

[This question paper contains 8 printed pages.]

(29)

Your Roll No.



Sr. No. of Question Paper : 1352

Unique Paper Code : 32171602

Name of the Paper : Organic Chemistry V :
Spectroscopy

Name of the Course : B.Sc. (Hons.) Chemistry

Semester : VI

Duration : 3.5 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **six** questions.
3. **All** questions carry equal marks.

1. (a) A and B are two isomers of C_3H_6O based upon peaks obtained in spectral data recorded in 1H NMR spectrophotometer: Identify A and B, give their IUPAC names and explain :

(i) A : 1H NMR, (in $CDCl_3$): δ 1.1(t,3H), δ 2.1 (m,2H), δ 9.5 (t, 1H)

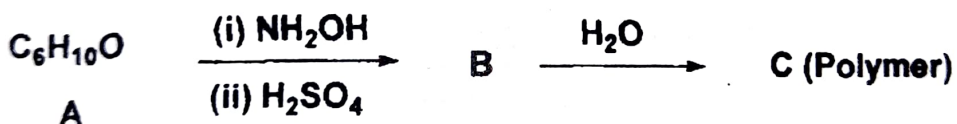
P.T.O.

IR (in Nujol) wave number: 2720cm^{-1}
(doublet, m) and 1735cm^{-1} (s)

(ii) B: ^1H NMR, (in CDCl_3) $\delta 2.3$ (s,6H)

IR (in Nujol) : 1710 cm^{-1} (s)

(b) Compound A shows strong peak in IR spectrum at 1717 cm^{-1} and give positive test with DNP. on reaction with hydroxylamine and followed by a well known Beckmann rearrangement gives compound B. Compound B polymerizes to give polymer, C. Identify, give name and structural formula of the compounds A, B and C (polymer).



(c) λ_{max} of Acetone in hexane is 279 nm while in water is 264.5 nm. Assign the given peak and explain by drawing transitions involved showing HOMO-LUMO. (4,4,4.5)

2. (a) Using N,N-Dimethylaniline writing all necessary conditions and reagents give synthesis of :

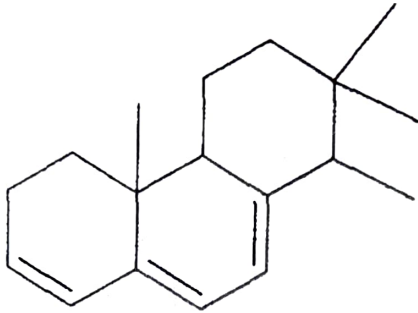
(i) Methyl orange and

(ii) Malachite green

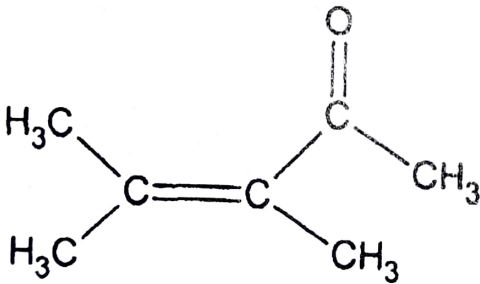
(b) Give stereochemical structure of (-)-chloramphenicol, its IUPAC name, uses and the name of species from which it is isolated.

(c) Calculate the λ max. for $\pi \rightarrow \pi^*$ in nm for the following compounds :

(i)



(ii)



Homoannular conjugated diene's base value = 253 nm

Heteroannular conjugated diene's base value = 215 nm

Increment for each substitution

Alkyl substituent or ring residue = 5 nm

Exocyclic double bond = 5 nm

Double bond extending conjugation = 30 nm

Acyclic enone base value = 215 nm

P.T.O.

α -Alkyl group or ring residue	= 10 nm
β -Alkyl group or ring residue	= 12 nm
γ -Alkyl group or ring residue	= 17 nm

for correction in solvent :

methanol/ethanol	= 0 nm
water	= +8 nm

Also calculate the λ max for both of the above compounds (i) and (ii) in water and ethanol using correction appropriately. (4,4,4.5)

3. (a) Give synthesis of Alizarin from anthraquinone. Give the structure of complex with Aluminium as mordant.
 - (b) Give the synthesis of Congo red dye. Mention the pH at which it gives the blue colour and red and explain with structure change.
 - (c) What is Leuco base in a triphenylmethane dyes? Explain with appropriate reaction. Give synthesis of crystal violet dye. (4,4,4.5)
4. (a) Calculate the frequency of C-H stretching vibration from the following data :

$$\text{Force Constant } K = 5 \times 10^5 \text{ gm sec}^{-2}$$

$$\text{Mass of carbon atom} = 20 \times 10^{-24} \text{ gm}$$

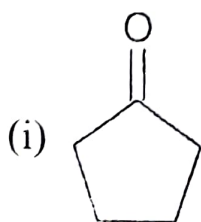
$$\text{Mass of hydrogen atom} = 1.6 \times 10^{-24} \text{ gm}$$

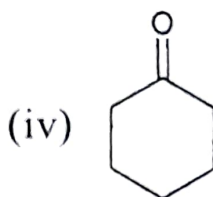
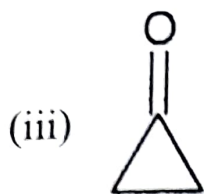
$$\text{Velocity of the radiation}(c) = 2.998 \times 10^{10} \text{ cm sec}^{-1}$$

(b) Attempt any **four** :

- (i) What is the source of IR radiations in IR spectrophotometer
- (ii) What are the Fundamental Vibrations?
- (iii) What are overtones in IR spectra?
- (iii) What is Fermi Resonance?
- (iv) Differentiate acetamide and ethyl amine using IR spectroscopy.
- (v) Differentiate in 1-Butyne and 2-Butyne using IR spectroscopy.

(c) Assign the appropriate C=O stretching frequency against the following structures. Justify the answer :





Stretch frequencies are

(a) 1745 cm^{-1}

(b) 1780 cm^{-1}

(c) 1815 cm^{-1}

(d) 1715 cm^{-1}

(4,4,4.5)

5. (a) Give the synthesis of Bakelite and its uses.

(b) Outline the synthesis of Nylon-6,6 and its uses.

(e) Write the mechanism involved when vinyl chloride in polymerised in presence of benzoyl peroxide?

(4,4,4.5)

6. (a) (i) Define chemical shift and coupling constant.

(ii) How will you differentiate in between cis and trans cinnamic acid ^1H NMR spectroscopy.

(b) Give expected number of signals by ^1H NMR spectra recorded in CDCl_3 in each of the following compounds :

- (i) 1,2-dichloroethane
- (ii) Ethyl acetate
- (iii) cyclohexane (at low temperature)
- (iv) 2-chloroethanol

(c) A compound with molecular weight 116 gave the following spectral information :

- (i) UV (in ethanol): $\lambda_{\max} = 283 \text{ nm}$ $\epsilon_{\max} = 22$
- (ii) IR (in Nujol): 3000-2500 (b), 1715 (s),
1342 cm^{-1} (w)
- (iii) NMR (in CDCl_3): δ 2.12 (s, 3H)
 δ 2.60 (t, 2H)
 δ 2.25 (t, 2H)
 δ 11.1 (t, 1H)

Find the structural formula of the compound.

(4,4,4.5)

7. (a) Give the Boots synthesis of Ibuprofen and its uses.
- (b) Give the synthesis of chloroquine from m-chloroaniline. Give its uses and side effects.

- (c) Give the structure of the main alkaloid present in curcumin. Discuss the therapeutic uses of curcumin. (4,4,4.5)
8. (a) Give the synthesis and uses of Buna-S rubber.
- (b) (i) What is Dacron? Write structures of its monomer(s).
- (ii) Give name and structures of two biodegradable polymers.
- (c) How do you prepare Polyurethane? Mention two uses. (4,4,4.5)
9. An organic compound with molecular formula C_4H_9NO gave the following spectral data :-
- (i) UV (in Ethanol): λ_{max} : 220 nm, ϵ_{max} : 63
- (ii) IR (in Nujol): 3500 cm^{-1} (m), 3402 cm^{-1} (m), 2960 cm^{-1} (w), 1682 cm^{-1} (s), 1610 cm^{-1} (s)
- (iii) NMR (in $CDCl_3$): δ 1 (d, 6H), δ 2.1 (septet, 1H), δ 6.8 (br s, 2H)
- Calculate DBE, assign spectral peaks appropriately in spectral data, give structural formula and the name of the compound. (12.5)
- (1500)

[This question paper contains 4 printed pages.]

(30)

Your Roll No.

Sr. No. of Question Paper : 4706

Unique Paper Code : 32177904

Name of the Paper : Analytical Methods in Chemistry

Name of the Course : B. Sc. (Hons.) Chemistry

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt a total of 6 questions.
3. **Three** questions to be attempted from **section A** and **three** from **section B**.
4. All questions are equal marks.
5. Log tables to be provide to the candidates.
6. Use of scientific calculator is allowed



SECTION - A

Attempt any 3 questions from this section

1. Attempt any **five** of the following :
 - (a) Explain electroanalytical methods.
 - (b) What are the advantages of continuous drying over the batch drying?
 - (c) Explain the sample injection system in GC?
 - (d) What is *Electro Osmotic flow*?
 - (e) Discuss the principle and one application of DSC?
 - (f) Differentiate between partition chromatography and adsorption chromatography. (5×2.5)

2. (a) What is thermal gravimetric analysis (TGA)? Discuss decomposition analysis of $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ using TGA.
 - (b) What are redox titrations? Explain with one example.
 - (c) Explain the preparation of TLC plates and give applications of TLC. (4,4,4.5)

3. Write short notes on the following :
- (a) Analytical applications of *thermogravimetry*.
 - (b) Chromatogram
 - (c) Cyclic voltammetry (4,4,4.5)
4. (a) Explain column chromatography and its applications.
- (b) What are the criteria for a good thermobalance?
- (c) Lead was determined in a sample of dust by eight different methods and the results are 9.11,9.14,9.21,9.12,9.08,9.09,9.14 and 9.16 Calculate the arithmetic mean and standard deviation. (4,4,4.5)

SECTION – B

Attempt any 3 questions from this section

5. (a) Give a schematic diagram of a glass electrode and explain its function. Why is the glass electrode stored in water?
- (b) How is potentiometry used to find E_{eq} in an *redox process*?

- (c) What are mobile phase and a stationary phase in a Thin Layer chromatography with examples?
(4,4,4.5)
6. Distinguish between the following :
- (a) standard deviation and average deviation.
- (b) Batch extraction and continuous extraction.
- (c) accuracy and precision. (4,4,4.5)
7. (a) What is the principle of paper chromatography? Explain the procedure of paper chromatography.
- (b) Explain the conductometric titration of a weak acid with a strong base.
- (c) Explain the types of Polarography with their applications. (4,4,4.5)
8. (a) Define the following terms and give the mathematical expression for each of the following :
- (i) Retardation factor
- (ii) Partition coefficient
- (b) Write short notes on batch extraction and counter current extraction.
- (c) Define the following :
- (i) (AAS) Atomic absorption spectroscopy
- (ii) Flame photometry (4,4,4.5)

[This question paper contains 8 printed pages.]

31

Your Roll No. 2023



Sr. No. of Question Paper : 4785

Unique Paper Code : 32171602

Name of the Paper : Organic Chemistry V :
Spectroscopy

Name of the Course : B.Sc. (Hons.) Chemistry

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

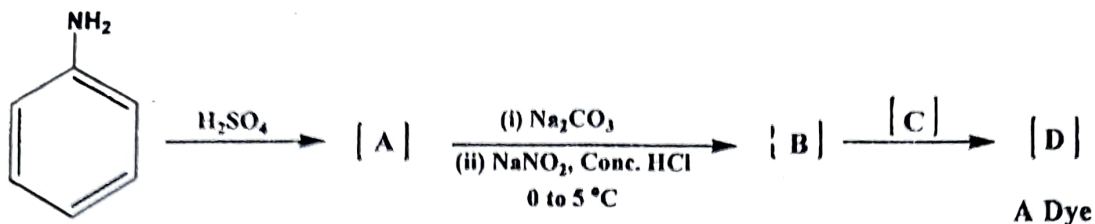
2. Attempt any **Six** questions in all.

1. Attempt any **five** questions :

(a) The PMR spectrum of dimethyl formamide shows two signals at 52.84 and 83.0 for the methyl protons at room temperature but a single sharp peak appears at high temperature (165°C). Explain.

P.T.O.

- (b) In IR spectroscopy, o-nitrophenol shows a band at 3200 cm^{-1} in KBr pellet as well as in chloroform solution, whereas in p-nitrophenol the values are different in two media (3330 cm^{-1} in KBr pellets and 3520 cm^{-1} in chloroform). Explain.
- (c) λ_{max} for aniline shifts from 230 nm in neutral solution to 203 nm in acidic medium. Name the effect and explain.
- (d) What are edible dyes? Give name and structure of two edible dyes.
- (e) Identify the class of following polymers and give two uses of each.
- (i) Polyacetylene
 - (ii) poly (L-lactic acid)
- (f) Azadirachtin has a bitter taste but a wonder drug. Comment. (5×2.5)
2. (a) Compound C is an aromatic amine which shows no peak in the region 3100 to 3600 cm^{-1} . Compound D absorbs at 465 nm and is red at pH below 3.1 and yellow above pH 4.4.



Identify compounds A, B, C and D and explain all the reactions involved. Discuss the use of compound D.

(b) Outline the synthesis of Malachite Green. Label the structures that form the leuco base, colour base and the dye salt.

(c) How is Indigotin obtained from Indigofera plants and why is it called Vat Dye? (4.5,4,4)

3. (a) Complete the following reaction by giving all the structures involved.

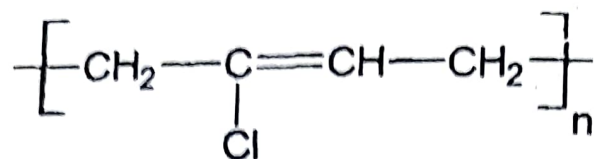
Heterocyclic compound (A) + An amine (B)
 \longrightarrow An antimalarial drug (C)

Give IUPAC name of compound (C). Discuss its uses and side effects.

(b) Give the name and one synthesis of a drug used for the treatment of typhoid.

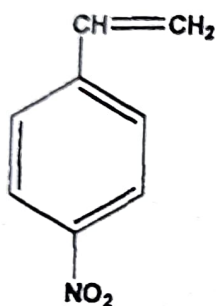
(c) What is the active principle of Zantac? Discuss its medicinal values. (4.5,4,4)

4. (a) Identify the following polymer.

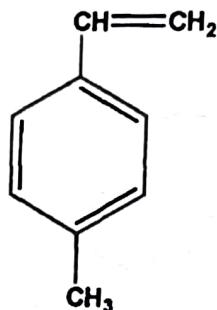


Give the synthesis of polymer and its monomer.

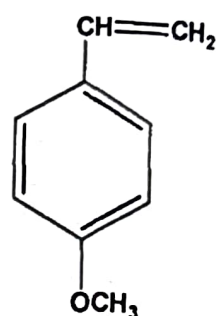
- (b) Arrange the following monomers in order of their decreasing ability to undergo anionic polymerization with reasons.



(A)



(B)



(C)

- (c) Discuss the uses of plasticized PVC and unplasticized PVC. Give the name and structure of two plasticizers. (4.5,4,4)

5. (a) In PMR spectroscopy, what information can be obtained from the following :

- (i) Number of signals
- (ii) Chemical shift
- (iii) Area under peaks

(iv) Splitting of signals

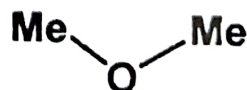
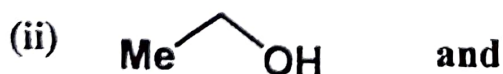
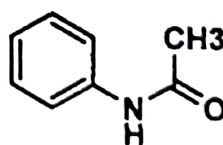
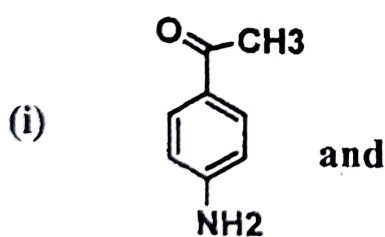
(v) Coupling constant

(b) A compound with molecular formula C_2H_2BrCl exhibits two doublets ($J=16$ Hz) in PMR spectra. Suggest a structure with explanation.

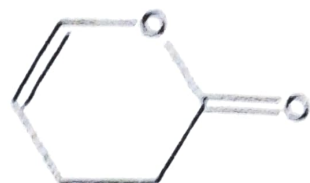
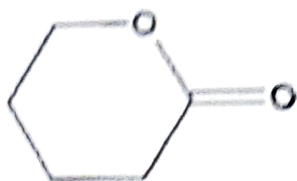
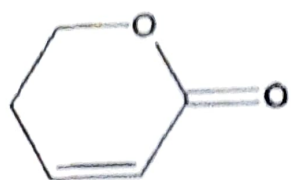
(c) Explain why the aldehydic protons appear much downfield in PMR spectrum. (4.5,4,4)

6. (a) IR spectrum of methyl salicylate exhibit peaks at 3300, 2990, 3050, 1590 and 1540 cm^{-1} . Assign these peaks with reasons.

(b) Distinguish the following pairs of compounds by IR spectroscopy



(c) The carbonyl stretching absorption for the following lactones are 1720, 1745 and 1760 cm^{-1} . Match the absorption with the appropriate structure and give a reason for each choice.

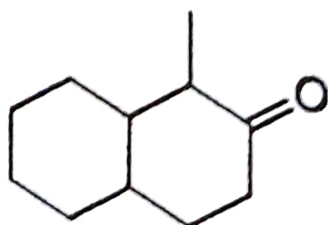


(4.5,4,4)

7. (a) (i) An organic compound in hexane exhibit $\lambda_{\max} = 305\text{nm}$ and in ethanol shows $\lambda_{\max} = 307\text{nm}$. What should be the nature of transition and why?

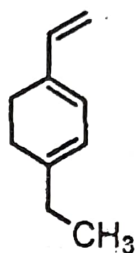
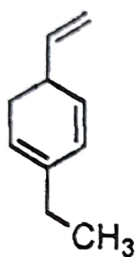
(ii) Discuss the effect of steric hinderance to coplanarity in UV spectra by taking an example of cis and trans stilbene.

(b) Compound A has formula $\text{C}_{11}\text{H}_{16}\text{O}$ and be reduced to B, $\text{C}_{11}\text{H}_{18}\text{O}$ with hydrogen in presence of palladium. Compound B was found to have the following structure.

**B**

The UV spectrum of A showed strong absorption with λ_{max} at 225nm and this absorption was not present in UV spectrum of B. What is the structure of A? (Use Woodward Fieser Rule)

(c) Distinguish among the following isomeric system by UV spectroscopy. (Use Woodward Fieser Rule)



Base value for homoannular (cisoid) diene = 253 nm

Base value for heteroannular (transoid) diene = 214 nm

Base value for Acyclic conjugated diene = 217 nm

Acyclic enone base value = 215 nm

Increment for :

Alkyl substituent or Ring residue attached to the parent diene = 5 nm

Double bond extending conjugation = 30 nm

Exocyclic double bonds = 5 nm

Homoannular diene component = 39 nm

α -alkyl group or ring residue = 10 nm

β -alkyl group or ring residue = 12 nm

γ -and higher alkyl group or ring residue = 18 nm
(4.5,4,4)

8. A and B are two isomers. Assign given peak values appropriately to two isomers of molecular formula C_3H_6O give their structures and explain all peaks :

UV (in n-hexane)

A: 184 nm (ϵ max 10000)

IR (in KBr)

2975,2827,
2725,1740 cm^{-1}

1H NMR ($CDCl_3$)

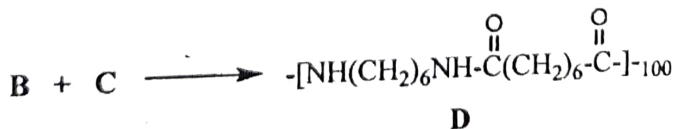
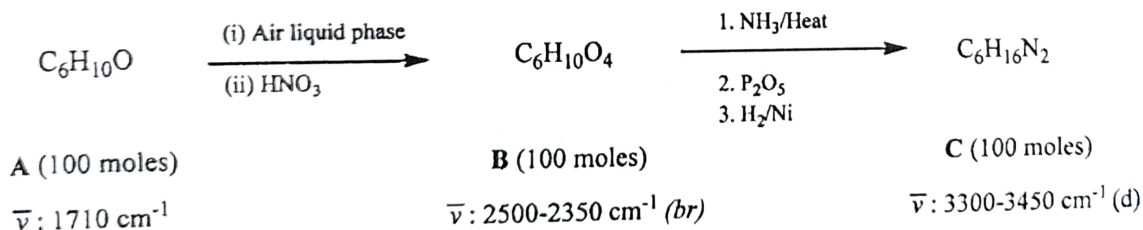
δ 9.8(t,1H);
 δ 2.47(m,2H);
 δ 1.2 (t, 2H)

B: transparent above 180 nm
(12.5)

980-1010 cm^{-1} (s)

δ 3.5(m, 2H); δ 4.5 (t, 4H)

OR



Identify A, B, C, D. Give their structures, names. Explain all peak of absorption of IR stretching frequencies. Give name of D and its uses. In D how much is the DP (degree of polymerization)?

(12.5)

(1500)

[This question paper contains 12 printed pages.]

(32)

Your Roll No. ...2023



Sr. No. of Question Paper : 4830

Unique Paper Code : 32177903

Name of the Paper : DSE 4 : Applications of
Computers in Chemistry

Name of the Course : **B.Sc. (H) CHEMISTRY**

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **Six** questions.
3. All Questions carry equal marks **12.5**.
4. Attempt **all** parts of a Question together.

1. (i) Identify errors in the following BASIC variable names if any

(a) ABC-1

(b) FIX

(c) T%

(d) 2AB

(ii) Identify errors in the following statements used in BASIC syntax IF ANY.

(a) FOR 1=10 TO 1

(b) IF A<> 10 THEN 100

(c) LOCATE (40,20)

(d) B\$= C + a\$

(iii) Write a user friendly program to print roots of a quadratic equation for real as well as imaginary roots (as $a+ib$ and $a-ib$)

(4,4,4.5)

2. (i) Solve the following, showing procedure using Binary addition, subtraction, multiplication and division

(a) $10101011 \times 101 + 11011010 / 11$

(b) $110100110 / 110 - 11011 / 11$

- (ii) Identify the errors in the following program of reading the matrix 'A(4×4)' elements and printing the transpose 'B' of matrix 'A' in matrix form on output screen.

```
FOR I=1 TO 4
```

```
FOR J=1 TO 4
```

```
READ A(I,J)
```

```
B(J,I) = A(I,J)
```

```
PRINT A(FJ)
```

```
NEXT I
```

```
PRINT
```

```
NEXT J
```

```
DATA 1,23.4,5.6,7.8,9
```

```
END
```

- (iii) Write a program in BASIC to assign “PHYSICAL CHEMISTRY” to a string variable A\$, extracting required string constants from A\$ using only string functions/commands and assign it to B\$ = “CHEMICAL PHYSICS” character constant and print it. (Note-No other string constants to be used). (4,4,4.5)

3. (i) Explain the following abbreviations :

(a) ABS

(b) BYTE

(c) BUG

(d) ASCII

(ii) Identify the errors in the following set of statements and rectify them

(a) WINDOW (0,0) TO (100,100)

(b) LINE (20,20-80,80),,BOX

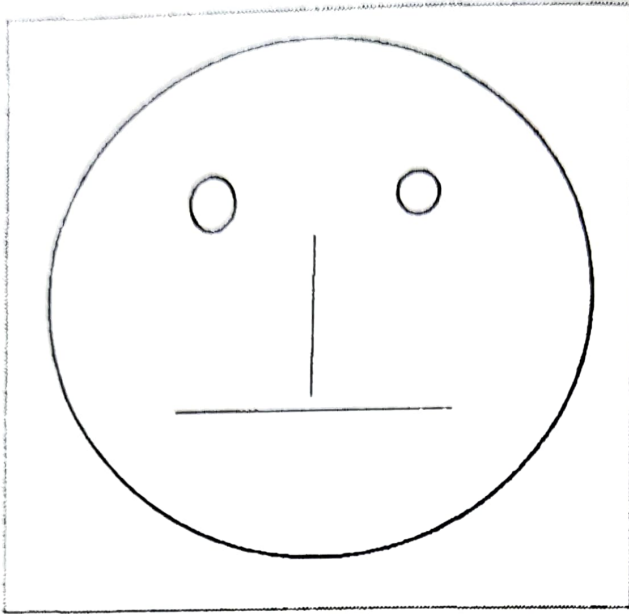
(c) PSET (30,35 ,(35,40)

(d) LINE -(100,100)

(iii) Write a program in BASIC to find the value of $\text{Exp}(x)$ for a given value of 'x', using following series of $\text{Exp}(x)$, till the contribution of $x^n/n!$, is less than 0.0001

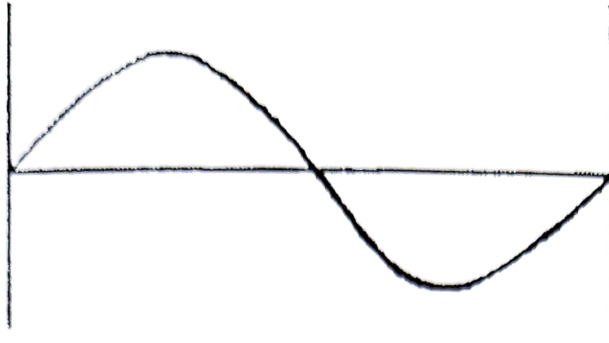
$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots, \quad -\infty < x < \infty \quad (4,4,4.5)$$

4. (i) Write a program in BASIC to draw following output



- (ii) Write a user-friendly program in BASIC in SCREEN 2 MODE to plot function $F(x)$ in the middle of the monitor screen, (e.g. in the following form for $N=2$), for a particle in one dimensional box of length L , for energy level N entered by user in a box.

$$F(x) = \sqrt{(2/L)} \sin \left(N * \pi * \frac{x}{L} \right)$$



- (iii) The position of equilibrium in a system consisting of 0.300 mol of gaseous N_2O_4 and 0.500 mol of gaseous NO_2 can be specified by the extent of reaction, x . It can be shown that the value of x is given by the equation:

$$4.730^2 + 2.0365x + 0.2325 = 0$$

and $-0.350 < x < -0.300$. Write a Program in BASIC using Newton Raphson method to estimate value of x . (4,4,4.5)

5. (i) Write down the errors in the following constants if any and correct them.

(a) 65,345

(b) "664341"

(c) RAM"KUMAR"

(d) \$234,674

(ii) Explain the following error messages :

(a) Subscript out of range,

(b) Division by zero

(c) Out of data

(d) Illegal function call

(iii) Write a general user friendly program in BASIC to print the Maximum wavelength electronic excitation transition arising from HOMO of a conjugated linear polyene (-C=C-C=C-----). The program requires only number of carbon atom in the molecule. Consider for polyene containing even number 'n' of carbon atoms with average

C-C bond length 140 pm and the linear molecule as one dimensional box of length $(140 \times n)$ pm.

$$\text{Energy for } n\text{th energy level; } E_n = \frac{n^2 h^2}{8m l^2}$$

(4,4,4.5)

6. (i) Write the following expression in BASIC syntax.

$$(a) F = 4\pi \left\{ \frac{m}{(2\pi RT)} \right\}^{3/2} v^2 e^{-mv^2/2RT}$$

$$(b) \ln(k) = \ln(A) - \frac{Ea}{RT}$$

- (ii) Differentiate between

(a) Compiler and Interpreter

(b) Low level language and high level language

- (iii) Write a program to calculate the pressure exerted by 2 moles of ammonia gas enclosed in a vessel of 5 L capacity at 27°C for an ideal gas equation and Van der Waals equation. Given that for ammonia: $a=4.17 \text{ atm L}^2 \text{ mol}^{-1}$ and $b=0.46 \text{ L mol}^{-1}$, gas constant $R=0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$. (4,4,4.5)

7. (i) Convert the following decimal numbers to its binary equivalent up to four places of decimal. Show the working also

(a) 26.0525 and

(b) 101.452

- (ii) Write a user friendly program in BASIC to read a list of titles of 5 following books :

1. Computer in BASIC, 2. Computer in FORTRAN, 3. Computer programming, 4. Application of Computer in Chemistry, 5.

Programming in BASIC and print how many of these have "Computer" in title and print these titles too.

- (iii) Write a program to plot Maxwell distribution function 'F' vs speed 'c' using QBASIC GRAPHICS, SCREEN 2 MODE for O₂ gas molecules moving with the velocity in the range of 0 to 1000 at the difference of 20 at two different temperatures at T₁ = 293 and T₂ = 313K.

$$F = 4\pi \left\{ \frac{m}{2\pi RT} \right\}^{3/2} c^2 e^{-mc^2/2RT} \quad (4,4,4.5)$$

8. (i) Convert following octal to their hexadecimal equivalent, show working too

(a) (764526)₈

(b) (457653)₈

- (ii) Write a user friendly program in BASIC to count the number of times "2" appears in the given integer 12272223 (Use String Commands).
- (iii) Write a program in Q-BASIC, Using trapezoidal method, to determine the change in molar entropy of Bromine gas when heated between 298 K and 373 K

Given: $C_{p,m}(T) = a + bT + c/T^2$

$a = 37.32$; $b = 0.5 \times 10^{-3}$; $c = -1.26 \times 10^5$

$$\Delta S = \int_{T_1}^{T_2} \frac{C_p(T)}{T} dT$$

(4,4,4.5)