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LIBS Postlab

Last modified: June 17, 2014

1. Observations for the spectra of different radiation sources:

Source	**Visual Appearance**	**Wavelengths** of 3-4 largest peaks in the emission spectrum (nm) – in the order of decreasing intensity

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Source	**Visual Appearance**	**Wavelengths** of 3-4 largest peaks in the emission spectrum (nm) – in the order of decreasing intensity

2. Summarize your observations for the emission spectra and plasma of the metal samples in the following table :

Sample Number	Visual appearance	Observed emission color from this sample	Wavelengths of 3-4 largest peaks in the emission spectrum (nm) – in the order of decreasing intensity	Your guess for what this material is
1				
2				
3				
4				
5				

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6				
7				
8				

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3. Why is this method not often used to analyze paintings and expensive works of art for the presence of specific metals in the paint? Brainstorm to come up with several detailed environmental applications in which LIBS would be of especially good use:

4. List 5 or more applications of lasers you've seen in your everyday life:

5. The laser used in this lab fires at a frequency of 10 Hz. For a total power of 1 W, calculate the energy delivered per laser pulse. Is this a significant amount of energy? If this laser was installed on battle ship in Star Wars, would it be sufficient to vaporize a small evil creature from Dark Planet? Assume that the evil creature consists of mostly water and weighs only 0.1 kg (approximately a quarter of a pound). The heat of vaporization for water is 2270 kJ/kg.

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6. Discuss what you learned from the spectra of different light sources
    a. What are the qualitative differences between the spectra of the laser sources, spectra of plasma-driven lamps, spectra of LED lamps, and spectra of incandescent lamps?
    b. What lines do you observe in the Hg lamp spectrum? Do they agree with the literature values (refer to the Hg-lamp paper on the course website)? Does your spectrometer measures wavelength accurately?
    c. Are the spectra from the fluorescence room lights, white LED, or white monitor screen truly “white”?
    d. Why do you think a TV remote is manufactured to emit in the region you measured?

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7. One of the emission lines from a hydrogen lamp is due to an electron relaxing from the n = 5 to n = 2 energy levels. Calculate the wavelength and color of the photons emitted using Bohr theory for a 1 electron species ($E_n = -R_H/n^2$) and Planck's Equation: $E_{photon} = hc/\lambda$. Note that $\Delta E = E_{final} - E_{initial}$ and that for emission, $E_{photon} = |\Delta E|$. $R_H = 2.179 \times 10^{-18}$ J. This problem is a great review for quantum theory in General Chemistry. (Bohr Theory does NOT work for the Hg lamp emission lines since Hg has 80 electrons). ($h = 6.626 \times 10^{-34}$ J s; $c = 3.00 \times 10^{8}$ m s^{-1}).