1. A sample of 1 cm pathlength rotates 200 nm polarized light by 0.01 deg. Calculate
   (a) $n_L - n_R$ (b) $[\phi]$ if C = 0.0001 M

2. A sample of 1 cm pathlength has an ellipticity of 0.01 deg. Calculate
   (a) axial ratio (a/b) of ellipse (b) $A_L - A_R$ (c) $[\theta]$ if C = 0.0001 M

3. Show that $[\theta] = 3298\ \Delta\varepsilon$

4. A student wishes to monitor the unfolding of a protein with addition of urea. Explain how she can determine when the protein is fully unfolded?

5. Far UV CD spectrum (190 to 260 nm) among proteins has distinct features for secondary structures like α-helix, β-sheet and random coil conformations. Given a CD spectrum of a protein with unknown structure, explain how fractional composition of its secondary structure can be estimated by semi-empirical CD calculation.

6. If fluorescence quantum yield of a protein is 0.33 and its fluorescence lifetime is 5 ns. Calculate the rate constants for radiative and non-radiative decays.

7. How can one measure the fluorescence quantum yield of an unknown fluorophore.

8. Describe what is GREEN FLUORESCENT PROTEIN. How is it useful?

9. When a fluorophore in the excited state (F^*) collides with a quencher Q, show that

$$\frac{F_0}{F} = 1 + K_{SV}[Q]$$

   Where K_{SV} is the Stern Volmer constant (= $k_q.\tau_0$) with k_q being the bimolecular quenching rate constant and τ_0 the fluorescence lifetime in the absence of the quencher; F_0 and F are the fluorescence intensity in absence and presence of the quencher at concentration [Q], respectively.

10. Chloride is an important biological anion that plays vital role in fluid absorption, neuronal processes and cellular pH. Diseases like Cystic Fibrosis arise due to defective chloride transport inside the cell. Hence measuring chloride ion concentration inside the cell is vital.
    A student has two fluorescent probes with her which can be excited at single wavelength. Probe A emits fluorescence with peak at 500 nm and is insensitive to presence of chloride, while B emits with peak at 600 nm revealing a distinct emission spectrum. Probe B fluorescence intensity decreases with increasing presence of chloride due to quenching. Explain how the student can setup experiment to measure chloride concentration inside a living cell. Assume both probes can freely cross the cell membrane.