Unit–IV

7. (a) Draw molecular orbital diagram for CO molecule.
   (b) Write Hannay and Smith formula to calculate percentage of Ionic character in compounds.
   (c) Arrange in order of increasing bond angles : H_2S, H_2O, H_2Se
8. (a) Discuss bonding and sharpe of molecule on basis of VSEPR theory: ClF_3. 2,1,1
   (b) Draw molecular orbitals coming out of combination of S-S orbital: and $P_x - P_x$ orbital.
   (c) Does electronegativity of central atom in the molecule has any effect on shape or molecule. Explain with *one* example. 2,1,1

Unit–V

Compulsory Question

9. (a) Is O_2 paramagnetic or not and why ? 1 each
   (b) Write electronic configuration of elements having atomic number 24.
   (c) Which have higher ionization energy –N or O ?
   (d) What is the cause of diagonal relationship ?
   (e) Give main biological functions of Na^+ and K^+ ions.
   (f) What is hybridization I in IF_7 ? 1×6=6

CHEMISTRY PAPER–II

(Organic Chemistry-A)

Time Allowed : Three Hours **Max. Marks : 22**

Note : Attempt *five* questions in all, selecting *one* question from each Unit and one compulsory question. Compulsory question carries 6 marks and remaining questions carry 4 marks each.

Unit–I

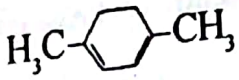
1. (a) What is Hybridisation ? Discuss sp. hybridisation in organic molecules by taking suitable example.
   (b) What are carboncations. Discuss their structure and classification. 2,2

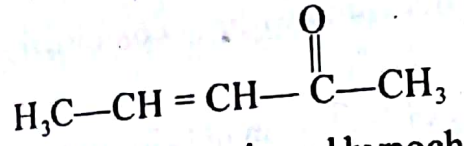
2. (a) Write short notes on the following :
   (i) Inductive effect (ii) Resonance
   (b) What are free radicals ? How does hyperconjugation explain the relative stability of primary, secondary and tertiary alkyl free radicals. 2,2

Unit–II

3. (a) Write short notes on the following :
(i) Chromophore (ii) Oxochrome
Give suitable examples also.

(b) Calculate λ_{max} for the following molecules on the basis of Woodward Fieser rules :

(i) 

(ii)  22

4. (a) Discuss hyperchromic and hypochromic shifts in UV spectrum. How can we achieve these shifts ?

(b) Explain the effect of conjugation on UV spectrum of conjugated enes. 22

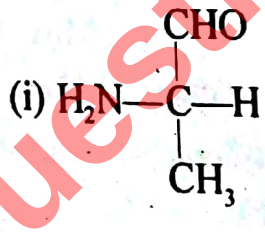
Unit–III

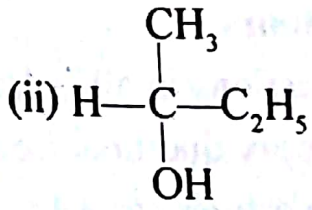
5. (a) Draw structure of all the isomers having molecular formula C_6H_{14} and give their IUPAC names.

(b) Write short notes on the following :
(i) enantiomers (ii) diasteromers
Give suitable example in each case. 22

6. (a) What do you understand by chiral and achiral molecules ? Give two examples of each.

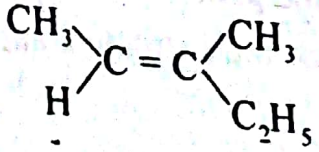
(b) Following sequence rules assign R or S to the following :

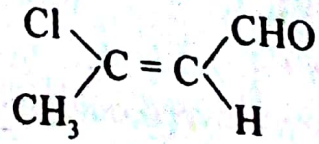
(i) 

(ii)  22

Unit–IV

7. (a) Assign priorities and then assign E or Z configuration to the following molecules :

(i) 

(ii) 

(b) Draw conformation of cis and trans 1, 2- dimethyl cyclohexane. 22

8. (a) Draw Sawhorse and Newman projection formulae for the conformations of propane.

(b) How do we find out configuration of geometric isomers on the basis of:

(i) melting point (ii) dipole moment ? 2,2

Compulsory Question

9. (a) What are electrophiles ? Give *two* examples of electrophilic species.

(b) What are carbenes ? Give example.

(c) Why does UV spectrum give rise to broad bands instead of sharp peaks ?

(d) What do you understand by inversion of configuration ? Explain with example.

(e) What is plane of symmetry ? Give *two* examples of molecules which do not have plane of symmetry.

(f) What are the conditions for a compound to exhibit geometric isomerism ? 1×6=6

CHEMISTRY PAPER–III

(Physical Chemistry-A)

Time Allowed : Three Hours **Max. Marks : 22**

Note : Attempt *five* questions in all, selecting *one* question from each Section. All questions carry equal marks. Section-E is compulsory . Simple/ Non-programmable calculator is allowed. Compulsory question carries 6 marks.

Section–A

1. (a) If $y = \log\left(\sqrt{x+a} + \sqrt{x-b}\right)$, find $\frac{dy}{dx}$.

(b) Integrate the following function w.r.t. x; $\int \frac{dx}{1-\sin x}$.

(c) Find the slope of the line passing through the points P(2, 3) and Q(7, 9). 1,2,1

Or

2. (a) Determine the maxima and minima point for the function $f(x) = x^3 - 3x^2 - 9x - 7$. Also find the maximum and minimum value.

(b) The volumetric analysis of oxalic acid solution with $KMnO_4$ solution gave the following titre values :

22·62, 22·75, 22·79, 22·84 and 22·92 ml.

Calculate :

(i) Average deviation of mean

(ii) Standard deviation 2,2

Section–B

3. (a) Define mean free path and collision diameter. Derive the relationship between them. Show how mean free path depends upon the temperature.

(b) At what temperature the root mean square velocity of chlorine gas will be equal to that of SO_2 at N.T.P. 2,2

Or

4. (a) How does Van der Waals equation explain the behaviour of real gases under different conditions of temperature and pressure.

(b) State the law of corresponding states and deduce the equation

$$\left[\left(\pi + \frac{3}{\phi^2}\right)\right](3\phi - 1) = 80.$$ 2,2

Section–C

5. (a) Explain with suitable examples 'Zero Order Reaction'.

(b) How can you prove that kinetically inversion of cane sugar is a unimolecular reaction.

(c) Write expression for the rate constant for a reaction of second order of the type $2A \rightarrow$ products. What are the units of the rate constant? 1,1,2

Or

6. (a) A first order reaction is 40% complete in 50 min. Calculate the value of the rate constant. In what time will the reaction be 80% complete.

(b) Define disintegration constant. Give the units of disintegration rate.

(c) Differentiate between Molecularity and Order of a reaction. 2,1,1

Section–D

7. (a) Write Arrhenius equation giving the effect of temperature on the rate constant of a reaction.

(b) For bimolecular collisions of dissimilar molecules derive expression for rate constant K.

(c) What is radioactive equilibrium ? Prove that the amounts of different substances at equilibrium are inversely proportional to their decay constants. 1,1,2

Or

8. (a) What is autocatalysis ? Explain with suitable examples.

(b) Describe the mechanism of enzyme-catalysed reactions as proposed by Michaelis and Menton.

(c) What are catalytic promoters and catalytic poisons. How do they work. 1,2,1

CHEMISTRY PAPER–I

(Inorganic Chemistry-A)

Time Allowed : Three Hours **Maximum Marks:**

Note : (i) Attempt *five* questions in all, selecting *one* question from e Unit.

(ii) Unit V is compulsory.

Unit–I

1. (a) Write a note on Radial Wave Function and Angular Wave Functi
   (b) Write Schrö ndinger wave equation in terms of spherical polar ordinates.
   (c) Write value of quantum numbers for $3d_{z^2}$ orbital.
2. (a) Draw Radial Probability distribution curve for $3d$ and $4d$ orbital 2
   (b) Define uncertainty principle. Can we apply it on stationary electr
   (c) How many Nodal planes are there in s-orbital ? 2

Unit–II

3. (a) Calculate effective nuclear charge of $3p$ electrons in the atom phosphorous.
   (b) Which have more electron affinity : F or Cl and why ?
   (c) Which has matter size (i) Ce or Ce^- (ii) F or Ne ? 2
4. (a) C is more electro-negative in $-C_2H_2$ or C_2H_4 and why ?
   (b) How many elements are there in p-block.
   (c) What is difference between electron affinity and electro-negativi
   Calculate electro-negativity of Chlorine if :
   $E_{H-H} = 104{\cdot}2$ k.cal/mole
   $E_{H-Cl} = 103{\cdot}28$ k.cal/mole and
   $E_{Cl-Cl} = 58{\cdot}25$ k.cal/mole 1

Unit–III

5. (a) Discuss bonding and shape of XeF_4 molecule.
   (b) Complete the reactions :
   $XeF_6 + 3H_2O \rightarrow ?$
   $XeF_4 + SbF_5 \rightarrow ?$
   $Xe_{(g)} + PtF_6(g) \rightarrow ?$
   $XeOF_4 + 3H_2 \rightarrow ?$
6. (a) Why sodium metal form peroxide (Na_2O_2) in preference to ox (Na_2O).
   (b) Why lithium is strongest reducing agent among alkali metals Explain. 1
   (c) Write brief note on Crown ethers.