EngineeringRise

Photoelectric effect and Einstein equation

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Photon energy	E = h f = h c/lambda = 1240/lambda(nm) eV Valid when: any photon; the 1240/lambda form needs lambda in nm and E in eV	J or eV (h = 6.63 x 10^-34 J s)
Photon momentum	p = E/c = h/lambda Valid when: any photon, in vacuum	kg m/s
Einstein equation	h f = phi + K_max Valid when: one photon absorbed by one electron; K_max for the fastest emitted electron	J or eV
Threshold	f_0 = phi/h; lambda_0(nm) = 1240/phi(eV) Valid when: photon frequency at or above f_0; lambda_0 form needs nm and eV	Hz (nm)
Stopping potential	e V_s = K_max; V_s = (h/e) f - phi/e Valid when: retarding potential that just stops the fastest photoelectrons	V
Graph slope (V_s against f)	h/e = 4.14 x 10^-15 V s Valid when: graph of V_s against f for any metal; slope is independent of the metal	V s
Photocurrent	I_sat = eta (P/E) e Valid when: every ejected electron is collected (saturation); eta electrons per photon	A (eta = electrons per photon)
Radiation force (normal incidence)	F = P/c absorbed; 2P/c reflected Valid when: beam at normal incidence on a perfect absorber (P/c) or reflector (2P/c)	N
Intensity from a point source	I proportional to 1/d^2 Valid when: point source in free space with no absorption	W/m^2

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/dual-nature-of-matter-and-radiation/photoelectric-effect-and-einstein-equ

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