(a) In what ways do photons resemble other particle such as electrons?
(b) In what ways do they differ?
(c) Do photons have mass?
(d) Do they have charge?
(e) Can they be accelerated?
(f) What mechanical properties do they have?

2. You find that when ultraviolet light of wavelength of 254 nm from a mercury arc lamp falls upon a clean copper surface, the stopping electric potential necessary to stop the emitted photoelectrons is 0.181 V.
(a) What is the photoelectric threshold wavelength for this copper surface?.
(b) What is the work function for this copper surface?.

3. The energy-level scheme for the hypothetical one-electron elements Physicium114 atom is as shown.
The potential energy is taken to be zero for an electron at an infinite distance from the nucleus.
(a) How much energy (in electron volts) does it take to ionize an electron in the ground level?
(b) An 18 eV photon is absorbed by Physicium114 in its ground level. When the atom returns to its ground level what possible energies can the photons have?
(c) What will happen if an 8 eV photon strikes a Physicium114 atom in its ground level? Why?
(d) Photons emitted in the Physicium114 transitions $n=3 \rightarrow n=2$ and $n=3 \rightarrow n=1$ will eject photoelectrons from an unknown metal but the photon emitted from the $n=4 \rightarrow n=3$ transition will not. What are the limits (maximum and minimum possible values) of the work function of the metal?

4. Radiation has been detected from space that is characteristic of a black-body radiator at $T = 2.728 \times 10^8 K$. (This radiation is a relic of the “Big Bang” at the beginning of the universe.)
(a) For this temperature, at what wavelength does the Planck distribution peak?
(b) In what part of the electromagnetic spectrum is this wavelength?

5. A 4.78 eV alpha particle from a radium $^{226}Ra$ decay makes a head-on collision with a uranium nucleus. A uranium nucleus has 92 protons.
(a) What is the distance of closest approach of the alpha particle to the center of the uranium nucleus? Assume that the uranium nucleus remains at rest and the distance of closest approach is much larger than the radius of the uranium nucleus.
(b) What is the force on the alpha particle at the instant when it is at the distance of closest approach?

6. A laser, that is used to weld detached retinas, emits light with a wavelength of 652 nm in pulses that are 20 ms long in duration. The average power during each pulse is 0.600 W.
(a) How much energy is in each pulse in joules? In electronvolts?
(b) What is the energy of one photon in joules? In electronvolts?
(c) How many photons in each pulse?