

Important Wave Energy Formulas PDF



Formulas Examples with Units

List of 23 Important Wave Energy Formulas

1) Deepwater Celerity given Wave Power of Deepwater Formula

Formula

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

Example with Units

$$4.5 \text{ m/s} = \frac{180 \text{ w}}{0.5 \cdot 80 \text{ j}}$$

Evaluate Formula 

2) Potential Energy given Total Wave Energy Formula

Formula

$$PE = TE - KE$$

Example with Units

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

Evaluate Formula 

3) Specific Energy or Energy Density given Wave Height Formula

Formula

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

Example with Units

$$13.5148 \text{ j/m}^3 = \frac{1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 3 \text{ m}^2}{8}$$

Evaluate Formula 

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

Formula

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

Example with Units

$$13.5067 \text{ j/m}^3 = \frac{20.26 \text{ j/m}}{1.5 \text{ m}}$$

Evaluate Formula 

5) Total Wave Energy for Wave Power of Deepwater Formula

Formula

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

Example with Units

$$80 \text{ j} = \frac{180 \text{ w}}{0.5 \cdot 4.5 \text{ m/s}}$$

Evaluate Formula 

6) Total Wave Energy given Kinetic Energy and Potential Energy Formula

Formula

$$TE = KE + PE$$

Example with Units

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

Evaluate Formula 



7) Total Wave Energy given Wave Power for Shallow Water Formula

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

$$20.2722\text{J/m} = \frac{1.225\text{kg/m}^3 \cdot 9.8066\text{m/s}^2 \cdot 3\text{m}^2 \cdot 1.5\text{m}}{8}$$

Evaluate Formula 

9) Wave Celerity given Wave Power for Shallow Water Formula

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

$$2.9991\text{m} = \sqrt{\frac{8 \cdot 20.26\text{J/m}}{1.225\text{kg/m}^3 \cdot 9.8066\text{m/s}^2 \cdot 1.5\text{m}}}$$

Evaluate Formula 

11) Wave Power for Deepwater Formula

Formula

$$P_d = 0.5 \cdot E \cdot C_o$$

Example with Units

$$180\text{w} = 0.5 \cdot 80\text{J} \cdot 4.5\text{m/s}$$

Evaluate Formula 

12) Wave Power for Shallow Water Formula

Formula

$$P_s = E \cdot C_s$$

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

$$1.4991\text{m} = \frac{8 \cdot 20.26\text{J/m}}{1.225\text{kg/m}^3 \cdot 9.8066\text{m/s}^2 \cdot 3\text{m}^2}$$

Evaluate Formula 



14) Kinetic Energy Formulas

14.1) Kinetic Energy due to Particle Motion Formula

Formula

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

Example with Units

$$10.1361 \text{ J} = \left(\frac{1}{16} \right) \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot \left(3 \text{ m}^2 \right) \cdot 1.5 \text{ m}$$

Evaluate Formula 

14.2) Kinetic Energy given Total Wave Energy Formula

Formula

$$KE = TE - PE$$

Example with Units

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

Evaluate Formula 

14.3) Wave Height given Kinetic Energy due to Particle Motion Formula

Formula

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

Example with Units

$$3 \text{ m} = \sqrt{\frac{10.136 \text{ J}}{0.0625 \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 1.5 \text{ m}}}$$

Evaluate Formula 

14.4) Wavelength for Kinetic Energy due to Particle Motion Formula

Formula

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

Example with Units

$$1.5 \text{ m} = \frac{10.136 \text{ J}}{0.0625 \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 3 \text{ m}^2}$$

Evaluate Formula 

15) Potential Energy Formulas

15.1) Length given Potential Energy due to Deformation of Free Surface Formula

Formula

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

Example with Units

$$1.5 \text{ m} = \frac{2 \cdot 324.35 \text{ J}}{1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 6 \text{ m}^2}$$

Evaluate Formula 

15.2) Potential Energy due to Deformation of Free Surface Formula

Formula

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

Example with Units

$$324.3549 \text{ J} = \frac{1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 6 \text{ m}^2 \cdot 1.5 \text{ m}}{2}$$

Evaluate Formula 



15.3) Potential Energy per unit Width in One Wave Formula

Formula

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

Evaluate Formula 

Example with Units

$$10.1361 \text{ J/m} = \left(\frac{1}{16} \right) \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot (3 \text{ m}^2) \cdot 1.5 \text{ m}$$

15.4) Surface Elevation given Potential Energy due to Deformation of Free Surface Formula

Formula

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

Example with Units

$$6 \text{ m} = \sqrt{\frac{2 \cdot 324.35 \text{ J}}{1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 1.5 \text{ m}}}$$

Evaluate Formula 

15.5) Wave Height given Potential Energy per Unit Width in One Wave Formula

Formula

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

Example with Units

$$2.9991 \text{ m} = \sqrt{\frac{10.13 \text{ J/m}}{0.0625 \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 1.5 \text{ m}}}$$

Evaluate Formula 

15.6) Wavelength for Potential Energy per unit Width in One Wave Formula

Formula

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

Example with Units

$$1.4991 \text{ m} = \frac{10.13 \text{ J/m}}{0.0625 \cdot 1.225 \text{ kg/m}^3 \cdot 9.8066 \text{ m/s}^2 \cdot 3 \text{ m}^2}$$

Evaluate Formula 



Variables used in list of Wave Energy Formulas above

- **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 in list of Wave Energy Formulas above

- **constant(s):** [g], 9.80665
Gravitational acceleration on Earth
- **Functions:** **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 



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