

Important Rotational Energy Formulas PDF



Formulas Examples with Units

List of 11 Important Rotational Energy Formulas

1) Beta using Rotational Energy Formula ↻

Formula

$$\beta_{\text{energy}} = 2 \cdot I \cdot \frac{E_{\text{rot}}}{[h\cdot]^2}$$

Example with Units

$$3E+70 = 2 \cdot 1.125 \text{ kg}\cdot\text{m}^2 \cdot \frac{150J}{1.1E-34^2}$$

Evaluate Formula ↻

2) Beta using Rotational Level Formula ↻

Formula

$$\beta_{\text{levels}} = J \cdot (J + 1)$$

Example

$$20 = 4 \cdot (4 + 1)$$

Evaluate Formula ↻

3) Centrifugal Distortion Constant using Rotational Energy Formula ↻

Formula

$$DC_j = \frac{E_{\text{rot}} - (B \cdot J \cdot (J + 1))}{J^2} \cdot ((J + 1)^2)$$

Example with Units

$$-1665.625 = \frac{150J - (60.8\text{m}^{-1} \cdot 4 \cdot (4 + 1))}{4^2} \cdot ((4 + 1)^2)$$

Evaluate Formula ↻

4) Energy of Rotational Transitions between Rotational Levels Formula ↻

Formula

$$E_{\text{RL}} = 2 \cdot B \cdot (J + 1)$$

Example with Units

$$608J = 2 \cdot 60.8\text{m}^{-1} \cdot (4 + 1)$$

Evaluate Formula ↻

5) Rotational Constant given Moment of Inertia Formula ↻

Formula

$$B_{\text{MI}} = \frac{[h\cdot]^2}{2 \cdot I}$$

Example with Units

$$4.9E-69\text{m}^{-1} = \frac{1.1E-34^2}{2 \cdot 1.125 \text{ kg}\cdot\text{m}^2}$$

Evaluate Formula ↻



6) Rotational Constant using Energy of Transitions Formula

Formula

$$B_{ET} = \frac{E_{nu}}{2 \cdot (J + 1)}$$

Example with Units

$$30 \text{ m}^{-1} = \frac{300 \text{ J}}{2 \cdot (4 + 1)}$$

Evaluate Formula 

7) Rotational Constant using Rotational Energy Formula

Formula

$$B_{RE} = \frac{E_{rot}}{J \cdot (J + 1)}$$

Example with Units

$$7.5 \text{ m}^{-1} = \frac{150 \text{ J}}{4 \cdot (4 + 1)}$$

Evaluate Formula 

8) Rotational Constant using Wave number Formula

Formula

$$B_{\text{wave_no}} = B \sim \cdot [hP] \cdot [c]$$

Example with Units

$$5\text{E-}22 \text{ m}^{-1} = 2500 \text{ 1/m} \cdot 6.6\text{E-}34 \cdot 3\text{E+}8 \text{ m/s}$$

Evaluate Formula 

9) Rotational Energy Formula

Formula

$$E_{\text{rotational}} = ([h]^{-2}) \cdot \frac{\beta}{2 \cdot I}$$

Example with Units

$$3.5\text{E-}68 \text{ J} = ([1.1\text{E-}34]^2) \cdot \frac{7}{2 \cdot 1.125 \text{ kg} \cdot \text{m}^2}$$

Evaluate Formula 

10) Rotational Energy using Centrifugal Distortion Formula

Formula

$$E_{\text{rot_CD}} = (B \cdot J \cdot (J + 1)) - (DC_J \cdot (J^2) \cdot ((J + 1)^2))$$

Example with Units

$$667616 \text{ J} = (60.8 \text{ m}^{-1} \cdot 4 \cdot (4 + 1)) - (-1666 \cdot (4^2) \cdot ((4 + 1)^2))$$

Evaluate Formula 

11) Rotational Energy using Rotational Constant Formula

Formula

$$E_{\text{rot_RC}} = B \cdot J \cdot (J + 1)$$

Example with Units

$$1216 \text{ J} = 60.8 \text{ m}^{-1} \cdot 4 \cdot (4 + 1)$$

Evaluate Formula 



Variables used in list of Rotational Energy Formulas above

- **B** Rotational Constant (1 per Meter)
- **B_{ET}** Rotational Constant given ET (1 per Meter)
- **B_{MI}** Rotational Constant given MI (1 per Meter)
- **B_{RE}** Rotational Constant given RE (1 per Meter)
- **B_{wave_no}** Rotational Constant given Wave Number (1 per Meter)
- **B_~** Wave Number in Spectroscopy (1 per Meter)
- **DC_j** Centrifugal Distortion Constant given RE
- **E_{nu}** Energy of Rotational Transitions (Joule)
- **E_{RL}** Energy of Rotational Transitions between RL (Joule)
- **E_{rot}** Rotational Energy (Joule)
- **E_{rot_CD}** Rotational Energy given CD (Joule)
- **E_{rot_RC}** Rotational Energy given RC (Joule)
- **E_{rotational}** Energy for Rotation (Joule)
- **I** Moment of Inertia (Kilogram Square Meter)
- **J** Rotational Level
- **β** Beta in Schrodinger Equation
- **β_{energy}** Beta using Rotational Energy
- **β_{levels}** Beta using Rotational Level

Constants, Functions, Measurements used in list of Rotational Energy Formulas above

- **constant(s): [c]**, 299792458.0
Light speed in vacuum
- **constant(s): [hP]**, 6.626070040E-34
Planck constant
- **constant(s): [h-]**, 1.054571817E-34
Reduced Planck constant
- **Measurement: Energy** in Joule (J)
Energy Unit Conversion ↻
- **Measurement: Moment of Inertia** in Kilogram Square Meter (kg·m²)
Moment of Inertia Unit Conversion ↻
- **Measurement: Wave Number** in 1 per Meter (1/m)
Wave Number Unit Conversion ↻
- **Measurement: Reciprocal Length** in 1 per Meter (m⁻¹)
Reciprocal Length Unit Conversion ↻



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