



**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**  
**FIRST SEMESTER EXAMINATION 2020\_1**

**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**

- 1a. List the different types of electromagnetic radiations in increasing order of energy. (5 mks)
- 1b. Give four areas of application of photochemistry in everyday life. (4 mks)
- 1c. What do you understand by the term 'photosensitization'? (4 mks)
- 1d. Draw and label a diagram that illustrates the four elements of a laser. (4 mks)
- 1e. State any FOUR features of a photochemical reaction (4 mks)
- 1f. State the Woodward-Hoffmann's rule for pericyclic reactions (4 mks)

**QUESTION TWO**

- 2a. State the portion of the electromagnetic spectrum associated with each of the following molecular processes: (i) molecular electronic transition (ii) molecular rotation (iii) ejection of core electrons (iv) molecular vibrations (v) Nuclear dissociation. (7½ marks)
- 2b. (i) Determine the wavelength (in meters) of photons whose energy is 92.0 kJ/mol. (7½ marks)

**QUESTION THREE**

- 3a. State and explain the Franck-Condon principle; use appropriate diagrams to illustrate. (9mks)
- 3b. Discuss how light absorption can be used to probe the dynamics of atoms and molecules. (6 mks)

**QUESTION FOUR**

4a. The change in fluorescence intensity (I) of a zinc(II) phthalocyanine derivative varies with the concentration of benzoquinone (BQ) quencher in DMF is as follows:

[BQ]/M	0	0.0028	0.0056	0.0084	0.0112
I	324.5	280.78	263.2	240.2	224.6

Given that the fluorescence lifetime of the zinc(II) phthalocyanine derivative in DMF is 4.10 ns, determine the bimolecular rate constant. 15 mks

**QUESTION FIVE**

- 5ai. State FOUR characteristics of pericyclic reactions. 4 mks
- 5a.iii. List SIX types of pericyclic reactions. 6 mks
- 5b. Distinguish between concerted and stepwise processes. 5 mks