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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2020/2021 ACADEMIC YEAR FOUR**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: CHE 420**

**COURSE TITLE: PHOTOCHEMISTRY**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 06/10/2021 TIME: 12.00-2.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of THREE (3) printed pages *please turn over***

* **Useful constants:** c = 3.0 x 108 m/s, h = 6.625 x 10-34 Js, Avogadro’s constant = 6.023x 1023 mol-1 R= 1.097×107 M-1, I nm=10-9M**)**

**QUESTION ONE (COMPULSORY)**

1. Explain the following terms as used in photochemistry **(6marks)**
2. Photosensitizer
3. Quantum Yield
4. Quenching
5. Distinguish the following **(8marks)**
6. Fluorescence from Phosphorescence
7. A reaction with low quantity yield from a reaction with high quantity yield
8. A primary photochemical reactions from a secondary photochemical reactions
9. Extinction coefficient from molar extinction coefficient
10. Calculate the energy per mole of light having wavelength of 300nm **(4marks)**
11. State the Stark-Einstein law of photochemical equivalence (**3marks)**
12. Suggest whether the following statements are true or false (**5marks)**
13. According to Einstein law of photochemical equivalence, each molecule which takes part in photochemical reaction absorbs one quantum of radiation
14. Delayed fluorescence is phosphorescence
15. Quantum yield of any reaction is always unity
16. Absorption of a photon by a molecule always leads to a chemical reaction
17. The molar extinction coefficient is unit less.
18. Give any two (2) examples of Fluorescent substance (**2marks)**
19. State any two limitations of Beer-Lambert’s law  **(2marks)**

**QUESTION 2 (20 MARKS)**

1. State any three (3) conditions that should be fulfilled by the reacting molecules in a photochemical reaction (**6marks)**
2. State four (4) reasons for high quantum yield (**4marks)**
3. In a photochemical reaction

CH2ClCOOH +H2O hv→ CH2OHCOOH + HCl

It was found that after irradiating the solution at 253.7nm for 837 minutes 3.436 χ10I J of energy was absorbed and 2.296 χ 10-5 mol of HCl were formed. Calculate the quantum yield of the reaction **(10 marks)**

**QUESTION 3 (20MARKS)**

1. State Grotthus-Draper law (**4mark**s)
2. Give any five **(5)** differences between photochemical reactions and thermal reactions (**10marks)**
3. State any three (3) categories of photochemical reaction based on quantum yield, Giving examples in each case (**6marks)**

**QUESTION 4 (20 MARKS)**

1. State and explain any the two (2) types of fluorescence (**6marks)**
2. What is meant by the term Chemiluminescence (**4marks)**
3. Expalin the mechanism of Chemiluminescence using the interaction between the aromatic anions (Ar-) and cations (Ar+**) (10 marks)**

**QUESTION 5 (20 MARKS)**

1. The quantum efficiency for the photochemical reaction**:** **H2 (g) + Cl2 (g) hv→ 2HCl (g)** is 1.0 × 106 with a wavelength of 480nm. Calculate the number of moles of HCl (g) produced per joule of radiant energy absorbed (**10marks)**
2. Draw a well labeled diagram/apparatus for the experimental measurement of photochemical reactions (**10marks)**