



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI – ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2025_1 EXAMINATION

COURSE CODE: CHM 414

COURSE TITLE: PHOTOCHEMISTRY AND PERICYCLIC REACTIONS

COURSE UNIT: 2

INSTRUCTION: Answer question one (1) and any other two questions

Time: 2 hours

1. (a).i. Mention **FOUR (4)** regions of the electromagnetic spectrum (radiations) and the kind of impact each has on atomic structure – **4 Marks**.

(ii). Arrange the **FOUR (4)** radiations mentioned in 1(a). i. above in order of increasing energy – **4 Marks**

(b). Briefly discuss the particulate nature of light and its importance – **3 Marks**.

(c). (i). State **TWO (2)** importance of photochemistry in our everyday life – **2 Marks**.

(ii). State the 2nd Law of photochemistry highlighting its significance in photochemistry – **2 Marks**.

(d). Using suitable example, describe Electrocyclic reactions – **6 Marks**.

(e). Using a carbonyl as example, explain the Orbital Overlap Selection Rule – **4 Marks**.

(f). State **FIVE (5)** features of pericyclic reactions. – **5 Marks**.

2. (a). State why ultraviolet light is preferred to visible light for reactions involving the dissociation of relatively strong bonds such as double oxygen (O=O) and the double C=O bond in carbon dioxide – **4 Marks**.

(b). Using suitable equations, enumerate any **THREE (3)** reaction pathways of a photochemical reaction – **6 Marks**.

(c). (i). State the Franck-Condon Principle – **2 Marks**.

(ii). Use suitable equation to explain what is photodissociation – **4 Marks**.

(d). Explain how coordination compounds undergo photochemical reactions. Write one equation to support your answer. – **4 Marks**.

3 (a). Highlight **FOUR (4)** features of a photochemical reaction – **4 Marks**.

(b). (i). Describe Stoke's shift and explain what happens to the wavelength after the shift – **4 Marks**.

(ii). State **THREE (3)** factors that determine the outcome of a Photochemical Reaction – **3 Marks**.

(c). What is quantum yield and how does its value vary? – **5 Marks**.

(d). List the apparatuses required to set up an experiment to study photochemical reactions – **4 marks**.

4 (a). State **TWO (2)** examples of secondary photochemical processes – **4 Marks**.

(b). Using a suitable equation only, show a photohydration reaction where Uracil can add a molecule of water to its 5-6 double bond when UV irradiated – **4 Marks**.

(c). Describe the following acronyms (i) FMO (ii) SOMO (iii) NBMO – **6 Marks**.

(d). Highlight any **THREE (3)** characteristics of LASERS – **6 Marks**.

5 (a). In a tabular form, differentiate between cycloaddition and group transfer reactions. – **4 Marks**.

(b). Explain why ruthenium (II) complex show a red-orange colour upon absorption of visible light whereas TiO₂ is white even in the UV region. – **7 Marks**.

(c). Highlight any **FIVE (5)** applications of laser that is related to industry – **5 Marks**.

(d). State the Woodward-Hoffmann rules for predicting pericyclic reactions – **4 Marks**.