



Gravitation Formulas

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List of 21 Gravitation Formulas

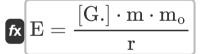
Gravitation

1) Gravitational Field Intensity

$$E = \frac{F}{m}$$

 $oxed{ex} 0.075758 {
m N/Kg} = rac{2.5 {
m N}}{33 {
m kg}}$

2) Gravitational Field Intensity due to Point Mass



 $\boxed{1.8 \text{E}^{\text{-}}\text{-}10 \text{N/Kg} = \frac{[\text{G.}] \cdot 33 \text{kg} \cdot 0.5 \text{kg}}{6 \text{m}} }$

3) Gravitational Potential Energy 🚰

$$extbf{U} = -rac{[\mathrm{G.}]\cdot\mathrm{m}_1\cdot\mathrm{m}_2}{\mathrm{r_c}}$$

 $oxed{ex} egin{aligned} -1.5 ext{E^--}10 ext{J} = -rac{[ext{G.}]\cdot 14 ext{kg}\cdot 16 ext{kg}}{102 ext{m}} \end{aligned}$

Open Calculator

Open Calculator 2



4) Time Period of Satellite

Open Calculator

$$au = \left(rac{2 \cdot \pi}{ ext{[Earth-R]}}
ight) \cdot \sqrt{rac{ ext{([Earth-R]} + ext{h})^3}{ ext{g}}}$$

ex
$$1.407245 \mathrm{h} = \left(rac{2 \cdot \pi}{\mathrm{[Earth-R]}}
ight) \cdot \sqrt{rac{\mathrm{([Earth-R]} + 13 \mathrm{m})^3}{9.8 \mathrm{m/s^2}}}$$

5) Universal Law of Gravitation

 $\mathbf{F} = rac{[\mathrm{G.}] \cdot \mathrm{m}_1 \cdot \mathrm{m}_2}{\mathrm{r}_c^2}$

Open Calculator 2

ex
$$1.4E^-12N = \frac{[G.] \cdot 14kg \cdot 16kg}{(102m)^2}$$

Gravitational Field G

6) Gravitational Field of Ring

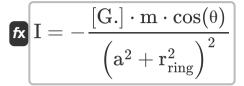
$$ext{I} = -rac{[G.]\cdot m\cdot a}{\left(r_{
m ring}^2 + a^2
ight)^{rac{3}{2}}}$$

Open Calculator

$$\boxed{ -3.4 \text{E} \, \hat{} \, -15 \text{N} / \text{Kg} = -\frac{ \left[\text{G.} \right] \cdot 33 \text{kg} \cdot 4 \text{m}}{ \left((5 \text{m})^2 + (4 \text{m})^2 \right)^{\frac{3}{2}} } }$$



7) Gravitational Field of Ring given Angle at any Point Outside Ring 🗗



Open Calculator 🗗

$$-1.1\text{E}^{-}-12\text{N}/\text{Kg} = -\frac{[\text{G.}] \cdot 33\text{kg} \cdot \cos(30^{\circ})}{\left(\left(4\text{m}\right)^{2} + \left(5\text{m}\right)^{2}\right)^{2}}$$

8) Gravitational Field of Thin Circular Disc

$$ag{I} = -rac{2\cdot [\mathrm{G.}]\cdot \mathrm{m}\cdot (1-\cos(heta))}{\mathrm{r_c^2}}$$

Open Calculator

$$= -\frac{2 \cdot [\text{G.}] \cdot 33 \text{kg} \cdot (1 - \cos(30^\circ))}{(102 \text{m})^2}$$

9) Gravitational Field when Point is Inside of Non Conducting Solid Sphere

$$\mathbf{f} \mathbf{x} = -rac{[\mathrm{G.}] \cdot \mathrm{m} \cdot \mathrm{a}}{\mathrm{R}^3}$$

Open Calculator

$$ext{ex} egin{aligned} -4.5 ext{E^--9N/Kg} &= -rac{[ext{G.}] \cdot 33 ext{kg} \cdot 4 ext{m}}{(1.25 ext{m})^3} \end{aligned}$$



10) Gravitational Field when Point is Outside of Conducting Solid Sphere

 $I = -\frac{[G.] \cdot m}{I}$

Open Calculator 🗗

 $extstyle -1.4 ext{E^--}10 ext{N/Kg} = -rac{[ext{G.}] \cdot 33 ext{kg}}{\left(4 ext{m}
ight)^2}$

11) Gravitational Field when Point is Outside of Non Conducting Solid Sphere

 $\mathbf{K} = -rac{[\mathrm{G.}] \cdot \mathrm{m}}{\mathrm{a}^2}$

Open Calculator

 $-1.4 \text{E}^{-10} \text{N/Kg} = -\frac{[\text{G.}] \cdot 33 \text{kg}}{(4 \text{m})^2}$

Gravitational Potential 🗗

12) Gravitational Potential

 $ext{fx} V = -rac{[G.] \cdot m}{s_{
m body}}$

Open Calculator

 $extbf{ex} iggl[-2.9 ext{E^--9J/kg} = -rac{[ext{G.}]\cdot 33 ext{kg}}{0.75 ext{m}} iggr]$



13) Gravitational Potential of Ring

 $ext{V} = -rac{[ext{G.}] \cdot ext{m}}{\sqrt{ ext{r}_{ ext{ring}}^2 + ext{a}^2}}$

Open Calculator

 $\boxed{ -3.4 \text{E} \, \widehat{} \, -12 \text{J/kg} = -\frac{ \left[\text{G.} \right] \cdot 33 \text{kg}}{ \sqrt{ \left(5 \text{m} \right)^2 + \left(4 \text{m} \right)^2 } } }$

14) Gravitational Potential of Thin Circular Disc

 $extbf{K} V = -rac{2\cdot [ext{G.}]\cdot ext{m}\cdot \left(\sqrt{ ext{a}^2+ ext{R}^2}- ext{a}
ight)}{ ext{R}^2}$

Open Calculator 🖸

 $= \frac{2 \cdot [\mathrm{G.}] \cdot 33 \mathrm{kg} \cdot \left(\sqrt{\left(4 \mathrm{m}\right)^2 + \left(1.25 \mathrm{m}\right)^2} - 4 \mathrm{m} \right)}{\left(1.25 \mathrm{m}\right)^2}$

15) Gravitational Potential when Point is Inside of Conducting Solid Sphere

 $V = -\frac{[G.] \cdot m}{R}$

Open Calculator

 $extstyle -1.8 ext{E^--9J/kg} = -rac{[ext{G.}] \cdot 33 ext{kg}}{1.25 ext{m}}$



16) Gravitational Potential when Point is Inside of Non Conducting Solid Sphere

 $\mathbf{x} = -rac{\left[\mathrm{G.}
ight] \cdot \mathrm{m} \cdot \left(3 \cdot \mathrm{r_c^2} - \mathrm{a^2}
ight)}{2 \cdot \mathrm{R}^3}$

Open Calculator

 $\begin{array}{c} \textbf{ex} \\ \textbf{-1.8E^--5J/kg} = -\frac{[\text{G.}] \cdot 33 \text{kg} \cdot \left(3 \cdot (102 \text{m})^2 - (4 \text{m})^2\right)}{2 \cdot \left(1.25 \text{m}\right)^3} \end{array}$

17) Gravitational Potential when Point is Outside of Conducting Solid Sphere

 $\mathbf{fx} \boxed{V = -\frac{[G.] \cdot m}{a}}$

Open Calculator 🗗

 $extstyle -5.5 ext{E^--}10 ext{J/kg} = -rac{ ext{[G.]} \cdot 33 ext{kg}}{4 ext{m}}$

18) Gravitational Potential when Point is Outside of Non Conducting Solid Sphere

 $V = -rac{[G.] \cdot m}{a}$

$$oxed{ex} -5.5 ext{E^--} -10 ext{J/kg} = -rac{[ext{G.}] \cdot 33 ext{kg}}{4 ext{m}}$$



Variation of Acceleration due to Gravity

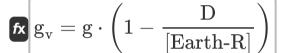
19) Variation of Acceleration due to Gravity on Altitude

$$\mathbf{f}\mathbf{x} \left[\mathbf{g}_{\mathrm{v}} = \mathbf{g} \cdot \left(1 - rac{2 \cdot \mathbf{h}}{\left[\mathrm{Earth-R}
ight]}
ight)
ight]$$

Open Calculator 🗗

$$9.79996 ext{m/s}^2 = 9.8 ext{m/s}^2 \cdot \left(1 - rac{2 \cdot 13 ext{m}}{ ext{[Earth-R]}}
ight)$$

20) Variation of Acceleration due to Gravity on Depth



Open Calculator

$$oxed{ex} 9.799995 \mathrm{m/s^2} = 9.8 \mathrm{m/s^2} \cdot \left(1 - rac{3 \mathrm{m}}{\mathrm{[Earth-R]}}
ight)$$

21) Variation of Acceleration on Surface of Earth due to Gravity Effect 🚰

$$\left|\mathbf{g}_{\mathrm{v}}=\mathbf{g}\cdot\left(1-rac{\left[\mathrm{Earth-R}
ight]\cdot\omega}{\mathbf{g}}
ight)
ight|$$

Open Calculator 🗗

$$oxed{\mathsf{ex}} egin{aligned} ext{-12742007.8m/s}^2 &= 9.8 ext{m/s}^2 \cdot \left(1 - rac{[ext{Earth-R}] \cdot 2 ext{rad/s}}{9.8 ext{m/s}^2}
ight) \end{aligned}$$



Variables Used

- a Distance from Center to Point (Meter)
- **D** Depth (Meter)
- E Gravitational Field Intensity (Newton per Kilogram)
- F Force (Newton)
- **g** Acceleration due to Gravity (Meter per Square Second)
- g_v Variation of Acceleration due to Gravity (Meter per Square Second)
- **h** Altitude (Meter)
- I Gravitational Field (Newton per Kilogram)
- m Mass (Kilogram)
- m₁ Mass 1 (Kilogram)
- m₂ Mass 2 (Kilogram)
- m_o Test Mass (Kilogram)
- r Distance between Two Bodies (Meter)
- R Radius (Meter)
- r_c Distance between Centers (Meter)
- r_{ring} Radius of Ring (Meter)
- Spody Displacement of Body (Meter)
- T Time period of Satellite (Hour)
- **U** Gravitational Potential Energy (Joule)
- V Gravitational Potential (Joule per Kilogram)
- θ Theta (Degree)
- ω Angular Velocity (Radian per Second)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Constant: [Earth-R], 6371.0088 Kilometer Earth mean radius
- Constant: [G.], 6.67408E-11 * Meter³/Kiogram Second²
 Gravitational constant
- Function: cos, cos(Angle)
 Trigonometric cosine function
- Function: sqrt, sqrt(Number)
 Square root function
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Time in Hour (h)
 Time Unit Conversion
- Measurement: Acceleration in Meter per Square Second (m/s²)
 Acceleration Unit Conversion
- Measurement: Energy in Joule (J)
 Energy Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s)
 Angular Velocity Unit Conversion





Gravitation Formulas... 11/12

• Measurement: Gravitational Potential in Joule per Kilogram (J/kg)

Gravitational Potential Unit Conversion

 Measurement: Gravitational Field Intensity in Newton per Kilogram (N/Kg)

Gravitational Field Intensity Unit Conversion





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