

2010 PhD Quals Questions
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1. I have several LEDs here of different colors. Can you first briefly tell me how an LED works and what is different about the devices that produce different colors of light?
2. Can you draw the Current-Voltage and Light-Current (L-I) curves for me for say two different color LEDs and identify which is which?
3. Can you sketch the characteristic spectral distribution for one of the LEDs? Why can you have photons with $\lambda < E_g$, but not greater than E_g ?
4. There is a lot of effort today to produce solid state lighting. How can I produce a White LED?
5. I now have a red laser. Can it be made of the same materials as a red LED? What is different about the laser compared to the LED?
6. Can you draw the I-V and L-I curves and spectral distribution for the laser? How do they differ from the LED and why?
7. If I now change the temperature of the LED and laser, how do the spectral characteristics change and why?
8. I have a polarizing filter and when I put it in front of the LED, it has virtually no effect, but when I put it in front of the laser, and rotate it, it changes from virtually zero transmission to unchanged transmission. What does this tell you about the fundamental recombination processes occurring in the laser vs. the LED?
9. If stimulated emission and absorption are reciprocal processes, can I use a LED or laser as a solar cell? What might I do differently to optimize the solar cell vs. a laser or LED?