1. Explain the following statements in one or two sentences:
   (a) The ionization energy of an element in a given group in the periodic table decreases with increase in the atomic number.
   (b) The basicity of acetic acid is found to be one, though there are four hydrogen's available in its molecule.
   (c) Ordinary hydrogen's always contains the ortho form in greater proportion (75%) than the Para form (25%) at room temperature.
   (d) Perfectly dried hydrogen and perfectly dried chlorine, when mixed together, don't react to form hydrogen chloride gas but introduction of a trace of moisture, leads to an immediate reaction producing hydrogen chloride.
   (e) The addition of NH_4Cl along with NH_4OH prevents the precipitation of the 5^{th} group metals [Ba, Ca and Sr] and allows Fe, Al, Cr to be precipitated as their hydroxides.

2. Complete the following equations and finally balance each one of the following equations :
   (a) $NH_3 + Cl_2 \rightarrow NH_4Cl$ + -----
   (b) $Na_2S_2O_2 + I_4 \rightarrow NaI$ + ------
   (c) $CuSO_4 + KCN \rightarrow K_2SO_4$ + --------
   (d) $AlO_3 + 3C + N_2 \rightarrow$ ----- + CO
   (e) $Sn + HNO_2$(dilute) $\rightarrow Sn(NO)_2$ + ----

3. (a) Choose the wrong statement among the following list and rewrite the wrong ones in the correct form:
   (i) The chemical formula for Plaster of Paris is $2CaSO_45H_2O$ and is obtained by strongly heating [200^0C] gypsum.
   (ii) Galvanizing of iron articles with molten zinc is not for protection of iron from corrosion but for decoration purposes.
   (iii) Alum is a double salt of potassium and copper sulphates with 24 molecules of water of hydration.
   (iv) The alloy namely Magnalium, used for making cheap balances of 30% of magnesium and 70% of iron.
   (b) Describe a good laboratory chemical test to distinguish between the following pairs of compounds :
   (i) Acetylene and Ethylene
   (ii) Acetaldehyde and Acetone
   (iii) Barium chloride and Magnesium chloride.
   (c) Explain in two or three sentences the following observations :
   (i) Cobalt, nickel, zinc and manganese are precipitated as their sulphides in IV group (through insoluble in water) but not in the II group, though H_2S is used as the reagent in both groups.
   (ii) Methyl orange is the preferred indicator for the titration of a weak base against a strong acid.

4. (a) Butene-1 has no isomers while Butene-2 exists into two isomeric forms. Indicate the structures of these isomers and name them.
   (b) Give the structure of the organic product of the following reactions.
   (i) $CH_3CH_2CH_2I + CN \rightarrow ?$

   (ii)

   CH_3

   $H_3C\text{-}C\text{-}Cl + OH^- \rightarrow ? + H_2O + Cl$

   CH_3

   (iii) $CH_3\ CH_2ONa + CH_3\ CH_2Cl \rightarrow ? + NaCl$

   (iv) $C_2H_5MgBr + D_2O \rightarrow ? + MgBrOD$

5. The volumes of ozone and chlorine diffusing during the same time are 35 ml and 29 ml respectively. If the molecular weight of chlorine is 71, calculate the molecular weight of ozone.

6. 10081 gm of copper displaces 3.67 gm of silver from a solution of silver nitrate. Find the equivalent weight of copper assuming that of Ag to be 107.88.

7. The aviation gasoline used 4.00 cm of tetraethyl lead ($(C_2H_5)_4Pb$, (relative density 1066) per 5 litres of the product. This compound is made as follows
   $4C_2H_5Cl + 4NaPb \rightarrow (C_2H_5)_4Pb + 4NaCl + 3Pb$
   How many grams of ethyl chlorides are needed to make enough tetraethyl lead for one gallon of gasoline? [mol. Wt. of tetraethyl lead is 323]

8. The same current is passed through solutions of silver nitrate and copper sulphate connected in series. If the weight of silver deposited is 0.72 gm, calculate the wt. of copper deposited (eq. wt. of Ag = 108, Cu=31.5).

9. A mixture of a solution of KOH and Na_2CO_3 required 15 ml of N/20 HCl solution when titrated using phenolphthalein as an indicator. But the same amount of the alkali mixture when titrated using methyl orange as an indicator 25 ml of the same acid. Calculate the amounts KOH and Na_2CO_3 present in the solution.

10. 20 ml of a solution of a ferrous salt required 18.4 ml of a decinormal solution of potassium dichromatic for complete oxidation. Calculate the weight of iron contained in a litre of the solution.