $p H-7$ ), phenolphthalein (end point at $p H=9$ ). Which is the most suitable indicator for the following titrations?
(a). $\mathrm{H}_{2} \mathrm{SO}_{4}$ with KOH
(b). KCn with HCl
(c). $\mathrm{NH}_{3}$ with $\mathrm{HNO}_{3}$
(d). HF with NaOH

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91. 20 " mL of "x M HCl neutralises completely 10 " mL of " $0.1 \mathrm{M} \mathrm{NaHCO}_{3}$ solution and a further 5 " mL of " $0.2 \mathrm{M} \mathrm{Na} a_{2} \mathrm{CO}_{3}$ to methyl orange end point. What is the value of $x$ ?

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92. How many " mL of " 0.1 M HCl is required to react completely using phenolphthalein with 2.0 g mixture of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ containing equimolar amounts of two?

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93. One gram of a mixture of $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ and $\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ dissolved in water consumes in titration 50.28 " mL of " 0.1 N NaOH with phenolphthalein as indicator. If 1 g of the mixture is heated to constant weight, what would be the weight of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ produced?

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94. A mixutre solution of KOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ requires 15 " mL of " $\frac{N}{20} \mathrm{HCl}$ when titrated with phenolphthalein as indicator.But the same amoound
of the solutions when titrated with methyl orange as indicator requires 25 " mL of " the same acid. Calculate the amount of KOH present in the solution.

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95. 500 ml mL " a solution contains 2.65 g of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and 4 g of NaOH . 20 " mL of " this solution titrated each time against $\frac{\mathrm{N}}{10} \mathrm{H}_{2} \mathrm{SO}_{4}$. Find out the titre value if (a). Methyl orange is taken as an indicator
(b). Phenolphthalein is taken as indicator.

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96. A solution contains $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3} 20 \mathrm{~cm}^{3}$ of this solution required $5.0 \mathrm{~cm}^{3}$ of $0.1 \mathrm{M}_{2} \mathrm{SO}_{4}$ solution for neutralisation using phenolphthalein as an indicator. Methyl orange is then added when a further $5.0 \mathrm{~cm}^{3}$ of $0.2 \mathrm{MH}_{2} \mathrm{SO}_{4}$ was required. Calculate the masses of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ in 1 litre of this solution.
97. A sample of fuming $\mathrm{H}_{2} \mathrm{SO}_{4}$ contains $\mathrm{H}_{2} \mathrm{SO}_{4}, \mathrm{SO}_{3}$ and $\mathrm{SO}_{2} .2 .0 \mathrm{~g}$ of the above sample was dissolved in water to make a 500 mL solution. 50 " mL of " the above solution on titration in presence of methyl orange requires 42.4 " mL of " 0.1 N NaOH . On the other hand, 100 mL of "the same sample solution requires 1.85 mL of " 0.1 N of $I_{2}$ where $I_{2}$ is reduced to $I^{\theta}$ ions. Determine the percentage composition of oleum sample. (In methyl orange,
$\left.\mathrm{SO}_{2}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{H}_{2} \mathrm{SO}_{3} \xrightarrow{\mathrm{NaOH}} \mathrm{HSO}_{3}^{\ominus}\right)$

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98. 6.5 g mixture of sample containing $\mathrm{KOH}, \mathrm{NaOH}$, and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ was dissolved in $\mathrm{H}_{2} \mathrm{O}$ and the volume was made up to 250 mL .25 mL of " this solution requires 26.23 " mL of " $0.5 \mathrm{~N} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$ using methyl orange as indicator, and 19.5 " mL of " same $\mathrm{H}_{2} \mathrm{SO}_{4}$ using phenolphathalein as
indicator for complete neutralisation. Calculate the percentage of KOH , NaOH , and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ in the sample.

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99. A sample of hard water contains $1 \mathrm{mg} \mathrm{CaCl} l_{2}$ and $1 \mathrm{mg} \mathrm{MgCl} l_{2}$ per litre. Calculate the hardness of water in terms of $\mathrm{CaCO}_{3}$ present in per $10^{6}$ parts of water.
(a). 2.5 ppm
(b). 1.95 ppm
(c). 2.15 ppm
(d). 195 ppm

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100. A water sample is found to contain 96 ppm of $\mathrm{SO}_{4}^{2-}$ and 122 ppm of $\mathrm{HCO}+3^{\ominus}$ with $\mathrm{Ca}^{2}$ ion as the only cation.
(a). Calculate the ppm of $\mathrm{Ca}^{2+}$ in water.
101. Hardness of water is 200 ppm . The normality and molarity of $\mathrm{CaCO}_{3}$ in the water is
(a). $2 \times 10^{-6}\left(N, 2 \times 10^{-6} M\right.$
(b). $4 \times 10^{-2} N, 2 \times 10^{-2} M$
(c). $4 \times 10^{-3} N, 2 \times 10^{-3} M$
(d). $4 \times 10^{-1} N, 2 \times 10^{-1} M$

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102. A sample of hard water contains $122 p p m$ of $\mathrm{HCO}_{3}^{\ominus}$ ions,. What is the minimum weight of CaO required to remove ions completely from 1 kg of such water sample?

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103. Calculate the amount of lime and soda required for the softening of $10^{6} \mathrm{~L}$ of a sample of boiler feed water with the following data:
$\mathrm{CaCO}_{3}=1.4^{\circ}$ Clark, $\mathrm{MgCO}_{3}=0.56^{\circ}$ Clark, $\mathrm{CaSO}_{4}=0.42^{\circ}$ Clark, $M g S O_{4}=0.14^{\circ}$ Clark, $\mathrm{MgCl}_{2}=0.035^{\circ}$ Clark, and $\mathrm{NaCl}=0.035^{\circ}$ Clark.

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104. A 200 mL sample of hard water requires 33.0 " mL of " $0.01 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$ for complete neutralisation.

200 " mL of " the same sample was boiled with 15.0 " mL of " 0.1 M NaOH solution, filtered and made up to 200 mL again. This sample now requires 53.6 " mL of " $0.01 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$. Calculate Mg hardness.

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105. The hardness of $10^{5} \mathrm{~L}$ of a sample of $\mathrm{H}_{2} \mathrm{O}$ was completely removed by passing through a zeolite softener. The bed on exhaustion required

500 L of NaCl solution containing $15 g L^{-1}$ of NaCl for regeneration.
Calculate the hardness of the sample of water.

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106.50 " mL of " water on titration with standard soap solution gave the following results: Lather factor $=0.4 \mathrm{~mL}$, total hardness $(T H)=8.2 m L$, permanent hardness $(P H)=2.5 m L$ and standard hard water (containing $0.2 g \mathrm{CaCO}_{3} L^{-1}$ ) $=19.9 \mathrm{~mL}$. Calculate each type of hardness in ppm.

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107. A 50 mL sample of hard water containing $\mathrm{Ca}^{2+}$ and $\mathrm{Mg}^{2+}$ ions is titrated with 50 mL 0.005 M EDTA solution at $p H=10$, using eriochrome black-T indicator to reach equivalence point.

In an equal another amount of hard water sample, $\mathrm{Mg}^{2+}$ ions are precipitated as $\mathrm{Mg}(\mathrm{OH})_{2}$ by adding suitable amount of NaOH . The solution after precipitation of $M g(O H)_{2}$, is stirred and then titrated
with EDTA solution using calcon as indicator, and it requires 10 mL of " above EDTA solution to reach equivalence point.
(a). Calculate the strength of $\mathrm{Ca}^{2+}$ and $\mathrm{Mg}^{2+}$ ions present in hard water.
(b). Calculate the hardness due to $\mathrm{Ca}(2+)$ ions in ppm of $\mathrm{CaCO}_{3}$.
(c). Calculate the hardness due to $\mathrm{Mg}^{2+}$ ions in ppm of $\mathrm{CaCO}_{3}$.
(d) Calculate the total hardness of water in ppm of $\mathrm{CaCO}_{3}$.

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108. A 50 mL sample of hard water containing $\mathrm{Ca}^{2+}$ and $\mathrm{Mg}^{2+}$ ions is titrated with $50 \mathrm{~mL} \cdot 0.005 M E D T A$ solution at $p H=10$, using eriochrome balck $-T$ indicator to reach equivalence point.

In a equal amount of hard water sample, $M g^{2+}$ ions are precipitated as $\mathrm{Mg}(\mathrm{OH})_{2}$ by adding suitable amount of NaOH . the solution, after precipitation of $\mathrm{Mg}(\mathrm{OH})_{2}$, is stirred and then titrated with EDTA solution using calcon as indicator, and it requires 10 mL of above $E D T A$ solution to reach equivalence point.
a. Calculate the strength of $\mathrm{Ca}^{2+}$ and $\mathrm{Mg}^{2+}$ ions present in hard water.
b. Calculate the hardness due to $\mathrm{Ca}^{2+}$ ions in p p m of $\mathrm{CaCO}_{3}$.
c. Calculate the hardness due to $\mathrm{Mg}^{2+}$ ions in p p m of $\mathrm{CaCO}_{3}$.
d. Calculate the total hardness of water in p p m of $\mathrm{CaCO}_{3}$.

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109. 100 mL sample of hard water is titrated with 500 " mL of " 0.001 M EDTA solution at $p H=10$, using eriochrome black-T indicator to reach equivalence point. An equal another amount of hard water sample is boiled for 30 min . After filtration and cooling, the same sample is titrated with 200 mL of " 0.011 M EDTA solution at $\mathrm{pH}=10$ using Mg-EDTA complex solution and erichrome black-T indicator to reach equivalence point.
(i). Calculate the total hardness of water sample (temporary + permanent) in ppm of $\mathrm{CaCO}_{3}$.

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110. A 20 mL mixture of $\mathrm{CO}, \mathrm{CH}_{4}$, and Helium (He) gases is exploded by an electric discharge at room temperature with excess of oxygen. The volume contraction is found to be 13 mL . A further contraction of 14 mL occurs when the residual gas is treated wityh KOH solution. Find out the composition of the gaseous mixture in terms of volume percentage.

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111. 95 " mL of " a mixture of a gaseous organic compound $A$ and just sufficient amount of oxygen required for the complete yields on burning 40 mL of " $\mathrm{CO}_{2}$ and 70 mL of " water vapour along with 10 mL of " nitrogen,volumes measured at the same temperature and pressure.

Compound A contains corbon, hydrogen, and nitrogen only as the constituent elements. Calculate.
(a). The volume of $O_{2}$ required for complete combustion
(b). The molecular formula of $A$.
112. An organic compound contains carbon, hydrogen and oxygen. If the ratio percentage of $C$ and $H$ is $6: 1$ calculate the simplest formula of the compound, given that one molecule of the compound contains half as much oxygen as would be required to burn all the carbon and hydrogen atoms in it to $\mathrm{CO}_{2}$ and $\mathrm{H}_{2} \mathrm{O}$

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113. 50 " mL of " a mixture of $\mathrm{NH}_{3}$ and $\mathrm{H}_{2}$ was completely decomposed into $N_{2}$ and $H_{2}$ by sparking. 40 " mL of " $O_{2}$ was then added and the mixture was sparked again. After cooling the mixture was shaken with alkaline pyrogallol and a contraction of 6 mL was observed. Calculate the percentage of $\mathrm{NH}_{3}$ in the original mixture.

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114. 10 " mL of " a gaseous hydrocarbon is exploded with 100 mL of " oxygen. The residual gas on cooling is found to measure 95 mL , of which

20 mL is absorbed by caustic soda and the remaining by alkaline pyrogallol. The formula of the hydrocarbon is
(a). $\mathrm{CH}_{4}$.
(b). $\mathrm{C}_{2} \mathrm{H}_{6}$
(c). $\mathrm{C}_{2} \mathrm{H}_{4}$
(d). $\mathrm{C}_{2} \mathrm{H}_{2}$

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115. A mixture of formic acid and oxalic acid is heated with conc. $\mathrm{H}_{2} \mathrm{SO}_{4}$. The gas products is collected and treated with KOH solution, whereby the volume decrease by $1 / 6$ th. The molar ratio of the two acids (formic acid/oxalic acid) is

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116. 9 " mL of " a mixture of methane and ethylene was exploded with 30 mL (excess) of oxygen. After cooling, the volume was 21.0 mL . Further
treatment with caustic potash solution reduced the volume to 7.0 mL . Determine the composition of the mixture.

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117. Ten millilitre ofa mixture of methane, ethylene, and carbon dioxide was exploded with excess of air: After the explosion, there was contraction of 17 ml and after treatment with KOH , there was a further contraction of 14 ml . What was the composition of the mixture?

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118. An organic compound $\left(C_{x} H_{2 y} O_{y}\right)$ was burnt with twice the amount of oxygen needed for complete combustion to $\mathrm{CO}_{2}$ and $\mathrm{H}_{2} \mathrm{O}$. The hot gases, when cooled to $0^{\circ} C$ and $1 a t m$ pressure, measured $2.24 L$. The water collected during cooling weighed $0.9 g$. The vapour pressure of pure water at $20^{\circ} \mathrm{C}$ is 17.5 mmHg and is lowered by 0.104 mm when 50 g of the organic compound is dissolved in $1000 g$ of water. Give the molecular formula of the organic compound.

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119. 15 " mL of " a gaseous hydrocarbon A requried for complete combustion. 357 mL of " air ( $21 \%$ oxygen by volume) and gaseous products occupied 327 mL (all volumes being measured at STP. The molecular formula of the hydrocarbon A is
(a). $\mathrm{C}_{2} \mathrm{H}_{6}$
(b). $\mathrm{C}_{2} \mathrm{H}_{4}$
(c). $C_{3} H_{6}$
(d). $C_{3} H_{6}$

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120. 20 " mL of " a gasous bydrocarbon (A) was exploded with excess of $\mathrm{O}_{2}$ in an eudiometer tube. On cooling, the volume was reduced by 50 mL . On further treatment with KOH , there was further contraction of 40 mL . The molecular formula of the hydrocarbon A is
(a). $\mathrm{C}_{2} \mathrm{H}_{6}$
(b). $\mathrm{C}_{2} \mathrm{H}_{4}$
$C_{3} H_{6}$
(d). $\mathrm{C}_{3} \mathrm{H}_{8}$

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121.5 " mL of "a gas A containing only C and H was mixed with an excess of $O_{2}(30 \mathrm{~mL})$ and the mixture was exploded by means of electric sperk. After explosion, the remaining volume of the mixed gases was 25 mL . On adding a concentrated solution of KOH , the volume further diminished to 15 mL . The residual gas was pure oxygen, The molecular formula of the gas $A$ is.

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122. A gaseous alkane was exploded with oxygen. The volume of $O_{2}$ for complete combustion to $\mathrm{CO}_{2}$ formed was in the ratio of $7: 4$. The molecular formula of alkane is:
123. A mixture of CO and $\mathrm{CO}_{2}$ having a volume of 30 mL is mixed with x " mL of " $O_{2}$ and electrically sparked. The volume after explosion is $(20+x) \mathrm{mL}$ under the same condition. What would be the residual volume if 45 " mL of " the original mixture is treated with aueous NaOH ?
(a). 10 mL
(b). 20 mL
(c). 30 mL
(d). 50 mL

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124. 50 mL of " pure and dry $O_{2}$ was subjected to silent electric discharge and on cooling to the original temperature, the volume of ozonised oxygen was found to be 47 mL The gas was brought into contact with turpentine oil, after absorption of $O_{3}$, the remaining gas occupied 41 mL volume. What is the molecular formula of ozone?
125. 16 " mL of " a gaseous compound $C_{n} H_{3 n} O_{m}$ was mixed with 60 mL of " $O_{2}$ and sparked. The gas mixture on cooling occupied 44 mL . After treatment with NaOH solution, the volume of gas remaining was 12 mL . Deduce the formula of the compound.

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126. In basic solution $\mathrm{CrO}_{4}^{2-}$ oxidises $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$ to form $\left[\mathrm{Cr}(\mathrm{OH})_{4}\right]^{\ominus}$ and $\mathrm{SO}_{4}^{2-}$ How many millilitres of $0.154 \mathrm{MNa}_{2} \mathrm{CrO}_{4}$ are required to react with 40.0 " mL of " $0.246 \mathrm{M} \mathrm{Na} 2_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$.

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127. 600 " mL of " $\mathrm{HNO}_{3}$ and 200 mL of " $\mathrm{Ca}(\mathrm{OH})_{2}$ of same molarity are mixed to give a resulting solution having $p H=1$. What is the molarity of $\mathrm{HNO}_{3}$ and $\mathrm{Ca}(\mathrm{OH})_{2}$ ?
128. A 20.0 mL solution containing 0.2 impure $\mathrm{H}_{2} \mathrm{O}_{2}$ reacts completely with 0.316 g of $\mathrm{KMnO}_{4}$ in acid solution. The purity of $\mathrm{H}_{2} \mathrm{O}_{2}$ (in\%) is
...........(mol .wt.of $\mathrm{H}_{2} \mathrm{O}_{2}=34$, mol. Wt. Of $\mathrm{KMnO}_{4}=158$ )

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129.10 g of a mixture of $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ and $\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ on heating gave 6.12 g of $\mathrm{Na}_{2} \mathrm{CO}_{3}$. Another 10 g of the mixture was dissolved in 1.0 L of solution. 25 mL of " this solution was titrated with 0.1 N NaOH . Find the volume of NaOH required.

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130. Number of ions present in 2.0 litre of a solution of $0.8 \mathrm{MK}_{4} \mathrm{Fe}(\mathrm{CN})_{6}$ is:
131. What is the charge involved when 0.1 " mol of " $C_{6} H_{5} N O_{2}$ is reduced to $C_{6} H_{5} \mathrm{NHOH}$ ?

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132. 1.0 g of metal nitrate gave 0.86 g of metal carbonate. Calculate the Equivalent weight of metal.

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133. A 36 mL mixture of an alkene and propane required 171 " mL of " $\mathrm{O}_{2}$ for complete combustion and yielded 109 " mL of " $\mathrm{CO}_{2}$ (all volume measured at same temperature and presasure). Calculate the molecular formula of olefin and composition of the mixture by volume.
134. 1.245 g of a sample of $\mathrm{CuSO}_{4} \cdot x \mathrm{H}_{2} \mathrm{O}$ was dissolved in water and $\mathrm{H}_{2} \mathrm{~S}$ passed till CuS was complete precipitated. The filtrate contained liberated $\mathrm{H}_{2} \mathrm{SO}_{4}$, which required 20 mL of " $\frac{N}{2} \mathrm{NaOH}$ for complete neutralisation. Calculate $x$, the number of molecules of water associated with $\mathrm{CuSO}_{4}(\mathrm{Cu}=63.6)$

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135. A 0.5 g sample of an iron containing mineral mainly in the form of $\mathrm{CuFe} S_{2}$ was reduced suitable to convert all the ferric ions into the ferrous form and was obtained as a solution. In the absence of any interfering matter, the solution required 42 " mL of " $0.1 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution for titration calculate the percentage of $\mathrm{CuFe} S_{2}$ in the mineral $(C u=63.5, F e=55.8)$

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136. A sample of $\mathrm{MnSO}_{4.4} \mathrm{H}_{2} \mathrm{O}$ is reacted in air to give $\mathrm{Mn}_{3} \mathrm{O}_{4}$. The residue $\mathrm{Mn}_{3} \mathrm{O}_{4}$ is dissolved in 100 mL of " $\frac{\mathrm{N}}{12} \mathrm{FeSO}_{4}$ containing $\mathrm{H}_{2} \mathrm{SO}_{4}$ The solution reacts completely with 50 mmL of " $\mathrm{KMnO}_{4} .25 \mathrm{~mL}$ of " this $\mathrm{KMnO}_{4}$ requires 30 " mL of " $\frac{\mathrm{N}}{10} \mathrm{FeSO}_{4}$ for complete oxidation determine the amount of $\mathrm{MnSO}_{4.4} \mathrm{H}_{2} \mathrm{O}$ in the sample.

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137. 0.804 g sample of iron ore was dissolved in acid. Iron was oxidised to +2 state and it requires $47.2 m L$ of $0.112 \mathrm{NKMnO}_{4}$ solution for titration, Calculate \% of Fe of $\mathrm{Fe}_{3} \mathrm{O}_{4}$ in ore.

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138. A polyvalent metal weghing 0.1 g and having atomic weight 51 reacted will dil $\mathrm{H}_{2} \mathrm{SO}_{4}$ to give 43.9 mL of " $\mathrm{H}_{2}$ at STP. This solution containing the metal in the lower oxidation state was found to require
58.8 " mL of " 0.1 permanganate for complete oxidation. What are the valencies of the metal.

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139. A sample of magnisium metal containing some $M g O$ as impurity was dissolved in 125 mL of " $0.1 \mathrm{~N} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$. The volume of $\mathrm{H}_{2}$ evolved at $27.3^{\circ} \mathrm{C}$ and 1 atm was 120.1 mL . Resulting solution was found to be 0.02 N with respect to $\mathrm{H}_{2} \mathrm{SO}_{4}$. Calculate (i) the weight of sample dissolved and (ii) the percentage by weight of $M g$ in the sample. Neglect any change in the volume of the solution (atomic weight of $M g=24.3$ ).

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140. A sample of $\mathrm{Fe}\left(\mathrm{SO}_{4}\right)_{3}$ and $\mathrm{FeC}_{2} \mathrm{O}_{4}$ was dissolved in $\mathrm{H}_{2} \mathrm{SO}_{4}$. 40 " mL of " $\frac{\mathrm{N}}{15} \mathrm{KMnO}_{4}$ was required for complete oxidation. After oxidation the mixture was reduced by $\frac{\mathrm{Zn}}{\mathrm{H}_{2} \mathrm{SO}_{4}}$. On again oxidation by same
$\mathrm{KMnO}_{4}, 25 \mathrm{~mL}$ was required. Calculate the ratio of fe in $" \mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ and $\mathrm{FeC}_{2} \mathrm{O}_{4}$.

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141. What volume of $0.1 \mathrm{M} \mathrm{KMnO}_{4}$ is required to oxidise " 5 mg of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ (ferrous oxalate) in acidic medium?

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142. 1.0 g a of moist sample of a mixture of KCl and $\mathrm{KClO}_{3}$ was dissolved in water and made up to 250 mL .25 mL of " this solution was treated with $\mathrm{SO}_{2}$. The chlorate was reduced to chloride and excess of $\mathrm{SO}_{2}$ was removed by boiling. The total chloride was precipitated as AgCl . The weight of the precipitate was 0.1435 g . In another experiment, 25 mL of " the original solution was heated with 30 mL of " 0.2 N solution of ferrous sulphate, and the unreacted ferrous sulphate required 37.5 mL of " 0.08 N solution of an oxidising agent for complete oxidation. Calculate the molar ratio of the chlorate to the chloride in the given
mixture $\mathrm{Fe}^{2+}$ reacts with $\mathrm{ClO}_{3}^{\ominus}$ according to the equation.
$\mathrm{ClO}_{3}^{\ominus}+6 \mathrm{Fe}^{2+}+6 \mathrm{H}^{\oplus} \rightarrow \mathrm{Cl}^{\ominus}+6 \mathrm{Fe}^{3+}+3 \mathrm{H}_{2} \mathrm{O}$

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143. 1 g sample of $\mathrm{AgNO}_{3}$ is dissolved in 50 mL of water, It is titrated with $50 m L$ of $K I$ solution. The Aglpercipitated is filtered off. Excess of $K I$ filtrate is titrated with $\mathrm{M} / 10 \mathrm{KIO}_{3}$ in presence of 6 MHCl till all $I^{-}$ converted into $I C I$. It requires 50 mL of $\mathrm{M} / 10 \mathrm{KIO}_{3}$ solution. 20 mL of the same stock solution of $K I$ requires 30 mL of $\mathrm{M} / 10 \mathrm{KIO}_{3}$ under similar conditions. Calculate $\%$ of $\mathrm{AgNO}_{3}$ in sample. The reaction is

$$
\mathrm{KIO}_{3}+2 \mathrm{KI}+6 \mathrm{HCl} \rightarrow 3 \mathrm{ICl}+3 \mathrm{KCl}+3 \mathrm{H}_{2} \mathrm{O}
$$

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144. 0.108 g of finely divided copper was treated with an excess of ferric sulphate solution untill Cu was completely dissolved. The solution after the addition of excess dil $\mathrm{H}_{2} \mathrm{SO}_{4}$, required 33.7 mL of $0.1 \mathrm{~N} \mathrm{KMnO}_{4}$ for complete oxidation. Find the equation which represents the reaction
between metallic copper and ferric sulphate solution.
$(C u=63.7, F e=56)$

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145. A $1 g$ sample of $\mathrm{Fe}_{2} \mathrm{O}_{3}$ 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 $100 m L$. An aliquot of $25 m L$ of this solution requires $17 m L$ of $0.0167 M$ solution of an oxidant for titration. Calculate no.of electrons taken up by oxidant in the above titration.

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146. You are given a 2.18 g sample containing a mixture of XO and $\mathrm{X}_{2} \mathrm{O}_{3}$. It takes 0.015 " mol of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ to oxdise the sample completely to form $\mathrm{XO}_{4}^{\ominus}$ and $\mathrm{Cr}^{3+}$. If $0.0187^{\mathrm{m}} \mathrm{mol}$ of " $\mathrm{XO}_{4}^{\ominus}$ is formed, what is the atomic mass of $X$ ?
147. A sample of hydrazine sulphate $\left(\mathrm{N}_{2} \mathrm{H}_{6} \mathrm{SO}_{4}\right)$ was dissolved in 100 mL water. 10 mL of this solution was reacted with excess of $\mathrm{FeCl}_{3}$ solution and warmed to complete the reaction. Ferrous ions formed were estimated and it required 20 mL of $\mathrm{M} / 50 \mathrm{KMnO}_{4}$ solutions. Estimate the amount of hudrazine sulphate in one litre of solution.

Given $4 \mathrm{Fe}^{3+}+\mathrm{N}_{2} \mathrm{H}_{4} \rightarrow \mathrm{~N}_{2}+4 \mathrm{Fe}^{2+}+4 \mathrm{H}^{+}$
$\mathrm{MnO}_{4}^{-}+5 \mathrm{Fe}^{2+}+8 \mathrm{H}^{+} \rightarrow \mathrm{Mn}^{2+}+5 \mathrm{Fe}^{3+}+4 \mathrm{H}_{2} \mathrm{O}$

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148. Borax in water gives the following:
$\mathrm{B}_{4} \mathrm{O}_{7}^{2-}+7 \mathrm{H}_{2} \mathrm{O} \rightarrow 4 \mathrm{H}_{2} \mathrm{BO}_{3}+\stackrel{\ominus}{\mathrm{O}} \mathrm{H}$
How many grams of borax $\left(\mathrm{Na}_{2} \mathrm{~B}_{4} \mathrm{O}_{7.10} \mathrm{H}_{2} \mathrm{O}\right)$ are required to
(a). Prepare 50 mL of " 0.2 M solutionl.
$(M w$ of borax $=382)$
149. An aqueous solution containing $0.10 \mathrm{~g}_{\mathrm{KIO}}^{3}$ (formula weight
$=214.0)$ was treated with an excess of Kl solution the solution was acidified with HCl . The liberated $I_{2}$ consumed 45.0 mLL of "thiosulphate solution to decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thosulphate solution.

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150. A 4.0 g sample contained $\mathrm{Fe}_{2} \mathrm{O}_{3}, \mathrm{Fe}_{3} \mathrm{O}_{4}$, and inert material. It was treated with an excess of aq KI solution in acidic medium, which reduced all iron to $\mathrm{Fe}^{2+}$ ions along with the liberation of iodine. The resulting solution was diluted to 50 mL and a 10 mL sample of it was taken the iodine liberated in the small sample was titrated with 12.0 " mL of " 0.5 M
$\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution. The iodine from another 25 mL was extracted, after which the $\mathrm{Fe}^{2+}$ ions were titrated with 16 " mL of " $0.25 \mathrm{M} \mathrm{MnO} \mathrm{O}_{4}^{\ominus}$ ions in $\mathrm{H}_{2} \mathrm{SO}_{4}$ solution. Calculate the mass of two oxides in the original mixture.
151. A sample of $M g$ was burnt in air to give a mixure of $M g O$ and $\mathrm{Mg}_{3} \mathrm{~N}_{2}$. The ash was dissolved in 60 Meq . of HCl and the resulting solution was back titrated with NaOH .12 Meq . Of NaOH was then added and the solution distrilled. The ammonia released was then trapped in 10Meq. of second acid solution. Back titration of this solution required $6 M e q$. of the base Calculate the percentage of $M g$ burnt to the nitride.

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152. 6.0 g of a steel containing sulphur as an impurity was burnt in excess of oxygen, where sulphur is oxidised to $\mathrm{SO}_{2}$. The $\mathrm{SO}_{2}$ evolved was oxidised to $\mathrm{SO}_{4}^{2-}$ ions by the action of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution in the presence of 30 mL solution of 0.04 M NaOH .22 .48 mL of " 0.024 M HCl was required to neutralise the excess of NaOH after the above oxidation. Calculate the percentage of sulphur in the given sample of steel (Atomic mass of $S$ is 32).
153. Find the amound of iron pyrites $\left(F e S_{2}\right)$ which is sufficient to produce enough $\mathrm{SO}_{2}$ on roasting (heating in excess of $\mathrm{O}_{2}$ ) such that is $\left(\mathrm{SO}_{2}\right)$ completely decolourise a 1 L solution of $\mathrm{KMnO}_{4}$ containing 15.8 g $L^{-1}$ of it. The equation are $\mathrm{FeS}_{2}+\mathrm{O}_{2} \rightarrow \mathrm{Fe}_{2} \mathrm{O}_{3}+\mathrm{SO}_{2}$
$\mathrm{KMnO}_{4}+\mathrm{SO}_{2} \rightarrow \mathrm{MnSO}_{4}+\mathrm{H}_{2} \mathrm{SO}_{4}+\mathrm{KHSO}_{4}$

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154. When a mixture of NaBr and NaCl is separately digested with $\mathrm{H}_{2} \mathrm{SO}_{4}$ all the halogens are expelled and $\mathrm{Na}_{2} \mathrm{SO}_{4}$ is formed quantitatively with a particular mixture, it was found that the weight of $\mathrm{Na}_{2} \mathrm{SO}_{4}$ obtained was precisely the same as the weight of $\mathrm{NaBr}+\mathrm{NaCl}$ mixture taken. Calculate the ratio of the weight of NaCl and NaBr in the mixture.

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155. On being heated in air, a mixture of Feo and $\mathrm{Fe}_{2} \mathrm{O}_{4}$ picks up oxygen to convert completely to $\mathrm{Fe}_{2} \mathrm{O}_{3}$. If the observed weight gain is $5 \%$ of the initial weight, what must have been the composition of the initial mixture?

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156. In the reaction of canadium oxide (VO) with iron oxide $\left(\mathrm{Fe}_{2} \mathrm{O}_{3}\right)$ the products are $\mathrm{V}_{2} \mathrm{O}_{5}$ and FeO . How many grams of $\mathrm{V}_{2} \mathrm{O}_{5}$ can be formed from 2.00 g of VO and 5.75 g of $\mathrm{Fe}_{2} \mathrm{O}_{3}$.

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157. 1.67 g mixture of Al and Zn was completely dissolved in acid and evolved 1.69 L of $\mathrm{H}_{2}$ at STP. Calculate the weight Al and Zn in the mixture.

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158.0 .05 g of a sample of $\mathrm{KClO}_{3}$ containing some KCl on decomposition liberated just sufficient oxygen for complete oxidation of 20 mL of " CO. The volume of CO was measured at $27^{\circ} \mathrm{C}$ and 750 mm Hg . Calculate the perentage purity of $\mathrm{KClO}_{3}$.

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159. 2.0267 g of the nitrate of a univalent metal was heated with excess of previously ignited silica. A loss in weight of 1.08 g took place due to the total expulsion of the nitrate part of the salt as $\mathrm{N}_{2} \mathrm{O}_{5}$, calculate the percentage of $\mathrm{NO}_{3}^{\ominus}$ group in the salt analysed.

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160. Brass is an ally of Cu and Zn . A sample of brass weighing 5.793 g when treated with excess of dil $\mathrm{H}_{2} \mathrm{SO}_{4}$ gives 324 mL of " dry $\mathrm{H}_{2}$ at $20^{\circ} \mathrm{C}$ and 750 mm pressure. What is the percentage of Cu by weight in the alloy.
161. Carnallite is a double chloride of K and Mg containing $38.86 \%$ of water. 0.458 g of it gave 0.71 g AgCl and 0.666 g of it gave 0.27 g magnesium pyrophosphate $\left(\mathrm{Mg}_{2} \mathrm{P}_{2} \mathrm{O}_{7}\right)$. Calculate the percentage of KCl in the carnallite.

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162. Crude calcium carbide is made in an electric furance by the following reactions:
$\mathrm{CaO}+3 \mathrm{C} \rightarrow \mathrm{CaC}_{2}+\mathrm{CO}$. The product contains $85 \%$ of $\mathrm{CaC}_{2}$ and $15 \%$ unreacted CaO.
(a). How much CaO should we start with to produce 450 kg of crude product?
163. The vapoour density of a mixture containing $\mathrm{NO}_{2}$ and $\mathrm{N}_{2} \mathrm{O}_{4}$ is 38.3 at 300 K . the number of moles of $\mathrm{NO}_{2}$ in 100 g of the mixture is approximately

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164. 4.08 g of a mixture of BaO and an unknown carbonate $\mathrm{MCO}_{3}$ was heated strongly. The residue weighed 3.64 g . This was dissolved in 100 mL of 1 NHCl . The excess of acid required of 16 mL of 2.5 NNaOH for complete neutralisation. Identify the metal $M$.

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165. The reaction $\mathrm{An}+\mathrm{CuSO}_{4} \rightarrow \mathrm{ZnSO}_{4}$ goes completely to the right. In an experiment, 10.0 g of Zn was added to 200 mL of " $\mathrm{CuSO}_{4}$ solution. After all the Cu was precipitated, it was found that not all the Zn had dissolved. After filtration, the total weight of the solid at the end of the reaction was 9.810 g . Calculate.
(a). The weight of copper deposited and,
(b). Molarity of $\mathrm{CuSO}_{4}$ in the original solution.

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166. On passing 10.0 L of a gaseous mixture of $\mathrm{NO}_{2}$ and $\mathrm{N}_{2}$ at STP, through an NaOH solution, a mixture of $\mathrm{NaNO}_{2}$ and $\mathrm{NaNO}_{3}$ is formed 6.32 g of $\mathrm{KMnO}_{4}$ is required to oxidise above $\mathrm{NaNO}_{2}$ in $\mathrm{H}_{2} \mathrm{SO}_{4}$ medium. Determine the percentage by mass of gaseous mixture ( $N_{2}$ does not react with NaOH )

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167. 1.67 g mixture of Al and Zn was completely dissolved in acid and evolved 1.69 L of $\mathrm{H}_{2}$ at STP. Calculate the weight Al and Zn in the mixture.

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1. Balance the following equatio in basic medium
$\mathrm{NH}_{3}+\mathrm{O}_{2} \rightarrow \mathrm{NO}_{2} \mathrm{H}_{2} \mathrm{O}$
In the commercial preparation of $\mathrm{HNO}_{3}$ by Ostwald process, the above reaction is carried out directly in the process, The above reaction is carried out directly in the gaseous state. Explian why the same equation describes the direct reaction and the reaction in basic medium?

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2. $C N^{\ominus}$ is oxidised by a strong oxidising agent to $\mathrm{NO}_{3}^{\ominus}$ and $\mathrm{CO}_{2}$ or $\mathrm{CO}_{3}^{2-}$ depending upon the acidity of the reaction mixture. $\mathrm{HNO}_{3}$ a strong oxidising agent is reduced by a moderate reducing agent to NO.

Write the balanced equation of $\mathrm{HNO}_{3}$ with KCN .

$$
\mathrm{CH}^{\ominus} \rightarrow \mathrm{CO}_{2}+\mathrm{NO}_{3}^{\ominus}
$$

$\mathrm{NO}_{3}{ }^{\ominus} \mathrm{NO}$
If this reaction is carried out, what safety precautions are required?
3. Complete and balance the following equation
(a). $P_{2} H_{4} \rightarrow P H_{3}+P_{4} H_{2}$

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## Ex 3.2

1. Calculate the equivalent weight of the underlined species in the following unbalanced reaction:
$\underline{B r}_{2}+\stackrel{\ominus}{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{BrO}_{2}^{\ominus}$ (basic medium)

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2. (a). What is the equivalent weight of (i) $\mathrm{Fe}\left(\mathrm{HC}_{2} \mathrm{O}_{4}\right)_{2}$

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3. Equivalent mass of $\mathrm{H}_{3} \mathrm{PO}_{2}$ when it disproportionate into $\mathrm{PH}_{3}$ and $\mathrm{H}_{3} \mathrm{PO}_{3}$ is:

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## Ex 3.3

1. Calculate the number of moles of $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$ required to oxidise 1 mol of " $\mathrm{Fe}\left(\mathrm{HC}_{2} \mathrm{O}_{4}\right)$ in acidic medium. How many moles of NaOH are required to react with 1 " mol of $\mathrm{Fe}\left(\mathrm{HC}_{2} \mathrm{O}_{4}\right)$ ?

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2. How many moles of $\mathrm{NO}_{2}^{\ominus}$ are oxidised to $\mathrm{NO}_{3}^{\ominus}$ by 2 " mol of " $\mathrm{MnO} \mathrm{O}_{4}^{\ominus}$ in dilute basic medium?

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3. What is the ratio of moles of $\mathrm{MnO}_{4}^{\ominus}$ used per " mol of " $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ in acidic medium to strong basic medium?

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4. 1 mole of equimolar mixture of ferric oxalate and ferrous oxalate requires x mole of $\mathrm{KMnO}_{4}$ in acidic medium for complete oxidation. x is :

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5. Complete the following reactions:
(a). $\mathrm{MnO}_{4}^{2-}+\mathrm{H}^{\oplus} \rightarrow \mathrm{Mn}^{2+}+$ ?
(b). $\mathrm{NO}_{2}+\mathrm{H}_{2} \mathrm{O} \rightarrow$ ? +NO
(d). $\mathrm{H}_{2} \mathrm{O}_{2}+\mathrm{Sn}^{2+} \rightarrow \mathrm{Sn}^{4+}+$ ?

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6. Gastric juice contains 3.65 g of HCl per litre. If a person produces 2.0 L of gastric per day how many antacid tablets, each containing 520 mg of " $\mathrm{Al}(\mathrm{OH})_{3}$, are needed to netralise all the HCl produced in one day?

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7. 100 mmL of " each thhree samples of $\mathrm{H}_{2} \mathrm{O}_{2}$ labelled 2.8 vol 5.6 vol , and 22.4 vol are mixed and then diluted with an equal volume of water.

Calculate the volume strength of the resultant $\mathrm{H}_{2} \mathrm{O}_{2}$ solution.

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8. 10 mL of " 2 M HCl and 20 mL of " 1 M HNO 3 and V volume of $5 \mathrm{MH}_{2} \mathrm{SO}_{4}$ are mixed together and the solution was made upto 5 L .10 " mL of " this acid solution exactly neutralises 28.6 " mL of " $\mathrm{Na}_{2} \mathrm{CO}_{3}$ solution containing 1 g of $\mathrm{Na}_{2} \mathrm{CO}_{4.10} \mathrm{H}_{2} \mathrm{O}$ in 100 mL of " water. Calculate the amount of $\mathrm{SO}_{4}^{2-}$ ions in grams present in solution.
9. If $10.0 \mathrm{~g} V_{2} O_{5}$ is dissolbed in acid and reduced to $V^{2+}$ by treatment with tin $(\mathrm{Sn})$ metal how many moles of $I_{2}$ could be reduced by the resulting $V^{2+}$ solution as it is oxidised to $V^{4+}$ ? (Atomic weight of V is 51)

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10. Alcohol level in blood is determined by the reaction with $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution in acidic medium. Calculate the blood level in mass percent if 10 " mL of " 0.05 M solution of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is required for the reaction of a 10.0 g sample of blood.

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11. Calculate the weight of $N_{2} H_{4}$ (hydrazine) oxidised to $N_{2}$ by 24 g $\mathrm{K}_{2} \mathrm{CrO} \mathrm{O}_{4}$, which is reduced to $\mathrm{Cr}(\mathrm{OH})_{4}^{\ominus}$ in basic medium.
12.8.1 g of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ reacts with 12.8 g of HI according to the equation
$\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+\mathrm{HI} \rightarrow \mathrm{CrI}_{3}+\mathrm{KI}+\mathrm{I}_{2}$
Calculate:
(a). Percentage by mass of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ left unreacted.
(b). Volume of $I_{2}(\mathrm{~g})$ evolved, if $I_{2}$ obtained is heated to 500 K and 1.0 atm pressure.

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13. 10.0 g of $\mathrm{CaOCl}_{2}$ is dissolved in water to make 200 mL solution 20 " mL of " it is acidified with acetic acid and treated with KI solution the $I_{2}$ liberated required 40 " mL of " $\frac{M}{20} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution. Find the percentage of available chlorine.

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1. 0.5 g of a mixture of $\mathrm{K}_{2} \mathrm{CO}_{3}$ and $\mathrm{Li}_{2} \mathrm{CO}_{3}$ requires 30 mL of " 0.25 N Hci for neutralisaion. Calculate the percentage composition of the mixture.

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2. Find the molarity of 1.0 L solution of $90 \% \mathrm{H}_{2} \mathrm{SO}_{4}$ by weight/volume. The density of the solution is 1.47

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3. What volume of $0.25 \mathrm{MH}_{2} \mathrm{SO}_{4}$ is required to neutralise 1.90 g of a mixture containing equimolar amounts of $\mathrm{NaHCO}_{3}$ and $\mathrm{NaCO}_{3}$ ?

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4. 12.25 g of $\mathrm{KClO}_{3}$ and 5.85 g of NaCl ar heated together. The residue obtained at the end of burning is dissolved in water to prepare a 500 mL solution. To the solution obtained, excess of $\mathrm{AgNO}_{3}$ is added. Find the moles of white precipitate formed. Also find the molarity of the solution after filtering out the precipitate with respect to $\mathrm{NaNO}_{3}$ and $\mathrm{KNO}_{3}$ (molecular mass of $\mathrm{KClO}_{3}$ is 122.5 and that of NaCl is 58.50 )

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5. In the analysis of 0.1 of sample of feldspar, 0.118 g of mixture of NaCl and KCl is obtained which on treatment with $\mathrm{AgNO}_{3}$ gives 0.2451 of AgCl .

Calculate the precentage of $\mathrm{Na}_{2} \mathrm{O}$ and $\mathrm{K}_{2} \mathrm{O}$ in feldspar.

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6. A mixture in which the mole ratio of $H_{2}$ and $O_{2}$ is $2: 1$ is used to prepare water by the reaction,

$$
2 \mathrm{H}_{2(g)}+\mathrm{O}_{2(g)} \rightarrow 2 \mathrm{H}_{2} \mathrm{O}_{(\mathrm{g})}
$$

The total pressure in the container is 0.8 atm at $20 .{ }^{\circ} \mathrm{C}$ after reaction is (assuming 80\% yield of water)

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7. When 400 g of a $20 \%$ Solution was cooled 50 g of the solute precipitated. What is the percent concentration of the remaining solution.

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## Ex 3.4 (B)

1. A solution of $\mathrm{KMnO}_{4}$ containing $3 g L^{-1}$ is used to titrate $\mathrm{H}_{2} \mathrm{O}_{2}$ solution containing $2 g L^{-1}$ What volume of $\mathrm{KMnO}_{4}$ will be required to react with 20 mL of " $\mathrm{H}_{2} \mathrm{O}_{2}$ ?

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2. Two acids $A$ and $B$ are titrated separately each time with 25 mL of " $\mathrm{N}-\mathrm{Na}_{2} \mathrm{CO}_{3}$ solution to requrie 10 mL and 40 mL respectively, of their solution for complete neutralisation. What volume of $A$ and $B$ would you mix to produce 1 L of N -acid solution?

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3. 1.00 g of a mixture, consisting of equal number of moles of carbonates of two alkali metals, required 44.4 " mL of " $0.5 \mathrm{~N}-\mathrm{HCl}$ for complete reaction. If the atomic weight of one of the metal is 7.00 . Find the atomic weight of the other metal.

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4. A sample of chalk $\left(\mathrm{CaCO}_{3}\right)$ is contaminated with calcium sulphate 1.0 g of the solid is dissolved in 230 " mL of " $\frac{N}{10} \mathrm{HCl}, 40.1 \frac{N}{10} \mathrm{NaOH}$ is requried to neutralise the excess acid. What ist he percentage of chalk in the mixture.

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5. The amount of CO in a gas ample can be determined by using the reaction.
$\mathrm{I}_{2} \mathrm{O}_{5}+5 \mathrm{CO} \rightarrow \mathrm{I}_{2}+5 \mathrm{CO}_{2}$
If a gas sample liberated 127 g of $I_{2}$, how many g of CO were present in the sample.

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6. 356 mg of " an alloy of Zn and Cd is precipitated as ZnS and CdS by $H_{2} S$. The mixed precipitate sulphur. The filterate is acidified and the divalent $\mathrm{Fe}^{2+}$ reqruied 1.6 millimoles of $\mathrm{KMnO}_{4}$ Find the percentage of Cd in the alloy. $(C d=112, Z n=65.4)$

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7. A sample containing 0.4775 of $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and inert material was dissolved in water and made strongly alkaline with KOH which converted $\mathrm{NH}_{4}^{\oplus}$ to $\mathrm{NH}_{3}$ The liberated $\mathrm{NH}_{3}$ was distilled of $\mathrm{H}_{2} \mathrm{SO}_{4}$ was back titrated with 11.3 m mL of " 0.1214 M NaOH . Calculate (a) $\%$ of $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}=124.10$

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8. A 0.5 g sample containing $\mathrm{MnO}_{2}$ is treated with HCl liberating $\mathrm{Cl}_{2}$ is passed into a solution of KI and 30.0 " mL of " $0.1 \mathrm{M} \mathrm{Na} a_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ are required to titrate the liberated iodine. Calculate the percentage of $\mathrm{MnO}_{2}$ is the sample.

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9. 0.3 g of KI is dissolved in 25 mL of " water. After adding to this solution double its volume of concentration HCl , a solution of $\mathrm{KIO}_{3}$ is graduaaly added with stirring. lodine is liberated as first but redissolved. It is
observed that 24.1 " mL of " iodate solution is just sufficient to dissolve the iodine. If the iodate solution contains 0.8 g per 100 mL formulate the reaction that has taken place.

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10. 0.5 g of pure iron wire was dissolved in excess of HCl in absence of air and was then heated with 0.25 g of $\mathrm{KNO}_{3}$. The following reaction takes place,

$$
3 \mathrm{FeCl}_{2}+\mathrm{KNO}_{2}+4 \mathrm{HCl} \rightarrow 3 \mathrm{FeCl}_{3}+\mathrm{KCl}+2 \mathrm{H}_{2} \mathrm{O}+\mathrm{NO}
$$

When the reaction was over, the resulting solution was titrated against $0.1 \mathrm{~N} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$. What volume of dichromate would be consumed? ATomic weight of $F e=55.585$ atomic weight of $K=39$ ?

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11. The volatile chloride of an element has a vapour density $\approx 69$. One gram of the chloride on hydrolysis yields hydrochloric acid and compound free of chlorine. Addition hydrochloric acid and compound
free of chlorine. Addition of $\mathrm{AgNO}_{3}$ to this solution precipitates 3.129 g of AgCl . What may be the atomic weight of the element.?

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12.2 g of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ are made to react in acid solution with $0.25 \mathrm{MKMnO}_{4}$ solution. What volume of $\mathrm{KMnO}_{4}$ would be required? The be reqruied? The resulting solution is treated with excess of $\mathrm{NH}_{4} \mathrm{Cl}$ solution and $\mathrm{NH}_{4} \mathrm{OH}$ solution. The precipitated $\mathrm{Fe}(\mathrm{OH})_{3}$ is filtered off, washed and ignited. What is the mass of the product obtained? (Atomic weight of $F e=56)$

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13. When $\mathrm{KIO}_{3}$ solution is heated with excess of oxalic acid it is found that 1.683 g of $\mathrm{KIO}_{3}$ is consumed per gram of iodine liberated. Formulate the stoichemistry of the products. (Atmic weight of iodine

$$
=127 \text { and } K=-39)
$$

14. 1.53 g of a compound containing only sulphur, oxygen and chlorine after easy hydrolysis with water yielded acid products which consumed 91 " mL of " $\frac{N}{2}$ sodium hydroxide for complete neutralisation in a parallel experiment, 0.4 g of the compound after hydrolysis with water, was treated with excess of $\mathrm{BaCl}_{2}$ solution and 0.7 g of $\mathrm{BaSO}_{4}$ was precipitated. What is the formula of the compound?

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15.25 " mL of " a mixture of $\mathrm{Co}, \mathrm{CO}_{2}$ and $\mathrm{H}_{2}$ were exploded mL with 10 " mL of " oxygen. The products has a volume of 18.5 " mL of " which 17 mL absorbed by alkali. What was the composition of the original mixture? All volume measurements were made at the same temperature and pressure?
16. Determine the probable formula of an acid salt which is an oxidising agent from the following data.Its equivalent weight as an acid is 390 and as an oxidising agent is 32.5 . It contains $10 \%$ of potassium and $65 \%$ of iodine.

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17. $\mathrm{H}_{2} \mathrm{O}_{2}$ solution $(20 \mathrm{~mL})$ reacts quantitatively with a solution of $\mathrm{KMnO}_{4}(20 \mathrm{~mL})$ acidified with dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$. The same volume of the $\mathrm{KMnO}_{4}$ solution is just decolourised by 10 mL of $\mathrm{MnSO}_{4}$ in neutral medium. simulataneously forming a dark brown precipitate of hydrated $\mathrm{MnO}_{2}$. The brown precipitate is dissolved in 10 mL of 0.2 M sodium oxalate under boiling condition in the presence of dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$. Write the balanced equations involved in the reactions and calculate the molarity of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution.

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18. An aqueous solution containing $0.5 \mathrm{~g} \mathrm{KIO}_{3}$ (formula weight $=214.0$ ) was treated with an excess of KI solution. The solution was acidified with HCl . The liberated $I_{2}$ consumed 45 " mL of " thiosulphate solution to decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thiosulphate solution. Also give a balanced chemical equation for the action of KI on $\mathrm{KIO}_{3}$.

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## Ex 3.5

1. 200 mL of " a solution of a mixture of NaOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ was first titrated with 0.1 M HCl using phenolphthalein indicator. 17.5 " mL of " HCl was required for the same HCl was again required for next end point. Find the amount of NaOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ in the mixture.

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2. 30 mL of " a solution of mixture of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ required 12 mL of " $0.05 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{4}$ using phenolphthalein as indicator. With methyl orange 30 " mL of " the same solution required 40 " mL of " same $\mathrm{H}_{2} \mathrm{SO}_{4}$. Calculate the amount of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ per litre in the mnixture.

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3. 0.58 g of $\mathrm{CH}_{3}\left(\mathrm{CH}_{2}\right)_{c} \mathrm{COOH}$ was burnt in excess air and the resulting gases $\left(\mathrm{CO}_{2}\right.$ and $\left.\mathrm{H}_{2} \mathrm{O}\right)$ were passed through excess NaOH solution. The resulting solution was divided into two equal parts. One part requires 50 " mL of " 1.0 M HCl for complete neutralisation using phenolphthalein indicator. Another part required 80 mL of " same HCl for neutralisation using methyl orange as indicator. Calculate the value of n and the amount of excess NaOH solution taken initially.

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4. Two drops of phenolphthalein was added to 40 mL of " HCl solution. When 30 " mL of " 0.1 M NaOH was added, part of the the solution turned pink, but colour disappeared on mixing the solutiion. Addition of NaOH was continued drop-wise untill a one-drop addition produced a lasting pink colour, and the colume of NaOH added was 32.56 mL . Calculate The concentration of HCl solution.

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5.50 mL of " a solution containing 1 g each of $\mathrm{Na}_{2} \mathrm{CO}_{3}, \mathrm{NaHCO}_{3}$ and NaOH was titrated with N HCl . What will be the titre value if:
(a). Only phenolphthalein is used as an indicator?

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6. 1.7225 g of a metal (bivalent) salt $A_{x}\left(\mathrm{CO}_{3}\right)_{y}(\mathrm{OH})_{z}$ was dissolved in water to make 100 " mL of " solution 50 " mL of " this solution required 10
" mL of " $0.5 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{4}$ solution for complete neutralisation using
phenolphthalein indicator. Another 50 mL solution required 15 mL of " same acid using methyl orange indicator. Deduce the formula of the salt.

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## Ex 3.6

1. If water contains 10 ppm of $\mathrm{MgCl}_{2}$ and 8 ppm of $\mathrm{CaSO}_{4}$, calculate the ppm of $\mathrm{CaCO}_{3}$.

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2. Calculate the quantity of lime required to soften $10^{3} \mathrm{~L}$ of $\mathrm{H}_{2} \mathrm{O}$ which contains $7.5 g L^{-1}$ of $\mathrm{Ca}\left(\mathrm{HCO}_{3}\right)_{2}$ and $5.0 \mathrm{gL} \mathrm{L}^{-1} \mathrm{ofMg}\left(\mathrm{HCO}_{3}\right)_{2}$

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3. Calculate the quantities of reagents required to soften $10^{3} \mathrm{~L}$ of water containing $\mathrm{Ca}\left(\mathrm{HCO}_{3}\right)_{2} \mathrm{Mg}\left(\mathrm{HCO}_{3}\right)_{2}$ and $\mathrm{CaSO}_{4}$ as 20.0 g , 15.0 g and 5.0 g per litre respectively by lime soda process.

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4. Calculate the quantities fo reagents required to soften 100 L of water containing the following impurities per litre in it.
(a). $\mathrm{CaCO}_{3}=20$,
(b). $M g C l_{2}=8.0 g$,
(c). $\mathrm{MgSO}_{4}=7 g$,
(d). $\mathrm{MgCO}_{3}=4.5 g$
(e). $\mathrm{CaSO}_{4}=2.5 g$
(f). $\mathrm{NaCl}=6.0 \mathrm{~g}$

Purity of lime $=90 \%$ purity of soda $=99.5 \%$

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5. 100 " mL of " tap water was titrated with $\frac{M}{50} \mathrm{HCl}$ with methyl orange as indicator if 30 " mL of " HCl were required, calculate the hardness of $\mathrm{CaCO}_{3}$ per $10^{6}$ parts of water. The hardness is temporary.

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6. In the determination of hardness of a sample of water, the following results were obtained:

Volume of sample of $\mathrm{H}_{2} \mathrm{O}=100 \mathrm{~mL}$
Volume of $\frac{\mathrm{N}}{50} \mathrm{Na}_{2} \mathrm{CO}_{3}$ added to it $=20 \mathrm{~mL}$
Volume of $\frac{N}{50} \mathrm{H}_{2} \mathrm{SO}_{4}$ used to back titrate the unreacted
$\mathrm{Na}_{2} \mathrm{CO}_{3}=10 \mathrm{~mL}$
Calculate the hardness of water in $\mathrm{g} L^{-1}$
A. (a) 23
B.
C.
D.

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7. An exhausted zeolite bed was revived by 250 L of NaCl solution containing $50 \mathrm{gL} L^{-1}$ of NaCl solution. How many litres of hard water of hardness 250 ppm can be softened on the zeolite bed?

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8. A sample of hard water has a hardness of 510 ppm . Express the hardness in French and Clark.

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9. A 200 mL sample of water requires 5 " mL of " $\frac{\mathrm{N}}{20} \mathrm{Na}_{2} \mathrm{CO}_{3}$ solution for complete precipitation of $\mathrm{Ca}^{2+}$ and $\mathrm{CaCO}_{3}$. Calculate the hardness in ppm.
10. A 200 mL sample of hard water requires 33.0 mL of " $0.01 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$ for complete neutralisation.

200 " mL of " the same sample was boiled with 15.0 " mL of " 0.1 M NaOH solution, filtered and made up to 200 mL again. This sample now requires 53.6 " mL of " $0.01 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$. Calculate Mg hardness.

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## Ex 3.7

1. 60 ml of mixture of equal volumes of $C l_{2}$ and an oxide of chlorine, i.e., $C l_{2} O_{n}$ was heated and then cooled back to the original temperature. The resulting gas mixture was found to have volume of 75 ml . On treatment with KOH solution, the volume contracted to 15 ml . Assume that all measurements are made at the same temperature and pressure. Deduce
the value of $n$ in $C l_{2} O_{n}$. The oxide of $C l_{2} \mathrm{n}$ heating decomposes quantiatively to $\mathrm{O}_{2}$ and $\mathrm{Cl}_{2}$.

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2. A 20 mL mixture of ethane, ethylene, and $\mathrm{CO}_{2}$ is heated with $O_{2}$. After explosion, there was a contraction of 28 mL and after treatment with KOH , there was a further contraction of 30 mL . What is the composition of the mixture?

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3. 8.4 " mL of " gaseous hydrocarbon A was burnt with 50 " mL of " $\mathrm{O}_{2}$ in a eudiometer tube. The volume of the products after cooling to room temperature was 37.4 mL . When reacted with NaOH , the volume contracted to 3.8 mL . What is the molecular formula of A .

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4. The weight of $1 L$ of ozonised oxygen at $S T P$ was found to be 1.5 g . When 100 mL of this mixture at $S T P$ was treated with turpentine oil, the volume was reduced to 90 mL . The molecular weight of ozone is

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5. 14 g of $O_{2}$ and 4 g of $C_{3} H_{8}$ are allowed to react the maximum possible extent to form only CO and $\mathrm{H}_{2} \mathrm{O}$. Find the weight of CO formed.

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## Exercises Subjective

1. A sample of clay was partially dried. It then contained $50 \%$ slica and $7 \%$ water. The original clay contained $12 \%$ water find the percentage of silica in the original sample
2. Chlloride samples are prepared for analysis by using $\mathrm{NaCl}, \mathrm{KCl}, \mathrm{NH}_{4} \mathrm{Cl}$ separately or as mixtures. What minimum volume of a $5.0 \%$ by weight $\mathrm{AgNO}_{3}$ Solution (Density $=1.02$ ) must be added to a sample wehging 0.321 g in order to ensure complete precipitation of choride in every possible cases?

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3. 2.1 g of a mixture of $\mathrm{NaHCO}_{3}$ and $\mathrm{KCIO}_{3}$ required 100 " mL of " 0.1 HCl for complete reaction. Calculate the amount of residue that would be obtained on heating 2.2 g of the same mixture strongly.

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4. 50 g caustic soda is completely converted into sodium chlorate and sodium chloride by the action of chlorine What weight of manganese dioxide and what volume of HCl (containing $300 g L^{-1}$ ) were used for the production of necessary chlorine?

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5. A 1.0 g sample of $\mathrm{KCIO}_{3}$ was heated under such conditions that a part of it decomposed according to the equation:
(i) $2 \mathrm{KCIO}_{3} \rightarrow 2 \mathrm{KCI}+3 \mathrm{O}_{2}$ and the remaining underwent a change according to the equation
(ii) $4 \mathrm{KCIO}_{3} \rightarrow 3 \mathrm{KClO}_{4}+\mathrm{KCI}$.

If the amount of oxygen evolved was 146.8 mL at S.T.R, calculate the percentage by weight of $\mathrm{KClO}_{4}$ in the residue.

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6. One litre of an acidified solution of $\mathrm{KMnO}_{4}$ containing 15 g of $\mathrm{KMnO}_{4}$ is decolourised by passing sufficient amount of $\mathrm{SO}_{2}$. If $\mathrm{SO}_{2}$. If $S O_{2}$ is produced by roasting of iron pyrites $\left(\mathrm{FeS}_{2}\right)$. What will be the amount of pyrites required to produce the necessary amount of $\mathrm{SO}_{2}$
7. 10 g of a sample of a mixture of $\mathrm{CaCl}_{2}$ and NaCl is treated to precipitate all the calcium as $\mathrm{CaCO}_{3}$. This $\mathrm{CaCO}_{3}$ is heated to convert all the Ca to CaO and the final mass of CaO is 1.62 g .The percent by mass of $\mathrm{CaCl}_{2}$ in the origial mixture is

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8.2 g of brass containing Cu and Zn only reacts with $3 \mathrm{M} \mathrm{HNO}_{3}$ solution.

Following are the reactions taking place
$\mathrm{Cu}(s)+\mathrm{HNO}_{3}(a q) \rightarrow \mathrm{Cu}^{2+}(a q)+\mathrm{NO}_{2}(g)+\mathrm{H}_{2} \mathrm{O}(I)$
$\mathrm{Zn}(\mathrm{s})+\mathrm{H}^{+}(a q)+\mathrm{NO}_{3}^{-}(a q) \rightarrow \mathrm{NH}_{4}^{+}+\mathrm{Zn}^{2+}(a q)+\mathrm{H}_{2} \mathrm{O}(\mathrm{l})$
The liberated $\mathrm{NO}_{2}(\mathrm{~g})$ was found to be 1.04 L at $25^{\circ} \mathrm{C}$ and 1 atm

$$
[C u=63.5, Z n=65.4]
$$

The percentage by mass of Cu in brass was

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9. A mass of 2.72 g of an alloy containing Pb , required for dissolved in $\mathrm{HNO}_{3}$ containing $50 \%$ by mass of $\mathrm{HNO}_{3}$. When a $\mathrm{H}_{2} \mathrm{SO}_{4}$ solution was added, 1.5 g of precipitate (A) appeared $H_{2} S$ gas was then passed into the remaining solution a secfond precipitate was formed which when calcined in air produced 1.6 g of a compound B . Determine the composition of an alloy. (Al does not form $A l_{2} S_{3}$ due to the hydrolysis of sulphide).

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10. On passing 10.0 L of a gaseous mixture of $\mathrm{NO}_{2}$ and $\mathrm{N}_{2}$ at STP, through an NaOH solution, a mixture of $\mathrm{NaNO}_{2}$ and $\mathrm{NaNO}_{3}$ is formed 6.32 g of $\mathrm{KMnO}_{4}$ is required to oxidise above $\mathrm{NaNO}_{2}$ in $\mathrm{H}_{2} \mathrm{SO}_{4}$ medium. Determine the percentage by mass of gaseous mixture ( $N_{2}$ does not react with NaOH )

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11. A sample of pure CuO was reduced with $\mathrm{H}_{2}$ gas and $\mathrm{H}_{2} \mathrm{O}$ formed was collected in a 44.8 L flask containing dry $N_{2}$. At $27^{\circ} \mathrm{C}$, the total pressure containing $\mathrm{N}_{2}$ and $\mathrm{H}_{2} \mathrm{O}$ was 1.0 atm. Relative humidity in the flask was $80 \%$ The vapour pressure of water at $27^{\circ} C$ is 25 mm . How many grams of CuO was reduced?

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12. A mixture of iron (II) and lead (II) caerbonates was calcined. As a result of thisk, an amount of 0.9 mmol of ${ }^{\mathrm{CO}} \mathrm{CO}_{2}$ was evolved. The mixture of metal oxides obtained by decomposing the above carbonates was treated with sulphuric acid, which, resulted in a mass of 151.6 g of a sulphate as precipitate. Determine the composition of the starting mixture of carbonates in mass percentage.

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13. Calculate the percentage of oxalate ion in a given sample of oxalate salt of which 0.6 g dissolved 100 mL of " water required 90 mL of " $\frac{M}{100} \mathrm{KMnO}_{4}$ for complete oxidation.

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14. 0.56 g of limestrone was treated with oxalic acid to give $\mathrm{CaC}_{2} \mathrm{O}_{4}$. The precipitate decolourised 50 mL of " $\frac{M}{25} \mathrm{KMnO}_{4}$ in acidic medium. Calculate percentage of CaO in limestone.

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15. Calculate the weight of $\mathrm{MnO}_{2}$ and the volume of HCl of specific gravity $1.2 \mathrm{~g} \mathrm{~g} \mathrm{~mL} L^{-1}$ and $5 \%$ by weight needed to produce 1.12 L of $C l_{2}$ at STP by the reaction $\mathrm{MnO}_{2}+4 \mathrm{HCl} \rightarrow \mathrm{MnCl}_{2}+3 \mathrm{H}_{2} \mathrm{O}+\mathrm{Cl}_{2}$

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16. In the following reaction
${ }^{\ominus}$
${ }^{\ominus} \mathrm{H}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-}+\mathrm{Br}_{2} \rightarrow \mathrm{SO}_{4}^{2-}+\mathrm{Br}^{\ominus}$
Starting with 0.15 " mol of " $\mathrm{Br}_{2} 0.01$ " mol of " $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$ and 0.4 " mol of " ${ }^{\ominus} \mathrm{OH}$ ions. How many moles of $\stackrel{\ominus}{O} H$ ions are left in the solution after the reaction is complete.

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17. Chlorine dioxide $\left(\mathrm{ClO}_{2}\right)$ is used now days for water treatment rather than $\mathrm{Cl}_{2} \mathrm{ClO}_{2}$ is obtained by passing $\left(\mathrm{Cl}_{2}(\mathrm{~g})\right.$ ) into a concentrated solution of sodium chlorite $\left(\mathrm{NaClO}_{2}\right)$. The reaction gives $90 \%$ yield. How many moles of $\mathrm{ClO}_{2}$ is produced in 3.78 L of $2.0 \mathrm{M} \mathrm{NaClO}_{2}(a q)$ ?

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18. In the reaction given
$\mathrm{Mg}(\mathrm{s})+\mathrm{NO}_{3}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Mg}(\mathrm{OH})_{2}(s)+\stackrel{\ominus}{\mathrm{O}} \mathrm{HO}(\mathrm{aq})+.\mathrm{NH}_{3}(g) 20^{\prime \prime}$ mL of " sample of $\mathrm{NO}_{3}^{\ominus}$ solution is treated with Mg . The $\mathrm{NH}_{3}^{g}$ was passed
into 50 " mL of " 0.1 M HCl . The excess HCl requried 30 " mL of " 0.1 M KOH for its neutralisation calculate the molarity of $\mathrm{NO}_{3}^{\ominus}$ ions in the original sample?

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19. Calculate the percentage of Cr in a sample of dichromate ore if 1.0 g of the sample after fusion is treated with 60 " mL of " 0.1 N $\mathrm{FeSO}_{4} \cdot\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4}$ and the excess of $\mathrm{Fe}^{2+}$ requires 11.2 mL of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{3}$ in the sample.

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20. Chile salt peter a source of $\mathrm{NaNO}_{3}$ also contains $\mathrm{NaIO}_{3}$ the $\mathrm{NaIO}_{3}$ is a source of $I_{2}$ produced as shown in the following equation:

Step I: $\mathrm{IO}_{3}^{\ominus}+3 \mathrm{HSO}_{3}^{\ominus}+3 \mathrm{SO}_{4}^{2-}$
Step II: $5 I^{\ominus}+I O_{3}^{\ominus}+6 \mathrm{H}^{\oplus} \rightarrow 3 \mathrm{I}_{2}(s)+3 \mathrm{H}_{2} \mathrm{O}$
One litre sample of chile salt peter solution containing $6.6 \mathrm{~g} \mathrm{NaIO}_{3}$ is treated with $\mathrm{NaHSO}_{3}$ Now an additional amount of same solution is
added to the reaction mixture to bring about the second titration.
Calculate the weight of $\mathrm{NaHSO}_{3}$ requried in step I and what additional volume of chile salt peter mist be added in step II to bring out complete conversion of $I^{\ominus}$ to $I_{2}$.

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21.0.5g mixture of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ and $\mathrm{KMnO}_{4}$ was treated with excess of $K I$ in acidic medium. lodine liberated required $100 \mathrm{~cm}^{3}$ of 0.15 N sodium thiosulphate solution for titration. Find the per cent amount of each in the mixture.

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22. A mixture containing $\mathrm{As}_{2} \mathrm{O}_{3}$ and $\mathrm{As}_{2} \mathrm{O}_{3}$ requried 20 mL of " 0.05 N $I_{2}$ for titration. The resulting solution is then acidified and excess KI was added. The liberated $I_{2}$ required 1.24 g hypo $\left(\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3} . \mathrm{H}_{2} \mathrm{O}\right)$ for complete reaction. Calculate the mass of the mixture.

The reactions are
$A s_{2} O_{3}+2 I_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow A s_{2} \mathrm{O}_{3}+4 \mathrm{H}^{\oplus}+4 I^{\ominus}$

$$
\mathrm{As}_{2} \mathrm{O}_{5}+4 \mathrm{H}^{\oplus}+4 I^{\ominus} \rightarrow \mathrm{As}_{2} \mathrm{O}_{3}+2 \mathrm{I}_{2}+2 \mathrm{H}_{2} \mathrm{O}
$$

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23. Ozone an estimated in air by passing certaing volume of air through an acidified or neutral or basic KI solution when $O_{2}$ is evolved and $I^{\ominus}$ is oxidised to $I_{2}$. Free $I_{2}$ evolved is titrated with standard $N a_{2} S_{2} O_{3}$ solution. In an experiment 10 L of air at 1 atom and $27^{\circ} \mathrm{C}$ was passed through an alkaline KI solution and $I_{2}$ liberated requried 2 mL of " $\frac{M}{800} \mathrm{Na} a_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution. Calculate the volume percentage of $\mathrm{O}_{3}$ in sample.

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24. 1.0 g sample of the Rochelle salt
[ $\mathrm{NaOOC}-\mathrm{CHOH}-\mathrm{CHOH}-\mathrm{COOK}]$
$\left(\mathrm{NaKC}_{4} \mathrm{H}_{4} \mathrm{O}_{6} \cdot 4 \mathrm{H}_{2} \mathrm{O}\right)(\mathrm{Mw}=282)$, on ignition, is converted
into $\mathrm{NaKCO}_{3}(\mathrm{Mw}=122)$, which is titrated with 50 " mL of " 0.1 $\mathrm{MH}_{2} \mathrm{SO}_{4}$. The excess of $\mathrm{H}_{2} \mathrm{SO}_{4}$ requries 30 mL 0.2 M KOH .

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25. 2.0 g sample of NaCN is dissolved in 50 " mL of " 0.3 M mild alkaline $K M n O_{4}$ and heated strongly to convert all the $C N^{\ominus}$ to $O C N^{\ominus}$. The solution after acidification with $\mathrm{H}_{2} \mathrm{SO}_{4}$ requries 500 " mL of " 0.05 M $\mathrm{FeSO}_{4}$ Calculate the percentage purity of NaCN in the sample.

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26. 12. $g$ of an impure sample of arsenious oxide was dissolved in water containing 7.5 g of sodium bicarbonate and the resulting solution was diluted to 250 mL . 25 mL of this solution was completely oxidised by $22.4 m L$ of a solution of iodine. $25 m L$ of this iodine solution reacted with same volume of a solution containing 24.8 g of sodium thiosulphate ( $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3} .5 \mathrm{H}_{2} \mathrm{O}$ ) in one litre. Calculate teh percentage of arsenious oxide in the sample ( Atomic mass of $A s=74$ )

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27. 10.0 g sample of $\mathrm{Cu}_{2} \mathrm{O}$ is dissolved in dil. $\mathrm{H}_{2} \mathrm{SO}_{4}$ where it undergoes disproportionation quantitatively. The solution is filtered off and 8.3 g pure KI cyrstals are added to clear filtrate in order to precipitate Cul with the liberation of $I_{2}$. The solution is again filtered and boiled till all the $I_{2}$ is removed. Now excess of an oxidising agent is added to the filtrate which liberates $I_{2}$ again. The liberated $I_{2}$ now requires 10 mL of 0.1 M $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$. The percentage by mass of $\mathrm{Cu}_{2} \mathrm{O}$ in the sample is

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28.3.0 g sample of KOCl and $\mathrm{CaOCl}_{2}$ is dissolved in water to prepare 100 mL solution, which requried 100 " mL of " 0.15 M acidified $\mathrm{K}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$. For the point. The clear solution is now treated with excess of $\mathrm{AgNO}_{3}$ solution which precipitates 2.87 g of AgCl . Calculate the mass percentage of KOCl and $\mathrm{CaOCl}_{2}$ in the mixture.
29. One mole of a mixture of $N_{2}, \mathrm{NO}_{2}$ and $\mathrm{N}_{2} \mathrm{O}_{4}$, has a mean molar mass of 55.4. On heating to a temperature at which $\mathrm{N}_{2} \mathrm{O}_{4}$ may be dissociated : $\mathrm{N}_{2} \mathrm{O}_{4} \rightarrow 2 \mathrm{NO}_{2}$, the mean molar mass tends to the lower value of 39.6.

What is the mole ratio of $\mathrm{N}_{2}: \mathrm{NO}_{2}: \mathrm{N}_{2} \mathrm{O}_{4}$ in the original mixture?

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30. 0.75 mmol of "solid $X_{4}$ and 2 mmol of "gaseous $O_{2}$ are heated to react completely in sealed vessel to produce only one gaseous compound Y . After the compound is formed the vessel is brought to the initial temeprature, the pressure is found to half the inital pressure. Calculate the molecular formula of compound?

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31. A difinite amount of $\mathrm{BaCl}_{2}$ was dissolved in HCl solution of unknown normality. 20 mL of " this solution was treated with 21.4 " mL of " 01 N

NaOH , for complete neutralisation. Further 20 " mL of " the solution was added to 50 " mL of " $0.1 \mathrm{~N} \mathrm{Na} \mathrm{Na}_{2} \mathrm{CO}_{3}$ and the precipitate was filtered off. The filtrate reacted with 10.5 m mL of " $0.08 \mathrm{~N} H_{2} \mathrm{SO}_{4}$ using phenolphthalein as indicator. Calculate the strength of $B a C l_{2}$ in mixture.

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## Exercises Linked Comprehension

1. $\mathrm{KMnO}_{4}$ reacts with $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, strongly basic and aqueous (neutral) media. 100 mL of $\mathrm{LMnO}_{4}$ reacts with 100 mL of $0.1 \mathrm{M} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, basic and neutral media.
Q. The molarity ( $M$ ) of $\mathrm{KMnO}_{4}$ solution in the acidic medium is
A. 0.2 M
B. 0.02 M
C. 0.4 M
D. 0.04 M

## Answer: B

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2. $\mathrm{KMnO}_{4}$ reacts with $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, strongly basic and aqueous (neutral) media. 100 mL of $\mathrm{LMnO}_{4}$ reacts with 100 mL of $0.1 \mathrm{M} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, basic and neutral media.
Q. The molarity (M) of $\mathrm{KMnO}_{4}$ solution in basic medium is:
A. 0.8 M
B. 0.08 M
C. 0.26 M
D. 0.026 M

## Answer: A

3. $\mathrm{KMnO}_{4}$ reacts with $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, strongly basic and aqueous (neutral) media. 100 mL of $\mathrm{LMnO}_{4}$ reacts with 100 mL of $0.1 \mathrm{M} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ in acidic, basic and neutral media.
Q. The molarity (M) of $\mathrm{KMnO}_{4}$ in aqueous medium is
A. 0.8 M
B. 0.08 M
C. 0.26 M
D. 0.026 M

## Answer: C

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4. The molarity (m) of $\mathrm{KMnO}_{4}$ in the acidic medium is (densityh of $K M n O_{4}$ solution $\left.=1.58 \mathrm{gmL}^{-1} \mathrm{Mw}\left(\mathrm{KMnO}_{4}\right)=158 \mathrm{gmol}^{-1}\right)$
A. 0.025
B. 0.25
C. 0.12
D. 0.012

## Answer: D

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5. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was reacted with a sample of $\mathrm{SeO}_{3}^{2-} 20$ The $B r_{2}$ thus evolved was removed and the excess of $\mathrm{NaAsO} \mathrm{O}_{2}$ The reaction involved are
$\mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-}+\mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O}$.. (i)
$\mathrm{BrO}_{3}^{\ominus}+\mathrm{ASO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus}$
$\left[M w\left(S e O_{3}^{2-}\right)=79+48=127 \mathrm{gmol}^{-1}\right]$
Q. n-factors of $\mathrm{BrO}_{3}^{\ominus}$ ion in equations (i) and (ii) respectively are
A. 10,6
B. 5,6
C. 6,10
D. 6,5

## Answer: B

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6. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was reacted with a sample of $\mathrm{SeO}_{3}^{2-} 20$ The $B r_{2}$ thus evolved was removed and the excess of $\mathrm{NaAsO}_{2}$ The reaction involved are

$$
\begin{align*}
& \mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-}+\mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O} . . \text { (i) } \\
& \mathrm{BrO}_{3}^{\ominus}+\mathrm{ASO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus} . .(\mathrm{ii)}  \tag{ii}\\
& {\left[\mathrm{Mw}\left(\mathrm{SeO}_{3}^{2-}\right)=79+48=127 \mathrm{gmol}^{-1}\right]} \\
& \text { Q. m" Eq of "SeO } 3_{3}^{2-} \text { is }
\end{align*}
$$

A. (a) $\frac{1}{6}$
B. $\frac{11}{6}$
C. $\frac{1}{36}$
D. $\frac{11}{36}$

## Answer: A

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7. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was reacted with a sample of $\mathrm{SeO}_{3}^{2-} 20$ The $\mathrm{Br}_{2}$ thus evolved was removed and the excess of $\mathrm{NaAsO}_{2}$ The reaction involved are
$\mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-}+\mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O} .$. (i)
$\mathrm{BrO}_{3}^{\ominus}+\mathrm{ASO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus}$
$\left[\mathrm{Mw}\left(\mathrm{SeO}_{3}^{2-}\right)=79+48=127 \mathrm{gmol}^{-1}\right]$
Q. m" Eq of "SeO ${ }_{3}^{2-}$ is
A. $\frac{55}{72}$
B. $\frac{55}{36}$
C. $\frac{11}{36}$
D. $\frac{11}{6}$

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8. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was reacted with a sample of $\mathrm{SeO}_{3}^{2-} 20$ The $\mathrm{Br}_{2}$ thus evolved was removed and the excess of $\mathrm{NaAsO}_{2}$ The reaction involved are

$$
\mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-}+\mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O} . . \text { (i) }
$$

$$
\begin{equation*}
\mathrm{BrO}_{3}^{\ominus}+\mathrm{ASO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus} \tag{ii}
\end{equation*}
$$

$\left[\mathrm{Mw}\left(\mathrm{SeO}_{3}^{2-}\right)=79+48=127 \mathrm{gmol}^{-1}\right]$
Q. Amount of $\mathrm{SeO}_{3}^{2-}$ in mg is
A. 19.4 mg
B. 194 mg
C. 970 mg
D. 97 mg

## Answer: D

9. 20 " mL of " $\frac{M}{60} \mathrm{KBrO}_{3}$ was reacted with a sample of $\mathrm{SeO}_{3}^{2-} 20$ The $\mathrm{Br}_{2}$ thus evolved was removed and the excess of $\mathrm{NaAsO}_{2}$ The reaction involved are
$\mathrm{SeO}_{3}^{2-}+\mathrm{BrO}_{3}^{\ominus}+\mathrm{H}^{\oplus} \rightarrow \mathrm{SeO}_{4}^{2-}+\mathrm{Br}_{2}+\mathrm{H}_{2} \mathrm{O}$. . (i)
$\mathrm{BrO}_{3}^{\ominus}+\mathrm{ASO}_{2}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{Br}^{\ominus}+\mathrm{AsO}_{4}^{3-}+\mathrm{H}^{\oplus}$
$\left[M w\left(\mathrm{SeO}_{3}^{2-}\right)=79+48=127 \mathrm{gmol}^{-1}\right]$
Q. Amount of $\mathrm{SeO}_{3}^{2-}$ in mg is
A. Excess of m " Eq of " $\mathrm{Br} \mathrm{O}_{3}^{\ominus}=m$ Eq of $\mathrm{AsO}_{2}^{\ominus}$ in reaction (ii)
B. $m \mathrm{Eq}$ of $\mathrm{SeO}_{3}^{2-}=$ otal m " Eq of $\mathrm{BrO} \mathrm{O}_{3}^{\ominus}$
C. $m \mathrm{~mol}$ of $\mathrm{SeO}_{3}^{2-}=$ total $\mathrm{m} " \mathrm{~mol}$ of " $\mathrm{BrO}_{3}^{\ominus}=\mathrm{m} " \mathrm{~mol}$ of" $\mathrm{BrO}_{3}^{\ominus}$ (excess) in reaction (ii).
D. m" Eq of " $\mathrm{SeO}_{3}^{2-}=$ total m" Eq of " $\mathrm{BrO} \mathrm{O}_{3}^{\ominus}-m \mathrm{Eq}$ of $\mathrm{BrO}_{3}^{\ominus}$ (excess) usd in reaction (ii)
10. A mixture of CO and $\mathrm{CO}_{2}$ when treated with $I_{2} \mathrm{O}_{5}$ gives $I_{2}$ vapours accoeding to the following equation:
$5 \mathrm{CO}+\mathrm{I}_{2} \mathrm{O}_{5} \rightarrow 5 \mathrm{CO}_{2}+\mathrm{I}_{2}$
$I_{2}$ vapour was separated and treated with $\mathrm{HClO}_{4}$ and the resultant $\mathrm{HIO}_{4}$ required 0.001 m mol of "hlycerol for complete oxidation. After treatment with $I_{2} O_{5}$ and removal of $I_{2}$,t he mixture was treated with excess of 0.1 N NaOH solution and finally this solution required 20 mL of " 1 N HCl to reach end point using phenolphthalein as indicator, followed by methyl orange as indicator after the first end point, 10 " mL of " further HCl was consumed.
Q. The number of moles of CO present initially is
A. 0.001
B. 0.002
C. 0.005
D. 0.01

## Answer: C

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11. A mixture of CO and $\mathrm{CO}_{2}$ when treated with $I_{2} \mathrm{O}_{5}$ gives $I_{2}$ vapours accoeding to the following equation:
$5 \mathrm{CO}+\mathrm{I}_{2} \mathrm{O}_{5} \rightarrow 5 \mathrm{CO}_{2}+\mathrm{I}_{2}$
$I_{2}$ vapour was separated and treated with $\mathrm{HClO}_{4}$ and the resultant $\mathrm{HIO}_{4}$ required 0.001 m mol of "hlycerol for complete oxidation. After treatment with $I_{2} O_{5}$ and removal of $I_{2}$,t he mixture was treated with excess of 0.1 N NaOH solution and finally this solution required 20 mL of
" 1 N HCl to reach end point using phenolphthalein as indicator, followed by methyl orange as indicator after the first end point, 10 " mL of " further HCl was consumed.
Q. The total volume of NaOH used in the problem is
A. 30 Ml
B. 300 mL
C. 60 mL
D. 600 mL

## Answer: B

## D Watch Video Solution

12. A mixture of CO and $\mathrm{CO}_{2}$ when treated with $\mathrm{I}_{2} \mathrm{O}_{5}$ gives $I_{2}$ vapours accoeding to the following equation:
$5 \mathrm{CO}+\mathrm{I}_{2} \mathrm{O}_{5} \rightarrow 5 \mathrm{CO}_{2}+\mathrm{I}_{2}$
$I_{2}$ vapour was separated and treated with $\mathrm{HClO}_{4}$ and the resultant $\mathrm{HIO}_{4}$ required 0.001 m mol of "hlycerol for complete oxidation. After treatment with $I_{2} O_{5}$ and removal of $I_{2}$,t he mixture was treated with excess of 0.1 N NaOH solution and finally this solution required 20 mL of " 1 N HCl to reach end point using phenolphthalein as indicator, followed by methyl orange as indicator after the first end point, 10 " mL of " further HCl was consumed.
Q. Total number of millimoles of $\mathrm{CO}_{2}$ in the above problem is
A. 5
B. 10
C. 50
D. 100

## Answer: B

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13. if $20 \mathrm{~mL} \frac{\mathrm{M}}{10} \mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ compeletely reacts with $\mathrm{FeC}_{2} \mathrm{O}_{4}$ in acidic medium,
Q. m" Eq of " $\mathrm{Fe} \mathrm{C}_{2} \mathrm{O}_{4}$ reacted is
A. 6
B. 20
C. 40
D. none

## Answer: B

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14. if $20 \mathrm{~mL} \frac{\mathrm{M}}{10} \mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ compeletely reacts with $\mathrm{FeC}_{2} \mathrm{O}_{4}$ in acidic medium,
Q. Millimoles of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ reacted is
A. $\frac{20}{3}$
B. $\frac{20}{2}$
C. $\frac{20}{6}$
D. $\frac{20}{10}$

## Answer: A

15. if $20 \mathrm{~mL} \frac{\mathrm{M}}{10} \mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ compeletely reacts with $\mathrm{FeC}_{2} \mathrm{O}_{4}$ in acidic medium,
Q. What is the volume of $\mathrm{CO}_{2}$ produced at $S T P$
A. 112 mL
B. 224 mL
C. 448 mL
D. none

## Answer: B

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16. Direct titration of $I_{2}$ with a reducing agent is called iodimetry. If $I_{2}$ is leberated by the oxidation of $I_{\theta}$ ion by a strong oxidising agent in neutral or acidic medium, the liberated $I_{2}$ is then titrated with reducing agent. lodometry is used to estimate the strngth of the oxidising agent. For example, in the estimation of $\mathrm{Cu}^{2+}$ with $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$
$\mathrm{Cu}^{2+}+I^{\ominus} \rightarrow \mathrm{CuI}_{2}+\mathrm{I}_{2}$ (iodometry)
$I_{2}+S_{2} O_{3}^{2-} \rightarrow S_{4} O_{6}^{2-}+I^{\ominus}$ (iodimetry)
Strach is used as an indicator at the end point, which forms bluecoloured complex with $I_{3}^{\ominus}$ Disappearance of blue colourindicates the end point whe free $I_{2}$ in not present.
Q. In the reaction
$2 \mathrm{CuSO}_{4}+4 \mathrm{KI} \rightarrow \mathrm{Cu}_{2} \mathrm{I}_{2}+2 \mathrm{~K}_{2} \mathrm{SO}_{4}+\mathrm{I}_{2}$
The equivalent weight of CuSO 4 is
$\left(M w=159.5 \mathrm{gmol}^{-1}\right)$
A. $M w$
B. $\frac{M w}{2}$
C. $\frac{M w}{4}$
D. $\frac{M w}{8}$

## Answer: A

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17. 638.0 g of $\mathrm{CuSO}_{4}$ solution is titrated with excess of 0.2 M KI solution.

The liberated $I_{2}$ required 400 mL of " $1.0 \mathrm{M} \mathrm{Na} a_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ for complete reaction. The percentage purity of $\mathrm{CuSO}_{4}$ in the sample is
A. $5 \%$
B. $10 \%$
C. $15 \%$
D. $20 \%$

## Answer: B

## - Watch Video Solution

18. Direct titration of $I_{2}$ with a reducing agent is called iodimetry. If $I_{2}$ is leberated by the oxidation of $I_{\theta}$ ion by a strong oxidising agent in neutral or acidic medium, the liberated $I_{2}$ is then titrated with reducing agent. lodometry is used to estimate the strngth of the oxidising agent. For example, in the estimation of $\mathrm{Cu}^{2+}$ with $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$
$\mathrm{Cu}^{2+}+I^{\ominus} \rightarrow \mathrm{CuI}_{2}+\mathrm{I}_{2}$ (iodometry)
$I_{2}+S_{2} O_{3}^{2-} \rightarrow S_{4} O_{6}^{2-}+I^{\ominus}$ (iodimetry)
Strach is used as an indicator at the end point, which forms bluecoloured complex with $I_{3}^{\ominus}$ Disappearance of blue colourindicates the end point whe free $I_{2}$ in not present.
Q. The volume of KI solution used for $\mathrm{CuSO}_{4}$ is:
A. 1 L
B. 2 L
C. 4 L
D. 5 L

## Answer: C

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19. 12 g of impure cyanogen undergoes hydrolysis by two different paths.
(i). $(\mathrm{CN})_{2}+4 \mathrm{H}_{2} \mathrm{O} \rightarrow\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$
(ii). $(\mathrm{CN})_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{NH}_{2} \mathrm{CONH}_{2}$

When 11.52 g of pure ammonium carbonate $\left[\left(\mathrm{NH}_{4}\right)_{2} \mathrm{CO}_{3}\right]$ was heated, the exact amount of urea was obtained. 20 " mL of " 1.6 M acidic $\mathrm{KMnO}_{4}$ is required to completely oxidise $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$.
Q. The percentage purity of cyanogen
A. $86.67 \%$
B. $76.67 \%$
C. $66.67 \%$
D. $56.67 \%$

## Answer: A

## - Watch Video Solution

20. 12 g of impure cyanogen undergoes hydrolysis by two different paths.
(i). $(\mathrm{CN})_{2}+4 \mathrm{H}_{2} \mathrm{O} \rightarrow\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$
(ii). $(\mathrm{CN})_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{NH}_{2} \mathrm{CONH}_{2}$

When 11.52 g of pure ammonium carbonate $\left[\left(\mathrm{NH}_{4}\right)_{2} \mathrm{CO}_{3}\right]$ was heated, the exact amount of urea was obtained. 20 " mL of " 1.6 M acidic $\mathrm{KMnO}_{4}$
is required to completely oxidise $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$.
Q. In which reaction, carbon is oxidised?
A. $40 \%$
B. $60 \%$
C. $30 \%$
D. $70 \%{ }^{\prime}$

## Answer: A

## - Watch Video Solution

21. 12 g of impure cyanogen undergoes hydrolysis by two different paths.
(i). $(\mathrm{CN})_{2}+4 \mathrm{H}_{2} \mathrm{O} \rightarrow\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$
(ii). $(\mathrm{CN})_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{NH}_{2} \mathrm{CONH}_{2}$

When 11.52 g of pure ammonium carbonate $\left[\left(\mathrm{NH}_{4}\right)_{2} \mathrm{CO}_{3}\right]$ was heated, the exact amount of urea was obtained. 20 " mL of " 1.6 M acidic $\mathrm{KMnO}_{4}$ is required to completely oxidise $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$.
Q. The percentage purity of cyanogen
A. $40 \%$
B. $60 \%$
C. $30 \%$
D. $70 \%{ }^{\prime}$

## Answer: B

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22. 12 g of impure cyanogen undergoes hydrolysis by two different paths.
(i). $(\mathrm{CN})_{2}+4 \mathrm{H}_{2} \mathrm{O} \rightarrow\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$
(ii). $(\mathrm{CN})_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{NH}_{2} \mathrm{CONH}_{2}$

When 11.52 g of pure ammonium carbonate $\left[\left(\mathrm{NH}_{4}\right)_{2} \mathrm{CO}_{3}\right]$ was heated, the exact amount of urea was obtained. 20 " mL of " 1.6 M acidic $\mathrm{KMnO}_{4}$ is required to completely oxidise $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{C}_{2} \mathrm{O}_{4}$.
Q. In which reaction, carbon is oxidised?
A. Reaction (i)
B. Reaction (ii)
C. Both
D. none

## Answer: B

## - Watch Video Solution

23. In the study of titration of NaOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$. NaOH and $\mathrm{NaHCO} \mathrm{CO}_{3}$, $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$, phenophthalein and methyl orange are used as indicators.
(a). When phenolphthalein is used as an indicator for the above mixture:
(i). It indicates complete neutralisation of NaOH or KOH
(ii). It indicates half neutralisation of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ because $\mathrm{NaHCO}_{3}$ is formed at the end point.
(b). When methyl orange is used as an indicator for the above mixture
(i). It indicates complete neutralisation of NaOH or KOH
(ii). It indicates half neutralisation of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ because NaCl is formed
at the end point.
Q. A 10 g moxture of $\mathrm{NaHCO}_{3}$ and KOH is dissolved in water to make 1000 mL solution. 100 " mL of " this solution required 50 mL of " 0.2 M HCl for complete neutralisation in the presence of phenolphthalein as indicator What is the percentage of $\mathrm{NaHCO}_{3}$ in the mixture?
A. $50 \%$
B. $56 \%$
C. $44 \%$
D. $60 \%$

## Answer: C

## - Watch Video Solution

24. In the study of titration of NaOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$. NaOH and $\mathrm{NaHCO} \mathrm{H}_{3}$, $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$, phenophthalein and methyl orange are used as indicators.
(a). When phenolphthalein is used as an indicator for the above mixture:
(i). It indicates complete neutralisation of NaOH or KOH
(ii). It indicates half neutralisation of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ because $\mathrm{NaHCO}_{3}$ is formed at the end point.
(b). When methyl orange is used as an indicator for the above mixture
(i). It indicates complete neutralisation of NaOH or KOH
(ii). It indicates half neutralisation of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ because NaCl is formed at the end point.
Q. 1 L solution of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and NaOH was made in $\mathrm{H}_{2} \mathrm{O} .100 \mathrm{~mL}$ of " this solution required 20 " mL of " 0.4 M HCl in the presence of phenolphthalein however, another 100 mL sample of the same solution required 25 mmL of " the same acid in the presence of methyl orange as indicator. What is the molar ratio of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and NaOH in the original mixture.
A. 3:2
B. 3:1
C. 1:3
D. 1:1

## D Watch Video Solution

25. $\mathrm{H}_{2} \mathrm{O}_{2}$ is reduced rapidly by $\mathrm{Sn}^{2+} . \mathrm{H}_{2} \mathrm{O}_{2}$ is decomposed slowly at room temperature to yield $\mathrm{O}_{2}$ and $\mathrm{H}_{2} \mathrm{O}_{2} .136 \mathrm{~g}$ of $10 \%$ by mass of $\mathrm{H}_{2} \mathrm{O}_{2}$ in water is treated with 100 mL of $3 M S n^{2+}$ and then a mixture is allowed to stand until no further reaction occurs. The reactions involved are:

$$
2 \mathrm{H}^{\oplus}+\mathrm{H}_{2} \mathrm{O}_{2}+\mathrm{Sn}^{2+} \rightarrow \mathrm{Sn}^{4+}+2 \mathrm{H}_{2}
$$

$2 \mathrm{H}_{2} \mathrm{O}_{2} \rightarrow 2 \mathrm{H}_{2} \mathrm{O}+\mathrm{O}_{2}$
The equivalent of $\mathrm{H}_{2} \mathrm{O}_{2}$ reacted with $\mathrm{Sn}^{2+}$ is
A. 0.2
B. 0.3
C. 0.4
D. 0.6

## Answer: D

## D Watch Video Solution

26. $\mathrm{H}_{2} \mathrm{O}_{2}$ is reduced rapidly by $\mathrm{Sn}^{2+} . \mathrm{H}_{2} \mathrm{O}_{2}$ is decomposed slowly at room temperature to yield $\mathrm{O}_{2}$ and $\mathrm{H}_{2} \mathrm{O} .136 \mathrm{~g}$ of $10 \%$ by mass of $\mathrm{H}_{2} \mathrm{O}_{2}$ in water is treated with 100 mL of $3 M S n^{2+}$ and then a mixture is allowed to stand until no further reaction occurs. The reactions involved are:
$2 \mathrm{H}^{\oplus}+\mathrm{H}_{2} \mathrm{O}_{2}+\mathrm{Sn}^{2+} \rightarrow \mathrm{Sn}^{4+}+2 \mathrm{H}_{2}$
$2 \mathrm{H}_{2} \mathrm{O}_{2} \rightarrow 2 \mathrm{H}_{2} \mathrm{O}+\mathrm{O}_{2}$
The equivalent of $\mathrm{H}_{2} \mathrm{O}_{2}$ left after reacting with $\mathrm{Sn}^{2+}$ is
A. 0.1
B. 0.2
C. 0.3
D. 0.4

## D Watch Video Solution

27. $\mathrm{H}_{2} \mathrm{O}_{2}$ is reduced rapidly by $\mathrm{Sn}^{2+} . \mathrm{H}_{2} \mathrm{O}_{2}$ is decomposed slowly at room temperature to yeild $\mathrm{O}_{2}$ and $\mathrm{H}_{2} \mathrm{O} .136 \mathrm{~g}$ of $10 \%$ by mass of $\mathrm{H}_{2} \mathrm{O}_{2}$ in water is treated with 100 mL of $3 M S n^{2+}$ and then a mixture is allowed to stand until no further reaction occurs. The reactions involved are:
$2 \mathrm{H}^{\oplus}+\mathrm{H}_{2} \mathrm{O}_{2}+\mathrm{Sn}^{2+} \rightarrow \mathrm{Sn}^{4+}+2 \mathrm{H}_{2}$
$2 \mathrm{H}_{2} \mathrm{O}_{2} \rightarrow 2 \mathrm{H}_{2} \mathrm{O}+\mathrm{O}_{2}$
The volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ left after reacting with $\mathrm{Sn}^{2+}$
A. 1.12 V
B. 11.2 V
C. 2.24 V
D. 22.4 V

## D Watch Video Solution

28. $\mathrm{H}_{2} \mathrm{O}_{2}$ is reduced rapidly by $\mathrm{Sn}^{2+} . \mathrm{H}_{2} \mathrm{O}_{2}$ is decomposed slowly at room temperature to yeild $\mathrm{O}_{2}$ and $\mathrm{H}_{2} \mathrm{O} .136 \mathrm{~g}$ of $10 \%$ by mass of $\mathrm{H}_{2} \mathrm{O}_{2}$ in water is treated with 100 mL of $3 M S n^{2+}$ and then a mixture is allowed to stand until no further reaction occurs. The reactions involved are:
$2 \mathrm{H}^{\oplus}+\mathrm{H}_{2} \mathrm{O}_{2}+\mathrm{Sn}^{2+} \rightarrow \mathrm{Sn}^{4+}+2 \mathrm{H}_{2}$
$2 \mathrm{H}_{2} \mathrm{O}_{2} \rightarrow 2 \mathrm{H}_{2} \mathrm{O}+\mathrm{O}_{2}$

Calculate the volume of $\mathrm{O}_{2}$ produced at $27^{\circ} \mathrm{C}$ and 1 atm after $\mathrm{H}_{2} \mathrm{O}_{2}$ is reacted with ${ }^{`} \mathrm{Sn}^{\wedge}(2+)$ and the mixture is allowed to stand.
A. 2.46 L
B. 4.92 L
C. 1.23 L
D. 7.38 L

## D Watch Video Solution

29. Three solutions eaach of 100 mL containing $0.4 \mathrm{M} A s_{2} S_{3}, 5 M \mathrm{NaOH}$ and $6 \mathrm{MH}_{2} \mathrm{O}_{2}$, respectively were mixed to form $\mathrm{AsO}_{4}^{3-}$ and $\mathrm{SO}_{4}^{2-}$ as products.
Q. When the above solution is allowed to stand for some time what volume of $O_{2}$ will be obtained $S T P$ ?
A. 0.112 L
B. 0.224 L
C. 0.224 L
D. 0.448 L

## Answer: C

30. Three solutions eaach of 100 mL containing $0.4 \mathrm{M} A s_{2} S_{3}, 5 M \mathrm{NaOH}$ and $6 \mathrm{MH}_{2} \mathrm{O}_{2}$, respectively were mixed to form $\mathrm{AsO}_{4}^{3-}$ and $\mathrm{SO}_{4}^{2-}$ as products.
Q. Percentage strength of the $\mathrm{H}_{2} \mathrm{O}_{2}$ solution left after reaction is
A. $0.017 \%$
B. $0.113 \%$
C. $0.51 \%$
D. $0.68 \%$

## Answer: C

## - Watch Video Solution

31. 100 mL solution of ferric alum $\left[\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} .\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4} \cdot 24 \mathrm{H}_{2} \mathrm{O}\right.$ $\left(M w=964 \mathrm{gmol}^{-1}\right)$ containing 2.41 g salt was boiled with Fe when the reaction
$\mathrm{Fe}+\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} \rightarrow 3 \mathrm{FeSO}_{4}$

Takes place. The unreacted iron was filtered off and the solution was titrated with $\frac{\mathrm{M}}{60} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ in acidic medium.
Q. Moles of $\mathrm{FeSO}_{4}$ formed when Fe reacts with $\mathrm{Fe}(2)\left(\mathrm{SO}_{4}\right)_{3}$ is
A. 0.0075
B. 0.005
C. 0.001
D. 0.002

## Answer: A

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32. 100 mL solution of ferric alum $\left[\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} .\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4} \cdot 24 \mathrm{H}_{2} \mathrm{O}\right.$ $\left(M w=964 \mathrm{gmol}^{-1}\right)$ containing 2.41 g salt was boiled with Fe when the reaction
$\mathrm{Fe}+\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} \rightarrow 3 \mathrm{FeSO}_{4}$
Takes place. The unreacted iron was filtered off and the solution was
titrated with $\frac{M}{60} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ in acidic medium.
Q. Moles of $\mathrm{FeSO}_{4}$ formed when Cu reacts with $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ is
A. 0.0075
B. 0.005
C. 0.001
D. 0.002

## Answer: B

## - Watch Video Solution

33. 100 mL solution of ferric alum $\left[\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} .\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4} \cdot 24 \mathrm{H}_{2} \mathrm{O}\right.$
$\left(M w=964 \mathrm{gmol}^{-1}\right)$ containing 2.41 g salt was boiled with Fe when the reaction
$\mathrm{Fe}+\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} \rightarrow 3 \mathrm{FeSO}_{4}$
Takes place. The unreacted iron was filtered off and the solution was titrated with $\frac{M}{60} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ in acidic medium.
Q. What is the titre value of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ when Fe reacts with $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ ?
A. 25 mL
B. 50 mL
C. 75 mL
D. 100 mL

## Answer: C

## - Watch Video Solution

34. 100 mL solution of ferric alum $\left[\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} .\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4} \cdot 24 \mathrm{H}_{2} \mathrm{O}\right.$ $\left(M w=964 \mathrm{gmol}^{-1}\right)$ containing 2.41 g salt was boiled with Fe when the reaction
$\mathrm{Fe}+\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3} \rightarrow 3 \mathrm{FeSO}_{4}$
Takes place. The unreacted iron was filtered off and the solution was titrated with $\frac{\mathrm{M}}{60} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ in acidic medium.
Q. What is the titre value of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ when Cu reacts with $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ ?

## A. 25 mL

B. 50 mL
C. 75 mL
D. 100 ml

## Answer: B

## - Watch Video Solution

35. 10 mL solution of $\mathrm{H}_{2} \mathrm{SO}_{4}$ and $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ (oxalic acid), on titration with with 0.1 M KOH , required 20 mL of "the base. 10 mL of " the same solution on titration with $\frac{M}{300} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required 50 ml mL of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$. Q. Strength of oxalic acid in the solution is:
A. $4.5 g L^{-1}$
B. $4.9 g L^{-1}$
C. $2.25 g L^{-1}$
D. $2.45 g L^{-1}$

## D Watch Video Solution

36. 10 mL solution of $\mathrm{H}_{2} \mathrm{SO}_{4}$ and $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ (oxalic acid), on titration with with 0.1 M KOH , required 20 mL of " the base. 10 mL of " the same solution on titration with $\frac{M}{300} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required 50 n " mL of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$. Q. The strength of $\mathrm{H}_{2} \mathrm{SO}_{4}$ is the solution is:
A. $4.5 g L^{-1}$
B. $4.9 g L^{-1}$
C. $2.25 g L^{-1}$
D. $2.45 g L^{-1}$

## Answer: B

## - Watch Video Solution

37. 10 mL solution of $\mathrm{H}_{2} \mathrm{SO}_{4}$ and $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ (oxalic acid), on titration with with 0.1 M KOH , required 20 mL of " the base. 10 mLL of " the same solution on titration with $\frac{M}{300} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required 50 mmL of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$.
Q. What should be the volume strength of $\mathrm{H}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$, if $\mathrm{H}_{2} \mathrm{O}_{2}$ react with the same volume of $\frac{M}{300} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution.
A. 5.6 V
B. 0.56 V
C. 11.2 V
D. 1.12 V

## Answer: B

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38. 10 " mL of " a gaseous organic compound containing $\mathrm{C}, \mathrm{H}$ and O only was mixed with 100 mL of " $O_{2}$ and exploded under condition which allowed the $\mathrm{H}_{2} \mathrm{O}$ formed to condense. The volume of the gas after
explosion was 90 mL . On treatment with KOH solution, a further contraction of 20 mL in volume was observed. The vapour density of the compound is 23 . All volume measurements were made under the same condition.
Q.The volume of $\mathrm{CO}_{2}$ is
A. 20 mL
B. 50 mL
C. 70 mL
D. 90 mL

## Answer: A

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39. 10 " mL of " a gaseous organic compound containing $\mathrm{C}, \mathrm{H}$ and O only was mixed with 100 mL of " $O_{2}$ and exploded under condition which allowed the $\mathrm{H}_{2} \mathrm{O}$ formed to condense. The volume of the gas after explosion was 90 mL . On treatment with KOH solution, a further
contraction of 20 mL in volume was observed. The vapour density of the compound is 23 . All volume measurements were made under the same condition.
Q.The volume of unreacted $O_{2}$ is
A. 20 mL
B. 50 mL
C. 70 mL
D. 90 mL

## Answer: C

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40. 10 " mL of " a gaseous organic compound containing $\mathrm{C}, \mathrm{H}$ and O only,mixed with 100 mL of " $O_{2}$ and exploded under conditionwhich allowed the $\mathrm{H}_{2} \mathrm{O}$ formed to condense.Volume of the gas after explosion was 90 mL . On treatment with KOH solution,further contraction of 20 mL in volume was observed. The vapour density of the compound is 23 . All
volume measurements were made under the same condition.
Q.The molecular formula of the compound is
A. $\mathrm{C}_{3} \mathrm{H}_{8} \mathrm{O}$
B. $\mathrm{C}_{3} \mathrm{H}_{6} \mathrm{O}$
C. $\mathrm{C}_{2} \mathrm{H}_{6} \mathrm{O}$
D. $\mathrm{C}_{2} \mathrm{H}_{4} \mathrm{O}$

## Answer: C

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41. Air sample from an industrial area of Delhi, which is heavily polluted by $\mathrm{CO}_{2}$, was collected and analysed. One such sample of 224 L of air measured at STP was passed through a 500 " mL of " 0.1 M KOH solution, where $\mathrm{CO}_{2}(\mathrm{~g})$ was absorbed completely. 50 mL of " the above solution was then treated with excess of $\mathrm{BaCl}_{2}$ solution where all the carbonate was precipitated as $\mathrm{BaCO}_{4}(s)$. The solution was filtered off and the filtrate required 30 " mL of " 0.1 M HCl solution for neutralisation.
Q. ppm strength of $\mathrm{CO}_{2}(\mathrm{~g})$ volume by volume ( mL of $\mathrm{CO}_{2}$ per $10^{6} \mathrm{~L}$ of air) is
A. 224
B. 2240
C. 2350
D. 1000

## Answer: D

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42. Air sample from an industrial area of Delhi, which is heavily polluted by $\mathrm{CO}_{2}$, was collected and analysed. One such sample of 224 L of air measured at STP was passed through a 500 " mL of " 0.1 M KOH solution, where $\mathrm{CO}_{2}(g)$ was absorbed completely. 50 " mL of " the above solution was then treated with excess of $B a C l_{2}$ solution where all the carbonate was precipitated as $\mathrm{BaCO}_{4}(s)$. The solution was filtered off and the filtrate required 30 " mL of " 0.1 M HCl solution for neutralisation.
Q. Calculate the weight of the precipitate of $\mathrm{BaCO}_{3}(\mathrm{~s})$ obtained from 50 " mL of " the above test solution.

$$
\left(B a=137, C=12, O=16, M w\left(B a C O_{3}\right)=137+12+3 \times 16=197 \mathrm{gm}\right.
$$

A. 3.94 g
B. 0.394 g
C. 1.97 g
D. 0.197 g

## Answer: C

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## Exercises Multiple Correct

1. What Volume of $0.1 \mathrm{M} \mathrm{KMnO}_{4}$ in acidic medium is required for complete oxidation of 100 mL of " $0.1 \mathrm{M} \mathrm{FeCO} \mathrm{O}_{2} \mathrm{O}_{4}$ and 100 mL of " 0.1 m ferric oxalate separately.
A. 60 " mL of " $\mathrm{KMnO}_{4}$ with $\mathrm{FeC}_{2} \mathrm{O}_{4}$
B. 40 mL of $\mathrm{KMnO}_{4}$ with $\mathrm{FeC}_{2} \mathrm{O}_{4}$
C. 40 mL of $\mathrm{KMnO}_{4}$ with ferric oxalate
D. 120 mL of $\mathrm{KMnO}_{4}$ with ferric oxalate

## Answer: A::D

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2. The following reaction takes places in basic medium:
 If 400 " mL of " $\frac{M}{5}$ chromate ion react with 500 mL of " $\frac{M}{4}$ stannite ion, then which of the following statements are correct?
A. Chromate ion $\mathrm{CrO}_{4}^{2-}$ is the limiting reagent.
B. Stannite ion, $\mathrm{HSnO}_{2}^{\ominus}$ is the limiting reagent.
C. At the end of reaction concentration of $\mathrm{CrO}_{2}^{\ominus}$ ions $\approx 0.08 \mathrm{M}$
D. At the end of reaction concentration of $\mathrm{HSnO}_{3}^{\ominus}$
$\approx 0.13 M$

## Answer: A::C::D

## - Watch Video Solution

3. A solution containing $\mathrm{Cu}^{2+}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ ions is titrated with 20 mL of " $\frac{M}{4} \mathrm{KMnO}_{4}$ solution in acidic medium. The resulting solution is treated with excess of KI after neutralisation. The evolved $I_{2}$ is then absorbed is 25 mL of " $\frac{M}{10}$ hypo solution. Which of the following statements are correct?
A. The difference of the number of m " mol of " $\mathrm{Cu}^{2+}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ ions in the solution is 10 m mol
B. The difference of the number of m " mol of " $\mathrm{Cu}^{2+}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ ions in the solution is 22.5 m mol .
C. The equivalent weight of $\mathrm{Cu}^{2+}$ ions in the titration with KI is equal to the atomic weight of $\mathrm{Cu}^{2+}$
D. The equivalent weight of KI in the titratio is $\frac{M}{2}$ ( $M=$ molesular weight of KI)

## Answer: A:C

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4. Which of the following statements about the following reaction is / are not correct?
$\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+3 \mathrm{H}_{2} \mathrm{O}_{2}+8 \mathrm{H}^{\oplus} \rightarrow 2 \mathrm{Cr}^{3+}+7 \mathrm{H}_{2} \mathrm{O}+3 \mathrm{O}_{2}$
A. $\mathrm{H}_{2} \mathrm{O}_{2}$ is oxidised to $\mathrm{O}_{2}$
B. $\mathrm{H}_{2} \mathrm{O}_{2}$ is reduced to $\mathrm{H}_{2} \mathrm{O}$
C. The oxidation number of chromium atom changes by 3 .
D. Hydrogen ions are oxidised to $\mathrm{H}_{2} \mathrm{O}$

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5. 100 " mL of " $\frac{\mathrm{M}}{10} \mathrm{Ca}\left(\mathrm{MnO}_{4}\right)_{2}$ in acidic medium can be oxidised completely with
A. 100 mL of $1 \mathrm{MFeSO}_{4}$ solution
B. $\frac{100}{3} \mathrm{~mL}$ of $1 \mathrm{MFeC}_{2} \mathrm{O}_{4}$ solution
C. 25 " mL of " $1 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution
D. 75 " mL of " $1 \mathrm{M} \mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ solution

## Answer: A::B

## D Watch Video Solution

6. Which of the following statements is/are correct about the reaction.
$4 \mathrm{CrO}_{5}+6 \mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow 2 \mathrm{Cr}_{2}\left(\mathrm{SO}_{4}\right)_{3}+6 \mathrm{H}_{2} \mathrm{O}+7 \mathrm{O}_{2}$
A. It is disproportionation reaction.
B. It is a an intramolecular redox reaction.
C. Cr acts as an oxidant, whereas O acts as a reductant.
D. $\mathrm{CrO}_{5}$ acts as-oxidant and reductant both.

## Answer: B::C::D

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7. 0.1 " mol of " $\mathrm{MnO}_{4}^{\ominus}$ (in acidic medium) can:
A. Oxidise 0.5 " mol of " $\mathrm{Fe}^{2+}$
B. Oxidise 0.166 " mol of ${ }^{\mathrm{FeC}} \mathrm{C}_{2} \mathrm{O}_{4}$
C. Oxidise 0.25 " mol of " $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$
D. Oxidise 0.6 " mol of " $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$

## Answer: A::B::C

8. $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ behave as acids as well as reducing agents. Which of the following are correct statements?
A. Equivalents weights of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ are equal to their molecular weights when acting as reducing agents.
B. Equivalents weight of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ are equal to half their molecular weights when acting as reducing agents.
C. 100 " mL of " 1 M solution of each is neutralised by equal volumes of $1 \mathrm{Nca}(\mathrm{OH})_{2}$
D. 100 mL of " 1 M solution of each is oxidised by equal volumes of 1 M $\mathrm{KMnO}_{4}$.

## Answer: B::D

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9. A compound contains atom $A, B$ and $C$. The oxidation number of $A$ is
+2 , of $B$ is +5 and $C$ is -2 . The possible formula of the compound is
A. $A\left(B C_{3}\right)_{2}$
B. $A_{3}\left(B C_{4}\right)_{2}$
C. $A_{3}\left(B_{4} C\right)_{2}$
D. $A B C_{2}$

## Answer: A::B

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10. Choose the correct statement:
A. 1 " mol of " $\mathrm{MnO}_{4}^{\ominus}$ ion can oxidise 5 mol of $\mathrm{Fe}^{2+}$ ion in acidic medium.
B. 1 " mol of " $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$ ion can oxidise 6 mol of " $\mathrm{Fe}^{2+}$ ion in acidic medium.
C. 1 " mol of " $\mathrm{C} u_{2} S$ can be oxidised by 1.6 mole of $\mathrm{MnO}_{4}^{\ominus}$ ion in acidic medium.
D. 1 " mol of "CuS can be oxidised by 1 " mol of " $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$ ion in acidic medium.

## Answer: A::B::C::D

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11. For the following balanced redox reaction:
$2 \mathrm{MnO}_{4}^{\ominus}+8 \mathrm{H}^{\oplus}+\mathrm{Br}_{2} \rightarrow 2 \mathrm{Mn}^{2+}+2 \mathrm{BrO}_{3}^{\ominus}+2 \mathrm{H}_{2} \mathrm{O}$
if the molecular weight of $M n O_{4}^{\ominus}: B r_{2}$ and $B r_{2}$ be $M_{1} M_{2}$ respectively, then
A. equivalent weight of $M n O_{4}^{\ominus}$ is $\frac{M_{1}}{5}$
B. Equivalents weight of $B r_{2}$ is $\frac{M_{2}}{10}$
C. The n-factor ratio of $\mathrm{MnO}_{4}^{\ominus}: \mathrm{Br}_{2} i s 1: 1$
D. none of these

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12. Which of the following statements is/are correct about the followig reaction? $\mathrm{Fe}_{3} \mathrm{O}_{4} \xrightarrow{\Delta} \mathrm{Fe}_{2} \mathrm{O}_{3}$.
A. The equivalent weight of $\mathrm{Fe}_{3} \mathrm{O}_{4}$ is $M_{1}\left(M_{1}=\right.$ molecular weight of

$$
\left.\mathrm{Fe}_{2} \mathrm{O}_{4}\right)
$$

B. The equivalent weight of $\mathrm{Fe}_{3} \mathrm{O}_{4}$ is $\frac{M_{1}}{3}$.
C. The equivalent weight of $\mathrm{Fe}_{2} \mathrm{O}_{3}$ is $\frac{3 M_{2}}{2}\left(M_{2}=\right.$ molecular weight of $\mathrm{Fe}_{2} \mathrm{O}_{3}$ ).
D. The equivalent weight of $F e_{2} O_{3}$ is $\frac{M_{2}}{2}$.

## Answer: A: C

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13. Which of the following statements is / are correct about $6.8 \%$ stregnth of $\mathrm{H}_{2} \mathrm{O}_{2}$.
A. Its normality is 4 N
B. Its molarity is 2 M .
C. Its volume strength is 22.4 V .
D. Volume strength $=11.2 \times M$.

## Answer: A::B::C::D

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14. Which of the following reactions is/are not intermolecular redox reaction?
A. $\mathrm{PbO}_{2}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{PbO}+\mathrm{H}_{2} \mathrm{O}_{2}$
B. $2 \mathrm{KClO}_{3} \rightarrow 2 \mathrm{KCl}+3 \mathrm{O}_{2}$
C. $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{Cr}_{2} \mathrm{O}_{7} \rightarrow \mathrm{~N}_{2}+\mathrm{Cr}_{2} \mathrm{O}_{3}+4 \mathrm{H}_{2} \mathrm{O}$
D. $\mathrm{NH}_{4} \mathrm{NH}_{2} \rightarrow \mathrm{~N}_{2}+2 \mathrm{H}_{2} \mathrm{O}$

## Answer: B::C::D

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15. 1 L sample of impure water containing sulphide ion is made ammoniacal and is titrated with 300 mL of " $0.1 \mathrm{M} \mathrm{AgNO}_{3}$ solution. Which of the following statements is/are correct about the above reaction?
A. The strength of $H_{2} S$ in water is $0.51 g L^{-1}$
B. The strength of $H_{2} S$ in water is $5.1 g L^{-1}$
C. The concentration of $\mathrm{H}_{2} S$ in water in ppm is 510 .
D. The concentration of $H_{2} S$ in water in ppm is 51 .

## Answer: A:C

16. Which of the following statements is/are correct about the reaction.
$\mathrm{H}_{2} \mathrm{SO}_{4}+\mathrm{Cu}_{3} \mathrm{P}+\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-} \rightarrow \mathrm{CuSO}_{4}+\mathrm{H}_{3} \mathrm{PO}_{4}+2 \mathrm{Cr}^{3+}$
A. The number of moles of $C r_{2} O_{7}^{2-}$ required to oxidise $6 " \mathrm{~mol}$ of " $\mathrm{Cu}_{3} \mathrm{P}$ to $\mathrm{CuSO}_{4}$ and $\mathrm{H}_{2} \mathrm{PO}_{4}$ is 11 mol .
B. The number of moles of $\mathrm{H}_{2} \mathrm{SO}_{4}$ used in the reaction is 62.
C. The number of moles of $\mathrm{Cr}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ formed in the reaction is 11 .
D. The number of moles of $\mathrm{K}_{2} \mathrm{SO}_{4}$ formed in the reaction is 11 .

## Answer: A::B::C::D

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17. Which of the following statements is/are correct in following reaction.
$\mathrm{As}_{2} \mathrm{~S}_{5}+\mathrm{NO}_{3}^{\ominus} \rightarrow \mathrm{AsO}_{4}^{3-}+\mathrm{NO}_{2}+\mathrm{SO}_{4}^{2-}$
A. The equivalent weight of $A s_{2} S_{5} i s \frac{M}{40}$. ( $M=$ molecular weight of $\left.A s_{2} S_{5}\right)$.
B. The equivalent weight of $\mathrm{NO}_{3}^{\ominus}$ is $\frac{M}{3}$.
( $M=$ molecular weight of $\mathrm{NO}_{3}^{\ominus}$ ion)
C. n-factor for the conversion of $A s_{2} S_{5}$ to $\mathrm{AsO}_{4}^{3-}$ is zero.
D. n-factor for the conversion of $A s_{2} S_{3}$ to $S O_{4}^{2-}$ is 30 .

## Answer: A: C

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18. In which of the reaction,oxygen is an oxidant.
A. $2 \mathrm{~F}_{2}+\mathrm{O}_{2} \rightarrow 2 \mathrm{~F}_{2} \mathrm{O}$
B. $\mathrm{C}+\mathrm{O}_{2} \rightarrow \mathrm{CO}_{2}$
C. $2 \mathrm{C}+\mathrm{O}_{2} \rightarrow 2 \mathrm{CO}$
D. $2 \mathrm{~N}_{2}+\mathrm{O}_{2} \rightarrow 2 \mathrm{~N}_{2} \mathrm{O}$

## D Watch Video Solution

19. $56.0 \mathrm{~g} \mathrm{KOH}, 138.0 \mathrm{~g} \mathrm{~K}_{2} \mathrm{CO}_{3}$ and $100.0 \mathrm{~g}_{\mathrm{KHCO}}^{3}$ is dissolved in water and the solution is made 1 L .10 " mL of " this stock solution is titrated with 2.0 M HCl . Which of the following statements is/are correct?
A. When phenolphthalein is used as an indicator from the very beginning the titre value of HCl will be 10 mL
B. When phenolphthalein is used as an indicator from the very beginning the titre value of HCl will be 40 mL .
C. When methyl orange is used as an indicator from the very beginning, the titre value of HCl will be 20 mL .
D. When methyl orange is used as an indicator after the first end point the titre value of HCl will be 10 mL .

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20. $x g$ of $\mathrm{H}_{2} \mathrm{O}_{2}$ requires 100 mL of $\mathrm{M} / 5 \mathrm{KMnO}_{4}$ in a titration in a solution having $p O H=1.0$ Which of the following is / are correct?
A. the value of $x$ is 1.7 g
B. the value of $x$ is 0.34 g
C. $\mathrm{MnO}_{4}^{\ominus}$ changes to $\mathrm{MnO}_{4}^{2-}$
D. $\mathrm{H}_{2} \mathrm{O}_{2}$ changes to $\mathrm{O}_{2}$.

## Answer: B::C::D

## D Watch Video Solution

21. A mixture of $n_{1}$ moles of $N a_{2} C_{2} O_{4}$ and $N a H C_{2} O_{4}$ is titrated separately with $\mathrm{H}_{2} \mathrm{O}_{2}$ and KOH , to reach at equivalence point. Which of
the following statement is/are correct?
A. Moles of $\mathrm{H}_{2} \mathrm{O}_{2}$ and KOH are $n_{1}+n_{2}$ and $n_{2}$
B. Moles of $\mathrm{H}_{2} \mathrm{O}_{2}$ and KOH is $n_{1}+\frac{n_{2}}{2}$ and $n_{1}$
C. n-factors of $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ with KOH and $\mathrm{H}_{2} \mathrm{O}_{2}$, respectively, are 1 and
22. 

D. n-factors of $\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ with $\mathrm{H}_{2} \mathrm{O}_{2}$ and KOH , respectively, are 2 and 1.

## Answer: A: C

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22. 100 mmL of " $0.2 \mathrm{M} \mathrm{Kal}(\mathrm{OH})_{2} \mathrm{CO}_{3}$ solution is completely neutralised by a standard solution of $\frac{M}{4} \mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$. Which of the following is/are wrong?
A. The volume of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ required is 160 mL .
B. the volume of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ required 80 mL .
C. The normality of $\mathrm{KAl}(\mathrm{OH})_{2} \mathrm{CO}_{3}$ is 0.4 N
D. It is a redox reaction.

## Answer: B::C::D

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23. Which of the following is/are correct about the redox reaction?
$\mathrm{MnO}_{4}^{\ominus}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-}+\mathrm{H}^{\oplus} \rightarrow \mathrm{Mn}^{+2}+\mathrm{S}_{4} \mathrm{O}_{6}^{2-}$
A. 1 " mol of " $S_{2} O_{3}^{2-}$ is oxidised by 8 " mol of " $M n O_{4}^{\ominus}$
B. The above redox reaction with the change of pH from 4 to 10 will have an effect on the stoichiometry of the reaction.
C. Change of pH form 4 to 7 will change the nature of the product.
D. At $p H=7, \mathrm{~S}_{2} \mathrm{O}_{3}^{2-}$ ions are oxidised to $\mathrm{HSO}_{4}^{\ominus}$

## Answer: B::C::D

24. 20 mL of " $\mathrm{H}_{2} \mathrm{O}_{2}$ is reacted completely with acidified $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution 40 " mL of " $\mathrm{K}_{2} \mathrm{Cr}_{3} \mathrm{O}_{7}$ solution was required to oxidised the $\mathrm{H}_{2} \mathrm{O}_{2}$ completely. Also, 2.0 m mL of " the same $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution required 5.0 mmL of "a $1.0 \mathrm{M} \mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ solution to reach equivalence point. Which of the following statements is/are correct?
A. The $\mathrm{H}_{2} \mathrm{O}_{2}$ solution is 5 M .
B. The volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ is 56 V .
C. The volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ is 112 V .
D. If 40 " mL of " $\frac{5 \mathrm{M}}{8 \mathrm{H}_{2} \mathrm{O}_{2}}$ is further added to the 10 mL of " above $\mathrm{H}_{2} \mathrm{O}_{2}$ solution the volume strength of the resulting solution is changed to 16.8 V .

## Answer: A::B::D

## - Watch Video Solution

25. Three different solution of oxidising agents. $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}, \mathrm{I}_{2}$, and $\mathrm{KMnO}_{4}$ is titrated separately with $0.19 \mathrm{gofK}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$. The molarity of each oxidising agent is 0.1 M and the reaction are:
(i). $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-} \rightarrow \mathrm{Cr}^{3+}+\mathrm{SO}_{4}^{2-}$
(ii). $I_{2}+S_{2} O_{3}^{2-} \rightarrow I^{\ominus}+S_{4} O_{6}^{2-}$
(iii). $\mathrm{MnO}_{4}^{\ominus}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-} \rightarrow \mathrm{MnO}_{2}+\mathrm{SO}_{4}^{2-}$
(Molecular weight of
$K_{2} S_{2} O_{3}=190, K_{2} C r_{2} O_{7}=294, K M n O_{4}=158$, and $\left.I_{2}=254 \mathrm{~mol}^{-1}\right)$
Which of the following statements is/are correct?
A. All three oxidising agents can act as self-indicators
B. Volume of $I_{2}$ used in minimum.
C. Volume of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ used in maximum.
D. weight of $\mathrm{KMnO}_{4}$ used in the titration is maximum.

## Answer: A: B::D

## - Watch Video Solution

26. Consider the following reaction:
$\mathrm{KClO}_{3}(s) \xrightarrow{\Delta} \mathrm{KCl}(\mathrm{s})+\mathrm{O}_{2}(\mathrm{~g})$, yield $=60 \%$
$\mathrm{Zn}(\mathrm{s})+\mathrm{H}_{2} \mathrm{SO}_{4}(a q) \rightarrow \mathrm{ZnSO}_{4}(a q)+\mathrm{H}_{2}(\mathrm{~g})$, yield $=50 \%$
$2 \mathrm{H}_{2}(g)+\mathrm{O}_{2}(\mathrm{~g}) \rightarrow 2 \mathrm{H}_{2} \mathrm{O}(\mathrm{l})$, yield $=50 \%$
What volume of $0.2 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{4}$ solution is required to produce enough $\mathrm{H}_{2}$ to completely react with $O_{2}$ liberated due decomposition of
$1.225 \mathrm{gKClO}_{3}$.
(Molecular weight of $\mathrm{KClO}_{3}=39+53.5+3 \times 16$
$=122.5 \mathrm{gmol}^{-1}$ )
A. 150 mL
B. 180 mL
C. 360 mL
D. 480 mL

## Answer: B

27. 2.0 g of an elements is reacted with aqueous solution containing KOH and $\mathrm{KNO}_{3}$ to yield $\mathrm{K}_{2} \mathrm{XO}_{2}$ and $\mathrm{NH}_{3} . \mathrm{NH}_{3}$ thus liberated is absorbed in 200 " mL of " $0.05 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{4}$. The excess acid required 10 mL of " 1.5 M NaOH for complete neutralisation Which of the following statements is/are correct?
A. The atomic weight of $X$ is 100 g
B. The equivalent weight of $X$ is 50 g
C. The equivalent weight of X is 25 g
D. The atomic weight of X is 200 g

## Answer: A::B

## - Watch Video Solution

28. Permanent hardness is due to $\mathrm{CI}^{\ominus}$ and $\mathrm{SO}_{4}^{2-}$ of $\mathrm{Mg}^{2+}$ and $\mathrm{Ca}^{2+}$ and is removed by adding $\mathrm{Na}_{2} \mathrm{CO}_{3}$.
$\mathrm{CaSO}_{4}+\mathrm{Na}_{2} \mathrm{CO}_{3} \rightarrow \mathrm{CaCO}_{3}+\mathrm{Na}_{2} \mathrm{SO}_{4}$ $\mathrm{CaCl}_{2}+\mathrm{Na}_{2} \mathrm{CO}_{3} \rightarrow \mathrm{CaCO}_{3}+2 \mathrm{NaCl}$

Which of the following statements is / are correct?
A. If hardness is $100 \mathrm{ppm} \mathrm{CaCO}_{3}$ the amount of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ requried to soften 10 L of hard water is 1.06 g .
B. If hardness is $100 \mathrm{ppm} \mathrm{CaCO}_{3}$, the amount of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ required to soften 10 L of hard is 10.6 g
C. If hardness is $420 \mathrm{ppm} \mathrm{MgCO}_{3}$, the amount of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ required to soften 10 L of hard water is 53.0 g .
D. If hardness is $420 \mathrm{ppm} \mathrm{MgCO}_{3}$ the amount of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ required to soften 10 L of hard water is 5.3 g .

## Answer: A: D

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29. The hardness of water due to $\mathrm{HCO}_{3}$ is 122 ppm . Select the correct statement(s).
A. The hardness of water in terms of $\mathrm{CaCO}_{3}$ is 200 ppm .
B. The hardness of water in terms of $\mathrm{CaCO}_{3}$ is 100 ppm .
C. The hardness of water in terms of $\mathrm{CaCl}_{2}$ is 222 ppm .
D. The hardness of water in terms of $\mathrm{MgCl}_{2}$ is 95 ppm .

## Answer: B::D

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30. 18 mL of " $1.0 \mathrm{M} B r_{2}$ solution undergoes complete disproportionation in basic medium to $B r^{\text {Thehard } \neq \text { ssofwater } \in \text { termsof }}$ and $\mathrm{BrO} \mathrm{O}_{3}^{\ominus}$. Then the resulting solution required 45 mL of " $A s^{3+}$ solution to reduce $\mathrm{Br} \mathrm{O}_{3}^{\ominus}$ to $\mathrm{Br}^{\ominus} . \mathrm{As}^{3+}$ is oxidised to $\mathrm{As}^{5+}$ which statements are correct?
A. $E w\left(B r_{2}\right)=\frac{M}{10}$
B. $E w\left(B r_{2}\right)=\frac{5 M}{3}$
C. Molarity of $\mathrm{As}^{+3}=0.4 M$
D. Molarity of $A s^{3+}=0.2 M$

## Answer: B::C

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## Exercises Single Correct

1.34 g of $\mathrm{H}_{2} \mathrm{O}_{2}$ is present in 1120 " mL of " solution. This solution is called
A. 10 vol solution
B. 20 vol solution
C. 34 vol solution
D. 32 vol solution

## Answer: A

2. A 5.0 mL solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ liberates 1.27 g of iodine from an acidified KI solution. The percentage strenth of $\mathrm{H}_{2} \mathrm{O}_{2}$ is
A. 11.2
B. 5.6
C. 1.7
D. 3.4

## Answer: D

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3. If 20 mL of " $0.1 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is required to titrate 10 mL of " a liquid iron supplement, then the concentration of iron in the the the vitamin solution is
A. 1.2 M
B. 2.4 M
C. 0.6 N
D. 1.56 M

## Answer: A

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4. If an ore sample containing $M n$, is treated with $50 m L$ of $0.2750 \mathrm{MNa} a_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and the unreacted $\mathrm{Na}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ required 18.28 mL of $0.1232 \mathrm{MKMnO}_{4}$ in acidic medium, then the number of moles of Mn in the ore is
A. $1.38 \times 10^{-2}$
B. $1.49 \times 10^{-3}$
C. $1.15 \times 10^{-2}$
D. $8.12 \times 10^{-3}$

## Answer: D

5. After 20 mL of " $0.1 \mathrm{M} \mathrm{Ba}(\mathrm{OH}))_{2}$ is mixed with 10 mL of " 0.2 M $\mathrm{HClO}_{4}$, the concentration of $\stackrel{\ominus}{O} \mathrm{H}$ ions is
A. $2 \times 10^{-3} M$
B. $10^{-3} \mathrm{M}$
C. 0.066 M
D. $\stackrel{\ominus}{O} H$ ions are completely neutralised.

## Answer: C

## - Watch Video Solution

6. $\mathrm{K}_{2} \mathrm{CrO}_{4}$ oxidises KI in the presence of KCl to $I_{2}$. The equivalent weight of the $\mathrm{K}_{2} \mathrm{CrO}_{4}$ is
A. $\frac{M w}{2}$
B. $M w \times \frac{2}{3}$
C. $\frac{M w}{3}$
D. $\frac{M w}{6}$

## Answer: C

## - Watch Video Solution

7. The $p H$ of $10^{-5} \mathrm{MHCI}$ solution if 1 mol of it is diluted to 1000 ml is :
A. 5
B. 8
C. 7.02
D. 6.98

## Answer: D

8. What volume of $0.1 \mathrm{M} \mathrm{KMnO}_{4}$ is required to oxidise " 5 mg of $\mathrm{FeC}_{2} \mathrm{O}_{4}$ (ferrous oxalate) in acidic medium?
A. 0.20 mL
B. 0.1 mL
C. 0.4 mL
D. 2.08 mL

## Answer: A

## Watch Video Solution

9.4 " mol of "a solution $A^{n+}$ requires 1.6 " mol of " $\mathrm{MnO}_{4}^{-}$ions for the oxidation of $A^{n+}$ to $A O_{3}^{\ominus}$ in acidic medium the value of n is (a). 1
(b). 2.
(c). 3.
(d). 4.
A. 1
B. 2
C. 3
D. 4

## Answer: C

## - Watch Video Solution

10. A mole of $\mathrm{N}_{2} \mathrm{H}_{4}$ loses 10 mol of electrons to form a new compound Y .

Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in $Y$ ? ( There is no change in the oxidation number of hydrogen. )
A. +1
B. -3
C. +3
D. +5

## Answer: C

## - Watch Video Solution

11. 100 mL of ozone at $S T P$ was passed through 100 mL of 10 volume $\mathrm{H}_{2} \mathrm{O}_{2}$ solution. What is the volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ after attraction?
A. 9.5
B. 9
C. 4.75
D. 4.5

## Answer: A

## - Watch Video Solution

12. 10 m mL of " a solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ of 10 violume strength decolourises 100 " mL of " $\mathrm{KMnO}_{4}$ solution acidified with dil $\mathrm{H}_{2} \mathrm{SO}_{4}$. The amount of
$\mathrm{KMnO}_{4}$ in the given solution is $K=39, M n=55$ )
A. 0.282 g
B. 0.564 g
C. 1.128 g
D. 0.155 g

## Answer: B

## - Watch Video Solution

13. $25 m L$ samples of distiled water, tap water and boiled water required, respectively, $1 m L, 13 m L$ and $5 m L$ of soap solution to form a permanent lather. The ratio of temporary to permanent hardness in the tap water is
A. 3:2
B. 2: 3
C. 1:2
D. 2:1

Answer: D

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14. $3.4 g$ sample of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution containing $x \mathrm{H}_{2} \mathrm{O}_{2}$ by weight requires $x m L o f a \mathrm{KMnO}_{4}$ solution for complete oxidation under acidic condition. The normality of $\mathrm{KMnO}_{4}$ solution is
A. 1 N
B. 2 N
C. 3 N
D. 0.5 N

## Answer: B

## - Watch Video Solution

15. If 100 mL of acidified $2 \mathrm{NH}_{2} \mathrm{O}_{2}$ is allowed to react with $\mathrm{KMnO}_{4}$ solution till there is light tinge of purples colour, the volume of oxygen produced at $S T P$ is :
A. 2.24 L
B. 1.12 L
C. 3.36 L
D. 4.48 L

## Answer: A

## - Watch Video Solution

16. In the following equation

$$
\mathrm{CrO}_{4}^{2-}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-}+\stackrel{\ominus}{\mathrm{O}} \mathrm{H} \rightarrow\left[\mathrm{Cr}(\mathrm{OH})_{4}\right]^{-1}+\mathrm{SO}_{4}^{2-}
$$

What volume of $0.2 \mathrm{M} \mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution require to completely react with 0.016 mole of chromate ion.
A. 30 mL
B. 80 mL
C. 20 mL
D. 60 mL

## Answer: B

## - Watch Video Solution

17. 0.7 g sample of iron ore was dissolved in acid. Iron was reduced to +2 state and it required 50 mL of " $\frac{M}{50} \mathrm{KMnO}_{4}$ solution for titration. The percentage of Fe and $\mathrm{Fe}_{3} \mathrm{O}_{4}$ in the ore is
A. $40 \% \mathrm{Fe}, 55.24 \%, \mathrm{Fe}_{3} \mathrm{O}_{4}$
B. $55.24 \% \mathrm{Fe}, 40 \% \mathrm{Fe}_{3} \mathrm{O}_{4}$
C. $8 \% \mathrm{Fe}, 11 \% \mathrm{Fe}_{3} \mathrm{O}_{4}$
D. $11 \% \mathrm{Fe}, 8 \% \mathrm{Fe}_{3} \mathrm{O}_{4}$
18.0.5 g of a mixture of $\mathrm{K}_{2} \mathrm{CO}_{3}$ and $\mathrm{Li}_{2} \mathrm{CO}_{3}$ requires 30 mL of " 0.25 N Hci for neutralisaion. Calculate the percentage composition of the mixture.
A. $96 \% \mathrm{~K}_{2} \mathrm{CO}_{3}, 4 \% \mathrm{Li}_{2} \mathrm{CO}_{3}$
B. $4 \% \mathrm{~K}_{2} \mathrm{CO}_{4}, 96 \% \mathrm{Li}_{2} \mathrm{CO}_{3}$
C. $48 \% \mathrm{~K}_{2} \mathrm{CO}_{3}, 52 \% \mathrm{Li}_{2} \mathrm{CO}_{3}$
D. $52 \% \mathrm{~K}_{2} \mathrm{CO}_{3}, 48 \% \mathrm{Li}_{2} \mathrm{CO}_{3}$

## Answer: A

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19. In the estimation of nitrogen by Kjeldahl's method, 2.8 g of an organic compound required 20 millimoles of $\mathrm{H}_{2} \mathrm{SO}_{4}$ for the complete
neutralisation of $\mathrm{NH}_{3}$ gas evolved. The percentage of nitrogen in the sample is
A. $20 \%$
B. $10 \%$
C. $40 \%$
D. $30 \%$

## Answer: A

## - Watch Video Solution

20. 0.3 g of platinichloride of an organic diacidic base left 0.09 g of platinum on ignition. The molecular weight of the organic base is
A. 120
B. 240
C. 180

## Answer: B

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21. 0.5 g of an organic substance containing phosphorus was heated with conc $\mathrm{HNO}_{3}$ in the carius tube, the phosphoric acid thus formed was precipitated with magnesia mixture $\left(\mathrm{MgNH}_{4} \mathrm{PO}_{4}\right)$ which on ignition gave a residue to 1.0 g of megnesium pyrophosphate $\left(M g_{2} P_{2} O_{7}\right)$ The percentage of phosphorous in the organic compound is
A. $55.85 \%$
B. $29.72 \%$
C. 19.81\%
D. $20.5 \%$

## Answer: A

22. A bolloon blown up has a volume of 300 mL at $27 \% \mathrm{C}$. The balloon is distended to $\frac{5}{6}$ of its maximum stretching capacity. The maximum temperature above which it will burst is
A. $77^{\circ} C$
B. $67^{\circ} \mathrm{C}$
C. $57^{\circ} \mathrm{C}$
D. $87^{\circ} \mathrm{C}$

## Answer: D

## - Watch Video Solution

23. The number of moles of $\mathrm{KMnO}_{4}$ that are needed to react completely with one mole of ferrous oxalate in acidic solution is
A. $\frac{1}{5}$
B. $\frac{2}{5}$
C. $\frac{3}{5}$
D. $\frac{5}{3}$

## Answer: C

## - Watch Video Solution

24. In a reaction, 4 mole of electrons are transferred to 1 mole of $\mathrm{HNO}_{3}$, the possible product obtained due to reduction is:
A. 0.5 mol of $N_{2}$
B. 0.5 mol of $\mathrm{N}_{2} \mathrm{O}$
C. 1 mol of $\mathrm{NO}_{2}$
D. 1 mol of $\mathrm{NH}_{3}$

## Answer: B

25. If equal volumes of $1 \mathrm{M} \mathrm{KMnO}_{4}$ and $1 \mathrm{~m} \mathrm{~K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solution are used to oxidise $\mathrm{Fe}^{2+}$ in acidic medium, then $\mathrm{Fe}^{2+}$ will be oxidised
A. More by $\mathrm{KMnO}_{4}$
B. More by $\mathrm{K}_{2} \mathrm{Cr}_{3} \mathrm{O}_{7}$
C. Equal in both cases
D. Can't be determined

## Answer: B

## - Watch Video Solution

26. $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ (sulphuryl chloride) reacts with water to given a mixture of $\mathrm{H}_{2} \mathrm{SO}_{4}$ and HCL . What volume of $0.2 \mathrm{M} \mathrm{Ba}(\mathrm{OH})_{2}$ is needed to completely neutralize 25 mL of $0.2 \mathrm{MSO}_{2} \mathrm{Cl}_{2}$ solution:
A. 1
B. 2
C. 3
D. 4

## Answer: D

## D Watch Video Solution

27. 100 mL of $0.01 \mathrm{M} \mathrm{KMnO}_{4}$ oxidised $100 \mathrm{~mL} \mathrm{H}_{2} \mathrm{O}_{2}$ in acidic medium.

The volume of same $\mathrm{KMnO}_{4}$ required in strong alkaline medium to oxidise 100 mL of same $\mathrm{H}_{2} \mathrm{O}_{2}$ will be:
A. $\frac{100}{3} m L$
B. $\frac{500}{3} m L$
c. $\frac{300}{5} m L$
D. None

## Answer: B

28. 10 mL of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution (volume strength $=x$ ) requires 10 mL of $N / 0.56 \mathrm{MnO}_{4}^{\ominus}$ solution in acidic medium. Hencex is
A. 0.56
B. 5.6
C. 0.1
D. 10`

## Answer: D

## - Watch Video Solution

29. How many moles of $\mathrm{HgI}_{4}^{2-}$ will be formed when 1 l mol of " $\mathrm{Hg}^{2+}$ and $1 \mathrm{~mol} I^{\theta}$ react according to the following equation?
$\mathrm{Hg}^{2+}+4 \mathrm{I}^{\ominus} \rightarrow \mathrm{HgI}_{4}^{2-}$
(a). 1 mol
(b). 0.5 mol
(c). 0.25 mol
(d). 2 mol
A. 1 mol
B. 0.5 mol
C. 0.25 mol
D. 2 mol

## Answer: C

## - Watch Video Solution

30. When $1 \times 10^{-3}$ " mol of "the chloride of an elements Y was completely hydrolysed, it was found that the resulting solution requried 20 " mL of " 0.1 M aqueous silver nitrate for complete precipitation of the chloride ion. Elements Y could be
A. Aluminium
B. Phosphorus
C. Silicon
D. Sulphur

## Answer: D

## - Watch Video Solution

31. In the mixture of $\left(\mathrm{NaHCO}_{3}+\mathrm{Na}_{2} \mathrm{CO}_{3}\right)$, volume of HCI required is x mL with phenolphthalein indicator and y mL with methly orange indicator in the same titration. Hence, volume of $H C I$ for complete reaction of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ is:
(a) $2 x$
(b) y
(c) $x / 2$
(d) $(y-x)$
A. $2 x$
B. $y$
C. $\frac{x}{2}$
D. $(y-x)$

## Answer: A

## - Watch Video Solution

32. Equivalent mass of $\mathrm{KMnO}_{4}$ in acidic, strongly basic and neutral are in the ratio of
A. $3: 4: 15$
B. $5: 3: 1$
C. $5: 1: 13$
D. $3: 15: 5$

## Answer: A

33. $\mathrm{NH}_{3}+\mathrm{Ocl}^{\ominus} \rightarrow \mathrm{N}_{2} \mathrm{H}_{4}+\mathrm{Cl}^{\ominus}$

On balancing the above equation in basic solution, using integral coefficient, which of the following whole number of will be the coefficient of $\mathrm{N}_{2} \mathrm{H}_{4}$ ?
A. 1
B. 2
C. 3
D. 4

## Answer: A

## - Watch Video Solution

34. 50 mL of $0.1 M$ solution of a salt reacted with 25 mL of $0.1 M$ solution of sodium sulphite. The half reaction for the oxidation of sulphite ion is:
$\mathrm{SO}_{3}^{2-}(a q)+\mathrm{H}_{2} \mathrm{O}(l) \rightarrow(a q)+2 \mathrm{H}^{+}(a q)+2 e^{-}$

If the oxidation number of metal in the salt was 3 , what would be the new oxidation number of metal:
A. 0
B. 1
C. 2
D. 4

## Answer: C

## - Watch Video Solution

35. 20 " mL of " x M HCl neutralises completely 10 " mL of " $0.1 \mathrm{M} \mathrm{NaHCO}_{3}$ solution and a further 5 " mL of " $0.2 \mathrm{M} \mathrm{Na} \mathrm{CO}_{3}$ to methyl orange end point. What is the value of $x$ ?
A. 0.167 M
B. 0.133 M
C. 0.15 M
D. 0.2 M

## Answer: C

## - Watch Video Solution

36. Atomic weight of barium is 137.34 The equivalent weight of barium is
$\mathrm{BaCrO} \mathrm{O}_{4}$ used an an oxidising agent in acid medium is
A. 137.34
B. 45.78
C. 114.45
D. 68.67

## Answer: B

37. The normality and volume strength of a solution made by mixing $1.0 L$ each of 5.6 volume and 11.2 volume $\mathrm{H}_{2} \mathrm{O}_{2}$ solution are:
A. $1 N, 5.6 v o l$
B. $1.5 N, 5.6 \mathrm{vol}$
C. $1.5 N, 8.4 v o l$
D. $1 N, 8.4 \mathrm{vol}$

## Answer: C

## ( Watch Video Solution

38. 36 " mL of " 0.5 M Br 2 solution when made alkaline undergoes complete disproportionation into $\mathrm{Br}^{\ominus}$ and $\mathrm{BrO}_{3}^{\ominus}$. The resulting solution requried 45 " mL of " As (III) solution to reduce $\mathrm{Br} \mathrm{O}_{3}^{\ominus}$ to $\mathrm{Br}^{\ominus}$. Given that as (III) is oxidised to As (V), what is the molarity of As (III) solution?
A. 0.2
B. 0.1
C. 0.4
D. 0.5

## Answer: C

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39. $\mathrm{RH}_{2}$ ( ion exchange resin) can replace $\mathrm{Ca}^{2+} \mathrm{d}$ in hard water as.
$\mathrm{RH}_{2}+\mathrm{Ca}^{2+} \rightarrow \mathrm{RCa}+2 \mathrm{H}^{+}$
1litre of hard water passing through $\mathrm{RH}_{2}$ has pH 2 . Hence hardness in ppmof $\mathrm{Ca}^{2+}$ is:
A. 200
B. 100
C. 50
D. 125

## - Watch Video Solution

40. 100 mL of $\mathrm{H}_{2} \mathrm{O}_{2}$ is oxidised by 100 mL of $0.01 \mathrm{MKMnO}_{4}$ in acidic medium $\left(\mathrm{MnO}_{4}^{\ominus}\right.$ reduced to $\left.\mathrm{Mn}^{2+}\right) .100 \mathrm{~mL}$ of the same $\mathrm{H}_{2} \mathrm{O}_{2}$ is oxidised by $V m L$ of $0.01 \mathrm{MKMnO}_{4}$ in basic medium. Hence $V$ is
A. 500
B. 100
C. $\frac{100}{3}$
D. $\frac{500}{3}$

## Answer: D

41. $F_{2}$ can be prepared by reacting hexfluoro magnante (IV) with antimony pentafluoride as:
$K_{2} \mathrm{KnF}_{6}+S b F_{5} \xrightarrow{150^{\circ} \mathrm{C}} \mathrm{KSbF} F_{6}+M n F_{3}+F_{2}$ ltBrgt The number of equivalent of $K_{2} M n F_{6}$ requried to react completely with one " mol of " $S b F_{5}$ in the given reaction is
A. 1.52
B. 5.0
C. 0.5
D. 4.0

## Answer: C

## - Watch Video Solution

42.3 " mol of "a mixture of $\mathrm{FeSO}_{4}$ and $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ requried 100 mL of " $2 \mathrm{M} \mathrm{KMnO}_{4}$ solution in acidic medium. Hence, mole fraction of $\mathrm{FeSO}_{4}$ in the mixture is
A. $\frac{1}{3}$
B. $\frac{2}{3}$
C. $\frac{2}{5}$
D. $\frac{3}{5}$

## Answer: D

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43. $28 \mathrm{NO}_{3}^{-}+3 \mathrm{As}_{2} \mathrm{~S}_{3}+4 \mathrm{H}_{2} \mathrm{O} \rightarrow 6 \mathrm{AsO}_{4}^{3-}+28 \mathrm{NO}+9 \mathrm{SO}_{4}^{2-}+\mathrm{H}^{+}$ What will be the equivalent mass of As_(2)S_(3)' in the above reaction?
A. $\frac{3 M}{28}$
B. $\frac{M}{4}$
C. $\frac{M}{24}$
D. $\frac{M}{28}$
44. Which of the following reaction is oxidation- reduction?
A. $\mathrm{H}^{\oplus}+\mathrm{OH}^{\ominus} \rightarrow \mathrm{H}_{2} \mathrm{O}$
B. $\frac{1}{2} \mathrm{H}_{2}+\frac{1}{2} \mathrm{Cl}_{2} \rightarrow \mathrm{HCl}$
C. $\mathrm{CaCO}_{3} \rightarrow \mathrm{CaO}+\mathrm{CO}_{2}$
D. (a) and (c)

## Answer: B

## Watch Video Solution

45. In the reaction $A^{+x}+\mathrm{MnO}_{4} \rightarrow A O_{3}+\mathrm{Mn}^{++}+\frac{1}{2} \mathrm{O}$, if one mole fo $\mathrm{MnO}_{4}$ oxidises 1.67 moles of $A^{+x}$ to $A O_{3}$, then what will be the value of $x$ ?

$$
\text { A. } 2
$$

B. 3
C. 4
D. 5

## Answer: A

## - Watch Video Solution

46. In the mixture of $\left(\mathrm{NaHCO}_{3}+\mathrm{Na}_{2} \mathrm{CO}_{3}\right)$, volume of HCI required is $x \mathrm{~mL}$ with phenolphthalein indicator and y mL with methly orange indicator in the same titration. Hence, volume of $H C I$ for complete reaction of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ is :
(a) $2 x$
(b) $y$
(c) $x / 2$
(d) $(y-x)$
A. $2 x$
B. $y$
C. $\frac{x}{2}$
D. $(y-x)$

## Answer: D

## - Watch Video Solution

47. Which of the following does not represent redox reaction?
A. $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+\stackrel{\ominus}{\mathrm{O}} \mathrm{O} \mathrm{H} \rightarrow \mathrm{CrO}_{4}^{2-}+\mathrm{H}_{2} \mathrm{O}$
B. $\mathrm{SO}_{5}^{2-}+2 \mathrm{I}^{\ominus}+2 \mathrm{H}^{\oplus} \rightarrow \mathrm{I}_{2}+\mathrm{SO}_{4}^{2-}$
C. $2 \mathrm{Ca}(\mathrm{OH})_{2}+2 \mathrm{Cl}_{2} \rightarrow \mathrm{Ca}(\mathrm{ClO})_{2}+\mathrm{CaCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}$
D. $P C l_{5} \rightarrow P C l_{3}+C l_{2}$

## Answer: A

## D Watch Video Solution

48. 10 mL of " $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ is oxidised by 10 mL of " $0.02 \mathrm{M} \mathrm{MnO} \mathrm{M}_{4}^{\ominus}$. Hence, 10 m mL of " $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ is neutralised by
A. 10 " mL of " 0.1 M NaOH
B. 10 " mL of " 0.02 M NaOH
C. 10 " mL of " $0.1 \mathrm{M} \mathrm{Ca(OH)})_{2}$
D. 10 " mL of" $0.05 \mathrm{~N} \mathrm{Ba}(\mathrm{OH})_{2}$

## Answer: A

## - Watch Video Solution

49. 1 mole of ferric oxalate is oxidised by $x$ mole of $\mathrm{MnO}_{4}^{-}$in acidic medium, Hence value of $x$ is:
A. 1.2
B. 1.6
C. 1.8

## D. 1.5

## Answer: A

## - Watch Video Solution

50. $2 \mathrm{~mole} \mathrm{~N}_{2}$ and $3 \mathrm{~mole} \mathrm{H}_{2}$ gas are allowed to react in a 20 L flask at 400 K and after complete conversion of $\mathrm{H}_{2}$ into $\mathrm{NH}_{3} .10 \mathrm{LH}_{2} \mathrm{O}$ was added and temperature reduced to 300 K . Pressure of the gas after reaction is :
$\mathrm{N}_{2}+3 \mathrm{H}_{2} \rightarrow 2 \mathrm{NH}_{3}$
A. $3 R \times \frac{300}{20}$
B. $3 R \times \frac{300}{10}$
C. $R \times \frac{300}{20}$
D. $R \times \frac{300}{10}$

## Answer: D

51. $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is obtained in the following steps:
$2 \mathrm{FeCrO}_{4}+2 \mathrm{Na}_{2} \mathrm{CO}_{3}+\mathrm{O} \rightarrow \mathrm{Fe}_{2} \mathrm{O}_{3}+2 \mathrm{Na}_{2} \mathrm{CrO}_{4}+2 \mathrm{CO}_{2}$
$2 \mathrm{Na}_{2} \mathrm{CrO}_{4}+\mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow \mathrm{Na}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}+\mathrm{H}_{2} \mathrm{O}+\mathrm{Na}_{2} \mathrm{SO}_{4}$
$\mathrm{Na}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}+2 \mathrm{KC}<\mathrm{oK}_{2} \mathrm{Cr}_{2}+2 \mathrm{NaCl}$
To get 0.25 " mol of " $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$, " mol of " $50 \%$ pure $\mathrm{FeCrO}_{4}$ required.
A. 1 mol
B. 0.50 mol
C. 0.25 mol
D. 0.125 mol

## Answer: A

## - Watch Video Solution

52. $40 \mathrm{~mL} L 0.05 \mathrm{M}$ solution of sodium sesquicarbonate dehydrate $\left(\mathrm{Na}_{2} \mathrm{CO}_{3} . \mathrm{NaHCO}_{3} .2 \mathrm{H}_{2} \mathrm{O}\right)$ is titrated against 0.05 MHCl solution, $x m L$ of acid is required to reach the phenolphthalein end point while mL
of same acid were required when methyl organe indicator was used in a separate titration. Which of the following is (are) correct statements?
a. $y-x=80 m L$
b. $y+x=160 m L$
c. If the titration is started with phenolphthalein indicator and methyl orange is added at the end point, $2 x m L$ of HCl would be required further to reach the end point
d. If the same volume of same solution is titrated against
$0.10 \mathrm{MNaOH}, x / 2 m L$ of base would be required

## - Watch Video Solution

53. What volume of $0.05 \mathrm{M} \mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ in acidic medium is needed for completel oxidation of 200 " mL of " $0.6 \mathrm{M} \mathrm{FeC} \mathrm{C}_{2} \mathrm{O}_{4}$ solution?
A. 1.2 mL
B. 1.2 L
C. 120 mL
D. 800 mL

## Answer: B

## D Watch Video Solution

54. $\mathrm{MnO}_{4}^{2-}$ (1 mole) in neutral aqueous medium is disproportionate to
A. $\frac{2}{3} \mathrm{~mol}$ of $\mathrm{MnO}_{4}^{\ominus}$ and $\frac{1}{3} \mathrm{~mol}$ of $\mathrm{MnO}_{2}$
B. $\frac{1}{3} \mathrm{~mol}$ of $\mathrm{MnO}_{4}^{\ominus}$ and $\frac{2}{3} \mathrm{~mol}$ of $\mathrm{MnO}_{2}$
C. $\frac{1}{3} \mathrm{~mol}$ of $\mathrm{Mn}_{2} \mathrm{O}_{7}$ and $\frac{2}{3} \mathrm{~mol}$ of $\mathrm{MnO}_{2}$
D. $\frac{2}{3} \mathrm{~mol}$ of $\mathrm{Mn}_{2} \mathrm{O}_{7}$ and $\frac{1}{3} \mathrm{~mol}$ of $\mathrm{MnO} \mathrm{O}_{2}$

## Answer: A

## - Watch Video Solution

55. If equal volumes of $0.1 \mathrm{MKMnO}_{4}$ and $0.1 \mathrm{MK}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ solutions are allowed to oxidise $F e^{2+}$ to $F e^{3+}$ in acidic medium, then $F e^{2+}$ oxidised will be:
A. More by $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$
B. More by $\mathrm{KMnO}_{4}$
C. Equal in both cases
D. The data is insufficient to predict the answer

## Answer: A

## - Watch Video Solution

56. 100 mL of $0.01 \mathrm{M} \mathrm{KMnO}_{4}$ oxidised $100 \mathrm{~mL} \mathrm{H}_{2} \mathrm{O}_{2}$ in acidic medium.

The volume of same $\mathrm{KMnO}_{4}$ required in strong alkaline medium to oxidise 100 mL of same $\mathrm{H}_{2} \mathrm{O}_{2}$ will be:
A. $\frac{100}{3} m L$
B. $\frac{500}{3} m L$
C. $\frac{300}{5} m L$
D. none of these

## Answer: D

## - Watch Video Solution

57. The volume strength of $1.5 \mathrm{~N} \mathrm{H}_{2} \mathrm{O}_{2}$ solution is
A. 4.8
B. 8.4
C. 3
D. 8

## Answer: B

58. The equivalent mass of $\mathrm{MnSO}_{4}$ is half of its molecular mass when it is
A. $M n_{2} O_{3}$
B. $\mathrm{MnO}_{2}$
C. $\mathrm{MnO}_{4}^{\ominus}$
D. $\mathrm{MnO}_{4}^{2-}$

## Answer: B

## - Watch Video Solution

59. What volume of $0.2 \mathrm{M} \mathrm{KMnO}_{4}$ is required to react with 1.58 g of hypo solution $\left(\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}\right)$ in acidc medium?
A. 20 mL
B. 10 mL
C. 16.6 mL
D. 50 mL

## Answer: B

60. Certain " mol of "HCn is oxidised completely by 25 " mL of " $\mathrm{KMnO}_{4}$. The products are $\mathrm{CO}_{2}$ and $\mathrm{NO}_{3}^{\ominus}$ ion. When all $\mathrm{CO}_{2}$ is passed through lime water, 1 g of $\mathrm{CaCO}_{3}$ is obtained the molarity of the $\mathrm{KMnO}_{4}$ used is
A. 1.44 M
B. 0.72 M
C. 036 M
D. none of these

## Answer: D

## - Watch Video Solution

61. 0.6 g of a sample of pyrolusite was boiled with 200 mL of " $\frac{N}{10}$ oxalic acid and excess of dilute sulphuric acid. The liquid was filtered and the
residue washed. The filtrate and washing were mixed and made up to 500 mL in a measuring flask. 100 mL of "this solution required 50 mL of " $\frac{\mathrm{N}}{30} \mathrm{KMnO}_{4}$ solution. Calculate the percentage of $\mathrm{MnO}_{2}$ in the sample ( $M n=55$ ).
A. $10.86 \%$
B. $5.43 \%$
C. $1.086 \%$
D. none of these

## Answer: B

## - Watch Video Solution

62. In basic solution $\mathrm{CrO}_{4}^{2-}$ oxidises $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$ to form $\left[\mathrm{Cr}(\mathrm{OH})_{4}\right]^{\ominus}$ and $\mathrm{SO}_{4}^{2-}$ How many millilitres of $0.154 \mathrm{MNa}_{2} \mathrm{CrO}_{4}$ are required to react with 40.0 " mL of " $0.246 \mathrm{M} \mathrm{Na} \mathrm{N}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$.
A. $240.2 m L$
B. $24.02 m L$
C. $266.65 m L$
D. 26.67 mL

## Answer: C

## - Watch Video Solution

63. KI reacts with $\mathrm{H}_{2} \mathrm{SO}_{4}$ producing $\mathrm{I}_{2}$ and $\mathrm{H}_{2} \mathrm{~S}$ the volume of 0.2 M $\mathrm{H}_{2} \mathrm{SO}_{4}$ required to produce 0.1 " mol of " $\mathrm{H}_{2} \mathrm{~S}$ is
A. 4 L
B. 2.5 L
C. 3.8 L
D. 5 L

## Answer: B

64. A 0.46 g sample of $A s_{2} O_{3}$ required 25.0 " mL of " $\mathrm{KMnO}_{4}$ solution for its titration. The molarity of $\mathrm{KMnO}_{4}$ solution is
A. 0.016
B. 0.074
C. 0.032
D. 0.128

## Answer: B

## - Watch Video Solution

65. The number of moles of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ reduced by one mole of $\mathrm{Sn}^{2+}$ ions is
A. $\frac{1}{3}$
B. $\frac{1}{6}$
C. $\frac{2}{3}$
D. 1

## Answer: A

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66. 10 " mL of " $\mathrm{H}_{2} \mathrm{O}_{2}$ solution (volume strength $=x$ ) required 10 mL of " $\frac{N}{0.56} \mathrm{MnO}_{4}^{\ominus}$ solution in acidic medium hence x is:
A. 0.56
B. 5.6
C. 0.1
D. 10

## Answer: D

67. Equivalent mass of $\mathrm{H}_{3} \mathrm{PO}_{2}$ when it disproportionate into $\mathrm{PH}_{3}$ and $\mathrm{H}_{3} \mathrm{PO}_{3}$ is:
A. $M$
B. $\frac{M}{2}$
C. $\frac{M}{4}$
D. $\frac{3 M}{4}$

## Answer: D

## - Watch Video Solution

68. What volume of $0.1 \mathrm{M} \mathrm{Ca}(\mathrm{OH})_{2}$ will be required neutralise 200 mL of " $0.2 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{3}$ using methyl red indicator to change the colour form pinnk (acidic medium) to yellow (basic medium)?
A. 300 mL
B. 200 mL
C. 100 mL
D. 30 mL

## Answer: 2

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69. What volume of $0.1 \mathrm{M} \mathrm{Ca}(\mathrm{OH})_{2}$ will be required to neutralise 200 " mL of " $0.2 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{3}$ using methyl orange indicator to change the colour from red (acidic medium) to yello (basic medium)?
A. 200 mL
B. 400 mL
C. $20 m L$
D. $40 m L$

## Answer: A

70. What volume of 0.2 M KOH will be requried to neutralise 100 mL of " $0.1 \mathrm{M} \mathrm{H}_{3} \mathrm{PO}_{4}$ using methyl red indicator (change of colour pink $\rightarrow$ yellow) and then bromothymol blue indicator is added.
A. 50 mL
B. 100 mL
C. 150 mL
D. 200 mL

## Answer: B

## - Watch Video Solution

71. What volume of $0.1 \mathrm{M} \mathrm{Ba}(\mathrm{OH})_{2}$ will be required to neutralise a mixture of 50 mL of " 0.1 M HCl and 100 mL of " $0.2 \mathrm{M} H_{3} P O_{4}$ using methyl red indicator?
A. 25 mL
B. 50 mL
C. 100 mL
D. 125 mL

## Answer: D

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72. When 100 " mL of " $0.1 \mathrm{M} \mathrm{Ba}(\mathrm{OH})_{2}$ is neutralised with a mixture of x " mL of " 0.1 M HCl and y " mL of " $0.2 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{3}$ using methyl orange indicator what is value of $x$ and $y$ ?
A. 200100
B. 100200
C. 300200
D. 200300

## Answer: A

73. If $10 g$ of $V_{2} O_{5}$ 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 $\mathrm{VO}^{2+}$ ions? [Assume no change in state of $\mathrm{Zn}^{2+}$ ions] $(V=51, O=16, I=127)$
A. 0.11 mol of " $I_{2}$
B. 0.22 mol of $I_{2}$
C. 0.055 mol of $I_{2}$
D. 0.44 mol of $I_{2}$

## Answer: A

## - Watch Video Solution

74. The volume of $0.5 \mathrm{M} \mathrm{H}_{3} \mathrm{PO}_{4}$ that completely dissolved 3.1 g of copper carbonate is (molecular mass of copper carbonate $=124 \mathrm{gmol}^{-1}$ )
A. 55.5 mL
B. 45.5 mL
C. 35.5 mL
D. 33.3 mL

## Answer: D

## - Watch Video Solution

75. 1 g of a sample of NaOH was dissolved in 50 " mL of " 0.33 M alkaline solution of $\mathrm{KMnO}_{4}$ and refluxed till all the cyanide was converted into $O C N^{\ominus}$. The reaction mixture was cooled and its 5 mL portion was acidified by adding $\mathrm{H}_{2} \mathrm{SO}_{4}$ in excess \& then titrated to end point against 19.0 " mL of " 0.1 M FeSO 4 solution. The percentage purity of NaCN sample is
A. $55.95 \%$
B. $65.95 \%$
C. $75.95 \%$
D. $85.95 \%$

## Answer: C

## - Watch Video Solution

76. 0.4 g of polybasic acid HnA (all the hydrogens are acidic) requries 0.5 g of NaOH for complete neutralisation. The number of replaceable hydrogen atoms and the molecular weight of A would be (Mw of acid $=96$ )
A. 2,94
B. 1,95
C. 3,93
D. 4,92

## Answer: D

77. A mixutre solution of KOH and $\mathrm{Na}_{2} \mathrm{CO}_{3}$ requires 15 " mL of " $\frac{N}{20} \mathrm{HCl}$ when titrated with phenolphthalein as indicator.But the same amoound of the solutions when titrated with methyl orange as indicator requires 25 " mL of " the same acid. Calculate the amount of KOH present in the solution.
A. 0.014 g
B. 0.14 g
C. 0.028 g
D. 1.4 g

## Answer: A

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78. 25.0 g of $\mathrm{FeSO}_{4} .7 \mathrm{H}_{2} \mathrm{O}$ was dissolved in water containing dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$ and the volume was made up to 1.0 L .25 .0 mmL of " this solution requried 20 " mL of " an $\frac{\mathrm{N}}{10} \mathrm{KMnO}_{4}$ solution for complete oxidation the percentage of $\mathrm{FeSO}_{4} 7 \mathrm{H}_{2} \mathrm{O}$ in the acid solution is
A. $78 \%$
B. $98 \%$
C. $89 \%$
D. $79 \%$

## Answer: C

## - Watch Video Solution

79. A 0.13 g of a specimen containing $\mathrm{MnO}_{2}$ is treated with iodide ions. If iodine liberated requires 30.0 " mL of " 0.075 M solution of $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$, the percentage of $\mathrm{MnO}_{2}$ in the mineral is
A. $75.3 \%$
B. $85.3 \%$
C. $95.3 \%$
D. none

## Answer: A

## - Watch Video Solution

80. Mass of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ required to produce $5.0 \mathrm{~L} \mathrm{CO}_{2}$ at $77^{\circ} \mathrm{C}$ and 0.82 atm pressure from excess of oxalic acid and volume of 0.1 N NaOH required to neutralise the $\mathrm{CO}_{2}$ evolved respectively are
A. $7 g, 2.86 L$
B. $5 g, 1.86 L$
C. $4 g, 0.86 L$
D. none

## D Watch Video Solution

81. A mixture of $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ and $\mathrm{KHC}_{2} \mathrm{O}_{4} . \mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ required equal volumess of $0.2 \mathrm{NKMnO}_{4}$ and 0.12 NNaOH separtely. What is the molar ration $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ and $\mathrm{KHC}_{2} \mathrm{O}_{4} . \mathrm{H}_{2} \mathrm{O}_{4}$ in the mixture?
A. $\frac{2}{11}$
B. $\frac{11}{2}$
C. $\frac{5}{2}$
D. $\frac{7}{2}$

## Answer: B

## - Watch Video Solution

82. the volume of HCl of specific gravity $1.2 \mathrm{~g} m L^{-1}$ and $4 \%$ nature by weight, needed to produce 1.78 L of $\mathrm{Cl}_{2}$ at STP. The reaction involved is:
$\mathrm{MnO}_{2}+4 \mathrm{HCl} \rightarrow \mathrm{MnCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}+\mathrm{Cl}_{2}$
A. $0.48 L$
B. $0.24 L$
C. $0.12 L$
D. $0.06 L$

## Answer: B

## - Watch Video Solution

83. How many moles of $\mathrm{O}_{2}$ will be liberated by one mole of $\mathrm{CrO} \mathrm{O}_{5}$ is the following reaction:
$\mathrm{CrO} \mathrm{O}_{5}+\mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow \mathrm{Cr}_{2}\left(\mathrm{SO}_{4}\right)_{3}+\mathrm{H}_{2} \mathrm{O}+\mathrm{O}_{2}$
A. $\frac{5}{2}$
B. $\frac{5}{4}$
C. $\frac{9}{2}$
D. none of these

## Answer: D

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84. The purity of $\mathrm{H}_{2} \mathrm{O}_{2}$ in a given sample is $85 \%$. Calculate the weight of impure sample of $\mathrm{H}_{2} \mathrm{O}_{2}$ which requires 10 mL of $\mathrm{M} / 5 \mathrm{KMnO}_{4}$ solution in a titration in acidic medium
A. 2 g
B. 0.2 g
C. 0.17 g
D. 0.15 g

## Answer: B

85. 0.848 g aqueous solution of a mixture containing $\mathrm{Na}_{2} \mathrm{CO}_{3} \mathrm{NaOH}$, and an inert matter is titrated with $\frac{M}{2} \mathrm{HCl}$. The colour of phenolphthalein disappears when 20 " mL of " the acid has been added. Methyl orange is then added and 8.0 mL more of the acid is requried to give a red colour to the solution. The percentage of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ is
A. 25
B. 12.5
C. 75
D. 50

## Answer: D

## - Watch Video Solution

1. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but ( $R$ ) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion: 5.0 " mol of "ferrous oxalate are completely oxidised by 2.5 moles of acidic solution of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$.

Reason( R : n -factor of ferrous oxalate against dichromate is 3 .

## Watch Video Solution

2. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct.
(e) if both (A) and (R) are incorrect.

Assertion (A): If x " mL of " $0.2 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{3}$ solution requires 10 " mL of " 0.24 M KOH solution then x " mL of " $0.1 \mathrm{M} \mathrm{H}_{2} \mathrm{SO}_{3}$ would require 20 " mL of " 0.01 M acidified $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$
solution.

Reason (R): $\mathrm{H}_{2} \mathrm{SO}_{3}$ is dibasic acid.

## D Watch Video Solution

3. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): $\mathrm{MnO}_{4}^{\ominus}+\mathrm{S}_{2} \mathrm{O}_{3}^{2-} \underset{p \mathrm{H=7}}{\longrightarrow} \mathrm{MnO}_{2}+\mathrm{HSO}_{4}^{\ominus}$

Reason (R): The n factor for $\mathrm{MnO}_{4}^{\ominus}$ and $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$ ions respectively are 3 and 8.

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4. (a). IF both (A) and (R) are correct and (R) is the correct explanation of (A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c). If (A) is correct, but ( $R$ ) is incorrect.
(d). If (A) is incorrect, but (R) is correct.
(e) if both (A) and (R) are incorrect.

Assertion (A): In the titration of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ with HCl using methyl orange indicator the volume required at the equivalence point is twice that of the acid required using phenolphthalein indicator.

Reason (R): 2 " mol of " HCl are required for complete neutralization of one mole of $\mathrm{Na}_{2} \mathrm{CO}_{3}$.
5. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): $H_{3} P O_{2}$ is mono basic acid.

Reason ( R ): Two H -atoms are attached to pghosphorous ( P ).

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6. (a). IF both (A) and (R) are correct and (R) is the correct explanation of (A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are
incorrect.
Q. Assertion (A): Equivalent mass of $\mathrm{KMnO}_{4}$ is equal to one-fifth of its molecular mass when it acts as oxidising agent in mild basic medium.

Reason (R): Oxidation number of Mn in $\mathrm{KMnO}_{4}$ is +7 .

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7. (a). IF both (A) and (R) are correct and (R) is the correct explanation of (A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but ( $R$ ) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): IN the reaction $\mathrm{i}_{\mathrm{Z}}(2)$ is a oxidant. $2 S_{2} O_{3}^{2-}+I_{2} \rightarrow S_{4} O_{6}^{2-}+2 I^{\ominus}$

Reason (R): During oxidation loss of electron takes place.

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8. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): In the titration of strong acid and strong base, phenolphthalein is used as suitable indocator.

Reason (R): $\mathbb{N}$ the titration of strong acid and strong base, the equivalence points lies is the pH range of $(3.0-10.5)$ and phenolphthalein have pH range of ( $8.0-9.8$ ).

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9. (a). IF both (A) and (R) are correct and (R) is the correct explanation of (A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): Concentration of $\mathrm{H}_{2} \mathrm{O}_{2}$ is expressed in volume Reason (R): Volume strength $=$ normality $\times 5.6$

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10. Assertion $(A)$ : Hardness of water is determined by titrating it with disodium salt of $E D T A$.

Reason ( $R$ ) :The indicator used in the titration is Eriochrome Black- $T$ at $p H=10$.

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11. (a). IF both (A) and (R) are correct and (R) is the correct explanation of (A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct.
(e) if both (A) and (R) are incorrect.

Assertion (A): if x " mL of " $0.1 \mathrm{M} \mathrm{KMnO}_{4}$ solution requires 100 mL of "
0.1 M CuS solution for complete neutralisation then x " mL of " same $\mathrm{KMnO}_{4}$ solution would require 75 mL of " $0.1 \mathrm{M} \mathrm{Cu} u_{2} S$ solution. Reason (R): n factor for Cus and $C u_{2} S$ respectively are 6 and 8 .

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12. Assertion $(A)$ : Temporary hardness in water is due to the presence of chlorides of magnesium.

Reason $(R)$ :Temporary hardness is removed by Clark's method.

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13. (a). If both (A) and (R) are correct and (R) is the correct explanation of
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If $(A)$ is incorrect, but $(R)$ is correct.
(e) if both (A) and (R) are incorrect.

Assertion (A): The amount CO in a gas sample can be determined by using the reaction

$$
\mathrm{I}_{2} \mathrm{O}_{5}+5 \mathrm{CO} \rightarrow \mathrm{I}_{2}+5 \mathrm{CO}_{2}
$$

IF gas sample liberates $127 . \mathrm{g}$ of 'I_(2)'. Then 70 g of CO were present in the sample.

Reason (R): CO gas is absorbed in ammonical CuCl solution.

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14. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but ( $R$ ) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): Estimation of reducing substance by the use of standard $I_{2}$ is called iodometry.

Reason ( R ): in the reaction
$I_{2}+S_{2} O_{3}^{2-} \rightarrow S_{4} O_{6}^{2-}+2 I^{\ominus}$
The n factor of $\mathrm{S}_{2} \mathrm{O}_{3}^{2-}$ is one.

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15. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct. Itbr. (e) if both (A) and (R) are incorrect.
Q. Assertion (A): When gaseous hydrocarbon are completely burnt in eudiometer tube with excess of $O_{2}$ and after cooling there is a
contraction in the volume of gases.
Reason (R): The volume of $\mathrm{H}_{2} \mathrm{O}$ is not considered.

## - Watch Video Solution

## Exercises Integer

1. N -factor for the following reaction is
$\mathrm{FeS}_{2} \rightarrow \mathrm{Fe}_{2} \mathrm{O}_{3}+\mathrm{SO}_{2}$
A. 8
B. 9
C. 10
D. 11

## Answer: D

2. In the following reaction
$\mathrm{As}_{2} \mathrm{~S}_{3}+\mathrm{NO}_{3}^{\ominus}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{AsO}_{4}^{3-}+\mathrm{SO}_{4}^{2-}+\mathrm{NO}+\mathrm{H}^{\oplus}$ The number of electrons involved in the oxidation reaction is
A. 22
B. 24
C. 26
D. 28

## Answer: D

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3. 1 mole of equimolar mixture of ferric oxalate and ferrous oxalate requres x mole of $\mathrm{KMnO}_{4}$ in acidic medium for complete oxidation. X is:
A. 2,6
B. 6,2
C. 3,6
D. 6,3

## Answer: C

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4. When a equimolar mixture of $C u_{2} \mathrm{~S}$ and CuS is tirated with $\mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ in acidic medium, the final products cintain $\mathrm{Cu}^{2+}, \mathrm{So}_{2}$ and $\mathrm{Mn}^{2+}$. If the mol. Mass of $\mathrm{Cu}_{2} \mathrm{~S}, \mathrm{CuS}$ and $\mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ are $\mathrm{M}_{1}, \mathrm{M}_{2}$ and $M_{3}$ respectively then :
A. 7,7
B. 6,6
C. 6,8
D. 8,6

## Answer: D

5. How many moles of $\mathrm{H}_{2} \mathrm{SO}_{4}$ are requried to produce 1 " mol of " $\mathrm{H}_{2} \mathrm{~S}$ when KI reacts with $\mathrm{H}_{2} \mathrm{SO}_{4}$ producing $\mathrm{I}_{2}$ and $\mathrm{H}_{2} \mathrm{~S}$ ?
A. 5
B. 4
C. 3
D. 2

## Answer: A

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6. Commerical 11.2 volume $\mathrm{H}_{2} \mathrm{O}_{2}$ solution has a molarity of
A. 2 M
B. 1 M
C. 3 M
D. 4 M

## Answer: B

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7.1 " mol of " $\mathrm{IO} \mathrm{O}_{3}^{\ominus}$ ions is heated with excess of $I^{\ominus}$ ions in the presence of acidic conditions as per the following equation
$I O_{3}^{\ominus}+I^{\ominus} \rightarrow I_{2}$
How many moles of acidified hypo solution will be required to react completely with $I_{2}$ thus produced?
A. 1
B. 3
C. 5
D. 6

## Answer: D

8. A bottle of $\mathrm{H}_{2} \mathrm{O}_{2}$ is labelled as $10 \mathrm{vol} \mathrm{H}_{2} \mathrm{O}_{2}$. 112 mmL of " this solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ is titrated against 0.04 M acidified solution of $\mathrm{KMnO}_{4}$ the volume of $\mathrm{KMnO}_{4}$ in litre is
A. 1 L
B. 2 L
C. 3 L
D. 4 L

## Answer: A

## - Watch Video Solution

9. if $20 \mathrm{~mL} \frac{\mathrm{M}}{10} \mathrm{Ba}\left(\mathrm{MnO}_{4}\right)_{2}$ compeletely reacts with $\mathrm{FeC}_{2} \mathrm{O}_{4}$ in acidic medium,
Q. What is the volume of $\mathrm{CO}_{2}$ produced at $S T P$
A. 1 M
B. 2 M
C. 3 M
D. 4 M

## Answer: A

## - Watch Video Solution

10. The oxidation state of oxygen of $\mathrm{H}_{2} \mathrm{O}_{2}$ in the final products when it reacts with $\mathrm{ClO}_{3}^{\ominus}$ is
A. 0
B. 1
C. -1
D. -2
11. What is the oxidation state of oxygen of $\mathrm{H}_{2} \mathrm{O}_{2}$ in the final products when it reacts with $\mathrm{As}_{2} \mathrm{O}_{3}$ ?
A. 0
B. 1
C. -1
D. -2

## Answer: D

## - Watch Video Solution

12. Washing soda ( $\mathrm{Na}_{2} \mathrm{CO}_{3} \cdot 10 \mathrm{H}_{2} \mathrm{O}$ ) is widely used in softening of hard waer. If 1 L of hard water requires 0.0286 g of washing soda, the hardness of $\mathrm{CaCO}_{3}$ in ppm is
A. 10 ppm
B. 5 ppm
C. 8 ppm
D. 6 ppm

## Answer: A

## - Watch Video Solution

13. Dissolved $O_{2}$ in water is determined by using a redox reaction
$2 \mathrm{Mn}^{2+}(a q)+4 O \stackrel{\ominus}{\mathrm{H}}(a q)+\mathrm{O}_{2}(g) \rightarrow 2 \mathrm{MnO}_{2}(s)+2 \mathrm{H}_{2} \mathrm{O}(l)$
How many equivalents of $O_{2}$ will be required to react with 1 mol of "'Mn(2+)'
A. 1
B. 2
C. 3
D. 4

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14. The normality of $2 \mathrm{M}_{3} \mathrm{BO}_{3}$ is
A. 6
B. 4
C. 2
D. 1

## Answer: C

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15. An acid solution of 0.2 " mol of " $\mathrm{KReO}_{4}$ was reduced with Zn and then titrated with 1.6 " Eq of "acidic $\mathrm{KMnO}_{4}$ solution for the reoxidation of the ehenium $(R e)$ to the perrhenate ion $\left(R e O_{4}^{\ominus}\right)$. Assuming that
rhenium was the only elements reduced, what is the oxidation state to which rhenium was reduced by Zn ?
A. 1
B. 2
C. -1
D. -2

## Answer: C

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16. A 150 mL of solution of $I_{2}$ is divided into two unequal parts. I part reacts with hypo solution solution in acidic medium. 15mLof0.4Mhypo was consumed. II part was added with $100 \mathrm{mLof0} 0.3 \mathrm{MNaOH}$ solution. Residual base required $10 \mathrm{~mL} 0.3 \mathrm{MH}_{2} \mathrm{SO}_{4}$ solution for complete neutralization. What was the initial concentration of $I_{2}$ ?
B. 2
C. 3
D. 4

## Answer: B

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## Archives Multiple Correct

1. Reduction of the metal centre in aqueous permanganate ion involves
A. 3 electrons in neutral medium
B. 5 electrons in neutral medium
C. 3 electrons in alkaline medium
D. 5 electrons in alkaline medium

## Answer: A::D

## Archives Single Correct

1. The volume strength of $1.5 \mathrm{~N}_{2} \mathrm{O}_{2}$ solution is
A. 4.8
B. 8.4
C. 3
D. 8

## Answer: B

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2. The number of moles of $\mathrm{KMnO}_{4}$ that will be needed to react with one mole of sulphite ion in acidic solution is:
A. $\frac{2}{5}$
B. $\frac{3}{5}$
C. $\frac{4}{5}$
D. 1

## Answer: A

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3. In the neutralization of $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ using $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ by idometry, the equivalent weight of $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is
A. $\frac{M w}{2}$
B. $\frac{M w}{6}$
C. $\frac{M w}{3}$
D. same as the molecular weight
4. Consider the titration of potassium dichromate solution with acidified Mohr's Salt solution using dimethylamine as indicator. The number of moles of Mohr's Salt required per mole of dichromate ion is
A. 3
B. 4
C. 5
D. 6

## Answer: D

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5. (a). IF both (A) and (R) are correct and (R) is the correct explanation of
(A).
(b). If both (A) and (R) are correct but (R) is not the correct explanation of
(A).
(c). If (A) is correct, but (R) is incorrect.
(d). If (A) is incorrect, but (R) is correct.
(e) if both (A) and (R) are incorrect.

Assertion (A): In the titration of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ with HCl using methyl orange indicator the volume required at the equivalence point is twice that of the acid required using phenolphthalein indicator.

Reason (R): 2 " mol of " HCl are required for complete neutralization of one mole of $\mathrm{Na}_{2} \mathrm{CO}_{3}$.

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## Archives Integer

1. The volume (in $m L$ ) of $0.1 \mathrm{MAgNO}_{3}$ required for complete precipitation of chloride ions present in 30 mL of 0.01 M solution of $\left[\mathrm{Cr}\left(\mathrm{H}_{2} \mathrm{O}\right)_{5} \mathrm{Cl}\right] \mathrm{Cl}_{2}$, as silver chloride is close to:
2. Reaction of $\mathrm{Br}_{2}$ with $\mathrm{Na}_{2} \mathrm{CO}_{3}$ in aqueous solution given sodium bromide and sodium bromate with evolution of $\mathrm{CO}_{2}$ gas. The number of sodium bromide molecules involved in the balanced chemical equation is

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## Subjective Type

1.5.5 g of a mixutre of $\mathrm{FeSO}_{4.7} \mathrm{H}_{2} \mathrm{O}$ and $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3.9} \mathrm{H}_{2} \mathrm{O}$ requires 5.4 " mL of " $0.1 \mathrm{NKMnO}_{4}$ solution for complete oxidation. Calculate the number of gram moles of hydrated ferric sulphate in the mixture.

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## Archives Subjective

1. In the analysis of 0.1 of sample of feldspar, 0.118 g of mixture of NaCl and KCl is obtained which on treatment with $\mathrm{AgNO}_{3}$ gives 0.2451 of AgCl . Calculate the precentage of $\mathrm{Na}_{2} \mathrm{O}$ and $\mathrm{K}_{2} \mathrm{O}$ in feldspar.

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2.5 " mL of " a gas A containing only C and H was mixed with an excess of $O_{2}(30 \mathrm{~mL})$ and the mixture was exploded by means of electric sperk. After explosion, the remaining volume of the mixed gases was 25 mL . On adding a concentrated solution of KOH , the volume further diminished to 15 mL . The residual gas was pure oxygen, The molecular formula of the gas $A$ is.

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3. One litre of mixture of CO and $\mathrm{CO}_{2}$ is passed through red hot charcoal in tube. The new volume becomes 1.4 litre. Find out \%
composition of mixture by volume. All measurements are made at same $P$ and $T$

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4. Find out the equivalent weight of $\mathrm{H}_{3} \mathrm{PO}_{4}$ in the reaction:
$\mathrm{Ca}(\mathrm{OH})_{2}+\mathrm{H}_{3} \mathrm{PO}_{4} \rightarrow \mathrm{CaHPO}_{4}+2 \mathrm{H}_{2} \mathrm{O}$

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5. Hydroxylamine reduces $\mathrm{Fe}^{3+}$ accoeding to the following reaction:
$2 \mathrm{NH}_{2} \mathrm{OH}+4 \mathrm{Fe}^{3+} \rightarrow \mathrm{H}_{2} \mathrm{O}+4 \mathrm{Fe}^{2+}+4 \mathrm{H}^{\oplus}+\mathrm{N}_{2} \mathrm{O}$
$\mathrm{Fe}^{2+}$ produced is is estimated by titration with $\mathrm{KMnO}_{4}$ solution A 10 mL sample of $\mathrm{NH}_{2} \mathrm{OH}$ is diluted to 1000 mL .50 mL of " this diluted sample is boiled with excess of Fe (III) solution. The resulting solution required 12 " mL of " $0.02 \mathrm{M} \mathrm{KMnO}_{4}$ for complete oxidation. Determine the strength of $\mathrm{NH}_{2} \mathrm{OH}$.
6. An organic compound $C_{x} H_{2 y} O_{y}$ was burnt with twice the amount of oxygen needed for complete combustion of $\mathrm{CO}_{2}$ and $\mathrm{H}_{2} \mathrm{O}$. The hot gases when cooled to $0^{\circ} \mathrm{C}$ and 1 atm pressure, measured 2.24 L , the water collected during cooling weighed 0.9 g The vapour pressure of pure water at $20^{\circ} \mathrm{C}$ is 17.5 mm Hg and is lowered by 0.104 mm when 50 g of the organic compound is dissolved in 1000 g of water. Give the molecular formula of the organic compound.

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7. 4.08 g of a mixture of BaO and an unknown carbonate $\mathrm{MCO}_{3}$ was heated strongly. The residue weighed 3.64 g . This was dissolved in 100 mL of 1 NHCl . The excess of acid required of 16 mL of 2.5 NNaOH for complete neutralisation. Identify the metal $M$.

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8. When 16.8 g of a white solid X was heated 4.4 g of an acid gas A which turned lime water milky, was driven off together with 1.8 g of a gas B which condensed to a colourless liquid. The solid that remained $Y$ dissolved in water to give an alkaline solution which with excess barium chloride solution gave a white precipitate $Z$. The precipitate effervesced with acid giving carbon dioxide. Identify $\mathrm{A}, \mathrm{B}$ and Y and write the equation for the thermal decomposition of $X$.

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9. $2.68 \times 10^{-3}$ moles of solution containing anion $A^{n+}$ require $1.61 \times 10^{-3}$ moles of $\mathrm{MnO}_{4}^{-}$for oxidation of $\mathrm{A}^{n+}$ to $\mathrm{AO}_{3}^{-}$in acidic medium. What is the value of $n$ ?

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10. 5 mL of $8 \mathrm{NHNO}_{3}, 4.8 \mathrm{~mL}$ of 5 NHCl , and a certain volume of $17 \mathrm{mH}_{2} \mathrm{SO}_{4}$ are mixed together and made upto 2 L .30 mL of the acid
mixture exactly neutralises 42.9 mL of $\mathrm{Na}_{2 \mathrm{CO}_{3}}$ solution containing 0.1 g of $\mathrm{Na}_{2} \mathrm{CO}_{3} .10 \mathrm{H}_{2} \mathrm{O}$ in 10 mL of water. Calculate:

The amount (in g) of the sulphate ions in the solution.

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11. What is the weight of sodium bromate and molarity of solution to prepare 85.5 mL of 0.672 N solution when half cell reaction are:
(i) $\mathrm{BrO}_{3}^{-} \rightarrow 6 \mathrm{H}^{+}+6 e^{-} \rightarrow \mathrm{Br}^{-}+3 \mathrm{H}_{2} \mathrm{O}$

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12. A sample of hydrazine sulphate $\left(\mathrm{N}_{2} \mathrm{H}_{6} \mathrm{SO}_{4}\right)$ was dissolved in 100 mL of " water. 10 m mL of " this solution was reacted with excess of $\mathrm{FeCl}_{3}$ solution and warmed to complete the reaction. $\mathrm{Fe}^{2+}$ ions formed were estimated and they required 20 mL of " $\frac{M}{50} \mathrm{KMnO}_{4}$ Solution. Estimate the amount of hydrazine sulphate in 1 L of solution.

Reactions:
$4 \mathrm{Fe}^{3+}+\mathrm{N}_{2} \mathrm{H}_{4} \rightarrow \mathrm{~N}_{2}+4 \mathrm{Fe}^{2+}+4 \mathrm{H}^{\oplus}$
$\mathrm{MnO}_{4}^{\ominus}+5 \mathrm{Fe}^{2+}+8 \mathrm{He}^{\oplus} \rightarrow \mathrm{Mn}^{2+} 5 \mathrm{Fe}^{3+}+4 \mathrm{H}_{2} \mathrm{O}$

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13. An equal volume of reducing agent is titrated separately with 1 M $\mathrm{KMnO}_{4}$ in acidic, neutral and alkaline media, the volumes of $\mathrm{KMnO}_{4}$ required are 20 mL in acid, 33.4 mL in neutral, and 100 mL in alkaline media. Find the oxidation state of Mn in each reduction product. Give balanced equation for all the three half reaction. Find the volume of $1 \mathrm{MK}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ consumed when the same volume of reducing agent is titrated in acidic medium.

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14. $n$ - Butance $\left(C_{4} H_{10}\right)$ is produced by monobromation of $C_{2} H_{6}$ followed by the Wurtz reaction. Calculate the volume of ethane at $S T P$ requried to produce $55 g$ of $n$-butane. The bromination takes place with $90 \%$ yield and the Wurtz reaction with $85 \%$ yield.

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15. A mixture of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and $\mathrm{NaHC} \mathrm{C}_{2} \mathrm{O}_{4}$ weighing $2.02 g$ was dissolved in water and the solution made upto one litre. $10 m L$ of this solution required 3.0 mL of 0.1 NNaOH solution for complete neutralization. In another experiment 10 mL of same solution in hot dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$ medium required $4 m L$ of $0.1 \mathrm{NKMnO}_{4}$ for complete neutralization. Calculate the amount of $\mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$ and $\mathrm{NaHC}_{2} \mathrm{O}_{4}$ in mixture.

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16. A solid mixture $(5.000 \mathrm{~g})$ consisting of lead nitrate and sodium nitrate was heated below $600^{\circ} \mathrm{C}$ until the weight of the residue was constant. If the loss in weight is $28 \%$, find the amount of lead nitrate and sodium nitrate in the mixture.

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17. A solution of $0.2 g$ of a compound containing $\mathrm{Cu}^{2+}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ ions on titration with $0.02 \mathrm{MKMnO}_{4}$ in presence of $\mathrm{H}_{2} \mathrm{SO}_{4}$ consumes $22.6 m \mathrm{~L}$ oxidant. The resulting solution is neutralized by $\mathrm{Na}_{2} \mathrm{CO}_{3}$, acidified with dilute $\mathrm{CH}_{3} \mathrm{COOH}$ and titrated with excess of KI . The liberated $I_{2}$ required $11.3 m L$ of0.05 $M N a_{2} S_{2} O_{3}$ for complete reduction. Find out mole ratio of $\mathrm{Cu}^{2+}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2+}$ in compound.

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18. 1.0 g of $\mathrm{Fe}_{2} \mathrm{O}_{3}$ solid of $55.2 \%$ purity is dissolved in acid. The solution is reduced by heating with Zn dust. The resultant solution is cooled and made up to 100 mL . An aliquot of 25 mL of " this solution requires 17 " mL of " 0.0167 M solution of an oxidant. Calculate the number of electrons taken up by oxidant in the above titration.

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19. A 2.0 g sample of a mixture containing sodium carbonate, sodium bicarbonate and sodium sulphate is gently heated till the evolution of
$\mathrm{CO}_{2}$ ceases. The volume of $\mathrm{CO}_{2}$ at 750 mmHg pressure and at 298 K is measured to be 123.9 mL . A 1.5 g of the same sample requires 150 mL of $(M / 10) \mathrm{HCl}$ for complete neutralisation. Calculate the percentage composition of the components of the mixture.

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20. 1.0 g of $\mathrm{AgNO}_{3}$ is dissolved in 50 mL of " water It is titrated with 50 " mL of " KI solution. The Agl precipitated is filtered off. Excess of KI in the filtrate is titrated with $\frac{M}{10} \mathrm{KIO}_{3}$ in the presence of 6 MHCl till all $I^{\ominus}$ converted into ICI. It requires 50 mL of " $\frac{M}{10} \mathrm{KIO}_{3}$ solution. 20 mL of " the same solution of KI requires 30 mLL of " $\frac{M}{10} \mathrm{KIO}_{3}$ under the same conditions. Determine the percentage of $\mathrm{AgNO}_{3}$ in the sample.

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21. The composition of a sample of Wustite is $F e_{0.93} O_{1.00}$. What percentage of the iron is present in the form of $F e(I I I)$ ?
22. A is a binary compound of a univalent metal. When 1.422 g of A reacts completely with 0.321 g of sulphur in an evacuated and sealed tube, 1.743 $g$ of white crystalline solid B produced, which produces a hydrated double salt C with $A l_{2}\left(\mathrm{SO}_{4}\right)_{3}$. Identfy $\mathrm{A}, \mathrm{B}$ and C .

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23. An ideal gaseous mixture of ethane $\left(C_{2} H_{6}\right)$ and ethene $\left(C_{2} H_{4}\right)$ occupies 28 litre at $1 \mathrm{~atm} 0^{\circ} \mathrm{C}$. The mixture reacts completely with $128 \mathrm{gmO}_{2}$ to produce $\mathrm{CO}_{2}$ and $\mathrm{H}_{2} \mathrm{O}$. Mole of fraction at $\mathrm{C}_{2} \mathrm{H}_{6}$ in the mixture is-

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24. $5.0 \mathrm{~cm}^{3}$ of $\mathrm{H}_{2} \mathrm{O}_{2}$ liberates 0.508 g of iodine from an acidified KI solution. The strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution in terms of volume strenth at

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25. A 20 mL mixture of $\mathrm{CO}, \mathrm{CH}_{4}$, and Helium (He) gases is exploded by an electric discharge at room temperature with excess of oxygen. The volume contraction is found to be 13 mL . A further contraction of 14 mL occurs when the residual gas is treated wityh KOH solution. Find out the composition of the gaseous mixture in terms of volume percentage.

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26. A 4.0 g sample contained $\mathrm{Fe}_{2} \mathrm{O}_{3}, \mathrm{Fe}_{3} \mathrm{O}_{4}$, and inert material. It was treated with an excess of aq KI solution in acidic medium, which reduced all iron to $\mathrm{Fe}^{2+}$ ions along with the liberation of iodine. The resulting solution was diluted to 50 mL and a 10 mL sample of it was taken the iodine liberated in the small sample was titrated with 12.0 " mL of " 0.5 M $N a_{2} S_{2} O_{3}$ solution. The iodine from another 25 mL was extracted, after
which the $\mathrm{Fe}^{2+}$ ions were titrated with 16 " mL of " $0.25 \mathrm{M} \mathrm{MnO} \mathrm{O}_{4}^{\ominus}$ ions in $\mathrm{H}_{2} \mathrm{SO}_{4}$ solution. Calculate the mass of two oxides in the original mixture.

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27. When 25 k mL of " an aqueous solution of $\mathrm{H}_{2} \mathrm{O}_{2}$ is titrated with an excess of KI solution in dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$, the liberated $I_{2}$ required 20 mL of " $0.3 \mathrm{NNa} 2_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution for complete reaction.volume strength of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution.

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28. An aqueous solution containing $0.5 \mathrm{~g} \mathrm{KIO}_{3}$ (formula weight $=214.0$
) was treated with an excess of KI solution. The solution was acidified with HCl . The liberated $I_{2}$ consumed 45 " mL of " thiosulphate solution to decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thiosulphate solution. Also give a balanced chemical equation for the action of KI on $\mathrm{KIO}_{3}$.
29. Calculate the volume of $0.5 \mathrm{M} \mathrm{H} \mathrm{H}_{2} \mathrm{SO}_{4}$ required to dissolve 0.5 g of copper (II) carbonate $\left(\mathrm{CuCO}_{3}\right)$.

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30. A plant virus is found to consist of uniform cylindrical particle of $150 \AA$ in diameter $5000 \AA$ A long. The specific volume of the virus is $0.75 \mathrm{mLg}^{-1}$. If the virus is considered to be a single particle, find its molar mass.

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31. $\mathrm{H}_{2} \mathrm{O}_{2}$ solution ( 20 mL ) reacts quantitatively with a solution of $\mathrm{KMnO}_{4}(20 \mathrm{~mL})$ acidified with dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$. The same volume of the $\mathrm{KMnO}_{4}$ solution is just decolourised by 10 mL of $\mathrm{MnSO}_{4}$ in neutral medium. simulataneously forming a dark brown precipitate of hydrated $\mathrm{MnO}_{2}$. The brown precipitate is dissolved in 10 mL of 0.2 M sodium
oxalate under boiling condition in the presence of dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$. Write the balanced equations involved in the reactions and calculate the molarity of $\mathrm{H}_{2} \mathrm{O}_{2}$ solution.

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32. One gram of charcoal adsorbs 400 mL of " 0.5 M acetic acid to form a mono layer and the molarity of acetic acid reduced to 0.49 . Calculate the surface area of charcoal adsorbed by each molecule of acetic acid. The surface area of charcoal is $3.01 \times 10^{2} m^{2} g^{-1}$.

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33. Around $20 \%$ surface sites have adsorbed $N_{2}$. On heating $N_{2}$ gas evolved form sites and were collected at 0.001 atm and 298 K in a container of volume $2.46 \mathrm{~cm}^{3}$ the density of surface sites is $6.023 \times 10^{14} \mathrm{~cm}^{-2}$ and surface area is $1000 \mathrm{~cm}^{2}$ find out the number of surface sites occupied per molecule of $N_{2}$.
