Name:

1) (12 points) You're developing a system to track reaction rates and chemical kinetics using a noncontact system. To validate your technique, you are testing it against the reaction colloquially known as the "blue bottle experiment". In the blue bottle experiment methylionium chloride (aka methylene blue) is reduced in an alkaline solution of glucose. With the required chemicals packed nicely in a sealed bottle, you can shake it to restart the reaction. How would you measure the reaction rate. Please thoroughly describe the technique you will use, sketch out the setup, describe any equipment needed, and cite any papers that you referenced.

2) (12 points) Can you use a hot plate to increase the intensity of anti-stokes Raman scattering? Explain. Please cite any papers or information you use to determine your answer.

3) (12 points) Explain the difference between Raman and fluorescence spectroscopy. Why do the spectra look different, and why is Raman scattering so weak in comparison.

4) (12 points, 4 each) A diffraction grating has a ruled area that is 10.40 cm wide, has 600.0 grooves per millimeter and is blazed at an angle of 45.00°.
    a. What is the wavelength of radiation diffracted at the blaze angle in the first, fourth and ninth orders?
    b. What is the resolving power in these orders?
    c. What is the resolution in terms of wavelength (nm), wavenumber (cm^{-1}), and frequency (GHz) in the ninth order at 300 nm?

5) (2 points) This class has a final project. Write two potential topics that you may choose to research. I'm using the term project here broadly; you can also write a paper of some sort. That being said, papers will be graded more stringently considering you are not performing an experiment, where we've seen in class, everything can go wrong. Don't spend too much time on this question. It's just to get you thinking about it.