SECTION B (3 x 6 = 18)

7. Explain the molecular interactions that cause water to be in low density, high density and lowest density states.

8. Beta-casein protein was isolated from milk by my student Anuradha. Explain how Anuradha can determine the exact number of phosphorylated groups attached to the isolated protein.

9. Highlight what happens to polymer conformation in Good solvents, Theta solvents, and Poor solvents. Explain how the changes in conformation can be accounted by molecular interactions.

10. How does the potential energy vary when a bond is stretched. Explain this for single and double bonds using appropriate plots and equations.

11. If the radiative and non-radiative decays rates for a molecule displaying fluorescence are as follows: $k_r = 2.1 \times 10^9\ s^{-1}$; $k_{nr} = 1.3 \times 10^9\ s^{-1}$; calculate the fluorescence quantum yield, fluorescence lifetime and intrinsic lifetime.

12. In a certain MS experiment done with a pure homogeneous protein sample, prominent peaks at the following m/z values were obtained:

1101.1368, 1192.8085, 1301.0574, 1430.9525, 1589.8125, 1788.5289, 2044.1063. Indicate the charge value for each peak. Calculate the molecular mass of the sample.

BT 301 Biophysics **MIDSEM 19 Sep 22** Instr: R. Swaminathan

Total marks = 30. Section A carries 12 marks; Section B carries 18 marks

SECTION A (2 x 6 = 12)

1. Calculate the optical rotation for a sample with 1 cm pathlength, possessing refractive index difference $(n_L - n_R) = 2 \times 10^{-8}$ exposed to light at 400 nm wavelength.

2. Arrange the following processes in the decreasing order of the rate at which they occur starting from the fastest event. (e.g. rocket > plane > car > bicycle):

Internal conversion; Solvent relaxation; Electronic absorption; Fluorescence; Phosphorescence

3. Describe how you can build a low cost minimal instrumental setup to measure the steady state fluorescence intensity in biological samples.

4. Draw the Jablonski diagram, label the energy levels and indicate the following transitions:

internal conversion, electronic absorption, fluorescence and intersystem crossing.

5. Explain how ice skating is made possible.

6. In the figure below, which method is schematically illustrated. For any three arrows among a—e, identify what the arrows are indicating.