Final Laser project:

You can use textbooks (I have plenty here), but please work from at least two journal articles. Look for articles that are more complete so as to find the most information. Check with me if you need sources.

You should have a number of calculations in your write-up and presentation – for the most part, these are no more (or not much more) complicated than what we've done in class). Let me know if you feel like you're getting sidetracked into a lengthy calculation.

Here are some generic question about your system that you should address.

Gain medium:

- What are dominant transitions for gain?
- Provide a representative level diagram – is it 4-level, 3-level, quasi-3-level? Provide estimates for the natural transition rates among the levels (if known).
- What is the main broadening mechanism? Is tuning possible, if so, over what range?
- How is the laser transition pumped? (optical, collisional, chemical, …)
- What is the storage time, stimulated emission cross-section, and how does that influence what kind of lasers can be made? (Think about pumping rate, whether the pump must be concentrated in a small area, role of relaxation oscillations, high vs low gain…)

Laser:

- Choose a type of laser: e.g. tunable cw, modelocked, q-switched, gain-switched, etc.
- Describe a typical resonator cavity used for this system, using ABCD to determine the mode size in the gain medium.
- Using data from a paper, or reasonable estimates, use the equations to calculate a representative threshold pump power and slope efficiency (if it is a cw laser), or do a simple model of the rate equations (using the code I handed out) if it is a q-switched or gain-switched laser. If you are looking at a mode-locked laser, discuss the method for mode-locking and the pulse duration limitations.

Applications:

- Describe some of the applications of the laser, and some of the implications for the application requirements that set limits on the laser design.