Physics 133, 3:30pm Spring 2006, Quiz 4 Name: KEY

TA: ____________

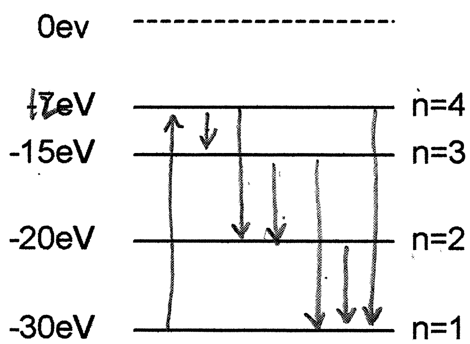
$f = \frac{c}{\lambda}$ $E = hf$ $h = 6.63 \times 10^{-34} J \cdot s = 4.14 \times 10^{-15} eV \cdot s$ $K_{max} = hf - E_0$

The energy levels for a hydrogen-like atom containing one electron are shown in the figure. Assume that the potential energy of an electron is zero if the electron is infinitely far from the nucleus, just as we did for the Bohr atom.

A) A 23 eV photon is absorbed by this atom. When it returns to the ground state, what are all the possible emission wavelengths? (10 pts)

B) How much energy does it take to ionize an electron in the ground state? (4 pts)

C) It turns out that photons emitted from the n=4 to n=2 state, and the n=2 to n=1 state can be used to induce the photoelectric effect in some unknown metal you have. However, photons emitted from the n=3 to n=2 state will not. Given this information, what are the maximum and minimum values possible for the work function of this metal? (6 pts)



A) $\lambda = \frac{c}{f} = \frac{hc}{E} = \frac{1240 eV\,nm}{E}$

$\Delta E = 3, 8, 5, 15, 10, 18$

Smallest λ is largest $E \Rightarrow \Delta E = 18 eV$

B) 30 eV

C) $n=4 \to n=2$ $\Delta E = 8 eV$ yes

$n=2 \to n=1$ $\Delta E = 10 eV$ yes

$n=3 \to n=2$ $\Delta E = 5 eV$ no

$K_{MAX} = hf - E_0$

$5 eV < E_0 < 8 eV$