

TDP (Honours) 5th Semester Exam., 2016

CHEMISTRY

(Honours)

FIFTH PAPER

Full Marks : 80

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer each Group in a separate answer booklet

GROUP—A

(Inorganic Chemistry)

(Marks : 40)

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. (a) Write down the general electronic configurations for lanthanide and actinide elements.

1+1

(b) What is the most common oxidation state of uranium? How is UF_6 prepared? What is its importance?

1+1+1

✓ (c) Explain the term lanthanide contraction.

(d) Discuss a suitable method for separation of lanthanide ions.

3

2+3+2+3=10

(2)

2. (a) Define mass defect and binding energy of nuclei. What is the relation between mass defect and binding energy? 1/2 * 2 + 1
- (b) Derive the expression for radioactivity disintegration, $t_{1/2} = \frac{0.693}{\lambda}$, here the terms have their usual significance. 4
- (c) Complete the following:
- (i) ${}_{88}\text{Ra}^{226} \rightarrow {}_{86}\text{Rn}^{222} + \dots$ 1 + 1
- (ii) ${}_{82}\text{Pb}^{210} \rightarrow {}_{83}\text{Bi}^{210} + \dots$ 4 + 4 + 2 = 10
3. (a) How is Zeise's salt prepared? Discuss its structure and bonding. 2 + 1 + 2 + 2
- (b) Make a comparative study of the first-row transition elements with those of second- and third-row transition elements with respect to their stability of oxidation states, absorption spectra and magnetic properties. 1 + 2 + 2 5 + 5 = 10

UNIT—II

4. (a) Define the term organometallics with suitable example. 2
- (b) How do you prepare ferrocene in laboratory? State its properties and discuss its structure. 1 + 2 + 2

M7/79

(Continued)

(3)

- (c) Among $[\text{Fe}(\text{C}_3\text{H}_5)(\text{CO})_2(\eta^5\text{-Cp})]$ and $[\text{Co}(\text{C}_3\text{H}_5)(\text{CO})_3]$ complexes, find out the hapticity of C_3H_5^- (allyl ligand) considering them as stable compounds. 1/2 * 2 2 + 5 + 3 = 10
5. (a) Distinguish between essential and beneficial elements of biological systems. Which metal ion is present at the active site of carbonic anhydrase? Discuss the role of carbonic anhydrase in biochemical processes. 1 + 1 + 1
- (b) What is the basic structural difference that exists between hemoglobin and myoglobin? Discuss the structural change that occurs when hemoglobin is oxygenated to form oxyhemoglobin. 1 + 4 5 + 5 = 10
6. (a) Distinguish between the terms accuracy and precision. What are the methods to express them? 1 + 1 + 1
- (b) What do you mean by F - and T -tests in analyzing data? Mention the criteria for rejection of data. 1/2 + 1/2 + 2
- (c) List the proper number of significant figures in the following data:
- 0.216, 90.7, 800.0, 0.0670 1 + 1 + 1
- 3 + 5 + 2 = 10

M7/79

(Turn Over)

(4)

GROUP—B

(Organic Chemistry)

(Marks : 40)

Answer four questions, taking **two** from each Unit

UNIT—III

7. (a) Account for the following facts :

(i) The dipole moment of pyrrole is greater than that of furan and is directed in opposite directions.

(ii) Furan undergoes Diels-Alder reaction but pyrrole does not.

(b) How can you convert the following (any two)?

(i) Pyran-2-one \rightarrow 1-Methyl pyridin-2-one

(ii) Aniline \rightarrow Quinoline

(iii) Pyridine \rightarrow 4-Nitropyridine

(c) When phenylhydrazine is reacted with 2-butanone under Fischer indole conditions, a mixture of two isomeric indoles is formed. Give their structures and explain with mechanism.

$$(1\frac{1}{2} + 1\frac{1}{2}) + (2 + 2) + 3 = 10$$

8. (a) The rate of mutarotation of D-glucose in 2-hydroxy pyridine is higher than that of a mixture of pyridine and phenol. Explain.

M7/79

(Continued)

(5)

(b) Convert the following :

D-fructose \rightarrow D-arabinose

(c) Write the plausible mechanism of the reaction between D-glucose and phenyl hydrazine (excess). Suggest an explanation why the reaction stops at the second carbon atom.

(d) Bromine water oxidation of β -D-glucopyranose is much faster than α -anomer. Give reason. $2 + 2 + (3 + 1) + 2 = 10$

9. (a) Define 'isoelectric point' of an amino acid. How is it calculated?

(b) Discuss azlactone method for the synthesis of phenylalanine.

(c) Outline the synthesis of dipeptide gly-ala, using Merrifield resin.

(d) How can you detect amino acid in a sample? Write down the mechanism of the chemical reaction involved in this reaction.

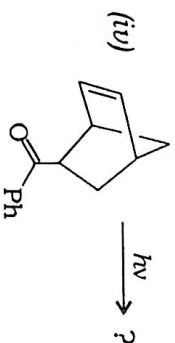
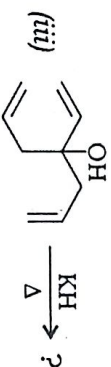
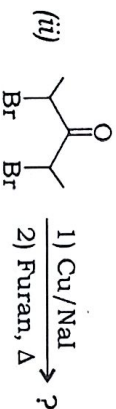
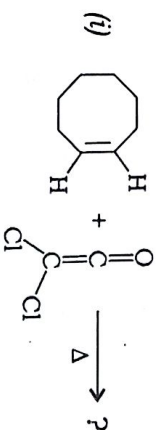
(e) Define tertiary structure of proteins. $2 + 2 + 2 + (1 + 2) + 1 = 10$

M7/79

(Turn Over)

UNIT—IV

10. (a) Predict the product with stereochemistry (wherever applicable) in the following reactions and indicate the reaction path (any three) :



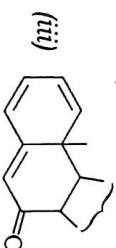
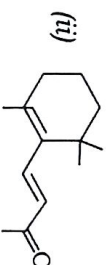
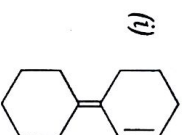
- (b) Using frontier orbital overlap, explain why Diels-Alder reaction between butadiene and ethylene is thermally allowed.
- (c) Give an example of [2, 3] sigmatropic rearrangement. (2+2+2)+3+1=10

M7/79

(Continued)

11. (a) What information we get from the ultraviolet visible (UV-vis) spectroscopy, NMR spectroscopy and IR spectroscopy of a compound?

- (b) Calculate the UV absorption maxima (λ_{max}) of the following compounds in ethanol (any two) :



- (c) Distinguish between the following pair by IR spectroscopy :

Acetone and di-*tert*-butyl ketone

- (d) How would you distinguish the following pairs by $^1\text{H-NMR}$ (any one) :
- (i) *p*-Dichlorobenzene and *o*-dichlorobenzene
- (ii) *cis*-2-butene and *trans*-2-butene (3+3+2+2=10)

M7/79

(Turn Over)

12. (a) What makes an organic compound coloured? Give the method of preparation of malachite green and methyl orange.
- (b) What is the difference between an antiseptic and a disinfectant?
- (c) Give the synthesis and uses of the following drugs (any *two*) :
- (i) Sulphaguanidine
 - (ii) Diazepam
 - (iii) Phenacetin
- $(1+2+2)+1+(2+2)=10$

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CHEMISTRY

(Honours)

FIFTH PAPER

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Answer each Group in separate answer script

GROUP—A

(Inorganic Chemistry)

(Marks : 40)

Answer four questions, taking two from each Unit

UNIT—I

1. (a) Comment on the 'basic properties of La and Lu trihydroxides'.
- (b) "The tendency of complex formation in 4f and 5f block elements is different." Explain.

(c) "Paramagnetism property in tripositive lanthanoids is due to both of orbital and spin motions." Explain.

(d) Give the reactions that take place in the ion-exchange separation of lanthanoids.



2. (a) Give the difference between σ and π bonded metal cyclopentadienyl complexes with one example of each.

(b) Describe the structure and bonding in $\text{Ni}(\text{CO})_4$.

(c) Give the preparations of the following :

(i) Sodium cobaltinitrite

(ii) Uranyl nitrate hexahydrate $3+3+4=10$

3. (a) Describe the stability of nucleus in the light of meson theory.

(b) Derive an expression for the disintegration constant of a radioactive element. Hence comment on the nature of the decay.

(c) Write notes on :

(i) Carbon dating

(ii) Nuclear fission

$$2+4+4=10$$

UNIT-II

4. (a) Calculate the EAN of central metal atom in the following :

(i) $\text{Fe}(\text{CO})_3(\text{C}_4\text{H}_6)$

(ii) $\text{Co}(\text{CO})_3(\pi\text{-C}_3\text{H}_5)$

(b) (i) Show the product



(ii) Explain the bonding of Zeise's salt.

(c) Write notes on :

(i) Hydroformylation

(ii) Insertion reaction

$$2+4+4=10$$

5. (a) What is apoenzyme? "Sodium pump is electrogenic in nature." Explain.

(b) Explain the function of carbonic anhydrase.

(c) Write notes on :

(i) Lewisite

(ii) Copper poisoning

$$3+3+4=10$$

6. (a) Explain—

(i) indeterminate error;

(ii) quotient test.

(4)

(b) In a set of measurements, the following concentrations of Fe(ppm) were reported : 20.2, 20.4, 20.3, 20.1, 19.9, 19.8, 20.5

Calculate the—

- (i) standard deviation;
- (ii) coefficient of variation.

(c) Two sets of results, obtained by standard method and a new method are given below (in mg/litre) :

Standard method	:	31	27	26	35	23	31	33
New method	:	26	22	23	30	24	28	30
							25	

Determine whether the precision of the new method differs significantly from that of the standard method. The critical value of F for 7 degrees of freedom is 2.13.

$$4+3+3=10$$

(5)

GROUP—B

(Organic Chemistry)

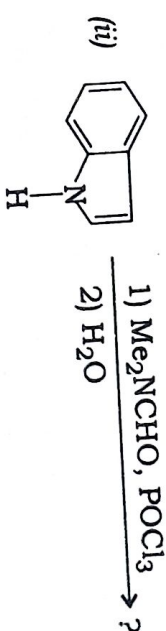
(Marks : 40)

Answer **four** questions, taking **two** from each Unit

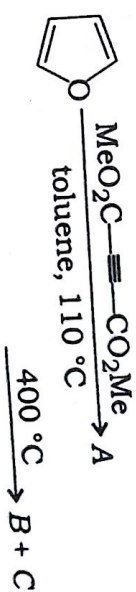
UNIT—III

7. (a) Bromine atom in 3-bromopyridine but not in bromobenzene can be replaced by sodium methoxide in methanol. Explain.

(b) Write the product(s) of the following reactions and give plausible mechanisms :



(c) Write down the structures of A, B and C in the following reaction :



(Turn Over)

- (d) How would you prepare furfural from pentose sugar? Suggest a plausible mechanism of the reaction.

$$2 + (2+2) + 1\frac{1}{2} + 2\frac{1}{2} = 10$$

8. (a) What is peptide bond? Outline the synthesis of dipeptide, gly-ala using BOC_2O as N-protecting agent.
- (b) Outline the path for the preparation of phenylalanine by Strecker's method.
- (c) Write down the reaction between glycine and ninhydrin. Suggest a plausible mechanism of the reaction.
- (d) What happens when alanine is treated with 2,4-dinitrofluorobenzene followed by treatment with aq. NaHCO_3 solution?
- (e) What is denaturation of proteins?
(1+2)+2+2+2+1=10

9. (a) What happens when—
- (i) D-glucose is treated with acetone (2 moles) in presence of anhy. ZnCl_2 and H_3PO_4 ;
- (ii) D-(+)-arabinose is subjected to Kiliani synthesis and the products are oxidised by dilute and hot HNO_3 ?

- (b) How many moles of HIO_4 will be required for the complete oxidative cleavage of D-glucose? Give the reaction involved.

- (c) What is invert sugar? Calculate the specific rotation of invert sugar which contains an equimolecular amount of D-(+)-glucose and D-(-)-fructose. Given specific rotation of D-(+)-glucose is $+52.7^\circ$ (at equilibrium) and that of D-(-)-fructose is -92.4° (at equilibrium); D-(-)-fructose is $+66.5^\circ$.
(2+2)+2½+(1+2½)=10

UNIT—IV

10. (a) What is pericyclic reaction? Explain the fates of (2E, 4E)-hexadiene in case of the following pericyclic reactions :
- (i) Photochemical electrocyclic ring closure
- (ii) Thermal cycloaddition reaction with acetylene
- (b) What is sigmatropic rearrangement? Explain [3, 3] sigmatropic rearrangement in the light of Claisen rearrangement.
- (c) What is Paterno-Buchi reaction? Discuss its mechanism along with the stereochemical consequences.
(1+2+2)+3+2=10

TDP (Honours) 5th Semester Exam., 2018

CHEMISTRY

(Honours)

FIFTH PAPER

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Answer each Group in separate answer script

GROUP—A

(Inorganic Chemistry)

(Marks : 40)

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. (a) Actinide shows the wider range of oxidation state than the lanthanides. Explain.
- (b) Compare the chemistry of lanthanides with actinides in respect of stability of oxidation state and magnetic properties.

(2)

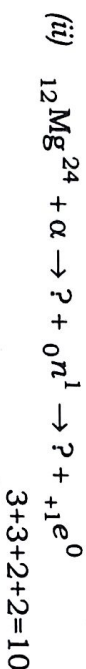
- (c) Arrange the lanthanide hydroxide La(OH)_3 on the basis of basicity value.
- (d) What do you mean by lanthanoid contraction? Give one important consequence of it. $2+4+2+2=10$

2. (a) Write the preparation and structure of uranium hexafluoride.

(b) Explain the ion-exchange method which is used for the separation of lanthanide elements.

(c) What do you mean by packing fraction? Explain its significance.

(d) Complete the following transformations :



3. (a) Show that the half-life of a radioactive element is independent of its initial amount.

(b) What do you mean by the terms artificial radioactivity and spallation reaction?

(c) Why is a fission bomb superior to a fission bomb?

M9/72

(Continued)

(3)

- (d) In what time 1 gm of Ra will become 0.01 gm if its half-life is 1540 years?
 $2+3+2+3=10$

UNIT—II

4. (a) Give an example of metal complexes with power for transmission of energy and show its structure. Discuss the biological function of chlorophyll.

(b) What do you mean by $\text{Na}^+ - \text{K}^+$ pump? Write its working mechanism in biological system. $(3+2)+(2+3)=10$

5. (a) Complete the following reactions :



(b) What is the structural difference between η^1 - and η^5 -metal cyclopentadienyl derivatives? Illustrate with examples.

(c) Discuss the different modes of coordination of NO with suitable example. CO

(d) What do you mean by hydroformylation reaction? Give one example with proper mechanism. $(1+1)+(2+3)+(1+2)=10$

M9/72

(Turn Over)

(4)

6. (a) State the principle for *F*-test. For which purpose this test is applied?
- (b) What is linear regression?
- (c) In the analysis of an iron ore, the percentages of Fe_2O_3 were found to be 66.00, 65.55, 66.85, 65.90, 67.85, 69.90 and 65.00. The value 69.90 appears to be suspected. As certain whether this should be retained or rejected? The *Q*-critical for 7-observation at 90% confidence level is 0.51. $4+2+4=10$

GROUP—B
(Organic Chemistry)

(Marks : 40)

Answer **four** questions, taking **two** from each Unit

UNIT—III

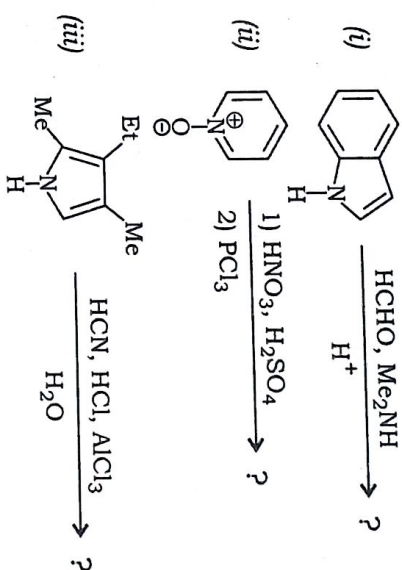
7. (a) Account for the following facts :
- (i) The dipole moment of pyrrole is greater than that of furan and is directed in opposite directions.
- (ii) Electrophilic substitution of indole takes place at 3-position and nucleophilic substitution of pyridine at 2-position.

M9/72

(Continued)

(5)

- (b) Write the product(s) of the following reactions and give plausible mechanisms (any two) :



- (c) Suggest a method of synthesis of quinoline using aniline as one of the starting materials and also suggest a plausible mechanism. $(1\frac{1}{2}+1\frac{1}{2})+(2+2)+3=10$

8. (a) What is anomeric effect? Explain with an example. How does an anomer differ from epimer?

- (b) How would you convert D-arabinose to D-glucose?
- (c) Glucose and fructose form same osazone with phenyl hydrazine. What conclusion can be drawn from this observation?
- (d) Explain mutarotation of sugars with suitable example.
- (e) What is acetal? $(1+2)+2+2+2+1=10$

M9/72

(Turn Over)

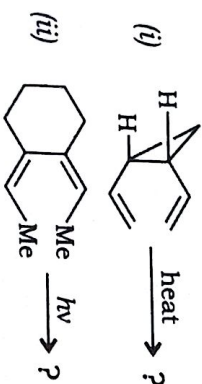
(6)

9. (a) Outline the synthesis of dipeptide, Gly-Ala using Merrifield resin.
- (b) How can you synthesize cysteine by using malonic ester?
- (c) Specific rotation of an α -amino acid is pH-dependent. Explain.
- (d) What happens when aniline is treated with aq. HNO_2 ? Write the chemical equation involved.
- (e) Write down the structure of an optically inactive amino acid. $3+2+2+2+1=10$

UNIT-IV

10. (a) With the help of symmetry properties of the molecular orbitals of butadiene, show that its conrotatory conversion to cyclobutene is a thermally allowed process.

- (b) Predict the product with stereochemistry (wherever applicable) in the following reactions :



Indicate reaction path and name of the reactions.

M9/72

(Continued)

(7)

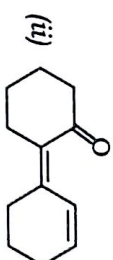
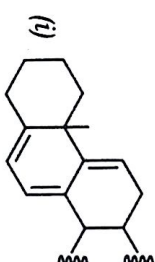
- (c) Complete the following reaction sequence and explain the process taking place in each step :



Cyclobutene + Dimethyl phthalate

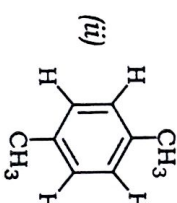
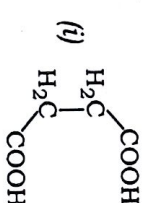
$3+(2+2)+3=10$

11. (a) Calculate the UV absorption, λ_{max} of the following compounds in ethanol :



- (b) 2-Hydroxy-3-nitroacetophenone shows two carbonyl stretching frequencies at 1692 cm^{-1} and 1658 cm^{-1} . Explain.

- (c) Predict the chemical shift positions with multiplicities for the protons in the following compounds :



- (d) Define chemical shift δ (ppm) used in NMR spectroscopy. $(1\frac{1}{2}+1\frac{1}{2})+2+(2+2)+1=10$

(Turn Over)

M9/72

12. (a) Give a synthetic method for the preparation of phenolphthalein. Why is it used as an indicator in acid-base titration? Explain with mechanism.
- (b) Suggest a method for the synthesis of DDT. Discuss its effect on wildlife and human health when it is applied in agricultural field.
- (c) Give the synthesis and uses of sulphaguanidine drug.
- (d) What is vat dye? Give an example.
 $(1\frac{1}{2}+1\frac{1}{2})+(2+1)+(2+1)+1=10$

TDP (Honours) 5th Semester Exam., 2020
(Held in 2021)

CHEMISTRY
(Honours)

FIFTH PAPER

Full Marks : 80

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Use separate answer-script for each Group

GROUP—A

(Inorganic Chemistry)

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. (a) Compare first and second row transition elements with respect to their oxidation states and spectral properties.
- (b) Write the structure of Zeise's salt.

(2)

- (c) Discuss the magnetic property of Sm^{3+} ion.
- (d) Discuss the ion-exchange method for separation of lanthanides. $3+2+2+3=10$
2. (a) How is sodium nitroprusside prepared in the laboratory? Mention its use in practical chemistry with suitable reactions.
- (b) Discuss the preparation and structure of cupric acetate.
- (c) Define binding energy. Calculate the binding energy per nucleon of the $^{40}_{18}\text{Ar}$ nucleus. The experimental mass of $^{40}_{18}\text{Ar} = 39.962384$ amu
 $M_{\text{H}} = 1.007825$ amu
 $M_{\text{n}} = 1.008665$ amu $3+3+4=10$
3. (a) Write short notes on any two of the following :
- (i) Carbon-14 dating
- (ii) Radioactive equilibrium
- (iii) Group displacement law

13-21/149

(Continued)

(3)

- (b) "Sun is the ultimate source of energy." Explain with suitable reason.
- (c) An archaeological specimen containing ^{14}C gives 40 counts in 5 minutes per gram of carbon. A specimen of freshly cut wood gives 20.3 counts per gram of carbon per minute. The counter used recorded a background count of 5 counts per minute in the absence of any ^{14}C containing sample. What is the age of the specimen?
 $(2 \times 2) + 3 + 3 = 10$

UNIT—II

4. (a) How is ferrocene prepared in laboratory? Discuss the structure of ferrocene.
- (b) Write the products of the following reactions :
- (i) $\text{Cp}_2\text{Fe} \xrightarrow[\text{AcOH}]{\text{HCHO/NHMe}_2} [\text{A}]$
- (ii) $\text{Cp}_2\text{Fe} \xrightarrow{[\text{H}^+]} [\text{B}]$
- (c) Define the term 'hapticity'. Give one example of a ligand with hapticity three.
- (d) What are pi-acid ligands? How can you differentiate the terminal and bridging modes of bonding of CO in polynuclear metal carbonyls?
 $(1\frac{1}{2} + 1\frac{1}{2}) + 2 + 2 + 3 = 10$

13-21/149

(Turn Over)

(4)

5. (a) Discuss the active and passive transport processes of solutes across the biological membrane.

(b) Draw the active site structure of oxyhaemoglobin. Explain that oxyhaemoglobin is diamagnetic.

(c) What is the principle of chelation therapy? Give one example of its application in the treatment of metal ions toxicity.
 $3+(2+1)+(2+2)=10$

6. (a) Define oxidative addition reaction with an example.

(b) What is Ziegler-Natta catalyst? Mention one of its applications.

(c) "Accuracy follows precision but precision does not follow accuracy." Justify.

(d) Percentages of iron in an ore are found to be 50.02, 50.23, 49.98, 49.88, 50.01 and 50.18. Calculate the mean deviation and standard deviation for the analysis.

$$2+2+3+3=10$$

(5)

GROUP-B

(Organic Chemistry)

Answer four questions, taking two from each Unit

UNIT-III

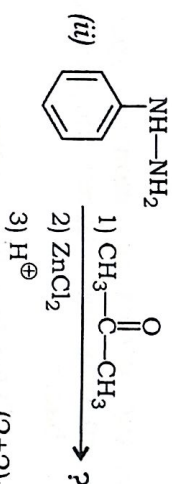
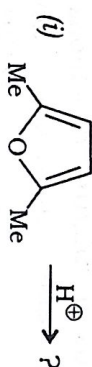
7. (a) Account for the following facts :

(i) The dipole moment of pyrrole is greater than that of furan and is directed in opposite direction.

(ii) Pyrrole loses its basicity at the cost of its aromaticity.

(b) How would you prepare 3-chloropyridine from pyrrole? Suggest a plausible mechanism of the reaction.

(c) Write the product(s) of the following reactions and give plausible mechanisms :



$$(2+2)+2+(2+2)=10$$

13-21/149

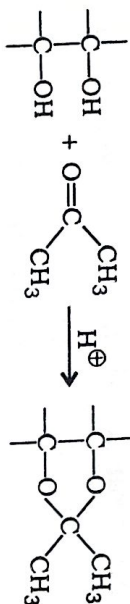
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13-21/149

(Turn Over)

(6)

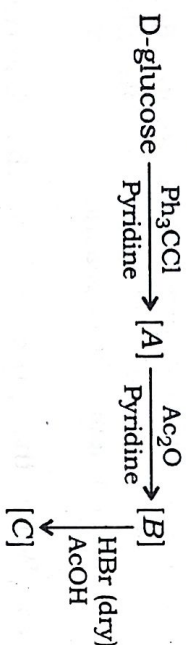
8. (a) Cis-1,2-diols react with anhydrous acetone in presence of acid catalyst forming isopropylidene derivatives



Write down the structures of the products that you would expect to be formed by treating—

- (i) α -D-glucopyranose;
(ii) β -D-fructofuranose.

- (b) Identify compounds A, B and C in the following sequence of reactions :



- (c) Oxidation of D-fructose with Tollen's reagent yields a mixture of anions of D-mannonic and D-gluconic acids. Explain why.
(2+2)+3+3=10

9. (a) Write the structure showing specific hydrogen bonding between the following pair of bases :

Cytosine and Guanine

(7)

- (b) Draw chain conformations of the following sugars in which the CH_2OH group is in an axial position :

- (i) β -D-glucopyranose
(ii) α -D-galactopyranose

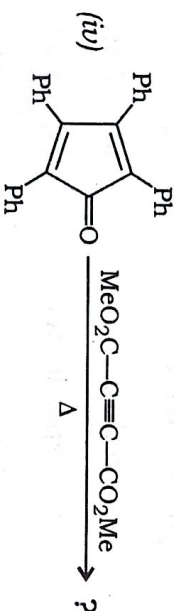
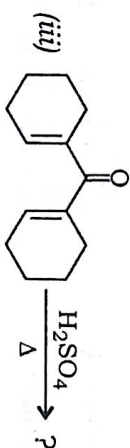
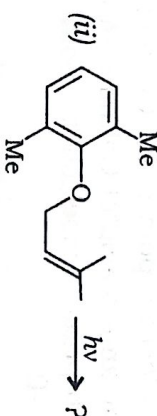
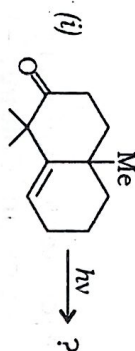
- (c) In the following table there are given some amino acids in Column—A and some isoelectric points in Column—B. Match the amino acid of Column—A with an appropriate isoelectric point of Column—B :

Column—A	Column—B
(i) Alanine	(1) 6.30
(ii) Cysteine	(2) 2.98
(iii) Proline	(3) 7.59
(iv) Aspartic acid	(4) 6.02
(v) Histidine	(5) 10.76
(vi) Arginine	(6) 5.02

- (d) Suggest a mechanism of the reaction of ninhydrin with α -amino acids.
2+3+3+2=10

UNIT—IV

10. (a) Predict the products with stereo-chemistry (wherever applicable) in the following reactions and indicate the reaction paths (any three) :



- (b) Using frontier orbital overlap, explain why Diels-Alder reaction between butadiene and ethylene is thermally allowed.

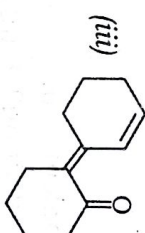
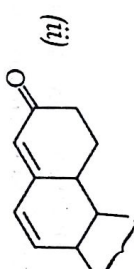
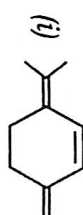
- (c) What is Cope rearrangement?

$$(2 \times 3) + 3 + 1 = 10$$

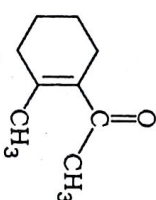
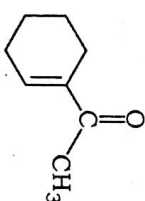
13-21/149

(Continued)

11. (a) Calculate the UV absorption maxima (λ_{max}) of the following compounds (any two) :



- (b) Distinguish between the following pairs by IR spectroscopy :



- (c) Predict the chemical shift positions with multiplicities for the protons in *p*-xylene.

- (d) 2-hydroxy-3-nitroacetophenone shows two carbonyl stretching frequencies at 1692 cm^{-1} and 1658 cm^{-1} . Explain.

- (e) What is coupling constant?

$$(1\frac{1}{2} \times 2) + 2 + 2 + 2 + 1 = 10$$

13-21/149

(Turn Over)

12. (a) Give the synthesis and uses of the following (any two) :

- (i) Congo red
- (ii) Diazepam
- (iii) Malachite green

(b) What makes an organic compound coloured? Give the method of preparation of methyl orange.

(c) Why is phenolphthalein used as indicator in acid-base titration? Explain with mechanism. $(2 \times 2) + (1 + 2) + 3 = 10$

TDP (Honours) 5th Semester Exam., 2021
(Held in 2022)

CHEMISTRY

(Honours)

FIFTH PAPER

Full Marks : 80

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer each Group in separate answer-script

GROUP—A

(Inorganic Chemistry)

(Marks : 40)

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. (a) Write down the electronic configuration of uranium and mention the different oxidation states of the element.

(2)

(b) Explain the following :

(i) Actinides form oxocation but lanthanides do not.

(ii) Basic character of lanthanide hydroxides goes on decreasing with the increase in atomic number.

(c) Explain the term 'lanthanide contraction'. What are its consequences in the properties of post-lanthanide elements?
 $2+(2 \times 2)+4=10$

2. (a) Briefly discuss the spectral property of lanthanides.

(b) How will you prepare potassium permanganate in laboratory? Discuss the redox reactions of permanganate ion in acidic mediums using suitable examples.

(c) How is nickel tetracarbonyl prepared? Explain its structure. $3+(2 \times 2)+(1+2)=10$

3. (a) Derive the expression for radioactivity disintegration, $t_{1/2} = 0.693/\lambda$. Here the terms have their usual meanings.

(b) What is packing fraction? How can you explain the stability of a nucleus in terms of packing fraction?

22M/129

(Continued)

(3)

(c) Complete the following :

(i) ${}_{13}\text{Al}^{27}(n, \alpha) \longrightarrow$

(ii) ${}_{88}\text{Ra}^{226} \longrightarrow \text{---} + {}_2\text{He}^4$

(iii) ${}_{16}\text{S}^{32}(\alpha, \gamma) \longrightarrow$
 $3+(2 \times 2)+(1 \times 3)=10$

UNIT—II

4. (a) What are different types of errors?

(b) Mention the criteria for rejection of data.

(c) In an analytical experiment, the following set of results is obtained :
10.05, 12.52, 9.63, 14.45,
18.82, 12.15, 9.95, 11.20

Calculate the mean and standard deviation for the result. $4+2+(2 \times 2)=10$

5. (a) Discuss the bonding and structure of ferrocene.

(b) Ferrocene $\xrightarrow[(1:1)]{(i) \text{ nBuLi}}$ A

(ii) $\text{CO}_2/\text{H}_2\text{O}$

Find A.

22M/129

(Turn Over)

(4)

(c) What are polynuclear metal carbonyls?
How can you distinguish between
terminal and bridging carbonyls by
infrared spectroscopy? $4+2+4=10$

6. (a) Discuss the structure of hemoglobin.
Explain the changes that take place
in the electronic configuration of Fe(II)
in hemoglobin on oxygenation.

(b) Discuss about the different transport
processes in biological systems.

(c) What is sodium-potassium ion pump?
Discuss its function. $4+2+4=10$

GROUP—B

(Organic Chemistry)

(Marks : 40)

Answer **four** questions, taking **two** from each Unit

UNIT—III

7. (a) Predict with mechanism of nitration
of pyrrole whether the substitution
occurs predominantly at C—2 or C—3
of pyrrole ring.

22M/129

(Continued)

(5)

(b) Explain the overall order of reactivity
of pyrrole, thiophene and furan.

(c) Write proper structure of the product
of the reaction between furan and
maleic anhydride.

(d) Outline the Skraup synthesis of
quinoline with mechanism.

(e) Which reagent will give quinoline oxide
from quinoline? $3+2+2+2+1=10$

8. (a) How do you prepare glucose from
sucrose?

(b) Explain mutarotation of sugars with
suitable examples (show mechanism).

(c) Write the Kiliani-Fischer synthesis of
D-glucose and its epimer.

(d) Write Haworth structure of α -D-fructo-
furanose and α -D-fructopyranose.

(e) Explain why glucose and fructose give
same osazone when they separately
treated with excess PhNHNH_2 .

$1+3+3+2+1=10$

9. (a) Give one example each of basic amino
acid and sulphur containing amino
acid.

22M/129

(Turn Over)

(6)

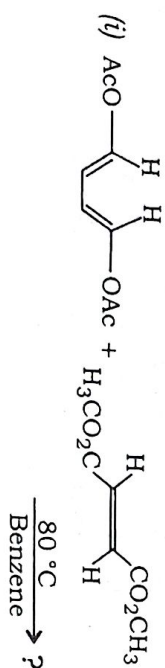
- (b) Write the structure of L-tryptophan.
- (c) Define essential amino acid with example.
- (d) Explain isoelectric point of amino acid with example.
- (e) Identify compound (A) :
- (A) $\xrightarrow{(i) \text{ Excess } \text{NH}_3}$ $\xrightarrow{(ii) \text{ H}_2/\text{Pd}}$ $\text{R}-\underset{\text{COOH}}{\overset{\text{NH}_2}{\text{CH}}}$
- $2+2+2+2+2=10$

UNIT-IV

10. (a) Which one will give cycloaddition reaction with 1,3-butadiene? Give product :



- (b) Write the product with stereochemistry :

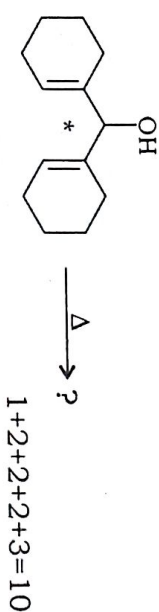


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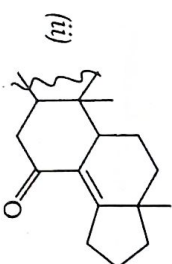
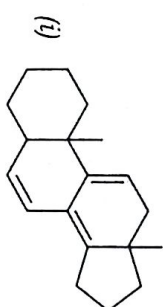
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(7)

- (c) Write the product with stereochemistry (showing conrotaton or disrotation).
- (i)
- (ii)
- (d) What is Claisen rearrangement?
- (e) Show the course of the following pericyclic reaction with stereochemical outcome :



11. (a) Calculate the UV absorption maxima (λ_{max}) of the following compounds :



22M/129

(Turn Over)

- (b) Why do alcohols show a broadband in IR spectra?
- (c) Why does $\text{—CH}_2\text{—}$ asymmetric stretching band appear at left side of the $\text{—CH}_2\text{—}$ stretching band?
- (d) Explain the common terms 'shielding' and 'de-shielding' in n.m.r. spectroscopy.
- (e) What happens when a spinning proton is placed in an external magnetic field?
- $$(1\frac{1}{2}+1\frac{1}{2})+2+2+2+1=10$$

12. (a) What are auxochromes? Explain briefly the valence bond theory of colour.
- (b) Write the chemical synthesis of sulfanilamide from aniline.
- (c) Write the preparation and uses of any *two* of the following :
- (i) DDT
- (ii) Endrin
- (iii) Parathion
- (d) What are natural pesticides?
- $$(1+2)+2+(2+2)+1=10$$

★ ★ ★