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 2021 1234

COURSE CODE: **CHM414**
COURSE TITLE: **PHOTOCHEMISTRY AND PERICYCLIC REACTIONS**
TIME: **2 HOURS**
INSTRUCTION: **Question one is compulsory. Answer question one and any other three questions.**

QUESTION ONE

1(a)(i) What is photochemistry? (2 marks)

(ii) What is electromagnetic spectrum and electromagnetic spectrum of object (2 marks)

(iii) State the three parameters that describe electromagnetic wave and discuss the relationship between them and with energy. Write three equations to support your answer. Which radiation has the least and highest energy (7 marks)

(b)(i) Define quantum yield and state its significant in photochemistry. Also present a mathematical expression for quantum yield (5 marks)

(ii) Calculate the number of photons emitted by a 1000 W yellow lamp in 1.0 s if the wavelength of the lamp is 580 nm (assume 100 % efficiency) ($h = 6.626 \times 10^{-34}$ j.s and $c = 3.0 \times 10^{8}$ m/s)

(9 marks)

QUESTION TWO

2(a)(i) State the two major field that make up light (1 mark)

(ii) State the conditions required before molecules can absorbed light hence write an equation that related the transition motion frequency with other frequencies. What is the practical application of this equation (6 marks)

(b) State four differences between thermal and photochemical reactions (8 marks)

QUESTION THREE

3(a)(i) State Grotthus-Draper and Stark Einstein laws of photochemistry (2 marks)

(ii) What is the significant of the two laws stated in (i) above (4 marks)

(iii) Discuss the photochemical reaction pathway from absorption of light, development of electronic excited states and the formation of products (3 marks)

b(i) Discuss the destructive effect of some photchemical reactions and justify why medical bottles are often made colour. Highlight the pervasive reaction responsible for the generation of the destructive reaction and give example (4 marks)

(ii) What is the usefulness of singlet oxygen in medicine (1 mark)

(iii) State one material whose photodegradation can cause environmental nuisance (1 mark)

QUESTION FOUR

4. Apart from intra molecular energy transfer, highlight (with suitable equation for each) the different steps an electronically excited molecules can assume in order to release its energy (9 marks)

b (i) How is photosynthesis and biolumiscence initiated and what is their significance (4 marks)

(ii) State the usefulness of photochemistry in polymerization and in vision (2 marks)

QUESTION FIVE

5(a) What is selection rule and its general features including possibility of transition into forbidden zone (2 marks)

(ii) What is the fundamental condition for absorption with respect to the incoming energy and how does the selection rule account for this (2 marks)

b. In not more than two sentences for each highlight the major features of the following selection rules

(i) Spin selection rule (3 marks)

(ii) LaPorte selection rule (2 marks)

(iii) Frank-Condonn selection rule (3 marks)

(iv) Orbital overlap selection rule (3 marks)