ECE344 Fall08
HOMEWORK 1
Introduction

1 The Photoelectric effect

(be careful with the units)

1. A metal has a workfunction of 4.3 eV. What is the minimum photon energy in Joule to extract an electron with $1eV$ kinetic energy from this metal through the photo-electric effect? What are the photon frequency in Terahertz and the photon wavelength in micrometer (we note that $\lambda = c/\nu$ where c is the velocity of the light $\simeq 3 * 10^8 m.s^-1$)? What is the corresponding photon momentum ?

2. A photocathode in Potassium has a workfunction of 2 eV. For an incoming radiation of $\lambda = 610nm$, what is the maximum velocity of an extracted electron ? For an incoming radiation of $\lambda = 630nm$, what is the maximum velocity of an extracted electron ?

2 Fundamentals of quantum mechanics

- Calculate the typical de Broglie wavelengths for (i) 0.1kg bullet at 100m/s (ii) electron at 10^6 m/s. Comment your results in terms of classical and quantum mechanical expectations (we give $h = 6.626 * 10^{-34} J.s$ and $m_{e^-} = 9.109 * 10^{-31} kg$)

- What is the de Broglie wavelength (in nanometer) of a free electron at $100eV$?

- Where is the most probable location to find an electron in the third energy state in an infinite square well ? (justify your answer)

- How many states are available in an infinite square well for an electron with energy $E < 1eV$?