Choose the best answer. (10 pts total)

1. What does the symbol, $\lambda$, refer to in equation 1? [1 pt]
   a. frequency   b. wave number   c. Rydberg constant   d. wavelength

2. In equation 2, the variable $d$ is the … [1 pt]
   a. width of the diffraction grating.
   b. number of lines per unit length in a diffraction grating.
   c. distance between the slits in a diffraction grating.
   d. distance between the diffraction grating and the screen (or meter stick) where the spectral lines appear.

3. According to equation 2, for the same diffraction grating and order of interference pattern, will small angles produce shorter or longer wavelengths than large angles? [1 pt]
   a. shorter   b. longer   c. Wavelength does not depend in any way on the angle.
   d. There is not enough information to tell.

4. If our diffraction grating has $1/d = 6.00 \times 10^2$ lines/mm (600 slits/mm), what is the distance, $d$, between the lines on the diffraction grating? [1 pt]
   a. 0.600 m   b. 1.67x$10^{-3}$ mm   c. 1.67x$10^{-6}$ m   d. Answers b and c.

5. Spectral lines are created by specific photons released from an atom. A photon is released when … [1 pt]
   a. an electron is in a quantized atomic state.
   b. an electron is at the Bohr radius
   c. the electron transitions from one quantized atomic state to another quantized atomic state
   d. The photon release occurs randomly.

6. For the hydrogen atom, visible spectral lines occur when … [1 pt]
   a. transitions end on the $n_f = 1$ energy level   b. transitions end on the $n_f = 2$ energy level
   c. the photon has an energy of -13.6 eV   d. the photon has an energy of -3.40 eV

7. Refer to figure 3 in the lab manual. How do you calculate the angle $\theta$? [1 pt]
   a. $\theta = x/L$   b. $\sin \theta = x/L$   c. $\tan \theta = x/L$   d. $\tan \theta = L/x$

8. What should $n_f$ equal for the Balmer series of spectral lines of hydrogen? [1 pt]
   a. 2   b. 3   c. 4   d. 5   e. None of these.

9. You measure an angle of $\theta = 29.47^\circ$ for a particular 2nd order spectral line for hydrogen. Use equation 2 to solve for the experimental wavelength of the spectral line.
   Use $d = 1.67x10^{-4}$ cm. [2 pts]
   a. $\lambda_{exp} = 8.22 \times 10^{-5}$ cm   c. $8.22 \times 10^{-3}$ m
   b. $\lambda_{exp} = 4.11 \times 10^{-5}$ cm   d. 434 nm   e. 655 x $10^{-7}$ m
   f. 485 x $10^{-7}$ m