Quantum Yield from a UV Bench Test (Fluence-Based Rate Constant)

Quantum yield of a compound from the slope of ln(C/C₀) against UV fluence in a collimated-beam test, its molar absorption coefficient and the wavelength.

Method: Quantum yield from the fluence-based rate constant Φ = k_f/(2.303ε) and the photon energy N_A hc/λ

Input parameters

Unit system: SI

Parameter	Value	Unit
Fluence-based rate constant (−slope of ln C/C₀ against dose)	0.001800	
Molar absorption coefficient (decadic), L/(mol·cm)	1,650.0	
Wavelength	254.00	nm
Log reduction of interest	1.0000	

Calculated results

Parameter	Value	Unit
Quantum yield per energy, mol/mJ	4.7378e-10	
Energy of one einstein (mole) of photons	470.97	kJ/mol
Quantum yield, mol/einstein	0.22313	
UV dose for the log reduction	1,279.2	mJ/cm²

Notes for this case

• Φ = k_f/(2.303 ε) with k_f in cm²/mJ and ε in L/(mol·cm); one einstein (a mole of photons) carries N_A hc/λ of energy, 471 kJ at 254 nm.

Formula and method

$$\Phi_m = \frac{k_f}{2.303\,\varepsilon}, \quad E_{einstein} = \frac{N_A h c}{\lambda}, \quad \Phi = \Phi_m E_{einstein}$$

$$H = \frac{2.303\,LRV}{k_f}$$

Variables

k_f	Fluence-based rate constant (−slope of ln C/C₀ against dose)	-
ε	Molar absorption coefficient (decadic), L/(mol·cm)	-
λ	Wavelength	m
LRV	Log reduction of interest	-
Φ_m	Quantum yield per energy, mol/mJ	-
$E_{einstein}$	Energy of one einstein (mole) of photons	J/mol
Φ	Quantum yield, mol/einstein	-
H	UV dose for the log reduction	J/m²

Method and standards

Direct photolysis in optically thin bench samples.

Assumptions and limits

- Optically thin sample, monochromatic light.

References

Quantum yield from the fluence-based rate constant Φ = k_f/(2.303ε) and the photon energy N_A hc/λ

Report details

Report reference	FCC-C862-60H9 (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Quantum Yield from a UV Bench Test (Fluence-Based Rate Constant)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/drinking-water/uv-quantum-yield-bench-test

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.