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Raman Spectroscopy Formulas

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List of 13 Raman Spectroscopy Formulas

Raman Spectroscopy

1) Anti Stokes Scattering Frequency

$$fx \quad \nu_{as} = \nu_{initial} + \nu_{vib}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 33Hz = 31Hz + 2Hz$$

2) Depolarization Ratio

$$fx \quad \rho = \left(\frac{I_{perpendicular}}{I_{parallel}} \right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 8.421053 = \left(\frac{16cd}{1.9cd} \right)$$

3) Electric Field given Polarizability

$$fx \quad E = \frac{\mu}{\alpha}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 599.7001V/m = \frac{400C*m}{0.667C*m^2/V}$$



4) Energy 1 of Vibrational Level 

$$fx \quad E_1 = E_2 - (f_{1,2} \cdot [hP])$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 55J = 55J - (90Hz \cdot [hP])$$

5) Energy 2 of Vibrational Level 

$$fx \quad E_2 = E_1 + (f_{1,2} \cdot [hP])$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 54J = 54J + (90Hz \cdot [hP])$$

6) Frequency Associated to Transition 

$$fx \quad f = \frac{E_2 - E_1}{[hP]}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 1.5E^{33}Hz = \frac{55J - 54J}{[hP]}$$

7) Incident Frequency given Anti Stokes Frequency 

$$fx \quad v_0 = v_{as} - v_{vib}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 32.5Hz = 34.5Hz - 2Hz$$

8) Incident Frequency given Stokes Frequency 

$$fx \quad v_0 = v_s + v_{vib}$$

[Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3_img.jpg\)](#)

$$ex \quad 30Hz = 28Hz + 2Hz$$



9) Molecular Dipole Moment

$$fx \quad \mu = \alpha \cdot E$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 400.2C \cdot m = 0.667C \cdot m^2/V \cdot 600V/m$$

10) Polarizability

$$fx \quad \alpha = \frac{\mu}{E}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 0.666667C \cdot m^2/V = \frac{400C \cdot m}{600V/m}$$

11) Stokes Scattering Frequency

$$fx \quad V_s = V_{initial} - V_{vib}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 29Hz = 31Hz - 2Hz$$

12) Vibrational Frequency given Anti Stokes Frequency

$$fx \quad V_{vib \text{ anti}} = V_{as} - V_0$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 4.5Hz = 34.5Hz - 30Hz$$

13) Vibrational Frequency given Stokes Frequency

$$fx \quad V_{vib} = V_0 - V_s$$

[Open Calculator !\[\]\(40770d9ed6ed4f1222ebf89a1396e8b2_img.jpg\)](#)

$$ex \quad 2Hz = 30Hz - 28Hz$$









Variables Used

- **E** Electric Field (Volt per Meter)
- **E₁** Energy Level 1 (Joule)
- **E₂** Energy Level 2 (Joule)
- **f** Transition Frequency (1 to 2) (Hertz)
- **f_{1,2}** Transition Frequency (Hertz)
- **I_{parallel}** Intensity of Parallel Component (Candela)
- **I_{perpendicular}** Intensity of Perpendicular Component (Candela)
- **v₀** Incident Frequency (Hertz)
- **v_{as}** Anti Stokes Frequency (Hertz)
- **v_{initial}** Initial Frequency (Hertz)
- **v_s** Stokes Scattering Frequency (Hertz)
- **v_{vib anti}** Vibrational Frequency in Anti Stokes (Hertz)
- **v_{vib}** Vibrational Frequency (Hertz)
- **α** Polarizability (Coulomb Square Meter per Volt)
- **μ** Molecular Dipole Moment (Coulomb Meter)
- **ρ** Depolarization Ratio



Constants, Functions, Measurements used

- **Constant:** [hP], $6.626070040 \times 10^{-34}$ Kilogram Meter² / Second
Planck constant
- **Measurement: Luminous Intensity** in Candela (cd)
Luminous Intensity Unit Conversion 
- **Measurement: Energy** in Joule (J)
Energy Unit Conversion 
- **Measurement: Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement: Electric Field Strength** in Volt per Meter (V/m)
Electric Field Strength Unit Conversion 
- **Measurement: Electric Dipole Moment** in Coulomb Meter (C*m)
Electric Dipole Moment Unit Conversion 
- **Measurement: Polarizability** in Coulomb Square Meter per Volt (C*m²/V)
Polarizability Unit Conversion 



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