

## Homework Assignment #7

### Chapter 3 The Particlelike Properties of Electromagnetic Radiation

Modern Physics (3rd Edition) by Kenneth Krane

**Due Date: March 9, 2017**

In these problems, when the problem asks for mass, energy, and momentum, please write your answers in units of:

**Mass**  $\rightarrow MeV/c^2$  not kilograms !!

**Momentum**  $\rightarrow MeV/c$  not kilograms·meters/sec !!

**Energy**  $\rightarrow MeV$  not joules !!

unless otherwise specified.

When you are asked for velocities, always quote your answers in units of “c,” the speed of light.

$$\text{velocity} = \beta c$$

#### Problems:

- 3.14 Writing the discrete Maxwell-Boltzmann distribution for Planck’s cavity wall
- 3.15 By differentiating Eq. 3.41 show that  $I(\lambda)$  has its maximum . . .
- 3.16 Integrate Eq. 3.41 to obtain Eq. 3.26.
- 3.18 The surface of the Sun has a temperature of about 6000K. At what wavelength . . .
- 3.19 The universe is filled with thermal radiation, which has a blackbody spectrum . . .
- 3.20 Assuming the human body (skin temperature 34°C) to behave like an ideal . . .
- 3.21 A cavity is maintained at a temperature of 1650K. At what rate does energy . . .
- 3.23 Assuming the Sun to radiate like an ideal thermal source at a temperature of . . .
- 3.25 Incident photons of energy 10.39 keV are Compton scattered, and the scattered . .

- 3.27 High-energy gamma rays can reach a radiation detector by Compton scattering from the surrounding . . .
- 3.29 Suppose an atom of iron at rest emits an X-ray photon of energy 6.4 keV.
- 3.30 What is the minimum X-ray wavelength produced in bremsstrahlung by . . .
- 3.37 The COBE satellite was launched in 1989 to study the cosmic background radiation and measure its temperature.
- 3.38 The WMAP satellite launched in 2001 studies the cosmic microwave background radiation and was able to chart small fluctuations . . .
- 3.44 A photon of energy  $E$  interacts with an electron at rest and undergoes pair production, producing a positive electron (positron) . . .