Enrolment No.: .....

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School of Chemical and Life Sciences (SCLS)
M. Sc. Chemistry, III Semester
End-term Examination 2023

Paper Name: Photochemistry and Pericyclic reaction **Paper Code: MCHCCO-303**
Time: 3 hours **Maximum Marks: 75**

Note: This paper has 3 sections A, B, and C, attempt all three sections; ***Section A:*** *Answer* ***all*** *the questions;* ***Section B:*** *Answer* ***any 2 out of 4;*** ***Section C:*** *Answer* ***all*** *the questions, each question has an* ***internal choice***

Abbreviations Used
CLO- Course Learning Outcome, PLO- Program learning Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create

SECTION- A

Attempt ***all*** questions **(10*2= 20 Marks)**

A 1.	What type of following electrocyclic reaction will a molecule with an even number of π-bonds undergo? a. Conrotatory thermal b. Conrotatory photochemical c. Disrotatory thermal d. Disrotatory photochemical	1/2	1-3	1-3
A 2.	Which of the following molecule can act as a photosensitizer? a. Benzophenone b. Acetophenone c. Benzene d. All of the above	1/2	1-3	1-3
A 3.	Define photo quenching.	1/2	1-3	1-3
A 4.	State Second law of photochemistry	1/2	1-3	1-3
A 5.	What is a cheletropic reaction? Give an example.	1/2	1-3	1-3
A 6.	Giving an example to show how [4+2]- cycloaddition occurs in dipolar compounds	1/2	1-3	1-3
A 7.	Define the Quantum yield of a photochemical reaction	3/4	4-5	4-5
A 8.	Give one photochemical reaction, each of the Diazo compounds and Azides	1/2	1-3	1-3
A 9.	α,β-Unsaturated ketones with γ hydrogens can undergo hydrogen atom transfer resulting in formation of a dienol, how the mechanism	1/2	1-3	1-3
A 10.	What is Flash Photolysis?	3/4	4-5	4-5

SECTION- B

Attempt ***any two*** out of the following four questions **(2*10=20 Marks)**

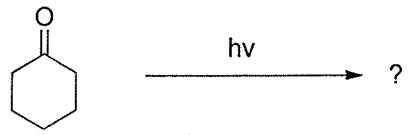
B 1. With the help of FMO method, explain the stereochemistry of [3,3] sigma tropic rearrangements under thermal and photochemical conditions 3/4 4-5 4-5

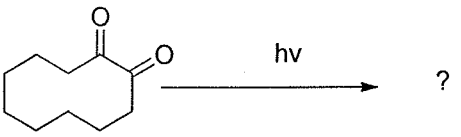
B 2. Explain the photochemical rearrangement of 4,4-diphenylcyclohexenone. 5/6 6-7 6-7

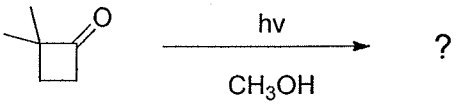
B 3. a. Photoreduction of benzophenone with diphenyl methanol involves a quantum yield of 1 compared to that of 2-propanol which has a quantum yield of 2. Explain. 5/6 6-7 6-7

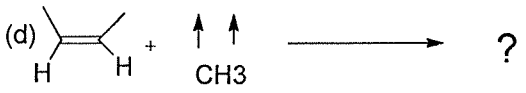
b. Why is the photoreduction of benzophenone derivatives greatly diminished when an ortho alkyl substituent is present? 5/6 6-7 6-7

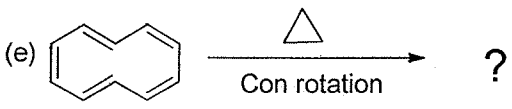
B 4. Complete the following photochemical reactions: 3/4 4-5 4-5

(a) 

(b) 

(c) 

(d) 

(e) 

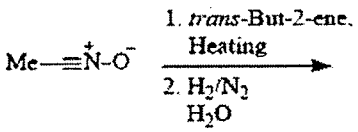
SECTION C

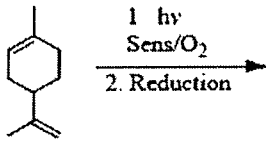
Attempt ***all*** questions, each question has an *internal choice* (7x5=35 Marks)

C 1. How does the percent transmittance of a solution vary with (a) increasing concentration and (b) increasing path length? A solution of thickness 2 cm transmitted 40% incident light. Calculate the concentration of solution given that $\varepsilon = 6000\ dm^3mol^{-1}\ cm^{-1}$ 3/4 4-5 4-5

OR

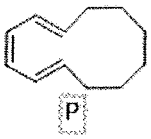
Give the product(s) and support your arguments with suitable mechanisms 5/6 6-7 6-7

i) 

ii) 

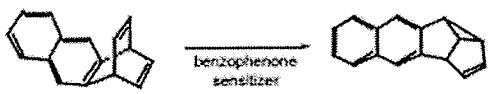
C 2. a) What product is formed when triene P undergoes thermal electrocyclic ring closure? 5/6 6-7 6-7

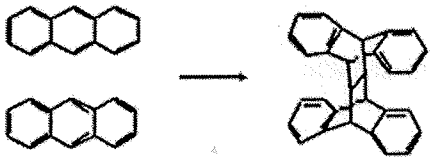
b) What product is formed when triene P undergoes photochemical ring closure? Label each process as conrotatory or disrotatory.



OR

Explain the formation with the mechanism. 5/6 6-7 6-7

i) 

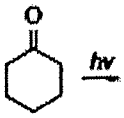
ii) 

C 3. Answer the following question for π-molecular orbitals of 1,3,5-hexatriene, 5/2 6-7 6-7

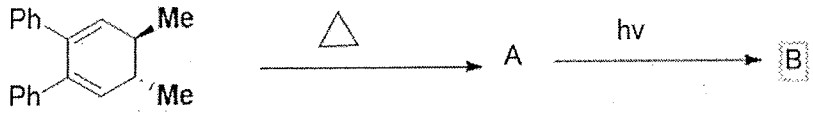
i. Which are the bonding orbitals and antibonding orbitals?
ii. Which orbitals are HOMO and LUMO in the ground state and excited state?
iii. Which orbitals are symmetric and asymmetric with respect to the mirror plane and C2 axis?

OR

Give all possible products with the mechanism 5/6 6-7 6-7



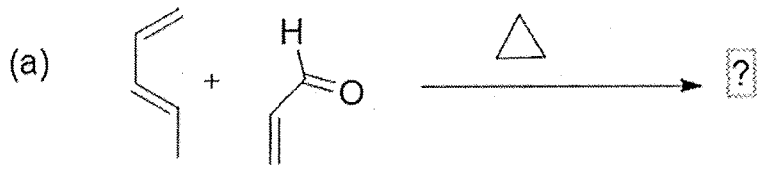
C 4. Identify A and B in the following reaction sequence. Label each process as conrotatory or disrotatory. 3/4 4-5 4-5

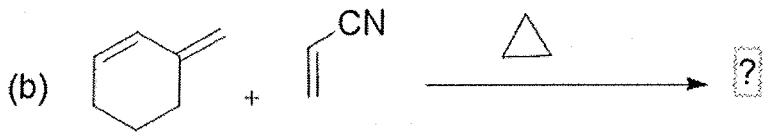


OR

Explain how indoles are synthesized from ortho-iodo aniline using a photochemical route. 5/6 6-7 6-7

C 5. Predict the product of the following reactions with the stereochemistry 3/4 4-5 4-5





OR

Can trans-stilbene be converted to phenanthrene through photo cyclization reactions? If so, explain how. 5/6 6-7 6-7

C 6. Explain the following: 3/4 4-5 4-5

a. Cope rearrangement.
b. Claisen rearrangement.

OR

Support the formation of product(s) by a suitable mechanism at each step of the reaction. 5/6 6-7 6-7

i)

ii)

C 7. What is the dominant photochemical reaction of Dibenzyl ketone in the gas phase 5/6 6-7 6-7

OR

Explain the formation of PAN (peroxyacetylnitrate) in the environment 3/4 4-5 4-5
