PHYS 201 FALL 2010 FINAL EXAM Time Limit: 2 hrs

Name _____Recitation Section _____

Instructions:

For Problem I. **Encircle** the letter representing the BEST Answer.

For Numerical Problems. Your work must show sufficient details to obtain full credit.

PROBLEM	SCORE
I	
II	
III	
IV	
V	
TOTAL	

Some Helpful Equations

$\omega = 2\pi f = 2\pi/T$ $v = \lambda f$ $k = 2\pi/\lambda$ $\omega = vk$ $\hbar = h/(2\pi)$

$E_n = p^2/2m = n^2h^2/(8mL^2)$, n = 1,2,… $\psi_n(x) = \sqrt{(2/L)} \sin(n\pi x/L)$ $\int|\psi(x)|^2\, dx = 1$

$\Psi(x) = Ae^{ikx}$ $E = \hbar^2k^2/(2m)$ $p = \hbar k$ $E_n = (n + ½)\,\hbar\omega$ $E_n = nhf$

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2} + V(x)\psi(x) = E\psi(x)$$ $eV_o = hf - \varphi = hc/\lambda - \varphi$ $K_{max} = eV_o$

$T = Ge^{-2\kappa L}$ $G = 16(E/U_o)(1 - E/U_o)$ $\kappa = \{\sqrt{[2m(U_o-E)]}\}/\hbar$ $R = 1 - T$

$\lambda = h/p = h/(mv)$ $E = hf = hc/\lambda$ $\Delta x\Delta p_x \geq \hbar$ $\Delta E\Delta t \geq \hbar$ $h = 6.626 \times 10^{-34}$ J-s

$hf = hc/\lambda = \Delta E$ $L_n = mv_nr_n = n\hbar$ $r_n = [\varepsilon_o h^2n^2/(\pi me^2)]Z^{-1} = n^2a_o/Z$ $a_o = \varepsilon_o h^2/(\pi me^2) = 0.529$ Å

$v_n = Ze^2/(2nh\varepsilon_o)$ $E_n = -Z^2me^4/[8h^2\varepsilon_o{}^2n^2] = Z^2(-13.67\text{ eV})/n^2$ Z = atomic #(Z =1, hydrogen)

$\Delta\lambda = (h/m_ec)(1 - \cos\varphi)$ $I = \sigma T^4$ $P = \varepsilon A\sigma T^4$ $\lambda_{max}T = 2.9 \times 10^{-3}$ m-K $\Delta t = \gamma\Delta t_o$ $L = L_o/\gamma$

$\gamma = 1/\sqrt{(1- u^2/c^2)}$ $x' = \gamma(x - ut)$ $t' = \gamma(t - ux/c^2)$ $v_x' = (v_x - u)/(1- uv_x/c^2)$

$v_x = (v_x' + u)/(1+ uv_x'/c^2)$ $c = 3 \times 10^8$ m/s $m_e = 9.1 \times 10^{-31}$ kg $m_p = 1.6 \times 10^{-27}$ kg

$e = 1.6 \times 10^{-19}$ C $h = 6.626 \times 10^{-34}$ J-s $= 4.136 \times 10^{-15}$ eV-s 1 eV $= 1.6 \times 10^{-19}$ J