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Wave Energy Formulas

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List of 23 Wave Energy Formulas

Wave Energy

1) Deepwater Celerity given Wave Power of Deepwater

Open Calculator

fx $$C_o = \frac{P_d}{0.5 \cdot E}$$

ex $$4.5\text{m/s} = \frac{180\text{W}}{0.5 \cdot 80\text{J}}$$

2) Potential Energy given Total Wave Energy

Open Calculator

fx $$PE = TE - KE$$

ex $$10.124\text{J/m} = 20.26\text{J/m} - 10.136\text{J}$$

3) Specific Energy or Energy Density given Wave Height

Open Calculator

fx $$U = \frac{\rho \cdot [g] \cdot H^2}{8}$$

ex $$13.51479\text{J/m}^3 = \frac{1.225\text{kg/m}^3 \cdot [g] \cdot (3\text{m})^2}{8}$$

4) Specific Energy or Energy Density given Wavelength and Wave Energy

Open Calculator

fx $$U = \frac{TE}{\lambda}$$

ex $$13.50667\text{J/m}^3 = \frac{20.26\text{J/m}}{1.5\text{m}}$$

5) Total Wave Energy for Wave Power of Deepwater

Open Calculator

fx $$E = \frac{P_d}{0.5 \cdot C_o}$$

ex $$80\text{J} = \frac{180\text{W}}{0.5 \cdot 4.5\text{m/s}}$$

6) Total Wave Energy given Kinetic Energy and Potential Energy

Open Calculator

fx $$TE = KE + PE$$

ex $$20.266\text{J/m} = 10.136\text{J} + 10.13\text{J/m}$$

7) Total Wave Energy given Wave Power for Shallow Water

Open Calculator

fx $$E = \frac{P_s}{C_s}$$

ex $$80\text{J} = \frac{224\text{W}}{2.8\text{m/s}}$$

8) Total Wave Energy in one Wavelength per unit Crest Width

Open Calculator

$$\mathrm{TE} = \frac{\rho \cdot [g] \cdot \mathrm{H}^2 \cdot \lambda}{8}$$

$$20.27218\mathrm{J/m} = \frac{1.225\mathrm{kg/m^3} \cdot [g] \cdot (3\mathrm{m})^2 \cdot 1.5\mathrm{m}}{8}$$

9) Wave Celerity given Wave Power for Shallow Water

Open Calculator

$$\mathrm{C_s} = \frac{\mathrm{P_s}}{\mathrm{E}}$$

$$2.8\mathrm{m/s} = \frac{224\mathrm{W}}{80\mathrm{J}}$$

10) Wave Height given Total Wave Energy in one Wavelength per unit Crest Width

Open Calculator

$$\mathrm{H} = \sqrt{\frac{8 \cdot \mathrm{TE}}{\rho \cdot [g] \cdot \lambda}}$$

$$2.999098\mathrm{m} = \sqrt{\frac{8 \cdot 20.26\mathrm{J/m}}{1.225\mathrm{kg/m^3} \cdot [g] \cdot 1.5\mathrm{m}}}$$

11) Wave Power for Deepwater

Open Calculator

$$\mathrm{P_d} = 0.5 \cdot \mathrm{E} \cdot \mathrm{C_o}$$

$$180\mathrm{W} = 0.5 \cdot 80\mathrm{J} \cdot 4.5\mathrm{m/s}$$

12) Wave Power for Shallow Water

Open Calculator

fx $$P_s = E \cdot C_s$$

ex $$224\text{W} = 80\text{J} \cdot 2.8\text{m/s}$$

13) Wavelength for Total Wave Energy in Wavelength per unit Crest Width

Open Calculator

fx $$\lambda = \frac{8 \cdot TE}{\rho \cdot [g] \cdot H^2}$$

ex $$1.499098\text{m} = \frac{8 \cdot 20.26\text{J/m}}{1.225\text{kg/m}^3 \cdot [g] \cdot (3\text{m})^2}$$

Kinetic Energy

14) Kinetic Energy due to Particle Motion

Open Calculator

fx $$KE = \left(\frac{1}{16}\right) \cdot \rho \cdot [g] \cdot \left(H^2\right) \cdot \lambda$$

ex $$10.13609\text{J} = \left(\frac{1}{16}\right) \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot \left((3\text{m})^2\right) \cdot 1.5\text{m}$$

15) Kinetic Energy given Total Wave Energy

Open Calculator

fx $$KE = TE - PE$$

ex $$10.13\text{J} = 20.26\text{J/m} - 10.13\text{J/m}$$

16) Wave Height given Kinetic Energy due to Particle Motion

Open Calculator

fx $$H = \sqrt{\frac{KE}{0.0625 \cdot \rho \cdot [g] \cdot \lambda}}$$

ex $$2.999986\text{m} = \sqrt{\frac{10.136\text{J}}{0.0625 \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot 1.5\text{m}}}$$

17) Wavelength for Kinetic Energy due to Particle Motion

Open Calculator

fx $$\lambda = \frac{KE}{0.0625 \cdot \rho \cdot [g] \cdot H^2}$$

ex $$1.499986\text{m} = \frac{10.136\text{J}}{0.0625 \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot (3\text{m})^2}$$

Potential Energy

18) Length given Potential Energy due to Deformation of Free Surface

Open Calculator

fx $$\lambda = \frac{2 \cdot E_p}{\rho \cdot [g] \cdot \eta^2}$$

ex $$1.499977\text{m} = \frac{2 \cdot 324.35\text{J}}{1.225\text{kg/m}^3 \cdot [g] \cdot (6\text{m})^2}$$

19) Potential Energy due to Deformation of Free Surface

Open Calculator

fx $$E_p = \frac{\rho \cdot [g] \cdot \eta^2 \cdot \lambda}{2}$$

ex $$324.3549\text{J} = \frac{1.225\text{kg/m}^3 \cdot [g] \cdot (6\text{m})^2 \cdot 1.5\text{m}}{2}$$

20) Potential Energy per unit Width in One Wave

Open Calculator

fx $$PE = \left(\frac{1}{16}\right) \cdot \rho \cdot [g] \cdot \left(H^2\right) \cdot \lambda$$

ex $$10.13609\text{J/m} = \left(\frac{1}{16}\right) \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot \left((3\text{m})^2\right) \cdot 1.5\text{m}$$

21) Surface Elevation given Potential Energy due to Deformation of Free Surface

Open Calculator

fx $$\eta = \sqrt{\frac{2 \cdot E_p}{\rho \cdot [g] \cdot \lambda}}$$

ex $$5.999954\text{m} = \sqrt{\frac{2 \cdot 324.35\text{J}}{1.225\text{kg/m}^3 \cdot [g] \cdot 1.5\text{m}}}$$

22) Wave Height given Potential Energy per Unit Width in One Wave

Open Calculator

fx $$H = \sqrt{\frac{PE}{0.0625 \cdot \rho \cdot [g] \cdot \lambda}}$$

ex $$2.999098\text{m} = \sqrt{\frac{10.13\text{J/m}}{0.0625 \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot 1.5\text{m}}}$$

23) Wavelength for Potential Energy per unit Width in One Wave

Open Calculator

fx $$\lambda = \frac{PE}{0.0625 \cdot \rho \cdot [g] \cdot H^2}$$

ex $$1.499098\text{m} = \frac{10.13\text{J/m}}{0.0625 \cdot 1.225\text{kg/m}^3 \cdot [g] \cdot (3\text{m})^2}$$

Variables Used

- C_o Deepwater Wave Celerity *(Meter per Second)*
- C_s Celerity for Shallow Depth *(Meter per Second)*
- **E** Total Wave Energy *(Joule)*
- E_p Potential Energy of Wave *(Joule)*
- **H** Wave Height *(Meter)*
- **KE** Kinetic Energy of Wave per Unit Width *(Joule)*
- P_d Wave Power for Deep Water *(Watt)*
- P_s Wave Power for Shallow Depth *(Watt)*
- **PE** Potential Energy per Unit Width *(Joule per Meter)*
- **TE** Total Energy of Wave per Width *(Joule per Meter)*
- **U** Energy Density of Wave *(Joule per Cubic Meter)*
- **η** Surface Elevation *(Meter)*
- **λ** Wavelength *(Meter)*
- **ρ** Density of Fluid *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Energy** in Joule (J)
  Energy Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Energy Density** in Joule per Cubic Meter (J/m³)
  Energy Density Unit Conversion
- Measurement: **Energy per Unit Length** in Joule per Meter (J/m)
  Energy per Unit Length Unit Conversion

Check other formula lists

- Cnoidal Wave Theory Formulas
- Horizontal and Vertical Semi-Axis of Ellipse Formulas
- Wave Energy Formulas
- Wave Parameters Formulas
- Wave Period Formulas
- Wave Period Distribution and Wave Spectrum Formulas
- Zero-Crossing Method Formulas

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