Answer on Question 75368, Physics, Quantum Mechanics

Question:

What is the stopping potential when the metal with work function $0.6\ eV$ is illuminated with the light of $2.0\ eV$?

a) $2.6\ V$

b) $3.6\ V$

c) $0.8\ V$

d) $1.4\ V$

Solution:

Using the mathematical description of the photoelectric effect, we can write the maximum kinetic energy E_{Kmax} of an emitted electron as follows:

$$E_{Kmax} = hf - \varphi,$$

here, $hf = 2.0\ eV$ is the energy of the incident photon, $\varphi = 0.6\ eV$ is the work function for the metal.

From the other hand, the maximum kinetic energy of an emitted electron can be determined from the stopping potential:

$$E_{Kmax} = eV_s,$$

here, e is the charge of electron, V_s is the stopping potential.

Finally, equating these two equations we can find the stopping potential:

$$eV_s = hf - \varphi,$$

$$V_s = \frac{hf - \varphi}{e} = \frac{2.0\ eV \cdot \frac{1.6 \cdot 10^{-19}\ J}{1\ eV} - 0.6\ eV \cdot \frac{1.6 \cdot 10^{-19}\ J}{1\ eV}}{1.6 \cdot 10^{-19}\ C} = 2.0\ V - 0.6\ V =$$

$$= 1.4\ V.$$

Answer:

d) $V_s = 1.4\ V$.