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
**SECOND SEMESTER EXAMINATION 2021_2**$_{45678}$

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

a(i)   Define the term radiative lifetime and write a mathematical expression for it. Can this lifetime

be consider to be the actual lifetime of the excited state? Give reason   (3 marks)

(ii)   What is population inversion   (1 mark)

(b) Present the consequence of interaction of the following radiation with matter

(i)	Radio wave	(2 marks)
(ii)	UV	(2 marks)
(iii)	Visible	(2 marks)
(iv)	X-ray	(2 marks)
(v)	Gamma ray	(2 marks)
(vi)	High energy gamma ray	(2 marks)

(c)(i)   Differentiate between gamma ray and X-ray   (3 marks)

(ii)   State which of the electromagnetic wave can be received by antenna   (1 mark)

1

(1d) Balance the following photochemical reaction   (5 marks)
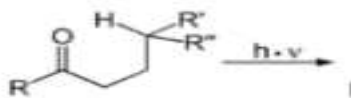
QUESTION TWO

2a.   Discuss the roles of the following in photochemical experiments

    (i)   Lamp selection   (2 marks)
    (ii)   The use of quartz   (2 marks)
    (iii)   Solvent and solvent selection including chlorinated, hydrocarbon and solvent containing unsaturation   (4 marks)

b.(i)   What is photoexcitation and how can it be initiated   (3 marks)

(ii)   What is quenching   (1 mark

(iii)   With suitable example, explain what is primary photochemical process   (2 marks)

(c)   State the beneficial effect of sunlight in vitamin D production   (1 mark)

Total = 15 mks

QUESTION THREE

3(a)   Discuss photochemical reactions possible for alkene under the following,

    (i)   Possible transition and characteristics of first excited state   (3 marks)

    (ii)   Types of reactions possible and what they involve or signify   (4 marks)

b.   What do you expect the thermodynamic stability of photochemical excited state of the following,

(i)   Medium sized organic compound   (2 marks)

(ii)   Transition metal complex   (2 marks)

(iii)   Triplet state   (2 marks)

c.   State the electronic selection rule with respect to absorption of light   (2 marks)

Total = 15 mks

QUESTION FOUR

4(a)(i)   Define the following with respect to the fate of molecules relaxing from excited state

   (i)   Flourescence   (2 marks)

   (ii)   Spontaneous emission   (1 mark)

   (iii)   Stimulated emission   (2 marks)

   (iv)   Laser emission   (3 marks)

b(i)   How is electron promoted between HOMO and LUMO? Hence what is the requirement for the promotion and why is UV light called photochemical window   (3 marks)

(ii)   Giving TiO_2 and a A ruthenium (II) complex as a representative of a d^6 and d^0 compounds respectively. Enumerate how UV absorption impart colour on them   (4 marks)

Total = 15 mks

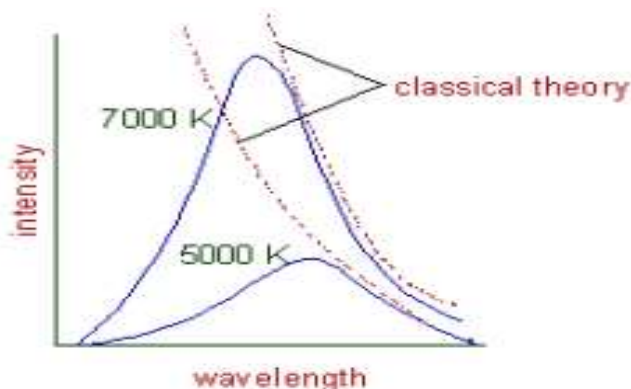**QUESTION FIVE**

5(a)(i)   What is black body ?   (1 marks)

(ii)   Is it possible to construct a perfect black body ? Explain the working principle of existing black body   (3 marks)

(iii)   Outline three conclusions that can be draw from the following diagram   (4 marks)

(iii)   Present classical physics concept of the above diagram. Hence outlined Max Planck proposal on black body   (7 marks)

3