PHYSICS 4E QUIZ 1 (open book) SPRING QUARTER 2012
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Problem 1 (10 pts)
A black body looks greenish. That's because it emits maximum power at wavelength 5100A. It emits 1W of power in the wavelength range 5100A to 5101 A.
(a) What is this body's temperature?
(b) How much power (in W) does it emit in the wavelength range 10,200A to 10,201A?
(c) How many photons of wavelength between 5100A and 5101 A does this body emit per second?

Problem 2 (10 pts)
In a Compton scattering experiment, the wavelength of the scattered photon is 3/2 the wavelength of the incoming photon.
(a) What is the range of possible values of the wavelength of the incoming photon for this to occur? Give your answer in A.

Assume that the situation described above (scattered photon has 3/2 the wavelength of the incoming photon) occurs when the scattering angle for the photon is the same as the scattering angle for the electron. Find:
(b) The scattering angle, in degrees.
(c) The wavelengths of the incoming and outgoing photons, in A.
(d) The kinetic energy of the scattered electron, in eV.

Problem 3 (10 pts)
In a Rutherford scattering experiment with α particles of kinetic energy 8MeV scattering off nuclei of Sn (atomic number=50) the distance of closest approach for a certain impact parameter is 2×10^{-4}A.
(a) What is the kinetic energy (in MeV) for that impact parameter (which is <u>not</u> zero) when the α particle is closest to the nucleus?
(b) What is the impact parameter (in A) for that case? <u>Hint</u>: use conservation of angular momentum.
(c) What is the distance of closest approach to the nucleus when the impact parameter is 0?

Assume throughout this problem that the α particle does not penetrate the nucleus.

Justify all your answers to all problems