PRACTICE PROBLEMS

PP-1

Q.1 Determine the average oxidation no. of following elements given in bold letters :

(a) $H_2\mathbf{S}_2O_8$ (b) $K_4\mathbf{Fe}(CN)_6$ (c) $\mathbf{Os}O_4$
(d) $HN\mathbf{C}$ (e) $\mathbf{Fe}_{0.94}O$ (f) $\mathbf{Fe}_3O_4$
(g) $\mathbf{N}H_2.\mathbf{N}H_2$ (h) $\mathbf{Fe}SO_4.(NH_4)_2SO_4.6H_2O$ (i) $NO\mathbf{Cl}O_4$
(j) $Na_2[\mathbf{Fe}(CN)_5NO]$ (k) $[\mathbf{Fe}(NO)(H_2O)_5]SO_4$ (l) $Na_2\mathbf{S}_4O_6$
(m) $(CH_3)_2\mathbf{S}O$ (n) $Na_2\mathbf{S}_2$

Q.2 Determine the oxidation number of the following elements given in bold letters :

(a) $Ba_2\mathbf{Xe}O_6$ (b) $\mathbf{C}_3O_2$ (c) $\mathbf{V}(BrO_2)_2$
(d) $Cs_4Na(H\mathbf{V}_{10}O_{28})$ (e) $K[\mathbf{Co}(C_2O_4)_2.(NH_3)_2]$ (f) $[\mathbf{Ni}(CN)_4]^{2-}$

Q.3 Find the oxidation number of bold lettered atoms :

(a) **Mn** in K_2MnO_4, K_2MnO_3, Mn_3O_4, $MnSO_4$, K_3MnF_6, MnO_2
(b) **C** in CH_4, C_2H_6, C_3H_8, C_2H_4, C_2H_2, $H_2C_2O_4$, CO_2
(c) **S** in $Na_2S_2O_3$, S_4, S_8, $Na_2S_2O_7$
(d) **N** in NH_3, NH_2OH, NaN_3, NH_4NO_2
(e) **Cl** in Cl_2, HOCl, Cl_2O, ClO_2, $KClO_3$, Cl_2O_7

Q.4 Determine the oxidation number of bold lettered atoms in the following :

(a) $8\ K\mathbf{Cl}O_3 + 24\ H\mathbf{Cl} \longrightarrow 8\ K\mathbf{Cl} + 12\ H_2O + 9\mathbf{Cl}_2 + 6\mathbf{Cl}O_2$
(b) $3\mathbf{I}_2 + 6NaOH \longrightarrow Na\mathbf{I}O_3 + 5Na\mathbf{I} + 3H_2O$

Q.5 Find the oxidation number of bold lettered atoms :

(i) $\mathbf{Sn}S_3^{-2}$ (ii) $\mathbf{S}_2O_3^{-2}$ (iii) $\mathbf{S}_2O_7^{-2}$ (iv) $\mathbf{N}H_4^+$
(v) $\mathbf{Cl}O_2^-$ (vi) $\mathbf{P}_2O_7^{-4}$ (vii) $\mathbf{O}_2^{-2}$ (viii) $\mathbf{C}_2O_4^{-2}$
(ix) $\mathbf{Cr}_2O_7^{-2}$ (x) $\mathbf{Mn}O_4^-$ (xi) $\mathbf{Be}_3N_2$ (xii) $Na_3\mathbf{Fe}(CN)_5NO$
(xiii) $K\mathbf{Cr}O_3.Cl$ (xiv) $\mathbf{F}_2H_2$ (xv) $\mathbf{Co}(NH_3)_6^{+3}$ (xvi) $\mathbf{Cu}H$
(xvii) $\mathbf{O}_2F_2$

PP-2

Balance the following equation using desired medium –

Q.1 $C_2H_5OH + Cr_2O_7^{2-} + H^+ \rightarrow Cr^{3+} + C_2H_4O + H_2O$

Q.2 $Sn(OH)_3^- + Bi(OH)_3 + OH^- \rightarrow Sn(OH)_6^{2-} + Bi$

Q.3 $IO_3^- + N_2H_4 + HCl \rightarrow N_2 + ICl_2^- + H_2O$

Q.4 $Hg_2Cl_2 + NH_3 \rightarrow Hg + HgNH_2Cl + NH_4Cl$

Q.5 $Zn + NO_3^- + H^+ \rightarrow Zn^{2+} + NH_4^+ + H_2O$

Q.6 $I_2 + NO_3^- + H^+ \rightarrow IO_3^- + NO_2 + H_2O$

Q.7 $MnO_4^- + SO_2^{2-} + H_2O \rightarrow MnO_2 + SO_4^{2-} + OH^-$

Q.8 $H_2O_2 + ClO_2 + OH^- \rightarrow ClO_2^- + O_2 + H_2O$

Q.9 $ClO^- + CrO_2^- + OH^- \rightarrow Cl^- + CrO_4^{2-} + H_2O$

Q.10 $Cl_2 + KOH \rightarrow KClO_3 + KCl + H_2O$

Q.11 $H_2O_2 + KMnO_4 \rightarrow MnO_2 + KOH + O_2 + H_2O$

Q.12 $HNO_2 + KMnO_4 + H_2SO_4 \rightarrow HNO_3 + KMnO_4 + K_2SO_4 + H_2O$

PP-3

Balance the following equation using desired medium –

Q.1 $N_2H_4 + AgNO_3 + KOH \rightarrow N_2 + Ag + KNO_3 + H_2O$

Q.2 $P + HNO_3 \rightarrow HPO_3 + NO + H_2O$

Q.3 $K_2Cr_2O_7 + HCl \rightarrow KCl + CrCl_3 + H_2O + Cl_2$

Q.4 $MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow CO_2 + Mn^{2+} + H_2O$

Q.5 $Cr_2O_7^{2-} + C_2O_4^{2-} + H^+ \rightarrow Cr^{3+} + CO_2 + H_2O$

Q.6 $KMnO_4 + H_2S + H_2SO_4 \rightarrow KHSO_4 + MnSO_4 + S + H_2O$

Q.7 $Cu(NH_3)_4Cl_2 + KCN + H_2O \rightarrow K_2Cu(CN)_3 + NH_3 + KCNO + NH_4Cl + KCl$

Q.8 $Ag + KCN + H_2O + O_2 \rightarrow KAg(CN)_2 + KOH$

Q.9 $Fe_3O_4 + MnO_4^- + H_2O \rightarrow Fe_2O_3 + MnO_2 + OH^-$

Q.10 $C_2H_5OH + MnO_4^- + OH^- \rightarrow C_2H_3O^- + MnO_2 + H_2O$

Q.11 $Cr_2O_7^{2-} + SO_3^{2-} + H^+ \rightarrow Cr^{3+} + SO_4^{2-} + H_2O$

Q.12 $ClO_3^- + SO_2 + H^+ \rightarrow ClO_2 + HSO_4^-$

Q.13 $Mn^{2+} + S_2O_8^{2-} + H_2O \rightarrow MnO_4^- + HSO_4^- + H^+$

PP-4

Q.1 214.2 g of sugar syrup contains 34.2 g of sugar. Calculate (i) molality of the solution and (ii) mole fraction of sugar in the syrup.

Q.2 How many g of a 5.0% by weight NaCl solution are necessary to yield 3.2 g NaCl ?

Q.3 Calculate the molarity, molality and mole fraction of ethyl alcohol in a solution of total volume 95 ml prepared by adding 50 ml of ethyl alcohol (density = 0.789 g ml^{-1}) to 50ml water (density = 1.00 g ml^{-1}).

Q.4 What volume of 96% H_2SO_4 solution (density 1.83 g/ml) is required to prepare 4 litre of 3.0 M H_2SO_4 solution?

Q.5 A litre of milk weighs 1.032 kg. The butterfat it contains to the extent of 4.0% by volume has a density of 865 kg/m^3. What is the density of the fat-free "skimmed" milk ?

Q.6 Mole fraction of glucose in a solution (solvent is a liquid having molecular mass 25) is 0.2. If density of solution is 1.4 gm/ml, then calculate molarity of the solution.

Q.7 10 ml of ethanol having density 0.7893 gm/ml is mixed with 20 ml of water having density 0.9971 g/ml. The resulting solution formed has density 0.9571 g/ml. Calculate

(i) % change in volume on mixing

(ii) molarity of the solution

(iii) molality of the solution

Q.8 A procedure calls for 100 cm^3 of 20.0% H_2SO_4, density 1.14 g/cm^3. How much concentrated acid, of density 1.84 g/cm^3 and containing 98.0% H_2SO_4 by weight, must be diluted with water to prepare 100 cm^3 acid of the required strength ?

Q.9 100 g of 1 molal ethylene glycol solution is prepared in the laboratory. Determine % by mass of each component.

Q.10 What volume of dilute nitric acid, of density 1.11 g/mL and 19% HNO_3 by weight, contains 10 g HNO_3?

PP-5

Q.1 Calculate % of free SO_3 and H_2SO_4 in 104.5% oleum sample.

Q.2 Calculate % of free SO_3 and H_2SO_4 in 102.25% oleum sample.

Q.3 Calculate % of free SO_3 and H_2SO_4 in 118% oleum sample.

Q.4 Calculate the weight of H_2SO_4 and SO_3 in 200 g of oleum sample labelled as 109%.

Q.5 Calculate the composition of the final solution if 100g of oleum labelled as 118% is added with
(a) 9 gm water (b) 18 g water (c) 1.20 g water

Q.6 What volume of 95.0 % alcohol by weight (density 0.809 g/cm^3) must be used to prepare 150 cm^3 of 30.0% alcohol by weight (density 0.957 g/cm^3) ?

Q.7 Calculate the resulting molarity of the solution that is obtained by adding 5 g of NaOH to 200 mL of $\frac{M}{4}$ NaOH solution (density = 1.05 g cm^{-3}). The density of resulting solution is 1.08 g cm^{-3}.

Q.8 A sample of drinking water was found to be severely contaminated with chloroform which is supposed to be carcinogen. The level of contamination was 15 ppm (by mass). Express this in percent by mass. Also find the molality of chloroform in water sample.

Q.9 Calculate the volume of 80% H_2SO_4 by mass (density = 1.80 g cm^{-3}) that is required to obtain one litre of 20% H_2SO_4 by mass (density = 1.25 g cm^{-3})

Q.10 (i) The given sample of sulphuric acid was found to have mole fraction of H_2SO_4 as 0.15. Calculate the molality of the solution.
(ii) In a solution of benzene and toluene, the mole fraction of toluene is 0.5. Calculate the mass % of the solution with respect to benzene ?

PP-6

Q.1 According to the reaction $SO_2 + H_2S \longrightarrow S + H_2O$, when 6.4 g of SO_2 is reacted with 4 g H_2S. Calculate:
(i) The limiting reagent (ii) Maximum amount of sulphure which can be produced
(iii) The amount of excess reagent remaining after the reaction is complete?

Q.2 According to the reaction $K_2Cr_2O_7 + 14\ HCl \longrightarrow 2CrCl_3 + 2KCl + 3Cl_2 + 7H_2O$ when 2.98g of $K_2Cr_2O_7$ and 5.84 g of HCl were reacted. Then calculate:
(i) The limiting reagent (ii) Maximum amount of $CrCl_3$ which can be produced
(iii) The amount of excess reagent remaining after the reaction is complete?
(iv) How much ml of Cl_2 will be evolved at STP after the reaction is complete?

Q.3 In a process for producing acetic acid, oxygen gas is bubbled into acetaldehyde containing manganese (II) acetate (catalyst) under pressure at 60ºC.

$$2CH_3CHO + O_2 \longrightarrow 2CH_3COOH$$

In a laboratory test of this reaction, 20g of CH_3CHO and 10g of O_2 were put into a reaction vessel
(a) How many gram of CH_3COOH can be produced?
(b) How many grams of the excess reactant remain after the reaction is complete?

Q.4 1 g of dry green algae absorbs 4.7×10^{-3} mole of CO_2 per hour by photosynthesis. If the fixed carbon atoms were all stored after photosynthesis as starch, $(C_6H_{10}O_5)_n$, how long would it take for the algae to double their own weight, assuming photosynthesis takes place at a constant rate ?

Q.5 When a mixture of NaBr and NaCl is repeatedly digested with sulphuric acid, all the halogens are expelled and Na_2SO_4 is formed quantitatively. With a particular mixture, it was found that the weight of Na_2SO_4 obtained was precisely the same as the weight of NaBr-NaCl mixture taken. Calculate the ratio of the weights of NaCl and NaBr in the mixture.

Q.6 Equal weights of phosphorus and oxygen are heated in a closed vessel producing P_2O_3 and P_2O_5 in 1 : 1 mole ratio. If the limiting component is exhausted, find what fraction of which component is left over.

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Q.7 0.75 mole of solid 'A_4' and 2 mole of gaseous O_2 are heated in a sealed vessel, completely using up the reactants and producing only one compound. It is found that when the temperature is reduced to the initial temperature, the contents of the vessel exhibit a pressure equal to half the original pressure. What conclusions can be drawn from these data about the product of the reaction.

Q.8 Equal weights of Zn metal and iodine are mixed together and the iodine is completely converted to ZnI_2. What fraction by weight of the original zinc remains unreacted ?

Q.9 From the following reaction sequence,

$$CaC_2 + H_2O \rightarrow CaO + C_2H_2$$
$$C_2H_2 + H_2 \rightarrow C_2H_4$$
$$nC_2H_4 \rightarrow (C_2H_4)_n$$

Calculate the mass of polyethylene which can be produced from 10 kg of CaC_2.

Q.10 From the following reactions,

$$2CoF_2 + F_2 \rightarrow 2CoF_3$$
$$(CH_2)_n + 4n\ CoF_3 \rightarrow (CF_2)_n + 2n\ HF + 4n\ CoF_2$$

Calculate how much F_2 will be consumed to produce 1 kg of $(CF_2)_n$.

PP-7

Q.1 Calculate the equivalent weight of eavh oxidant and reductant in :
(a) $Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$
(b) $NO_3^- \rightarrow N_2$
(c) $N_2 \rightarrow NH_3$
(d) $Fe_3O_4 + KMnO_4 \rightarrow Fe_2O_3 + MnO_2$
(e) $FeC_2O_4 \rightarrow Fe^{3+} + CO_2$

Q.2 Dechromate ion in acid solution oxidizes stannous ions as

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

(a) If $SnCl_2$ is the source of Sn^{2+} how many g of $SnCl_2$ would be contained in 2 litre of 0.1 N solution?
(b) If $K_2Cr_2O_7$ is the source of $Cr_2O_7^{2-}$, what is the normality of the solution containing 4.9 g $K_2Cr_2O_7$ in 0.1 litre of solution?

Q.3 Calculate the normality of a solution containing 6.32 g of $KMnO_4$ per litre of solution.

Q.4 20 ml of a solution of H_2SO_4 neutralizes 21.2 ml of 3% solution of Na_2CO_3. How much water should be added to each 100 ml of the solution bring down its strength to decinormal.

Q.5 Calculated the equivalent weight of bold lettered according to the following reactions:

(i) $H_3AsO_4 + 2OH^- \rightarrow HAsO_4^- + 2H_2O$

(ii) $H_3PO_4 + Ca(OH)_2 \rightarrow CaHPO_4 + 2H_2O$

(iii) $3SO_2 + 2KMnO_4 + 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 2H_2SO_4$

(iv) $SO_2 + 2H_2S \rightarrow 2S + 2H_2O$

Q.6 Calculate the number of millilitres of 0.05 M $KMnO_4$ needed to oxidise 25 ml of 0.04 N H_2SO_3 in acidic solution.

Q.7 What should be the weight of $NaNO_3$ to make 50 ml of an aqueous solution so that it contains 70 mg Na^+ ml ?

Q.8 Calculate the normality of the mixture having 40 ml of 0.05 N HCl and 60 ml of 0.1 N H_2SO_4.

Q.9 What is the strength in g/*l* of solution of H_2SO_4, 12 ml of which neutrtalises 15 ml of N/10 NaOH solution.

Q.10 In a reaction $Cr_2O_7^{2-}$ was reduced to Cr^{3+} in acidic solution. What is the concentration of 0l.1 M $Cr_2O_7^{2-}$ expressed in equivalent per litre?

PP-8

Q.1 Equal volumes of 0.05 M $Ba(OH)_2$ and 0.14 M HCl reallowed to react. Calculate the normality of each of the ions present after the reaction.

Q.2 Calculate the strength in g/*l* of 3 N HCl and N/2 H_2SO_4 solution.

Q.3 What weight of $CuSO_4.5H_2O$ must be taken to make 0.5 litre of 0.01 M copper (II) ion solution?

Q.4 Calculate the molarity of hydrogen chloride in a solution when 0.365 g of it has abeen dissolved in 100 ml of the solution.

Q.5 10 ml of the sulphuric acid solution (sp. gravity = 1.84) contains 98% by weight of pure acid. Calculate the volume of 2.5 N – NaOH solution required to just neutralize the acid.

Q.6 Derive a formula for the volume V_2 which must be added by V_1 ml of concentrated solution of molarity M_1 to give a solution of molarity M_2.

Q.7 Calculate the number of milliequivalents gram equivalent weight in grams and number of moles contained in 10 litres of 0.5 M $Ba(OH)_2$ solution (Ba = 137).

Q.8 Calculate number of meq. of the acids present in :

(i) 100 ml of 0.5 M oxalic acid solution.

(ii) 50 ml of 0.1 M sulphuric acid solution.

Q.9 Calculate the normality of solution of $FeSO_4.7H_2O$ containing 2.49/100 ml which converts to ferric form in a reaction.

Q.10 What weight of $KMnO_4$ will be required to prepare 250 ml of its $\frac{N}{10}$ solution if eq. wt. of $KMnO_4$ = 31.5 ?

PP-9

Q.1 How many millilitres of 0.05 M $KMnO_4$ solution are required to oxidise 2.0 g of $FeSO_4$ in a dilute acid solution?

Q.2 A sample of $Na_2CO_3.H_2O$ weighing 0.62 g is added to 100 ml of 0.1 N–H_2SO_4. Will the resulting solution be acidic, basic or neutral?

Q.3 How many millilitres of concentrated supphuric acid of sp. gr. 1.84 containing 98% H_2SO_4 by weight are required to prepare 200 ml of 0.50 N solution?

Q.4 Calculate the strength of 20 volume of H_2O_2 in therms of :
(i) normality (ii) gram per litre (iii) molarity and (iv) percentage.

Q.5 A solution of 0.4 g sample of H_2O_2 reacted with 0.632 g of $KMnO_4$ in the presence of sulphuric acid. Calculate the percentage purity of the sample of H_2O_2.

Q.6 What is the molarity and molality of a 13% solution (by weight) of H_2SO_4 solution? Its density is 1.090 g/ml. To what volume should 100 ml of this acid be diluted in order to prepare 1.5 N solution?

Q.7 25 ml of a solution of Fe^{2+} ions was titrated with a solution of the oxidising agent $Cr_2O_7^{2-}$. 32.45 ml of 0.0153 M $K_2Cr_2O_7$ solution was required. What is the molarity of the Fe^{3+} solution?

Q.8 10.03 g of vinegar was diluted to 100 ml and a 25 ml of sample was titrated with the 0.0176 M $Ba(OH)_2$ solution. 34.30 ml was required for equivalence. What is the percent of acetic acid in the vinegar ?

Q.9 0.1 g sample of chromite was fused with excess of Na_2O_2 and brought into solution according to the following reaction.

$$2Fe(CrO_2)_2 + 7Na_2O_2 \rightarrow 2NaFeO_2 + 4Na_2CrO_4 + 2Na_2O$$

The solution was acidified with dil. HCl and 1.2 g of Mohr's salt added. The excess ferrous salt required 24 ml of 0.05 N $K_2Cr_2O_7$ for titration. Determine the percentagte of chromium in the sample.

Q.10 392 g $FeSO_4.(NH_4)_2SO_4.xH_2O$ was dissolved in enough water containing dill. H_2SO_4 and the solution made up to 1 litre. 100 ml of this solution needed 0.03326 g of 95% pure $KMnO_4$ crystals. Determine the number of water molecules present as water of crystallization.

PP-10

Q.1 0.108 g of finely divided copper was treated with an excess of ferric sulphate solution until copper was completely dissolved. The solution after the addition of excess dilute sulphuric acid required 33.7 ml of 0.1 N $KMnO_4$ for complete oxidation. Find the equation which represents the reaction between metallic copper and ferric sulphate solution. (Cu = 63.6 Fe = 56)

Q.2 The reaction $Zn + CuSO_4 = Cu + ZnSO_4$, goes completely to the right. In one experiment 10 g of metallic zinc was added to 200 ml of copper sulphate solution. After all copper is precipitated it was found that all the zinc is not dissolved. After filtration, total solid at the end of the raction was 9.810 g. Calculate (i) the weight of copper deposited and (ii) molarity of copper sulphate in the original solution. (Cu = 63.5, Zn = 65.4)

Q.3 Zinc can be determined volumetrically by the precipitation reaction

$$3Zn^{2+} + 2[4K^+, Fe(CN)_6^{4+}] \rightarrow K_2Zn[Fe(CN)_6]_2 + 6K^+$$

A sample of zinc ore weighing 1.5432 g was prepared for reaction and required 34.68 ml of 0.1043 M $K_4Fe(CN)_6$ for titration. What is the percentage of zinc in the ore ?

Q.4 For the standarisation of a $Ba(OH)_2$ solution 0.2 g of potassium acid phthalate (wt. of one mol = 204.2 g) was weighed . which was then titrated with $Ba(OH)_2$ solution. The titration indicated equivalence at 27.80 ml of $Ba(OH)_2$ solution. What is the molarity of the base? The euqation for reaction is

$$2KHC_8H_4O_4 + Ba(OH) \rightarrow 2H_2O + 2K^+ + 2C_8H_4O_4^{2-} + Ba^{2+}$$

Q.5 A chemist is preparing to analyse samples that will contain no more than 0.5 g of uranium. His procedure cells for preparing the uranium as U^{4+} ion and oxidising it by MnO_4^- in acid solution.

$$5U^{4+} + 2MnO_4^- + 6H_2O \rightarrow 5UO_2^{2+} + 4H_3O^+$$

If he wants to react the total U^+ sample with a maximum of 50 ml of $KMnO_4$ solution, what concentration should he choose ?

Q.6 1.00 g of a mixture consisting of equal number of moles of carbonates of the two univalent metals, required 44.4 ml of 0.5 N HCl for complete reaction. If the atomic weight of one of the metals is 7, find the atomic weight of the other metals. What will be the total amount of sulphate formed on gravimetric conbersion of 1 g of the mixture of sulphates?

Q.7 A sample of magnesium metal containing some magnesium oxide as impurity was dissolved in 125 ml of 0.01 N H_2SO_4. Calculate:

(i) the weight of the sample dissolved and

(ii) the percentage by weight of magnesium in the sample. Neglect any change in the volume of the solution.

Q.8 10 ml of H_2O_2 weighs 10.205 g. The solution was diluted to 250 ml, 25 ml of which required 35.8 ml of a decinormal solution of $KMnO_4$. Calculate the weight in gram of H_2O_2 in 100 ml and also the volume strength of the solution.

Q.9 1.00 g 0f a moist sample of a mixture of KCl and $KClO_3$ was dissolved in water and made up to 250 ml. 25 ml of this solution was treated with SO_2 to reduce the chlorate to chloride and excess SO_2 was removed by boiling. The total chloride was precipitated as silver chloride. The weight of the precipitate was 0.1435g. In another experiment, 25 ml of the original solution was heated with 30 ml of 0.2 N solution of ferrous sulphate and unreacted ferrous sulphate required 37.5 ml of 0.08 N solution of an oxidising agent for complete oxidation. Calculate the mole ratio of chlorate to chloride in the given mixture. Fe^{2+} reacts with ClO_3 according to the reaction.

$$ClO_3^- + 6\ Fe^{2+} + 6H^+ \rightarrow Cl^- + 6Fe^{3+} + 3H_2O$$

Q.10 25 ml of a 0.107 M H_3PO_4 was titrated with a 0.115 solution of a NaOH solution to the end point identified by the colour change of the indicating bromocresol green. This required 23.1 ml. The titration was repeated using phenolphthalein indicator. This time 25 ml of 0.107 M H_3PO_4 required 46.8 ml of the 0.115 M NaOH. What is the coefficient 'n' in the equation, $H_3PO_4 + nOH^- \rightarrow nH_2O\ [H_{(3-n)}PO_4]^{n-}$ for each reaction?

PP-11

Q.1 A zinc rod weighing 25.00 g was kept in 100 ml of 1 M $CuSO_4$ solution. After a certain time molarity of Cu^{2+} in solution was 0.8 M. What was the molarity of the sulphate ion (SO_4^{2-})? What was the weight of the zinc rod after cleaning ?

Q.2 Calculate the percentage of available chlorine in a sample of 3.546 g of bleaching powder which was dissolved in 100 ml of water, 25 ml of this solution, on treatment with KI and dilute acide, required 20 ml of 0.125 N sodium thiosulphate solution.

Q.3 0.2 g of a chloride of an element was dissolved in water and then treated with excess of silver nitrate solution resulting in the formation of 0.47 g of lilver chloride. Find the equivalent weight of the element.

Q.4 A 0.518 g sample of limestone is dissolved and then Ca is precipitated as CaC_2O_4. After filtering and washing the precipitate, it requires 40 ml of 0.25 N $KMnO_4$ solution acidified with H_2SO_4 to titrate it. What is the percentage of CaO in limestone?

$$MnO_4^- + CaC_2O_4 + H_2SO_4 \rightarrow CaSO_4 + Mn^{2+} + CO_2 + H_2O$$

Q.5 A 10 g mixture of Cu_2S and CuS was treated with 200 ml of 0.75 M MnO_4^- in acid solution producing SO_2, Cu^{2+} and Mn^{2+}. The SO_2 was boiled off and the excess MnO_4^- was titrated with 175 ml of 1 M Fe^{2+} solution. Calculate the percentage of CuS in the original mixture.

Q.6 A mixture containing As_2O_3 and As_2O_5 required 20.10 ml of 0.05 N iodine for titration. The resulting solution in this acidified and excess of KI was added. The libereated iodine required 1.113 g hypo ($Na_2S_2O_3$. $5H_2O$) for the complete reaction. Calculate the mass of the mixture. The reaction are:

$$As_2O_3 + 2I_2 + 2H_2O \rightarrow As_2O_5 + 4H^+ + 4I^-$$

$$As_2O_5 + 4H^+ + 4I^- \rightarrow As_2O_3 + 2I_2 + 2H_2O$$

Q.7 0.5 g sample of impure calcium carbonate is dissolved in 50 ml of 0.0985 N–HCl. After the reaction is complete, the excess HCl requires 6.0 ml of 0.105 N–NaOH for neutralization. Determine the percentage of Na_2CO_3 in the sample.

Q.8 HNO_3 and silver was analysed by Volhard method. 25 ml of a KCNS solution was required for complete precipitation. Determine the normality of KCNS solution.

Q.9 In the given reaction $Cr_2O_7^{2-} + 2Cl^- + H^+ \rightarrow Cr^{3+} + Cl_2 + H_2$

(a) Calculate the volume of 0.4 N – $K_2Cr_2O_7$ required to liberate all Cl_2 from 1.20 g of NaCl in a solution acidify with H_2SO_4.

(b) How many g of $K_2Cr_2O_7$ are required ?

(c) How many moles of Cl_2 are liberated ?

(d) What is normality of $K_2Cr_2O_7$?

Q.10 0.84 g iron ore containing X per cent of iron was taken in a solution containing all the iron in ferrous state. The solution required X ml of a potassium dichromate solution for oxidation of iron content to ferric state. Calculate the strength of potassium dichromate solution.

PP-12

Q.1 A solution contains Na_2CO_3 and NaOH. Using phenolphthalein as indicator, 25 ml of a mixture requires 19.5 ml of 0.005 N HCl for the end point. If methyl orange is indicator, then 25 ml of solution requres 25.0 ml of the same HCl for end point.

Q.2 An equal volume of a reducing agent is titrated separately with 1 M $KMnO_4$ in acidic neutral and alkaline media, when 20 ml, 33.4 ml and 100 ml of $KMnO_4$ were used balanced equations for the three half reactions. Find out the volume of 1 M $K_2Cr_2O_7$ consumed, if the same volume of the reducing agent is titrated in acid medium.

Q.3 Find out the volume in ml of 0.1 N HCl solution requred to react completely with 1 g mixture of Na_2CO_3 containing equimolar amounts of two compounds.

Q.4 A 0.5 g sample containing MnO_2 is treated with HCl, liberating Cl_2. The Cl_2 is passed into a solution of KI and 30 cm^3 of 0.1 M $Na_2S_2O_3$ are required to titrate the liberated I_2, calculate the percentage of MnO_2 in the sample.

Q.5 5 g of an alloy of Cu was dissolved in a litre of dil. H_2SO_4. To 20 cc of this solution excess of KI was added and it required 20 cc of hypo solution for titration. To 20 cc of $K_2Cr_2O_7$, sulphuric acid was added and then excess of KI. This solution required 30 cc of the same hypo solution. Calculate the amount of copper in the alloy.

Q.6 One litre of a mixture of O_2 and O_3 at NTP was allwed to react with an excess of acidified solution of KI. The liberated I_2 required 40 ml of M/10 $Na_2S_2O_3$ solution for titration. What is the weight % of O_3 in the mixture?

Q.7 1 g of commercial $AgNO_3$ is dissolved in 50 ml of water. It is treated with 50 ml of KI solution. AgI thus precipitated is filtered off. Excess of KI in the filterate is titrated with $\frac{M}{10}KIO_3$ solution in the presence of 6 M HCl till all I ions are converted into ICl. It requires 50 ml $\frac{M}{10}KIO_3$ solution. 20 ml of the same stock solution of KI requires 30 ml of $\frac{M}{10}KIO_3$ under similar conditions. Calculate the percentage of $AgNO_3$ in the sample.

$$KIO_3 + 2KI + 6HCl \rightarrow 3ICl + 3KCl + 3H_2O$$

Q.8 A mixture of pure $K_2Cr_2O_7$ and $KMnO_4$ weighing 0561 g was treated with excess of KI in acid medium. Iodine liberated required 100 ml of 0.15 N hypo solution for exact oxidation. What is the percentage of each in the mixture?

Q.9 An ore containing Sn^{2+} was titrated with a dichromate solution containing 2.5 g of $K_2Cr_2O_7$ in 0.5 litre. A 0.4 g sample ofa the ore required 10.0 cm^3 of titrant to reach equivalence point. Calcualate the percentage of tin in the ore

Q.10 1.08 g of NH_4Cl was boiled with 62 cc of N/2 NaOH till free from ammonia. 44 cc of $\frac{N}{4}HCl$ were required for neutralizing excess of alkali in the mixture. Calculate the percentage of ammonia in the salt.

PP-13

Q.1 What weight of LiOH is necessary to neutralize 7.5 g of phosphoric acid (H_3PO_4), if one of the three hydrogen atoms reains unneutralized.

Q.2 A certain weight of oxalic acid is converted into water, CO_2 and CO. The latter reacts with I_2O_5 as : $I_2O_5 + 5CO \rightarrow I_2 + 5CO_2$. The iodine liberated required 30.6 cc of 0.1066 $Na_2S_2O_3$. What weight of oxalic acid, $H_2C_2O_4.2H_2O$ was present.

Q.3 Upon heating a litre of $\frac{N}{2}HCl$ solution, 2.675 g of hydrogen chloride is lost and the volume of the solution shrinks to 750 ml. Calculate (i) normality of the resulting solution and (ii) number of milli equivalents of HCl in 100 ml of the original solution.

Q.4 1.5 g mixture of KCl and $KClO_3$ was dissolved and acidified with HCl. An excess of KI solution was added and the solution was made up to 500 cc. 20 cc of this solution required 21 cc of $\frac{N}{10}Na_2S_2O_3$ solution to react with iodine libereated. Calculate the percentage of $KClO_3$ in the mixture.

Q.5 A sample of chromite ore (FeO. Cr_2O_3) was treated as follows:

(a) 0.3 g was fused with Na_2O_2 and the melt extracted with water. 100 cc of $\frac{N}{10}FeSO_4$ solution were added to whole of acidified filterate. It required 25.9 cc of $\frac{N}{10}$ $K_2Cr_2O_7$ for titration.

(b) The insoluble residue for the melt was dissolved in acid and after reduction required 12.4 cc of N/10 $K_2Cr_2O_7$ for oxidation. Calcualte the percentage of Fe and Cr in the sample.

Q.6 What is the mass in grams of 2.21 mol of phosphorous trichloride?

Q.7 Calculate the number of moles of water in 23.2 ml

Q.8 Calculate the number of phosophorous and oxygen atoms in 16.8 g of H_3PO_4.

Q.9 Calculate the mass in grams of a molecule of HBr.

Q.10 Calculate the mass in grams of a molecule of HBr.

PP-14

Q.1 How many grams of each of the following compoundws is represented by :
(a) 2 SO_3 (b) 4.56 HNO_3 (c) 9.33 $\times 10^{-8}$ $KClO_3$ (d) 1.68 Mg_3N_2 (e) $4CuSO_4 . 5H_2O$

Q.2 How many calcium ions and how many chloride ions are present in 2.12 mol of $CaCl_2$?

Q.3 What is the mass in grams of 3.01×10^{20} molecules of NF_3 ?

Q.4 What is the mass ratio of potassium/chlorine in potassium chloride?

Q.5 What is the mass ratio of zirconium/chlorine in zirconium tetrachloride?

Q.6 A solution is made by mixing 200 ml of 0.100 (M) $K_2Cr_2O_7$; 250 ml of 0.2 (M) H_2SO_3(a weak electrolyte) and 250 ml of 1.00 (M) $HClO_4$ (a strong electrolyte). A reaction occurs in which H_2SO_3 and $Cr_2O_7^{-2}$ are converted in acidic solution to HSO_4^{-1} and Cr^{+3}.Assuming the final volume is 0.800 litres, calcualte the final concentration of each species that was spresent in the initial solution.

Q.7 What volume of $CO)_2$ at 27ºC and 750 mm Hg has been absorbed by 1 litre of a solution of NaOH if after absorption 25 ml of the solution required 20 ml of 0.1234 (N) HCl for neutralisation using phenol phthalein and 24.17 ml of same HCl for neutralisation by using methyl orange.d

Q.8 A solution containing 0.1 mole of $FeSO_4$ is oxidised to $Fe_2(SO_4)_3$ in acidic medium by adding 100 ml of a sample of H_2O_2. The H_2O_2 left behind (after oxidation) required 7.86 ml of 2 [M] $KMnO_4$. Calculate the volume strength of the original sample of H_2O_2.

Q.9 A solution contains a mixture of H_2SO_4 and oxalic acid. 25 ml of athe solution requires 35.5 ml of 0l.1 (N) NaOH for neutralisation and 23.45 ml (N) $KMnO_4$ for oxidation. Calculate the amount of each component in 1000 ml of the original solution and normality of the solution with respect to each component.

Q.10 The calcium content in a solution of 1.048 g of substance being analysed was precipitated with 25 ml of oxalic acid. The excess of $C_2O_4^{-2}$ in one -fourth of the filltrate was back titrated with 5 ml of 0.1025 (N) $KIMnO_4$. To determine the concentration of $H_2C_2O_4$ solution taken, it was diluted fourfold. The titration of 25 ml of this diluted solution used 24.1 ml of the same $KMnO_4$ solution. What is the percentage of CaO in the substance?

PP-15

Q.1 1.00 g of a mixture of equal number of moles of carbonates of two alkali metals required 44.4 ml of 0.5N HCl for complete reaction. The atomic weight of one metal is 7, find out the atomic weight of another metal. Also caculate amount of sulphat formed on quantitative conversion of 1.0 gm of the mixture in to sulphates.

Q.2 1.387 g of a sample containing KCl and NH_4Cl is heated unitl NH_3 is completely removed. The residue is dissolved in 20 ml (N/10) $AgNO_3$ solution. Calculate the percentage of chlorine in the mixture.

Q.3 A 10 g mixture of Cu_2S and CuS was treated with 200 ml of 0.75M MnO_4^{-1} in acid solution producing SO_2, Cu^{+2} and Mn^{+2}. The SO_2 was boiled of and the excess of MnO_4^{-1} was titrated with 175 ml of 1 M Fe^{+2} solution. Calculate the % of CuS in original mixture.

Q.4 0.804 g sample of iron ore (Fe + Fe_3O_4) was dissolved in acid. Iron in Fe_3O_4 was oxidized to +2 state and it required 47.2 ml of 0.112N $KMnO_4$ solution for titration Calculate the percentage of Fe and Fe_3O_4 in ore.

Q.5 A sample of ferrous sulphate and ferrous oxalate was dissolved in dil. H_2SO_4. The complete oxidation of reaction mixture required 40 ml N/15 $KMnO_4$. After the oxidation the reaction mixture was reduced by Zn and H_2SO_4.On again, oxidation by same $KMnO_4$ 25 ml required. Calculate the ratio of Fe in $FeSO_4$ and FeC_2O_4.

Q.6 0.5 g sample of Fe containing mineral mainly in the form of $CuFeS_2$ was reduced suitably to convert all the Fe^{+3} ion into Fe^{+2} and was obtained as solution. In the absence of any interferring radical, the solution required 42 ml of 0.01 M $K_2Cr_2O_7$ for titration. Calculate the % of $CuFeS_2$ in sample.

Q.7 Hydroxylamine reduces Fe^{+3} according to the equation

$$4Fe^{+3} + 2NH_2OH \rightarrow N_2O + H_2O + 4Fe^{+2} + 4H^+$$

The Fe^{+2} produced is estimated by titration with standard $KMnO_4$ solution. The reaction is

$5Fe^{+2} + MnO_4^{-1} + 8H^+ \rightarrow Mn^{+2} + 5Fe^{+3} + 4H_2O$.

A 10 ml of hydroxylamine solution was diluted to one litre. 50 ml of this dilute solution was boiled with an excess of Fe^{+3} solution. The resulting solution required 12 ml of 0.02M $KMnO_4$ solution for complete oxidation of Fe^{+2}. Calculate the weight of NH_2OH in one litre of the original solution.

Q.8 A 5 c.c. solution of H_2O_2 liberates 0.508 g of I_2 from acidified KI solution. Calculate the strength of H_2O_2 solution in terms of volume strength at S.T.P.

Q.9 5.7 g of bleaching powder was suspended in 500 ml of water . 25ml of this suspension on treatment with KI and HCl liberated iodine which reacted with 24.35 ml $\frac{N}{10}Na_2S_2O_3$. Calculate the percentage of avilable Cl_2 in bleaching powder.

Q.10 5 g sample of brass was dissolved in one litre dil. H_2SO_4. 20 mL of this solution were mixed with KI and liberated iodine required 20 mL of 0.0327 N hypo solution for titration. Calculate amount of Cu in alloy.

PP-16

1. $Br_2 + NaOH \xrightarrow{\text{Hot \& conc.}} NaBr + NaBrO_3 + H_2O$

2. $P_4 + 3NaOH + 3H_2O \longrightarrow \underset{\text{Sodium hypophosphite}}{NaH_2PO_2} + \underset{\text{Phosphine}}{PH_3}$

3. $S + NaOH \longrightarrow \underset{\substack{\text{sodium}\\\text{thiosulphate}}}{Na_2S_2O_3} + \underset{\substack{\text{sodium}\\\text{sulphide}}}{Na_2S} + H_2O$

4. $KMnO_4 + H_2SO_4 + H_2O_2 \longrightarrow K_2SO_4 + MnSO_4 + H_2O + O_2$

5. $Na_2S_2O_3 \xrightarrow{\text{Heat}} Na_2SO_4 + Na_2S_5$

6. $KI + H_2SO_4 \longrightarrow K_2SO_4 + I_2 + SO_2 + H_2O$

7. $KI + K_2Cr_2O_7 + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + I_2 + H_2O$

8. $KMnO_4 + KI + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + I_2 + H_2O$

9. $Mg + FeCl_3 + H_2O \longrightarrow MgCl_2 + Fe(OH)_3 + H_2$

10. $MgSO_4 \xrightarrow{\text{above } 200^oC} MgO + SO_2 + SO_3 + O_2$

11. $Ca(OH)_2 + NH_4Cl \xrightarrow{\text{Heat}} CaCl_2 + NH_3 \uparrow + H_2O$

12. $\underset{\text{Colemanite}}{Ca_2B_6O_{11}} + Na_2CO_3 \longrightarrow \underset{\text{(Insoluble)}}{CaCO_3} + \underbrace{Na_2B_4O_7 + NaBO_2}_{\text{(soluble)}}$

13. $BCl_3 + LiAlH_4 \longrightarrow B_2H_6 + AlCl_3 + LiCl$

14. $B_2H_6 + NH_3 \xrightarrow{450\ K} B_3N_3H_6 + H_2$

15. $Na_2B_4O_7 + NH_4Cl \longrightarrow BN + NaCl + B_2O_3 + H_2O$

16. $Al_2O_3 + C \xrightarrow{2000^oC} Al_4C_3 + CO\uparrow$

17. $AlCl_3 + NH_4OH \longrightarrow Al(OH)_3 + NH_4Cl$

18. $LiAlH_4 + ROH \longrightarrow Al(OR) + Li(OR) + H_2$

19. $LiAlH_4 + RNH_2 \longrightarrow Li[Al(RNH)_4] + H_2$

20. $LiAlH_4 + (CH_3)_3N \longrightarrow AlH_3.N(CH_3)_3] + Li_3AlH_6$

21. $Fe_2O_3 + CO \xrightarrow{600-700^oC} Fe + CO_2$

22. $KHCO_3 \longrightarrow K_2CO_3 + H_2O + CO_2$

23. $Pb(OH)_2 + Ca(OCl)_2 \longrightarrow PbO_2 + CaCl_2 + H_2O + O_2$

24. $(CH_3COO)_2Pb \longrightarrow PbO + CO_2 + CH_3COCH_3$

25. $(CH_3COO)_2Pb + K_2CrO_4 \longrightarrow PbCrO_4 + CH_3COOK$

26. $PbCO_3 \,.\, Pb(OH)_2 \longrightarrow \underset{\text{Red lead}}{Pb_3O_4} + H_2O + CO + CO_2$

27. $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + H_2O$

28. $Al_2O_3 + N_2 + C \xrightarrow{1273K} \underset{\text{Aluminium nitride}}{AlN} + CO$

29. $Mg_3N_2 + H_2O \longrightarrow Mg(OH)_2 + NH_3$

30. $NH_4H_2PO_4 \xrightarrow{\text{Heat}} NH_3 + HPO_3 + H_2O$

31. $NH_3 + Cl_2 \longrightarrow N_2 + NH_4Cl$

32. $NH_3 + NaClO \longrightarrow N_2 + NaCl + H_2O$

33. $ZnSO_4 + NH_4OH \longrightarrow Zn(OH)_2 + (NH_4)_2SO_4$

34. $K_2HgI_4 + NH_3 + KOH \longrightarrow H_2NHgOHgI + KI + H_2O$

35. $NH_3 + O_2 \xrightarrow[750^oC,\ 6\ atm]{\text{Pt gauze}} NO + H_2O$

36. $SnCl_2 + HCl + NO \longrightarrow SnCl_4 + NH_2OH$

37. $NO_2 + NaOH \longrightarrow NaNO_2 + NaNO_3 + H_2O$

38. $KMnO_4 + H_2SO_4 + NO_2 + H_2O \longrightarrow K_2SO_4 + MnSO_4 + HNO_3$

39. $K_2Cr_2O_7 + H_2SO_4 + HNO_2 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + HNO_3 + H_2O$

40. $SnCl_2 + HCl + HNO_3 \longrightarrow SnCl_4 + NH_2OH + NH_4NO_3 + H_2O$

41. $C_{12}H_{22}O_{11} + HNO_3 \longrightarrow (COOH)_2 + NO_2 + H_2O$

42. $Zn + HNO_3 \longrightarrow Zn(NO_3)_2 + N_2O + H_2O$

43. $Hg + HNO_3 \longrightarrow Hg(NO_3)_2 + NO + H_2O$

44. $Pt + HNO_3 + HCl \longrightarrow H_2PtCl_6 + NOCl + H_2O$

45. $\begin{matrix} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{matrix} + HONO_2 \xrightarrow[\text{Below } 25^oC]{H_2SO_4} \begin{matrix} CH_2ONO_2 \\ | \\ CHONO_2 \\ | \\ CH_2ONO_2 \end{matrix} + H_2O$

46. $P_4 + CuSO_4 + H_2O \xrightarrow{\text{Heat}} Cu_3P + H_3PO_4 + H_2SO_4$

47. $CuSO_4 + H_3PO_2 + H_2O \longrightarrow Cu_2H_2 + H_3PO_4 + H_2SO_4$

48. $KMnO_4 + H_2SO_4 + H_3PO_3 \longrightarrow K_2SO_4 + MnSO_4 + H_3PO_4 + H_2O$

49. $MgSO_4 + NH_4Cl + H_3PO_4 \longrightarrow Mg(NH_4)PO_4 + H_2SO_4 + HCl$

50. $Ca_3(PO_4)_2 + HNO_3 \longrightarrow Ca(H_2PO_4)_2 + Ca(NO_3)_2$

51. $Pb_3O_4 \xrightarrow{\text{Heat}} PbO + O_2$

52. $MnO_2 + H_2SO_4 \longrightarrow MnSO_4 + H_2O + O_2$

53. $C_2H_{2(g)} + O_{2(g)} \longrightarrow CO_{2(g)} + H_2O\ ;$

54. $MnO_2 + H_2SO_4 \longrightarrow MnSO_4 + H_2O + O_2$

55. $Fe_3O_4 + HCl \longrightarrow FeCl_2 + FeCl_3 + H_2O$

56. $KMnO_4 + H_2SO_4 + HNO_2 \longrightarrow K_2SO_4 + MnSO_4 + HNO_3 + H_2O$

57. $K_4[Fe(CN)_6] + H_2O + O_3 \longrightarrow K_3[Fe(CN)_6] + KOH + O_2$

58. $FeS_2 + O_2 \xrightarrow{\text{Heat}} Fe_3O_4 + SO_2 + S$

59. $CaS_5 + CaS_2O_3 + HCl \longrightarrow CaCl_2 + H_2O + S$

60. $K_2Cr_2O_7 + H_2SO_4 + H_2S \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + S$

61. $C_{10}H_8 + H_2SO_4 \longrightarrow C_8H_6O_4 + H_2O + SO_2 + CO_2$

62. $K_2S_2O_8 + H_2SO_4 \longrightarrow H_2SO_4 + K_2S_2O_7$

63. $KMnO_4 + HCl \longrightarrow KCl + MnCl_2 + H_2O + Cl_2\uparrow$

64. $NaCl + MnO_2 + H_2SO_4 \longrightarrow NaHSO_4 + MnSO_4 + H_2O + Cl_2$

65. $CaMnO_3 + HCl \longrightarrow CaCl_2 + MnCl_2 + Cl_2\uparrow + H_2O$

66. $Na_2S_2O_3 + H_2O + Cl_2 \longrightarrow Na_2SO_4 + HCl + S$

67. $KBr + MnO_2 + H_2SO_4 \longrightarrow KHSO_4 + MnSO_4 + H_2O + Br_2\uparrow$

68. $NaBr + NaBrO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + Br_2 + H_2O$

69. $C_2H_5OH + KOH + I_2 \longrightarrow CHI_3 + HCOOK + KI + H_2O$

70. $K_2Cr_2O_7 + HCl \longrightarrow KCl + CrCl_3 + H_2O + Cl_2$

71. $K_2Cr_2O_7 + H_2SO_4 + HBr \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + Br_2$

72. $Au + HNO_3 + HCl \longrightarrow H[AuCl_4] + NOCl + H_2O$

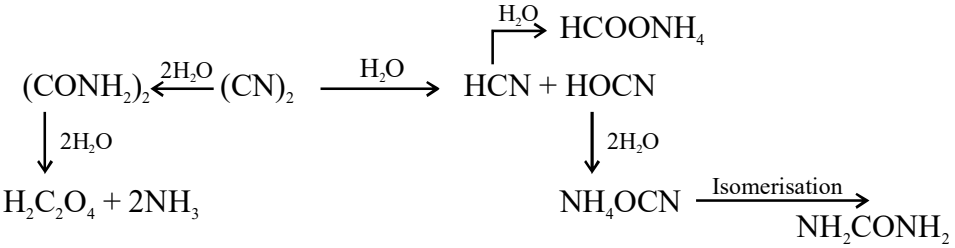
73. $CaOCl_2 + H_2O + CO_2 \longrightarrow CaCl_2 + CaCO_3 + HOCl$

74. $Ba(ClO_3)_2 + H_2SO_4 \longrightarrow BaSO_4 + HClO_3$

75. $CaOCl_2 + KI + CH_3COOH \longrightarrow (CH_3COO)_2Ca + H_2O + I_2 + KCl$

76. $KClO_3 + H_2SO_4 \longrightarrow KHSO_4 + ClO_2 + HClO_4 + H_2O$

77.



78. $XeF_4 + C_2H_4 \longrightarrow Xe + CH_2F.\ CH_2F + CHF_2.CH_3$

79. $XeF_4 + H_2O \longrightarrow XeO_3 + HF + Xe + O_2$

80. $XeF_6 + H_2O \longrightarrow XeO_3 + HF$

81. $Pu^{2+} + XeO_3 + H^+ \longrightarrow Pu^{4+} + Xe + H_2O$

82. $XeOF_4 + H_2O \longrightarrow XeO_2F_2 + HF$

83. $FeSO_4 + H_2SO_4 + NO_2 \longrightarrow Fe_2(SO_4)_3 + NO + H_2O$

PP-17

NaOH

(I) $P_4 + NaOH + H_2O \rightarrow PH_3 + NaH_2PO_2$

(II) $F_2 + NaOH \rightarrow NaF + OF_2 + H_2O$

(III) $Cl_2 + NaOH\ (dil.) \rightarrow NaCl + NaOCl + H_2O$

(IV) $Cl_2/Br_2/I_2 + NaOH \rightarrow NaCl + NaClO_3 + H_2O.$

(V) $Zn + NaOH \rightarrow Na_2ZnO_2 + H_2$

(VI) $Al + NaOH + H_2O \rightarrow NaAlO_2 + H_2$

(VII) $PbO + NaOH \rightarrow Na_2PbO_2 + H_2O$

(VIII) $Si + NaOH + H_2O \rightarrow Na_2SiO_3 + H_2$

(IX) $SnO + NaOH \rightarrow Na_2SnO_2 + H_2O$

(X) $Fe_2O_3 + NaOH + H_2O \rightarrow NaFeO_2 + H_2$

(XI) $HgCl_2 + NaOH \rightarrow NaCl + HgO + H_2O$

(XII) $AgNO_3 + NaOH \rightarrow Ag_2O + NaNO_3 + H_2O$

(XIII) $NH_4Cl + NaOH \rightarrow NaCl + NH_4OH$

(XIV) $SO_3 + NaOH \rightarrow Na_2SO_4 + H_2O$

(XV) $P_4O_7 + NaOH \rightarrow Na_2HPO_3 + H_2O + Na_3PO_4$.

(XVI) $FeCr_2O_4 + NaOH + O_2 \rightarrow Fe_2O_3 + Na_2CrO_4 + H_2O$

Na_2CO_3

(I) $AlCl_3 + Na_2CO_3 \rightarrow Al(OH)_3 + NaCl + CO_2 + H_2O$

(II) $CrCl_3 + Na_2CO_3 + H_2O \rightarrow Cr(OH)_3 + NaCl + CO_2$

(III) $SnCl_4 + Na_2CO_3 \rightarrow SnO_2 + NaCl + CO_2$

(IV) $BaCl_2 + Na_2CO_3 \rightarrow BaCO_3 + NaCl$

(V) $Ca(CN)_2 + Na_2CO_3 \rightarrow CaCO_3 + NaCN$

SiO_2

(I) $Na_2CO_3 + SiO_2 \rightarrow Na_2SiO_3 + CO_2$

(II) $Na_2SO_3 + SiO_2 \rightarrow Na_2SiO_3 + SO_2$

(III) $Na_2SO_4 + SiO_2 \rightarrow Na_2SiO_3 + SO_2$

(IV) $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$

(V) $Na_3PO_4 + SiO_2 \rightarrow Na_2SiO_3 + P_4O_{10}$

(VI) $MnCO_3 + SiO_2 \rightarrow MnSiO_3 + CO_2$

(VII) $Ca_3(PO_4)_2 + SiO_2 + C \rightarrow CaSiO_3 + P_4 + CO$

HNO_3

(I) $B + HNO_3 \rightarrow H_3BO_3 + NO_2$

(II) $P_4 + HNO_3 \rightarrow H_3PO_4 + NO_2 + H_2O$

(III) $S + HNO_3 \rightarrow H_2SO_4 + NO_2 + H_2O$

(IV) $C + HNO_3 \rightarrow CO_2 + NO_2 + H_2O$

(V) $I_2 + HNO_3 \rightarrow HI + H_2O + NO_2$

H_2SO_4

(I) $P_4 + H_2SO_4 \rightarrow H_3PO_4 + H_2O + SO_2$

(II) $S + H_2SO_4 \rightarrow H_2SO_4 + SO_2 + H_2O$

(III) $C + H_2SO_4 \rightarrow CO_2 + H_2O + SO_2$

H_2S

(I) $FeCl_3 + H_2S \rightarrow FeCl_2 + HCl + S$

(II) $H_2O_2 + H_2S \rightarrow H_2O + S$

(III) $SO_2 + H_2S \rightarrow S + H_2O$

(IV) $H_2S + O_3 \rightarrow H_2O + S + O_2$

(V) $HNO_3 + H_2S \rightarrow NO_2 + S + H_2O$

(VI) $H_2SO_4 + H_2S \rightarrow H_2O + SO_2 + S$

(VII) $KMnO_4 + H_2SO_4 + H_2S \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + S$

(VIII) $NaOH + H_2S \rightarrow Na_2S + H_2S + H_2O$

SO_2

(I) $SO_2 + H_2O + Cl_2 \rightarrow H_2SO_4 + HCl$

(II) $KMnO_4 + SO_2 + H_2O \rightarrow K_2SO_4 + MnSO_4 + H_2SO_4$

(III) $K_2Cr_2O_7 + SO_2 + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$

(IV) $Fe_2(SO_4)_3 + SO_2 + H_2O \rightarrow FeSO_4 + H_2SO_4 + H_2SO_4$

(V) $KIO_3 + SO_2 + H_2O \rightarrow K_2SO_4 + H_2SO_4 + I_2$

$Na_2S_2O_3$

(I) $Na_2S_2O_3 + HCl \rightarrow NaCl + SO_2 + S + H_2O$

(II) $Na_2S_2O_3 + H_2SO_4 \rightarrow Na_2SO_4 + SO_2 + S + H_2O$

(III) $Na_2S_2O_3 + I_2 \rightarrow NaI + Na_2S_4O_6$

(IV) $Na_2S_2O_3 + FeCl_3 \rightarrow Na_2S_4O_6 + FeCl_2 + NaCl$

(V) $AgBr + Na_2S_2O_3 \rightarrow Na_3[Ag(S_2O_3)_2] + NaBr$

(VI) $Cu_2S_2O_3 + Na_2S_2O_3 \rightarrow Na_4[Cu_6(S_2O_3)_5]$

$KMnO_4$

(I) $KMnO_4 + H_2O \xrightarrow{\text{Alkaline}} MnO_2 + KOH + O$

(II) $KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + K_2SO_4 + MnSO_4 + H_2O$

(III) $KMnO_4 + H_2SO_4 + H_2S \rightarrow K_2SO_4 + MnSO_4 + H_2SO_4 + S + H_2O$

(IV) $KMnO_4 + MnSO_4 + H_2O \rightarrow K_2SO_4 + MnO_2 + H_2SO_4$

$K_2Cr_2O_7$

(I) $K_2Cr_2O_7 + KI + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + I_2$

(II) $K_2Cr_2O_7 + Na_2SO_3 + H_2SO_4 \rightarrow Na_2SO_4 + K_2SO_4 + Cr_2(SO_4)_3 + H_2O$

(III) $K_2Cr_2O_7 + FeSO_4 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + H_2O + K_2SO_4$

(IV) $K_2Cr_2O_7 + H_2SO_4 + 3SO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$

(V) $K_2Cr_2O_7 + H_2SO_4 + NaCl \rightarrow KHSO_4 + NaHSO_4 + Cr_2O_2Cl_2 + H_2O$

H_2O_2

OXIDISING NATURE:

(a) $PbS + H_2O_2 \rightarrow PbSO_4 + H_2O$

(b) $NaNO_2 + H_2O_2 \rightarrow NaNO_3 + H_2O$

(c) $Na_2SO_3 + H_2O_2 \rightarrow Na_2SO_4 + H_2O$

(d) $Na_3AsO_3 + H_2O_2 \rightarrow Na_3AsO_4 + H_2O$

(e) $KI + H_2O_2 \rightarrow KOH + I_2$

(f) $H_2S + H_2O_2 \rightarrow H_2O + S$

(g) $FeSO_4 + H_2SO_4 + H_2O_2 \rightarrow Fe_2(SO_4)_3 + H_2O$

(h) $K_4Fe(CN)_6 + H_2SO_4 + H_2O_2 \rightarrow K_3Fe(CN)_6 + K_2SO_4 + H_2O$

(i) $HCHO + H_2O_2 \rightarrow HCOOH + H_2O$

(j) $HCHO + H_2O_2 \rightarrow HCOOH + H_2$

(k) $Cr(OH)_3 + NaOH + H_2O_2 \rightarrow Na_2CrO_4 + H_2O$

(l) $K_2Cr_2O_7 + H_2SO_4 + H_2O_2 \rightarrow CrO_5 + K_2SO_4 + H_2O$

(m) $CrO_5 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + H_2O + O_2$

(n) $MnSO_4 + H_2O_2 + NaOH \rightarrow MnO_2 + Na_2SO_4 + H_2O$

(o) $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + OH^-$

Reducing nature

(e) $Pb_3O_4 + HNO_3 + H_2O_2 \rightarrow Pb(NO_3)_2 + H_2O + O_2$

(f) $Cl_2 + H_2O_2 \rightarrow HCl + O_2$

(g) $KMnO_4 + H_2SO_4 + H_2O_2 \rightarrow K_2SO_4 + MnSO_4 + H_2O + O_2$

(h) $K_3Fe(CN)_6 + KOH + H_2O_2 \rightarrow K_4Fe(CN)_6 + H_2O + O_2$

OZONE

(i) $HCl + O_3 \rightarrow H_2O + Cl_2 + O_2$

(ii) $FeSO_4 + H_2SO_4 + O_3 \rightarrow Fe_2(SO_4)_3 + H_2O + O_2$

(iv) $PbS + O_3 \rightarrow PbSO_4 + O_2$

(vi) $K_4Fe(CN)_6 + H_2O + O_3 \rightarrow K_3Fe(CN)_6 + KOH + O_2$

Potassium ferrocyanide Potassium permanganate

(vii) $I_2 + H_2O + O_3 \rightarrow HIO_3 + O_2$

Iodic acid

(ix) $I_2 + O_3 \rightarrow I_4O_9 + O_2$

(x) $Ag_2O + O_3 \rightarrow Ag + O_2$

(xi) $Hg + O_3 \rightarrow Hg_2O + O_2$

ANSWERS PRACTIC PROBLEMS

PP-1

1 Determine the average oxidation no. of following elements given in bold letters :

(a) (+6) (b) (+2) (c) (+8) (d) (+2)
(e) (0) (f) (+8/3) (g) (–2) (h) (+2)
(i) (+7) (j) (+2) (k) (+1) (l) (+5/2)
(m) (0) (n) (–1)

2 Determine the oxidation number of the following elements given in bold letters :

(d) (+8) (e) (+4/3) (f) (+2) (h) (+5)
(j) (+3) (k) (+2)

3 Find the oxidation number of bold lettered atoms :

(a) [+6, +4, +8/3, +2, +3, +4]
(c) [–4, –3, –8/3, –2, –1, +3, +4]
(e) [+2, 0, 0, +6]
(f) [–3, –1, –1/3, –3, +3]
(g) [0, +1, +1, +4, +5, +7]

4 Determine the oxidation number of bold lettered atoms in the following :

(a) [+5, –1, 0, +4]
(b) [0, +5, –1]

5 Find the oxidation number of bold lettered atoms :

(i) (+4) (ii) (+2) (iii) (+6) (iv) (–3)
(v) (+3) (vi) (+5) (vii) (–1) (viii) (+3)
(ix) (+6) (x) (+7) (xi) (+2) (xii) (+1)
(xiii) (+6) (xiv) (–1) (xv) (+3) (xvi) (–1)
(xvii) (+1)

PP-2

1. $3C_2H_5OH + Cr_2O_7^{2-} + 8H^+ \rightarrow 2Cr^{3+} + 3C_2H_4O + 7H_2O$
2. $Sn(OH)_3^- + 2Bi(OH)_3 + 3OH^- \rightarrow 3Sn(OH)_6^{2-} + 2Bi$
3. $IO_3^- + N_2H_4 + 2HCl \rightarrow N_2 + ICl_2^- + 3H_2O$
4. $2Hg_2Cl_2 + 4NH_3 \rightarrow 2Hg + 2HgNH_2Cl + 2NH_4Cl$
5. $4Zn + NO_3^- + 10H^+ \rightarrow 4Zn^{2+} + NH_4^+ + 3H_2O$
6. $I_2 + 10NO_3^- + 8H^+ \rightarrow 2IO_3^- + 10NO_2 + 2H_2O$
7. $2MnO_4^- + 3SO_2^{2-} + H_2O \rightarrow 2MnO_2 + 3SO_4^{2-} + 2OH^-$
8. $H_2O_2 + 2ClO_2 + 2OH^- \rightarrow 2ClO_2^- + O_2 + 2H_2O$
9. $3ClO^- + 2CrO_2^- + 2OH^- \rightarrow 3Cl^- + 2CrO_4^{2-} + H_2O$

10. $3Cl_2 + 5KOH \rightarrow KClO_3 + 5KCl + 3H_2O$

11. $3H_2O_2 + 2KMnO_4 \rightarrow 2MnO_2 + 2KOH + 3OH_2 + 2H_2O$

12. $5HNO_2 + 2KMnO_4 + 3H_2SO_4 \rightarrow 5HNO_3 + 2KMnO_4 + K_2SO_4 + 3H_2O$

PP-3

1 $N_2H_4 + 4AgNO_3 + 4KOH \rightarrow N_2 + 4Ag + 4KNO_3 + 4H_2O$

2 $3P + 5HNO_3 \rightarrow 3HPO_3 + 5NO + H_2O$

3 $K_2Cr_2O_7 + 8HCl \rightarrow 2KCl + 2CrCl_3 + 7H_2O + 3Cl_2$

4 $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$

5 $Cr_2O_7^{2-} + 3C_2O_4^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 6CO_2 + 7H_2O$

6 $2KMnO_4 + 5H_2S + 4H_2SO_4 \rightarrow 2KHSO_4 + 2MnSO_4 + 5S + 8H_2O$

7 $2Cu(NH_3)_4Cl_2 + 7KCN + H_2O \rightarrow K_2Cu(CN)_3 + 6NH_3 + KCNO + 2NH_4Cl + 2KCl$

8 $4Ag + 8KCN + 2H_2O + O_2 \rightarrow 4KAg(CN)_2 + 4KOH$

9 $6Fe_3O_4 + 2MnO_4^- + H_2O \rightarrow 9Fe_2O_3 + 2MnO_2 + 2OH^-$

10 $3C_2H_5OH + 2MnO_4^- + OH^- \rightarrow 3C_2H_3O^- + 2MnO_2 + 5H_2O$

11 $Cr_2O_7^{2-} + 3SO_3^{2-} + 8H^+ \rightarrow 2Cr^{3+} + 3SO_4^{2-} + 4H_2O$

12 $2ClO_3^- + SO_2 + H^+ \rightarrow 2ClO_2 + HSO_4^-$

13 $2Mn^{2+} + 5S_2O_8^{2-} + 8H_2O \rightarrow 2MnO_4^- + 10HSO_4^- + 6H$

PP-4

1 0.555 m, 0.0099 **2** 64 gm

3 9.027 M, 17.152 m, 0.236 **4** 669.4 m*l* **5** 1040 kg/m^3

6 5 M **7** (i) 3.06% (ii) 5.9M (iii) 8.6 m

8 12.7 cm^3 **9** 5.84 % ethylene glycol, 94.16% solvent

10 47.416 ml

PP-5

1 (i) 9.1% (ii) 5.357 N (iii) 2.678 M (iv) 91 g/L

2 '20 V'

3 (i) 17% (ii) 10 N (iii) 5 M (iv) 170 g/L

4 34; 1120 ml **5** 303.57 g/l **6** 56.1 cm^3 **7** 0.88 M

8 1.5×10^{-3} %, 1.25×10^{-4} m **9** 173.53 ml **10** (i) 9.8 m, (ii) 45.88%

PP-6

1 (i) SO_2, (ii) 6.4 gm, (iii) 0.6 gm

2 (i) $K_2Cr_2O_7$, (ii) 3.21 gm, (iii) 0.73 g HCl, (iv) 672 ml **3** 27.27 g, 2.73 g

4 7.88 m **5** 1.476 : 1 **6** 3.125% **7** A_3O_4

8 0.74 **9** 4375 g **10** 1.52 Kg

PP-7

1 (a) Ewt. of $Na_2S_2O_3$ = 158, Ewt. of I_2 = 127 (b) Ewt. of NO_3^- = 12.4
(c) E wt. of N_2 = 4.66 (d) Ewt. of Fe_3O_4 = 232, Ewt. of $KMnO_4$ = 52.67
(e) E wt. of FeC_2O_4 = 48]

2 (a) 18.97 g (b) 1 N **3** 0.2 N **4** [500 ml]
5 (i) 71 (ii) 49 (iii) 32 (iv) 16 **6** 4 ml **7** 13.935 g
8 0.08 N **9** 6.12 g/*l* **10** 0.3 N $Cr_2O_7^{2-}$

PP-8

1 $N_{Ba^{++}}$ =0.05 N, N_{Cl^-} = 0.02 N, N_{OH^-} = 0.003 N **2** 109.5, 24.5

3 1.248 g **4** 0.1 M **5** 147.2 ml **6** $V_2 = \dfrac{V_1(M_1 - M_2)}{M_2}$

7 10,000, 10 g, 5.00 **8** (i) 100 (ii) 16 **9** 0.086 N **10** 0.70 g

PP-9

1 **2** neutral **3** 2.72 ml
4 (i) 3.58N (ii) 60.86 g/*l* (iii) 1.79 M (iv) 6.086% **5** 85%
6 1.45M, 1.52 m, 193.3 ml **7** 0.1192 **8** 2.90%
9 32.92% **10** 6

PP-10

1 Cu +n $Fe_2(S)_4)_3$ = $CuSO_4$ + 2$FeSO_4$) **2** 6.35 g, 0.5 M **3** 23%
4 0.0176 M **5** **6** 23.1, 1.4 g **7** 0.1235 g, 95.95%
8 6.086 g, 20 V **9** 0.5×10^{-3} mol, 0.5×10^{-3} mol **10** 1,2

PP-11

1 1 M, 23.6926 g **2** 25.56 **3** 25.56 **4** 54.1%
5 **6** 0.2498 g **7** **8** 0.164 N
9 (a) 51.3 ml (b) 1 g (c) 1.02×10^{-2} mol (d) 0.066 M **10**

PP-12

1 0.1048 g/litre NaOH and 0.1357 g/litre Na_2CO_3 **2** +2, +4, +6 16.67 ml
3 1457.0 ml **4** 25.8% **5** 41.46% **6** **7** 85%
8 45.86% $K_2Cr_2O_7$ and 54.15 $KMnO_4$ **9** 15.05% **10** 31.5%

PP-13

1 3.673 g **2** 1.026 g **3** (i) 0.569 % (ii) 50 **4** 71.46 %
5 (a) Cr = 42.81 % (b) Fe 23.15 % **6** 304 **7** 1.29
8 1.03×10^{23} P atoms ; 4.12×10^{23} O atoms
9 1.34×10^{22} molecules; 6.78×10^{22} atoms of oxygen **10** 1.34×10^{-22} g

PP-14

1 (a) 160.2 g (b) 288 g (c) 1.15×10^{-5} g (d) 169 g (e) 1000 g

2 1.27×10^{24} Ca^{++} , 2.54×10^{24} Cl^{-} **3** 2.55×10^{-2} g

4 1.10 **5** 0.644

6 K = 0.050; $Cr_2O_7^{-2}$ =0.438, H_2SO_4 = 0, H^+ = 0.334, ClO_4^{-1} = 0.438

7 0.512 litres **8**

9 H_2SO_4 = 2.302 g /I; osalic acid 5.909 g/I and 0.0482 (N) with respect to H_2SO_4 and 0.0938(N) with respect to oxalic acid

10 20.92%

PP-15

1 1.39 gm **2** 64.31% **3** 57.94%

4 Fe = 36.82% , Fe_3O_4 = 50.87% **5** 7/3 **6** 92.48%

7 39.6 gm/litre **8** 4.48% **9** 30.33%

10 41.60%