



TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY

INCOMPLETE EXAMINATION FOR CREDIT HOUR STUDENTS

COURSE TITLE: LASER CHEMISTRY		COURSE CODE: CH4113	
DATE: 23 JANUARY, 2014	TERM: FIRST	TOTAL ASSESSMENT MARKS: 50	TIME: 2 HOURS

Answer the following questions (5 marks per point):

1- Using suitable diagrams and illustrations, describe each of the following laser systems:

- i - Carbon dioxide laser
- ii - Excimer laser
- iii - Proton transfer dye laser
- iv - Bonding in molecular oxygen O_2 and its first two excited states according to molecular orbital theory.
- v - Construct the energy level diagram of species in a typical triplet sensitization experiment in which a mixture of naphthalene and benzophenone was irradiated through a 315 nm cut-in filter given the following absorption data:

For naphthalene $S_0 \longrightarrow S_1$ at 385 nm and $S_0 \longrightarrow T_1$ at 465 nm.

For benzophenone $S_0 \longrightarrow S_1$ at 385 nm and $S_0 \longrightarrow T_1$ at 413 nm.

The cut-in filter that absorbs below 315 nm. [Hint: The energy in k cal mol^{-1} is obtained as $28500 / \lambda$ (nm)]

- 2- The synthesis of vinyl chloride from 1,2-dichloroethane is an important multibillion industrial process demonstrating the advantages of laser applications. Write the reaction scheme and mention the advantages of laser application in comparison with thermal applications.
- 3- The technique of thermal lensing is an important application on laser collimation. Draw a time-resolved thermal lensing experimental setup and trace upon using the technique to study singlet oxygen sensitization kinetics.
- 4 - Discuss each of the following:
 - (a) The technique of Raman spectroscopy showing energy level diagram, the spectral output and band assignment.
 - (b) The principle of MUCAP reagent operation
 - (c) Oxygen sensors based on fluorescence quenching
 - (d) Photodynamic therapy (PDT)
- 5 - Explain the reason for each of the following:
 - (a) Carbonyl compounds are common triplet sensitizers
 - (b) R6G- I^- solutions are strongly fluorescent in ethanol but non-fluorescent in chloroform.

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