QUIZ 6
Winter 2004
11:30 Section
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Name (1 pt) KEY Recitation Instructor (1 pt) - - -

Consider a metal whose work function is 2.0 eV. The metal is illuminated by light of wavelength λ. (Φ)

(a) If the stopping potential for photoelectrons emitted from the surface is 3 volts, what is the wavelength of the light?

→ Use photoelectric equation: $\boxed{\frac{hc}{\lambda} = KE_{max} + \Phi}$ (1)

→ Also from energy conservation $\boxed{KE_{max} = eV_s}$ (2)

(1), (2) ⇒ $\boxed{hc = 1240\,eV_{nm}}$

$$\frac{1240\,eV_{nm}}{\lambda} = 3\,eV + 2\,eV = 5\,eV$$

$$\Rightarrow \lambda = \frac{1240\,\cancel{eV}_{nm}}{5\,\cancel{eV}} \Rightarrow \boxed{\lambda = 248\,nm}$$

(b) What is the initial velocity of the electrons as they are emitted from the photocathode? ($v_0 \equiv v_{max}$)

From (2) in part (a) we have:

$$eV_s = \underbrace{\frac{1}{2} m_e v_0^2}_{KE_{max}} \Rightarrow v_0 = \sqrt{\frac{2eV_s}{m_e}} = \sqrt{\frac{2(1.6\cdot10^{-19}\,C)(3\,Volts)}{9.11\cdot10^{-31}\,kg}}$$

$$\Rightarrow \boxed{v_0 \simeq 1.03\cdot10^{6}\ \frac{m}{s}}$$

$m_e = 9.11 \times 10^{-31}$ kg
$q_e = -1.6 \times 10^{-19}$ C