1. (6 pts) Thermal Radiation

At what wavelength is the most light emitted by the Earth (T~300 °K)? By the Sun with a surface temperature of 5800 °K? By a star with a surface temperature of 20,000 °K? In what part of the electromagnetic spectrum would you best be able to detect each object? (In the case of the Sun, can you think of any human evolutionary implications of your result?)

2. (6 pts) Radiation in Every-Day Life

Do Problem 24 of Chapter 6. Turn in only parts a, b and c, but read part d for your own edification. For part a the important conceptual point is the last question about at what wavelengths most of the light from an incandescent bulb is emitted.

3. (4 pts) Radio Waves on Earth

Suppose the frequency of an AM radio station is 1100 kHz. (1 kHz is 1 kilohertz or 10^3 hertz or 10^3 cycles/sec.) What is the wavelength of the light transmitted by the station? Give your answer in m and nm. Remember, visible light has a wavelength between 400 nm and 700 nm!

4. (6 pts) The Energy of a Photon

Do Problem 21 of Chapter 6. Note that a watt is defined as 1 joule/sec, and Planck’s constant = 6.626 x 10^{-34} joule sec. Show units throughout your work for full credit.

5. (6 pts) The Composition and Speed of a Comet

In a laboratory on Earth a physicist observes the emission-line spectrum of oxygen, and identifies the wavelength of each line. She finds:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>400.0 nm</td>
<td>500.0 nm</td>
<td>600.0 nm</td>
</tr>
<tr>
<td>601.0 nm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An astronomer takes a spectrum of a comet and observes:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An astronomer takes a spectrum of a comet and observes:
400.4 nm 500.5 nm 600.6 nm 601.6 nm

a) (2 pts) Is oxygen present in the comet? Why, or why not, or can’t tell?
b) (4 pts) What is the radial velocity of the comet? Is the comet coming towards us or moving away?

6. (3 pts) Sample Exam Question:

In the accompanying energy level diagram,

a) Which emission line has the longest wavelength?
b) Which absorption line has the shortest wavelength?
c) Which transition represents ionization?

[Diagram of energy levels with arrows indicating transitions between levels a, b, c, d, and e.]

7. (3 pts)

Briefly explain the reasoning behind your answers to question 6.

Update for Lab 2

If you chose not to turn in your lab 2 last week because clouds kept you from getting observation of the moon early or late in the observing period, you have a second chance. Make additional observations of the moon as needed between March 22 and April 5, with the goal of having a broad time coverage over two weeks. And change the date in Question 3 to April 26.
You don’t have to repeat observations that you already have – think carefully about your answer to question 3 and then make use of it. Explain how you have combined the two sets of observations.

NEW DUE DATE: APRIL 7 in lecture or APRIL 9 at my office.

Update for Lab 3

Given how cloudy this spring has been, make sure you make use of any clear nights to make an observation for Lab 3 once a week or so.