

Optics within the life science

Minor 1
90 minutes

42 marks
11th November 2020

Instructions:

- Use A4 sheets for answering questions
- Answers have to be hand written
- On every page mention name, entry number, page number
- **XX** highlighted in the question corresponding to last two digits of your entry number.

Q1. If the Hooke's Law force constant for a C-C triple bond is 5 times that for a C-C single bond, which has vibrational wavenumber of 10^{XX} cm^{-1} , calculate the wavenumber for C-C triple bond.

Q2. If a 0.0100 M solution exhibits $4X.X\%$ T at some wavelength, what will be the percent transmittance for a 0.0200 M solution of the same substance?

Q3. The absorbance of a 2.31×10^{-5} M solution of a compound is 0.8^{XX} at a wavelength of 266 nm in a 1.00 cm cell. Calculate the molar absorptivity at this wavelength.

Q4. Define FRET and draw absorption, emission spectrum for FRET pair probes.

Q5. Write down few limitations of quantification methods based on absorbance spectroscopy.

Q6. Draw a schematic of fluorescence spectrometer and identify key components?

Q7. Match the items on the left with appropriate items on the right by putting the letters in the box provided. More than one letter can and should be used when appropriate. There may be some letters that will not be appropriate for any item on the left.

_____ Ionizes molecules	a. 1500 cm^{-1}
_____ Can cause electron transition	b. 5 cm
_____ Excites molecule rotation	c. 20000 cm^{-1}
	d. 600 Mhz
	e. 1 \AA
	f. 260 nm
	g. 2 cm^{-1}

Q8. What are applications of time resolved IR spectroscopy ?

Q9. How can one measure pH of intracellular space?

Q10. Why nano materials are used in Surface enhanced Raman Spectroscopy?

Q11. How could IR spectroscopy be used to distinguish between the following pair of compounds?



Q12. Write short notes on FTIR with a schematic of components. What are unique advantages of FTIR?

Q13. Explain how real time fluorescent probes for DNA quantification work?

Q14. If you have to measure chemi-luminescence output from a reaction, which of the following instrument will be suitable? Fluorescence spectrometer/UV Visible absorption spectrometer.