K22P 0156

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.) Examination, April 2022
(2018 Admission Onwards)
CHEMISTRY
CHE 2C.05 : Theoretical Chemistry – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions **each** in **one** word or sentence. **Each** question carries **1** mark.

1. What is dihedral plane of symmetry ?
2. What are conjugate elements ?
3. What is the point group of a cube ? Write down its symmetry elements.
4. A character table has the following operations : E, $2C_3$, C_2, $3\sigma_v$, $3\sigma_d$ and one other class containing two equivalent operations. What is the missing operation ?
5. Calculate the bond length of CO molecule whose rotational constant is 1.92118 cm^{-1}.
6. What is the region of electromagnetic spectrum to which a frequency of 6×10^{13} Hz belongs ?
7. Which kind of spectroscopy could be used to measure the binding energy of an electron in the $1\pi_u$ molecular orbital of O_2 ?
8. ^{13}C NMR is much simpler to interpret than proton NMR. Why ? **(8×1=8)**

SECTION – B

Answer **eight** questions. Answer may be in **two** or **three** sentences. **Each** question carries **2** marks.

9. What are the criteria that need to be satisfied by a set of elements to form a group ?
10. Show that σ_v and σ_v' are members of the same class in C_{3v}.
11. Arrange various operations generated by C_6 axis into different classes.

P.T.O.

12. What are orthogonal matrices ? Write down the orthogonal matrices of σ_{xz} and $C_2(z)$.

13. Write a note on improper rotations.

14. What is meant by direct product representation ?

15. Why is the Q branch not seen in the vibrational rotational spectrum ?

16. Calculate the zero point energy of hydrogen molecule. Given, the fundamental vibrational frequency = 4400 cm^{-1}.

17. Write down the advantages of Raman scattering over IR spectrum.

18. Explain the rule of mutual exclusion.

19. What is spin-spin relaxation ?

20. Which is the free radical used in the calibration of ESR spectra and why ?

(8×2=16)

SECTION – C

Answer **four** questions **each** in **one** paragraph. **Each** question carries **3** marks.

21. Construct a group multiplication table for C_{3v}.

22. State and explain Great Orthogonality theorem. What are the important rules that can be deduced from the theorem ?

23. Reduce the following representation of C_{3v}.

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_a	5	2	–1
Γ_b	7	1	–3

24. Show that when n is even, the reciprocal of S_n^m is S_n^{n-m}.

25. What are the factors on which the intensity of spectral lines depends ?

26. For the molecule HBr, B = 253.771 GHz and υ_0 = 79.414 THz. Under the rigid rotator-Harmonic oscillator approximation, calculate the frequencies of the first two lines of the R and P branches for the vibrational-rotational spectrum of HBr.

27. Discuss the various types of electronic transitions giving examples.

28. Explain shielding and deshielding effects in NMR spectra. **(4×3=12)**

SECTION – D

Answer either **A** or **B** of **each** question. **Each** question carries **6** marks.

29. A) Draw a standard flowchart that shows the steps in assigning point group to a molecule.

OR

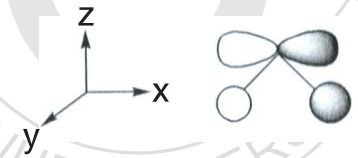
B) Construct the character table for C_{2h}.

30. A) Determine the IR and Raman active modes of vibrations in trifluoroborane using character table given below.

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A1′	1	1	1	1	1	1		(x^2+y^2, z^2)
A2′	1	1	–1	1	1	–1	R_z	
E′	2	–1	0	2	–1	0	(x, y)	$(x^2 – y^2, xy)$
A1″	1	1	1	–1	–1	–1		
A2″	1	1	–1	–1	–1	1	z	
E″	2	–1	0	–2	1	0	(R_x, R_y)	(xz, yz)

OR

B) Derive a representation for the molecular orbital of water molecule shown below.



31. A) What is Fortrat parabola ? Obtain the expression for the band head in terms of B′ and B″.

OR

B) Explain the classical and quantum theory of Raman spectroscopy.

32. A) With the help of Franck-Condon principle, illustrate the shapes of the absorption bands.

OR

B) Explain (a) Factors affecting chemical shift and (b) Applications of ESR.

(4×6=24)

K24P 1067

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree (CBCSS – OBE – Regular)
Examination, April 2024
(2023 Admission)
Chemistry
MSCHE02C10/MSCHD02C10 : ORGANIC CHEMISTRY – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Short answer questions. Answer **any five** questions. **Each** question carries **3** marks.

1. Distinguish between configuration and conformation with examples.
2. State axial haloketone rule.
3. What is enantiomeric excess ? How is it determined experimentally ?
4. Explain prochiral center with an example.
5. Write two examples of [3, 3] sigmatropic rearrangement.
6. Write the differences in reaction conditions and products of Woodward and Prevost's hydroxylation. **(5×3=15)**

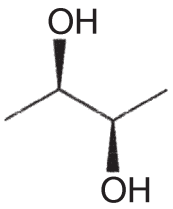
SECTION – B

Paragraph questions. Answer **any three** questions. **Each** question carries **six** marks.

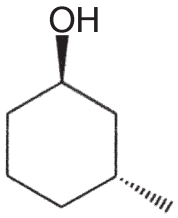
7. Draw the preferred conformations of the following compounds :
   a) Trans-4-ter-butyl cyclohexanol
   b) Trans-decalin
   c) Cis-4-ter-butyl cyclohexanol.

P.T.O.

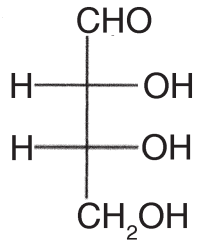
8. Assign R and S configuration to the following compounds :



(a)



(b)



(c)

9. Explain Fluxional molecules with two examples.

10. Write the synthesis of (S)-(-)-ipsenol from (S)-(-)-leucine ?

11. How will you convert methanal to 2-phenyl ethanal ? **(3×6=18)**

SECTION – C

Essay type questions. Answer **any three** questions. **Each** question carries **nine** marks.

12. Write an essay on octant rule and its applications.

13. Write an essay on sharpless asymmetric epoxidation explaining the stereochemistry, applications and reagents used.

14. Explain chiral pool synthesis with two specific examples.

15. Explain electrocyclic ring closure and ring opening of a 4n and 4n+2 system with frontier molecular orbital theory.

16. Write a note on synthetic utility of lithium aluminum hydride and sodium borohydride including mechanism, differences and modified reagents. **(3×9=27)**

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K23P 0464

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.)
Examination, April 2023
(2019 Admission Onwards)
CHEMISTRY
CHE2E.01 : Environmental Chemistry and Disaster Management

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **1** mark.

1. What is a pollutant ?
2. Which atmospheric region contains ozone layer ?
3. What is particulate matter ?
4. What is the acceptable range of pH as per Indian standards of drinking water ?
5. What type of pollution causes acid rain ?
6. What is disaster management ?
7. What is thermal pollution ?
8. What is an environmental disaster ? **(8×1=8)**

SECTION – B

Answer **any eight** questions. Answer may be in **two** or **three** sentences. **Each** question carries **2** marks.

9. Define COD.
10. What are the different components of the environment ?

P.T.O.

11. What are the major sources of nitrogen oxides ?

12. What are the major sources of radioactive pollution ?

13. What is soil pollution ?

14. What are pandemics ?

15. What are primary air pollutants ? Give an example.

16. What is disaster risk management ?

17. How disasters are classified ? Explain.

18. Differentiate between GIS and GPS.

19. Define disaster mitigation.

20. What are the environmental impacts of natural disasters ? **(8×2=16)**

SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **3** marks.

21. Discuss about Bhopal disaster.

22. Explain eutrophication.

23. Explain greenhouse effect and its consequences.

24. Write a note on remote sensing for disaster management.

25. What is smog ? Distinguish between classical smog and photochemical smog.

26. What are ion selective electrodes ? Explain their working principle.

27. Discuss about the types and effects of urban disasters.

28. Write a note on the consequences of acid rain. **(4×3=12)**

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries **6** marks.

29. A) Give an account on :
    i) Acid rain and its formation.
    ii) Ozone layer depletion and its consequences.

    OR

    B) Give an account on :
    i) Air pollutants and their classification.
    ii) Control of air pollution.

30. A) Discuss about sewage treatment processes.

    OR

    B) Discuss about water quality classification and water quality standards.

31. A) Explain the principle of AAS and X-ray fluorescence spectrometer. Discuss how they can be used to analyse environmental samples.

    OR

    B) Explain the instrumentation of GC. Discuss the application of GC to environmental analysis.

32. A) Discuss about Disaster Management Act and Policy in India.

    OR

    B) What is disaster management cycle ? Explain the various phases of disaster management cycle and their significance. **(4×6=24)**

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K22P 0159

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.) Examination, April 2022
(2018 Admission Onwards)
CHEMISTRY
CHE2E.01 : Environmental Chemistry and Disaster Management

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **one** mark.

1. What is a primary air pollutant ?
2. Define resilience.
3. What is remote sensing ?
4. What are the constituents of photochemical smog ?
5. What is eutrophication ?
6. Name the instrument used to measure cadmium in an effluent sample.
7. Define air pollution.
8. What is disaster management ? **(8×1=8)**

SECTION – B

Answer **any eight** questions. Answer may be **two** or **three** sentences. **Each** question carries **two** marks.

9. Differentiate COD and BOD.
10. What are the consequences of acid rain ?
11. Give two applications of ion selective electrode.
12. Explain soil profile.
13. How can we classify disasters ?
14. What are the components of GIS ?
15. What is the principle behind the working of GC ?

P.T.O.

16. What are the effects of radioactive pollution ?
17. Give two methods to control soil pollution.
18. Write a short note on air quality standards.
19. What is disaster mitigation ?
20. What is Kyoto protocol ? **(8×2=16)**

SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **3** marks.

21. Explain Bhopal gas disaster.
22. What are the steps involved in disaster management cycle ?
23. What are the causes and consequences of ozone layer depletion ?
24. Explain various segments of atmosphere.
25. Briefly explain the features of Disaster Management Act in India.
26. Write short notes on risk management and crisis management.
27. What are the threats of carbon dioxide pollution ?
28. Explain some measures that can be adopted to control thermal pollution.

(4×3=12)

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries **6** marks.

29. Explain the sources and effects of air pollution.

    OR

    Explain the various strategies of disaster management plan in India.

30. Explain the working of AAS with its principle and instrumentation.

    OR

    Discuss sewage treatment processes.

31. Explain the organizational structure in disaster management in India.

    OR

    Explain the toxic effects of pesticides in man and environment.

32. Explain some technologies adopted for disaster management.

    OR

    Discuss the formation and adverse effects of photochemical smog. **(4×6=24)**

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K23P 0463

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.) Examination, April 2023
(2019 Admission Onwards)
CHEMISTRY
CHE2C.07 : Physical Chemistry – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **1** mark :

1. Expand ln (n!), according to Stirling's approximation.
2. What is partition function ?
3. What are bosons ?
4. What do you mean by liquid crystal ?
5. Give one example of non-stoichiometric defects.
6. What will be the magnitude of magnetic field inside a superconductor ?
7. State the Law of Constancy of Interfacial Angles.
8. Write Bragg's equation and explain the terms.

SECTION – B

Answer **any eight** questions. **Each** question carries **2** marks :

9. What is the difference between ortho and para hydrogen ?
10. Why do we need quantum statistics ?
11. What is Einstein's theory of heat capacity ?

P.T.O.

12. Differentiate between micro and macro states in thermodynamics.

13. Write Sackur Tetrode equation and what are its advantages ?

14. What do you understand about mesomorphic state in liquid crystals ? Give examples.

15. What are F centers in an ionic crystal ?

16. Differentiate between intrinsic and extrinsic defects.

17. What do you mean by the Meissner effect ?

18. What is meant by the structure factor ?

19. Differentiate between isomorphism and polymorphism.

20. What are Miller indices ? Compute the Miller indices for a plane intersecting at $x = \frac{1}{4}$, y = 1 and x = 1/2.

SECTION – C

Answer **any four** questions. **Each** question carries **3** marks :

21. Derive Boltzmann distribution law.

22. Compare the heat capacity of gases using classical and quantum theories.

23. Compare Bose-Einstein and Fermi-Dirac statistics.

24. Explain shortly on Communal Entropy.

25. How imperfections of a crystal influence its physical properties ?

26. Write a short note on spinel's and perovskites.

27. Write a short note on different types of crystal lattices.

28. Explain the Debye-Scherer method for X-ray structure analysis.

SECTION – D

Answer **four** questions. **Each** question carries **6** marks :

29. Derive : (i) vibrational partition function (ii) internal energy in terms of the partition function.

OR

Derive : (i) translational and (ii) electronic partition function.

30. Apply Fermi Dirac statistics for electrons gas.

OR

Derive an expression for Bose-Einstein condensate.

31. Explain : (i) Bragg method of crystal analysis (ii) indexing of reflections.

OR

How systematic absences can be used for space-group determination ?

32. Explain briefly on crystal defects.

OR

Explain the electronic structure of solids by using band theory.

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K22P 0157

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.) Examination, April 2022
(2018 Admission Onwards)
CHEMISTRY
CHE2C.06 : Organic Chemistry – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **one** mark.

1. Cycloaddition of tropone to butadiene is an example for a _____ cycloaddition.
2. Reagents for Clemmenson reduction are _____.
3. Nicotine contains pyridine while conine contains _____.
4. Which is symmetry allowed and why : (1, 3) or (1, 7)-H shift ?
5. DNA does not contain the base _____
6. Monomers to synthesize nylon 6,6 are _____.
7. A monoterpene used to prepare borane reagents is _____.
8. Deficiency of Vitamin C causes _____ disease.

SECTION – B

Answer **any eight** questions. Answer may be in **two** or **three** sentences. **Each** question carries **two** marks.

9. Illustrate the formation of the product when ethyl benzoate is treated with (i) DIBAL-H and (ii) LAH.

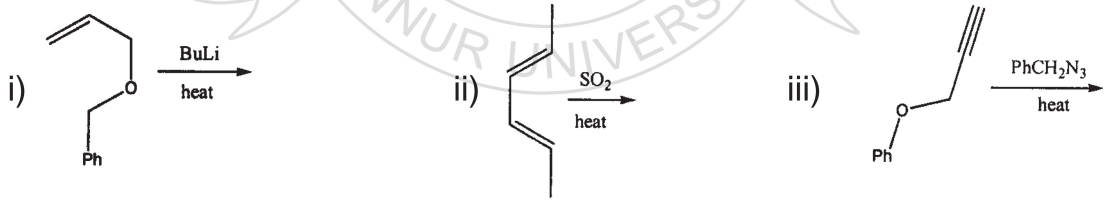
P.T.O.

10. What products are formed when cyclopentadiene undergoes cycloaddition to (i) maleic anhydride and (ii) diethyl acetylene dicarboxylate ?
11. What is the consequence of heating (i) *O*-allyl phenyl ether and (ii) hept-2, 6-diene ?
12. How is cyclopropanone converted to methylene cyclopropane ?
13. How is Boc protecting group introduced in cysteine ? How is it removed ? Illustrate.
14. Illustrate the mechanism for Birch reduction of anisole.
15. Illustrate the mechanism for the conversion of 2-methyl cyclohexanone to 2,6-dimethyl cyclohexanone.
16. Explain the Hofmann and Emde degradation strategies providing an example each.
17. Differentiate between natural and synthetic rubbers.
18. Depict the structure and synthesis of adenosine.
19. Explain briefly what is meant by rubber reinforcement.
20. What are the essential features of flavonoids ? Give example.

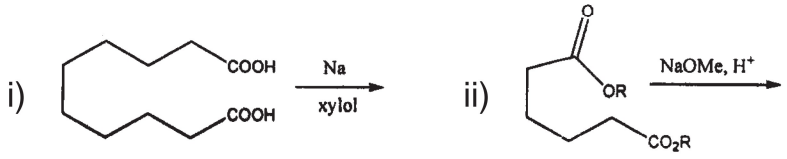
SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **three** marks.

21. Predict the product formed and identify the class of reaction for (i), (ii) and (iii) :



22. Predict the products and illustrate the mechanisms :



23. Illustrate the Wolff Kishner reduction and explain the Huang Milon modification.

24. Singlet oxygen is generated by the Retro Diels Alder reaction of the peroxide P; 9,10-diphenylanthracene is formed as the side product. What is the structure of P ?
25. How are steroids classified ? Give examples.
26. How are polyurethanes synthesized ? What are its applications ?
27. What are the various techniques for processing of plastics ?
28. Differentiate between LDPE and HDPE.

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries **six** marks.

29. A) Explain SPPS.

OR

B) Explain (i) vulcanization and (ii) compounding.

30. A) Explain biosynthesis of monoterpene.

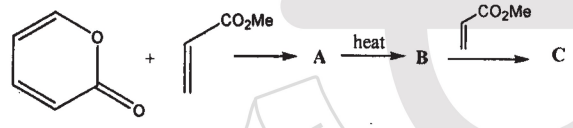
OR

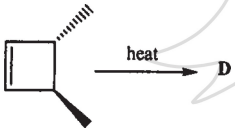
B) Discuss the biosynthesis of cholesterol.

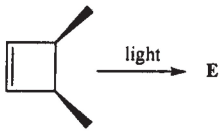
31. A) Explain the orbital correlation diagram for sigmatropic reaction.

OR

B) Identify A-E.

i) 

ii) 

iii) 

32. A) Cinnamaldehyde when reduced using $NaBH_4$ yields X. X reacts with cinnamyl bromide to yield Y which in turn reacts with mCPBA to yield Z. Identify X, Y and Z and illustrate the reaction sequence.

OR

B) Illustrate (i) Peterson olefination, (ii) Barton reaction and (iii) Simmons-Smith reaction.

K23P 0461

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.) Examination, April 2023
(2019 Admission Onwards)
CHEMISTRY
CHE. 2C.05 : Theoretical Chemistry – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **one** mark.

1. What is the resulting point group by combining inversion to C_{3v} point group ?
2. By using the 3 × 3 matrix prove that C_2 rotation axis is its own inverse.
3. Find out the point group of
   a) Ethane (eclipsed)
   b) $CH_2 = C = C = CH_2$.
4. What is the difference between the rigid and non-rigid rotator model ?
5. What are the two different types of selection rules in spectroscopy ?
6. Which region of electromagnetic spectrum is used in NMR spectroscopy ?
7. What are the different factors that contribute to the intensity of spectral lines ?
8. Define normal mode of vibration. **(8×1=8)**

P.T.O.

SECTION – B

Answer **any eight** questions. Answer may be in **two** or **three** sentences. **Each** question carries **two** marks.

9. What are Abelian groups ? Give an example.

10. Define cyclic group. Give an example.

11. By using the 3×3 matrix for C_n and C_n^{-1} prove $C_n \times C_n^{-1} = E$ (identity operation).

12. Explain the reason for applying the external magnetic field in magnetic resonance spectroscopy.

13. In a given organic compound two kinds of protons exhibit signals at 50 Hz, 200 Hz using a 60 MHz instrument. What will be their relative position using 90 MHz instrument ? Also convert the position of signals into delta scale.

14. Sketch the vibrational modes of H_2O molecule.

15. Explain the relevance of Heisenberg's uncertainty principle in predicting the line width of spectrum.

16. How many NMR energy levels are possible for nucleus with a spin I=3/2 ?

17. Show that all cyclic groups are abelian.

18. How IR spectroscopy is used in identifying the nitro and cyano groups ?

19. What are overtone bands in IR spectrum ?

20. How do you calculate the fundamental vibrational modes of poly atomic molecules ? **(8×2=16)**

SECTION – C

Answer **any four** questions. **Each** question carries **three** marks.

21. Explain Predissociation.

22. The rotational spectrum of $^{79}Br^{19}F$ shows a series of equidistant lines separated by 0.71433 cm^{-1}. Calculate the rotational constant, moment of inertia and Br-F bond length.

23. Discuss the classical theory of Raman effect.

24. Explain the rule of mutual exclusion principle. Rationalize this using group theory.

25. Write down the group multiplication table for C_{3v} point group.

26. Taking the Px orbital on each carbon atom of the Cis- butadiene generate a reducible representation and reduce it.

27. Generate a 3×3 matrix for C_3 and S_4 rotation axis.

28. Explain the difficulties involved in recording ^{13}C NMR spectra. **(4×3=12)**

SECTION – D

Essay type questions. Answer **any four** questions. **Each** question carries **6** marks.

29. A) Find out the IR and Raman active vibrational modes of H_2O using group theory.

OR

B) Using group theory, explain the MO diagram of water molecule.

30. A) Explain the different types of measurement techniques in NMR spectroscopy.

OR

B) Explain the different types of electronic transitions in molecules and Fortrat diagram.

31. A) How microwave spectroscopy can be used in determining the bond length of linear diatomic molecules.

OR

B) How IR and Raman spectroscopies can be used in determining the structure of molecules ?

32. A) State and explain Great Orthogonality Theorem. Using this derive the C_{3v} character table.

OR

B) Generate a 3×3 matrix for C_n and C_n^{-1} rotation axis using x, y, z co-ordinates of point in three dimensional space. **(4×6=24)**

Character table for C_{2v} point group

	E	**$C_2(z)$**	**$\sigma_v(xz)$**	**$\sigma_v(yz)$**	**Linear, rotations**	**Quadratic**
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	–1	–1	R_z	xy
B_1	1	–1	1	–1	x, R_y	xz
B_2	1	–1	–1	1	y, R_x	yz