1. (a) Calculate the number of atoms of oxygen present in 88 grams of carbon dioxide. What would be the weight of carbon monoxide having the same number of oxygen atoms?
   (b) $KClO_3$ on heading decomposes to KCl and O_2. What is the volume of oxygen at STP liberated by the thermal decomposition of 0.1 mole of $KClO_3$?
   (c) The atomic number of nitrogen is 7 and that of hydrogen is 1. How many electrons are there in the ammonium ion NA^+ ?
   (d) What designation is given to an orbital having n=3 and l= 2?

2. (a) A gas occupies 300 ml at 27^0C and 730 mm pressure. What would be its volume at standard temperature and pressure (STP)?
   (b) Consider the reaction : $Zn + Cu^{++} \rightarrow Zn^{++} + Cu$
   With reference to the above which of the following is the correct statement?
   (i) Zn is reduced to Zn^{++} (ii) Zn is oxidised to Zn^{++} (iii) Zn^{++} is oxidised to Zn
   (iv) Cu++ is oxidised to Cu
   (c) How do you arrive at the oxidation number of Cr in the ion $Cr_2O_7^{2-}$?
   (d) 250 ml of 0.10 M K_2SO_4 solution is mixed with 250 ml of 0.20 M KCL solution. What is the concentration of K^+ ion in the resulting solution?

3. (a) The two extra nuclear electrons in the 1s orbital of helium have anti parallel spins. Why not they have parallel spins?
   (b) Write the ground state (orbital) electron configuration of nitrogen (atomic number 7).
   (c) Consider the element of the second row of the periodic table: Li, Be, B, C, N, O, F, Ne and explain the meaning of ‘s’ and ‘p’ block elements.
   (d) Which of the following statement about transition metals is wrong?
   (i) They form coloured compounds
   (ii) All their compounds are diamagnetic
   (iii) They exhibit variable valence
   (iv) They contain partially filled d orbital’s.

4. (a) Chlorine has tow isotopes of atomic mass units 34.97 and 36.97. The relative abundances of these two isotopes are 0.755 and 0.245 respectively. Find the average atomic weight of chlorine.
   (b) Titium ^8_2H an isotope of hydrogen disintegrates emitting 8β particle. Give the disintegration reaction and identify the product.
   (c) an isotope of uranium with mass number 238 and atomic number 92 disintegrates in a series of steps losing 8 alpha particles and 6 beta particles, ultimately giving a stable isotope. What is the mass number and atomic number of the resulting stable isotope?

5. (a) Arrange the following elements in the increasing order of their ionisation energy.
   Hydrogen, Helium and Lithium
   (b) Arrange the following elements in the increasing order of their electro negativity.
   Hydrogen, Fluorine and Chlorine
   (c) Sodium metal vaporises on heating and the vapour will have some diatomic molecules of sodium (Na_2). What type of bonding is present in these molecules?
   (d) Taking carbon (atomic number 6) as an example explain the meaning of valence electrons.

6. (a) Two voltammeters, the first containing copper sulphate solution and the second acidulated water are connected in series. When a current is passed for a certain period of time 0.3177 gram of copper is deposited in the first voltammeter, what weight of hydrogen will be liberated in the second?
   (b) From the following data of heat of combustion, find the heat of formation of methanol.
   (i) $CH_2OH\ (l) + \frac{3}{2}O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O(l)\ \Delta H=-726$ kJ
   (ii) $C\ (s) + O_2\ (g) \rightarrow CO_2\ (g)\ \Delta H=-394$ kJ
   (iii) $H_2(g) + \frac{1}{2}O_2\ (g) \rightarrow H_2O(l)\ \Delta H=-286$ kJ
   (c) Which of the following statements is wrong?
   (i) Covalent compound are generally soluble in polar solvents.
   (ii) Covalent compounds have low melting and boiling points.
   (iii) Ionic compounds conduct electricity in the fused state.

7. (a) Nitrogen and hydrogen react to form ammonia as per the reaction.
   $\frac{1}{2}N_2 + \frac{3}{2}H_2 \rightleftharpoons NH_3\ \Delta H=-46$ kJ
   When a mixture of the three gases is in equilibrium predict whether the amount of ammonia increases or decreases if
   (i) the pressure on the system is increased.
   (ii) the temperature of the system is raised
   (iii) the concentration of hydrogen is increased.
   (b) Froth flotation method is used for the concentration or which one of the following ores:
   (i) oxide ores (ii) sulphide ores (iii) carbonate ores (iv) silicate ores
   (c)) What is the essential difference between cast iron and ordinary steel?

8. (a) What is the essential difference between cast iron and Haematite
   Fe_3O_4, $FeCO_3$, FeS_2, Fe_2O_3
   (b) Arrange the following in the increasing order of their size
   F^+, Li^+, Na^+ and Cl^-
   (c) Out of the following identify

(i) the d block element

(ii) the f block element Ca, Mn, U, Al

(d) Hydrogen reacts with hot calcium metal to give a hydride. Give the formula of the hydride. The hydride reacts with water evolving hydrogen. What would be the other product of their reaction? Write the balanced equation for the reaction.

9. (a) Write the structural formulae of the isomers of the alkyl chloride C2H2Cl.

   (b) What is the functional group of (i) an aldyhide and (ii) a nitro compound ?

   (c) Fill the blanks in the following equations:

   (i) CaC_2 + …. → …. + C_2H_2

   (ii) CH_3CH_2OH + …. $\xrightarrow{\frac{ZnCl_2}{300^0C}}$ $CH_2CH_2NH_3$ + …

   (d) How is acetylene converted to acetaldehyde?

10. (a) Which one of the following enzymes converts glucose to ethyl alcohol?

    Diastase, Invertase, Maltase, Zymase

    (b) With reference to the production of gasoline, explain the meaning of cracking.

    (c) Write the structures of aniline and phenol.

    (d) Aromatic compounds burn with a sooty flame because

    (i) they have a ring structure of carbon atoms

    (ii) they have a relatively high percentage of hydrogen

    (iii) they have a relatively high percentage of carbon

    (iv) the resist reaction with oxygen of air

    (c) Show how primary, secondary and tertiary amines may be considered as derived from ammonia.