

Academic Assignment Chapter - 1

SOME BASIC CONCEPTS IN PHYSICAL CHEMISTRY

- In the reaction:
 $C(s) + 2S(s) \rightarrow CS_2(l)$
 4 g of carbon was heated with 8 g of sulphur. (Atomic mass : C = 12, S = 32)
 (a) Which is the limiting reagent?
 (b) How much carbon disulphide (CS_2) will be formed when the reaction is complete
 (2)
- Calculate the number of moles of hydrogen atoms in 64 g of methane. (1)
- Why the term 'formula mass' is used instead of molecular mass for the ionic compounds such as NaCl? (1)
- The following data are obtained when dihydrogen and dioxygen reacts together to form different compounds: (1)

	Mass of dihydrogen	Mass of dioxygen
()	11g	114 g
()	8 g	128 g

State the law of chemical combination which is obeyed by the above experimental data.

- (a) Which out of molarity and molality is a better unit for expressing the concentration of a solution of and why?
 (b) Calculate the mole fraction of glucose and water in 1 molal glucose solution. (3)
- An organic compound contains 85.72% carbon and 14.28% hydrogen. 20L of this compound at STP weighs 25g. Calculate empirical and molecular formulae of this compound. (2)
- One litre of oxygen at STP is made to react with three litres of carbon monoxide at STP, according to the following reaction:
 $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$
 Calculate the mass of each substance found after the reaction.
 Which one is the limiting reactant? (3)

Academic Assignment Chapter – 2

ATOMIC STRUCTURE

- (a) How many electrons in an atom may have the following quantum numbers:
 $n = 4; l = 0$

(b) Calculate the number of photons emitted in 10 hours by a 60 W sodium lamp emitting radiations of wavelength 6000 \AA . (3)
- Applying aufbau principle, write the electronic configuration of element with $Z = 21$. Also, write the possible values of principle and azimuthal quantum numbers for the unpaired electron in the atom. (2)
- When electromagnetic radiation of wavelength 306 nm falls on the surface of sodium, electrons are emitted with a kinetic energy of $1.7 \times 10^5 \text{ Jmol}^{-1}$.
What is the minimum energy needed to remove an electron from a sodium atom? What is the maximum wavelength that will cause a photoelectron to be emitted?
($h = 6.626 \times 10^{-34} \text{ Js}$) (5)
- The angular momentum of an electron in the Bohr's orbit of hydrogen atom is $4.22 \times 10^{-34} \text{ kgm}^2\text{s}^{-1}$. Calculate the wavelength of the spectral line when the electron falls from this level to next lower level. Identify (a) the series of spectral line corresponding to this transition, and (b) spectral region in which the transition takes place. (5)
- (a) Name the series of lines in the hydrogen spectrum which appear in the visible region of the electromagnetic spectrum.

(b) Calculate the energy associated with second orbit of Be^{3+} .

(c) Calculate the change in angular momentum of an electron in the hydrogen atom when it jumps from ground state to 2^{nd} energy level. (5)
- (a) State Heisenberg's Uncertainty Principle.

(b) What is its significance?

(c) A cricket ball of mass 50 g and having speed of 50 m/s can be measured within accuracy of 2% . Calculate the uncertainty in the position. (5)
- (a) How many electrons in an atom may have the following quantum numbers?
 $n = 3$ & $m_s = -1/2$

(b) State the rule which deals with the filling of electrons in the orbitals belonging to same subshell.

(c) Which of the following orbitals will be filled first and why?
 $3d$ & $4p$. (3)

Academic Assignment Chapter – 3

PERIODIC PROPERTIES

1. Assign the position in terms of period and group to the element having outer electronic configuration ns^2np^1 , where $n = 6$. (1)
2. Between the two elements with atomic numbers 9 and 19, choose the one which is more electronegative? Give reason. (1)
3. Predict the period and the group to which the element having electronic configuration $1s^22s^22p^63s^23p^1$ belongs. (1)
4. (a) Ne atom and Na^+ ion are isoelectronic species. Do they have same ionization enthalpies? Explain. (1)
(b) Chlorine can be converted into chloride ion more easily as compared to fluorine into fluoride ion. Give reason. (2)
5. (a) What do you understand by isoelectronic species? Name a species that will be isoelectronic with Ne. (1)
(b) The first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium. Why? (1)
(c) $\Delta_{eg}H_1$ for oxygen is negative but its $\Delta_{eg}H_2$ is positive. Why? (3)
6. Arrange the following as instructed:
(i) O, S, Cl, F
(decreasing order of electron gain enthalpy)
(ii) F, Cl, Br, I
(increasing order of reactivity)
a. F, Ne, Na^+ , N^{3-}
(decreasing order of ionic radii) (3)
7. Write the atomic number of the element present in the third period and seventeenth group of the periodic table. (1)
8. Write the IUPAC name and symbol for the element with atomic number 114. (1)
9. Account for the following:
(a) The first ionization enthalpy of magnesium is higher than that of aluminium.
(b) Fifth period of the periodic table has 18 elements.
(c) The first element of all the groups show anomalous behaviour. (3)
10. An element having atomic number 29. Write
(i) electronic configuration of this element
(ii) all the quantum number for an unpaired electron of this element. (3)
11. Arrange the following in order of property indicated against each:
(a) Na^+ , F, Mg^{+2} , Al^{+3} (increasing ionic size)
(b) B, C, N, O (increasing first ionization enthalpy)
(c) I, Br, F, Cl (increasing negative electron gain enthalpy) (3)

Academic Assignment Chapter – 4

CHEMICAL BONDING

- Using the valence shell electron pair repulsion (VSEPR) model, predict the shape of the following molecules:
 - ClF_3
 - H_2O(2)
- Draw and name the shapes of the following molecules using VSEPR theory:
 - BrF_3
 - XeF_4(2)
- Give an example of a molecule in which a double bond is made up of only π bonds.
 - The dipole moment of BeF_2 is zero. Why?(2)
- Write the molecular orbital configuration of N_2 molecule. Compare the relative stabilities of N_2 , N_2^+ and N_2^- on the basis of molecular orbital theory. (2)
- Which out of NH_3 and NF_3 is expected to have higher dipole moment and why?
 - Compare the relative stability of the following species and indicate their magnetic properties by writing molecular electronic configuration. O_2 , O_2^{2+} .(5)
- Use M.O. theory to explain why the Be_2 molecule does not exist.
 - Write the resonance structures for SO_3 and NO_2 .
 - What is the change in hybridization (if any) of the Al atom in the following reaction?
 $\text{AlCl}_3 + \text{Cl}^- \rightarrow \text{AlCl}_4^-$(5)
- Among NH_3 , H_2O and HF , which would you expect to have highest magnitude of hydrogen bonding. Give reason to support your answer. (2)
- Write molecular orbital configuration of N_2 and N_2^+ . Calculate the bond order and predict their magnetic behavior. (3)
- Account for the following:
 - Although ammonia and water both have distorted tetrahedral geometries, bond angle in water is less than that of ammonia.
 - All carbon to oxygen bonds in CO_3^{2-} are equivalent.
 - BF_3 has a zero dipole moment although B-F bonds are polar.
 - Write the molecular orbital configuration of O_2^+ . Also calculate its bond order and magnetic nature.(5)
- On the basis of VSEPR theory, predict the shape of BrF_5 .
 - Name the molecular orbital formed by the combination of following atomic orbitals (assume Z-axis as the internuclear axis)
 - $2p_x + 2p_x$
 - $2p_z - 2p_z$
 - In the molecule of ethene (C_2H_4)

Academic Assignment Chapter - 5

STATES OF MATTER

1. Draw the graphs of P vs $1/V$ and PV vs P for fixed mass of a gas at constant T . (2)
2. At 25°C and 760 mm of Hg pressure a gas occupies 600 mL volume. What will be its pressure at the height where temperature is 10°C and volume of the gas is 640 mL? (2)
3. Rohan visited a fair in his native village during summer vacation. He was fascinated by the huge hot air balloon was a flame. There was a big basket attached below the balloon which could carry four people at a time. He observed when the flame is increased, the balloon inflates (as volume of air increases) and it rises in the atmosphere. On decreasing the flame, the balloon deflates and comes back to the ground.
 - (i) Name the gas law which is used in the working of the hot air balloon.
 - (ii) Write the mathematical expression for the law.
 - (iii) What qualities/values of Rohan are highlighted in the above incident? (4)
4. Draw PV vs P curve for an ideal gas. (1)
5. (i) 35 ml of oxygen was collected at 6°C and 758 mm pressure. Calculate its volume at STP.
(ii) What is the value of compressibility factor 'Z' for:
 - (a) Ideal gas
 - (b) Real gas above Boyle's temperature. (3)
6. What is the physical significance of Vander Waal's constant 'a'? (1)
7. What is the effect of temperature on viscosity of liquids and why? (1)
8. Why gas fizzes out when soda water bottle is opened? (1)
9. Explain:
 - (a) The boiling point of a liquid rises on increasing pressure.
 - (b) Drops of liquid assume spherical shape. (2)
10. A sample of nitrogen gas occupies a volume of 1 L at a pressure of 0.2 bar at 60°C . Calculate the pressure if the gas is compressed to 0.225 L at -3°C ? (2)
11. Define viscosity. How viscosity varies with temperature? (1)
12. (a) Plot a graph of pressure of a gas, p Vs $1/V$ at constant temperature.
(b) State Dalton's law of partial pressure. A gaseous mixture contains 2.2 bar He, 1.1 bar H_2 and 4.2 bar N_2 . What is the mole fraction of N_2 ? (3)
13. 4.4 g of a gas at S.T.P. (0°C and 1 bar) occupies a volume of 2.27 liters. The gas is:
 - (a) O_2
 - (b) CO
 - (b) NO_2
 - (d) CO_2 (1)
14. One day Seema's mother was cooking rice in an open vessel. Seema went to the kitchen and told her mother that she would cook the rice today. She asked her mother to take rest. But, Seema cooked the rice in a pressure cooker instead of an open vessel.
 - (a) Explain the scientific concept being applied by Seema.
15. State Dalton's law of partial pressure. Write the relation between partial pressure of a gas and its mole fraction. (2)

Academic Assignment Chapter – 6

Thermodynamics

1. For the reaction: $A_2(g) \rightarrow 2A(g)$ What are the signs of ΔH and ΔS ? (1)
2. (a) Define the state function.
 (b) Neither q nor w is a state function but $q+w$ is a state function. Explain.
 (c) Find out the work done (J) when 11.2g of Iron (Fe) dissolves in HCl to give ferrous chloride and dihydrogen gas in
 (i) an open vessel at 25°C and 1 bar external pressure.
 (ii) a closed vessel at 25°C and 1 bar. (5)
3. (a) Define standard molar enthalpy of formation.
 (b) Under what temperature condition the enthalpy change in a reaction is equal to its free energy change?
 (c) Calculate the equilibrium constant K_c for the formation of NO_2 from NO and O_2 at 298 K

$$\text{NO}(g) + \frac{1}{2} \text{O}_2(g) \rightleftharpoons \text{NO}_2(g)$$

$$\Delta_f G^\circ(\text{NO}_2) = 52.0 \text{ KJ/mol}$$

$$\Delta_f G^\circ(\text{NO}) = 87.0 \text{ KJ/mol and}$$

$$\Delta_f G^\circ(\text{O}_2) = 00.0 \text{ KJ/mol}$$
 (5)
4. The value of $\Delta_f H^\circ$ for NH_3 is $-45.9 \text{ KJ mol}^{-1}$. Calculate enthalpy change for the reaction:
 $2\text{NH}_3(g) \rightarrow \text{N}_2(g) + 3\text{H}_2(g)$ (1)
5. Calculate the work done by 1 mole of the gas in each of the following cases:
 (Given: $\log 5 = 0.6989$ and $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)
 (i) For expansion of the gas from volume 1L to 5L against constant external pressure of 1 bar.
 (ii) For reversible isothermal expansion of the gas from volume 1L to 5L at 27°C .
 (iii) For free expansion of the gas from 1L to 5L. (3)
6. (i) Write the conditions in terms of ΔH and ΔS when a reaction would be always spontaneous.
 (ii) The value of $\Delta_f H^\circ$ for NH_3 is -91.8 kJmol^{-1} . Calculate enthalpy change for the following reaction:
 $2\text{NH}_3(g) \rightarrow \text{N}_2(g) + 3\text{H}_2(g)$ (3)
7. (a) What is the difference between extensive and intensive properties?
 (b) (i) For the reaction
 $2\text{Cl}(g) \rightarrow \text{Cl}_2(g)$
 What are the signs of ΔH and ΔS ?
 (ii) When $\Delta H > 0$ and $\Delta S < 0$, a reaction is never spontaneous. Why?
 (c) Consider the following two reactions:
 $\text{Fe}_2\text{O}_3(s) + 3\text{CO}(g) \rightarrow 2\text{Fe}(s) + 3\text{CO}_2(g) \quad \Delta H = -26.8 \text{ KJ}$
 $\text{FeO}(s) + \text{CO}(g) \rightarrow \text{Fe}(s) + \text{CO}_2(g) \quad \Delta H = -16.5 \text{ KJ}$

Academic Assignment Chapter – 7

EQUILIBRIUM

- Write formulae of the conjugate bases of the following Bronsted acids.
 $\text{HF}, \text{HCO}_3^-$ (1)
- (a) $2\text{N}_2\text{O}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g})$; $\Delta H > 0$ what will be the effect on equilibrium when
 (i) volume of vessel increases
 (ii) temperature decreases
 (b) Equal volumes of 0.004M solution of sodium iodate (NaIO_3) and copper chromate (CuCrO_4) are mixed together. Will it lead to precipitation of copper iodate?
 For copper iodate, $[\text{Cu}(\text{IO}_3)_2]$, $K_{sp} = 7.4 \times 10^{-8}$. (5)
- (a) In which direction will the equilibrium shifts on imposing the following changes. Give reason.
 (i) $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$ (Pressure is increases)
 (ii) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ $\Delta H = -92.4 \text{ kJ mol}^{-1}$ (Temperature is decreased)
 (b) The solubility of $\text{Mg}(\text{OH})_2$ is $4.176 \times 10^{-3} \text{ g L}^{-1}$ at 290°C . Find out its K_{sp} at this temperature. (5)
- Predict which of the following reactions will have an appreciable concentration of products:
 (a) $\text{Cl}_2(\text{g}) + \text{NO}(\text{g}) \rightleftharpoons 2\text{NOCl}(\text{g})$ $K_c = 3.7 \times 10^8$
 (b) $\text{Cl}_2(\text{g}) + 2\text{NO}_2(\text{g}) \rightleftharpoons 2\text{NO}_2\text{Cl}(\text{g})$ $K_c = 1.8$ (1)
- What mass of nitric acid should be added to water to prepare 1L of solution having pH = 2? (2)
- (a) For the reaction

$$2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g}) \quad \Delta H = -57.2 \text{ kJ mol}^{-1}$$
 (Brown) (Colourless)
 The equilibrium mixture has a light brown colour. What will be the effect of increasing temperature on the intensity of brown colour and why?
 (b) The ionization of hydrazine takes place according to the following reaction:

$$\text{NH}_2\text{NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_2\text{NH}_3^+ + \text{OH}^-$$
 The pH of 0.004 M hydrazine solution is 10.2. Calculate its ionization constant, K_b .
 7. The K_p for the reaction $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ is 640 mm at 775 K. Calculate the percentage dissociation of N_2O_4 at equilibrium pressure of 160 mm. (3)
- (i) Magnesium is precipitated from a solution of its salt by NH_4OH as per the following reaction:

$$\text{Mg}^{2+}(\text{aq}) + 2\text{NH}_4\text{OH}(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2 + 2\text{NH}_4^+(\text{aq})$$
 If NH_4Cl is also added to the reaction mixture, precipitate of $\text{Mg}(\text{OH})_2$ is not obtained. Explain.
 (ii) Calculate the pH at which $\text{Mg}(\text{OH})_2$ begins to precipitate from a solution containing 0.1M Mg^{2+} ions. K_{sp} of $\text{Mg}(\text{OH})_2 = 1 \times 10^{-11}$. (3)
- (a) Write the conjugate acid and conjugate base of NH_3 .
 (b) Calculate the pH of the solution obtained when 1 ml of 13.6 M HCl is diluted with water to give 1 litre of the solution. (3)

Academic Assignment

Chapter – 8 REDOX REACTION

1. (i) Identify the substance getting reduced as well as oxidized in the following reaction –

$$\text{N}_2\text{H}_4(\text{l}) + 2\text{H}_2\text{O}_2(\text{l}) \rightarrow \text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$$
 (ii) For the following reaction taking place in a galvanic cell:

$$\text{Zn}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$$
 (a) Write the cell representation
 (b) Which of the electrodes is negatively charged?
 (c) Which are the carriers of current in the solution? (3)
2. (a) Justify that the following is a disproportionation reaction:

$$\text{P}_4(\text{s}) + 3\text{OH}^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) \rightarrow \text{PH}_3(\text{g}) + 3\text{H}_2\text{PO}_2^-(\text{aq})$$
 (b) Balance the following redox reaction in acidic medium:

$$\text{XeO}_6^{4-} + \text{F}^- \rightarrow \text{XeO}_3(\text{g}) + \text{F}_2(\text{g})$$
 (3)
3. (i) Balance the following redox reaction in acidic medium:

$$\text{MnO}_4^-(\text{aq}) + \text{SO}_2(\text{g}) \rightarrow \text{Mn}^{2+}(\text{aq}) + \text{HSO}_4^-(\text{aq})$$
 (ii) Given the standard electrode potentials,
 $K^+/K = -2.93 \text{ V}$, $\text{Ag}^+/\text{Ag} = 0.88 \text{ V}$, $\text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}$, $\text{Hg}^{2+}/\text{Hg} = 0.79 \text{ V}$
 Arrange these metals in increasing order of their reducing power. (3)
4. (a) What is a disproportionation reaction? Give an example.
 (b) Balance the following redox reaction in acidic medium :

$$\text{Cl}_2\text{O}_7(\text{g}) + \text{H}_2\text{O}(\text{aq}) \rightarrow \text{ClO}_2^-(\text{aq}) + \text{O}_2(\text{g})$$
 (3)
5. Balance the following redox reaction in acidic medium?

$$\text{MnO}_4^- + \text{SO}_2 \rightarrow \text{Mn}^{+2} + \text{HSO}_4^-$$
 (3)
 Also name the substance which is oxidized and reduced in the above reaction.
6. (a) Given the standard electrode potentials
 $K^+/K = -2.93 \text{ V}$; $\text{Ag}^+/\text{Ag} = +0.80 \text{ V}$; $\text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}$
 Arrange these metals in order of increasing reducing power.
 (b) Balance the following equation in acidic medium:

$$\text{Cr}_2\text{O}_7^{2-} + \text{SO}_2(\text{g}) \rightarrow \text{Cr}^{3+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$$
 (3)
7. (a) Depict the galvanic cell in which the following reaction takes place:

$$\text{Zn}(\text{s}) + \text{Cu}^{+2}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$$
 (b) Which of the electrode acts as a cathode and which one acts as an anode.
 (c) What is the function of the salt bridge in the electrochemical cells? (3)
8. (a) Balance the following redox reaction in an acidic medium

$$\text{MnO}_4^-(\text{aq}) + \text{SO}_2(\text{g}) \rightarrow \text{Mn}^{+2}(\text{aq}) + \text{HSO}_4^-(\text{aq})$$
 (b) What is the oxidation number of oxygen in CaO_2 ? (3)
9. (a) (i) Write the cell notation for the Galvanic cell in which the following reaction takes place

$$\text{Zn}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$$

Academic Assignment Chapter - 9

HYDROGEN

- (a) Isotopes have same chemical properties but differ in their rates of reaction, explain.
 - (b) Arrange NH_3 , H_2O , HF in order of increasing magnitude of hydrogen bonding.
 - (c) Water has a strong hydrating tendency. Give reason. (3)
- (a) What is de-mineralised water? How is it prepared?
 - (b) Which type of molecular hydrides behave as Lewis bases? Elements of which groups of the periodic table form such hydrides? Give an example of such hydrides. (3)
- (i) What is meant by Hydrogen economy?
 - (ii) Give one reaction each to show that H_2O_2 acts as both oxidizing and reducing agents. (3)
- (i) Why H_2O_2 cannot be stored in metallic or glass containers?
 - (ii) What do you understand by electron-rich and electron-deficient hydrides? Give one example of each. (3)
- (a) Name the isotope of hydrogen which is
 - (i) used in nuclear reactor
 - (ii) radioactive
 - (b) Why is hydrogen peroxide stored in wax lined bottles in dark?
 - (c) Why does ice float on the surface of water? (3)
- (a) Why hard water is softened before using in boilers?
 - (b) Write chemical reactions to show the amphoteric nature of water.
 - (c) Write two uses of interstitial hydrides? (3)
- Account for the following:
 - (a) Temporary hardness of water can be removed by boiling.
 - (b) Hydrogen is relatively inert at room temperature.
 - (c) Hydrogen peroxide cannot be stored in presence of light. (3)
- Last Christmas, Rahul and his friends had gone to Kasauli on a school trip. On their visit they found that the locals used to light coal fire in their ill-ventilated houses at night to keep them warm. Rahul and his friends explained to them how the gas released on burning coal in limited oxygen was dangerous and that it could even cost them their lives.
 - (a) How does the gas produced by incomplete burning of coal lead to loss of human life?
 - (b) What is water gas? How is it prepared?
 - (c) What values are associated with Rahul and his friends behavior? (4)
- What do you mean by 10 Vol H_2O_2 ? (1)
- (a) How can we increase the production of dihydrogen from water gas?
 - (b) What causes permanent hardness of water? Name one method to remove permanent hardness of water. (2)
- (a) How atomic hydrogen and oxy-hydrogen torches find use for cutting and welding purpose?
 - (b) Why metallic hydrides are called interstitial hydrides? (2)

Academic Assignment Chapter - 10

s-block elements

1. (i) When alkali metals are dissolved in liquid ammonia, deep blue solutions are formed. Explain it with chemical equation.
(ii) Potassium carbonate cannot be prepared by Solvay process. Why? (3)
2. Write balanced chemical equations involved when
(i) quicklime is heated with silica
(ii) calcium nitrate is heated. (2)
3. Why do the solubilities of alkaline earth metal carbonates and sulphates in water decreases down the group? (2)
4. Give reasons:
(a) Excess of CO_2 should be avoided during the formation of calcium carbonate from slaked lime.
(b) Beryllium is not readily attacked by acids.
(c) Ionic mobility of alkali metal ions in aqueous solutions increases down the group. (3)
5. Name the alkali metal used to make the alloy 'white metal' with lead. (1)
6. Why magnesium does not impart colour to the flame while calcium does? (1)
7. Gaurav, a brilliant football player, was suffering from muscle cramp, fatigue, irritability and headache since past few days. He feared that he would not be allowed to play in the coming up tournament. His coach consoled him and assured him that increase in the intake of potassium rich food in his diet would help him recover fast. Answer the following questions:
(i) What is the importance of potassium in the cell fluid? (any two)
(ii) Name any other metal which is also involved in the transmission of nerve signals.
(iii) Write two values shown by Gaurav's coach. (4)
8. (a) Give the reactions involved in the Solvay's process for the preparation of sodium carbonate.
(b) State as to why :
(i) Be and Mg do not impart any colour to the flame whereas other alkaline earth metals do so.
(ii) Alkali metals dissolve in liquid ammonia giving deep blue solution.
(iii) BeSO_4 is soluble in water but BaSO_4 is insoluble in water. (5)
9. (a) Which alkali metal ion forms largest hydrated ion in aqueous solution and why?
(b) Write chemical equation for the preparation of Plaster of Paris and give its one use.
(c) Write balanced equations for:
(i) $\text{LiNO}_3 \xrightarrow{\hspace{1cm}}$
(ii) $\text{BeCl}_2 + \text{LiAlH}_4 \rightarrow$
(iii) $\text{CaO} + \text{P}_4\text{O}_{10} \rightarrow$ (5)
10. Write balanced equations for:
 $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow$ (1)

Academic Assignment Chapter – 11

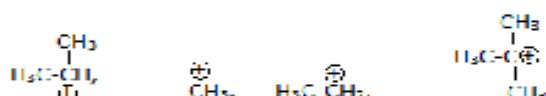
p-block elements

1. PbCl_4 is a stable compound while PbI_4 does not exist. Why? (2)
2. (i) What is meant by inert pair effect?
(ii) Give reasons –
(a) Conc. HNO_3 can be transported in aluminium container.
(b) Carbon shows catenation property but lead does not. (3)
3. Account for the following:
(a) CO is poisonous even in small quantities but CO_2 is not.
(b) pH of water in the atmosphere decreases when excessive amount of CO_2 is released into the atmosphere.
(c) Aqueous solution of Borax is alkaline in nature. (3)
4. Give reasons:
(a) Boron does not form ionic compounds.
(b) Diamond is harder than graphite.
(c) SiCl_4 is easily hydrolysed while CCl_4 is not. (3)
5. (i) When aqueous solution of borax is acidified with hydrochloric acid, white crystalline solid is formed, which is soapy to touch. Name the solid formed. Is this solid acidic or basic in nature. Explain with the help of chemical equation.
(ii) Why is borazine also called 'inorganic benzene'? (3)
6. (a) Why is boric acid considered a weak acid?
(b) Write any two reactions to justify the amphoteric nature of aluminium? (2)
7. (a) Why is atomic radius of gallium smaller as compared to aluminium?
(b) What are silicones? Write its one use.
(c) CCl_4 does not hydrolyse whereas SiCl_4 undergoes hydrolysis. Why? (3)
8. (a) $[\text{SiF}_6]^{2-}$ exists whereas $[\text{SiCl}_6]^{2-}$ does not exist. Why?
(b) Why is the atomic radius of Gallium smaller as compared to Aluminium? (2)
9. Write equations for the chemical reactions when:
(i) Silicon is heated with methyl chloride at high temperature in the presence of copper.
(ii) Boric acid is added to water. (2)
10. What happens when (write chemical equations only) :
(a) Aluminium is treated with dilute NaOH.
(b) Sodium borohydride is reacted with iodine.
(c) Silicon dioxide is treated with hydrogen fluoride. (3)
11. How many 2-centered 2-electron bonds and 3-centered-2-electron bonds are there in the structure of diborane? (1)
12. (a) SiCl_4 undergoes hydrolysis but CCl_4 does not. Why?
(b) Suggest a reason as to why CO is poisonous.

Academic Assignment Chapter – 12

BASIC CONCEPT IN ORGANIC CHEMISTRY

- (a) Give two examples of electron withdrawing and electron donating groups.
 - (b) Arrange the following carboxylic acids in decreasing order of acidity:
 CH_3COOH , $\text{NH}_2\text{CH}_2\text{COOH}$, $\text{Cl-CH}_2\text{-COOH}$
 Which electron displacement effect explains the above order of acidity? (3)
- (a) Name the technique used for separating glycerol from spent lye in the soap industry.
 - (b) Draw the structure of a methyl carbocation. Mention its shape and hybridization. (3)
- (a) Arrange the following species in the decreasing order of their stability and give reason for your answer.



- (b) What is the principle of paper chromatography? Also, write the formula for the calculation of R_f value.
 - (c) Write the correct IUPAC name of the following compound:
 7-Ethyl-2-methyloctane. (5)
- (a) Define heterolytic fission. Explain the formation of reactive intermediates formed as a result of this fission.
 - (b) Draw the resonating structures of phenol using curved arrow notation.
 - (c) Write the IUPAC name and structure of the next homologue of acetone. (5)
 - (a) Arrange the following carbocations in the order of decreasing stability:
 CH_3^+ , $(\text{CH}_3)_2\text{CH}^+$, $(\text{CH}_3)_3\text{C}^+$, CH_3CH_2^+
 How can inductive and hyperconjugation effect explain the stability of primary, secondary and tertiary carbocations. Draw the orbital diagram for methyl carbocation indicating the shape and hybridization involved. (5)
 - (a) What conclusion would you draw if during Lassaigne's test a blood red colouration is obtained? Discuss the principle underlying the estimation of phosphorus. Write the chemical formula of the yellow precipitate formed in the test for phosphorus.
 - (b) 0.2 g of an organic compound containing phosphorus gave 1.877 g of ammonium phosphomolybdate (molar mass = 1877) by usual analysis. Calculate the percentage of phosphorus in the organic compound. (5)
 - (a) Write the IUPAC name of

$$\begin{array}{c} \text{O} \quad \quad \quad \text{O} \\ || \quad \quad \quad | \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{O}-\text{H} \end{array}$$
 (1)

Academic Assignment Chapter – 13

HYDROCARBON

- Why iodination of alkane is carried out in the presence of HNO_3 or HIO_3 ?
 - Why ethyne is acidic in nature? Give a chemical reaction to show acidic character of ethyne. (3)
- Addition of HBr to but-1-ene in the presence of benzoyl peroxide yields 1-bromo-butane as the major product. Write mechanism also.
 - How will you carry out the following conversions:
 - Propyne to propanone
 - Benzene to m-nitrochloro benzene (5)
- Give reasons:
 - Trans but-2-ene has higher melting point than cis but-2-ene.
 - Comment on the solubilities of alkanes in water.
 - Identify A, B and C in the following reactions:
 - Isopropyl bromide $\xrightarrow{\text{alc. KOH, Heat}}$ A $\xrightarrow{\text{HBr/H}_2\text{O}_2}$ B
 - $$\text{CH}_3(\text{CH}_2)_4\text{CH}_3 \xrightarrow{\text{Cr}_2\text{O}_3 + \text{Al}_2\text{O}_3} \text{B} \xrightarrow{\text{C}} \text{Cyclohexene ring with } \text{C}(=\text{O})\text{CH}_3 \text{ group}$$
 - $$\text{CH}_3\text{C}\equiv\text{CH} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{B} \xrightarrow[413\text{ K}]{\text{Conc. H}_2\text{SO}_4} \text{C}$$
- Discuss the mechanism of halogenations of benzene.
 - How will you convert benzene into:
 - p-nitrochlorobenzene
 - m-nitrochlorobenzene (5)
- complete the following reactions:
 - $$\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 + \text{HBr} \rightarrow$$
 - $$\begin{array}{c} \text{CH}_3\text{CH}_3 \\ | \quad | \\ \text{CH}_3\text{C}=\text{CCH}_3 \\ | \quad | \\ \text{CH}_2\text{CH}_3 \end{array} \xrightarrow[\text{(II) Zn + H}_2\text{O}]{\text{(i) O}_3}$$
 - $$\text{CH} \xrightarrow[\text{333 K}]{\text{CH}_3\text{COOH + H}_2\text{O}} \text{HgSO}_4/\text{H}^+ \rightarrow$$
 - $$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl} \xrightarrow[\text{Heat}]{\text{alc. KOH}} \rightarrow$$
- Describe the following with the help of chemical equations:
 - Wurtz Reaction

Academic Assignment Chapter – 14

ENVIRONMENTAL CHEMISTRY

1. (i) Name two pollutants that are emitted on burning fossil fuels.
(ii) What are the two common components of photochemical smog? Write the chemical reaction involved in their formation. (3)
2. Amit Kumar is working as a manager of a leading cosmetics unit. His company was producing perfumes & deodorants with too much quantity of CFCs. Amit had studied chemistry at Sr. Sec. Level. So he suggested the unit members to produce perfumes with an alternate safer chemical instead of CFCs. The new product would be able to provide more sprays per bottle and can help in reducing a very big environmental problem too.
(i) What are CFCs.
(ii) Which environmental problem is referred to in the question? How Amit's suggestion would help in reducing it?
(iii) What are the moral values shown by Amit by making such a suggestion? (4)
3. (i) How can you apply green chemistry to reduce the use of chlorine in bleaching?
(ii) From where does ozone come in photochemical smog?
(iii) Why is classical smog also called reducing smog? (3)
4. On World Environment Day, ABC School invited eminent speakers to come and address the school children on the issue of environment conservation. Some of the students were so impressed by the program that they decided to spread awareness in their housing societies. They requested the residents to abstain from using polyethene bags and switch to cloth/jute bags. They also convinced people to observe 'NO ELECTRICITY HOUR' for one hour on every Saturday night.
(a) What values are shown by the students?
(b) What do you mean by green chemistry?
(c) How will green chemistry help in reducing environmental pollution? (4)
5. Rahul visited his grandmother's house in vacations. He observed that families from nearby localities bring loads of laundry to wash in the river. Also they make their animals bathe in the river and dump garbage around it. Rahul advised them to keep the environment clean, maintain healthy and hygienic surroundings and prevent water pollution.
(a) What is the effect of water pollution?
(b) What do you mean by Biochemical Oxygen Demand (BOD)?
(c) What is the threat to aquatic animals due to water pollution?
(d) What values are possessed by Rahul? (4)
6. (a) Why the statues and monuments in India are affected by acid rain?
(b) Distinguish between photochemical smog and classical smog? (3)
7. (a) Write the names of any two gases responsible for green house effect.
(b) What is classical smog?

SET - A

Full length question paper (chapter 1-6)

1. What is the SI unit of surface tension? (1)
2. An atom of an element contains 29 electrons and 35 neutrons. Deduce
(a) number of protons and (1)
(b) the electronic configuration of the element. (1)
3. What is bond energy? Why is it called enthalpy of atomization? (1)
4. Write the electronic configuration of Cr^{3+} (Atomic number of Cr = 24). (1)
5. Express the following numbers to four significant figures :
(i) 5.607892 (ii) 1.7896×10^3 (1)
6. What will be SI unit for the quantity $\text{pV}^2\text{T}^2/\text{n}$ (1)
7. Define average atomic mass. (1)
8. What is the energy in joules required to shift the electron of the hydrogen atom from the first Bohr orbit to the fifth Bohr orbit and what is the wavelength of the light emitted when the electron returns to the ground state? (2)
9. Calculate the uncertainty in position of an electron if uncertainty in its velocity is 0.001% . Velocity of electron = 300 ms^{-1} . (2)
10. Compare the relative stability of following species and indicate their magnetic properties.
 $\text{O}_2, \text{O}_2^-, \text{O}_2^{2-}$. (2)
11. Enthalpy of combustion of methane, graphite and dihydrogen at 298 K are $-890.3 \text{ kJ mol}^{-1}$, $-393.5 \text{ kJ mol}^{-1}$ and $-285.8 \text{ kJ mol}^{-1}$ respectively. Calculate the enthalpy of formation of $\text{CH}_4(\text{g})$. (2)
12. (i) State Heisenberg's Uncertainty principle. (2)
(ii) Which orbital is represented by $n = 4$ and $l = 3$? (2)
13. Which out of NH_3 and NF_3 has higher dipole moment? Why? (2)
14. Write molecular orbital diagram for O_2^{2+} ? (2)
15. The following data are obtained when dinitrogen and dioxygen react together to form different compounds:

	Mass of dinitrogen	Mass of dioxygen
(a)	14 g	16 g
(b)	14 g	32 g
(c)	28 g	32 g
(d)	28 g	80 g

Which law of chemical combination is obeyed by the above experimental data? Give its statement. (2)
16. All the three oxygen atoms in O_3 are equivalent, explain? (2)

SET - B

FULL LENGTH (1-6)

1. State Avogadro law. (1)
2. Write the IUPAC name and symbol of an element having atomic number 118. (1)
3. Which one of the following is not extensive state function:
Enthalpy change, internal energy change and pressure? (1)
4. Write electronic configuration of Cu^+ . ($Z = 29$). (1)
5. Write the Lewis dot structures of BeF_2 and SiCl_4 . (1)
6. State Hund's rule of maximum multiplicity rule. (1)
7. Calculate the mass of sodium acetate required to make 500 ml of 0.375 molar aqueous solutions. Molar mass of sodium acetate is $82.0245 \text{ g mol}^{-1}$. (2)
8. Explain giving reason, which of the following sets of quantum numbers are not possible.
(a) $n = 1, l = 1, m_l = 0, m_s = +1/2$ (b) $n = 0, l = 2, m_l = -2, m_s = -1/2$ (2)
9. Write the general outer electronic configuration of s, p, d and f block elements. (2)
10. Write the conditions of temperature and pressure when gases deviate most from the ideal behavior? (2)
11. In a process 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process? (2)
12. 56 kg of $\text{N}_2(\text{g})$ and 10 kg of $\text{H}_2(\text{g})$ are mixed to produce $\text{NH}_3(\text{g})$. Calculate the number of moles of ammonia gas formed. (2)
13. Write two points of difference between a sigma bond and a pi bond. (2)
14. (a) How many sigma and pi bonds are there in the following molecule.
 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{C}\equiv\text{CH}$.
(b) which type of hybrid orbitals are used by the second carbon atom in the following molecule.
 $\text{CH}\equiv\text{C}-\text{CH}_2-\text{CH}=\text{CH}_2$ (2)
15. Calculate the total pressure in a mixture of 8g $\text{O}_2(\text{g})$ and 4 g $\text{H}_2(\text{g})$ confined in a vessel of 1 dm^3 at 27°C . ($R = 0.083 \text{ bar dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$) (2)
16. Why do real gases deviate from the ideal behavior? What are the conditions under which real gases show ideal behavior? (2)
17. What are the frequency and wavelength of a photon during a transition from $n = 5$ to $n = 2$ state in the He^+ ion. (3)
18. Among the second period elements the actual ionization enthalpies are in the order:
 $\text{Li} < \text{B} < \text{Be} < \text{C} < \text{O} < \text{N} < \text{F} < \text{Ne}$
Explain why:
(a) Be has higher I.E. than B.
(b) O has lower I.E. than N and F.
(1+2)
19. (a) State Pauli's exclusion Principle.
(b) List the quantum numbers (m_l and l) for 3d orbitals.
(c) Write the electronic configuration of Cr^{3+} ($Z = 24$). (3)
20. Assign a reason for each of the following statements:
(i) First ionization enthalpy of boron ($Z = 5$) is slightly less than that of beryllium ($Z = 4$).

SET - A

(7-11 Equilibrium, Redox, Hydrogen, s-block, p-block)

- Boric acid is considered as a weak acid. Why? (1)
- What do you understand by the term hydrogen economy? (1)
- Diamond is covalent, yet has high melting point. Why? (1)
- Can we store copper sulphate in an iron vessel? Why? (1)
- What is the effect of increasing pressure on the equilibrium?

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$$
 (1)
- Find the conjugate base for the species of H_2O and NH_4^+ . (1)
- The ionization constant of acetic acid is 1.74×10^{-5} . Calculate the degree of dissociation of acetic acid in its 0.05 M solution. Calculate the concentration of acetate ion in the solution and its pH. (2)
- What happens when:
 (a) Mg is burnt in air. (b) $\text{Cl}_2(\text{g})$ reacts with slaked lime. (2)
- Explain :
 (i) Why are alkali metals not found in nature ?
 (ii) BeSO_4 is soluble in water but BaSO_4 is insoluble in water. (2)
- (a) Balance the following equation in basic medium by ion electron method or by oxidation number method:

$$\text{P}_4(\text{s}) + \text{OH}^-(\text{aq}) \rightarrow \text{PH}_3(\text{g}) + \text{H}_2\text{PO}_2^-(\text{aq})$$

 (b) Write two informations about the reaction :

$$(\text{CN})_2(\text{g}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{CN}^-(\text{aq}) + \text{CNO}^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$$
 (3)
- (a) Name the class of hydrides to which H_2O and NaH belong.
 (b) What is understood by hydride gap
 (c) What do you mean by 15 volume H_2O_2 solution? (3)
- Consider the following endothermic reaction :

$$\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$$

 (i) Write expression for K_p for the above reaction
 (ii) How will the values of K_p and composition of equilibrium mixture be affected by
 1. Increasing the pressure
 2. Increasing the temperature
 3. Using a catalyst (3)
- (a) Balance the following redox reaction in acidic medium by ion electron method.

$$\text{Cr}_2\text{O}_7^{2-} + \text{SO}_2(\text{g}) \rightarrow \text{Cr}^{3+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$$

 (b) Given the standard electrode potentials

$$\text{K}^+/\text{K} = -2.93 \text{ V}, \text{Ag}^+/\text{Ag} = +0.80 \text{ V}, \text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}.$$

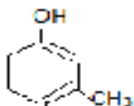
 Arrange these metals in order of increasing reducing power. (2+1)
- Give one method of preparation of H_2O_2 . Write chemical reactions to justify that H_2O_2 can function as an oxidizing as well as reducing agent. Write its two uses. (3)
- (a) If solubility product for CaF_2 is 1.7×10^{-10} at 298 K, calculate the solubility in mol L^{-1} .
 (b) What is silicate? (3)
- Assign a reason for each of the following statements:
 (a) Alkali metals dissolve in liquid ammonia to form deep blue solution.
 (b) Beryllium and magnesium do not give colour to the flame whereas other alkaline earth metals do so.
 (c) Potassium carbonate (K_2CO_3) cannot be prepared by Solvay process. (3)

SET – B

Full length (7-11) Equilibrium, Redox, Hydrogen, s-block, p-block



- Carbon shows the property of catenation remarkably. Assign a reason for this statement. (1)
- List two properties showing similarity between Lithium and Magnesium. (1)
- Write the equilibrium constant expression for following reaction:
 $2\text{NOCl(g)} \rightleftharpoons 2\text{NO(g)} + \text{Cl}_2\text{(g)}$ (1)
- Identify the substance reduced in the following reaction:
 $\text{Fe}_2\text{O}_3\text{(s)} + 3\text{CO(g)} \rightarrow 2\text{Fe(s)} + 3\text{CO}_2\text{(g)}$ (1)
- Why does Boron trifluoride behave as Lewis acid? (1)
- Why common salt is added to precipitate out soap from the solution during its manufacture. (1)
- What do you understand by terms :
(i) Hydrogenation (ii) Water gas shift reaction (2)
- Identify (A), (B), (C) and (D) and give their chemical formula :
(A) + NaOH \rightarrow NaCl + NH₃ + H₂O, NH₃ + CO₂ + H₂O \rightarrow (B)
(B) + NaCl \rightarrow (C) + NH₄Cl, (C) (heat) \rightarrow Na₂CO₃ + H₂O + (D) (2)
- Explain that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium. (2)
- Balance the following equation :
 $\text{Br}_2 + \text{H}_2\text{O}_2 \rightarrow \text{BrO}_3^- + \text{H}_2\text{O}$ (acidic medium) (2)
- What do you understand by electron deficient and electron precise compounds of hydrogen? Provide justification with suitable example. (2)
- Draw the structures of:
(a) BeCl₂ (Vapour) (b) BeCl₂ (Solid) (2)
- Balance the following redox reaction by ion-electron method :
 $\text{MnO}_4^- \text{(aq)} + \text{I}^- \text{(aq)} \rightarrow \text{MnO}_2 \text{(s)} + \text{I}_2 \text{(s)}$ (basic medium) (2)
- Comment on each of the following observations :
(a) The mobilities of alkali metal ions in aqueous solution are
 $\text{Li}^+ < \text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$
(b) Lithium is the only metal to form nitride directly. (2)
- (i) How does H₂O₂ behave as a bleaching agent?
(ii) Write chemical reactions to show amphoteric nature of water. (3)
- What are silicones? How are they prepared? Give its two uses. (3)
- Write the formula of plaster of Paris and its main uses. (3)
- Explain :
(i) Boron is unable to form BF₆³⁻ ion. (ii) [SiF₆]²⁻ is known whereas [SiCl₆]²⁻ not known.
(iii) Conc. HNO₃ can be stored in aluminium container. (3)
- Write balanced equation for :
(i) BF₃ is reacted with ammonia. (ii) Al is treated with dilute NaOH.
(iii) CO (g) is heated with ZnO. (3)
- (a) Balance the following reaction in acidic medium:
 $\text{MnO}_4^- \text{(aq)} + \text{SO}_2 \text{(g)} \rightarrow \text{Mn}^{2+} \text{(aq)} + \text{HSO}_4^- \text{(aq)}$

Class – XI Full length (12-14) SET – A (Organic, Hydrocarbon & Chemistry in daily life)

1. Indicate the number of σ and π bonds in the molecule $\text{CH}_2=\text{C}=\text{CH}_2$ (1)
2. What is Green House Effect? (1)
3. What is 'Lassaigne's extract'? (1)
4. Write short notes on (Give at least one example) :
 - (a) Friedel-Crafts Alkylation
 - (b) Antimarkonikoff's Rule (2)
5. Write two points of difference between a sigma bond and a pi bond. (2)
6. (a) How many sigma and pi bonds are there in the following molecule :
 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{C}\equiv\text{CH}$
 (b) Which type of hybrid orbitals are used by the second carbon atom in the following molecule :
 $\text{CH}\equiv\text{C}-\text{CH}_2-\text{CH}=\text{CH}_2$ (2)
7. (a) Which of the following species act as nucleophiles?
 NH_3 , BF_3 , NO_2^+ and $\text{C}_2\text{H}_5\text{O}^-$
 (b) Identify the electrophilic centre in :
 CH_3COOH (2)
8. Write the IUPAC names of the following compounds.
 - (a)  (2)
 - (b) $\text{CH}_3-\text{CH}(\text{CH}_3)\text{CH}-\text{CH}_2-\text{CH}_2-\text{COOH}$ (2)
9. (a) What are harmful effect of Acid Rain?
 (b) What do you mean by BOD? (2)
10. (a) Indicate the number of σ and π bonds in HCONHCH_3 .
 (b) Out of benzene, m-dinitrobenzene and toluene which will undergo nitration most easily and why? (2)
11. (a) How will you convert Benzene into :
 (i) acetophenone (ii) m-nitrochlorobenzene
 (b) Write the structures of products obtained by ozonolysis of pent-2-ene (3)
12. (a) 0.3780 g of an organic compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the % of chlorine present in the compound.
 (b) Indicate the total number of σ and π bonds present in HCONHCH_3 (3)
13. (a) Write the formula of Prussian blue colour formed in Lassaigne's test for nitrogen detection. (b) Write formula for estimation of Nitrogen by Kjeldahl's method.
 (c) Method used to separate :
 (i) glycerol from spent lye in soap industry
 (ii) aniline from aniline water mixture. (3)

SET –B

Chapter 12-14 (Organic, Hydrocarbon & Chemistry in daily life)

1. Explain why n-pentane has higher boiling point than neo-pentane. (1)
2. Propanal and ethanal are the ozonolysis products of an alkene. What is the structural formula of the alkene? (1)
3. An organic compound contains 69% carbon and 4.8% hydrogen, the remainder being oxygen. Calculate the mass of carbon dioxide and water produced when 0.20 g of this substance is subjected to complete combustion. (2)
4. (a) Draw cis and trans- structures for Hex-2-ene. Which isomer will have higher boiling point and why?
(b) Explain why  is not aromatic (2)
5. Define : (i) Green Chemistry (ii) Ozone hole (2)
6. Which hybrid orbitals are used by underlined carbon in the following molecules:
(a) $\text{CH}_3\text{-}\underline{\text{C}}\text{HO}$ (b) $\text{CH}_3\text{-CH=}\underline{\text{C}}\text{H}_2$ (2)
7. In Duma's method for estimation of nitrogen, 0.3 g of an organic compound gave 50 ml of nitrogen collected at 300 K temperature and 715 mm pressure. Calculate % composition of Nitrogen in the compound. (Aqueous tension at 300 K = 15 mm) (2)
8. An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of alkene 'A'. (2)
9. (i) Identify electrophilic centre in the following
 CH_3CHO and CH_3CN .
(ii) Name a suitable technique of separation of the components from a mixture of calcium sulphate and camphor. (2)
10. (a) Write IUPAC name of :
 $\text{CH}_2\text{-CH}_2\text{-CH-CH}_2$
 (b) Give mechanism of electrophilic substitution reaction of halogenation of Arenes (3)
11. 0.25 g of an organic compound gave 30 cm³ of moist dinitrogen at 288 K and 745 mm pressure. Calculate the % of nitrogen. (Aq. Tension at 288 K = 12.7 mm) (3)
12. (a) Explain the terms inductive and electromeric effects.
(b) Giving proper justification, categorise the following molecules / ions as nucleophile or electrophile. HS^- , BF_3 , $\text{C}_2\text{H}_5\text{O}^-$, $(\text{CH}_3)_3\text{N}$ (3)
13. (a) What is the difference between classical smog and photochemical smog? What are their harmful effects?
(b) What are the reactions involved for ozone layer depletion in the stratosphere? (3)