



K21P 0747

Reg. No. :

Name :

II Semester M.Sc. Degree (CBSS – Reg./Suppl. (Including Mercy Chance)/Imp.)
Examination, April 2021
(2014 Admission Onwards)

CHEMISTRY
CHE2C.07 : Physical Chemistry – II

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **all** questions. **Each** question carries **one** mark.


1. Calculate the heat capacity of CO_2 using equipartition of energy.
2. Define partition function. What is its significance ?
3. What are super cooled liquids ? What are their uses ?
4. Define thermionic emission.
5. What are perovskites ?
6. Calculate the spin only magnetic moment of a octahedral complex $[\text{Fe}(\text{CN})_6]^{4-}$.
7. Define space lattice.
8. What is the probable lattice type of crystalline material which give 100, 110, 111, 200, 210 XRD reflections ?
(8×1=8)

SECTION – B

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

9. Find out the number of distributing 20 particles when the number of particles in E_1, E_2, E_3, E_4 and E_5 energy levels are 4, 4, 6, 3 and 3 respectively. Assume particles to be distinguishable.

P.T.O.

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10. Electronic energy does not contribute towards internal energy. Why ?
 11. Distinguish between ortho hydrogen and para hydrogen. Write down the expression for specific heat capacity of hydrogen showing their contribution.
 12. Differentiate between Fermions and Bosons with suitable examples.
 13. Distinguish between twisted nematics and chiral nematics in liquid crystals.
 14. Write a brief account on Bose-Einstein condensation.
 15. What are phonons ? Explain their significance in thermal conductivity of solids.
 16. What are superionic conductors ? Give two examples.
 17. Which types of solids exhibit para magnetism ? What is the unit of magnetic moment ?
 18. Silicon has a face-centered cubic structure with two atoms per lattice point, just like diamond. At 25°C , $a = 543.1 \text{ pm}$. What is the density of the silicon ?
 19. Explain the Miller indices with an example.
 20. The value of 'n' in Bragg's law is always sets equal to 1. What happens to the higher order diffraction peaks ?

(8×2=16)

SECTION – C

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

21. Find the temperature at which 10% of the molecules will be in the first excited state, if it is 400 kJ/mol above the ground state. Both states are non-degenerate.
22. Calculate the translational partition function for one mole of O_2 at one atm and 25°C assuming the gas behaves ideally.
23. Exemplify the X-ray diffraction study of simple liquids.
24. Illustrate briefly the results of Einstein theory of atomic crystal and Debye's modification to it (Derivations not needed).
25. Write an account on Hall effect.
26. Explain the terms Peizelectricity and Ferroelectricity with suitable examples.
27. Discuss about polymorphism observed in crystals.
28. 'Each crystalline solid gives a characteristic X-ray powder diffraction pattern which may be used as a fingerprint for its identification.' Discuss the validity of this statement taking example of NaCl and NaF powder patterns.

(4×3=12)



SECTION – D

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

29. A) Deduce Maxwell-Boltzmann distribution law.

OR

B) Derive an expression for the rotational contribution to the total energy of an ideal gas in terms of partition function.

30. A) Discuss about the various phases observed in thermotropic liquid crystals.

OR

B) Write a detailed account on free electron fermi gas in solids.

31. A) Explain Meissner effect. Based on this distinguish and classify various examples of Type I and Type II superconductors.

OR

B) Account for the various types of imperfection in solids. List the techniques in creating these imperfections.

32. A) Explain the X-ray diffraction techniques in the characterization of solids.

OR

B) Discuss the importance of structure factor in X-ray diffraction technique.

(4×6=24)



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II Semester M.Sc. Degree (CBSS – Reg./Suppl. (Including Mercy Chance)/Imp.)
Examination, April 2021
(2014 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. Define the reciprocal of an element in a group.
2. What is a subgroup ?
3. What is the Mulliken symbol for one dimensional representation ?
4. What is the result of product $C2(x)C2(y)$?
5. Which of the following diatomic molecules don't absorb in the IR region ?
HCl, ClBr, N_2 , H_2 , O_2 .
6. Which of the following vibrational transitions will be observed for a diatomic molecule (treated as harmonic oscillator) ?
 $v = 1$ to $v = 3$; $v = 2$ to $v = 3$; $v = 5$ to $v = 4$.
7. Mention any two nuclei having half integer spin.
8. Write down the approximate chemical shift value of aldehyde proton. **(8×1=8)**

SECTION – B

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

9. Define similarity transformation.
10. Prove that if element, A is conjugate with B, then B is conjugate with A.
11. Distinguish between horizontal and vertical plane with diagrams.

P.T.O.

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12. What is called an irreducible representation ?
13. Differentiate between operator E and Mulliken symbol E.
14. Explain with example D_{2h} point group.
15. What information about the molecular geometry of N₂O can be determined from knowing that a pure rotational absorption spectrum is observed for this molecule ?
16. Explain the significance of transition moment integral.
17. Calculate the wave number of IR radiation whose wave length is 2 μ m.
18. State the significance of Franck-Condon principle.
19. Why a reference standard is needed in NMR spectroscopy ? Give one example.
20. What is chemical shift ?

(8x2=16)

SECTION - C

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

21. Prove that in any Abelian group, each element is in a class by itself.
22. Derive the matrix representation of symmetry operations, proper rotation and improper rotation.
23. State and explain Great Orthogonality Theorem.
24. Write down the C_{2v} character table and reduce the following C_{2v} representations :

C _{2v}	E	C ₂	$\sigma(XZ)$	$\sigma(YZ)$
Γ_1	3	-1	1	1
Γ_2	2	0	0	2

25. Discuss the vibrational coarse structure or progressions.
26. Describe quantum theory of Raman spectra.
27. Illustrate dissociation and predissociation with diagrams.
28. Explain the spin-spin coupling involved in the NMR spectra of AMX type molecule.

(4x3=12)

SECTION - D

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

29. A) i) Assign the point groups to following molecules and justify : N_2 , CO , NH_3 , BF_3 .

ii) Explain with examples improper axis and improper rotation. What are the different kinds of operations generated by S_n ($n = \text{odd and even}$) operation ?

OR

B) Construct the reducible representation for SO_2 molecule from the Cartesian coordinates of atoms.

30. A) Derive the character table for C_{2h} .

OR

B) Determine the hybridization in BF_3 using the D_{3h} character table given below.

31. A) Compare and contrast IR and Raman spectroscopy.

OR

B) Explain in detail various factors that influence the intensity of spectral lines.

32. A) Explain shielding effects in NMR spectrum.

OR

B) What is Fortrat Parabola ? Obtain the expression for the band head in terms of B' and B'' .

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
$A_{1'}$	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_{2'}$	1	1	-1	1	1	-1	R_z	
E'	2	-1	0	2	-1	0	(x, y)	$(x^2 - y^2, xy)$
$A_{1''}$	1	1	1	-1	-1	-1		
$A_{2''}$	1	1	-1	-1	-1	1	z	
E''	2	-1	0	-2	1	0	(R_x, R_y)	(xz, yz)

(4×6=24)

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**II Semester M.Sc. Degree (CBSS-Reg./Suppl. (Including Mercy Chance)/
Imp.) Examination, April 2021
(2014 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. Illustrate the Diels-Alder reaction of cyclopentadiene and fumaric acid.
2. Depict one example of a (3, 3) sigmatropic rearrangement reaction.
3. How does the Wolff-Kishner reduction take place ?
4. Suggest reagents to convert acetone to 2-methyl but-2-ene.
5. Give the structure and importance of quinine.
6. Give an example for a triterpene molecule.
7. Teflon and PAN have industrial importance. What are their structures ?
8. Give an example for a synthetic rubber.

(8×1=8)**SECTION – B**

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

9. Illustrate the consequence of secondary orbital interaction.
10. Depict the HOMO and LUMO of the hexatriene molecule.

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11. Con-rotation leads to inversion. Justify the statement with suitable illustration.
 12. What is McMurry coupling. Illustrate an example.
 13. Give two applications of Gilman reagent.
 14. Compare the reaction conditions for Oppenauer oxidation and MPV reduction.
 15. Give an example each for a normal steroid and an allo steroid.
 16. Differentiate penicillin from cephalosporin structurally.
 17. What are the structural features of a flavanoid molecule ? Give examples.
 18. What are fillers ? Why are they used in rubber industry ? Give example.
 19. Give the structures of any two Vitamin B complexes.
 20. Explain the vision process.

(8×2=16)

SECTION – C

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

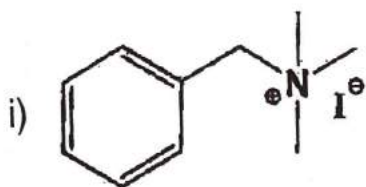
21. Predict the products formed when the following molecules are heated
 - i) (2Z, 4E)- hexadiene and
 - ii) (2Z, 4Z, 6E)- octatriene.
22. Depict the cycloaddition of furan with dimethyl acetylenedicarboxylate.
23. Illustrate the Woodward and Prevost hydroxylations.
24. Explain the Birch reduction of anisole.
25. Explain the most important steps in the structure elucidation of cholesterol.
26. What are the chief steps in the biosynthesis of camphor ?
27. How are polyurethanes and caprolactams synthesized ?
28. Give a synthetic route for adenine and quanine.

(4×3=12)

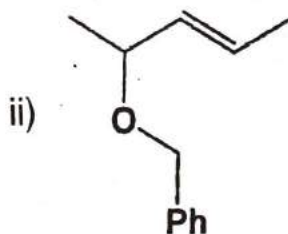
SECTION – D

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

29. A) Predict the products formed when the following compounds are treated with a base.



OR



B) Illustrate the Click reactions between azides and acetylenes. Give four more examples of such 1,3-dipolar cycloadditions.

30. A) Illustrate Sharpless asymmetric epoxidation and Barton reaction.

OR

B) Give the schematic representation to depict the application of

i) SeO_2

ii) NaCNBH_3

iii) mCPBA and

iv) DIBAL-H

31. A) Explain the biosynthesis of papaverine.

OR

B) Discuss the biosynthesis of pinenes.

32. A) Describe the role of protecting groups in peptide synthesis.

OR

B) Discuss the structure and synthesis of ascorbic acid.

(4×6=24)

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Imp.) Examination, April 2021
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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 an epidemic ?
2. What are greenhouse gases ?
3. Define a xenobiotic.
4. What is los angeles smog ?
5. Write any two uses of biofilms.
6. What is non-point source of pollution ?
7. Define black carbon.
8. What is GIPs ?

(8×1=8)

SECTION – B

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

9. What is an aquifer ?
10. Define oxygen demanding waste.



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- 11. What are secondary air pollutant ?
- 12. What are water-borne diseases ?
- 13. Define biomagnification.
- 14. What is high volume air samples ?
- 15. Define nuclear fission.
- 16. Composition of storm water.
- 17. Define activated sludge.
- 18. What are air pollution indicators ?
- 19. What is photochemical smog ?
- 20. Define risk analysis.

(8x2=16)

SECTION – C

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

- 21. Describe the process of soil formation.
- 22. Illustrate the vertical stratification of atmosphere.
- 23. What is oxygen sag curve ?
- 24. Comment on risk management act and policy in India.
- 25. Classify the different pesticides based on their chemical properties.
- 26. What are the climatic factors that triggered Bhopal gas tragedy ?
- 27. What are tertiary waste water treatment methods ?
- 28. Describe any two detectors of gas chromatography.

(4x3=12)

SECTION – D

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

29. A) Describe the process of preparedness, planning and development of risk reduction plan with reference to Tsunami.

OR

B) Describe the causes and effect of eutrophication.

30. A) Explain the sources of pollution in soil and their control measures.

OR

B) Explain the methods for control of air pollution in industries.

31. A) Describe the principle, instrumentation and environmental applications of AAS.

OR

B) What are the sources and effects of radioactive pollution ?

32. A) Explain the climate changed induced disasters and mitigatory measures.

OR

B) Describe the applications of remote sensing and GIS in disaster prediction and management.

(4×6=24)
