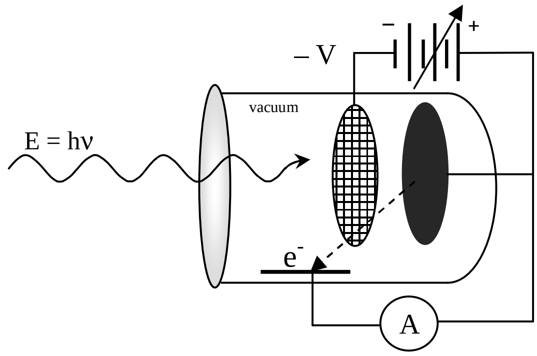
Photoelectric Effect



$\frac{1}{2} m\upsilon^2 > eV$ electron can get through V= stopping potential

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1. Current flows only if light has greater than a minimum frequency, ν_o.

2. Current is finite and instantaneous even if light intensity is small.

3. Kinetic energy of ejected electrons is not a function of the intensity.

4. Current is proportional to intensity = (amplitude)^2.

Conclusion:

$E_{photon} = h\nu = \frac{1}{2} m\upsilon^2 + e\,\Gamma = \frac{1}{2} m\upsilon^2 + \Phi$

$h = 6.626\text{x}10^{-34}$ J s $\hbar = h/2\pi = 1.055 \text{ x } 10^{-34}$ J s

ν = frequency

m_e = mass electron = $9.1093897\text{x}10^{-31}$ kg

υ = speed

e = charge on electron = $1.60217733\text{x}10^{-19}$ C

Φ = work function = ionization potential of a metal atom in the solid

Γ = also called the work function

$E_{photon} = h\nu = \frac{1}{2} m\upsilon^2 + h\nu_o$ $E = hc/\lambda$

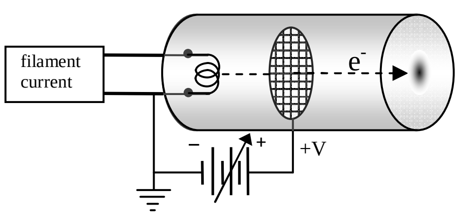
Energy units: Electron Volts

1 J = 1 C V C = Coulomb: fundamental unit of charge

1 eV = kinetic energy of an electron after acceleration across a potential of 1V

1 eV = e (1V) = $1.60218\text{x}10^{-19}$ C (1V) = $1.60218\text{x}10^{-19}$ J $E = h\nu/e$ in eV

1 eV = $1.60218\text{x}10^{-19}$ J($6.0221367\text{x}10^{23}$ mol^{-1})(1 kJ/1000 J) = 96.485 kJ mol^{-1}



$E_k = e\,V$