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Rotational Energy Formulas

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List of 11 Rotational Energy Formulas

Rotational Energy

1) Beta using Rotational Energy

Open Calculator

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

ex $$3E\hat{}70 = 2 \cdot 1.125\text{kg}\cdot\text{m}^2 \cdot \frac{150\text{J}}{[h\text{-}]^2}$$

2) Beta using Rotational Level

Open Calculator

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

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

3) Centrifugal Distortion Constant using Rotational Energy

Open Calculator

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

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

4) Energy of Rotational Transitions between Rotational Levels

Open Calculator

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

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

5) Rotational Constant given Moment of Inertia

Open Calculator

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

ex $$4.9E\hat{}\text{-}69m^{-1} = \frac{[h\text{-}]^2}{2 \cdot 1.125kg \cdot m^2}$$

6) Rotational Constant using Energy of Transitions

Open Calculator

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

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

7) Rotational Constant using Rotational Energy

Open Calculator

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

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

8) Rotational Constant using Wave number

Open Calculator

fx $$B_{wave\_no} = B\sim \cdot [hP] \cdot [c]$$

ex $$5E\hat{}\text{-}22m^{-1} = 2500/m \cdot [hP] \cdot [c]$$

9) Rotational Energy

Open Calculator

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

ex $$3.5E\hat{}\text{-}68J = \left([h\text{-}]^2\right) \cdot \frac{7}{2 \cdot 1.125kg{\cdot}m^2}$$

10) Rotational Energy using Centrifugal Distortion

Open Calculator

fx $$E_{rot\_CD} = (B \cdot J \cdot (J+1)) - \left(DC_j \cdot \left(J^2\right) \cdot \left((J+1)^2\right)\right)$$

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

11) Rotational Energy using Rotational Constant

Open Calculator

fx $$E_{rot\_RC} = B \cdot J \cdot (J+1)$$

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

Variables Used

- **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

- Constant: **[c]**, 299792458.0 Meter/Second
  Light speed in vacuum
- Constant: **[hP]**, 6.626070040E-34 Kilogram Meter² / Second
  Planck constant
- Constant: **[h-]**, [hP] / (2 * pi)
  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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- **Bond Length Formulas**
- **Kinetic Energy for System Formulas**
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