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Motion in Bodies Connected by Strings Formulas

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List of 13 Motion in Bodies Connected by Strings Formulas

Motion in Bodies Connected by Strings

Body Lying on Rough Inclined Plane

1) Acceleration of System given Mass of Body A

fx Open Calculator

$$a_{mb} = \frac{m_a \cdot [g] \cdot \sin(\alpha_1) - \mu_{cm} \cdot m_a \cdot [g] \cdot \cos(\alpha_1) - T}{m_a}$$

ex

$$3.357449 m/s^2 = \frac{29.1kg \cdot [g] \cdot \sin(34^\circ) - 0.2 \cdot 29.1kg \cdot [g] \cdot \cos(34^\circ) - 14.56N}{29.1kg}$$

2) Acceleration of System given Mass of Body B

fx Open Calculator

$$a_{mb} = \frac{T - m_b \cdot [g] \cdot \sin(\alpha_2) - \mu_{cm} \cdot m_b \cdot [g] \cdot \cos(\alpha_2)}{m_b}$$

ex

$$3.959007 m/s^2 = \frac{14.56N - 1.11kg \cdot [g] \cdot \sin(55^\circ) - 0.2 \cdot 1.11kg \cdot [g] \cdot \cos(55^\circ)}{1.11kg}$$

3) Frictional Force on Body A

Open Calculator

$$F_A = \mu_{cm} \cdot m_a \cdot [g] \cdot \cos(\alpha_1)$$

$$47.31707\text{N} = 0.2 \cdot 29.1\text{kg} \cdot [g] \cdot \cos(34^\circ)$$

4) Frictional Force on Body B

Open Calculator

$$F_B = \mu_{cm} \cdot m_b \cdot [g] \cdot \cos(\alpha_2)$$

$$1.24872\text{N} = 0.2 \cdot 1.11\text{kg} \cdot [g] \cdot \cos(55^\circ)$$

5) Tension in String given Mass of Body A

Open Calculator

$$T_a = m_a \cdot ([g] \cdot \sin(\alpha_1) - \mu_{cm} \cdot [g] \cdot \cos(\alpha_1) - a_{min})$$

$$97.71177\text{N} = 29.1\text{kg} \cdot ([g] \cdot \sin(34^\circ) - 0.2 \cdot [g] \cdot \cos(34^\circ) - 0.5\text{m/s}^2)$$

6) Tension in String given Mass of Body B

Open Calculator

$$T_b = m_b \cdot ([g] \cdot \sin(\alpha_2) + \mu_{cm} \cdot [g] \cdot \cos(\alpha_2) + a_{mb})$$

$$13.884\text{N} = 1.11\text{kg} \cdot ([g] \cdot \sin(55^\circ) + 0.2 \cdot [g] \cdot \cos(55^\circ) + 3.35\text{m/s}^2)$$

Body Lying on Smooth Inclined Plane

7) Acceleration of System with Bodies Connected by String and Lying on Smooth Inclined Planes

Open Calculator

$$a_{mb} = \frac{m_a \cdot \sin(\alpha_a) - m_b \cdot \sin(\alpha_b)}{m_a + m_b} \cdot [g]$$

$$3.348792\text{m/s}^2 = \frac{29.1\text{kg} \cdot \sin(23.11^\circ) - 1.11\text{kg} \cdot \sin(84.85^\circ)}{29.1\text{kg} + 1.11\text{kg}} \cdot [g]$$

8) Angle of Inclination of Plane with Body A

Open Calculator

$$\alpha_a = a\sin\left(\frac{m_a \cdot a_{mb} + T}{m_a \cdot [g]}\right)$$

$$23.11798^\circ = a\sin\left(\frac{29.1\text{kg} \cdot 3.35\text{m/s}^2 + 14.56\text{N}}{29.1\text{kg} \cdot [g]}\right)$$

9) Angle of Inclination of Plane with Body B

Open Calculator

$$\alpha_b = a\sin\left(\frac{T - m_b \cdot a_{mb}}{m_b \cdot [g]}\right)$$

$$84.85361^\circ = a\sin\left(\frac{14.56\text{N} - 1.11\text{kg} \cdot 3.35\text{m/s}^2}{1.11\text{kg} \cdot [g]}\right)$$

10) Tension in String if Both Bodies are Lying on Smooth Inclined Planes

Open Calculator

$$T = \frac{m_a \cdot m_b}{m_a + m_b} \cdot [g] \cdot (\sin(\alpha_1) + \sin(\alpha_2))$$

$$14.45253\text{N} = \frac{29.1\text{kg} \cdot 1.11\text{kg}}{29.1\text{kg} + 1.11\text{kg}} \cdot [g] \cdot (\sin(34^\circ) + \sin(55^\circ))$$

Body Passing Over Smooth Pulley

11) Acceleration of Bodies

Open Calculator

$$a_{bs} = \frac{m_a - m_b}{m_a + m_b} \cdot [g]$$

$$9.086002\text{m/s}^2 = \frac{29.1\text{kg} - 1.11\text{kg}}{29.1\text{kg} + 1.11\text{kg}} \cdot [g]$$

12) Mass of Body B of Smaller Mass

Open Calculator

fx $$m_b = \frac{T}{a_{mb} + [g]}$$

ex $$1.106665\text{kg} = \frac{14.56\text{N}}{3.35\text{m/s}^2 + [g]}$$

13) Tension in String if Both Bodies are Freely Hanging

Open Calculator

fx $$T_h = \frac{2 \cdot m_a \cdot m_b}{m_a + m_b} \cdot [g]$$

ex $$20.97084\text{N} = \frac{2 \cdot 29.1\text{kg} \cdot 1.11\text{kg}}{29.1\text{kg} + 1.11\text{kg}} \cdot [g]$$

Variables Used

- a_{bs} Acceleration of Bodies *(Meter per Square Second)*
- a_{mb} Acceleration of Body in Motion *(Meter per Square Second)*
- a_{min} Minimum Acceleration of Body in Motion *(Meter per Square Second)*
- F_A Frictional Force A *(Newton)*
- F_B Frictional Force B *(Newton)*
- m_a Mass of Body A *(Kilogram)*
- m_b Mass of Body B *(Kilogram)*
- T Tension of String *(Newton)*
- T_a Tension of String in Body A *(Newton)*
- T_b Tension of String in Body B *(Newton)*
- T_h Tension in Hanging String *(Newton)*
- α_1 Inclination of Plane 1 *(Degree)*
- α_2 Inclination of Plane 2 *(Degree)*
- α_a Angle of Inclination with Body A *(Degree)*
- α_b Angle of Inclination with Body B *(Degree)*
- μ_{cm} Coefficient of Friction

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- 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: **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.
- 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 Connected by Strings Formulas**
- **Motion in Bodies Hanging by String Formulas**
- **Projectile Motion Formulas**

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