

Assignment 2

Chemical Arithmetic

Q 1. Balance (Show the method in each case) :

- $\text{CuF}_2 + \text{NH}_3 \rightarrow \text{Cu}_3\text{N} + \text{NH}_4\text{F} + \text{N}_2$ (Oxidation No. method)
- $\text{Na}_2\text{CrO}_4(\text{aq}) + \text{Na}_2\text{S}_2\text{O}_4(\text{aq}) + \text{NaOH}(\text{aq}) \rightarrow \text{Cr}(\text{OH})_3(\text{s}) + \text{Na}_2\text{SO}_3(\text{aq})$ (Ion-electron method)
- $\text{As}_2\text{O}_3(\text{s}) + \text{KMnO}_4(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) + \text{H}_2\text{O} \rightarrow \text{H}_3\text{AsO}_4(\text{aq}) + \text{MnSO}_4(\text{aq})$ (Ion-electron method)
- $\text{B}_2\text{Cl}_4 + \text{NaOH} \rightarrow \text{NaBO}_2 + \text{NaCl} + \text{H}_2\text{O} + \text{H}_2$ (Oxidation No. method)
- $\text{KCN}(\text{aq}) + \text{KMnO}_4(\text{aq}) + \text{KOH}(\text{aq}) \rightarrow \text{MnO}_2(\text{s}) + \text{KCNO}(\text{aq}) + \text{H}_2\text{O}$ (Ion-electron method)
- $\text{P}_4(\text{s}) + \text{HNO}_3(\text{aq}) + \text{H}_2\text{O} \rightarrow \text{NaH}_2\text{PO}_4(\text{aq}) + \text{NO}(\text{g})$ (Ion-electron method)
- $\text{CrI}_3 + \text{KOH} + \text{Cl}_2 \rightarrow \text{K}_2\text{CrO}_4 + \text{KIO}_4 + \text{KCl} + \text{H}_2\text{O}$ (Oxidation No. method)
- $\text{Pb}(\text{N}_3)_2 + \text{Co}(\text{MnO}_4)_2 \rightarrow \text{CoO} + \text{MnO}_2 + \text{Pb}_3\text{O}_4 + \text{NO}$ (Oxidation No. method)

Complete and balance the following net ionic equations, using ion electron method:

- $\text{Zn}(\text{s}) + \text{As}_2\text{O}_3(\text{s}) + \dots \rightarrow \text{AsH}_3(\text{g}) + \text{Zn}^{2+}(\text{aq}) + \dots$
- $\text{Zn}(\text{s}) + \text{NO}_3^-(\text{aq}) + \dots \rightarrow \text{NH}_4^+(\text{aq}) + \dots$

Ques No 2. 1 L N/40 NaOH, 50 mL N/20 HCl and 50 mL M/5 H_2SO_4 are mixed. Find whether the resultant solution will be acidic, basic or neutral. Also find the normality of resultant solution assuming no change in volume on mixing the solutions.

Ques No 3. A metal M and a nonmetal X forms a binary compound MX_2 of molecular weight 220. When heated with excess oxygen, it is converted to M_2O_3 and XO_2 . What is the equivalent weight of MX_2 ?

Ques No 4. A 10 M solution of ammonia in water was found to be 13.44 m. What is the density of the solution in g.mL^{-1} ?

Ques No 5. 1.56 g of a metal hydroxide, on heating leaves a residue of 1.02 g of its oxide. What is the equivalent weight of the metal?

Ques No 6. When all the chloride ions in 200 mL of a 3 M solution of BaCl_2 was precipitated by adding a solution of AgNO_3 , the final solution was found to be 1.00 M in Ba^{2+} ions. What was the molarity of the AgNO_3 solution?

Ques No 7. a. From the given data, calculate the equivalent weights of the solutes in each of the following cases:

Case (i) N/15 oxalic acid solution 4.2 g hydrated oxalic acid crystals per liter.

Case (ii) A solution of CaCl_2 , 20 mL of which can precipitate all the oxalic acid as oxalate from 15 mL of the solution referred to above, contains 5.475 g of hydrated CaCl_2 crystals per liter

b. Calculate the number of water of crystallization in hydrated crystals of oxalic acid and calcium chloride respectively.

Ques No 8. When 25 mL of $\text{C}_2\text{H}_5\text{OH}$ (density 0.80 g.cm^{-3}) is dissolved in water to prepare a 250 mL solution, the density of the solution was found to be 0.950 g.cm^{-3} . Calculate-

- a. Molarity of pure ethanol;
- b. Molarity of ethanol in the final solution;
- c. Volume of the final solution which will contain 5.22 mL of pure ethanol;
- d. Mass of pure ethanol in 25 mL of the final solution;
- e. Percentage composition (w/w) of ethanol in the final solution;
- f. Percentage composition (v/v) of ethanol in the final solution;
- g. Molality of ethanol in the final solution;
- h. Mole fraction of water in the final solution;
- i. Volume of final solution needed to prepare 1 liter of 0.087 M ethanol solution;
- j. Mass of final solution needed to 250 mL of a 0.1 M solution of ethanol

Ques No 9. 1.00 g of H_2O_2 containing x% H_2O_2 by weight requires x mL of a KMnO_4 solution for complete neutralization under acidic conditions. Calculate the normality of the KMnO_4 solution.

Ques No 10. 500 mg of a mixture of K_2CO_3 and Li_2CO_3 require 30 mL of a 0.25 N HCl solution for complete neutralization. What is the percentage composition (w/w) of the mixture?