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Buoyancy And Floatation Formulas

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List of 24 Buoyancy And Floatation Formulas

Buoyancy And Floatation

Buoyancy Force and Center of Buoyancy

1) Buoyancy Force given Volume of Vertical Prism

$$\text{fx } F_{\text{Buoyant}} = \omega \cdot V$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 44566.83\text{N} = 75537\text{N}/\text{m}^3 \cdot 0.59\text{m}^3$$

2) Buoyant Force on Entire Submerged Body

$$\text{fx } F_{\text{Buoyant}} = \omega \cdot V$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 44566.83\text{N} = 75537\text{N}/\text{m}^3 \cdot 0.59\text{m}^3$$

3) Buoyant Force on Vertical Prism

$$\text{fx } F_{\text{Buoyant}} = \omega \cdot H_{\text{Pressurehead}} \cdot A$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$\text{ex } 44944.51\text{N} = 75537\text{N}/\text{m}^3 \cdot 0.7\text{m} \cdot 0.85\text{m}^2$$

4) Buoyant Force when Body Floats at between two Immiscible Fluids of Specific Weights

$$\text{fx } F_{\text{Buoyant}} = (\omega \cdot v_1 + \omega_1 \cdot v_2)$$

[Open Calculator !\[\]\(166772600a13ad0a433053f90fe45649_img.jpg\)](#)

$$\text{ex } 53523.54\text{N} = (75537\text{N}/\text{m}^3 \cdot 0.001\text{m}^3/\text{kg} + 65500\text{N}/\text{m}^3 \cdot 0.816\text{m}^3/\text{kg})$$



5) Cross Sectional Area of Prism given Buoyancy Force

$$\text{fx } A = \frac{F_{\text{Buoyant}}}{\omega \cdot H_{\text{Pressurehead}}}$$

Open Calculator 

$$\text{ex } 0.837433\text{m}^2 = \frac{44280\text{N}}{75537\text{N}/\text{m}^3 \cdot 0.7\text{m}}$$

6) Cross Sectional Area of Prism given Volume of Vertical Prism dV

$$\text{fx } A = \frac{V}{H_{\text{Pressurehead}}}$$

Open Calculator 

$$\text{ex } 0.842857\text{m}^2 = \frac{0.59\text{m}^3}{0.7\text{m}}$$

7) Pressure Head Difference given Buoyancy Force

$$\text{fx } H_{\text{Pressurehead}} = \frac{F_{\text{Buoyant}}}{\omega \cdot A}$$

Open Calculator 

$$\text{ex } 0.68965\text{m} = \frac{44280\text{N}}{75537\text{N}/\text{m}^3 \cdot 0.85\text{m}^2}$$

8) Pressure Head Difference given Volume of Vertical Prism dV

$$\text{fx } H_{\text{Pressurehead}} = \frac{V}{A}$$

Open Calculator 

$$\text{ex } 0.694118\text{m} = \frac{0.59\text{m}^3}{0.85\text{m}^2}$$



9) Specific Weight pf Fluid given Buoyancy Force

[Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5_img.jpg\)](#)

$$\text{fx } \omega = \frac{F_{\text{Buoyant}}}{H_{\text{Pressurehead}} \cdot A}$$

$$\text{ex } 74420.17\text{N/m}^3 = \frac{44280\text{N}}{0.7\text{m} \cdot 0.85\text{m}^2}$$

10) Total Buoyant Force given Volumes of Elementary Prism Submerged in Fluids

[Open Calculator !\[\]\(ec9132f1d27c8919987d92907322654d_img.jpg\)](#)

$$\text{fx } F_{\text{Buoyant}} = (\omega \cdot v_1 + \omega_1 \cdot v_2)$$

$$\text{ex } 53523.54\text{N} = (75537\text{N/m}^3 \cdot 0.001\text{m}^3/\text{kg} + 65500\text{N/m}^3 \cdot 0.816\text{m}^3/\text{kg})$$

11) Volume of Submerged Body given Buoyant Force on Entire Submerged Body

[Open Calculator !\[\]\(758ebdf4629c903da74c2e079717ae32_img.jpg\)](#)

$$\text{fx } V = \frac{F_{\text{Buoyant}}}{\omega}$$

$$\text{ex } 0.586203\text{m}^3 = \frac{44280\text{N}}{75537\text{N/m}^3}$$

12) Volume of Vertical Prism

[Open Calculator !\[\]\(248b91fcdac4810ffd15cf33fb6aec6f_img.jpg\)](#)

$$\text{fx } V = H_{\text{Pressurehead}} \cdot A$$

$$\text{ex } 0.595\text{m}^3 = 0.7\text{m} \cdot 0.85\text{m}^2$$



Determination of Metacentric Height

13) Angle Made by Pendulum

$$\text{fx } \theta = a \tan\left(\frac{d}{l}\right)$$

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

$$\text{ex } 71.56505^\circ = a \tan\left(\frac{150\text{m}}{50\text{m}}\right)$$

14) Distance Moved by Pendulum on Horizontal scale

$$\text{fx } d = l \cdot \tan(\theta)$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$\text{ex } 149.4342\text{m} = 50\text{m} \cdot \tan(71.5^\circ)$$

15) Length of Plumb Line

$$\text{fx } l = \frac{d}{\tan(\theta)}$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 50.1893\text{m} = \frac{150\text{m}}{\tan(71.5^\circ)}$$



Metacentric Height for Floating Bodies Containing liquid

16) Distance between Centre of Gravity of these Wedges

$$fx \quad z = \frac{m}{\omega \cdot V}$$

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42_img.jpg\)](#)

$$ex \quad 1.121911m = \frac{50000N \cdot m}{75537N/m^3 \cdot 0.59m^3}$$

17) Moment of Turning Couple due to Movement of Liquid

$$fx \quad m = (\omega \cdot V \cdot z)$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$ex \quad 46795.17N \cdot m = (75537N/m^3 \cdot 0.59m^3 \cdot 1.05m)$$

18) Volume of either Wedge

$$fx \quad V = \frac{m}{\omega \cdot z}$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$ex \quad 0.630407m^3 = \frac{50000N \cdot m}{75537N/m^3 \cdot 1.05m}$$



Stability of Submerged and Floating Bodies

19) Restoring Couple when Floating Body in Stable Equilibrium

fxOpen Calculator 

$$R_{\text{Restoring Couple}} = \left(W_{\text{body}} \cdot x \cdot \left(D \cdot \left(\frac{180}{\pi} \right) \right) \right)$$

ex

$$12960\text{N}\cdot\text{m} = \left(18\text{N} \cdot 8\text{m} \cdot \left(90^\circ \cdot \left(\frac{180}{\pi} \right) \right) \right)$$

20) Righting Couple when Floating Body in Unstable Equilibrium

fxOpen Calculator 

$$R_{\text{Righting Couple}} = \left(W_{\text{body}} \cdot x \cdot \left(D \cdot \left(\frac{180}{\pi} \right) \right) \right)$$

ex

$$12960\text{N}\cdot\text{m} = \left(18\text{N} \cdot 8\text{m} \cdot \left(90^\circ \cdot \left(\frac{180}{\pi} \right) \right) \right)$$

21) Weight of Body given Restoring Couple

fxOpen Calculator 

$$W_{\text{body}} = \frac{R_{\text{Restoring Couple}}}{x \cdot \left(D \cdot \left(\frac{180}{\pi} \right) \right)}$$

ex

$$18\text{N} = \frac{12960\text{N}\cdot\text{m}}{8\text{m} \cdot \left(90^\circ \cdot \left(\frac{180}{\pi} \right) \right)}$$



22) Weight of Body given Righting Couple

[Open Calculator !\[\]\(3d8c13c92b853674f749aac6fa869926_img.jpg\)](#)

$$\text{fx } W_{\text{body}} = \frac{R_{\text{Righting Couple}}}{x \cdot \left(D \cdot \left(\frac{180}{\pi}\right)\right)}$$

$$\text{ex } 18.00139\text{N} = \frac{12961\text{N}\cdot\text{m}}{8\text{m} \cdot \left(90^\circ \cdot \left(\frac{180}{\pi}\right)\right)}$$

Time Period of Transverse Oscillation of a Floating Body

23) Radius of Gyration of Body given Time Period

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{fx } k_G = \sqrt{\left(\left(\frac{T}{2 \cdot \pi}\right)^2\right) \cdot ([g] \cdot GM)}$$

$$\text{ex } 0.10385\text{m} = \sqrt{\left(\left(\frac{5.38\text{s}}{2 \cdot \pi}\right)^2\right) \cdot ([g] \cdot 0.0015\text{m})}$$

24) Time Period of One Complete Oscillations

[Open Calculator !\[\]\(4688aadfd656ded00cd6bdfae55089a9_img.jpg\)](#)

$$\text{fx } T = 2 \cdot \pi \cdot \left(\frac{k_G^2}{[g] \cdot GM}\right)^{\frac{1}{2}}$$

$$\text{ex } 5.439553\text{s} = 2 \cdot \pi \cdot \left(\frac{(0.105\text{m})^2}{[g] \cdot 0.0015\text{m}}\right)^{\frac{1}{2}}$$











Variables Used



- **A** Cross-Sectional Area of Body (Square Meter)
- **d** Distance Moved (Meter)
- **D** Angle Between Bodies (Degree)
- **F_{Buoyant}** Buoyant Force (Newton)
- **GM** Metacentric Height (Meter)
- **H_{Pressurehead}** Difference in Pressure Head (Meter)
- **k_G** Radius of Gyration of Body (Meter)
- **l** Length of Plumb Line (Meter)
- **m** Moment of turning Couple (Newton Meter)
- **R_{Restoring Couple}** Restoring Couple (Newton Meter)
- **R_{Righting Couple}** Righting Couple (Newton Meter)
- **T** Time Period of Rolling (Second)
- **V** Volume of Body (Cubic Meter)
- **W_{body}** Weight of Body (Newton)
- **x** Distance from submerged to Floating Body (Meter)
- **z** Distance between Center of Gravity of these Wedges (Meter)
- **θ** Tilting Angle of Body (Degree)
- **v₁** Specific Volume at Point 1 (Cubic Meter per Kilogram)
- **v₂** Specific Volume at Point 2 (Cubic Meter per Kilogram)
- **ω** Specific Weight of body (Newton per Cubic Meter)
- **ω₁** Specific Weight 2 (Newton per Cubic Meter)



Constants, Functions, Measurements used



















- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Constant:** **[g]**, 9.80665 Meter/Second²
Gravitational acceleration on Earth
- **Function:** **atan**, atan(Number)
Inverse trigonometric tangent function
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Function:** **tan**, tan(Angle)
Trigonometric tangent function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Time** in Second (s)
Time Unit Conversion 
- **Measurement:** **Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement:** **Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement:** **Force** in Newton (N)
Force Unit Conversion 
- **Measurement:** **Angle** in Degree (°)
Angle Unit Conversion 
- **Measurement:** **Torque** in Newton Meter (N*m)
Torque Unit Conversion 
- **Measurement:** **Specific Volume** in Cubic Meter per Kilogram (m³/kg)
Specific Volume Unit Conversion 



- **Measurement: Moment of Force** in Newton Meter ($\text{N}\cdot\text{m}$)
Moment of Force Unit Conversion 
- **Measurement: Specific Weight** in Newton per Cubic Meter (N/m^3)
Specific Weight Unit Conversion 



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