



# Shoaling, Refraction and Breaking Formulas

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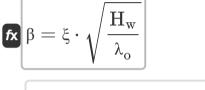




# List of 16 Shoaling, Refraction and Breaking Formulas

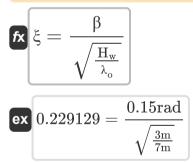
### Shoaling, Refraction and Breaking 🖉

#### 1) Beach Slope given Breaking Wave and Wave Height at Breaking Point



$$\textbf{ex} \ 0.149916 \text{rad} = 0.229 \cdot \sqrt{\frac{3\text{m}}{7\text{m}}}$$

#### 2) Breaking Wave given wave height at Breaking Point 🕑



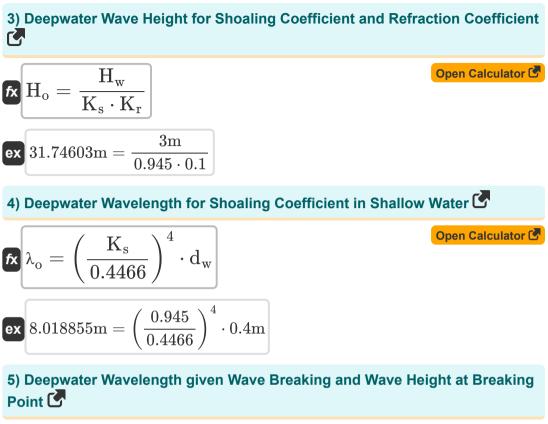
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$$\begin{aligned} & \mathbf{\hat{k}} \mathbf{\hat{\lambda}_{o}} = \frac{\boldsymbol{\xi}^{2} \cdot \mathbf{H}_{w}}{\boldsymbol{\beta}^{2}} \\ & \mathbf{ex} \ 6.992133 \mathrm{m} = \frac{(0.229)^{2} \cdot 3\mathrm{m}}{(0.15 \mathrm{rad})^{2}} \end{aligned}$$

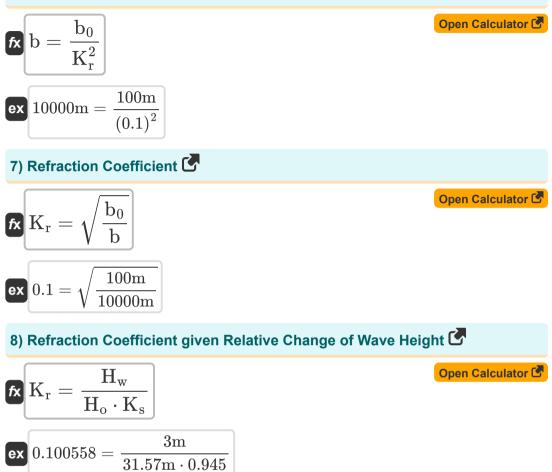
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#### 6) Distance between Two Rays at General Point 🕑







### 9) Shoaling Coefficient 🗹

fx Open Calculator C  

$$K_s = \left( \tanh(k \cdot d) \cdot \left( 1 + \left( 2 \cdot k \cdot \frac{d}{\sinh(2 \cdot k \cdot d)} \right) \right) \right)^{-0.5}$$
ex

$$0.951161 = \left( anh(0.2\cdot10 ext{m})\cdot \left( 1 + \left( 2\cdot0.2\cdotrac{10 ext{m}}{ ext{sinh}(2\cdot0.2\cdot10 ext{m})}
ight) 
ight) 
ight)^{-0.5}$$

### 10) Shoaling Coefficient given Wave Celerity 🕑

fx 
$$\mathrm{K_s} = \sqrt{rac{\mathrm{C_o}}{\mathrm{C} \cdot 2 \cdot \mathrm{n}}}$$

ex 
$$0.67082 = \sqrt{rac{4.5 \mathrm{m/s}}{20 \mathrm{m/s} \cdot 2 \cdot 0.25}}$$

### 11) Shoaling Coefficient in Shallow Water



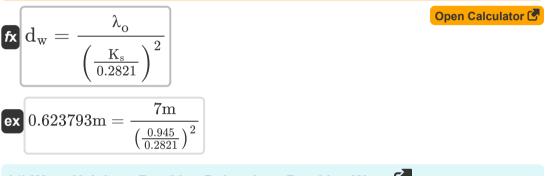


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#### 12) Water Depth given Shoaling Coefficient in Shallow Water 🕑



#### 13) Water Depth when Reduced Shoaling Coefficient in Shallow Water



$$\begin{aligned} & \textbf{K} \quad \mathbf{H}_{w} = \frac{\lambda_{o} \cdot \beta^{2}}{\xi^{2}} \\ & \textbf{ex} \quad 3.003375m = \frac{7m \cdot (0.15rad)^{2}}{(0.229)^{2}} \end{aligned}$$

### 15) Wave Height given Shoaling Coefficient and Refraction Coefficient

fx 
$$\mathrm{H_w} = \mathrm{H_o} \cdot \mathrm{K_s} \cdot \mathrm{K_r}$$

**ex** 2.983365m = 31.57m  $\cdot 0.945 \cdot 0.1$ 





Open Calculator

# 16) Wave Length for Reduced Shoaling Coefficient in Shallow Water

$$\lambda_{o} = d_{w} \cdot \left(\frac{K_{s}}{0.2821}\right)^{2}$$

$$ex 4.488667m = 0.4m \cdot \left(\frac{0.945}{0.2821}\right)^{2}$$

$$Qpen Calculator C$$





## Variables Used

- **b** Distance Between Two Rays (Meter)
- **b**<sub>0</sub> Distance Between Two Rays at Deepwater (Meter)
- C Celerity of the Wave (Meter per Second)
- Co Deepwater Wave Celerity (Meter per Second)
- d Coastal Mean Depth (Meter)
- **d**<sub>w</sub> Water Depth in Ocean (Meter)
- Ho Wave Height in Deepwater (Meter)
- H<sub>w</sub> Wave Height for Surface Gravity Waves (Meter)
- k Wave Number for Water Wave
- Kr Refraction Coefficient
- K<sub>s</sub> Shoaling Coefficient
- **n** Ratio of Group Velocity to Phase Velocity
- β Beach Slope (Radian)
- λ<sub>o</sub> Deep-Water Wavelength (Meter)
- **ξ** Breaking Wave







### **Constants, Functions, Measurements used**

- Function: sinh, sinh(Number) The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.
- 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.
- Function: tanh, tanh(Number) The hyperbolic tangent function (tanh) is a function that is defined as the ratio of the hyperbolic sine function (sinh) to the hyperbolic cosine function (cosh).
- Measurement: Length in Meter (m) Length Unit Conversion
- Measurement: Speed in Meter per Second (m/s) Speed Unit Conversion
- Measurement: Angle in Radian (rad) Angle Unit Conversion

# **Check other formula lists**

- Group Velocity, Beats, Energy Transport Formulas
- Linear Dispersion Relation of Linear Wave Formulas
- Non-Linear Wave Theory
   Formulas
- Shoaling, Refraction and Breaking
  Formulas

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