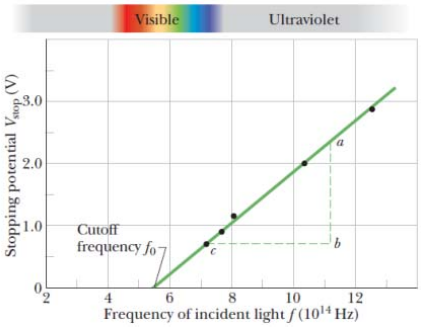
Photo-electric effect



1. HR.p1062. Find the work-function for the surface described by the measurements shown in the figure.
Answer: $\Phi = 2.3\ eV$

2. HR.38.26. An orbiting satellite can become charged by the photoelectric effect when sunlight ejects electrons from its outer surface. Suppose a satellite is coated with Pt . Find the longest wavelength of incident sunlight that can eject electrons from Pt.
Note: Satellites must be designed to minimize such charging because it can ruin the sensitive microelectronics.
Answer: $233\ nm$

3. HR.38.23. Light of wavelength $200\ nm$ shines on an Al surface.
a) What is the kinetic energy and speed of the fastest and the slowest ejected electrons?
b) What is the stopping potential for this situation?
c) What is cutoff wavelength for Al?
Answer: $2\ eV;\ 4.42\ 10^{-3}c;\ 2V;\ 295\ nm$

4. HR.38.25. The stopping potential for electrons emitted from a surface illuminated by light of wavelength $491\ nm$ is $0.71\ V$. When the incident wavelength is changed to a new value, the stopping potential is $1.43\ V$.
a) What is this new wavelength?
b) What is the work function of the surface?
Answer: $382\ nm; 1.82\ eV$

Work functions for different elements

Element	Na	Al	Ag	Cu	Si	C	Ni, Au	Pt
$\Phi\ (eV)$	2.7	4.2	4.3	4.7	4.8	5.0	5.1	5.32

Compton scattering

5. HR.38.34. (modified) A $3\ pm$ photon undergoes Compton scattering of a stationary free electron. The photon scatters at $90°$ from its initial direction.
a) What is the Compton shift of the scattered rays?
b) What percentage of the initial x-ray photon energy is transferred to an electron in such scattering?
c) What is the electron's kinetic energy?
Answer: $2.43\ pm;\ 44.8\%;\ 185\ keV$

6. HR.38.37. Consider a collision between an X-ray photon of initial energy $50\ keV$ and an electron at rest, in which the photon is scattered backward and the electron is knocked forward.
a) What is the energy of the backscattered photon?
b) What is the kinetic energy and momentum of the electron?
Answer: $41.8\ keV;\ 8.2\ keV;\ 91.8\frac{keV}{c}$