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Q-No. of Q.P: 5625 SET-A

H

Unique Paper Code	:	217601
Name of the Paper	:	Inorganic Chemistry – V (CHHT–615)
Name of the Course	:	B.Sc. (H) Chemistry
Semester	:	VI
Duration	:	3 hours
Maximum Marks	:	75 Marks

Instructions for the Candidates

1. Write your Roll Number on the top immediately on receipt of this question paper.
2. Attempt any ***Five*** questions.
3. ***All*** questions carry equal marks.

1. a) Why is $Ni(CO)_4$ a monomer, but the analogous cobalt compound a dimer?

   b) Give a test for identification of CO_3^{2-} and SO_3^{2-} ions in presence of each other in a mixture.

   c) What are homoleptic carbonyls? Why don't carbonyls belonging to early and later transition series obey the EAN rule?

   d) What is the source of energy for the working of the Sodium–potassium pump? Give a diagrammatic representation of the working of the Sodium–potassium pump. Why is this process called selective?

(3,3,4,5)

2. a) Acetylation of one of the rings in Ferrocene deactivates the ring and to some extent the second ring as well. Discuss the chemistry involved.

   b) Where is iron stored in the body? In what form is it stored and what is the oxidation state of iron in it?

   c) A mixture of cations and anions on boiling with conc. HCl leaves a white residue. This residue is soluble only in ammonium acetate. Identify this residue? Give the chemical equations involved.

   d) How does the structure and magnetic behavior of Haemoglobin change when it binds to O_2? Explain the changes in structure diagrammatically.

(3,3,4,5)

3. a) Using 18 electron rule as a guide, indicate the values of m, n and the 3d metal (M) in the following
   i) $[(\eta^6\text{-}C_6H_6)_mCr(CO)_n]$
   ii) $[Co(\pi\text{-}C_3H_5)(CO)_n]$
   iii) $[(\eta^5\text{-}C_5H_5)M(C_2H_4)_2]$

   b) Mention any three features a chelating agent should possess to be used in medicine.

   c) Draw the structure of the following metal carbonyls (***any four***)
   i) $Fe_3(CO)_{12}$
   ii) $Cr(CO)_6$
   iii) $Mn_2(CO)_{10}$
   iv) $Ru_3(CO)_{12}$
   v) $Fe_2(CO)_9$

   d) Give the systematic procedure for analysis of an aqueous solution containing only Ni^{2+} and Co^{2+} ions. Give the reactions involved.

(3,3,4,5)

4. a) Define masking. How is masking used to identify Cu^{2+} and Cd^{2+} ions present together in group II of qualitative analysis?

   b) What are interfering anions? Discuss, with chemical equations, the removal of any one interfering anion from the mixture.

   c) What are the causes of excess and deficiency of iron in the body? Name the diseases associated with the excess and deficiency of iron in the body. How can excess of iron be removed from the body and how can the deficiency be cured?

   d) Define the term hapticity, giving two examples.

   e) Discuss two methods of preparation of organometallic compounds with π acceptor ligand CO.

(3,3,5,2,2)

5. a) Draw the oxygen saturation curves for Haemoglobin and Myoglobin and discuss their shapes.

   b) Two different structures are consistent with 18 e^- rule for $Co_2(CO)_8$. How will you predict the structures on the basis of IR spectral studies?

   c) Give the use of the following reagents (***any two***) in the identification of ions in qualitative analysis and discuss the chemistry involved.
   i) Sodium nitroprusside
   ii) Ammonium molybdate
   iii) Dimethylglyoxime

d) Which is the metal ion present at the active site of enzyme carboxypeptidase A? Describe the active site of the enzyme and list the various interactions that help the enzyme to function.

(4,3,3,5)

6. a) Give any one confirmatory test to identify the following anions (***any two***) in qualitative analysis. Explain with reactions.
   i) NO_3^-
   ii) SO_4^{2-}
   iii) Cl^-

   b) Explain the following:
   i) Even though titanium and silicon are abundant in earth's crust they are not essential elements in humans. Give reason.
   ii) Bohr effect in Haemoglobin.

   c) In qualitative analysis, the group II sulfides are precipitated in acidic medium. Give reasons.

   d) Give the reaction of Ferrocene with
   i) n-BuLi
   ii) HCHO and $HNMe_2$ in presence of CH_3COOH

   e) Which out of the following is a poor nucleophile and why?
   $Co(CO)_4^-$, $Mn(CO)_5^-$

(3,4,3,3,2)

7. a) Discuss the mechanism of action of cisplatin as an anti-tumor drug.

   b) What are xenobiotic elements? Give two examples.

   c) Why are few drops of nitric acid added before proceeding for analysis of group III cations in qualitative analysis?

   d) Explain synergism in metal carbonyls using VBT.

   e) Give the use of yellow ammonium sulfide in the separation of group II A and group II B cations in qualitative analysis.

(4,2,3,4,2)

Sl. No. of Q.P.: 5626

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Unique Paper Code : 217603

Name of the Course : **B.Sc. (Hons.) CHEMISTRY, ~~Part III~~**

Name of the Paper : Organic Chemistry V (CHHT-616)

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 . **Answer six question in all. Question No. 1 is compulsory.**

SET A

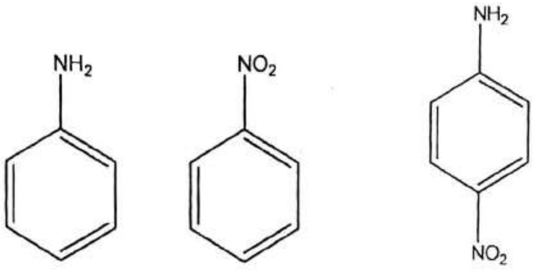
Q1. Answer any five parts.

(1) How many NMR signals will be obtained in Cyclobutanol ? Label different types of Protons.

(2) How will you differentiate between following sulphonamides using IR?

$R\text{-}SO_2NH_2 \qquad RSO_2NHR$

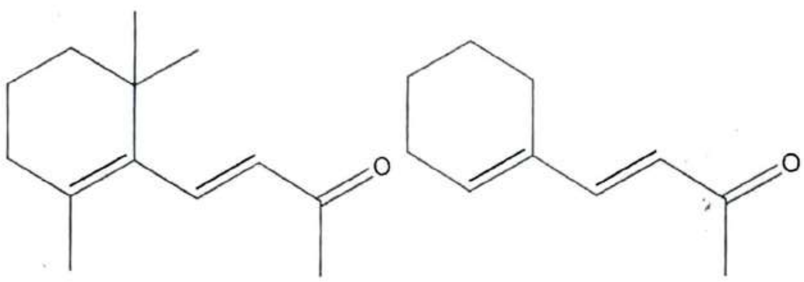
(3) Arrange the following compounds in order of increasing wavelength of absorption. Give reason also.



(4) Why are Isotactic polypropylene films are less permeable to gas as compared to atactic Polypropylene films? Give their structures also.

(5) How do plasticisers make the polymer flexible and rubbery. ? Explain it by an example. .

(6) Predict which one will have higher λ max value.(no data is required) Give reason for your answer.



(7) Indigotin on reduction with alkaline sodium hyposulphite gives indigotin white .Give the structure of indigotin white.

(3 x 5)

Q 2 (1) Aldehyde protons appear quite downfield in the NMR spectrum.Give the name of this "Effect" and explain this phenomenon.

(2) From among the isomeric compounds of molecular formula C_4H_9Cl ,give the structure of compound having in its NMR

(i) Only a single peak
(ii) Several peaks including two distinct three proton signals, one of them a triplet at δ 1.0 and other a doublet at δ 1.5

(3) How many NMR signals are obtained from cycohexane

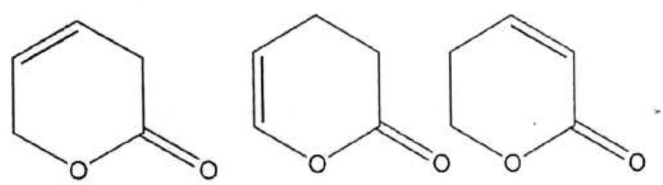
(i) at room temperature

(ii) **at --89⁰C** .Give reason also.

(4x3)

Q3 (1) What is Fermi Resonance in IR ? Explain it with an example.

(2) Giving reason, arrange the following compounds in order of increasing Wave length of absorption in their IR spectra.

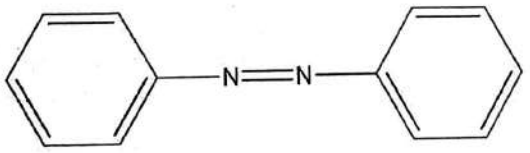


(3) Calculate the approximate wave number of the fundamental absorption peak due to the Stretching vibration of $C\equiv C$ group.

Force constant for $C\equiv C$ group = 15.6 x10^5 dynes /cm

Reduced mass = 6 x 1.67 x 10^{-24} g (4 x 3)

Q4 (1) Explain the following data for azobenzene



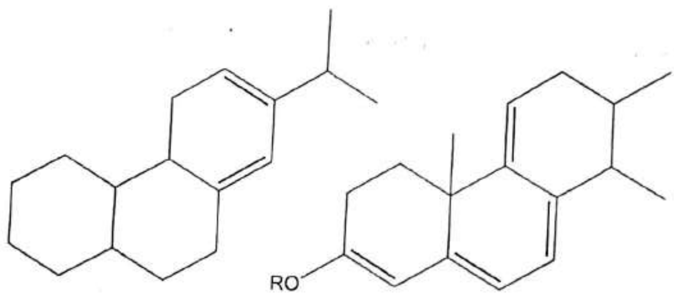
trans(anti) λmax =318 nm , εmax = 22600

cis (syn) λmax =282 nm , εmax =5200

Your answer should account for both λ max and ε max values.

(2) Calculate molar absorptivity εmax for a compound containing **9.37 x10^{-5}** mol /L of Solution in a 1.0 cm cell at λmax =235 nm ,when A =1.18 .

(3) Calculate λmax for the following compounds.



Base value for homoannular diene =253 nm , alkyl group/ring residue =5nm
Base value for heteroannular diene =214 nm , exocyclic double bond =5nm

Double bond extending conjugation =30 nm ,OR = 6nm

(4 x3)

Q 5 (1) Give one synthesis of Malachite Green .Is it a cationic dye or anionic dye? Give reason. Specify each product as leuco base, colour base or dye.

(2) A on reaction with tin and HCl, gives Sulphanilic acid and 1- amino-4 (N,N dimethyl)amino benzene .What is A? Give its synthesis. How does its colour change in acidic and alkaline medium? Explain your answer by proper structures.

Q 6 (1) Give mechanism of polymerisation of Acrylonitrile using a suitable anionic initiator . (4, 8)

(2) A polymer sample contains only two types of macromolecules. Those with relative Molar mass of 10000 and those with an RMM of 100000 .Assuming equal number of Molecules (N) ,calculate $\overline{Mn}$ and $\overline{Mw}$.

(3) Give synthesis of PET starting from ethylene glycol and dimethyl ester of terephthalic acid.

(4 x 3)

Q 7 A compound with molecular formula $C_8H_{11}N$ shows following spectral data :

IR : 3400 ,above 3000 ,1600 cm^{-1} ,

NMR : δ	7.2	5 H	complex splitting
	1.2	3H	t
	3.1	2H	q
	3.5	1H	singlet

Calculate DBE, Explain both IR and NMR data and give the structure of the compound.

(12)

Q8 Attempt any three

(1) Resol resin -- Give its synthesis
(2) Non sulphur Vulcanization of Rubbers -Write a short note.
(3) Synthesis of Alizarin from anthracene
(4) Rosaniline –Synthesis and uses.

(4 x3)

③

Sl - No. 07 Q.P.: 5627

26/5

300

Unique Paper Code : 217605

Name of the Paper : Physical Chemistry - V [CHHT 617]

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

Semester : VI

H

Duration : 3 hours

Maximum Marks : 75

Instructions for Candidates

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

TOTAL SIX QUESTIONS TO BE ANSWERED

QUESTION NO. 1 IS COMPULSORY

Answer any FIVE other questions

Use of scientific calculator is allowed but it cannot be shared.

Logarithmic tables may be provided if required.

PHYSICAL CONSTANTS

Planck's constant 6.626×10^{-34} Js

Velocity of light 3×10^{8} ms^{-1}

Avogadro's number 6.023×10^{23} mol^{-1}

Nuclear magneton 5.051×10^{-27} JT^{-1}

Bohr magneton 9.274×10^{-31} JT^{-1}

Mass of electron 9.109×10^{-31} kg

1 atomic mass unit 1.66×10^{-27} kg

1. Attempt any FIVE:
   (a) Determine the energy in kJ mol^{-1} for one Einstein of UV light from a light source operating at 254 nm.
   (b) Prove that $\left[\hat{L}_z, \hat{L}_x\right] = \frac{ih}{2\pi}\hat{L}_y$
   (c) Explain briefly the phenomena of predissociation.

(d) A particle of mass m is confined in a three dimensional cubic box of length L. What are the quantum numbers associated with the level whose energy is $14h^2/8mL^2$? What is the degeneracy of this level?

(e) State how many radial, angular and total nodes are present in each of the H-like wavefunctions

i. Ψ_{2s}

ii. Ψ_{3p}

(f) (i) HF gives a rotational spectrum whereas H_2 does not. Comment.

(ii) Explain diagrammatically the interaction of a rotating HF molecule with incident electromagnetic radiation.

(3x5=15)

2. (a) Evaluate the mean value of the radius $\langle r \rangle$ at which the electron in the H-atom is found, given that

$$\psi_{1,0,0} = \frac{1}{\sqrt{\pi}}\left(\frac{1}{a_0}\right)^{3/2} \exp\left(-\frac{r}{a_0}\right)$$

where a_0 is the Bohr's radius.

$$\left[\int_0^\infty x^n \exp(-ax)dx = \frac{n!}{a^{(n+1)}}\right]$$

(b) Will this value of $\langle r \rangle$ be the same for He^+ ? Explain briefly.

(c) Draw the energy level diagram for oxygen molecule. Explain the magnetic properties of this molecule on the basis of the diagram.

(5, 2, 5)

3. (a) Configuration Interaction improves the wave function for hydrogen molecule. Explain briefly.

(b) What is meant by the term 'rigid rotator'? Show that the total energy of a rigid rotator is $\frac{L^2}{2I}$ where L is angular momentum and I is the moment of inertia. How does this result differ from the quantum mechanical result?

(c) Consider a particle of mass m confined to a one dimensional box of length l. A possible solution for this system is

$$\psi_n(x) = \sqrt{\frac{2}{l}} \sin\frac{n\pi x}{l}$$

(i) Show that $\psi_n(x)$ is not an eigen function of $\hat{p}_x$. Suggest a reason for your answer.

(ii) Determine $\langle p_x^2 \rangle$ for the above system and hence evaluate the total energy associated with the particle.

$$\left[\int_0^l \sin^2 ax\, dx = \int_0^l \frac{1}{2}(1-\cos\frac{2ax}{l})\, dx\right]$$

(3, 4, 5)

4. (a) Write the Hamiltonian for Lithium atom and setup the corresponding Schrödinger equation.

(b) The force constant for $^{1}H^{19}F$, considered as a harmonic oscillator, is 966 Nm^{-1}

(i) Calculate the frequency of the incident electromagnetic radiation required to excite the molecule from the ground state to the first excited state

(ii) Calculate the zero point energy of the molecule.

(c) Determine the center of mass for $^{12}C^{16}O$ given that the rotational constant has a value of 1.9302 cm^{-1}.

(4, 4, 4)

5. (a) Raman rotational spectrum of a molecule is observed with Hg light. The Rayleigh line is observed at 22947 cm^{-1}, Stokes lines are observed at 22581, 22337, 22094, and 21851 cm^{-1}.Calculate the rotational constant and assign these values to various transitions.

(b) Derive the following

$$\left(J_{max} = \sqrt{\frac{kT}{2hcB}} - \frac{1}{2} \right)$$ where the symbols have their usual meaning.

(c) A certain substance in a cell of length l absorbs 10% of the incident light .What fraction of the incident light will be absorbed if the length of the cell is $4l$?

(4, 4, 4)

6. (a) State the Variation Theorem.

(b) Identify the following molecule and assign frequencies to the possible modes of vibrations. Justify the assignment of the frequencies and suggest a possible structure for the molecule

Molecular Formula	**Electronic Configuration**	**Transition Frequency (cm^{-1})**	**IR**	**Raman**
AB_2	A: $1s^22s^22p^2$ B: $1s^22s^22p^63s^23p^4$	397 656 1523 796	PQR contour ---- PR contour ----	--- Active ---- Active (weak)

(c)What is the magnitude of the magnetic field required for ^{1}H to resonate at 200MHz when the value of g_N=5.585 ?

(3, 6, 3)

7. (a) Indicate which of the following will lead to an eigenvalue equation. Report the eigenvalue, if any

(i) $\frac{d^2}{dx^2}\left(\sin\frac{\pi x}{2}\right)$ (ii) $\frac{\partial}{\partial y}\left\{x^2 \exp(6y)\right\}$

(b) In the MO treatment for hydrogen molecule ion the LCAO-MO wavefunction is $\psi_{MO} = c_1\varphi_{H_a} + c_2\varphi_{H_b}$ where φ_{H_a} and φ_{H_b} correspond to the normalized 1s wavefunctions for the hydrogen atoms H_a and H_b in the ion.

(i) Write the expression for the Hamiltonian.

(ii) Optimize the energy with respect to c_1 and c_2 and express the result in the form of secular determinant.

(iii) Use the following data to evaluate energy:

$$\int \varphi_{H_a} \hat{H}\, \varphi_{H_a} d\tau = \int \varphi_{H_b} \hat{H}\, \varphi_{H_b} d\tau = -2\ a.u.$$

$$\int \varphi_{H_a} \hat{H}\, \varphi_{H_b} d\tau = \int \varphi_{H_b} \hat{H}\, \varphi_{H_a} d\tau = -1\ a.u$$

$$\int \varphi_{H_a}\, \varphi_{H_b} d\tau = 0.25\ a.u.$$

(c) Define orthogonality. Give an example of a pair of orthogonal wavefunctions.

(3, 6, 3)

8. (a) Sketch the low and high resolution NMR spectra of $CH_3CH_2CHCl_2$ and $CH_3CCl_2CH_3$. Explain the differences briefly.

(b) Sketch the ESR spectrum of methyl radical.

(c) Outline briefly the approximations of Hückel Molecular Orbital Theory.

(5, 3, 4)

9. Write short notes on **any three**

(a) Birge-Sponer Plot

(b) Bathochromic and hypsochromic shift

(c) Fermi Resonance

(d) Bohr's Correspondence Principle

(3 x 4)

(4)

17/5/18
3(2)

(~~SET~~-B)

Sl. No. 07 Q.P.: 5628

Unique Paper Code : 217607

Name of the Paper : Applications of Computers in Chemistry

H

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

Semester : VI

Duration : 3 hours

Maximum Marks : 75

Write your roll no. on the top immediately after receipt of the question paper.

Attempt all questions in proper order

1. a) Write the following expressions in BASIC **3x5**

   i) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

   ii) $\bar{\upsilon} = 109677 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

   iii) $x = e^{-i\omega t}\ (\sqrt{a^2+b^2})$

   b) What is the purpose of following LIBRARY FUNCTIONS?

   i) SGN (X) ii) SQR (X) iii) RND (X)

   c) Identify the invalid variables and write the correct ones also identifying type (numeric or alphanumeric) :

   i) 1$A ii) 25S iii) $NAME

   d) Identify the invalid constants. Write the correct form and identify their type (numeric or string)

   i) -5E10^2 ii) '-135' iii) '###;

e) Define the following terms

i) PIXEL ii) ALU iii) MODEM

2. a) Identify & correct the error in the following BASIC statements

i) For A$ = N$ TO 10

ii) DATA, "MONTH", "TIME", -7.12; 81 **2**

b) Distinguish between

i) RAM and ROM

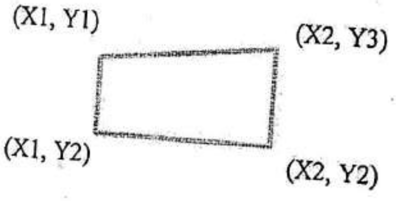
ii) BUG and VIRUS **2**

c) Write a program in BASIC (using user-defined functions) for finding the roots of the following polynomial equation using Iterative Method within the tolerance 10^{-6}:

$$x^3 - x^2 - 2x + 1 = 0$$

4

d) Write a program in BASIC to generate a Trapezoid using DRAW statement as per the dimensions shown in the figure below and label the figure also:



X1=60: X2=80:

Y1=40: Y2=50: Y3=20

4

3. a) What will be the output form of the following program?

```
10   READ X, Y, Z
20   PRINT USING "###.##  ##.#  ##.###^^^^"; X; Y; Z
30   DATA 95.5, -8.7, 375.5
```

2

b) Rewrite the following program using IF_THEN_ELSE commands:

```
10   LET S = 0
```

```
20    FOR N = 1 TO 10 STEP 2
30    LET S = S + N* N
40    NEXT N
50    PRINT S
60    END
```

2

c) Write the BASIC statements to produce the following effects

i) Assign string MARCH 10 to a variable

ii) Increase the value assigned to a variable X by 2.3

iii) Display * five times vertically using a loop

iv) To introduce a string as 'HYPOTHETICAL' and return the number of characters in that string

4

d) Comment on the errors in the following program and correct them:

```
10 CLX
20 REMARK *EVALUATION OF EXP (Z)*
30 INPUT Z
40 LET S=1;
50 LET N =1; LET T=1
60 LET T = T X Z ÷ N
70 S = S + T
80 IF T < 0.0001 THEN 110
90 LET N = N + 1
100 GOTO LINE60
110 PRINT N, S
120 STOP
```

4

4. a) Draw the output and show the position of the coordinates for the following set of statements:

```
10 CLS
20 SCREEN 2
30 VIEW (10,10)-(300,180), ,1
40 WINDOW (1,1)- (100,100)
```

```
50 CIRCLE (50,50), 10
60 END
```
2

b) Let Q =3 and Let R =5. Is the following relational expressions true or false:

i) NOT Q > 3 OR R < 3 AND Q - R < 0

ii) NOT (Q = 7 OR R <> 5) AND Q + 3 * R = 0 OR R >= 0 2

c) Comment on the errors in the following program and correct them:

```
REM TO DRAW A BOX IN GRAPHICS SCREEN 1
SCREEN
VIEW (20,20 ) – (330, 180)
LINE (150, 100)-(150,100),, BOX
LOCATE (20): PRINT "BOX#
END
```
4

d) i) Write a program for calculating $\sum x$, $\sum y$, $\sum xy$, Σx^2y making use of READ statement to enter the following data:

S. No.	x	y
1	3	7
2	6	11
3	15	19
4	24	27
5	31	35
6	36	39
7	45	45
8	54	49

ii) Write the expected output also. 3,1

5. a) Write a program segment that computes the sum of all the elements in a 2-D array B (already input) with M rows and N columns. 2

b) If A$ = "MY COUNTRY IS INDIA"

B$ = "I LOVE MY COUNTRY A LOT!"

Then find the values of

i) LEFT$ (A$, 2)

ii) LEN (MID$ (B$, 5, 3) **2**

c) Write a program to evaluate the series (for $-1 < x < 1$):

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 + \ldots\ldots.. \quad \mathbf{4}$$

d) WAP to multiply the given matrices and print the resultant matrix S.

$$E = \begin{bmatrix} 5 & 5 & 9 \\ 9 & 8 & 4 \\ 5 & 1 & 4 \end{bmatrix} \qquad T = \begin{bmatrix} 4 & 5 & 4 \\ 4 & 5 & 6 \\ 8 & 8 & 7 \end{bmatrix}$$

4

7. a) What will be the output of the following program:?

```
10 LET A$= "100"
20 LET B$= "100"
30 PRINT A$+B$
40 PRINT A$;B$
50 PRINT A$,B$
60 PRINT A$;"*";B$
```

2

b) With the help of suitable examples, explain the meaning of the following error messages:

i) FOR without NEXT

ii) Syntax error on line 30 **2**

c) Write a program in BASIC to plot and determine the m and c so that y = mx +c fits the following data in least squares sense

X	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Y	0.27	0.72	1.48	2.66	4.48	7.26	11.43	17.64	26.78

Slope $=(N\sum x_i y_i - \sum x_i \sum y_i) \;/\; (N\sum x_i^2 - (\sum x_i)^2)$

Intercept $= (\sum x_i^2 \sum y_i - \sum x_i y_i \sum x_i) \;/\; (N\sum x_i^2 - (\sum x_i)^2)$ **4**

d) Write a program in BASIC using user defined function, to find the value of the integral using Simpson's rule with n=6.

$$\int_0^1 dt/\sqrt{(t^2+1)(3t^2+4)}$$ **4**

10/5/18
(5)

10/5

Sl. No. of Q.P. : 6267

[This question paper contains 3 printed pages.]

Unique Paper Code: 2171601

Your Roll No ....

Name of the Paper: **Theory/Inorganic- Organometallic, Bio-inorganic Chemistry**

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

F-10

Semester **VI**

Duration : **3** Hours

Instructions for Candidates

Maximum Marks : **75**

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

1. (a) Briefly describe the Perutz mechanism of oxygenation of the haemoglobin.

5 marks

(b) What is the role of the enzyme carbonic anhydrase? Which metal ion is present in its active site and the atoms coordinating to it?

4 marks

(c) Differentiate between active and passive transport and give an example for each. Discuss the Na^+/K^+ pump with a neat diagram.

6 marks

2. (a) what is the role of iron in our body? Write down the diseases caused by the deficiency and excess of iron. What is ferritin and what is its function in our body?

7 marks

(b) In case of heavy metal poisoning like Hg2+, Pb2+ etc. EDTA solution is administered. Which would be the better option EDTA solution or Ca EDTA solution? Explain with reason.

2 marks

(c) Draw the structures of *cis*–platin and *trans*–platin. Which is the better anti–cancer drug and why? What is the mechanism by which cis platin blocks cell proliferation?

4 marks

(d) Discuss the Bohr effect in the oxygenation of haemoglobin and draw the saturation curves for haemoglobin and myoglobin.

2 marks

3. (a) What are the metal ions present in the biological systems? Classify them into essential and non-essential.

2 marks

(b) What are toxic metals and why are they so?

2 marks

(c) What are metallobiomolecules? Describe in brief with classification.

2 marks

(d) What are ionophores, explain with example. What is the mechanism of ionophore action?

3 marks

(e) Which metal is present in carboxypeptidase A? Draw the coordination sphere of the metal in its active site and explain the action of this enzyme. Why the enzyme carboxypeptidase A is essential in biological system?

6 marks

4. (a) What are organometallic compounds? Classify them according to the types of bond present. Give 10 examples of organometallic compounds.

5 marks

(b) What do you mean by hapticity of ligands? Explain. Give examples of ligands with the hapticity of 3,4,5 and 6.

5 marks

(c) Desribe the 18 electron rule. Give 5 examples of complexes which strictly follow 18 electron rule and 5 examples of which do not follow the 18 electron rule.

5 marks

5. (a) What is synergic effect explain using the molecular orbital diagram with CO ligand as an example?

5 marks

(b) What is Ziese's salt? Write its chemical formula and draw its molecular structure. What is the bond order of the ethylene molecule bonded to the metal in Ziese's salt. Write its preparation in brief.

5 marks

(c) Draw the structure of ferrocene. What are its two possible conformations? Is it an organometallic compound? Discuss its synthesis.

5 marks

6.(a) What is Ziegler–Natta polymerisation? Discuss the mechanism of polymerization along with the role of triethylaluminium.

4 marks

(b) Draw the structure of methyl lithium tetramer and trimethyl aluminium dimer and discuss the concept of multicentre bonding in this context.

4 marks

(c) Is ferrocene aromatic? Explain with reason. Write down the electrophilic aromatic substitution reactions, alkylation and acetylation for ferrocene and compare its reactivity with ferrocene.

5 marks

(d) Draw the structures of the species present in the etherial solution of ethyl magnesiun bromide and methyl magnesiun bromide.

2 marks

7. (a) which of the following complexes will have the shortest C—O bond, $[Ni(CO)_4]$, $[Co(CO)_4]^-$ and $[Fe(CO)_4]^{2-}$ and why?

2 marks

(b) which of the following complexes will have the shortest C—O stretching frequency, $[Cr(CO)_6]$, $[V(CO)_6]^-$ and $[Fe(CO)_4]^{2-}$ and why? Arrange the following in ascending order of C—O stretching frequency with proper justification, M—CO, M_3—CO and M_2—CO.

4 marks

(c) Using 18 electron rule tell the number of M—M bonds and bridging CO ligands in the following complexes: $Co_2(CO)_8$, $Fe_2(CO)_9$, $Fe_3(CO)_{12}$ and $Ir_3(CO)_{12}$.

4 marks

(d) Using 18 electron rule tell the number of CO ligands in the following complexes: $Fe(CO)_n(NO)_2$, $[Fe(\eta^3\text{–allyl})(CO)_nCl]$ and $HCo(CO)_n$.

4 marks

8. (a) Explain why nitrate ion needs to be confirmed by the aluminium powder test in presence of Br^- ion?

2 marks

(b) How these ions are tested in presence of each other?

SO_4^{2-} and SO_4^{2-}

Cu^{2+} and Cd^{2+}

5 marks

(c) What are interfering ions? Why do they interfere only after group II of the cation analysis?

4 marks

(d) Group II sulphides are precipitated in acidic medium whereas Group IV sulphides are precipitated in alkaline medium. Explain.

4 marks

(6)

Sl-No: 7 Q.P: 6268

15

Unique Paper Code : 2171602

Name of the Paper : Theory Physical- Quantum Chemistry, Photochemistry &Surface Chemistry

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

Semester : VI

F-10

Duration : 3 hours

Maximum Marks: 75 Marks

Instructions for Candidates

1. Write your roll no. on the top immediately on receipt of this question paper.
2. Attempt only **six** questions out of **eight**.
3. **Question No. 1** is compulsory.
4. Use of scientific calculators and logarithmic tables is allowed.
5. Attempt all parts of a question together.

Physical Constants

Planck's constant	6.626×10^{-34} Js
Velocity of light	3.0×10^{8} ms^{-1}
Avagadro's Number	6.023×10^{23} mol^{-1}
Mass of electron	9.1×10^{-31} kg
Boltzzmann constant	1.38×10^{-23} J K^{-1}

1. Attempt *any five:*

(a) Write the expression for the Hamiltonian for the helium atom explaining briefly the terms involved.

(b) Determine whether or not the operators $x^2 \frac{d^2}{dx^2}$ and $\frac{d^2}{dx^2}$ commute.

(c) Define Hermitian operator. Give an example.

(d) Bond length increases on removing an electron from N_2 but decreases on removing an electron from O_2. Explain.

(e) Fluorescence is a fast process while phosphorescence is a slow process. Explain.

(f) Why spontaneous chemisorption is an exothermic process? Give reason.

(g) Why does an aqueous solution of potassium dichromate not follow Lambert-Beer's Law? Will the law be followed if the solution is acidified with dilute sulphuric acid? Explain.

(3×5)

2. (a) Consider a particle of mass '*m*' confined in a one-dimensional box of length '*l*'. A solution for this system is

$$\psi_n = \sqrt{\frac{2}{l}}\, sin\frac{n\pi x}{l}$$

(i) Show that ψ_n is not an eigenfunction of $\hat{p}_x$.

(ii) Show that the wave functions ψ_1 and ψ_2 are orthogonal.

(b) Calculate the energy required for a particle of mass 10^{-30} kg to move from energy level 3 to 4 in a one-dimensional box of length 973 pm.

(c) State Bohr's correspondence principle.

(6,4,2)

3. (a) State Variation theorem.

Apply variation theorem to the function $\psi_x = x(a - x)$ to the particle in a box (V=0 for $0 \leq x \leq 1$ and V= ∞ elsewhere) and estimate the ground state energy. Given= $E_0 = \frac{h^2}{8ml^2}$

(b) Distinguish between energy levels and quantum states. How many energy levels and quantum states are possible for a particle in three-dimensional box whose energy is $\frac{17h^2}{8ml^2}$

(c) Can we write $E = \frac{\hat{H}\psi}{\psi}$? Give reasons for your answer.

(6,4,2)

4. (a) What is meant by an "acceptable" wavefunction? State which of the following wavefunctions are acceptable in wave mechanics over the range x = 0 to x = 2π

(i) sin x

(ii) cosec x

(iii) tan x
(iv) cos x + sin x

(b) Evaluate <r> for the electron in the 1s atomic orbital of the H-atom for which the normalized wavefunction is $\psi(r) = (\pi a_0^3)^{-\frac{1}{2}} \exp\left(-\frac{r}{a_0}\right)$, where a_0 is Bohr's radius.

$$\text{Given: } \int r^n \exp(-ar)\, dr = \frac{n!}{a^{(n+1)}}$$

(c) Draw $R_{2,0}$, $R_{2,0}^2$ and $r^2R_{2,0}^2$ versus r for hydrogen atom.

(4,4,4)

5. (a) The LCAO-MO wavefunction for the H_2^+ ion can be written as:

$$\Psi = c_1\varphi_A + c_1\varphi_B,$$

where φ_A and φ_B are normalized AO's centered on the nuclei H_A and H_B respectively. Evaluate the expression for the normalized ground state wavefunction.

(b) Set up the Hamiltonian for the hydrogen molecule within the Born Oppenheimer approximation.

(c) Using Hückel molecular orbital theory,
   (i) Write down the secular determinant for ethene.
   (ii) Express energies as functions of the parameters α and β for ethene.

(4,4,4)

6. (a) The adsorption of gases on solids can be described by Freundlich's empirical equation: $(x/m) = kp^{1/n}$
Explain the terms involved and also explain why the value of 'n' should be equal to or greater than one.

(b) A diatomic gas is adsorbed as atoms on the surface according to the reaction

$$G_2 + 2S \rightleftharpoons 2GS$$

Show that $\theta = \frac{K^{1/2}p^{1/2}}{1+K^{1/2}p^{1/2}}$

(c) Explain why chemisorption is monolayer whereas physical adsorption is multilayer.

(4,4,4)

7. (a) On what principle is uranyl oxalate actinometer based? Explain the role of uranyl ion.

(b) Given the following mechanism of photochemical decomposition of hydrogen iodide

$$HI + h\nu \xrightarrow{I_{abs}} H + I$$
$$H + HI \xrightarrow{k_2} H_2 + I$$
$$I + I \xrightarrow{k_3} I_2$$
$$H + I_2 \xrightarrow{k_4} HI + I$$

Show that the quantum efficiency of this reaction is

$$\phi = \frac{2}{1 + \frac{k_4[I_2]}{k_2[HI]}}$$

(c) Give at least two reasons each for high and low quantum yield.

(4,4,4)

8. Write short notes on *any three*:

(a) Surface active substances

(b) Quenching

(c) Photostationary state

(d) Effect of temperature and pressure on adsorption.

(e) Lambert-Beer's law

(4,4,4)

7

19/5/18
19/5

S.No. of Question Paper: 6269

Your Roll No......................

Unique paper code: 2171603

Name of the paper: Section A: Inorganic- Chemistry of Inorganic Solids, Nanomaterials, Section B: Physical- Molecular Spectroscopy.

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

~~Scheme of Examinations- Earstwhile FYUP~~

P-10

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. The question paper carries two Sections (Section A and Section B)
3. Each Section caries $37^1/_2$ marks.
4. Use separate sheet for each Section

Section A

Attempt **any three** questions in all

Question No. 1 is compulsory and carries $7^1/_2$ marks

1. Answer the following:

(a) Give an example of Inorganic liquid crystal.

Or

----------- Inorganic material is used to improve mechanical properties of poly(propene fumarate) for bone tissue engineering.

(b) What factors are responsible for intense color in inorganic solids.

(c) What is the role of autoclave in Hydrothermal method for the synthesis of inorganic solids.

(d) Classify as Solid cationic and solid anionic electrolyte:

(i) Ag_2HgI_4

(ii) YSZ

(iii) Sodium β-Alumina

(e) What is the origin of color in the following compounds:

(i) $PbCrO_4$

(ii) $CoAl_2O_4$

(iii) $Cr_2O_3 . nH_2O$

(f) Give an example and one application of black pigment.

$(1, 1, 1, 1^1/_2, 1^1/_2, 1^1/_2)$

2. (a) What are carbon nanotubes? Briefly describe the different types of carbon nanotubes and their uses.

(b) Give full form of the following **(Any three)**:

(i) QW & QD

(ii) SWNT & MWNT

(iii) CVD

(iv) YSZ

(c) Describe different types of self assembly which offer routes to the control of architecture of nanomaterials. Give an example of each type.

Or

Describe ceramic method for the preparation of inorganic solids. What are its disadvantages over other methods.

(d) Why nanomaterials are different from bulk materials.

(5, 4, 4, 2)

3. (a) Give one method of preparation of silver and gold nanoparticles. Explain the steps involved. Write one application of each.

(b) Give an example of natural nanocomposite.

Or

Give an example of white pigment.

(c) What is bone tissue engineering. Explain by giving a suitable example.

Or

Describe biomimetics with respect to how artificial fossilization is used to create titania paper.

(d) What are fullerides? Why are they called Buckminster fullerenes? Explain the structure of the best known fulleride.

(5, 1, 4, 5)

4. Write short notes on **any three**:
   (a) Sol-Gel method for the synthesis of Inorganic solids
   (b) Bottom up and Top down approach to fabricate nanomaterials
   (c) Molecular magnets
   (d) Hydrothermal method for the synthesis of Inorganic solids
   (e) DNA and Nanomaterials
   (f) Mixed inorganic pigments

(5×3)

Section B

Use of scientific calculator is allowed.

Constants:

Avogadro's number = $6.023 \times 10^{23}\ \text{mol}^{-1}$

Planck's constant, $h = 6.626 \times 10^{-34}$ Js

Boltzmann constant, $k = 1.38 \times 10^{-23}\ \text{JK}^{-1}$

Velocity of light, $c = 3 \times 10^{8}\ \text{ms}^{-1}$

All questions carry equal marks. Attempt **any 3** questions.

1. **a)** What is meant by degeneracy? Calculate degeneracy for the J = 0, 1 and 2 rotational energy levels. 2

b) Population of the rotational level attains a maximum value at J_{max}. Why? 2½

c) Derive the following expression for J_{max}: 4

$$J_{max} = \sqrt{\frac{kT}{2Bhc}} - \frac{1}{2}$$

where, B is the rotational constant.

d) The rotational constant (B) of HBr is $8.45 \times 10^{2}\ \text{m}^{-1}$. Calculate: 4

i. The moment of inertia of the molecule.
ii. The internuclear distance of HBr.

2. **a)** Explain briefly the appearance of *hot bands* in IR spectroscopy. 2
b) Sketch all the possible normal vibration modes of CO_2 molecule. Which of these vibrational modes are IR active/inactive? Give reason. 2½
c) The energy of the various allowed vibrational energy levels of a diatomic molecule following the Morse potential is given by, 4

$$V_v = \left(v + \frac{1}{2}\right) h\nu_e[1 - (v + \frac{1}{2})x_e]$$

where, v is the vibrational quantum number, ν_e is the equilibrium vibrational frequency and x_e is the anharmonicity constant. Using the above expression, derive:

$$v_{max} = \frac{1}{2x_e} - \frac{1}{2}$$

where, v_{max} is the vibrational quantum number corresponding to the vibrational energy level where a diatomic molecule dissociates into atoms.
d) The fundamental and first overtone transitions of NO are centred at 1876 cm^{-1} and 3724 cm^{-1} respectively. Calculate the equilibrium vibrational frequency and the anharmonicity constant. 4

3. **a)** Homo-nuclear diatomic molecules are IR inactive but Raman active. Why? 2
b) Intensities of Stokes and anti-Stokes lines are comparable in rotational Raman spectra but in vibrational Raman spectra, Stokes lines are more intense. Explain. 2½
c) Explain the rule of mutual exclusion by taking typical examples of CO_2 and H_2O molecules. 4
d) For A_2B molecule, the following spectroscopic data are available, 4

Wavenumber (cm^{-1})	**Infrared**	**Raman**
589	Active (PQR)	Inactive
1285	Active (PR)	Active (polarized)
2224	Active (PR)	Active (depolarized)

Predict the structure of the A_2B molecule and assign the observed lines to the corresponding vibrations.

4. **a)** What is the effect of isotopic substitution on the rotational spectra of the molecule? Give suitable example. 2
b) What is the basic requirement for a molecule to exhibit: 2½
i. Rotational spectrum
ii. Vibrational spectrum
iii. Raman spectrum
c) With the help of suitable diagrams, explain the difference between fluorescence and phosphorescence. 4
d) Give reason for the following: 4
i. The vibrational frequency of C–C bond is lower than that for C=C bond.
ii. The vibrational frequency of C–H bond is higher than that for C–F bond.

(8)

This question paper contains 6 printed pages. 10/5/18

Your Roll No. ....

Sl. No. of Ques. Paper	**: 6495**	**HC**
Unique Paper Code	**: 32171601**	
Name of Paper	**: Inorganic Chemistry IV**	
Name of Course	**: B.Sc. (Hons.) Chemistry**	
Semester	**: VI**	
Duration	**: 3 hours**	
Maximum Marks	**: 75**	

*Attempt **five** questions in all. Question No. 1 is compulsory. All questions carry equal marks.*

1. Answer any *fifteen* questions from the following :

   (i) Explain why despite being a 17 electron species $V(CO)_6$ does not dimerise.

   (ii) Using the 18-electron rule as a guide, find the number of metal–metal bonds in $Fe_3(CO)_{12}$ and the charge on the species $[Co(CO)_4]^x$

   (iii) What is meant by the term hapticity?

   (iv) Is the given compound an organometallic compound?

   $Zn(Et)_4$ $\quad\quad$ $B(OMe)_3$

   (v) Give one example of each of the following :

   (a) Ionic organometallic compound

   (b) π complex

(vi) Which is a more powerful nucleophile :

$[Mn(CO)_5]$ *or* $[Co(CO)_4]$?

(vii) Give the name and chemical formula of the compound which gives green-edged flame in the test for BO_3^{3-} ions with ethanol and conc. sulphuric acid.

(viii) What do you understand by common ion effect? Explain giving an example.

(ix) Give the chemical name of BAL.

(x) How will the C-C bond length be affected in Zeise's salt when the hydrogen of ethene is replaced by fluorine?

(xi) Why is direct nitration of ferrocene not possible?

(xii) Name a disease associated with excess of copper.

Fill in the blanks :

(xiii) Wilkinson's catalyst is used for the .... of alkene.

(xiv) Among the Group II sulphides, the colour of CdS is ...., and Sb_2S_3 is ....

(xv) Both *F* and $C_2O_4^{2-}$ give a white precipitate on adding freshly prepared .... solution to acidified soda extract but in case of the latter, acid extract of the precipitate decolourises dilute ....

(xvi) Effect of pH on oxygen uptake of Hb is known as ....

(xvii) High dose of iron supplementation may lead to ....

1×15=15

2. (a) Explain the changes observed in the IR stretching frequency of the C–O bond in :

(i) terminal and bridging carbonyl group, and

(ii) carbonyl compounds of the same metal when some CO molecules are replaced by poor π acceptor groups.

(b) What is meant by synergic effect? How does it account for the formation of carbonyl complexes of transition metals in low oxidation states? Does the synergic effect also play a role in strengthening platinum-carbon bond in Zeise's salt?

(c) Draw the structure of methyl lithium. In which category of organometallic compounds will you place it? What are the coordination numbers of Li and C in the tetramer? 3×5=15

3. (a) Give two methods of synthesis of ferrocene and discuss its structures in solid and gaseous states.

(b) Give two reactions of ferrocene which show it is more reactive than benzene.

(c) Predict whether the following obey the EAN rule :

(i) $[Mn(C_2H_4)(CO_5)]^+$, $[Co(\pi\text{-}C_3H_5)(CO)_3]$, $Cr(CO)_6$

(ii) Two different structures of $Co_2(CO)_8$ are consistent with 18 electron rule. How will you predict the structure on the basis of IR studies? 3×5=15

4. (a) Give the complete cycle describing each step to outline the working of the Ziegler-Natta catalyst for the isotactic polymerization of ethene.

(b) What are the characteristics of a good catalyst? How can a catalyst be deactivated?

(c) Give a possible mechanism of conversion of synthesis gas to synthetic gasoline by Fischer-Tropsch method.

3×5=15

5. (a) A mixture of salts, when heated with ethanol and conc. H_2SO_4 gave a gas *A* which burnt with a green-edged flame when ignited. The mixture also gave a red gas *B* when heated with potassium dichromate and conc. H_2SO_4 The pungent gas evolved on heating the mixture with sodium hydroxide solution gave a brown precipitate *C* with potassium tetraiodomercurate (II). The residue left on boiling the mixture with dilute HCl is soluble in hot water and the hot solution gives a white precipitate *D* with dilute sulphuric acid and a yellow precipitate *E* with potassium chromate solution. Identify (with formula) *A*, *B*, *C*, *D* and *E* and name the ions present.

(b) (i) How is the 'lake test" for aluminium performed? What do you understand by 'lake'?

(ii) Explain the brown ring test for nitrate ion. Give the composition of the brown ring.

(c) Give the appropriate test with reactions to distinguish between :

(i) F^- and $C_2O_4^{2-}$

(ii) CO_3^{2-} and $C_2O_4^{2-}$ 3×5=15

6. (a) (i) How is the unequal concentration of Na^+ and K^+ ions in extra cellular and intracellular fluid controlled in the human body? Give a diagrammatic representation of the process and explain the mechanism involved in it.

(ii) What would have happened if the ATPase involved in the sodium-potassium pump did not undergo eversion?

(b) In what parts of human body are ferritin and transferrin found? What are their functions? Explain.

(c) What are the functions of Haemoglobin and Myoglobin? Highlight their differences. 3×5=15

7. (a) Which metal is present at the active site of the enzyme carbonic anhydrase? What is its coordination number and

how is it satisfied? What special features of this metal make it an excellent biocatalyst?

(b) Illustrate the curve in the graph that shows the degree of saturation of haemoglobin and myoglobin as a function of the pressure of oxygen.

(c) How does cis-platin block cell proliferation? $3\times5=15$

This question paper contains 7 printed pages] (9) 2018

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **6496**

Unique Paper Code : **32171602**

Name of the Paper : **Organic Chemistry-V**

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

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Attempt *six* questions in all.

Question No. **1** carries 15 marks.

1. Answer any *five* parts :

   (*a*) Write the open chain structure for the aldaric acid obtained by the oxidation of mannose with concentrated nitric acid. Is the product optically active ? Explain with the help of structures.

   (*b*) Which compound out of the following pairs will show carbonyl stretching vibration at higher frequency and why ?

   (*i*) $RCOCH_2CH_3$ and $RCOCl$.

   (*ii*) $RCOCH_3$ and $RCONH_2$

(*c*) Define Triblock polymers giving suitable example/s.

(*d*) Explain the change in λ_{max} value for $n \rightarrow \pi^*$ transition of acetone on changing from a non-polar solvent to polar solvent.

(*e*) Indicate the conditions under which the following changes take place ?

Leuco base $\rightleftarrows$ Colour base $\rightleftarrows$ Dye

(*f*) How many types of chemically equivalent protons are there in $CH_3CHClCH_2CH_3$? Give reason.

(*g*) Write the structure and common name of 4-O-α—D-glucopyranosyl-β–D-(+)-glucopyranose. 5×3=15

2. An organic compound A, has molecular formulae $C_9H_{10}O_2$. Deduce the structure of A based on the following spectral data :

NMR

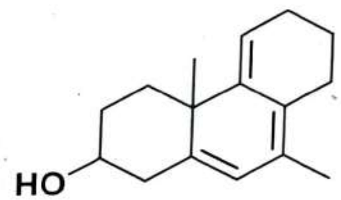
δ values	Intensity	Multiplicity
7.22	5	singlet
5.0	2	singlet
1.96	3	singlet

IR 1745 cm^{-1}, 1225 cm^{-1}, 2950 cm^{-1}, 3030 cm^{-1}; **UV**: λ_{max} 264 (ε 40) in water.

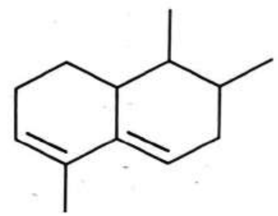
Calculate the double bond equivalents for A, deduce the structure of A and explain the complete spectral data. 12

3. (*a*) Calculate the λ_{max} value for the following compounds giving details (any *three*) :

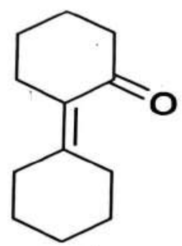
(*i*)

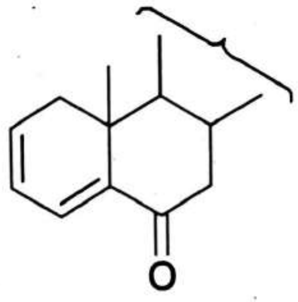


(*ii*)



(*iii*)



(*iv*) 

Values for calculations :

Heteroannular diene: 214 nm

Acyclic/Six membered cyclic α, β-unsaturated ketone : 215 nm

Homoannular diene : 253 nm

Alkyl group/ Exocyclic double bond : 5 nm

Extended conjugation : 30 nm 3×2=6

(*b*) How will you distinguish between the following pairs of compounds using IR spectrum ? Give reasons.

(*i*) o-hydroxymethylbenzoate and p-hydroxymethylbenzoate

(*ii*) Acetophenone and benzaldehyde 3×2=6

4. (*a*) Differentiate between the following pairs of compounds based on UV spectroscopy :

(*i*) Fumaric acid and Maleic acid

(*ii*) Butanone and methylvinylketone

(*b*) Explain Anisotropic effect and state why ethylinic protons absorb at higher δ value as compared to acetylenic protons in NMR spectra.

(*c*) An organic compound A, having molecular formulae C_3H_6O, gave the following spectral data : **UV** : λ_{max} 292 nm, ε 21.

IR : 1710 cm^{-1}, no absorption near 2720 & 2820 cm^{-1}. Deduce the structure of A and explain the entire spectral data. 4,4,4.

5. (*a*) Convert D-ribose to next higher aldose.

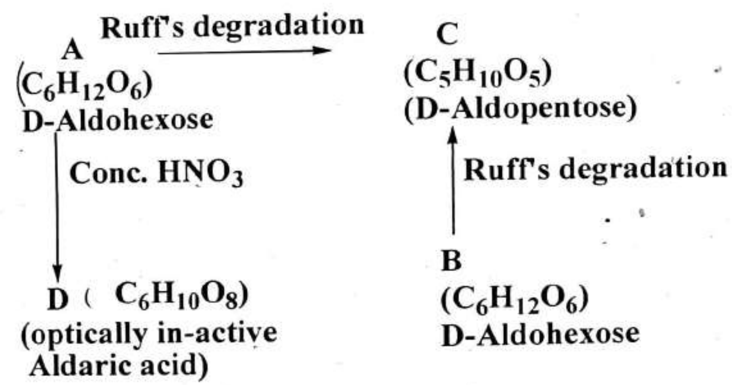
(*b*) Glucose on treatment with acetic anhydride leads to two isomeric pentacetyl derivatives, neither of these reduces Tollen's or Fehling's reagents. Account for these observations and give structures of their derivatives.

(c) Explain Amadori rearrangement for the formation of fructosazone from D-fructose. 4,4,4

6. (*a*) What are epimers ? Explain using suitable examples. Suggest a method to convert D- (+)-Glucose to D-(+)-Mannose.

(*b*) What are reducing and non-reducing sugars ? Explain with the help of suitable structures and give one example for each category.

(*c*)



A is a C-3 epimer of glucose. Deduce the structures of A,B,C,D and explain all the reactions. 4,4,4.

7. (*a*) Write the mechanism of polymerisation of isobutylene to polyisobutylene by using BF_3 in presence of traces of water.

(*b*) Differentiate between addition and condensation polymerisation giving suitable examples.

(*c*) What do you understand by the terms-Syndiotactic, Isotactic and Atactic polymers ? Explain taking polyvinylchloride as an example. 4,4,4

8. (*a*) Give one synthesis of Indigotin from anthranilic acid. Which form of Indigotin is used for dying ?

(*b*) Write down the possible structures of Phenolphthalein in :

(*i*) Acidic medium

(*ii*) Alkaline medium

(*iii*) Strongly alkaline medium.

Explain in which medium will Phenolphthalein be pink in colour and why ?

(*c*) Dyes can be distinguished on the basis of their classification, structures and uses. Differentiate between Methyl orange and Malachite green using all the above mentioned properties. 4,4,4

(10)

12/5/18

[This question paper contains 8 printed pages]

Your Roll No. : ....

Sl. No. of Q. Paper : 9417 **HC**

Unique Paper Code : 32177903

Name of the Course : **B.Sc (Hons.) - Chemistry : DSE-3**

Name of the Paper : Applications of Computers in Chemistry

Semester : VI

Time : 3 Hours ***Maximum Marks : 75***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) **All** questions are compulsory.

(c) Attempt **all** parts of a question together

1. Attempt any **five** parts :

a. Write the full form of any three of the following :

(i) DOS

(ii) ISP

(iii) ALU

P.T.O.

(iv) HLL

(v) GUI

b. Write in following algebraic expression in BASIC:

(i) $x = \frac{n(x_1^2 - x_2^2)}{2(a+b)x}$

(ii) $k = Ae^{(-E_a/RT)}$

(iii) $y = |x|$

c. Explain the following commands

(i) INT(X) (ii) FIX(X) (iii) DEF FNA(X)

d. Differentiate between the following:

(i) Overflow error and Underflow error

(ii) Machine language and Assembly language

(iii) Software and hardware

e. Convert the following numbers

(i) $(175.25)_{10}$ to binary number

(ii) $(11101.1101)_2$ to decimal number

f. Explain the following terms:

(i) Debugging

(ii) ASCII code

(iii) Syntax error (3×5)

2. Attempt any **three** :

(a) Identify and correct the error in following :

(i) Let 2A= "CHEMISTRY"

(ii) LOCATE (30, 20)

(b) Which of the following cannot be used as file names in BASIC. Give reason :

(i) Quadratic (ii) Save (iii) Chem-1
(iv) Welcome

(c) Write a program to calculate mean and variance of the following data :

X: 1.99, 1.87, 1.925, 1.895, 1.989

(d) Write a program in BASIC to print all odd numbers between 0 and N and find the sum of their square. (4,4,4)

3. Write the output of the following programs

(a)
```
SCREEN 2
WINDOW (0,0)-(100,100)
R= .5
FOR I= 1 TO 5
CIRCLE (40,60),R
R= R+1
NEXT I
END
```

(b)
```
A$ = "PHYSICAL"
B$ = "CHEMISTRY"
C$ = A$ + B$
D$ = LEFT$(A$, 3)
E$  =D$ + "."+B$
SWAP A$, B$
Print A$, B$, C$, D$ and E$
```


(c)
```
SCREEN 2
LINE (10,10)-(400,10)
LINE (10,10)-(10, 100)
PSET (50,50)
CIRCLE (50,50),20
END
```

(4,4,4)

4. (a) Indicate the error in the following program. Write the corrected program.

```
10 PRINT A
20 INPUT A,B
30 FOR I = 1 TO 10
40 FOR J = I+1 TO 10
45 C= 0: D = 0
50 C = A + I + C
60 D= B + J + D
70 NEXT I
80 NEXT J
90 PRINT C, D
100 END
```

(b) Write statements in BASIC to get the following output :

(i) Print HELLO in the centre of the screen

(ii) One dimensional array of 5 names using INPUT command

(iii) Generate a rectangle with diagonal coordinates (20,20) and (500,180)

(iv) Generate random number between 0 and 10.

(c) (i) What is the use of REM command ?

(ii) Explain Newton Raphson's method for solving a polynomial. (4,4,4)

5. (a) Write a program for calculation of enthalpyusing trapezoidal method from the expression :

$$\Delta H = \int_{T_1}^{T_2} \left(A + BT + CT^2\right) dt$$

(b) Write a program in BASIC to evaluate the following series :

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!}$$

The value should be accurate till 4th place after decimal.

(c) Identify valid and invalid variables. Give reasons

(i) REM

(ii) A$2

(iii) SUM

(iv) B-1 (4,4,4)

6. Attempt **all** parts

(a) Explain binary bisection method for solving the polynomial.

(b) Write a program in BASIC to find the root lying between 0 and 1 for the following equation using binary bisection method.

$$x^4 - x - 10 = 0$$

(c) Write a program to print the transpose of the matrix :

$$\begin{matrix} 3 & 5 & 7 \\ 2 & 4 & 6 \\ 1 & 9 & 8 \end{matrix}$$

(4,4,4)

(11)

This question paper contains 4 printed pages.

13/5/18

Your Roll No. ....

S. No. of Paper	: **9422**
Unique Paper Code	: **32177908**
Name of the Paper	: **Green Chemistry**
Name of the Course	: **B.Sc. (Hons.) Chemistry / B.Sc. (Prog.)**
	: **DSE-3 / 1B**
Semester	: **VI**
Duration	: **3 hours**
Maximum Marks	: **75**

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

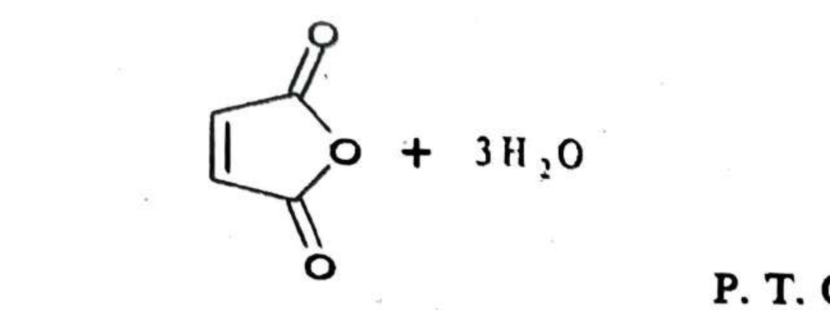
Attempt any ***five*** *questions. Each question carries 15 marks. Attempt all parts of a question together.*

1. (a) Define atom economy.

(b) Explain by taking suitable example, how per cent yield is different from atom economy in a chemical reaction.

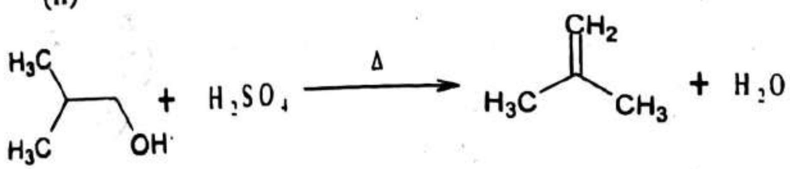
(c) Find out the per cent yield and atom economy of the following reactions. Compare and comment on their values:

(i)

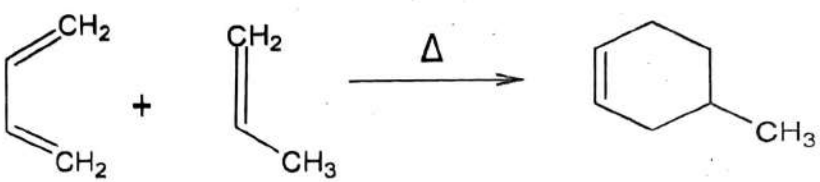


P. T. O.

(ii)



(iii)



(Molecular mass of C=12, N=14, O=16, S=32, H=1)

(d) What are Rightfit pigments? What are their advantages over heavy metal or organic pigments? 1,2,3 x 3,3

2. (a) What do you understand by alternative sources of energy? Give one example.

(b) Explain the principle of heat transfer in conventional method of heating and compare it with microwave assisted heating.

(c) What type of vessels are used in microwave assisted chemical reactions?

(d) Discuss the following reactions under microwave radiations. Give at least two advantages over the conventional method.

(i) Hoffman Elimination

(ii) Diels Alder Reaction. 2,3,2,2 x 4

3. (a) Why is ultrasound preferred over the conventional energy source?

(b) Explain the benefits of Simmons Smith reaction in ultrasonic condition over conventional method by providing both the routes.

(c) What are ionic liquids? Explain with an example.

(d) How is supercritical CO_2 a viable green alternative? Discuss its role in drycleaning.

(e) Explain the difference between homogeneous and heterogeneous catalyst by taking suitable example.

2,3,3,4,3

4. (a) Write down the green synthesis of the following compounds:

(i) Catechol

(ii) Polylactic acid.

Also give the conventional synthetic route and explain why the conventional method is not green.

(b) What are the advantages of biocatalysts over heavy metal catalysts?

(c) Discuss the application of enzymes in the industrial process by taking the example of Adipic acid.

(d) What are VOC's? What are its greener alternatives?

2 x 4,2,2,3

5. (a) What is green chemistry?

(b) How is Green Chemistry need of the hour?

(c) Write down twelve principles of green chemistry and briefly discuss any two principles with suitable example.

(d) How do chlorofluorocarbons (CFCs) and N_2O deplete the ozone layer? Explain this with relevant chemical reactions.

2,2,7,4

6. (a) Write short notes on any *four* of the following:

(i) Solventless processes.

(ii) Analytical techniques to minimize the generation of hazardous substances in chemical processes.

(iii) Waste or pollution prevention hierarchy.

(iv) Aqueous phase reactions.

(v) Inherent safer designs to prevent chemical accidents.

(vi) Green Chemistry in sustainable development.

(b) Discuss the role of tellurium in organic synthesis.

3 x 4,3

800

(12)

[This question paper contains 4 printed pages.] 14/5/18

Your Roll No..............

Sr. No. of Question Paper : 9423A **HC**

Unique Paper Code : 32177909

Name of the Paper : Industrial Chemicals and Environment

Name of the Course : **B.Sc. (Hons.) Chemistry : DSE-4**

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 **five** questions in all.
3. **All** questions carry **15** marks each.
4. Question No. **1** is compulsory.

1. (a) Fill in the blanks : **(any five)**

   (i) Lapse rate is ________ in Troposphere.

   (ii) Chronic exposure of plants to SO_2 gas leads to ________ .

   (iii) Region of a water body receiving minimum sunlight is known as ________ zone.

(iv) Nitric acid can be manufactured by ________ process.

(v) Nuclear waste is commonly disposed off in ________ .

(vi) Borax is frequently used for ________ .

(b) Define the following with suitable reactions or examples **(any five)**

(i) Acid rain

(ii) Cryogenic science

(iii) Inversion

(iv) ALBEDO

(v) Oxygen enrichment process

(vi) Green Chemistry

(c) Draw a labelled diagram of different regions of atmosphere showing altitude, temperature variation and chemical species existing in each region. (5,5,5)

2. (a) How is hypo manufactured? What are the main applications of hypo and what precautions should be kept in mind while using it?

(b) Discuss the aerobic digestion process applied during treatment of water.

(c) Using a suitable example, explain the refining of metals by Mond's process.

(d) "Biocatalysts are a boon for green chemistry." Elaborate. (5,4,3,3)

3. (a) What are the major sources and sinks of different NOx? Give a method of estimating the amount of NOx in an air sample.

(b) In the case of Blast furnace show how carbon reduces iron oxide at all temperatures.

(c) How is low grade coal converted into liquid fuel?

(d) Discuss three different properties of water that make it an essential component of life. (5,4,3,3)

4. (a) How do fertilizers pollute a water body? How can this pollution be controlled? Give "Liebig's law of minimum" and explain its significance.

(b) Name four different greenhouse gases. How are they affecting global warming?

(c) List the advantages of wind energy, how can it be harnessed?

(d) Draw a labelled diagram of biogeochemical cycle of Sulphur. (5,4,3,3)

5. (a) What is the difference between BOD and COD? How does the method of determination of the two parameters vary, discuss in detail?

(b) Name the pollutants present in the effluents of each, tannery and textile industries. Suggest a method of treatment for the same.

(c) How is nuclear fission different from nuclear fusion? Compare their energy efficiency.

(d) How does catalytic converter in an automobile reduce air pollution? (5,4,3,3)

6. Write short notes on **any three** of the following :

(a) Photochemical smog

(b) Manufacture and uses of Nitrogen

(c) Methods of controlling particulate matter in air

(d) Disposal of sludge (5×3)