Important Raman Spectroscopy Formulas PDF

Formulas
Examples
with Units

List of 13
Important Raman Spectroscopy Formulas

1) Anti Stokes Scattering Frequency Formula

Evaluate Formula

Formula

$$v_{as} = v_{initial} + v_{vib}$$

Example with Units

$$33\,\text{Hz} = 31\,\text{Hz} + 2\,\text{Hz}$$

2) Depolarization Ratio Formula

Evaluate Formula

Formula

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

Example with Units

$$8.4211 = \left(\frac{16\,\text{cd}}{1.9\,\text{cd}} \right)$$

3) Electric Field given Polarizability Formula

Evaluate Formula

Formula

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

Example with Units

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

4) Energy 1 of Vibrational Level Formula

Evaluate Formula

Formula

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

Example with Units

$$55\,\text{J} = 55\,\text{J} - \left(90\,\text{Hz} \cdot 6.6\text{E-}34 \right)$$

5) Energy 2 of Vibrational Level Formula

Evaluate Formula

Formula

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

Example with Units

$$54\,\text{J} = 54\,\text{J} + \left(90\,\text{Hz} \cdot 6.6\text{E-}34 \right)$$

6) Frequency Associated to Transition Formula

Evaluate Formula

Formula

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

Example with Units

$$1.5\text{E+}33\,\text{Hz} = \frac{55\,\text{J} - 54\,\text{J}}{6.6\text{E-}34}$$

7) Incident Frequency given Anti Stokes Frequency Formula

Evaluate Formula

Formula

$$v_0 = v_{as} - v_{vib}$$

Example with Units

$$32.5\,\text{Hz} = 34.5\,\text{Hz} - 2\,\text{Hz}$$

8) Incident Frequency given Stokes Frequency Formula

Evaluate Formula

Formula

$$v_0 = v_s + v_{vib}$$

Example with Units

$$30\,\text{Hz} = 28\,\text{Hz} + 2\,\text{Hz}$$

9) Molecular Dipole Moment Formula

Evaluate Formula

Formula

$$\mu = \alpha \cdot E$$

Example with Units

$$400.2\,\text{C*m} = 0.667\,\text{C*m}^2/\text{V} \cdot 600\,\text{V/m}$$

10) Polarizability Formula

Evaluate Formula

Formula

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

Example with Units

$$0.6667\,\text{C*m}^2/\text{V} = \frac{400\,\text{C*m}}{600\,\text{V/m}}$$

11) Stokes Scattering Frequency Formula

Evaluate Formula

Formula

$$v_s = v_{initial} - v_{vib}$$

Example with Units

$$29\,\text{Hz} = 31\,\text{Hz} - 2\,\text{Hz}$$

12) Vibrational Frequency given Anti Stokes Frequency Formula

Evaluate Formula

Formula

$$v_{vib\ anti} = v_{as} - v_0$$

Example with Units

$$4.5\,\text{Hz} = 34.5\,\text{Hz} - 30\,\text{Hz}$$

13) Vibrational Frequency given Stokes Frequency Formula

Evaluate Formula

Formula

$$v_{vib} = v_0 - v_s$$

Example with Units

$$2\,\text{Hz} = 30\,\text{Hz} - 28\,\text{Hz}$$

Variables used in list of Raman Spectroscopy Formulas above

- **E** Electric Field *(Volt per Meter)*
- E_1 Energy Level 1 *(Joule)*
- E_2 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)*
- v_0 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 in list of Raman Spectroscopy Formulas above

- constant(s): **[hP]**, 6.626070040E-34
  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 ($C*m^2/V$)
  Polarizability Unit Conversion

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