1. In an emission spectrum (Fig.1), the Y and Ba peaks are narrow while YO peak is visibly wide. Why?

2. An empty cell showed 12 interference peaks in the wavelength range of 3000 to 1800 cm\(^{-1}\). Calculate the path length of the cell.

3. To determine the amount of quinine in a water sample, the emission measurements were made:

   #1  pure deionized water \( I_{450} = 15 \)
   #2  20 mL of water sample was diluted to 50 mL \( I_{450} = 105 \)
   #3  0.20 mL of quinine solution (0.050 μg/mL) was diluted to 50 mL \( I_{450} = 90 \)

   Calculate the concentration of quinine in the water sample (in μg/mL).

4. The results of an FTIR preview single scan show peak-to-peak noise of 2.0 %. How many scans do you need to reduce this noise to 0.3%?

5. Nitrogen, oxygen, and argon are main components of air (78%, 21%, 1%) but they do not interfere with IR measurements. A small amount of CO\(_2\) (0.03%) produces visible distortion and makes spectra noisy. Explain.

6. A test for the sensitivity of a spectrofluorimeter is to measure the intensity of the Raman peak of a cell filled with water. If wavelength of excitation is 250 nm, at which wavelength (in nm) you expect the Raman peak (the Raman displacement of water is 3380 cm\(^{-1}\)).

7. A spectrum of emission line of Na atom at 589 nm is shown in Figure 2. Estimate the bandwidth of 0.4 cm\(^{-1}\).

8. The Galaxy 5000 FTIR instrument in our laboratory provides the bandwidth of 0.4 cm\(^{-1}\). What is resolution (resolving power) of this instrument? What length of mirror drive provides this resolution?

9. To determine the amount of compound B in a water sample, the following measurements were made using UV spectrophotometer:

   #1  pure deionized water \( A = 0.010 \)
   #2  10 mL of water sample was diluted to 25 mL \( A = 0.260 \)
   #3  10 mL of water sample + 2.0 mL of B solution (0.50 μg/mL) was diluted to 25 mL \( A = 0.510 \)

   Calculate the concentration of compound B in the water sample.

10. Calculate the third order resolution of a grating that is 2 cm long and is ruled as 600 lines/mm.