Motion in Bodies Hanging by String Formulas

List of 15 Motion in Bodies Hanging by String Formulas

Motion in Bodies Hanging by String

Body Lying on Rough Horizontal Plane

1) Acceleration of System with Bodies One Hanging Free and Other Lying on Rough Horizontal Plane

Open Calculator

fx
$$a_s = \frac{m_1 - \mu_{hs} \cdot m_2}{m_1 + m_2} \cdot [g]$$

ex
$$5.940081 \text{m/s}^2 = \frac{29\text{kg} - 0.24 \cdot 13.52\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

2) Tension in String given Coefficient of Friction of Horizontal Plane

Open Calculator

fx
$$T_{st} = (1 + \mu_{hor}) \cdot \frac{m_1 \cdot m_2}{m_1 + m_2} \cdot [g]$$

ex
$$130.0352\text{N} = (1 + 0.438) \cdot \frac{29\text{kg} \cdot 13.52\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

Body Lying on Rough Inclined Plane

3) Acceleration of System with Bodies One Hanging Free, Other Lying on Rough Inclined Plane

Open Calculator

fx $$a_i = \frac{m_1 - m_2 \cdot \sin(\theta_p) - \mu_{hs} \cdot m_2 \cdot \cos(\theta_p)}{m_1 + m_2} \cdot [g]$$

ex $$5.24631\text{m/s}^2 = \frac{29\text{kg} - 13.52\text{kg} \cdot \sin(13.23°) - 0.24 \cdot 13.52\text{kg} \cdot \cos(13.23°)}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

4) Coefficient of Friction given Frictional Force

Open Calculator

fx $$\mu_{hs} = \frac{F_{fri}}{m_2 \cdot [g] \cdot \cos(\theta_p)}$$

ex $$0.24 = \frac{30.97607\text{N}}{13.52\text{kg} \cdot [g] \cdot \cos(13.23°)}$$

5) Coefficient of Friction given Tension

Open Calculator

fx $$\mu_{hs} = \frac{m_1 + m_2}{m_1 \cdot m_1 \cdot [g]} \cdot T_{st} \cdot \sec(\theta_b) - \tan(\theta_b) - \sec(\theta_b)$$

ex $$0.246058 = \frac{29\text{kg} + 13.52\text{kg}}{29\text{kg} \cdot 29\text{kg} \cdot [g]} \cdot 130\text{N} \cdot \sec(327.5°) - \tan(327.5°) - \sec(327.5°)$$

6) Frictional Force

Open Calculator

$$F_{fri} = \mu_{hs} \cdot m_2 \cdot [g] \cdot \cos(\theta_p)$$

$$30.97607\text{N} = 0.24 \cdot 13.52\text{kg} \cdot [g] \cdot \cos(13.23°)$$

7) Inclination of Plane for given Frictional Force

Open Calculator

$$\theta_p = a\cos\left(\frac{F_{fri}}{\mu_{hs} \cdot m_2 \cdot [g]}\right)$$

$$13.23003° = a\cos\left(\frac{30.97607\text{N}}{0.24 \cdot 13.52\text{kg} \cdot [g]}\right)$$

8) Mass of Body B given Frictional Force

Open Calculator

$$m_2 = \frac{F_{fri}}{\mu_{hs} \cdot [g] \cdot \cos(\theta_p)}$$

$$13.52\text{kg} = \frac{30.97607\text{N}}{0.24 \cdot [g] \cdot \cos(13.23°)}$$

9) Tension in String given Coefficient of Friction of Inclined Plane

Open Calculator

$$T_{st} = \frac{m_1 \cdot m_2}{m_1 + m_2} \cdot [g] \cdot \left(1 + \sin(\theta_p) + \mu_{hs} \cdot \cos(\theta_p)\right)$$

$$132.2499\text{N} = \frac{29\text{kg} \cdot 13.52\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g] \cdot (1 + \sin(13.23°) + 0.24 \cdot \cos(13.23°))$$

Body Lying on Smooth Horizontal Plane

10) Acceleration in System

Open Calculator

$$a_b = \frac{m_1}{m_1 + m_2} \cdot [g]$$

ex $$6.688449 \text{m/s}^2 = \frac{29\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

11) Tension in String if only One Body is Freely Suspended

Open Calculator

$$T_{fs} = \frac{m_1 \cdot m_2}{m_1 + m_2} \cdot [g]$$

ex $$90.42783\text{N} = \frac{29\text{kg} \cdot 13.52\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

Body Lying on Smooth Inclined Plane

12) Acceleration of System with Bodies One Hanging Free and Other Lying on Smooth Inclined Plane

Open Calculator

$$a_s = \frac{m_1 - m_2 \cdot \sin(\theta_p)}{m_1 + m_2} \cdot [g]$$

ex $$5.974816 \text{m/s}^2 = \frac{29\text{kg} - 13.52\text{kg} \cdot \sin(13.23°)}{29\text{kg} + 13.52\text{kg}} \cdot [g]$$

13) Angle of Inclination given Acceleration

Open Calculator

fx $$\theta_p = a\sin\left(\frac{m_1 \cdot [g] - m_1 \cdot a_s - m_2 \cdot a_s}{m_2 \cdot [g]}\right)$$

ex $$13.88807° = a\sin\left(\frac{29\text{kg} \cdot [g] - 29\text{kg} \cdot 5.94\text{m/s}^2 - 13.52\text{kg} \cdot 5.94\text{m/s}^2}{13.52\text{kg} \cdot [g]}\right)$$

14) Angle of Inclination given Tension

Open Calculator

fx $$\theta_p = a\sin\left(\frac{T \cdot (m_1 + m_2)}{m_1 \cdot m_2 \cdot [g]} - 1\right)$$

ex $$13.23° = a\sin\left(\frac{111.1232\text{N} \cdot (29\text{kg} + 13.52\text{kg})}{29\text{kg} \cdot 13.52\text{kg} \cdot [g]} - 1\right)$$

15) Tension in String when One Body is Lying on Smooth Inclined Plane

Open Calculator

fx $$T = \frac{m_1 \cdot m_2}{m_1 + m_2} \cdot [g] \cdot (1 + \sin(\theta_p))$$

ex $$111.1232\text{N} = \frac{29\text{kg} \cdot 13.52\text{kg}}{29\text{kg} + 13.52\text{kg}} \cdot [g] \cdot (1 + \sin(13.23°))$$

Variables Used

- a_b Acceleration of System *(Meter per Square Second)*
- a_i Acceleration of System in Inclined Plane *(Meter per Square Second)*
- a_s Acceleration of Body *(Meter per Square Second)*
- F_{fri} Force of Friction *(Newton)*
- m_1 Mass of Left Body *(Kilogram)*
- m_2 Mass of Right Body *(Kilogram)*
- T Tension *(Newton)*
- T_{fs} Tension in Freely Suspended String *(Newton)*
- T_{st} Tension in String *(Newton)*
- θ_b Inclination of body *(Degree)*
- θ_p Inclination of Plane *(Degree)*
- μ_{hor} Coefficient of Friction for Horizontal Plane
- μ_{hs} Coefficient of Friction for Hanging String

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **acos**, acos(Number)
  The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sec**, sec(Angle)
  Secant is a trigonometric function that is defined ratio of the hypotenuse to the shorter side adjacent to an acute angle (in a right-angled triangle); the reciprocal of a cosine.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

Check other formula lists

- **Motion in Bodies Hanging by String Formulas**
- **Projectile Motion Formulas**

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