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Problem 49.39 (RHK)

The work function for a metal is 1.85 eV. (a) *We have to find the stopping potential for light having a wavelength of* 410 nm; (b) *the maximum speed of the emitted photoelectrons at the metal's surface*.

Solution:

Energy of a photon of wavelength 410 nm is

$$\varepsilon = \frac{hc}{\lambda} = \frac{6.63\times10^{-34}\times3\times10^{8}}{410\times10^{-9}}\ \text{J} = 4.85\times10^{-19}\ \text{J}$$

$$= 4.85\times10^{-19}\times6.24\times10^{18}\ \text{eV}$$

$$= 3.03\ \text{eV}.$$

The work function of the metal is 1.85 eV.

Therefore, the stopping potential for the incident light will be

$$V_0 = -\left(3.03-1.85\right)\ \text{V} = -1.18\ \text{V}.$$

The maximum energy with which photoelectrons will be emitted from the metal's surface will therefore be 1.18 eV.

Therefore, the maximum speed of photoelectrons near the metal's surface will be

$$v = \sqrt{\frac{2 \times 1.18 \times 1.6 \times 10^{-19}}{9.11 \times 10^{-31}}} = 6.44 \times 10^{5} \text{ m s}^{-1}.$$