Physics 212 – Quiz #2
Chapter 2

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Name: Key Id#:

1. In a Compton scattering experiment, the scattered photon has an energy of 160 keV, while the energy of the recoiling electron is 40 keV. What is the scattering angle of the photon in this experiment?

$$E = K + E' = 40 + 160 = 200 \text{ keV}$$

$$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{12400 \text{ eV}\cdot\text{Å}}{200\,000 \text{ eV}} = 0.062 \text{ Å}$$

$$E' = \frac{hc}{\lambda'} \Rightarrow \lambda' = \frac{hc}{E'} = \frac{12400 \text{ eV}\cdot\text{Å}}{160\,000} = 0.0775 \text{ Å}$$

$$\lambda' - \lambda = \lambda_c (1 - \cos\theta)$$

$$0.0775 - 0.062 = 0.0243 (1 - \cos\theta)$$

$$1 - \cos\theta = 0.6378 \Rightarrow \cos\theta = 0.362$$

$$\Rightarrow \boxed{\theta = 68.7^\circ}$$

2. The work function of tungsten is 5.4 eV. What is stopping potential when the surface is illuminated by light of wavelength 175 nm?

$$K_{max} = eV_s = hf - \phi = \frac{hc}{\lambda} - \phi$$

$$= \frac{12400 \text{ eV}\cdot\text{Å}}{1750 \text{ Å}} - 5.4 = 7.09 - 5.4 = 1.69 \text{ eV}$$

$$\Rightarrow V_s = \frac{1.69 \text{ eV}}{e} = \boxed{1.69 \text{ V}}$$