Homework Assignment #1 – due in class Thu. 9/14
(remember: no ragged edges; write on one side of page only;
leave room for comments/corrections)

1.   a) The human eye's daylight sensitivity (photopic vision) peaks at about 5550 Å (555 nm).
What frequency does this correspond to? At what color do we perceive this wavelength?

b) Nighttime (scotopic) vision peaks at about 5070 Å (507 nm); what frequency does this
correspond to? At what color do we perceive this wavelength?

c) In general, photopic vision is full-color, while scotopic vision is more monochrome,
though one can still get a vague impression of color in low light. Based on your
answers to a) and b), and your own experience, describe your perception of a scene in
full daylight compared with moonlight or other low-light environment.

You may need to do some investigation on the web to find more detailed correlation
between color and wavelength than the textbook gives.

2.   Dental x-rays have a wavelength of about 0.5 Å (0.05 nm). How many times more energy
does one of these photons carry than a visible-light photon of 5500 Å (550 nm)? *Hint:*
Try solving this problem using scaling arguments, rather than performing full
calculations for both cases. Scaling (solving the full equation for one situation, and then
using ratios of variables to calculate the answer for other situations) is a very useful
technique that saves time and reduces the chance of a calculation error.

3.   The highest-energy gamma rays that have been detected to date come from as-yet
unidentified sources inside globular star clusters. These gamma rays have energies
exceeding 10 TeV (1 TeV=10^{12} eV). How fast (in m/sec) would a 0.1 mg fruit fly have to
be moving for its kinetic energy to equal that of a 10 TeV gamma ray? At this rate, how
many times could it crawl around a 1-cm diameter grape in one second?

4.   A hotter blackbody emits more red light than a cooler blackbody does. So, explain why a
cooler blackbody looks redder than a hotter one.

**N.B.: At the end of each of Kutner's chapters, there is a _Questions_ section as well as
a _Problems_ section. Be sure to do the right assignment!**

From Ch 2 in Kutner: Question 2.4; Problems 2.13, 2.18