PHYS 2604
Assignment #5

Given: Thursday, October 22, 2009
Due: Tuesday, November 3, 2009 **in class**

1. Calculate the temperature of a blackbody if the spectral distribution peaks at

   a) gamma rays, $\lambda = 1.00 \times 10^{-14}\ m$?

   b) red light, $\lambda = 670\ nm$?

   c) AM radio waves, $\lambda = 204\ m$?

2. A particular radiating cavity has the maximum of its spectral distribution at a wavelength of $27.0\ \mu m$ (in the infrared region of the spectrum). The temperature is then changed such that the total power radiated by the cavity doubles.

   a) Compute the new temperature.

   b) At what wavelength does the new spectral distribution have its maximum value?

3. This is a relativistic Doppler shift problem. One of the strongest emission lines observed from distant galaxies comes from hydrogen and has a wavelength of $\lambda = 122\ nm$, in the ultraviolet region of the electromagnetic spectrum. ($1\ nm = 1 \times 10^{-9} m$)

   a) How fast must a galaxy be moving away from us in order for that line to be observed in the visible regions at a wavelength of $366\ nm$?

   b) What would be the wavelength of the same line if the galaxy were moving toward us at the same speed?

4. How many photons per second are contained in a beam of electromagnetic radiation of total power $125\ W$ if the source is

   a) an AM radio station of frequency $1100\ kHz$?

   b) x rays of wavelength $8.0\ nm$?

   c) gamma rays of energy $4.0\ MeV$?

Over……

5. A surface is irradiated with monochromatic light of variable wavelength. Above a wavelength of $\lambda = 5000\ \dot{A}$, no photoelectrons are emitted from the surface. With an unknown wavelength, a stopping potential of $3\ V$ is necessary to eliminate the photoelectric current. What is the unknown wavelength?