



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY, JABI - ABUJA.**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE AND APPLIED SCIENCE**  
**OCTOBER/NOVEMBER 2019, SECOND SEMESTER EXAMINATION**

**COURSE CODE:** CHM 414  
**COURSE TITLE:** PHOTOCHEMISTRY AND PERICYCLIC REACTIONS  
**COURSE UNIT:** 2  
**TIME:** 2 HOURS  
**INSTRUCTION:** Question one is compulsory. Answer question one and any other three questions.

**QUESTION ONE**

- 1ai. What happens when X-rays, high-energy gamma rays and near infrared interact with matter? 6marks
- 1a.ii. Distinguish between X-rays and gamma rays. 4 marks
- 1bi. List four (4) possible reactions that an electronically excited species may undergo. 2 marks
- 1b.ii. Differentiate between (i) concerted and stepwise processes (ii) synchronous and asynchronous systems. 4 marks
- 1c. Explain the following characteristics of LASER
- i. Monochromaticity 3 marks
  - ii. Directionality 3 marks
  - iii. Coherence 3 marks

**QUESTION TWO**

- 2ai. What do you understand by the term selection rule in photochemistry? 2 marks
- 2a.ii. Describe the following selection rules:
- i. La Porte selection rule 2 marks
  - ii. Spin selection rule 2 marks
  - iii. Orbital Overlap selection rule 2 marks
- 2bi. What is quantum yield ? 2 marks
- 2b.ii. Calculate the number of photons emitted by a 200 W yellow lamp in 1.0 s. Take the wavelength of yellow light as 560 nm and assume 100 % efficiency. 5 marks

**QUESTION THREE**

- 3a. State the Franck-Condon Principle. 2 marks

- 3b. Write short notes on the following:
- i. Internal conversion 3 marks
  - ii. Photosensitization 2 marks
  - iii. Fluorescence 2 marks
  - iv. Intersystem crossing 2 marks
- 3c. List any two (2) Characteristics of pericyclic reactions. 4 marks

#### QUESTION FOUR

- 4a. Discuss briefly the processes involved in a photochemical reaction. 9 marks
- 4b. State three (3) applications of LASER. 3 marks
- 4c. Describe any one intramolecular pericyclic reaction. 3 marks

#### QUESTION FIVE

- 5a. Classify cycloaddition reactions according to the number of pi electrons that interact in the reaction. 6 marks
- 5b. Explain sigmatropic rearrangements, giving at least two examples. 5 marks
- 5c Describe stimulated emission with the aid of a diagram. 4 marks