



K22P 0158

Reg. No. :

Name :

II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.)
Examination, April 2022
(2018 Admission Onwards)

CHEMISTRY
CHE2C.07 : Physical Chemistry – II

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer all questions. Each question carries 1 mark.

(8×1=8)

1. What is thermodynamic probability ?
2. Ortho-para ratio of molecular Hydrogen at ordinary temperature is 3 : 1. Justify the statement.
3. What are ensembles ?
4. Mention two applications of liquid crystals.
5. The intercepts with x, y and z axes are given as $\frac{1}{2}$, 1 and $\frac{3}{4}$, find out the corresponding Miller indices for the same.
6. What is antiferromagnetism ?
7. Write the general chemical formula of spinels.
8. What do you mean by 'k space' ?

P.T.O.

SECTION – B

Answer **eight** questions. Answers may be in 2 or 3 sentences. Each question carries 2 marks. (8×2=16)

9. What is residual entropy ?
10. Write a note on thermal de-Broglie wavelength.
11. What are nematic liquid crystals ?
12. Differentiate between bosons and fermions.
13. Hydrogen behaves as a monoatomic gas at low temperatures. Why ?
14. Differentiate plane and point defects in crystals.
15. Which type of imperfections imparts colour to compounds and give reasons for the phenomenon ?
16. Comment about the 'systematic absences' in X ray crystallography.
17. At what angle would the first order diffraction be observed in X ray diffraction of a set of crystal planes for which 'd' is 2.04×10^{-10} m, if the X rays used have a wavelength of 1.54×10^{-10} m ?
18. Some crystal defects show lowering of crystal density while others show no change at all. Why ?
19. Why only 14 Bravais lattices are possible in crystal structures ?
20. In CO, spacing between excited rotational states is $0.025 \text{ kJ mol}^{-1}$. If the degeneracy of the first excited state is 3, calculate the fraction of molecules in the first excited state at room temperature.

SECTION – C

Answer **four** questions **each** in a paragraph. **Each** question carries 3 marks. (4×3=12)

21. Derive Sackur-Tetrode equation.
22. Calculate the translational partition function of a molecule of Oxygen gas at 298 K moving in a vessel of volume 24.4 dm^3 .
23. Using the Sackur-Tetrode equation, calculate the translational entropy of argon gas at 298 K and $1.013 \times 10^5 \text{ Nm}^{-2}$ pressure. The atomic weight of argon in g mol^{-1} is 39.95.
24. Calculate the no. of ways of distributing distinguishable molecules a, b, c between three energy levels so as to obtain the following set of occupation number $N_0 = 1, N_1 = 1, N_2 = 1$. Also write the different configuration.
25. Show that 5-fold axis of symmetry is absent in solids.
26. Explain the principle of structure elucidation using X ray crystallography.
27. Explain the 'BCS' theory of super conductivity.
28. What is Hall effect and list some of its applications.

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries 6 marks. (4×6=24)

29. A) Derive Bose-Einstein statistics .

OR

- B) Write a note on theories of liquid state.



30. A) Apply Fermi-Dirac statistics to understand thermionic emission.

OR

B) a) Calculate the translational partition function for benzene in a volume of 1m^3 at 25°C .

b) Calculate rotational partition function for F_2 at 25°C .

Given $I = 32.5 \times 10^{-47} \text{ kg m}^2$.

31. A) Explain the Debye Sherrer method for the structure elucidation of crystals.

OR

B) Write a note on the different crystal defects and its effects on the properties of the compounds.

32. A) Discuss briefly electrical properties of semiconductors.

OR

B) Explain the terms :

a) piezoelectricity and ferro electricity and

b) isomorphism and polymorphism.





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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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II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.) Examination, April 2022
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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 $6 \times 10^{13} \text{ Hz}$ 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, $B = 253.771 \text{ GHz}$ and $\nu_0 = 79.414 \text{ THz}$. 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

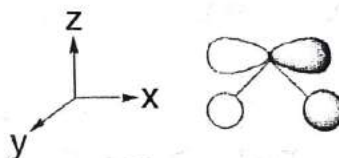
- B) Construct the character table for C_{2h} .

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	$2S_3$	$3\sigma_v$		
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)

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.

(4x6=24)

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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.

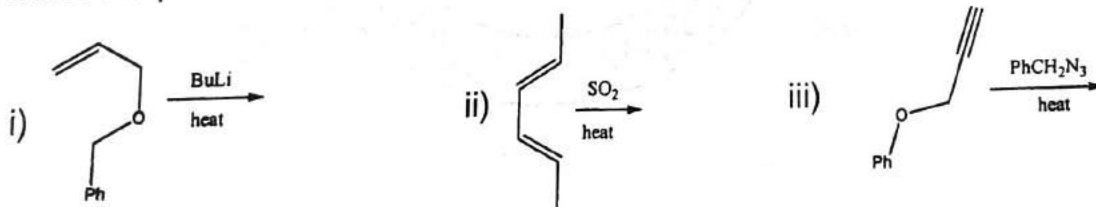
P.T.O.

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.

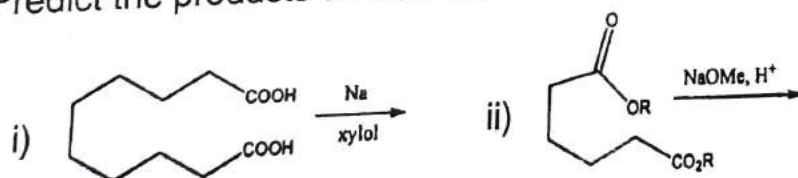
SECTION – C

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.



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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.

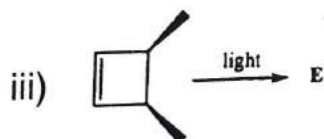
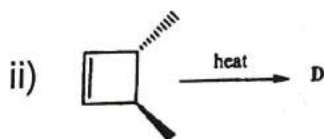
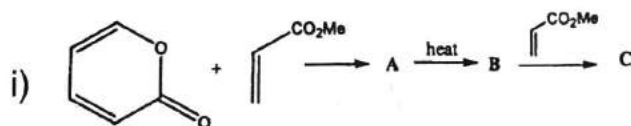
OR

- B) Discuss the biosynthesis of cholesterol.

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

OR

- B) Identify A-E.



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.



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Max. Marks : 60

SECTION – A

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

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2. Define resilience.
3. What is remote sensing ?
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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.

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SECTION – C

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

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